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PCT LEGAL ADMINISTRATION

Novak Druce & Quigg LLP
525 Okeechobee Blvd
Suite 1500
West Palm Beach FL 33401

In re Application of: PIRIM, Patrick. :
U.S. Application No.: 11/676,926 :
U.S. Patent No.: 7,650,015 :
Filing Date: February 20, 2007 :
Attorney's Docket No.: 8042-2-1 :
For: IMAGE PROCESSING METHOD :

DECISION ON
PETITIONS UNDER
37 CFR 1.78(a)(3)
AND 1.55(c)

This decision is issued in response to the "FOURTH REQUEST FOR RECONSIDERATION OF PETITION DECISION" filed on March 17, 2015, which requests reconsideration under 37 CFR §§ 1.78(a)(3) and 1.55(c). For the reasons set forth below, the petitions are **GRANTED**.

37 CFR 1.78(a)(3)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the corrected benefit claim under 35 U.S.C. 120 is submitted after the expiration of the time period specified in 37 CFR 1.78(a)(2)(ii). Under the circumstances present here, the petition is properly considered under 37 CFR 1.78(a)(3). See MPEP section 1481.03.

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

With regard to item (i), a proper reference to the prior-filed application(s) has been included in an application data sheet or in an amendment to the first sentence of the specification as required by 37 CFR 1.78(a)(2)(iii).

With regard to item (ii), the surcharge set forth in 37 CFR 1.17(t) has been submitted.

With regard to item (iii), the statement of unintentional delay contained in the petition differs slightly from the language contained in 37 CFR 1.78(a)(3)(iii) and is hereby construed as a statement that the entire delay between the date the claim was due under 1.78(a)(2)(ii) and the date the claim was filed was unintentional. If this interpretation is incorrect, applicant is required to immediately notify the Office. As construed, the provided statement of unintentional delay is acceptable.

For the reasons above, the petition under 37 CFR 1.78(a)(3) is **GRANTED**.

Applicant is advised that the inclusion of a prior-filed application on any filing receipt should not be construed as meaning that the application is necessarily entitled to the benefit of the prior-filed application. In order for an application to be entitled to the benefit of the prior-filed application, all other requirements under 35 U.S.C. 120 and 37 CFR 1.78 must be met.

37 CFR 1.55(c)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the foreign priority claim under 35 U.S.C. 119(a)-(d) or 365(a) directed to French application number FR 9609420 was not submitted prior to the expiration of the time period specified in 37 CFR 1.55(a)(1). Accordingly, this is an appropriate petition under the provisions of 37 CFR 1.55(c).

A grantable petition under 37 CFR 1.55(c) to accept an unintentionally delayed claim for foreign priority requires the following:

(1) the claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;

(2) the surcharge as set forth in 37 CFR 1.17(t);

(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

With regard to requirement (1), petitioner has submitted an ADS which sets forth the foreign priority claim.

With regard to requirement (2), the surcharge has been paid.

With regard to requirement (3), petitioner has provided a statement of unintentional delay with respect to 37 CFR 1.55(a)(1).

For these reasons, the petition under 37 CFR 1.55(c) is **GRANTED.**

DECISION

For the reasons set forth above, the petitions under 37 CFR 1.78(a)(3) and 1.55(c) are **GRANTED**.

This patented application is being returned to the files repository. It is noted that a Certificate of Correction was issued on 10 May 2011.

/George Dombroske/
George Dombroske
PCT Legal Examiner
International Patent Legal Administration
Telephone: (571) 272-3283

ATTACHMENT: Corrected Filing Receipt

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Pirim	Docket No.:	8042-2-1
Application No.:	11/676,926	Examiner:	Seth MANAV
Patent No.:	7,650,015	Art Unit:	2624
Filed:	02-20-2007	Confirmation No.:	9051

For: IMAGE PROCESSING METHOD

Commissioner for Patents,
P.O. Box 1450
Alexandria, Virginia 22313-1450

FOURTH REQUEST FOR RECONSIDERATION OF PETITION DECISION

Sir:

This is in response to the Petition decision mailed March 9, 2015. Please reconsider the decision in view of the following remarks.

The decision states:

37 CFR 1.78(a)(3)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the corrected benefit claim under 35 U.S.C. 120 is submitted after the expiration of the time period specified in 37 CFR 1.78(a)(2)(ii). Under the circumstances present here, the petition is properly considered under 37 CFR 1.78(a)(3). See MPEP section 1481.03.

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

Item (1): With regard to Item (1) the decision states the Application Data Sheet filed on November 24, 2014 does not comply with 37 CFR 1.76(c)(2) allegedly because it is not entitled “Supplemental Application Data Sheet” and does not identify the information that is being changed, preferably with underlining for insertions and strike-through or brackets for text removed.

Applicant submits herewith a Marked-up Supplemental Application Data Sheet in the format as originally filed identifying information being changed, a Marked-up Supplemental Application Data Sheet PTO form identifying information being changed and a Clean Application Data Sheet PTO form.

Item (2): With regard to item (2), the decision states the surcharge set forth has been previously submitted.

Item (3): With regard to item (3), the prior Request for Reconsideration states, “The entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.” This remains true. The entire delay between the date the claim was due and the filing of this petition was unintentional.

The decision states the statement previously submitted of unintentional delay is acceptable.

37 CFR 1.55(c)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the foreign priority claim under 35 U.S.C. 119(a)-(d) or 365(a) directed to French application number FR 9609420 was not submitted prior to the expiration of the time period specified in 37 CFR 1.55(a)(1). Accordingly, this is an appropriate petition under the provisions of 37 CFR 1.55(c).

A grantable petition under 37 CFR 1.55(c) to accept an unintentionally delayed claim for foreign priority requires the following:

(1) the claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;

(2) the surcharge as set forth in 37 CFR 1.17(t);

(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

Item (1): With regard to Item (1) the decision states the Application Data Sheet filed on November 24, 2014 does not comply with 37 CFR 1.76(c)(2) allegedly because it is not entitled "Supplemental Application Data Sheet" and does not identify the information that is being changed, preferably with underlining for insertions and strike-through or brackets for text removed.

Applicant submits herewith a Marked-up Supplemental Application Data Sheet in the format as originally filed identifying information being changed, a Marked-up Supplemental Application Data Sheet PTO form identifying information being changed and a Clean Application Data Sheet PTO form.

Item (2): With regard to item (2), the decision states the surcharge set forth has been previously submitted.

Item (3): With regard to item (3), the prior Request for Reconsideration states, "The entire delay between the date the claim was due under 37 CFR

1.55(a)(1) and the date the claim was filed was unintentional." This remains true. The entire delay between the date the claim was due and the filing of this petition was unintentional.

The decision states the statement previously submitted of unintentional delay is acceptable.

No additional surcharge should be owed, but the Director is hereby authorized to charge any deficiency in fees filed, asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account 14-1437. Please credit any excess fees to such account.

Respectfully submitted,
NOVAK DRUCE + QUIGG, LLP

/Michael P. Byrne/

Date: March 17, 2015

Michael P. Byrne, Reg. No. 54,015
525 Okeechobee Blvd.
15th Floor
West Palm Beach, FL 33401
Phone: (561) 847-7800
Fax: (561) 847-7801

SUPPLEMENTAL APPLICATION DATA SHEET

(1) Applicant Information

Inventor (1) name: PIRIM, Patrick
Residence: Paris, France
Mailing Address: 56 Rue Patay, Paris 75013, France
Citizenship: France

(2) Correspondence Information
Correspondence Address: ***30448***

(3) Application Information
Title: IMAGE PROCESSING METHOD
Total No. of Drawing Sheets: 13
Suggested Figure for Publication: 14
Attorney Docket Number: 8042-2-1
Type of Application: Non-Provisional

(4) Representative Information
Representative Information: ***30448***
Gregory M. Lefkowitz, Registration No. 56,216
AKERMAN SENTERFITT
P.O. Box 3188
West Palm Beach, FL 33402-3188
Telephone: (561) 653 5000

(5) Domestic Priority Information

This application is a divisional of U.S. Application No. 09/792,294, filed February 23, 2001, now US Patent No. 7,181,047;
U.S. Application No. 09/792,294 is a continuation-in-part of US Application No. 09/230,502, filed ~~January 26, 1999~~September 13, 1999, now US Patent No. 6,486,909, which is a 371 of international application No. PCT/FR97/01354, filed on July 22, 1997. U.S. Application No. 09/792,294 is a continuation-in-part of application No. PCT/EP98/05383, filed on August 25, 1998.

(6) Foreign Priority Information

~~International Application No. PCT/EP98/05383, filed August 25, 1998~~
This Application claims priority to French Patent Application No. 96 09420, filed July 26, 1996

SUPPLEMENTAL APPLICATION DATA SHEET

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	
Title of Invention	IMAGE PROCESSING METHOD	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Patrick		PIRIM	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Paris	**Country Of Residence**	FR
Citizenship under 37 CFR 1.41(b)	FR		

Mailing Address of Applicant:

Address 1	56 Rue Patay		
Address 2			
City	Paris	**State/Province**	
Postal Code	75013	**Country**	FR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. [Add]

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	86000
Email Address	wpbdocket@novakdruce.com [Add Email] [Remove Email]

Application Information:

Title of the Invention	IMAGE PROCESSING METHOD		
Attorney Docket Number	8042-2-1	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	13	**Suggested Figure for Publication (if any)**	

SUPPLEMENTAL APPLICATION DATA SHEET

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	
Title of Invention	IMAGE PROCESSING METHOD	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	86000		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
11676926	Division of	09792294	2001-02-23	7181047	2007-02-20
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
09792294	Continuation in part of	09230502	1999-09-13	6486909	2002-11-26

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09230502	a 371 of international	PCT/FR97/01354	1997-07-22
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09792294	Continuation in part of	PCT/EP98/05383	1998-08-25

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

SUPPLEMENTAL APPLICATION DATA SHEET

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	
Title of Invention	IMAGE PROCESSING METHOD	

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

~~Application Number~~	~~Country~~	~~Parent Filing Date (YYYY-MM-DD)~~	~~Priority Claimed~~
~~PCT/EP98/05383~~	~~EP~~	~~1998-08-25~~	(●) ~~Yes~~ ( ) ~~No~~

Remove

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
96 09420	FR	1996-07-26	(●) Yes ( ) No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1

If the Assignee is an Organization check here. ☒

Organization Name	IMAGE PROCESSING TECHNOLOGIES LLC		
Mailing Address Information:			
Address 1	75 Montebello Road		
Address 2	Montebello Park		
City	Suffern	**State/Province**	NY
Country	US	Postal Code	10901-3746
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button.

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Michael P. Byrne/			Date (YYYY-MM-DD)	2014-11-24
First Name	Michael	Last Name	Byrne	Registration Number	54015

SUPPLEMENTAL APPLICATION DATA SHEET

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	

Title of Invention	IMAGE PROCESSING METHOD

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	
Title of Invention	IMAGE PROCESSING METHOD	

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Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 [Remove]

Applicant Authority ◉ Inventor ◯ Legal Representative under 35 U.S.C. 117 ◯ Party of Interest under 35 U.S.C. 118

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Patrick		PIRIM	

Residence Information (Select One) ◯ US Residency ◉ Non US Residency ◯ Active US Military Service

City	Paris	**Country Of Residence** i	FR
Citizenship under 37 CFR 1.41(b) i	FR		

Mailing Address of Applicant:

Address 1	56 Rue Patay		
Address 2			
City	Paris	**State/Province**	
Postal Code	75013	**Country** i	FR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. [Add]

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
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☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	86000
Email Address	wpbdocket@novakdruce.com [Add Email] [Remove Email]

Application Information:

Title of the Invention	IMAGE PROCESSING METHOD		
Attorney Docket Number	8042-2-1	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	13	**Suggested Figure for Publication (if any)**	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	

Title of Invention	IMAGE PROCESSING METHOD

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	86000		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
11676926	Division of	09792294	2001-02-23	7181047	2007-02-20
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
09792294	Continuation in part of	09230502	1999-09-13	6486909	2002-11-26

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09230502	a 371 of international	PCT/FR97/01354	1997-07-22
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09792294	Continuation in part of	PCT/EP98/05383	1998-08-25

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	

Title of Invention	IMAGE PROCESSING METHOD

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country i	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
96 09420	FR	1996-07-26	(●) Yes ○ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1 Remove

If the Assignee is an Organization check here. ☒

Organization Name	IMAGE PROCESSING TECHNOLOGIES LLC		
Mailing Address Information:			
Address 1	75 Montebello Road		
Address 2	Montebello Park		
City	Suffern	**State/Province**	NY
Country i	US	Postal Code	10901-3746
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button. Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Michael P. Byrne/			Date (YYYY-MM-DD)	2014-11-24
First Name	Michael	Last Name	Byrne	Registration Number	54015

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	21796178
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	86002
Filer:	Michael P. Byrne/Krystal Travers
Filer Authorized By:	Michael P. Byrne
Attorney Docket Number:	8042-2-1
Receipt Date:	17-MAR-2015
Filing Date:	20-FEB-2007
Time Stamp:	16:43:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition for review by the Office of Petitions.	P0257591.pdf	1390345 01a37c023bad24be389d012b4fdbfbf2ea46209d	no	4

Warnings:

Information:

2	Application Data Sheet	P0257589.pdf	17643 029cd09546226f22d6e048e7ad061ddd7e991fff	no	1
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
3	Application Data Sheet	P0257571.pdf	950784 134a102924ef6829ece6f505b7459bd98ffd331b	no	5
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
4	Application Data Sheet	P0246318.pdf	1090572 1efd09d1b8c58455a75e829250ee7d00fe5d95d2	no	4
Warnings:					
Information:					
			Total Files Size (in bytes):	3449344	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

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MAR 09 2015

PCT LEGAL ADMINISTRATION

Novak Druce & Quigg LLP
525 Okeechobee Blvd
Suite 1500
West Palm Beach FL 33401

In re Application of: PIRIM, Patrick.	:	DECISION ON
U.S. Application No.: 11/676,926	:	PETITIONS UNDER
U.S. Patent No.: 7,650,015	:	37 CFR 1.78(a)(3)
Filing Date: February 20, 2007	:	AND 1.55(c)
Attorney's Docket No.: 8042-2-1	:	
For: IMAGE PROCESSING METHOD	:	

This decision is issued in response to the "THIRD REQUEST FOR RECONSIDERATION OF PETITION DECISION" filed on November 24, 2014, which requests reconsideration under 37 CFR §§ 1.78(a)(3) and 1.55(c). For the reasons set forth below, the petitions are **DISMISSED**.

37 CFR 1.78(a)(3)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the corrected benefit claim under 35 U.S.C. 120 is submitted after the expiration of the time period specified in 37 CFR 1.78(a)(2)(ii). Under the circumstances present here, the petition is properly considered under 37 CFR 1.78(a)(3). See MPEP section 1481.03.

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

With regard to item (1), the Application Data Sheet filed on November 24, 2014 does not comply with 37 CFR 1.76(c)(2) because it is not entitled "Supplemental Application Data Sheet" and does not identify the information that is being changed, preferably with underlining for insertions and strike-through or brackets for text removed. Applicants are advised to provide a formally acceptable ADS.

With regard to item (2), the surcharge set forth in 37 CFR 1.17(t) has been submitted.

With regard to item (3), the statement of unintentional delay contained in the petition differs slightly from the language contained in 37 CFR 1.78(a)(3)(iii) and is hereby construed as a statement that the entire delay between the date the claim was due under 1.78(a)(2)(ii) and the date the claim was filed was unintentional. If this interpretation is incorrect, applicant is required to immediately notify the Office. As construed, the provided statement of unintentional delay is acceptable.

For the reasons above, the petition under 37 CFR 1.78(a)(3) is **DISMISSED**.

37 CFR 1.55(c)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the foreign priority claim under 35 U.S.C. 119(a)-(d) or 365(a) directed to French application number FR 9609420 was not submitted prior to the expiration of the time period specified in 37 CFR 1.55(a)(1). Accordingly, this is an appropriate petition under the provisions of 37 CFR 1.55(c).

A grantable petition under 37 CFR 1.55(c) to accept an unintentionally delayed claim for foreign priority requires the following:

(1) the claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;

(2) the surcharge as set forth in 37 CFR 1.17(t);

(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

With regard to requirement (1), petitioner has submitted an ADS which sets forth the foreign priority claim. However, as described above, the Application Data Sheet filed on November 24, 2014 does not comply with 37 CFR 1.76(c)(2) because it is not entitled "Supplemental Application Data Sheet" and does not identify the information that is being changed, preferably with underlining for insertions and strike-through or brackets for text removed. Applicants are advised to provide a formally acceptable ADS

With regard to requirement (2), the surcharge has been paid.

With regard to requirement (3), petitioner has provided a statement of unintentional delay with respect to 37 CFR 1.55(a)(1).

For these reasons, the petition under 37 CFR 1.55(c) is **DISMISSED.**

DECISION

For the reasons set forth above, the petitions under 37 CFR 1.78(a)(3) and 1.55(c) are **DISMISSED**.

Any further correspondence with respect to this matter may be filed electronically via EFS-Web selecting the document description "Petition for review and processing by the PCT Legal Office" or by mail addressed to Mail Stop PCT, Commissioner for Patents, Office of PCT Legal Administration, P.O. Box 1450, Alexandria, Virginia 22313-1450, with the contents of the letter marked to the attention of the Office of PCT Legal Administration.

/George Dombroske/
George Dombroske
PCT Legal Examiner
International Patent Legal Administration
Telephone: (571) 272-3283

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Pirim	Docket No.:	8042-2-1
Application No.:	11/676,926	Examiner:	Seth MANAV
Patent No.:	7,650,015	Art Unit:	2624
Filed:	02-20-2007	Confirmation No.:	9051

For: IMAGE PROCESSING METHOD

Commissioner for Patents,
P.O. Box 1450
Alexandria, Virginia 22313-1450

THIRD REQUEST FOR RECONSIDERATION OF PETITION DECISION

Sir:

This is in response to the Petition decision mailed September 22, 2014. Please reconsider the decision in view of the following remarks.

The decision states:

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

The decision states the Petition fails to comply with items (1) and (3) above. Regarding requirement (1) the decision states the ADS submitted is defective. Applicant submits a Supplemental Application Data Sheet.

Regarding requirement (3), the decision states, "Petitioner did not provide an updated statement of unintentional delay…." Petitioner respectfully disagrees, because page 3 of the prior Request for Reconsideration states, "The entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional." This remains true. The entire delay between the date the claim was due and the filing of this petition was unintentional.

No additional surcharge should be owed, but the Director is hereby authorized to charge any deficiency in fees filed, asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account 14-1437. Please credit any excess fees to such account.

Respectfully submitted,
NOVAK DRUCE + QUIGG, LLP

/Michael P. Byrne/

Date: November 24, 2014

Michael P. Byrne, Reg. No. 54,015
525 Okeechobee Blvd.
15th Floor
West Palm Beach, FL 33401
Phone: (561) 847-7800
Fax: (561) 847-7801

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	
Title of Invention	IMAGE PROCESSING METHOD	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 [Remove]

Applicant Authority ◉ Inventor ◯ Legal Representative under 35 U.S.C. 117 ◯ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Patrick		PIRIM	

Residence Information (Select One) ◯ US Residency ◉ Non US Residency ◯ Active US Military Service

City	Paris	**Country Of Residence** i	FR
Citizenship under 37 CFR 1.41(b) i	FR		

Mailing Address of Applicant:

Address 1	56 Rue Patay		
Address 2			
City	Paris	**State/Province**	
Postal Code	75013	**Country** i	FR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. [Add]

Correspondence Information:

**Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).**

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	86000	
Email Address	wpbdocket@novakdruce.com	[Add Email] [Remove Email]

Application Information:

Title of the Invention	IMAGE PROCESSING METHOD		
Attorney Docket Number	8042-2-1	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	13	**Suggested Figure for Publication (if any)**	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	

Title of Invention	IMAGE PROCESSING METHOD

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	86000		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
11676926	Division of	09792294	2001-02-23	7181047	2007-02-20
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
09792294	Continuation in part of	09230502	1999-09-13	6486909	2002-11-26

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09230502	a 371 of international	PCT/FR97/01354	1997-07-22
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09792294	Continuation in part of	PCT/EP98/05383	1998-08-25

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	

Title of Invention	IMAGE PROCESSING METHOD

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country i	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
96 09420	FR	1996-07-26	(●) Yes ( ) No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Add

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1

Remove

If the Assignee is an Organization check here. ☒

Organization Name	IMAGE PROCESSING TECHNOLOGIES LLC		
Mailing Address Information:			
Address 1	75 Montebello Road		
Address 2	Montebello Park		
City	Suffern	**State/Province**	NY
Country i	US	Postal Code	10901-3746
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button.

Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Michael P. Byrne/			Date (YYYY-MM-DD)	2014-11-24
First Name	Michael	Last Name	Byrne	Registration Number	54015

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	20785207
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	86002
Filer:	Michael P. Byrne/Krystal Travers
Filer Authorized By:	Michael P. Byrne
Attorney Docket Number:	8042-2-1
Receipt Date:	24-NOV-2014
Filing Date:	20-FEB-2007
Time Stamp:	16:41:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	P0246316.PDF	636987 aef7c1118f36bacfa0763991cc3aa06c631ebe7d	no	2

Warnings:

Information:

2	Application Data Sheet	P0246318.PDF	1090572 1efd09d1b8c58455a75e829250ee7d00fe5d95d2	no	4
Warnings:					
Information:					
		Total Files Size (in bytes):	1727559		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

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SEP 22 2014

PCT LEGAL ADMINISTRATION

Novak Druce & Quigg LLP
525 Okeechobee Blvd
Suite 1500
West Palm Beach FL 33401

In re Application of: PIRIM, Patrick.	:	
U.S. Application No.: 11/676,926	:	DECISION ON
U.S. Patent No.: 7,650,015	:	PETITIONS UNDER
Filing Date: February 20, 2007	:	37 CFR 1.78(a)(3)
Attorney's Docket No.: 8042-2-1	:	AND 1.55(c)
For: IMAGE PROCESSING METHOD	:	

This decision is issued in response to the "SECOND REQUEST FOR RECONSIDERATION OF PETITION DECISION" filed on July 15, 2014, which requests reconsideration under 37 CFR §§ 1.78(a)(3) and 1.55(c). For the reasons set forth below, the petitions are **DISMISSED** without prejudice.

37 CFR 1.78(a)(3)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the corrected benefit claim under 35 U.S.C. 120 is submitted after the expiration of the time period specified in 37 CFR 1.78(a)(2)(ii). Under the circumstances present here, the petition is properly considered under 37 CFR 1.78(a)(3). See MPEP section 1481.03.

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

The present petition fails to comply with items (1) and (3) above.

Regarding requirement (1), the Application Data Sheet (ADS) filed on July 15, 2014 indicates that parent application no. 09/230,502 is "a 371 of international PCT/FR97/01354," but also indicates that 09/230,502 is a "Continuation in part of PCT/EP98/05383." However, the filing date (35 U.S.C. 363) date of 09/230,502 is its international filing date, 22 July 1997. This is prior to the 25 August 1998 international filing date of purported "priority" application PCT/EP98/05383. Comparative review of parent application no. 09/792,294 reveals that petitioner may have intended instead to insert a claim that 09/792,294 is a CON of PCT/EP98/05383.

Regarding requirement (3), a decision dismissing the petition filed on 20 May 2011 was mailed on 05 January 2012, and the instant response was filed on 15 July 2014. Petitioner did not provide an updated statement of unintentional delay; it is not adequately clear at this time whether the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

For these reasons, it would not be appropriate to grant petition under 37 CFR 1.78(a)(3) on the basis of the present record.

37 CFR 1.55(c)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the foreign priority claim under 35 U.S.C. 119(a)-(d) or 365(a) directed to French application number FR 9609420 was not submitted prior to the expiration of the time period specified in 37 CFR 1.55(a)(1). Accordingly, this is an appropriate petition under the provisions of 37 CFR 1.55(c).

A grantable petition under 37 CFR 1.55(c) to accept an unintentionally delayed claim for foreign priority requires the following:

(1) the claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;

(2) the surcharge as set forth in 37 CFR 1.17(t);

(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

In the Decision mailed on 05 January 2012, the previous petition under 37 CFR 1.55(c) filed on 20 May 2011 was dismissed without prejudice because requirement (1) had not been satisfied. Petitioner now has submitted an ADS which sets forth the foreign priority claim. However, said ADS is defective for other reasons (as described above). Therefore, it would not be appropriate at this time to conclude that applicants have satisfied the requirements for a grantable petition under 357 CFR 1.55(c) for acceptance of an unintentionally delayed foreign benefit claim. It is noted that the instant renewed petition includes a statement of unintentional delay with respect to 37 CFR 1.55(a)(1).

DECISION

For the reasons set forth above, the petitions under 37 CFR 1.78(a)(3) and 1.55(c) are **DISMISSED** without prejudice.

Any further correspondence with respect to this matter may be filed electronically via EFS-Web selecting the document description "Petition for review and processing by the PCT Legal Office" or by mail addressed to Mail Stop PCT, Commissioner for Patents, Office of PCT Legal Administration, P.O. Box 1450, Alexandria, Virginia 22313-1450, with the contents of the letter marked to the attention of the Office of PCT Legal Administration.

/George Dombroske/
George Dombroske
PCT Legal Examiner
International Patent Legal Administration
Telephone: (571) 272-3283

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Pirim	Docket No.:	8042-2-1
Application No.:	11/676,926	Examiner:	Seth MANAV
Patent No.:	7,650,015	Art Unit:	2624
Filed:	02-20-2007	Confirmation No.:	9051

For: IMAGE PROCESSING METHOD

Commissioner for Patents,
P.O. Box 1450
Alexandria, Virginia 22313-1450

SECOND REQUEST FOR RECONSIDERATION OF PETITION DECISION

Sir:

A Petition to Accept Unintentionally Delayed Priority Claims under 37 C.F.R. §§ 1.55(c) and 1.78(a)(3) was filed on August 20, 2010. A decision on the Petition was mailed on April 05, 2011.

A request for reconsideration of the petition decision was filed on May 20, 2011. A second decision was mailed on January 5, 2012.

Please consider the decision in view of the following marks.

Domestic Priority Claim 37 CFR 1.78 (a)(3)

The decision states:

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

The decision interprets 1.78(a)(3)'s reference to 1.78(a)(2) as a requirement that "an accompanying amendment to the specification of the application or a supplemental application data sheet" (Decision at p. 2) is needed. More specifically, the decision cites to 1.78(a)(2)(iii), which states, "[i]f the later-filed application is a non-provisional application, the reference required by this paragraph must be included in an application data sheet (§ 1.76), or the specification must contain or be amended to contain such reference in the first sentence(s) following the title."

Applicant submits a Supplemental Application Data Sheet reflecting the priority correction.

37 C.F.R. §1.55(c)

The decision states:

A grantable petition under 37 CFR 1.55(c) to accept an unintentionally delayed claim for foreign priority requires the following:

(1) the claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;
(2) the surcharge as set forth in 37 CFR 1.17(t);
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

The decision concludes that the petition does not comply with 1.55(c)(1), alleging MPEP §201.13 requires that "a claim for foreign priority must be contained in either an oath or declaration … or an application data sheet." (Decision at p. 3). MPEP §201.13 actually states, "[a] priority claim need not be in any special form and may be a statement signed by a registered attorney or agent. A priority claim can be made on filing: (A) by including a copy of an unexecuted or executed oath or declaration specifying a foreign priority claim (see 37 CFR 1.63(c)(2)); or (B) by submitting an application data sheet specifying a foreign priority claim (see 37 CFR 1.76)." The entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

Applicant submits a Supplemental Application Data Sheet reflecting the priority correction.

No additional surcharge should be owed, but the Director is hereby authorized to charge any deficiency in fees filed, asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account 14-1437. Please credit any excess fees to such account.

Respectfully submitted,
NOVAK DRUCE + QUIGG, LLP

/Michael P. Byrne/

Date: July 15, 2014

Michael P. Byrne, Reg. No. 54,015
525 Okeechobee Blvd.
15th Floor
West Palm Beach, FL 33401
Phone: (561) 847-7800
Fax: (561) 847-7801

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	
Title of Invention	IMAGE PROCESSING METHOD	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 [Remove]

Applicant Authority ◉Inventor ○Legal Representative under 35 U.S.C. 117 ○Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Patrick		PIRIM	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Paris	**Country Of Residence** i	FR
Citizenship under 37 CFR 1.41(b) i			

Mailing Address of Applicant:

Address 1	56 Rue Patay		
Address 2			
City	Paris	**State/Province**	
Postal Code	75013	**Country** i	FR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. [Add]

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	86000	
Email Address	wpbdocket@novakdruce.com	[Add Email] [Remove Email]

Application Information:

Title of the Invention	IMAGE PROCESSING METHOD		
Attorney Docket Number	8042-2-1	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	13	**Suggested Figure for Publication (if any)**	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	

Title of Invention	IMAGE PROCESSING METHOD

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	86000		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
11676926	Division of	09792294	2001-02-23	7181047	2007-02-20
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
09792294	Continuation in part of	09230502	1999-09-13	6486909	2002-11-26

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09230502	a 371 of international	PCT/FR97/01354	1997-07-22
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09230502	Continuation in part of	PCT/EP98/05383	1998-08-25

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. [Add]

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	8042-2-1
	Application Number	
Title of Invention	IMAGE PROCESSING METHOD	

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country i	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
96 09420	FR	1996-07-26	◉ Yes ○ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Add

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1

Remove

If the Assignee is an Organization check here. ☒

Organization Name	IMAGE PROCESSING TECHNOLOGIES LLC		
Mailing Address Information:			
Address 1	75 MONTEBELLO ROAD		
Address 2	MONTEBELLO PARK		
City	SUFFERN	**State/Province**	NY
Country i	US	Postal Code	10901-3746
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button.

Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Michael P. Byrne/			Date (YYYY-MM-DD)	2014-07-15
First Name	Michael	Last Name	Byrne	Registration Number	54015

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	19579528
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	86002
Filer:	Michael P. Byrne
Filer Authorized By:	
Attorney Docket Number:	8042-2-1
Receipt Date:	15-JUL-2014
Filing Date:	20-FEB-2007
Time Stamp:	14:36:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	P0233899.PDF	1194986 9f3b78aca012a116d4c52b826ef314b23b0b4822	no	3

Warnings:

Information:

2	Application Data Sheet	P0233907.PDF	1089368 d66e8fb7c82a1a616be0dabceddf6235828e863a	no	4

Warnings:

Information:

Total Files Size (in bytes):	2284354

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

MAILED
FEB 03 2014
OFFICE OF PETITIONS

J. Rodman Steele, Jr.
Novak Druce & Quigg LLP
525 Okeechobee Blvd
Suite 1500
West Palm Beach FL 33401

In re Patent No. 7,650,015	:	
Issue Date: January 19, 2010	:	
Application No. 11/676,926	:	NOTICE
Filed: February 20, 2007	:	
Attorney Docket No. 8042-2-1	:	

This is a notice regarding your request for acceptance of a fee deficiency submission under 37 CFR 1.28.

The Office no longer investigates or rejects original or reissue applications under 37 CFR 1.56. **1098 Off. Gaz. Pat. Office 502 (January 3, 1989)**. Therefore, nothing in this Notice is intended to imply that an investigation was done.

Your fee deficiency submission under 37 CFR 1.28 is hereby **ACCEPTED**.

This application is no longer entitled to small entity status. Accordingly, all future fees paid in this application must be paid at the large entity rate.

Petitioner has appointed a representative to conduct all business before the Patent and Trademark Office (Office). The Office will not engage in dual correspondence with petitioner and petitioner's representative. Accordingly, petitioner must conduct all future correspondence with this Office through the representative of record. If petitioner no longer wishes to be represented by the representative of record, then a revocation of the power of attorney or authorization of agent must be submitted. A correspondence address must be included on the correspondence instructing the Office where all future communications should be mailed.

Inquiries related to this communication should be directed to the undersigned at (571) 272-3213.

Cheryl Gibson-Baylor

Cheryl Gibson-Baylor
Petitions Paralegal Specialist
Office of Petitions

IMAGE
PROCESSING
TECHNOLOGIES

December 30, 2013

Mail Stop M Correspondence
Director of USPTO
P.O. Box 1450
Alexandria, VA 22313-1450

ATT: Maintenance Fee Branch

Via Facsimile: (571) 273-6500

RE: U.S. P.N. 7,650,015; issued January 19, 2010
Serial No. 11/676,926; filed February 20, 2007

Dear Sir/Madam:

Please be advised that we wish to change the status of the above-referenced patent from a small entity to a large entity, retroactive to May 17, 2013.

On June 11, 2013 the 4th-year maintenance fee of $800 for a small entity was paid using our Deposit Account. The Director is hereby authorized to charge the deficiency in fees paid to Deposit Account No. 503240 in accordance with the requested entity status amendment. Thank you.

Sincerely,

Image Processing Technologies LLC

Alexander Poltorak

Alexander Poltorak
Chairman & CEO of General Patent Corporation,
Managing Member of Image Processing Technologies LLC

01/02/2014 MBANGURA 00000094 503240 7650015
01 FC:1599 800.00 DA

:bw

GENERAL PATENT
CORPORATION

FACSIMILE TRANSMITTAL SHEET

Confidential

DATE: *December 30, 2013*

TO: Maintenance Fee Branch

COMPANY: USPTO **FAX:** *(571) 273-6500*

FROM: Alexander Poltorak **PHONE:** *(845) 368-4000*
FAX: *(845) 368-8770*

RE: Change of Entity Status – US 7,650,015

Number of pages including this cover sheet: 2

☐ *Urgent* ☐ *For Review* ☐ *Please Comment* ☐ *Please Reply* ☐ *Please Recycle*

MESSAGE:

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Gregory A. Nelson
Novak Druce & Quigg LLP
525 Okeechobee Blvd
Suite 1500
West Palm Beach FL 33401

MAILED

JAN 05 2012

PCT LEGAL ADMINISTRATION

In re Application of: PIRIM, Patrick. :
U.S. Application No.: 11/676,926 :
U.S. Patent No.: 7,650,015 :
Filing Date: February 20, 2007 :
Attorney's Docket No.: 8042-2-1 :
For: IMAGE PROCESSING METHOD :

DECISION ON PETITIONS UNDER 37 CFR 1.78(a)(3) AND 1.55(c))

This decision is issued in response to the "REQUEST FOR RECONSIDERATION OF PETITION DECISION" filed on 20 May 2011, which requests reconsideration under 37 CFR §§ 1.78(a)(3) and 1.55(c). The petition under 37 CFR 1.78(a)(3) seeks to correct the domestic priority claim in the above-captioned patent to identify the patent as a divisional of U.S. application number 09/792,294, which is a continuation-in-part (CIP) of US. Application number 09/230,502, which is the national stage under 35 U.S.C. 371 of PCT/FR97/01354. The petition under 37 CFR 1.55(c) seeks to add an unintentionally delayed claim of foreign priority to French application FR 9609420.

For the reasons set forth below, the petitions are **DISMISSED** without prejudice.

1. **37 CFR 1.78(a)(3)**

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the corrected benefit claim under 35 U.S.C. 120 is submitted after the expiration of the time period specified in 37 CFR 1.78(a)(2)(ii).[1] Under the circumstances present here, the petition is properly considered under 37 CFR 1.78(a)(3). See MPEP section 1481.03.

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

---

[1] It is noted that the addition of the statement identifying U.S. application number 09/230,502 as the national stage of PCT/FR97/01354 is not considered the addition of a new benefit claim that requires a petition under 37 CFR 1.78. See MPEP section 1893.03(c), "a national stage application submitted under 35 U.S.C. 371 may not claim benefit of the filing date of the international application of which it is the national stage since its filing date is the international filing date of the international application." See also Broadcast Innovation, L.L.C. and IO Research PTY LTD v. Charter Communications, Inc. and Comcast Corporation, 420 F.3d 1364, 1367 (Fed. Cir., Aug 19, 2005): "Where proper reference to a national stage application exists, no reference to the corresponding PCT application is required because the national stage application effectively has the same U.S. filing date as the PCT application."

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

The present petition fails to comply with item (1) above.

37 CFR 1.78(a)(2)(iii) states that the required reference to the prior-filed application(s) "must be included in an application data sheet (37 CFR 1.76) or the specification must be amended to contain such reference in the first sentence(s) following the title." Petitioner here has filed a Certificate of Correction setting forth the corrected reference to the prior-filed applications; however, petitioner did not include an accompanying amendment to the specification of the application or a supplemental application data sheet. Accordingly, petitioner has not provided the reference to the prior-filed applications in the form required by 37 CFR 1.78.

Petitioner argues that a request for Certificate of Correction may be used in lieu of an amendment or ADS to make the required reference. However, pursuant to the requirements of 35 U.S.C. 120 and Office policy, in the circumstances presented, petitioner must submit **both** a request for Certificate of Correction **and** an amendment to the application adding the specific reference to the parent application. *Cf.* the Decision on Petition in 09/792,294, mailed on September 27, 2011. Petitioner is also advised that the amendment included in the instant petition does not comply with 37 CFR 1.121(b)(1)(iii).

Based on the above, the petition under 37 CFR 1.78(a)(3) may not be granted on the present record.

2. 37 CFR 1.55(c)

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the foreign priority claim under 35 U.S.C. 119(a)-(d) or 365(a) directed to French application number FR 9609420 was not submitted prior to the expiration of the time period specified in 37 CFR 1.55(a)(1). Accordingly, this is an appropriate petition under the provisions of 37 CFR 1.55(c).[2]

A grantable petition under 37 CFR 1.55(c) to accept an unintentionally delayed claim for foreign priority requires the following:

[2] As noted in the present petition, pursuant to MPEP section 201.16, a certificate of correction accompanied by a grantable petition under 37 CFR 1.55(c) is permissible for adding an unintentionally delayed foreign priority claim to an issued patent where the foreign priority claim to be added was perfected in a parent application prior to the issuance of the patent.

(1) the claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;
(2) the surcharge as set forth in 37 CFR 1.17(t);
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

The present petition fails to comply with item (1) above.

Pursuant to MPEP section 201.13, a claim for foreign priority must be contained in either an oath or declaration (37 CFR 1.63(c)(2)) or an application data sheet (37 CFR 1.76). Petitioner here has filed a Certificate of Correction setting forth the foreign priority claim; however, petitioner did not include an accompanying oath or declaration or a supplemental application data sheet containing such claim. *Cf.* the Decision on Petition in 09/792,294, mailed on September 27, 2011. Accordingly, petitioner has not submitted the foreign priority claim in an acceptable form.

Based on the above, applicants have failed to satisfy the requirements for a grantable petition under 357 CFR 1.55(c) for acceptance of an unintentionally delayed foreign benefit claim.

DECISION

For the reasons set forth above, the petitions under 37 CFR 1.78(a)(3) and 1.55(c) are **DISMISSED** without prejudice.

Any further correspondence with respect to this matter may be filed electronically via EFS-Web selecting the document description "Petition for review and processing by the PCT Legal Office" or by mail addressed to Mail Stop PCT, Commissioner for Patents, Office of PCT Legal Administration, P.O. Box 1450, Alexandria, Virginia 22313-1450, with the contents of the letter marked to the attention of the Office of PCT Legal Administration.

/George Dombroske/
George Dombroske
PCT Legal Examiner
Office of PCT Legal Administration
Telephone: (571) 272-3283

/Boris Milef/
Boris Milef
PCT Legal Examiner
Office of PCT Legal Administration

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Pirim	Docket No.:	8042-2-1
Application No.:	11/676,926	Examiner:	Seth MANAV
Patent No.:	7,650,015	Art Unit:	2624
Filed:	02-20-2007	Confirmation No.:	9051

For: IMAGE PROCESSING METHOD

Mail Stop PCT,
Commissioner for Patents,
Office of PCT Legal Administration
P.O. Box 1450
Alexandria, Virginia 22313-1450

REQUEST FOR RECONSIDERATION OF PETITION DECISION

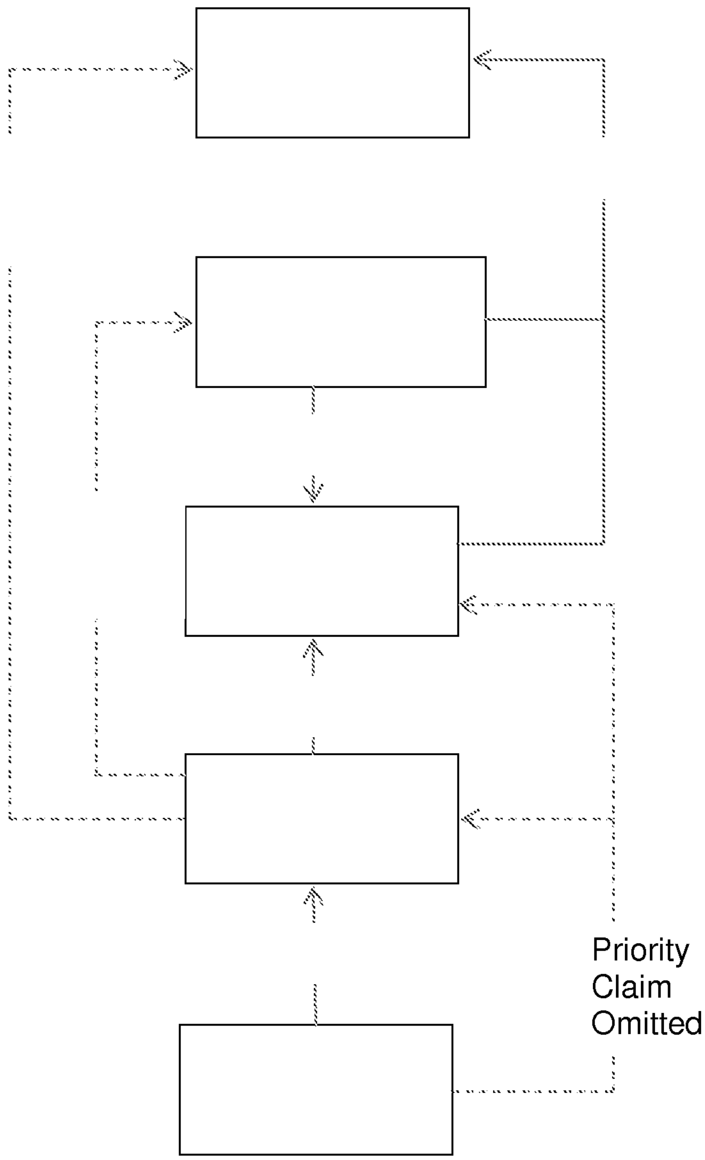
Sir:

A Petition to Accept Unintentionally Delayed Priority Claims under 37 C.F.R. §§ 1.55(c) and 1.78(a)(3) was filed on August 20, 2010. A decision on the Petition was mailed on April 05, 2011.

Please reconsider the decision in view of the following remarks.

Remarks

The Diagram below summarizes the pertinent facts, which are stated, in full, in the original petition.



Domestic Priority Claim - 37 C.F.R. §1.78(a)(3)

The decision acknowledges that the petition is correctly filed under 37 C.F.R. §1.78(a)(3), which states:

> If the reference required by 35 U.S.C. 120 and paragraph (a)(2) of this section is presented after the time period provided by paragraph (a)(2)(ii) of this

section, the claim under 35 U.S.C. 120, 121, or 365(c) for the benefit of a prior-filed copending nonprovisional application or international application designating the United States of America may be accepted if the reference identifying the prior-filed application by application number or international application number and international filing date was **unintentionally delayed**. A petition to accept an unintentionally delayed claim under 35 U.S.C. 120, 121, or 365(c) for the benefit of a prior-filed application must be accompanied by:

(i) **The reference required** by 35 U.S.C. 119(a) – (d) or 365(a) or paragraph (a)(2) of this section to the prior-filed application, unless previously submitted;

(ii) The **surcharge** set forth in § 1.17(t); and

(iii) **A statement that the entire delay** between the date the claim was due under paragraph (a)(2)(ii) of this section and the date the claim was filed **was unintentional**. The Director may require additional information where there is a question whether the delay was unintentional.

The decision states:

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

The decision interprets 1.78(a)(3)'s reference to 1.78(a)(2) as a requirement that "an accompanying amendment to the specification of the application or a supplemental application data sheet" (Decision at p. 2) is needed. More specifically, the decision cites to 1.78(a)(2)(iii), which states, "[i]f the later-filed application is a nonprovisional application, the reference required by this paragraph must be included in an application data sheet (§ 1.76), or the specification must contain or be amended to contain such reference in the first sentence(s) following the title."

It is respectfully submitted the decision interprets 1.78(a)(3) incorrectly. As explained in MPEP §1481.03:

> Where 35 U.S.C. 120 and 365(c) priority based on an international application is to be asserted or corrected in a patent via a Certificate of Correction, the following conditions must be satisfied:
>
> (A) all requirements set forth in 37 CFR 1.78(a)(1) must have been met in the application which became the patent to be corrected;
>
> (B) it must be clear from the record of the patent and the parent application(s) that priority is appropriate (see MPEP § 201.11); and
>
> (C) the patentee must submit with the request for the certificate copies of documentation showing designation of states and any other information needed to make it clear from the record that the 35 U.S.C. 120 priority is appropriate. See MPEP § 201.13(b) as to the requirements for 35 U.S.C. 120 priority based on an international application.
>
> If all the above-stated conditions are satisfied, **a Certificate of Correction can be used to amend the patent to make reference to a prior copending application**, or to correct an incorrect reference to the prior copending application. Note *In re Schuurs*, 218 USPQ 443 (Comm'r Pat. 1983) which suggests that a Certificate of Correction is an appropriate remedy for correcting, in a patent, reference to a prior copending application. Also, note *In re Lambrech*, 202 USPQ 620 (Comm'r Pat. 1976), citing *In re Van Esdonk*, 187 USPQ 671 (Comm'r Pat. 1975).

Therefore, there is no requirement for a separate paper specifying amendments to the claims. Changes to an issued patent, are made with a Certificate of Correction. Favorable reconsideration of the petition filed on August 19, 2010 is respectfully requested.

Foreign Priority Claim - 37 C.F.R. §1.55(c)

37 C.F.R. §1.55(c) provides that:

> (c) Unless such claim is accepted in accordance with the provisions of this paragraph, any claim for priority under 35 U.S.C. 119(a)-(d) or 365(a) not presented within the time period provided by paragraph (a) of this section is considered to have been waived. If a claim for priority under 35 U.S.C. 119(a)-(d) or 365(a) is presented after the time period provided by paragraph (a) of this section, the claim may be accepted if the claim identifying the prior foreign application by specifying its application number, country (or intellectual property authority), and the day, month, and year of its filing was unintentionally delayed. A petition to accept a delayed claim for priority under 35 U.S.C. 119(a)-(d) or 365(a) must be accompanied by:
>
> (1) The **claim** under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;
>
> (2) The **surcharge** set forth in § 1.17(t); and
>
> (3) A **statement that the entire delay** between the date the claim was due under paragraph (a)(1) of this section and the date the claim was filed **was unintentional**. The Director may require additional information where there is a question whether the delay was unintentional.

The decision states:

> A grantable petition under 37 CFR 1.55(c) to accept an unintentionally delayed claim for foreign priority requires the following:
>
> (1) the claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;
> (2) the surcharge as set forth in 37 CFR 1.17(t);
> (3) a statement that the entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

The decision incorrectly concludes that the petition does not comply with 1.55(c)(1), alleging MPEP §201.13 requires that "a claim for foreign priority must be contained in either an oath or declaration … or an application data sheet." (Decision at p. 3). MPEP §201.13 actually states, "[a] priority claim need not be in any special form and may be a statement signed by a registered attorney or agent. A priority claim can be made on filing: (A) by including a copy of an unexecuted or executed oath or declaration specifying a foreign priority claim (see 37 CFR 1.63(c)(2)); or (B) by submitting an application data sheet specifying a foreign priority claim (see 37 CFR 1.76)."

More importantly, the decision errs by not considering MPEP §201.16, which explains:

> … **a certificate of correction** under 35 U.S.C. 255 and 37 CFR 1.323 may be requested and issued in order to perfect a claim for foreign priority benefit in a patented continuing application if the requirements of 35 U.S.C. 119(a)-(d) or (f) had been satisfied in the parent application prior to issuance of the patent and the requirements of 37 CFR 1.55(a) are met. Furthermore, if the continuing application (other than a design application), which issued as a patent, was filed on or after November 29, 2000 **, in addition to the filing of a certificate of correction request, patentee must also file **a petition for an unintentionally delayed foreign priority claim under 37 CFR 1.55(c).**

Therefore, in the present situation, the request for certificate of correction that accompanied the petition was appropriate. Favorable reconsideration of the petition filed on August 19, 2010 is respectfully requested.

<u>Telephonic Interview</u>

A telephonic interview occurred on April 5, 2011 between Mr. Richard M. Ross, Attorney Advisor, Office of PCT Legal Administration and the undersigned representative, regarding an almost identical petition decision mailed March 31, 2011, regarding U.S. Patent No. 7,181,047. Mr. Ross suggested attaching a normally formatted specification amendment to facilitate reconsideration. Such an amendment is attached.

Please note that the attached amendment only includes corrections to the cover page of the patent. The Request for Certificate of Correction also specifies a number of corrections to the claims. Please enter a Certificate of Correction for the corrections to the claims.

Fee Authorization

The Director is hereby authorized to charge any deficiency in fees filed, asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account 14-1437. Please credit any excess fees to such account.

Respectfully submitted,
NOVAK DRUCE + QUIGG, LLP

/Michael P. Byrne/

Date: May 20, 2011

Michael P. Byrne, Reg. No. 54,015
300 New Jersey Ave, NW
5th Floor
Washington, D.C. 20001
Phone: (202) 659-0100
Fax: (202) 659-0105

Enclosure: “AMENDMENT” TO FACILITATE RECONSIDERATION OF PETITION DECISION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Pirim	Docket No.:	8042-2-1
Application No.:	11/676,926	Examiner:	Seth MANAV
Patent No.:	7,650,015	Art Unit:	2624
Filed:	02-20-2007	Confirmation No.:	9051

For: IMAGE PROCESSING METHOD

Mail Stop PCT,
Commissioner for Patents,
Office of PCT Legal Administration
P.O. Box 1450
Alexandria, Virginia 22313-1450

"AMENDMENT" TO FACILITATE RECONSIDERATION OF PETITION DECISION

Sir:

Please enter and consider the following amendments and remarks.

Amendments to the Specification

To the first page of the patent, below the Prior Publication Data section, please add the following secions:

Related U.S. Application Data

(63) Divisional of application No. 09/792,294, filed on Feb. 23, 2001, now Pat. No. 7,181,047, which is a continuation-in-part of application No. 09/230,502, filed on Sept. 13, 1999, now Pat. No. 6,486,909, which is a national stage of PCT/FR97/01354, filed on Jul. 22, 1997.

Foreign Application Priority Data

Jul. 26, 1996 (FR) ....96 09420.

Please replace the paragraph at column 1, lines 6 – 12 with the following paragraph:

The present application claims the priority as a divisional of U.S. application Ser. No. 09/792,294, filed Feb. 23, 2001, now U.S. Pat. No. 7,181,047[[;]], which claims priority as a continuation-in-part to U.S. application Ser. No. 09/230,502, filed Jan. 26, 1999, now U.S. Pat. No. 6,486,909, which is a national stage of International Application No. PCT/FR97/01354, filed Jul. 22, 1997; U.S. Application Ser. No. 09/792,294 also ~~which~~ claims priority as a continuation-in-part to International Application No. PCT/EP98/05383, filed Aug. 25, 1998; all of which are incorporated herein by reference in their entirety.

Remarks

This paper should not be required, because it is duplicative of corrections presented in the Request for Certificate of Correction filed on August 20, 2010. It is being submitted merely to expedite reconsideration of the Petition to Accept Unintentionally Delayed Priority Claims under 37 C.F.R. §§ 1.55(c) and 1.78(a)(3) filed on August 20, 2010 and denied on April 5, 2011.

Fee Authorization

The Director is hereby authorized to charge any deficiency in fees filed, asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account 14-1437. Please credit any excess fees to such account.

Respectfully submitted,
NOVAK DRUCE + QUIGG, LLP

/Michael P. Byrne/

Date: May 20, 2011

Michael P. Byrne, Reg. No. 54,015
300 New Jersey Ave, NW
5th Floor
Washington, D.C. 20001
Phone: (202) 659-0100
Fax: (202) 659-0105

Electronic Acknowledgement Receipt

EFS ID:	10136024
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	86002
Filer:	Michael P. Byrne/Lorraine Quiles
Filer Authorized By:	Michael P. Byrne
Attorney Docket Number:	8042-2-1
Receipt Date:	20-MAY-2011
Filing Date:	20-FEB-2007
Time Stamp:	15:27:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition for review by the Office of Petitions.	RequestforReconsideration.pdf	90799 ebafa297433000397196dd4074d49eebf9d210cd	no	10

Warnings:

Information:

Total Files Size (in bytes):	90799

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,650,015 B2
APPLICATION NO. : 11/676926
DATED : January 19, 2010
INVENTOR(S) : Patrick Pirim

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

To the Title page of the patent, below the Prior Publication Data section, please add the following sections:

--Related U.S. Application Data

(63) Divisional of application No. 09/792,294, filed on Feb. 23, 2001, now Pat. No. 7,181,047, which is a continuation-in-part of application No. 09/230,502, filed on Sept. 13, 1999, now Pat. No. 6,486,909, which is a national stage of PCT/FR97/01354, filed on Jul. 22, 1997.

(30) Foreign Application Priority Data

Jul. 26, 1996 (FR) ....96 09420--.

Column 1, in the Cross-Reference to Related Applications Section, please replace the entire first paragraph (lines 6-12) with the following:

--The present application claims the priority as a divisional of U.S. Application Ser. No. 09/792,294, filed Feb. 23, 2001, now U.S. Pat. No. 7,181,047, which claims priority as a continuation-in-part to U.S. Application Ser. No. 09/230,502, filed Jan. 26, 1999, now U.S. Pat. No. 6,486,909, which is a national stage of International Application No. PCT/FR97/01354, filed Jul. 22, 1997; U.S. Application Ser. No. 09/792,294 also claims priority as a continuation-in-part to International Application No. PCT/EP98/05383, filed Aug. 25, 1998; all of which are incorporated herein by reference in their entirety. --

Column 26, lines 42-43, please begin “on a frame-by-frame basis:” on a new line; lines 44-57, please further indent each paragraph; line 49, please delete the “,” in “input signal, in” to read --input signal in--; line 67, please replace “and calculate an” with --and calculating an--

Column 27, line 19, please change the “,” to a “;” after “target,” to read --target;--; line 20, please change the “,” to a “;” after “histogram,” to read --histogram;--; line 20, please change the “,” to a “;” after “target,” to read --target;--.

Signed and Sealed this
Tenth Day of May, 2011

David J. Kappos
Director of the United States Patent and Trademark Office

Column 28, lines 19-20, please replace “and calculate an” with --and calculating an--.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Gregory A. Nelson
Novak Druce & Quigg LLP
525 Okeechobee Blvd
Suite 1500
West Palm Beach FL 33401

MAILED

APR 05 2011

PCT LEGAL ADMINISTRATION

In re Application of: PIRIM, Patrick. :
U.S. Application No.: 11/676,926 :
U.S. Patent No.: 7,650,015 :
Filing Date: February 20, 2007 :
Attorney's Docket No.: 8042-2-1 :
For: IMAGE PROCESSING METHOD :

DECISION ON PETITIONS UNDER 37 CFR 1.78(a)(3) AND 1.55(c))

This decision is issued in response to "PETITION TO ACCEPT UNINTENTIONALLY DELAYED PRIORITY CLAIMS UNDER 37 CFR §§ 1.78(a)(3) and 1.55(c)" filed August 20, 2010. The petition under 37 CFR 1.78(a)(3) seeks to correct the domestic priority claim in the above-captioned patent to identify the patent as a divisional of U.S. application number 09/792,294, which is a continuation-in-part (CIP) of US. Application number 09/230,502, which is the national stage under 35 U.S.C. 371 of PCT/FR97/01354. The petition under 37 CFR 1.55(c) seeks to add an unintentionally delayed claim of foreign priority to French application FR 9609420.

For the reasons set forth below, the petitions are **DISMISSED** without prejudice.

1. <u>37 CFR 1.78(a)(3)</u>

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the corrected benefit claim under 35 U.S.C. 120 is submitted after the expiration of the time period specified in 37 CFR 1.78(a)(2)(ii). Under the circumstances present here, the petition is properly considered under 37 CFR 1.78(a)(3). <u>See</u> MPEP section 1481.03.

A grantable petition under 37 CFR 1.78(a)(3) must be accompanied by the following:

(1) the reference required by 35 U.S.C. 120 and 37 CFR 1.78(a)(2)(i) to the prior-filed application, unless previously submitted;
(2) the surcharge set forth in 37 CFR 1.17(t); and
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional.

The present petition fails to comply with item (1) above.

37 CFR 1.78(a)(2)(iii) states that the required reference to the prior-filed application(s) "must be included in an application data sheet (37 CFR 1.76) or the specification must be amended to contain such reference in the first sentence(s) following the title." Petitioner here has filed a Certificate of Correction setting forth the corrected reference to the prior-filed applications; however, petitioner did not include an accompanying amendment to the specification of the application or a supplemental application data sheet. Accordingly, petitioner has not provided the reference to the prior-filed applications in the form required by 37 CFR 1.78.

In addition, it would not be appropriate to grant the petition at this time since the petition under 37 CFR 1.78(a)(3) in parent application number 09/792,294 has not been granted and, as such, the claimed chain of continuity has not been established.

Based on the above, the petition under 37 CFR 1.78(a)(3) may not be granted on the present record.

2. <u>37 CFR 1.55(c)</u>

The above-captioned U.S. patent issued from an application filed after November 29, 2000, and the foreign priority claim under 35 U.S.C. 119(a)-(d) or 365(a) directed to French application number FR 9609420 was not submitted prior to the expiration of the time period specified in 37 CFR 1.55(a)(1). Accordingly, this is an appropriate petition under the provisions of 37 CFR 1.55(c).[1]

A grantable petition under 37 CFR 1.55(c) to accept an unintentionally delayed claim for foreign priority requires the following:

(1) the claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;
(2) the surcharge as set forth in 37 CFR 1.17(t);
(3) a statement that the entire delay between the date the claim was due under 37 CFR 1.55(a)(1) and the date the claim was filed was unintentional.

[1] As noted in the present petition, pursuant to MPEP section 201.16, a certificate of correction accompanied by a grantable petition under 37 CFR 1.55(c) is permissible for adding an unintentionally delayed foreign priority claim to an issued patent where the foreign priority claim to be added was perfected in a parent application prior to the issuance of the patent.

The present petition fails to comply with item (1) above.

Pursuant to MPEP section 201.13, a claim for foreign priority must be contained in either an oath or declaration (37 CFR 1.63(c)(2)) or an application data sheet (37 CFR 1.76). Petitioner here has filed a Certificate of Correction setting forth the foreign priority claim; however, petitioner did not include an accompanying oath or declaration or a supplemental application data sheet containing such claim. Accordingly, petitioner has not submitted the foreign priority claim in an acceptable form.

In addition, it would not be appropriate to grant the petition at this time since the petition under 37 CFR 1.55(c) in parent application number 09/792,294 has not been granted and, as such, the foreign priority claim to be added has not been perfected in the parent case.

Based on the above, applicants have failed to satisfy the requirements for a grantable petition under 37 CFR 1.55(c) for acceptance of an unintentionally delayed foreign benefit claim.

CONCLUSION

For the reasons set forth above, the petitions under 37 CFR 1.78(a)(3) and 1.55(c) are **DISMISSED** without prejudice.

Any further correspondence with respect to this matter may be filed electronically via EFS-Web selecting the document description "Petition for review and processing by the PCT Legal Office" or by mail addressed to Mail Stop PCT, Commissioner for Patents, Office of PCT Legal Administration, P.O. Box 1450, Alexandria, Virginia 22313-1450, with the contents of the letter marked to the attention of the Office of PCT Legal Administration.

/George Dombroske/
George Dombroske
PCT Legal Examiner
Office of PCT Legal Administration
Telephone: (571) 272-3283

/Boris Milef/
Boris Milef
PCT Legal Examiner
Office of PCT Legal Administration

SPE RESPONSE FOR CERTIFICATE OF CORRECTION

Paper No.: ______

DATE : 9/2/10

TO SPE OF : ART UNIT 2624

SUBJECT : Request for Certificate of Correction for Appl. No.: 11/676926 Patent No.: 7650015 B2

Please respond to this request for a certificate of correction within 7 days.

FOR IFW FILES:

Please review the requested changes/corrections as shown in the **COCIN** document(s) in the IFW application image. No new matter should be introduced, nor should the scope or meaning of the claims be changed.

Please complete the response (see below) and forward the completed response to scanning using document code **COCX**.

FOR PAPER FILES:

Please review the requested changes/corrections as shown in the attached certificate of correction. Please complete this form (see below) and forward it with the file to:

Certificates of Correction Branch (CofC)
Randolph Square – 9D10-A
Palm Location 7580

Virginia Tolbert
Certificates of Correction Branch
571-272-0460

Thank You For Your Assistance

The request for issuing the above-identified correction(s) is hereby:
Note your decision on the appropriate box.

- ☐ **Approved** — **All** changes apply.
- ☐ **Approved in Part** — Specify below which changes **do not** apply.
- ☐ **Denied** — State the reasons for denial below.

Comments: ______________________________

____

____

____

____

SPE RESPONSE FOR CERTIFICATE OF CORRECTION

Paper No.: ______

DATE : 9/2/10

TO SPE OF : ART UNIT 2624

SUBJECT : Request for Certificate of Correction for Appl. No.: 11/676926 Patent No.: 7650015 B2

Please respond to this request for a certificate of correction within 7 days.

FOR IFW FILES:

Please review the requested changes/corrections as shown in the **COCIN** document(s) in the IFW application image. No new matter should be introduced, nor should the scope or meaning of the claims be changed.

Please complete the response (see below) and forward the completed response to scanning using document code **COCX**.

FOR PAPER FILES:

Please review the requested changes/corrections as shown in the attached certificate of correction. Please complete this form (see below) and forward it with the file to:

Certificates of Correction Branch (CofC)
Randolph Square – 9D10-A
Palm Location 7580

Virginia Tolbert
Certificates of Correction Branch
571-272-0460

Thank You For Your Assistance

The request for issuing the above-identified correction(s) is hereby:
Note your decision on the appropriate box.

- ☑ **Approved** — All changes apply.
- ☐ **Approved in Part** — Specify below which changes **do not** apply.
- ☐ **Denied** — State the reasons for denial below.

Comments: All Corrections have been approved.

VIKKRAM BALI 2624

PTOL-306 (REV. 7/03) U.S. DEPARTMENT OF COMMERCE Patent and Trademark Office

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Application of	PIRIM	Confirmation No.	9051
Patent No.	7,650,015 B2	Group:	2624
Issue Date:	January 19, 2010	Examiner:	SETH, MANAV
Application No.	11/676,926	Docket No.	8042-2-1
Filing Date:	February 20, 2007		

For: IMAGE PROCESSING METHOD

PETITION TO ACCEPT UNINTENTIONALLY DELAYED PRIORITY CLAIMS UNDER 37 CFR §§ 1.78(a)(3) and 1.55(c)

ATTN: Petitions Office
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir or Madam:

Patent Owner hereby petitions (I) under 37 CFR § 1.78(a)(3) to request acceptance of unintentionally delayed domestic priority claims under 35 U.S.C. §§ 120 and 365(c) for the benefit of prior-filed co-pending non-provisional applications and international applications designating the United States; and (II) under 37 CFR § 1.55(c) to request acceptance of an unintentionally delayed foreign priority claim under 35 U.S.C. § 119(a)-(d) for the benefit of a prior-filed foreign application.

PERTINENT FACTS

1. U.S. Patent Application No. 09/230,502 (entitled "Image Processing Apparatus and method") was filed on September 13, 1999 and issued as U.S. Patent No. 6,486,909.

a. U.S. Patent No. 6,486,909 is the § 371 national stage of international application No. PCT/FR97/01354, filed on July 22, 1997. Patrick Pirim is the inventor for both PCT/FR97/01354 and U.S. Patent No. 6,486,909.

   i. International Application No. PCT/FR97/01354 claims priority to French Patent Application No. FR 96 09420, filed in France on July 26, 1996.

b. U.S. Patent No. 6,486,909 also claims priority to French Patent Application No. FR 96 09420, filed in France on July 26, 1996.

c. The priority and relationship to PCT/FR97/01354 and FR 96 09420 are recited on the face of U.S. Patent No. 6,486,909.

2. U.S. Patent Application No. 09/792,294 (entitled "Methods and Apparatus for Identifying and Localizing an Area of Relative Movement in a Scene") was filed on February 23, 2001 and issued as U.S. Patent No. 7,181,047.

   a. U.S. Patent No. 7,181,047 claims priority as a continuation-in-part to U.S. Patent Application No. 09/230,502, filed on September 13, 1999, now U.S. Patent No. 6,486,909.

   b. A Petition to Accept Unintentionally Delayed Priority Claim and Request for Certificate of Correction has been filed for U.S. Patent No. 7,181,047 to perfect priority claims to International Application No. PCT/FR97/01354 and French Patent Application No. FR 96 09420.

3. U.S. Patent Application No. 11/676,926, the application for the above-referenced patent, was filed on February 20, 2007 and issued as the above-referenced patent, U.S. Patent No. 7,650,015.

a. The first paragraph of the specification in U.S. Patent No. 7,650,015 states: "The present application claims the priority of U.S. application Ser. No. 09/792,294, filed Feb. 23, 2001, now U.S. Pat. No. 7,181,047; which claims priority to U.S. application Ser. No. 09/230,502, filed Jan. 26, 1999, now U.S. Pat. No. 6,486,909; which claims priority to International Application No. PCT/EP98/05383, filed Aug. 25, 1998; all of which are incorporated herein by reference in their entirety."

b. Applicant attempted to correct and clarify priority claims in a Request for Corrected Filing Receipt filed on August 27, 2007, which states: "As noted in the Official Filing Receipt, the instant application is a divisional of US 09/792,294. The '294 application claims priority to two applications: it is a §371 national phase application of PCT/EP98/05383 and a CIP application of US 09/230,502. The '502 application is a §371 national phase application of PCT/FR97/01354, which claims the priority benefit of FR 96/09420."

4. In U.S. Patent No. 7,650,015, a priority claim to U.S. Patent Application No. 09/792,294, filed February 23, 2001, now U.S. Patent No. 7,181,047 was unintentionally omitted.

5. In U.S. Patent No. 7,650,015, a priority claim to U.S. Patent Application No. 09/230,502, filed September 13, 1999, now U.S. Patent No. 6,486,909 was unintentionally omitted.

6. In U.S. Patent No. 7,650,015, a priority claim to International Application No. PCT/EP98/05383 was unintentionally omitted.

7. In U.S. Patent No. 7,650,015, a priority claim to International Application No. PCT/FR97/01354 was unintentionally omitted.

8. In U.S. Patent No. 7,650,015, a priority claim to French Patent Application No. FR 96 09420 was unintentionally omitted.

9. Patent owner has acted diligently and without delay from the time the errors in Facts 4-8 were discovered to the filing of the present Petition.

10. A Request for Certificate of Correction of U.S. Patent No. 7,650,015, together with supporting documentation, has been filed concurrently:

    a. The Request for Certificate of Correction requests to perfect the unintentionally delayed claims for domestic priority under 35 U.S.C. § 255, 37 CFR § 1.323 and MPEP § 1481.03 because the requirements of 37 CFR § 1.78(a)(1) and MPEP § 1481.03 have been met

    b. The Request for Certificate of Correction also requests to perfect the unintentionally delayed claim for foreign priority under 35 U.S.C. § 255, 37 CFR § 1.323 and MPEP § 201.16 because the requirements of 35 U.S.C. 119(a)-(d) or (f) had been satisfied in the parent application prior to issuance of the patent and the requirements of 37 CFR 1.55(a) were met.

DISCUSSION

I. UNINTENTIONALLY DELAYED DOMESTIC PRIORITY CLAIMS

A. Authority For Unintentional Delay In Claiming the Benefit of Prior-Filed Co-Pending Non-Provisional Applications and International Applications Designating the U.S. Under 35 USC §§ 120 and 365(c) In The Above-Referenced Patent

37 CFR § 1.78(a)(3) provides that:

> (3) If the reference required by 35 U.S.C. 120 and paragraph (a)(2) of this section is presented after the time period provided by paragraph (a)(2)(ii) of this section, the claim under 35 U.S.C. 120, 121, or 365(c) for the benefit of a prior-filed copending nonprovisional application or international application designating the United States of America may be accepted if the reference identifying the prior-filed application by application number or international application number and international filing date was unintentionally delayed. A petition to accept an unintentionally delayed claim under 35 U.S.C. 120, 121, or 365(c) for the benefit of a prior-filed application must be accompanied by:

(i) The reference required by 35 U.S.C. 120 and paragraph (a)(2) of this section to the prior-filed application, unless previously submitted;
(ii) The surcharge set forth in § 1.17(t); and
(iii) A statement that the entire delay between the date the claim was due under paragraph (a)(2)(ii) of this section and the date the claim was filed was unintentional. The Director may require additional information where there is a question whether the delay was unintentional.

MPEP § 1481.03 provides that:

Where priority is based upon 35 U.S.C. 120 to **a national application**, the following conditions must be satisfied:
(A) all requirements set forth in 37 CFR 1.78(a)(1) must have been met in the application which became the patent to be corrected;
(B) it must be clear from the record of the patent and the parent application(s) that priority is appropriate (see MPEP § 201.11); and
(C) a grantable petition to accept an unintentionally delayed claim for the benefit of a prior application must be filed, including a surcharge as set forth in 37 CFR 1.17(t), as required by 37 CFR 1.78(a)(3).
Where 35 U.S.C. 120 and 365(c) priority based on **an international application** is to be asserted or corrected in a patent via a Certificate of Correction, the following conditions must be satisfied:
(A) all requirements set forth in 37 CFR 1.78(a)(1) must have been met in the application which became the patent to be corrected;
(B) it must be clear from the record of the patent and the parent application(s) that priority is appropriate (see MPEP § 201.11);
(C) the patentee must submit together with the request for the certificate, copies of documentation showing designation of states and any other information needed to make it clear from the record that the 35 U.S.C. 120 priority is appropriate (see MPEP § 201.13(b) as to the requirements for 35 U.S.C. 120 priority based on an international application; and
(D) a grantable petition to accept an unintentionally delayed claim for the benefit of a prior application must be filed, including a surcharge as set forth in 37 CFR 1.17(t), as required by 37 CFR 1.78(a)(3).
If all the above-stated conditions are satisfied, a Certificate of Correction can be used to amend the patent to make reference to a prior copending application, or to correct an incorrect reference to the prior copending application, for benefit claims under 35 U.S.C. 120 and 365(c).

B. Claim Under 35 U.S.C. §§ 120 or 120 and 365(c) and Surcharge Set Forth In 37 CFR § 1.17

Patent Owner respectfully requests acceptance of unintentionally delayed priority claims under 35 U.S.C. § 120 as a divisional of application No. 09/792,294, filed Feb. 23, 2001, now

U.S. Pat. No. 7,181,047, which claims priority to application No. 09/230,502, filed Jan. 26, 1999, now U.S. Pat. No. 6,486,909; and unintentionally delayed priority claims under 35 U.S.C. §§ 120 and 365(c) to international application Nos. PCT/FR97/01354, filed on July 22, 1997 and designating the United States of America and PCT/EP98/05383, filed on August 25, 1998 and designating the United States of America. In accordance with MPEP § 1481.03, all requirements set forth in 37 CFR 1.78(a)(1) have been met in the application for U.S. Patent No. 7,650,015; it is clear from the record of U.S. Patent No. 7,650,015 and its parent applications that priority is appropriate; and the patent owner submitted the required documentation with the Request for Certificate of Correction. *See* Facts 1-3 and 10.

Credit card payment in the amount of $1410.00 accompanies this Request. Please charge any necessary fee or credit any overpayment pursuant to 37 CFR § 1.17 to Deposit Account No. 14-1437.

C. Statement Regarding Unintentional Delay

The entire delay between the date the claim was due under paragraph (a)(2)(ii) of 37 CFR §1.78 and the date the claim was filed was unintentional.

II. UNINTENTIONALLY DELAYED FOREIGN PRIORITY CLAIM

A. Authority For Unintentional Delay In Claiming the Benefit of A Prior-Filed Foreign Application Under 35 USC § 119(a)-(d) In The Above-Referenced Patent

37 CFR § 1.55(c) provides that:

> (c) Unless such claim is accepted in accordance with the provisions of this paragraph, any claim for priority under 35 U.S.C. 119(a)-(d) or 365(a) not presented within the time period provided by paragraph (a) of this section is considered to have been waived. If a claim for priority under 35 U.S.C. 119(a)-(d) or 365(a) is presented after the time period provided by paragraph (a) of this section, the claim may be accepted if the claim identifying the prior foreign application by specifying its application number, country (or intellectual property

authority), and the day, month, and year of its filing was unintentionally delayed. A petition to accept a delayed claim for priority under 35 U.S.C. 119(a)-(d) or 365(a) must be accompanied by:
(1) The claim under 35 U.S.C. 119(a)-(d) or 365(a) and this section to the prior foreign application, unless previously submitted;
(2) The surcharge set forth in § 1.17(t); and
(3) A statement that the entire delay between the date the claim was due under paragraph (a)(1) of this section and the date the claim was filed was unintentional. The Director may require additional information where there is a question whether the delay was unintentional.

MPEP 201.16 provides that:

> In summary, a certificate of correction under 35 U.S.C. 255 and 37 CFR 1.323 may be requested and issued in order to perfect a claim for foreign priority benefit in a patented continuing application if the requirements of 35 U.S.C. 119(a)-(d) or (f) had been satisfied in the parent application prior to issuance of the patent and the requirements of 37 CFR 1.55(a) are met. Furthermore, if the continuing application (other than a design application), which issued as a patent, was filed on or after November 29, 2000 **, in addition to the filing of a certificate of correction request, patentee must also file a petition for an unintentionally delayed foreign priority claim under 37 CFR 1.55(c).

B. Claim Under 35 U.S.C. § 119(a)-(d) and Surcharge Set Forth In 37 CFR § 1.17

Patent Owner respectfully requests acceptance of an unintentionally delayed foreign priority claim under 35 U.S.C. § 119(a)-(d) to French Patent Application No. FR 96 09420, filed in France on July 26, 1996. In accordance with MPEP § 201.16, the requested foreign priority claim was perfected in a parent application. *See* Facts 1-3.

Please charge any necessary fee or credit any overpayment pursuant to 37 CFR § 1.17 to Deposit Account No. 14-1437.

C. Statement Regarding Unintentional Delay

The entire delay between the date the claim was due under paragraph (a)(1) of 37 CFR §1.55 and the date the claim was filed was unintentional.

CONCLUSION

The grant of the present Petition to accept the unintentionally delayed priority claims under 35 USC §§ 119(a)-(d), 120 and 365(c) is respectfully requested. In the event that the Office requires additional information regarding this Petition or the patent otherwise, please contact the undersigned representative Karen Kline (direct line: 561-847-7814).

Respectfully submitted,

NOVAK DRUCE + QUIGG LLP

Date: August 19, 2010

/Gregory A. Nelson/

Gregory A. Nelson, Reg. No. 30,577
Karen C. Kline, Reg. No. 59,907
525 Okeechobee Blvd., 15th Floor
West Palm Beach, FL 33401
Tel: 561-847-7800
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Electronic Patent Application Fee Transmittal

Application Number:	11676926
Filing Date:	20-Feb-2007
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Filer:	Gregory A. Nelson/TJ FATUM
Attorney Docket Number:	8042-2-1

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Priority accept. unintent. delayed claim	1454	1	1410	1410
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Certificate of correction	1811	1	100	100

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1510**

Electronic Acknowledgement Receipt

EFS ID:	8256662
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	86002
Filer:	Gregory A. Nelson/TJ FATUM
Filer Authorized By:	Gregory A. Nelson
Attorney Docket Number:	8042-2-1
Receipt Date:	20-AUG-2010
Filing Date:	20-FEB-2007
Time Stamp:	12:41:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1510
RAM confirmation Number	6046
Deposit Account	141437
Authorized User	KLINE,KAREN

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		8042-2-1_COC_081910.pdf	22875704 8ca4bed295c82c232c8fda1167a0599c58a4292a	yes	164

Multipart Description/PDF files in .zip description

Document Description	Start	End
Request for Certificate of Correction	1	154
Request for Certificate of Correction	155	156
Petition for review by the Office of Petitions.	157	164

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (PTO-875)	fee-info.pdf	31704 c2fb8643ffe59325d6f29a104a31c3ba637883ee	no	2

Warnings:

Information:

Total Files Size (in bytes): 22907408

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Application of	PIRIM	Confirmation No.	9051
Patent No.	7,650,015 B2	Group:	2624
Issue Date:	January 19, 2010	Examiner:	SETH, MANAV
Application No.	11/676,926	Docket No.	8042-2-1
Filing Date:	February 20, 2007		

For: IMAGE PROCESSING METHOD

REQUEST FOR CERTIFICATE OF CORRECTION

ATTN: Certificate of Corrections Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir or Madam:

On behalf of Image Processing Technologies LLC, the assignee of record, the undersigned hereby requests that a Certificate of Correction pursuant to 37 C.F.R. § 1.323 be issued on the above-entitled patent. The corrections are indicated in appropriate form on attached Form PTO/SB/44.

The requested corrections either (i) relate to perfecting delayed priority claims which were imperfectly submitted by applicant; or (ii) relate to typographical errors which were made by the applicant. All of the requested corrections do not constitute new matter, do not affect the scope of any claim and do not require reexamination.

With respect to the requested correction for priority claims, 37 CFR 1.78 states:

(2)(i) Except for a continued prosecution application filed under § 1.53(d), any nonprovisional application or international application designating the United States of America claiming the benefit of one or more prior-filed copending nonprovisional applications or international applications designating the United States of America must contain or be amended to contain a reference to each such prior-filed application, identifying it by application number (consisting of the series code and serial number) or international application number and international filing date and indicating the relationship of the applications. Cross references to other related applications may be made when appropriate (see § 1.14).

* * *

(iii) If the later-filed application is a nonprovisional application, the reference required by this paragraph must be included in an application data sheet (§ 1.76), or the specification must contain or be amended to contain such reference in the first sentence(s) following the title.

* * *

(3) If the reference required by 35 U.S.C. 120 and paragraph (a)(2) of this section is presented after the time period provided by paragraph (a)(2)(ii) of this section, the claim under 35 U.S.C. 120, 121, or 365(c) for the benefit of a prior-filed copending nonprovisional application or international application designating the United States of America may be accepted if the reference identifying the prior-filed application by application number or international application number and international filing date was unintentionally delayed. A petition to accept an unintentionally delayed claim under 35 U.S.C. 120, 121, or 365(c) for the benefit of a prior-filed application must be accompanied by:

(i) The reference required by 35 U.S.C. 120 and paragraph (a)(2) of this section to the prior-filed application, unless previously submitted;

(ii) The surcharge set forth in § 1.17(t); and

(iii) A statement that the entire delay between the date the claim was due under paragraph (a)(2)(ii) of this section and the date the claim was filed was unintentional. The Director may require additional information where there is a question whether the delay was unintentional.

Applicant included references to priority claims to the applications for U.S Patent No. 7,181,047 and U.S. Patent No. 6,486,909 and International Application No. PCT/EP98/05383 in the Application Data Sheet and Preliminary Amendment filed on February 20, 2007, but did not indicate the relationship of the applications. In the Request for Corrected Filing Receipt filed on August 27, 2007, applicant further identified International Application No. PCT/FR97/01354 and French Application No. FR 96 09420 and clarified the relationships of the applications. In the Corrected Filing Receipt mailed on April 22, 2008, the USPTO acknowledged the following:

Domestic Priority data as claimed by applicant
This application is a DIV of 09/792,29402/23/2001 PAT 7,181,047
which is a CIP of 09/230,502 09/13/1999 PAT 6,486,909
which is a 371 of PCT/FR97/01354 07122/1997
Foreign Applications
EUROPEAN PATENT OFFICE (EPO) PCT/EP98/05383 08125/1998
FRANCE 96 09420 07/26/1996

Assignee notes that PCT/FR97/01354 and PCT/EP98/05383 are international applications, each designating the United States and identifying Patrick Pirim as the inventor. Subsequently, the Bibliographic Data Sheet dated December 1, 2009, lists no applications under Continuing Data or Foreign Applications and indicates that Foreign Priority was claimed but the conditions of 35 USC 119(a)-(d) had not been met. A copy of the cited documents is filed herewith. As the record indicates, applicant attempted to claim priority to the applications for U.S Patent No. 7,181,047 and U.S. Patent No. 6,486,909, International Application Nos. PCT/FR97/01354 and PCT/EP98/05383, and French Application No. FR 96 09420.

Assignee submits that the requirements set forth in 37 CFR § 1.78(a)(1) are met in U.S. Patent No. 7,650,015, but that the references required by 35 U.S.C. § 120 and 37 CFR § 1.78(a)(2) were unintentionally delayed. Assignee also submits that the requirements set forth in MPEP § 1481.03 have been met in; therefore a Certificate of Correction is a valid means for amending U.S. Patent No. 7,650,015 to include the delayed priority claims to the applications for U.S Patent No. 7,181,047 and U.S. Patent No. 6,486,909 and International Application Nos. PCT/FR97/01354 and PCT/EP98/05383. *See* MPEP § 1481.03.

Additionally, a petition for unintentionally delayed priority claims under 37 CFR 1.78(a)(3) is filed herewith.

With respect to the requested correction for the delayed foreign priority claim to FR 96 09420, MPEP § 201.16 states: "a certificate of correction under 35 U.S.C. 255 and 37 CFR 1.323

may be requested and issued in order to perfect a claim for foreign priority benefit in a patented continuing application if the requirements of 35 USC 119(a)-(d) or (f) had been satisfied in the parent application prior to the issuance of the patent and the requirements of 37 CFR 1.55(a) are met." MPEP § 201.16. Such a delayed claim "constitutes in essence a mere affirmation of the applicant's previously expressed desire to receive benefits under 35 U.S.C. 119(a)-(d) or (f)." *Id.*

U.S. Patent No. 7,650,015 is a divisional of U.S. Patent No. 7,181,047, which is a continuation-in-part of U.S. application no. 09/230,502, filed on September 13, 1999, now U.S. Patent No. 6,486,909 (hereinafter, "Parent Application"). Assignee notes that the Parent Application is a national stage of International Application No. PCT/FR97/01354, which claims priority to FR 96 09420. As noted above, applicant attempted to claim domestic priority claim to the Parent Application during prosecution of the application for U.S. Patent No. 7,650,015 and Assignee now submits a request to perfect the delayed claim. Additionally, Assignee submits that the priority claim to FR 96 09420 was perfected in the Parent Application and the priority claim to FR 96 09420 is identified on the first page of the issued patent for the Parent Application. A copy of the first page of U.S. Patent No. 6,486,909 is filed herewith. The requirements of 35 USC § 119(a)-(d) or (f) had been satisfied in U.S. Patent No. 6,486,909 prior to the issuance of the patent and the requirements of 37 CFR § 1.55(a) are met; therefore a Certificate of Correction is a valid means for amending U.S. Patent No. 7,650,015 to include the delayed foreign priority claim. *See* MPEP § 201.16.

Additionally, a petition for an unintentionally delayed foreign priority claim under 37 CFR 1.55(c) is filed herewith.

For the foregoing reasons, it is respectfully requested that the Commissioner issue a Certificate of Correction making the aforementioned requested corrections. Please contact the undersigned if clarification is required.

Credit card payment in the amount of $100.00 accompanies this Request. Although no additional fees are believed to be due, the Commissioner for Patents is hereby authorized to charge any underpayment in fees to Deposit Account No. 14-1437. In the event that the Office requires additional information regarding this Request, please contact the undersigned representative Karen Kline (direct line: 561-847-7814).

Respectfully submitted,

NOVAK DRUCE + QUIGG LLP

Date: August 19, 2010

/Gregory A. Nelson/

Gregory A. Nelson, Reg. No. 30,577
Karen C. Kline, Reg. No. 59,907
525 Okeechobee Blvd., 15th Floor
West Palm Beach, FL 33401
Tel: 561-847-7800
Fax: 561-847-7801

CITED DOCUMENTS

APPLICATION DATA SHEET

(1) Applicant Information

Inventor (1) name:	PIRIM, Patrick
Residence:	Paris, France
Mailing Address:	56 Rue Patay, Paris 75013, France
Citizenship:	France

(2) Correspondence Information

Correspondence Address: ***30448***

(3) Application Information

Title:	IMAGE PROCESSING METHOD
Total No. of Drawing Sheets:	13
Suggested Figure for Publication:	14
Attorney Docket Number:	8042-2-1
Type of Application:	Non-Provisional

(4) Representative Information

Representative Information: ***30448***
Gregory M. Lefkowitz, Registration No. 56,216
AKERMAN SENTERFITT
P.O. Box 3188
West Palm Beach, FL 33402-3188
Telephone: (561) 653 5000

(5) Domestic Priority Information

U.S. Application No. 09/792,294, filed February 23, 2001, now US Patent No. 7,181,047;
US Application No. 09/230,502, filed January 26, 1999, now US Patent No. 6,486,909

(6) Foreign Priority Information

International Application No. PCT/EP98/05383, filed August 25, 1998

{WP372965;1}

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of PIRIM

Application No. Examiner:

Date Filed: February 20, 2007 Group Art Unit:

For: IMAGE PROCESSING APPARATUS AND METHOD

PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Prior to examination on the merits, entry of the following amendments is respectfully requested.

Amendments to the Specification begin on page 2.

Amendments to the Claims appear in the Claim Listing which begins on page 3.

Remarks begin on page 6.

AMENDMENTS TO THE SPECIFICATION

On page 1, the title of the invention:

IMAGE PROCESSING ~~APPARATUS AND~~ METHOD

On page 1, before the section entitled "BACKGROUND OF THE INVENTION ", insert the following:

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the priority of U.S. Application No. 09/792,294, filed February 23, 2001, now US Patent No. 7,181,047; which claims priority to US Application No. 09/230,502, filed January 26, 1999, now US Patent No. 6,486,909; which claims priority to International Application No. PCT/EP98/05383, filed August 25, 1998; all of which are incorporated herein by reference in their entirety.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	PIRIM et al.	Confirmation No:	9051
Application No.:	11/676,926	Group:	2624
Date Filed:	February 20, 2007	Examiner:	
Attn'y Docket No.:	8042-2-1		
For:	IMAGE PROCESSING METHOD		

REQUEST FOR CORRECTED FILING RECEIPT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

It is noted that in the PTO electronic file, there are two Official Filing Receipts of record, one mailed on March 13, 2007 and the other mailed on March 14, 2007. For the purposes of this Request, the undersigned refers to the most recent Official Filing Receipt which was mailed on March 14, 2007.

The Official Filing Receipt indicates the instant application is a divisional of U.S. Patent Application No. 09/792,294; however, there are additional priority applications which should be listed. As noted in the Official Filing Receipt, the instant application is a divisional of US 09/792,294. The '294 application claims priority to two applications: it is a §371 national phase application of PCT/EP98/05383 and a CIP application of US 09/230,502. The '502 application is a §371 national phase application of PCT/FR97/01354, which claims the priority benefit of FR 96/09420. Accordingly, it is respectfully requested that the Official Filing Receipt be revised as follows:

> This application is a DIV of 09/792,294, 02/23/2001, PAT 7,181,047, which is a §371 national stage entry of PCT/EP98/05383, 08/25/1998 and a CIP of 09/230,502, 09/13/1999, PAT 6,486,909, which is §371 national stage entry of PCT/FR97/01354, July 22, 1997, which claims the benefit of FR 96/09420, 07/26/1996.

{WP423793;1}

Attached is a copy of the Official Filing Receipt indicating the requested revisions. Correction of the priority dates and prompt issuance of a corrected Filing Receipt is respectfully requested. Although no fee is believed to be due, the Commissioner is hereby authorized to charge any underpayment in fees to Deposit Account No. 50-0951. Please contact the undersigned if further clarification of the above is needed.

Respectfully submitted,

AKERMAN SENTERFITT

Date: Aug. 27, 2007

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{WP423793;1}

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
11/676,926	02/20/2007	2624	425	8042-2-1	7	2

CONFIRMATION NO. 9051

CORRECTED FILING RECEIPT

30448
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Applicant(s)

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(WO/1998/005002) METHOD AND DEVICE FOR REAL-TIME DETECTION, LOCATION AND DETERMINATION OF THE SPEED AND DIRECTION OF MOVEMENT OF AN AREA OF RELATIVE MOVEMENT IN A SCENE

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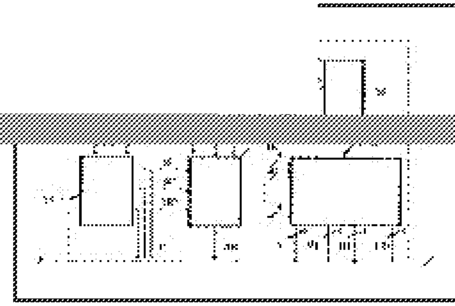
Title: (EN) METHOD AND DEVICE FOR REAL-TIME DETECTION, LOCATION AND DETERMINATION OF THE SPEED AND DIRECTION OF MOVEMENT OF AN AREA OF RELATIVE MOVEMENT IN A SCENE

(FR) PROCEDE ET DISPOSITIF FONCTIONNANT EN TEMPS REEL, POUR LE REPERAGE ET LA LOCALISATION D'UNE ZONE EN MOUVEMENT RELATIF DANS UNE SCENE, AINSI QUE POUR LA DETERMINATION DE LA VITESSE ET DE LA DIRECTION DU DEPLACEMENT

Abstract: (EN) A method and device for real-time detection, location and determination of the speed and direction of movement of an area of relative movement in a scene, are disclosed. According to the method, the digital video input signal S(PI) is subjected to a time-based processing step wherein changes in the value of each pixel between one frame and the corresponding previous frame are used to generate a binary signal DP representing a significant change or the lack thereof, and a digital signal CO representing the degree of change; and to a spatial processing step wherein both signals are



combined with a delay unit (18). Clock (20) and control (19) units are provided for clocking the operation of units (15) and (17).

(FR) L'invention a pour objet un procédé et un dispositif, fonctionnant en temps réel, pour le repérage, la localisation, la détermination de la vitesse et de la direction du déplacement en temps réel d'une zone en mouvement relatif dans une scène. Le procédé réalise un traitement temporel du signal vidéo numérique d'entrée S(PI), consistant à déduire, des variations de la valeur de chaque pixel entre une trame et la trame correspondante antérieure, un signal binaire DP de variation ou non-variation significative et un signal numérique CO représentatif de l'importance de cette variation, et un traitement spatial, consistant à répartir sur une matrice par roulement ces deux signaux pour une même trame qui défile à travers la matrice et à déduire de cette répartition matricielle le mouvement relatif recherché et ses paramètres. A cet effet, le dispositif comporte une unité de traitement temporel (15) associée à une mémoire (16) et une unité de traitement spatial (17) associée à une unité à retards (18); les unités d'horloge (20) et de commande (19) cadençant le fonctionnement des unités (15 et 17).

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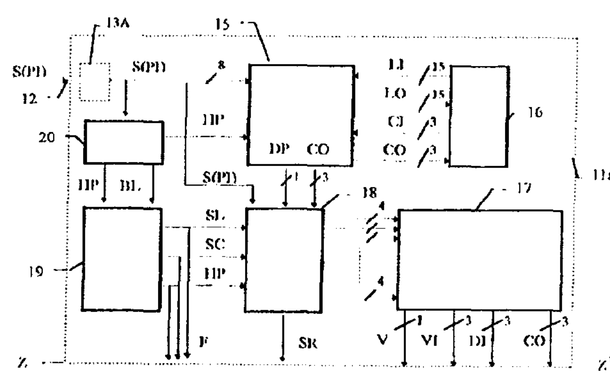
(54) Title: METHOD AND DEVICE FOR REAL-TIME DETECTION, LOCATION AND DETERMINATION OF THE SPEED AND DIRECTION OF MOVEMENT OF AN AREA OF RELATIVE MOVEMENT IN A SCENE

(54) Titre: PROCEDE ET DISPOSITIF FONCTIONNANT EN TEMPS REEL, POUR LE REPERAGE ET LA LOCALISATION D'UNE ZONE EN MOUVEMENT RELATIF DANS UNE SCENE, AINSI QUE POUR LA DETERMINATION DE LA VITESSE ET DE LA DIRECTION DU DEPLACEMENT

(57) Abstract

A method and device for real-time detection, location and determination of the speed and direction of movement of an area of relative movement in a scene, are disclosed. According to the method, the digital video input signal S(PI) is subjected to a time-based processing step wherein changes in the value of each pixel between one frame and the corresponding previous frame are used to generate a binary signal DP representing a significant change or the lack thereof, and a digital signal CO representing the degree of change; and to a spatial processing step wherein both signals are distributed over a matrix for a single frame passing therethrough, and the relative movement to be sensed as well as the parameters thereof are deduced from the resulting matrix distribution. For this purpose, the device comprises a time processing unit (15) combined with a memory (16) and a spatial processing unit (17) combined with a delay unit (18). Clock (20) and control (19) units are provided for clocking the operation of units (15) and (17).



(57) Abrégé

L'invention a pour objet un procédé et un dispositif, fonctionnant en temps réel, pour le repérage, la localisation, la détermination de la vitesse et de la direction du déplacement en temps réel d'une zone en mouvement relatif dans une scène. Le procédé réalise un traitement temporel du signal vidéo numérique d'entrée S(PI), consistant à déduire, des variations de la valeur de chaque pixel entre une trame et la trame correspondante antérieure, un signal binaire DP de variation ou non-variation significative et un signal numérique CO représentatif de l'importance de cette variation, et un traitement spatial, consistant à répartir sur une matrice par roulement ces deux signaux pour une même trame qui défile à travers la matrice et à déduire de cette répartition matricielle le mouvement relatif recherché et ses paramètres. A cet effet, le dispositif comporte une unité de traitement temporel (15) associée à une mémoire (16) et une unité de traitement spatial (17) associée à une unité à retards (18); les unités d'horloge (20) et de commande (19) cadençant le fonctionnement des unités (15 et 17).

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PROCEDE ET DISPOSITIF FONCTIONNANT EN TEMPS REEL, POUR LE REPERAGE ET LA LOCALISATION D'UNE ZONE EN MOUVEMENT RELATIF DANS UNE SCENE, AINSI QUE POUR LA DETERMINATION DE LA VITESSE ET DE LA DIRECTION DU DEPLACEMENT

La présente invention a pour objet un procédé et un dispositif permettant de repérer et de localiser une zone en mouvement relatif dans une scène et de déterminer la vitesse et la direction orientée de ce mouvement relatif, et ceci en temps réel.

Par mouvement relatif, on entend aussi bien le mouvement de ladite zone (qui peut être constituée par un «objet», au sens le plus large incluant un être vivant ou une portion d'un être vivant, une main par exemple) dans un environnement sensiblement immobile, que l'immobilité plus ou moins complète de ladite zone (ou «objet») dans un environnement en déplacement au moins partiel.

L'invention est relative au traitement d'un signal vidéo numérique en provenance d'un système d'observation, constitué par un système optique d'entrée ou objectif, apte à former une image de la scène observée, et par un système de conversion optoélectronique ou capteur, apte à convertir ladite image qu'il reçoit en un signal numérique de sortie.

En général le système d'observation est constitué par une caméra vidéo ou caméscope, qui observe la scène à surveiller (ledit signal de sortie numérique étant alors constitué par le signal vidéo numérique débité par une caméra à sortie numérique ou par la sortie d'un convertisseur analogique/numérique dont l'entrée est connectée à la sortie d'une caméra débitant un signal vidéo analogique).

Le système d'observation pourrait également être constitué par l'objectif d'un instrument d'optique (jumelles, lunette d'observation, viseur), dont on prélève au moins une portion du faisceau lumineux sortant, et par un capteur photo-électronique, de type CCD ou CMOS par exemple, avec l'électronique associée habituelle, capteur recevant l'image formée par ladite portion de faisceau lumineux et le convertissant, par l'électronique associée, en un signal vidéo numérique de sortie.

L'invention consiste essentiellement à traiter le signal vidéo numérique de sortie d'un système d'observation, notamment d'une caméra vidéo, à sortie numérique pour en déduire des signaux signalant l'existence et la localisation d'une zone en déplacement relatif dans ladite scène, ainsi que la vitesse et la direction orientée du déplacement dans le cas où ladite zone se déplace effectivement dans ladite scène relativement à un environnement sensiblement immobile, et ceci en temps réel.

Le système le plus perfectionné pour repérer et localiser un objet en mouvement relatif et déterminer sa vitesse et sa direction orientée de déplacement est le système de la vision animale ou humaine, par exemple d'un chasseur à l'affût localisant le déplacement d'un animal, ainsi que la direction et la vitesse de ce déplacement.

Dans la technique antérieure on a proposé des dispositifs de surveillance du type rétine artificielle, soit analogiques (Giocomo Indiveri et al. in Proceedings of MicroNeuro'96 p. 15 à 22), soit numériques (Pierre-François Rüedi in Proceedings of MicroNeuro'96 p. 23 à 29), mais il s'agit dans le premier article de détecteurs et unités analogiques à structure complexe et dans le second article de moyens de repérage des bords d'un objet ; en outre dans les dispositifs décrits on a recours à des mémoires très rapides et de grande capacité pour pouvoir opérer en temps réel, et on obtient des renseignements limités en ce qui concerne les zones ou objets en mouvement.

On a ainsi proposé de mémoriser, dans une première mémoire bi-dimensionnelle, le signal d'une trame en provenance d'une caméra vidéo, ou analogue, constitué par une suite de données concernant les pixels représentatifs de la scène observée par la caméra à un instant t_0, puis, dans une deuxième mémoire bi-dimensionnelle, le signal vidéo, pour la trame correspondante suivante, représentatif de ladite scène à un instant t_1. Si un objet s'est déplacé entre t_0 et t_1, on détermine, d'une part, la distance d parcourue par celui-ci dans la scène entre t_1 et t_0 et, d'autre part, la durée $T = t_1 - t_0$ entre les débuts de deux trames correspondantes successives relatives aux mêmes pixels. La vitesse du déplacement est alors égale à d/T. Un tel système nécessite une capacité totale de mémoire très importante si on désire obtenir des indications précises de vitesse et de direction orientée caractérisant le déplacement. En outre, un certain retard existe en ce qui concerne l'obtention des indications de vitesse et de direction du déplacement ; en effet de telles informations ne sont disponibles qu'à l'instant $t_1 + R$, en appelant R la durée des calculs portant sur l'intervalle $t_0 - t_1$. Ce double inconvénient (nécessité d'une grande capacité de mémoire et retard à l'obtention des informations désirées) limite les applications d'un tel système.

Par ailleurs le brevet français No 2.611.063, dont l'un des inventeurs (Monsieur Patrick Pirim) est l'inventeur de la présente invention, décrit un procédé et un dispositif de traitement en temps réel d'un flot de données séquencé, constitué en particulier par le signal de sortie d'un caméscope, afin de réaliser une compression des données. Selon ce brevet antérieur, on forme l'histogramme des niveaux du signal suivant une loi de classification pour une première séquence, on mémorise la fonction de Gauss représentative associée à cet histogramme, dont on extrait les niveaux maximum et minimum, on compare les niveaux de la séquence ultérieure, ou deuxième séquence, aux dits niveaux du signal pour la première séquence, mémorisé avec une constante de temps constante, identique pour chaque pixel, on engendre un signal binaire de classification qui caractérise ladite séquence suivante par rapport à la loi de classification, on engendre, à partir de ce signal binaire, un signal auxiliaire représentatif de la durée et de la position d'une plage de valeurs significatives et enfin on engendre, à partir dudit signal auxiliaire, un signal de localisation de la plage ayant la plus longue durée, dite plage dominante; et on répète ces opérations pour les séquences suivantes du signal séquencé. Ce procédé et ce dispositif de classification permettent une compression des données en ne retenant que les paramètres intéressants du flot traité de données séquencé. En particulier ce procédé permet de traiter un signal vidéo numérique représentatif d'une image vidéo en vue d'extraire et localiser au moins une caractéristique d'au moins une zone de ladite image. On peut ainsi classer les niveaux de luminance et/ou de chrominance du signal et caractériser et localiser un objet dans l'image.

Quant au brevet des Etats-Unis n° 5 488 430, il réalise la détection et l'estimation d'un déplacement en déterminant séparément les changements horizontaux et verticaux de l'image de la zone observée. On y utilise des signaux de différence pour détecter des déplacements de la droite vers la gauche, ou inversement et du haut vers le bas, ou inversement, dans les directions horizontale et verticale respectivement, en effectuant la fonction logique OU EXCLUSIF sur des signaux de différence horizontaux/verticaux et des signaux de différence de trames, d'une part, et en utilisant un rapport des sommes de signaux horizontaux/verticaux et des sommes des signaux de différence de trames par rapport à une fenêtre K x 3, d'autre part. Dans ce brevet U.S. 5 488 430 on utilise les valeurs calculées de l'image suivant les deux directions orthogonales horizontale et verticale avec un écart répétitif identique K dans ces deux directions orthogonales, cet écart K étant défini en fonction des vitesses de déplacement qu'on cherche à déterminer. Le dispositif selon ce brevet U.S. détermine la direction des mouvements suivant chacune des deux directions orthogonales en appliquant aux signaux de différence un ensemble d'opérations de calcul indiquées aux colonnes 12 (en début et en fin) et 13 (en début) qui nécessite des opérateurs électroniques, notamment de division, de multiplication et de sommation, fort complexes (donc difficiles à réaliser) ; des opérateurs complexes supplémentaires sont en outre nécessaires pour obtenir, à partir des projections sur les deux axes horizontal et vertical, la vitesse et la direction orientée du déplacement (extraction de racine carrée pour obtenir l'amplitude de la vitesse et calcul de la fonction arctg pour obtenir la direction orientée). On ne prévoit pas, enfin, dans le brevet 5 488 430 la mise en oeuvre d'un lissage des valeurs de pixel au moyen d'une constante de temps, variable pour chaque pixel, afin de compenser les variations trop rapides de ces valeurs.

Au contraire, la mise en oeuvre du procédé selon l'invention est réalisée au moyen d'un dispositif, faisant l'objet de l'invention, qui est de type numérique, avec une structure relativement simple et une mémoire de capacité relativement réduite, et permet l'obtention rapide des informations désirées, avec des résultats et des applications très variées (qui correspondent suivant l'application à une demi-image complète dans le cas de trames entrelacées ou à une image complète).

Un article par Alberto Tomita Sr. et Rokuya Ishii, intitulé «Hand Shape Extraction from a Sequence of Digitized Gray-Scale Images», dans Institute of Electrical and Electronics Engineers, vol. 3, 1994, p. 1925-1930, met en oeuvre une détection de mouvement par soustraction entre images successives, suivie de la formation d'histogrammes basée sur la forme de la main humaine, afin d'extraire la forme d'une main humaine dans une scène numérisée. L'analyse par histogramme est basée sur une échelle de gris inhérente à la main humaine. On ne prévoit aucune formation d'histogrammes de coordonnées du plan. Le but unique des auteurs de cet article est de détecter les déplacements d'une main humaine, par exemple afin de remplacer, pour l'introduction de données dans un ordinateur, la souris habituelle par une main dont on repère les déplacements.

Au contraire la présente invention n'est pas limitée à détecter le déplacement d'une main, mais permet de détecter le déplacement relatif de tout objet, au sens le plus large, dans une scène et n'utilise pas des histogrammes basés sur les valeurs de gris d'une main, mais des histogrammes de certaines variables numériques particulières représentatives du déplacement éventuel et des histogrammes de coordonnées du plan.

Selon la présente invention :

- on traite un signal vidéo numérique, en provenance d'un système d'observation, signal constitué, à la manière connue, par une succession de trames (qui correspondent à une demi-image dans le cas de deux trames entrelacées par image ou à une image complète dans le cas d'une seule trame par image) comportant chacune un nombre déterminé de lignes successives et, dans chacune de ces lignes, un nombre déterminé de pixels ou points d'image,
- afin d'obtenir, en utilisant une mémoire de capacité relativement faible, des signaux aptes à indiquer s'il existe, dans la scène observée, une zone en déplacement relatif et, dans ce cas, à préciser la localisation, ainsi que la vitesse et la direction (orientée) de ladite zone si elle se déplace effectivement par rapport à son environnement,
- et ceci en élaborant deux signaux numériques caractéristiques, l'un, d'une variation ou non-variation significative du signal de pixel pour le même emplacement de pixel entre deux trames correspondantes successives et, l'autre, de l'amplitude de cette variation, lorsqu'elle existe, et en répartissant matriciellement ces deux signaux pour les pixels d'une portion de trame à un même instant.

L'invention a tout d'abord pour objet un procédé, en temps réel, pour le repérage et la localisation d'une zone en mouvement relatif dans une scène observée par un système d'observation à sortie constituée par un signal vidéo numérique du type comportant une succession de trames correspondantes, composées chacune d'une succession de lignes, composées chacune d'une succession de pixels, ainsi que pour la détermination de la vitesse et de la direction orientée du déplacement, ledit procédé étant caractérisé en ce qu'il consiste à effectuer sur le signal vidéo numérique de sortie successivement :

- un traitement de lissage dudit signal vidéo numérique de sortie mettant en oeuvre une constante de temps numérique dont la valeur numérique peut être modifiée pour chacun des pixels dudit signal de sortie, indépendamment pour chacun d'entre eux ;
- une mise en mémoire d'une trame dudit signal de sortie après le lissage, d'une part, et de la constante de temps de lissage associée à la dite trame, d'autre part ;
- un traitement temporel consistant, pour chaque position de pixel, à déterminer l'existence, d'une part, et l'amplitude, d'autre part, d'une variation significative de l'amplitude du signal de pixel entre la trame actuelle et la trame juste antérieure lissée, mise en mémoire, et à générer deux signaux numériques, le premier signal étant un signal binaire ou monobit à deux valeurs possibles dont l'une représente l'existence d'une telle variation significative et l'autre l'absence d'une telle variation entre deux trames successives, la valeur dudit signal binaire modifiant la valeur mémorisée de ladite constante de temps afin de la diminuer si ledit signal représente une variation significative et afin de l'augmenter si ce signal ne représente pas une telle variation , la diminution ou l'augmentation étant réalisée d'une manière quantifiée, tandis que le second signal numérique, dit d'amplitude, est un signal multibits à nombre limité de bits, quantifiant l'amplitude de cette variation ; et
- un traitement spatial consistant, pour chaque trame de signal vidéo numérique d'entrée,
  - à répartir, afin de caractériser les valeurs des pixels, en une matrice à nombre de lignes et nombre de colonnes réduits, par rapport respectivement au nombre de lignes et au nombre de pixels par ligne dans le signal vidéo, uniquement les valeurs, au même instant d'observation, pour une fraction des pixels d'une trame - fraction qui défile par balayage à travers ladite matrice pendant la durée d'une trame - dudit signal binaire, d'une part, et dudit signal numérique d'amplitude, d'autre part,
  - à déterminer, dans cette double représentation matricielle instantanée, une zone particularisée, dans laquelle à la fois ledit signal binaire a la valeur recherchée représentant la présence, ou respectivement l'absence, de variation significative et ledit signal numérique d'amplitude varie, ou respectivement ne varie pas, d'une valeur significative entre pixels voisins dans la matrice suivant une direction orientée à partir d'un pixel d'origine, et ceci pour une même portion de trame, donc à un même instant d'observation, et

- à engendrer des signaux représentatifs de l'existence et de la localisation de la zone en déplacement relatif, ainsi que la vitesse relative intertrames et la direction orientée de ce déplacement, s'il existe, relativement à son environnement, à partir de la répartition matricielle instantanée de ces deux signaux numériques, binaire et d'amplitude.

De préférence, le procédé selon invention est caractérisé en ce qu'il consiste, en outre,

- à former les histogrammes des valeurs des signaux répartis matriciellement, d'une part, et les histogrammes des inclinaisons de deux axes, à pente variable, de coordonnées dans un plan, d'autre part,
- à repérer, dans chaque histogramme formé, un domaine de variation significative de la valeur traitée et
- à déduire, de chaque domaine repéré, l'existence et la localisation, ainsi que la vitesse et la direction orientée, d'une zone en mouvement relatif.

Dans des modes de réalisation particuliers :

- ladite matrice est une matrice carrée à même nombre impair $(2l + 1)$ de lignes et de colonnes, et on considère les matrices emboîtées de 3 x 3, 5 x 5, 7 x 7,...$(2l + 1)$ x $(2l + 1)$ éléments centrées sur le centre de cette matrice carrée afin de déterminer la matrice emboîtée de plus petite taille dans laquelle ledit signal numérique varie dans une direction orientée à partir dudit centre, la valeur dudit signal binaire représentant un dépassement du seuil selon cette direction,
- ladite matrice est une matrice hexagonale et on considère les matrices hexagonales emboîtées de taille croissante centrées sur le centre de cette matrice hexagonale afin de déterminer la matrice emboîtée de plus petite taille dans laquelle ledit signal numérique varie dans une direction orientée,
- ladite matrice est une matrice en L renversé à une seule ligne et une seule colonne et on considère les matrices emboîtées de 3 x 3 pixels, 5 x 5 pixels, 7 x 7 pixels... $(2l + 1)$ x $(2l + 1)$ pixels, pour la ligne et la colonne uniques, afin de déterminer la matrice de plus petite taille dans laquelle le signal varie dans une direction orientée, à savoir la ligne de plus grande pente à quantification constante.

Avantageusement ladite constante de temps est de la forme 2^p, p étant un nombre inférieur à 16, pouvant donc être exprimé par pas plus de 4 bits, la diminution ou l'augmentation de la constante de temps étant réalisée par la soustraction ou l'addition d'une unité à p.

Dans ce cas, si on le désire, on considère des portions successives décroissantes de trames complètes suivant l'algorithme temps - échelle de Mallat et sélectionne la plus grande de ces portions, qui donne des indications de déplacement, vitesse et orientation, compatible avec la valeur de p.

L'invention a également pour objet un dispositif, fonctionnant en temps réel, pour le repérage et la localisation d'une zone en mouvement relatif dans une scène observée par un système d'observation à sortie constituée par un signal vidéo numérique, du type comportant une succession de trames correspondantes, des lignes successives dans chaque trame correspondante et des pixels successifs dans chaque ligne, ainsi que pour la détermination de la vitesse et de la direction orientée du déplacement, par mise en oeuvre du procédé susmentionné, ledit dispositif recevant, en entrée, ledit signal vidéo de sortie et étant caractérisé en ce qu'il comporte en combinaison :

- des moyens de lissage dudit signal vidéo numérique de sortie mettant en oeuvre une constante de temps numérique dont la valeur numérique peut être modifiée pour chacun des pixels dudit signal de sortie, indépendamment pour chacun d'entre eux ;
- des moyens de mémorisation d'une trame dudit signal de sortie après lissage, d'une part, et de la constante de temps de lissage associée à ladite trame, d'autre part ;
- une unité de traitement temporel pour analyser les variations temporelles de l'amplitude du signal de pixel, pour une même position de pixel, entre la trame actuelle et la trame juste antérieure lissée, mise en mémoire, dudit signal vidéo numérique, ladite unité comportant, en association avec une mémoire apte à recevoir, stocker et restituer des informations relatives à la trame correspondante précédente lissée, des moyens de comparaison pour déterminer, pour chaque position de pixel dans la trame du signal vidéo entrant, si la valeur absolue de la différence entre le signal de pixel actuel et une valeur représentative du signal de pixel, pour la même position de pixel, dans la trame antérieure, valeur représentative stockée dans ladite mémoire, dépasse ou non un seuil, en générant un signal binaire ou monobit à deux valeurs, dont l'une représente l'existence d'un dépassement et dont l'autre représente l'absence d'un dépassement, et des moyens de calcul aptes à déterminer un signal numérique d'amplitude multibits, à nombre réduit de bits, dont la valeur est fonction de l'amplitude de la variation de la valeur du même pixel entre la trame actuelle et la trame juste antérieure lissée, mise en mémoire, du signal vidéo numérique ; et
- un ensemble de traitement spatial, dont les entrées reçoivent, de l'unité de traitement temporel, lesdits signaux binaire et numérique d'amplitude successifs pour les pixels d'une même trame, ladite unité comportant des moyens aptes à caractériser les valeurs d'amplitude des pixels, ces moyens répartissant, suivant une matrice à nombre de lignes et nombre de colonnes réduits par rapport respectivement au nombre de lignes et au nombre de pixels par ligne dans une trame dudit signal vidéo numérique, uniquement lesdits signaux binaire et numérique d'amplitude relatif à un même instant, c'est-à-dire à une même trame, celle-ci défilant par balayage à travers

ladite matrice pendant la durée d'une trame, des moyens de repérage pour déterminer, dans ladite matrice, une zone de pixels dans laquelle, à cet instant, le signal binaire a la valeur recherchée et des moyens pour déterminer, dans ladite matrice, une zone de pixels dans laquelle, à ce même instant, le signal numérique d'amplitude varie d'une quantité significative entre pixels voisins, et des moyens qui, en réponse aux indications des deux derniers moyens précédents, génèrent des signaux représentatifs de cette zone de pixels, donc de l'existence et de la localisation d'une zone en mouvement relatif dans la scène observée, ainsi que de la vitesse relative intertrames et de la direction orientée de cette zone lorsqu'elle se déplace effectivement relativement à son environnement.

De préférence l'unité de traitement spatial comporte, en outre, une sortie débitant un signal vidéo numérique retardé constitué par le signal vidéo numérique d'entrée retardé d'une durée égale à la durée des lignes d'une matrice diminuée de la durée d'une ligne afin de fournir un signal de sortie contemporain de l'analyse de la matrice dans ladite unité de traitement temporel.

De préférence, dans le dispositif selon l'invention, l'ensemble de traitement spatial comporte des moyens de retard en cascade dont chacun impose un retard égal à l'écart temporel entre les débuts de deux lignes successives et des moyens à retard en cascade pour chaque ligne imposant chacun un retard égal à l'écart temporel entre deux pixels successifs d'une ligne, les sorties de l'ensemble de tous les registres et de l'entrée des premiers registres de chaque ligne débitant à un instant donné les valeurs dudit signal binaire et dudit signal numérique d'amplitude, à un même instant, vers lesdits moyens de repérage.

Avantageusement le dispositif selon l'invention comporte également des moyens formant les histogrammes des valeurs de sortie de ladite unité de traitement spatial, ainsi que les histogrammes des inclinaisons de deux axes, à pente variable, de coordonnées dans un plan, des moyens pour repérer, dans chaque histogramme, un domaine de variation significative de la valeur traitée, afin de valider ce domaine en leur sortie et de déduire, pour l'ensemble des histogrammes, des signaux de sortie qui signalent et localisent une zone de la scène observée en mouvement relatif, si elle existe, ainsi que la vitesse et la direction orientée de ce mouvement si ladite zone se déplace effectivement par rapport à son environnement.

Si on désire détecter le mouvement d'un objet dans un environnement sensiblement immobile, on détermine la zone de la matrice dans laquelle simultanément le signal binaire a la valeur correspondant à un dépassement du seuil et le signal numérique d'amplitude varie d'une valeur significative entre pixels voisins d'une trame.

Au contraire, si on désire détecter l'immobilité d'un objet dans un environnement sensiblement en mouvement, on détermine la zone de la matrice dans laquelle simultanément le signal binaire a la valeur correspondant à un non-dépassement du seuil et le signal numérique d'amplitude ne varie pas entre pixels voisins d'une trame.

De préférence, dans le dispositif pour le repérage, la localisation et la détermination de la vitesse et de la direction orientée du déplacement d'une zone en mouvement relatif dans une scène, par mise en oeuvre du procédé susmentionné :

- lesdits moyens de lissage comportent une entrée qui reçoit ledit signal vidéo numérique et calculent, pour les pixels successifs d'une trame de ce signal vidéo, un signal lissé, dans lequel les variations temporelles du signal vidéo numérique d'entrée sont diminuées, par mise en oeuvre d'un signal de seuil reçu sur une autre entrée et d'une constante de temps relative à chaque position de pixel d'une trame, dont la valeur est successivement modifiée afin que le lissage conserve, tout en la réduisant, la tendance de variation du signal vidéo numérique entrant, ces moyens de lissage coopérant avec l'unité de mémoire qui reçoit, stocke et restitue les valeurs actualisées, pour chaque portion de pixel d'une trame, du signal lissé et de ladite constante de temps et débitent, sur leurs sorties, au moins la succession, pour chaque position de pixel, des valeurs de la constante de temps actualisée et des valeurs d'un signal binaire de dépassement ou non-dépassement dudit seuil par la valeur absolue de la différence entre la valeur du pixel et sa valeur lissée ; ladite unité de traitement spatial réalisant la répartition matricielle, par lignes et colonnes en nombre réduit, des sorties desdits moyens de lissage, à savoir des valeurs successives de la constante de temps et dudit signal binaire ;
- on prévoit des moyens de repérage pour repérer, dans ladite répartition matricielle, une zone de pixels dans laquelle, à la fois, soit la valeur dudit signal binaire correspond à un dépassement de seuil et ladite constante de temps varie entre pixels voisins d'une valeur significative dans une direction, et pour produire des signaux de sortie indiquant la localisation de ladite zone et la vitesse et la direction orientée du déplacement dans ladite zone, soit la valeur dudit signal binaire correspond à un non-dépassement du seuil et ladite constante de temps ne varie pas entre pixels voisins et pour produire des signaux de sortie indiquant la localisation de ladite zone.

Dans les modes de réalisation préférés :

- lesdits moyens de lissage comprennent, en combinaison avec une mémoire vidéo ou mémoire de trame (field memory) qui stocke les valeurs successives, pour chaque pixel de trame, de ladite constante de temps et du signal vidéo numérique lissé, des moyens de calcul, pour chaque pixel, de la valeur absolue de la différence entre la valeur du signal vidéo numérique provenant de la caméra et la valeur du signal vidéo numérique précédent lissé, des moyens pour comparer cette différence à un seuil et pour engendrer un signal binaire, dont une des deux valeurs indique un dépassement dudit seuil et l'autre valeur indique un non-dépassement de celui-ci ; des moyens de mise à jour de la constante de temps recevant de ladite mémoire la valeur juste antérieure de la constante de temps et la diminuant si elle reçoit un signal binaire dont la valeur indique un dépassement de seuil, mais l'augmentant si la valeur du signal binaire indique un non-dépassement, la diminution ou l'augmentation n'ayant toutefois pas lieu si elle aboutissait respectivement à une valeur négative ou à une valeur supérieure à une valeur seuil, et des moyens de mise à jour de la valeur lissée du signal vidéo numérique qui ajoutent algébriquement à la valeur antérieure de ce signal lissé reçue de ladite mémoire le quotient de la différence entre le signal vidéo numérique en provenance de la camera et le signal vidéo numérique lissé précédent en provenance de ladite mémoire par un facteur égal à la valeur de la constante de temps antérieure en provenance de ladite mémoire ;

- ladite constante de temps est sous la forme 2^p, p étant un nombre entier inférieur à 16, pouvant donc être représenté par au plus 4 bits, la diminution ou l'augmentation de la constante de temps étant réalisée par la soustraction ou l'addition d'une unité à p ;
- lesdits moyens de répartition matricielle comprennent, en combinaison avec des moyens de retard appliquant des retards successifs, égaux à la durée d'une ligne du signal vidéo, au signal vidéo numérique en provenance de la caméra pour débiter sur une succession des sorties, ce signal vidéo retardé de la durée d'un retard, de deux retards et ainsi de suite jusqu'à un nombre de retards égal au nombre de lignes de la matrice de répartition spatiale diminué d'une unité, des moyens de répartition matricielle suivant les lignes successives de la matrice recevant, d'une part, le signal vidéo numérique de la caméra non retardé et ce signal progressivement retardé en provenance des sorties des moyens de retard et, d'autre part, les valeurs de la constante de temps et dudit signal binaire en provenance desdits moyens de lissage, pour réaliser une répartition matricielle, par lignes et par colonnes, à un instant donné desdites valeurs de la constante de temps et du signal binaire pour les pixels d'une portion de trame du signal vidéo numérique de dimension égale à celle de la matrice ;
- les moyens de répartition matricielle comportent une succession de conducteurs de signaux numériques en nombre égal à celui des lignes de la matrice de répartition, chacun avec des registres à décalage, connectés en série, imposant chacun un retard égal à l'écart temporel entre deux pixels successifs d'une ligne du signal vidéo numérique, la position d'un pixel réparti dans la matrice étant déterminé par un point de la matrice situé en amont d'un registre à retard, dont le nombre par ligne est égal au nombre de colonnes dans la matrice diminué d'une unité, et par un point en aval du registre à décalage le plus en aval ;

– lesdits moyens de repérage, dans ladite matrice, d'une zone en déplacement, par détection de la présence simultanée d'une valeur du signal binaire indiquant un dépassement et de la variation de la valeur de la constante de temps, comprennent des moyens pour déterminer, suivant des directions orientées discrètes numérisées, la pente de la variation de la valeur de la constante de temps au voisinage d'un pixel au centre de ladite matrice, constituant l'origine pour lesdites directions, et des moyens pour sélectionner la pente la plus forte de variation au voisinage de ce centre-origine et en déterminer la direction orientée, en tenant compte d'un critère de choix pour la sélection de la direction en cas de plus d'une direction de même pente maximale de variation, ces derniers moyens débitant, en sortie, des signaux représentatifs de la vitesse et de la direction orientée du déplacement dans la zone en déplacement, avec un signal de validation indiquant que ces signaux de vitesse et de direction sont validés, ainsi que de la valeur de la constante de temps.

De préférence dans le cas où le dispositif selon l'invention les comporte, les moyens formant les histogrammes comprennent chacun :

– des entrées recevant le signal dont on forme l'histogramme et un signal de validation en provenance des moyens de répartition matricielle ; et
– des moyens pour établir deux histogrammes unidimensionnels linéaires pour les deux coordonnées du plan et pour combiner ces deux histogrammes linéaires en un histogramme de surface représentant la zone de variation significative du signal d'entrée ; et
– une sortie débitant un signal représentatif de cette zone.

En outre les moyens formant les histogrammes comprennent de préférence :

– des moyens de calcul de changement de repère, dont les entrées reçoivent un signal de séquence de lignes, un signal de séquence de colonnes et un signal d'horloge de pixel et dont la sortie est représentative du changement de repère ;
– deux moyens de formation d'histogrammes pour deux axes, recevant les deux signaux de repère et formant les histogrammes de ces axes ; et
– des moyens de zone recevant les sorties des deux moyens de formation d'histogrammes pour les deux axes et débitant, en sortie, un signal d'information de pente globale des deux axes.

Dans certaines applications, on peut prévoir que ladite constante de temps est constituée par le numéro d'ordre des intervalles, en nombre limité, et en grandeur progressivement croissante, selon lesquels on découpe la valeur absolue de la différence entre la valeur de pixel actuel et la valeur juste antérieure du même pixel après lissage, pour chaque position de pixel.

Avantageusement pour déterminer le signal binaire de dépassement ou non-dépassement du seuil, on compare à un seuil, pour chaque position de pixel, la valeur absolue de la différence entre la valeur du pixel actuel qui entre et la valeur du même pixel lissée juste antérieure en provenance de la mémoire.

En ce qui concerne le signal numérique d'amplitude, on le génère, de préférence, sous la forme d'un nombre entier qui représente la tendance au rapprochement entre la valeur du pixel actuel et la valeur de ce même pixel juste antérieure lissée, pour chaque position de pixel.

Une des caractéristiques de l'invention est constituée par le fait que, pour déterminer tant le signal binaire que le signal numérique d'amplitude, on utilise, pour la valeur du pixel juste antérieure, une valeur lissée de celui-ci mise en mémoire, afin de réduire les variations temporelles excessives de ce signal de pixel qui peuvent exister dans le signal vidéo numérique d'entrée en provenance de la caméra vidéo ou autre dispositif d'observation à sortie numérique.

On sait en effet qu'une opération de lissage a pour effet de substituer progressivement, à un signal numérique à variations importantes d'amplitude dans le temps, un signal présentant des variations plus réduites et donc plus facilement quantifiables avec un nombre réduit de paliers, donc de bits, dans le signal numérique d'amplitude lissé.

On va décrire maintenant, avec référence au dessin annexé, un mode de réalisation préféré, donné à titre d'exemple illustratif, et nullement limitatif, d'un dispositif selon l'invention mettant en oeuvre le procédé selon l'invention.

Sur ce dessin :

La Fig. 1 illustre très schématiquement l'ensemble du système selon l'invention avec son entrée et ses sorties, ainsi que le signal d'entrée pour ce système.

La Fig. 2 représente, sous forme de blocs fonctionnels, les principales unités d'un dispositif selon l'invention formant un ensemble de traitement temporel et spatial.

La Fig. 3 et la Fig. 4 illustrent les schémas fonctionnels, respectivement de l'ensemble de traitement temporel par calcul et de l'ensemble de traitement spatial par répartition matricielle, qui font partie du dispositif de la Fig. 2.

La Fig. 5 schématise le traitement temporel et le traitement spatial dans un système selon l'invention.

La Fig. 6 illustre la valeur numérique, selon le code de Freeman, des directions discrètes à partir d'un centre d'origine dans la matrice de la Fig. 4.

La Fig. 7 illustre deux matrices emboîtées de petite taille à l'intérieur de la matrice de répartition temporelle.

Les Fig. 8 et 9 décrivent deux autres types de matrice, respectivement hexagonale et en L renversé.

La Fig. 10 illustre schématiquement l'assemblage, selon la ligne $Z - Z^1$ du dispositif de la Fig. 2 avec un ensemble supplémentaire selon une réalisation préférée de l'invention.

La Fig. 11 représente, sous forme de blocs, ledit ensemble supplémentaire de la Fig. 10; la Fig. 2 et la Fig. 11 étant assemblées le long de la ligne $Z - Z^1$, en traits mixtes, figurant sur la Fig. 2 et la Fig. 10.

La Fig. 12 illustre la formation de deux histogrammes unidimensionnels et, à partir de ceux-ci, d'un histogramme superficiel de zone en déplacement, pour un signal d'entrée.

La Fig. 13 représente plus en détail un bloc ou unité de formation et traitement d'histogramme et son bloc de combinaison linéaire associé.

La Fig. 14 illustre un histogramme unidimensionnel.

La Fig. 15 et la Fig. 16 illustrent l'utilisation de la variation de la pente d'observation d'une scène.

La Fig. 17, la Fig. 18 et la Fig. 19 illustrent, sous forme de blocs pour les deux premières figures, d'autres applications possibles d'un dispositif selon l'invention, la première figure concernant la vidéoconférence, la seconde étant relative à la surveillance des autoroutes (ou routes principales) et la troisième concernant la commande d'une machine par le mouvement de la main d'un opérateur.

Les Fig. 20 et 21 représentent schématiquement l'application de l'invention à la surveillance de l'endormissement d'un conducteur automobile.

La Fig. 22 montre l'image transformée suivant le diagramme de Mallat.

En référant d'abord à la Fig. 1, on voit que, dans le mode de réalisation préféré, le dispositif 11, selon l'invention, comporte d'abord une entrée 12 qui reçoit un signal vidéo numérique S d'une caméra vidéo ou caméscope 13, à un ou plusieurs capteurs CCD de type CMOS, avec sortie numérique directe ou à sortie analogique convertie, dans un convertisseur analogique/numérique, en sortie numérique. Ce signal S est constitué, à la manière connue, par une succession de paires de trames entrelacées telles que TR_1 et TR'_1, TR_2 et TR'_2, comportant chacune une succession de lignes de balayage horizontal, chaque ligne (telle que $l_{1.1}$, $l_{1.2}$, ... $l_{1.17}$... de TR_1 et $l_{2.1}$ de TR_2) étant constituée par une succession de signaux élémentaires de pixels ou points-images PI représentatifs de points (tels que : $a_{1.1}$, $a_{1.2}$, et $a_{1.3}$ pour la ligne $l_{1.1}$; $a_{2.1}$. $a_{2.2}$ pour la ligne $l_{1.2}$; $a_{17.1}$ et $a_{17.2}$ pour la ligne $l_{1.17}$; $a_{1.1}$, $a_{1.2}$ pour la ligne $l_{2.1}$) de la scène 13a surveillée par la caméra 13 ; c'est pourquoi sur le dessin on a indiqué S(PI), à savoir un signal S constitué par des pixels PI.

A la manière connue, S(PI) comporte des signaux de synchronisation trame ST au début de chaque trame et de synchronisation ligne SL au début de chaque ligne.

On voit donc que le signal S(PI) est constitué

- par une succession de séquences (les trames successives) dans le cadre d'un domaine temporel et
- dans chaque séquence (dans chaque trame) par une série de sous-séquences (lignes, pixels) dans le cadre d'un domaine spatial.

Dans le domaine temporel, on désignera par l'expression «trames successives» les trames successives de même nature (c'est-à-dire les trames impaires, par exemple TR_1 , ou respectivement paires, par exemple TR'_1) des paires de trames, par exemple TR_1 - TR'_1, formant les images successives du signal vidéo numérique S(PI) et par l'expression «pixels successifs dans la même position» les valeurs de pixel (PI) successives en un même emplacement des trames successives de même nature, par exemple $a_{1.1}$ de $l_{1.1}$ de la trame TR_1 et $a_{1.1}$ de $l_{2.1}$ de la trame correspondante suivante TR_2.

Le dispositif 11 comporte par ailleurs des sorties 14 débitant divers signaux numériques, élaborés par lui, utiles pour signaler l'existence d'une zone ou «objet» (au sens le plus général indiqué ci-dessus) en déplacement relatif et sa localisation, de même que sa vitesse et sa direction de déplacement si celui-ci est effectif par rapport à un environnement sensiblement immobile, à savoir le signal complexe ZH groupant schématiquement les signaux signalant d'existence et la localisation de cette zone ou objet, la vitesse V et de direction orientée DI du déplacement, et éventuellement le signal vidéo numérique d'entrée S retardé en synchronisme avec les signaux précédents, pour tenir compte de leur temps de calcul, ce signal retardé SR permettant de visionner, sur l'écran d'un moniteur ou d'un téléviseur 10, l'image perçue par la camera 13 au moment où sont disponibles les renseignements concernant la zone éventuelle en déplacement relatif, à savoir le signal ZH, (V, DI), utilisables dans un ensemble de traitement et contrôle 10a.

Avec référence à la Fig. 2, on va expliciter la structure de la première partie du dispositif 11 de la Fig. 1, cette première partie étant représentée à l'intérieur du cadre 11a en traits interrompus de cette Fig. 2.

L'ensemble 11a comprend essentiellement, d'une part, une unité de traitement temporel 15, avec une unité mémoire associée 16, et, d'autre part, une unité de traitement spatial 17, avec une unité à retards 18 et une unité de séquencement 19 associées, ainsi qu'une horloge de pixel 20 cadençant l'unité de traitement temporel 15 et l'unité de séquencement 19.

L'unité 15 de traitement temporel, qui réalise, entre autres, un lissage du signal vidéo :

- élabore, à partir du signal vidéo numérique S, provenant de la caméra vidéo 13 et comportant une succession de valeurs de pixel PI, et à partir des impulsions HP engendrés par l'horloge 20 (à partir du signal S) à la cadence des pixels dans une trame (en particulier 13,5 MHz), un certains nombre de grandeurs, comme exposé ci-après avec référence à la Fig. 3, et échange avec la mémoire 16 les valeurs de deux de ces grandeurs, à savoir les valeurs lissées L du signal vidéo numérique et les valeurs C de la constante de temps du lissage, les valeurs L et C étant suivies de la lettre O pour les valeurs entrant dans la mémoire 16 à partir de l'unité 15 ou de la lettre I pour les valeurs sortant de la mémoire 16 pour atteindre l'unité 15, et

- débite, en sortie, un signal binaire DP de dépassement ou non-dépassement de seuil et un signal numérique CO indiquant la valeur calculée actualisée de la constante de temps, à savoir la valeur CO envoyée dans la mémoire 16.

La structure par blocs de calcul et/ou comparaison de l'unité de traitement temporel 15 est explicitée sur la Fig. 3 ; l'unité 15 comporte quatre blocs 15a, 15b, 15c, 15d.

Le premier bloc 15a de l'unité 15, à partir

- du signal vidéo numérique d'entrée S, constitué formé par une succession de signaux de pixels PI, et
- d'une valeur lissée LI de ce signal S pour la trame correspondante juste antérieure, calculée auparavant par l'unité 15 en tant que LO et stockée temporairement dans la mémoire 16 (comme expliqué ci-après)
- à la cadence imposée par les signaux d'horloge HP de l'horloge 20, calcule la valeur absolue AB de la différence entre les valeurs entrantes de PI et LI pour une même position de pixel (par exemple $a_{1.1}$, de $l_{1.1}$ de TR_1 et de $l_{2.1}$ de TR_2)

$$AB = |PI - LI|.$$

Le deuxième bloc 15b est un bloc de test :

- il reçoit le signal numérique précité AB de l'unité 15a et un signal numérique de valeur de seuil SE, qui pourrait être fixe, mais qui est en général fonction de la valeur de pixel ; on le fait alors varier dans le même sens que celui-ci pour constituer une correction de gamma (les moyens connus afin d'effectuer la variation de SE pour réaliser une correction de gamma étant représentés par le bloc optionnel 15e en traits interrompus) ; et
- il compare ces deux signaux numériques représentatifs de AB et SE afin de déterminer un signal binaire DP, c'est-à-dire pouvant prendre deux valeurs 1 et 0, qui signalent un dépassement ou un non-dépassement, respectivement, dudit seuil SE par AB :
- si AB est supérieur à SE, DP se verra attribuer, dans l'unité 15b, la valeur 1 représentative d'un dépassement ;
- si AB est inférieur ou égal à SE, DP recevra, dans l'unité 15b, la valeur 0 représentative de non-dépassement.

En fait lorsque DP = 1, il y a une trop grande différence entre PI et LI, c'est-à-dire entre le signal vidéo numérique d'entrée et le signal vidéo numérique précédent lissé, et il faut diminuer cette différence en réduisant la constante de temps de lissage et inversement si DP = 0 il faut augmenter cette constante de temps.

Le troisième bloc 15c réalise justement la variation désirée de valeur de la constante de temps en fonction de la valeur de DP :

- si DP = 1, le bloc 15c diminue d'une valeur unitaire U la contante de temps : CO (nouvelle valeur de cette constante) = CI (ancienne valeur de la constante) - U ;
- si DP = 0, le bloc 15c augmente de la même valeur unitaire U la constante de temps : CO = CI + U.

A cet effet le bloc 15c reçoit, sur une entrée, le signal de dépassement binaire précité DP en provenance du bloc 15b et, sur une autre entrée, le signal CI, qui est la valeur de la constante de temps antérieure stockée dans la mémoire 16, et effectue la diminution ou l'accroissement, de la valeur unité U, de la constante de temps entrante CI qui devient CO envoyée dans ladite mémoire 16 en remplacement de CI.

Avantageusement la constante de temps, dont dépend la convergence du lissage (en fonction du temps nécessaire pour que la valeur lissée atteigne la valeur d'entrée du signal vidéo numérique), est représentée par une puissance de 2, à savoir par une valeur 2^p, et c'est alors ce nombre entier p qui sera diminué ou augmenté, dans le bloc 15c, d'une unité, c'est-à-dire de 1 ; alors sur la Fig. 3 on a U = 1 pour p,

- si DP = 1, le bloc 15c soustrait une unité (1) du facteur p de la constante de temps 2^p, qui devient 2^{p-1} ;
- si DP = 0, le bloc 15c ajoute une unité (1) au facteur p de la constante de temps 2^p, qui devient 2^{p+1}.

Le choix d'une constante de temps du type 2^p a le double avantage de correspondre à la physiologie de la vision humaine et de permettre des calculs plus simples, ce qui simplifie la structure du bloc 15c.

Le bloc 15c doit assurer en outre une double condition, à savoir garder CO entre deux valeurs limites : CO ne doit pas devenir négatif ($CO \geq 0$) et ne doit pas dépasser un seuil N ($CO \leq N$). Dans le cas particulier où CI et CO sont de la forme 2^p, le seuil supérieur N est représenté par un nombre entier n qui constitue une valeur maximale pour p.

Le seuil supérieur N (ou n) peut être soit constant, soit variable ; dans ce dernier cas une unité optionnelle 15f (en traits interrompus) réalise cette variation de N (ou n) sur l'ordre de l'utilisateur par exemple. Une augmentation de N a pour conséquence d'augmenter la sensibilité de la détection du déplacement, tandis que la diminution de N améliore la détection des grandes vitesses.

Enfin le quatrième bloc 15d reçoit, sur une première entrée, la valeur CO de la nouvelle constante de temps élaborée dans le bloc 15c , sur une deuxième entrée, le signal vidéo numérique d'entrée S sous la forme d'une information de valeur de pixel PI et, sur une troisième entrée, la valeur lissée du signal vidéo numérique d'entrée précédent, à savoir LI, en provenance de la mémoire 16 et il calcule

$$LO = LI + (PI - LI) / CO$$

qui est débité sur sa sortie.

En fait le terme (PI - LI) / CO représente la modification apportée à la valeur lissée du signal vidéo numérique, en tenant compte de la valeur modifiée CO de la constante de temps et il est proportionnel à la différence algébrique entre la valeur effective du pixel d'entrée actuel PI en provenance de la caméra 13 et sa valeur de lissage antérieure LI et inversement proportionnel à CO.

Si $CO = 2^p$, alors

$$LO = LI + (PI - LI) / 2^{po}$$

en tenant compte de *po*, valeur de *p* calculée dans l'unité 15c, et qui remplace dans la mémoire 16 la valeur précédente *pi* de *p*.

Par conséquent l'unité de traitement temporel 15 à quatre blocs de calcul 15a, 15b, 15c, 15d :

- reçoit S(PI) de la caméra vidéo 13, les impulsions d'horloge HP, pour le cadencement des opérations, les signaux de seuil SE et N (ou *n*) ;
- détermine, à partir de signaux d'entrée LI et CI en provenance de la mémoire associée 16, des signaux actualisés LO et CO qui sont envoyés dans ladite mémoire en remplacement respectivement de LI et CI et qui représentent respectivement les nouvelles valeurs calculées du signal vidéo numérique lissé et de la constante de temps ;
- et débite en sortie, vers l'unité de traitement spatial 17, à travers l'unité à retards 18, le signal CO précité et le signal binaire de dépassement DP qu'elle a calculés à partir de PI, LI et SE.

L'opération de lissage a pour but de normaliser les variations de la valeur numérique du signal vidéo d'entrée pour chaque pixel ou point d'image, à savoir la variation de chaque PI, en réduisant les écarts de variation et en substituant, pour chaque pixel, aux valeurs successives réelles variables de PI en ce point d'image des valeurs lissées LO, moins variables que les valeurs PI.

Ainsi à chaque PI entrant, l'unité de traitement temporel 15 substitue, en combinaison avec la mémoire 16, une valeur lissée LO à variations réduites, par mise en oeuvre d'un signal binaire DP de dépassement ou non d'un seuil et d'un signal CO de constante de temps qui sont actualisés et envoyés dans l'unité de traitement spatial 17 illustrée sur la Fig. 4.

On peut repérer chaque pixel à l'intérieur de la surface d'une trame par deux coordonnées (en principe orthogonales) d'abscisses et d'ordonnées, à savoir x et y, en attribuant au pixel deux indices i (numéro de la ligne) pour la coordonnée y et j (numéro du pixel dans la ligne) pour la coordonnée x. Chaque pixel d'indices i et j a une valeur vidéo (valeur de l'amplitude du signal vidéo) PI_{ij}.

Si on considère maintenant l'évolution, dans le temps t, des PI_{ij} pour des trames correspondantes successives aux instants successifs t_0, t_1, t_2, t_3 ... , séparés par une période T correspondant à la période d'image (égale en général à deux périodes de trame) et qui peut être de 0,04 s dans le cas d'une fréquence de 25 Hz pour le signal d'image vidéo et de 0,0333... s dans le cas d'une fréquence de 30 Hz pour ce signal, ou de 50 Hz pour des capteurs à image progressive (1 trame/1 image), le signal d'un pixel vidéo d'indices de localisation i et j a des valeurs successives notées PI_{ijt0}, PI_{ijt1}, PI_{ijt2}, PI_{ijt3} ... à ces instants t_0, t_1, t_2, t_3 ...

Dans le cadre de l'invention on substitue, dans l'unité de traitement temporel 15, à P_{ijt} les valeurs de lissage successives LO_{ijt}, savoir LO_{ijt0}, LO_{ijt1}, LO_{ijt2}, LO_{ijt3} ...

Pour chacun des pixels ou points d'image successifs de coordonnées i, j, à l'instant t, c'est-à-dire P_{ijt}, on substitue à sa valeur réelle PI_{ijt} une valeur lissée donnée par la formule

$$LO_{ijt} = LI_{ij(t-1)} + (PI_{ijt} - LI_{ij(t-1)}) / CO_{ijt}$$

La constante de temps est de préférence de la forme 2^{pijt}.

Les calculs effectués dans l'unité 15, notamment dans le bloc 15d, pour chaque intervalle de temps T séparant t_1 de t_0, t_2 de t_1, t_3 de t_2, etc. assurent une convergence de la valeur LO_{ijt} vers la valeur PI_{ijt}, dont la rapidité dépend de la constante de temps qui est variable dans l'espace (et dépend donc de i et j) et dans le temps (et dépend donc de t) et qu'on peut écrire CO_{ijt}.

Dans tous les cas plus CO_{ijt} est grand, plus la convergence de LO_{ijt} est lente. Si $CO_{ijt} = 1$, il n'y a plus de lissage.

On peut évidemment dans les formules précédentes substituer respectivement les coordonnées cartésiennes y et x aux indices i et j de numéro d'ordre de ligne et de pixel par ligne.

Le bloc 15a calcule $AB = |PI - LI|$, les indices i, j et t n'étant pas explicités, la grandeur AB étant représentative de la variabilité instantanée du signal vidéo numérique S(PI) par rapport au signal lissé LI, pour chaque triplet i, j, t.

C'est une des caractéristiques d'un dispositif selon l'invention de réaliser, dans l'unité 15 de traitement temporel, un lissage des valeurs de pixel, de déterminer les valeurs successives, pour chaque pixel, d'une constante de temps de lissage et d'un signal binaire de dépassement ou non-dépassement d'un seuil par la valeur absolue de la différence entre la valeur du pixel et la valeur lissée de ce pixel pour deux trames correspondantes successives, pour distribuer, suivant une matrice plane, à la fois les valeurs numériques, à un même instant, de ladite constante de temps et les valeurs dudit signal binaire pour les pixels d'une portion limitée de trame, portion qui balaie la trame, afin de localiser, grâce aux variations locales de ces deux valeurs à cet instant, une zone en mouvement relatif et de déterminer la vitesse et la direction (orientée) de déplacement effectif en fonction de cette répartition, ceci étant effectué un ensemble de traitement spatial, décrit ci-après avec référence à la Fig. 4.

La convergence du lissage est assurée par les blocs de calcul 15b et 15c qui déterminent une variation de la valeur de la nouvelle constante de temps entrante CO (en fait CO_{ijt}) telle qu'elle accélère la convergence. Ceci est réalisé en comparant AB (en fait AB_{ijt}) à un seuil SE, qui peut avoir une valeur constante ou de préférence variable et dans ce dernier cas être fonction de la valeur de pixel afin d'assurer une correction de gamma : si la valeur de pixel croît, le seuil croît et vice et versa. Le résultat de la comparaison de AB avec le seuil SE (en fait SE_{ijt} si le seuil varie en fonction de la valeur de pixel, cette variation étant réalisé dans un bloc éventuel de calcul 15e) génère dans le bloc 15b le signal binaire de déplacement DP à deux valeurs possibles 1 et 0, comme expliqué ci-dessus.

Le signal binaire DP arrive dans le bloc 15c pour faire varier la valeur de la constante de temps. A cette fin l'unité de calcul 15c reçoit également la valeur de la constante de temps entrante CI en provenance de la mémoire 16 et l'actualise en nouvelle valeur de la constante de temps CO qui est, entre autres, envoyée dans la mémoire 16 où elle est substituée à l'ancienne valeur CI ; en fait pour les valeurs de CI et CO, il s'agit de CI_{ij} et CO_{ij} à deux instants successifs, par exemple t_0 et t_1, séparés par l'intervalle T entre deux trames correspondantes (soit impaires, soit paires) successives.

Le bloc 15c recevant DP et CI ajoute ou soustrait une valeur unitaire (U) à la valeur de la constante de temps CI ou une unité à p lorsque CO est de la forme 2^p suivant que le signal binaire DP représente un dépassement (DP = 1) ou un non-dépassement (DP = 0).

S'il y a dépassement, c'est que la valeur de cette constante est trop forte et on le diminue et vice et versa.

En outre le bloc 15c s'assure que la nouvelle valeur de la constante de temps CO, déduite de CI par addition ou soustraction d'une unité, reste comprise entre 0 (CO non négatif) et une valeur seuil N (CO non supérieur à N). Si cette double condition n'est pas remplie, le bloc 15c ne modifie pas la valeur de CI (qui était elle effectivement à l'intérieur de l'intervalle de 0 à N, limites comprises) et alors CO = CI.

La valeur limite supérieure N ou *n* peut ou bien être constante ou bien être variable ; dans ce dernier cas elle ne doit pas dépasser une valeur limite N max (ou *n* max) ; la variation éventuelle étant imposée par le bloc 15f sous l'effet d'une commande à la disposition de l'utilisateur.

En variante, on peut faire dépendre N ou *n* de PI (N, *n* et PI étant en fait affectés du triplet d'indices *i, j, t*) afin d'assurer une régulation de la variation de LO (qui est calculé dans le bloc 15d) en fonction du niveau de PI, ce qui peut s'exprimer par «N_{ijt} ou n_{ijt} est une fonction de PI_{ijt}», la détermination de N_{ijt} ou $n_{ijt} = f(PI_{ijt})$ étant effectuée dans un bloc de calcul substitué au bloc illustré 15f et recevant, en plus de N, la valeur de PI à partir de la caméra vidéo 13.

On peut avantageusement imposer à la constante de temps C (en fait à chaque C_{ijt}) la condition d'avoir une valeur numérique qui soit un multiple de 2, plus particulièrement une puissance de 2, quel que soient *i, j* et *t* ; dans ce cas particulier $C_{ijt} = 2^{p(ijt)}$, *p* étant un nombre entier petit, fonction de *i, j* et *t*, représentable par un nombre réduits de bits. Cette condition procure les avantages supplémentaires mentionnés ci-dessus :

- la loi de convergence du lissage est voisine des lois de la physiologie de la vision humaine
- la réalisation électronique des blocs 15c et 15d est plus simple ; en particulier, dans le bloc 15d, qui a pour objet de déterminer l'évolution de la valeur de la constante de temps, pour chaque couple *i, j*, par la formule

$$LO = LI + (PI - LI) / CO,$$

les calculs sont simplifiés si CO est de la forme 2^p (*p* étant un nombre entier petit), la valeur de seuil *n* de *p* étant elle-même un nombre entier petit, représentable par un nombre limité de bits.

Dans tous les cas, la nouvelle valeur LO de lissage du signal vidéo numérique d'entrée S est envoyée dans la mémoire 16 dans laquelle elle se substitue à LI (et ceci pour chaque couple d'indices *ij*).

On peut constater, à l'examen des Fig. 2 et 3 que l'unité de traitement temporel 15, qui comporte les blocs de calcul 15a, 15b, 15c, 15d, et éventuellement le bloc 15e et/ou le bloc 15f, et qui coopère avec la mémoire 16, détermine, comme exposé ci-dessus, et délivre en sortie, pour chaque triplet *i, j, t,*

- d'une part, la valeur lissée LO actualisée qui est transférée à la mémoire 16 en remplacement de la valeur de lissage antérieur LI

– d'autre part, deux signaux numériques, à savoir :

– un signal binaire DP, qui indique soit le dépassement (DP = 1), soit le non-dépassement (DP = 0) d'un certain seuil par la variation en valeur absolue du signal de pixel entrant en provenance de la caméra vidéo par rapport au signal de pixel antérieur lissé pour le même point ; et

– un signal numérique d'amplitude, constitué par la valeur de la constante de temps actualisée CO ;

ces signaux numériques DP et CO sont reçus, à travers l'unité à retards 18, par l'unité de traitement spatial 17 qui sera décrite ci-après, le signal CO étant également reçu par mémoire 16 dans laquelle la valeur CO se substitue à la valeur antérieure CI pour le même pixel.

On voit donc que la capacité de la mémoire 16 pour stocker les valeurs successives du signal de pixel lissé, d'une part, et de la constante de temps, d'autre part, c'est-à-dire, en supposant qu'il y ait R pixels dans une trame, donc 2R pixels par image complète, doit être d'au moins $2R(e+f)$ bits en appelant e et f les nombres de bits attribués respectivement à un signal de pixel et à une constante de temps. En fait la capacité de la mémoire n'a pas besoin d'être beaucoup plus grande ; il suffit qu'elle dépasse $2R(e+f)$ bits du nombre de bits nécessaire pour assurer son fonctionnement correct, notamment pour l'adressage et l'extraction des bits des signaux de pixel lissés et des bits des constantes de temps en fonction des indices i et j. Si chaque image vidéo est constituée par une seule trame il suffira de $R(e+f)$ bits au lieu de $2R(e+f)$ bits.

Les sorties DP_{ij} et CO_{ij}, à un instant t, de l'ensemble de traitement temporel 15 sont analysées et utilisées dans un ensemble de traitement spatial illustré sur la Fig. 4, l'assemblage des Fig. 3 et 4 étant illustré sur la Fig. 2.

En fait l'ensemble 15 de traitement temporel traite les signaux de trames, tandis que l'ensemble 17 de traitement spatial de la Fig. 4 traite les sous-séquences de lignes et de pixels dans une trame.

Sur la Fig. 5 on a schématisé le traitement temporel des séquences de trames correspondantes successives TR_1, TR_2, TR_3 superposées sur la figure et le traitement spatial dans la première de ces trames, c'est-à-dire TR_1, en illustrant les coordonnées cartésiennes x et y et un pixel PI de coordonnées y, x, c'est-à-dire d'indices i, j au temps t_1 ; les pixels successifs de mêmes indices ij sur les trois trames TR_1, TR_2, TR_3 sont indexés i,j,t_1, ijt_2 et ijt_3 respectivement et ils ont les valeurs de pixels PI_{ijt1}, PI_{ijt2} et PI_{ijt3} respectivement. Un plan de la Fig. 5 correspond à un traitement spatial d'une trame, tandis que la superposition des plans correspond au traitement temporel (le temps t étant la variable)

L'unité de traitement spatial 17, à laquelle est associé une unité à retards 18 (également illustrée sur la Fig. 4), coopère avec une unité de commande 19 qui est contrôlée par une horloge 20 qui débite une impulsion d'horloge HP à chacun des signaux de pixel successifs (Fig. 2 pour l'ensemble)

Les sorties DP_{ij} et CO_{ij} de l'unité 15 de traitement temporel sont réparties dans l'unité 17 suivant une matrice 21 de dimension réduite comportant un nombre de lignes et un nombre de colonnes très inférieurs respectivement au nombre de lignes L et de pixels M par ligne des DP_{ij} et CO_{ij} à un instant t donné. En particulier la matrice peut comprendre $2l + 1$ lignes suivant l'axe des y et $2m + 1$ colonnes suivant l'axe des x (en coordonnées cartésiennes), l *et* m étant des nombres entiers petits. Avantageusement on choisit l et m parmi les puissances de 2, l étant égal à 2^a et m à 2^b, a et b étant des nombres entiers de l'ordre de 2 à 5 par exemple. Pour simplifier le dessin et l'explication, on prend, à titre d'exemple, $m = l$ (bien qu'ils puissent être différents) et $m = l = 2^3 = 8$; dans ce cas la matrice 21 aura $2 \times 8 + 1 = 17$ lignes et 17 colonnes.

Sur la Fig. 4 on a représenté une partie des 17 lignes Y_0, Y_1, ... Y_{15}. Y_{16} et une partie des 17 colonnes X_0, X_1, ... X_{15}.X_{16} constituant la matrice 21 de l'unité 17.

Il s'agit de répartir suivant la matrice 21 à $l + 1$ lignes, en particulier 17 lignes, et $m + 1$ colonnes, en particulier 17 colonnes, les flux entrants des DP_{ijt} et CO_{ijt}, c'est-à-dire des signaux binaires de dépassement DP et des signaux numériques d'amplitude représentant la constante de temps CO, qui arrivent de l'unité 15 de traitement temporel, suivant une distribution matricielle plus étendue pour une trame, à savoir de L lignes, en particulier 312,5, et M pixels par ligne, en particulier de l'ordre de 250 à 800 suivant le standard TV utilisé.

Pour distinguer les deux matrices à savoir celle du signal vidéo de $L \times M$ et celle de l'unité 17 de $l \times m$, référencée 21, on utilisera les indices i et j suivant les deux coordonnées de la première (qui n'apparaît que lorsqu'on visualise sur un écran de téléviseur ou moniteur le signal vidéo numérique) et les indices x *et* y suivant les deux coordonnées de la seconde (représentée sur la Fig. 4) ; à un instant donné, un pixel de valeur instantanée PI_{ijt} est caractérisé à l'entrée de l'unité de traitement spatial 17 par deux signaux numériques DP_{ijt} et CO_{ijt}. La matrice du $L \times M$ de ces deux signaux se déplace par balayage à travers la matrice 21 de $(2l + 1) \times (2m + 1)$ beaucoup plus petite, comme expliqué ci-après avec référence à la Fig. 4, la matrice 21 matérialisant $(2l + 1) \times (2m + 1)$ pixels correspondant à une même trame.

Dans cette matrice 21, chaque pixel est défini par un numéro d'ordre de ligne compris entre 0 et 16 (bornes incluses) pour les lignes Y_0 à Y_{16} respectivement et un numéro d'ordre de colonne compris entre 0 et 16 (bornes comprises) pour les colonnes X_0 à X_{16} respectivement, dans le cas où $l = m = 8$, soit $2l + 1 = 2m + 1 = 17$. Dans ce cas la matrice 21 réalisera une représentation dans le plan de 17 x 17 = 289 pixels, alors que la matrice du signal vidéo comportera plusieurs dizaines ou centaines de milliers des pixels ou même d'avantage.

Sur la Fig. 4, on a illustré par des rectangles allongés horizontaux Y_0 à Y_{16}, dont seulement quatre ont été représentés, à savoir Y_0, Y_1, Y_{15} et Y_{16}, et par des lignes verticales X_0 à X_{16}, dont seulement quatre ont été représentées, à savoir X_0, X_1, X_{15} et X_{16}, cette matrice 21 (de l'unité 17) à 17 x 17 points d'image ou pixels d'indices définis à l'intersection d'une ligne d'ordonnée et d'une colonne d'abscisse. Par exemple la position de pixel P_{88} est à l'intersection de la colonne 8 et de la ligne 8, comme illustré sur la figure en e, centre de la matrice 21.

Pour réaliser la répartition spatiale successive de portions de cette matrice de L x M suivant la matrice 21 de $(2l + 1)(2m + 1)$, on associe à l'unité 17 une unité à retards 18 qui reçoit, d'une part, les signaux DP et CO (affectés des indices *ijt*) et, d'autre part, le signal de pixel d'entrée S, c'est-à-dire PI (également d'indices *ijt*), ainsi qu'un signal HP en provenance d'une horloge 20 et des signaux de séquence ligne SL et de séquence colonne SC (Fig. 2 et 4).

Comme représenté sur la Fig. 1, le signal S(PI) comporte, en plus des signaux de valeurs de pixel tels que $a_{1.1}$, $a_{1.2}$ constituant une séquence temporelle (trames successives) et des sous-séquences spatiales (pixels par lignes dans chaque trame), des signaux de synchronisation ST, SL, dont l'unité d'horloge 20 déduit non seulement un signal d'horloge, à la fréquence de 13,5 MHz par exemple, à savoir un top pour chaque pixel d'une trame vidéo, mais également des signaux de blanking BL qui rendent non-opératoire l'unité 19 pendant les signaux de synchronisation précités.

En réponse à ces signaux HP et BL en provenance de l'horloge 20 (Fig. 2) l'unité de cadencement 19 débite sur l'unité à retards 18 un signal de séquence lignes SL à une fréquence égale au quotient de 13,5 MHz par le nombre de colonnes par trame, soit par exemple 400, et un signal de trame SC dont la fréquence est égale au quotient précité 13,5/400 MHz divisé par le nombre de lignes d'image vidéo, par exemple 312,5, ainsi que HP.

C'est à partir de ces signaux SL et SC et du signal d'horloge HP que l'unité 18 assure la répartition spatiale ligne par ligne suivant la matrice 21.

A cet effet les lignes successives Y_0 à Y_{16} reçoivent les signaux DP et CO :

– non retardés (ligne Y_0) ;
– retardés d'une période TP, égale à la durée d'une ligne de trame (ligne Y_1),
– retardés de 2TP (ligne Y_2),

et ainsi de suite jusqu'à

– retardés de 16TP (ligne Y_{16}).

Les retards successifs de la durée d'une ligne de trame, savoir TP, sont réalisés dans une cascade de seize circuits à retard r_1, r_2, ... r_{16} qui desservent les lignes Y_1, Y_2 ... Y_{16} respectivement, la ligne Y_0 étant desservie directement par les signaux DP et CO non retardés en provenance de l'unité 15.

L'ensemble des circuits r_1, r_2, ... r_{16} peut être constitué par une ligne à retard à seize sorties, le retard imposé par une section quelconque entre deux sorties successives étant constant et égal à TP.

Le défilement de la totalité de la matrice trame de L x M sur la matrice 21 de $(2l + 1)(2m + 1)$ est assurée, en ce qui concerne les lignes successives des trames successives par roulement, par l'unité de cadencement 19 grâce aux signaux SL de séquence lignes, comme suit.

En ce qui concerne le déplacement par roulement des pixels d'une ligne de la matrice d'une trame sur la matrice de 17 x 17, par exemple de X_0 à X_{16} sur la ligne Y_0, elle est réalisée par une cascade de seize registres à décalage d sur chacune des 17 lignes de Y_0 à Y_{16} (soit au total 16 x 17 = 272 registres à décalage) disposés dans chaque ligne entre deux positions successives de pixels, soit entre les positions PI_{00} et PI_{01} le registre d_{01}, entre les positions PI_{01} et PI_{02} le registre d_{02}, etc. Chaque registre impose un retard de TS égal à l'écart temporel entre deux pixels successifs d'une ligne, grâce aux signaux SC de séquence colonne.

On notera que du fait que les lignes l_1 , l_2 ,...l_{17} d'une trame TR_1 (Fig. 1), tant pour S(PI) que pour DP et CO, arrivent décalées de TP (durée complète d'une ligne) l'une après l'autre à l'unité 18 et que celle-ci les distribue avec des retards croissant progressivement de TP sur les lignes Y_0, Y_1 ... Y_{17}, celles-ci affichent à un instant donné les signaux de DP et CO pour les lignes l_1 , l_2 , ... l_{17} d'une même portion de trame.

De même dans une ligne donnée, telle que l_1, les signaux de pixels successifs $a_{1.1}$, $a_{1.2}$... arrivent décalés de TS et les registres à décalage d imposent un retard également égal à TS ; il en résulte donc que les signaux de DP et CO pour des pixels d'une ligne donnée Y_0 à Y_{16} de la matrice 21, pixels disponibles sur cette ligne, sont contemporains, c'est à dire qu'ils correspondent à une même portion de trame.

Il s'agit donc, tant pour les lignes que pour les pixels de ces lignes d'une portion de trame, d'un traitement purement spatial, car la matrice 21 affiche, en ses 17 x 17 positions de pixels, les valeurs de DP et CO pour les 17 pixels de chacune des 17 lignes d'une même matrice du signal vidéo numérique S(PI), bien que ces pixels, tels que $a_{1.1}$, arrivent successivement ligne par ligne et pixel par pixel dans chacune des lignes successives (Fig. 1) dans l'unité 18, de même que les signaux correspondants DP et CO qui sont affichés.

Les signaux représentatifs des CO et des DP contemporains de la matrice 21 sont disponibles, à un instant donné, sur les $16 \times 17 = 272$ sorties des registres à décalage, ainsi qu'en amont des 17 registres en tête des 17 lignes, c'est-à-dire des registres $d_{0.1}$, $d_{1.1}$ ... $d_{16.1}$, ce qui fait au total $16 \times 17 + 17 = 17 \times 17$ sorties pour les 17×17 positions $P_{0.0}$, $P_{0.1}$, ... $P_{8.8}$ ... $P_{16.16}$.

A l'intérieur de la matrice 21, autour du centre de celle-ci $\underline{e}$ de coordonnées $x = 8$, $y = 8$ (et c'est pour cela que le nombre de lignes et le nombre de colonnes de la matrice 21 est de préférence impair : $2l + 1$ et $2m + 1$ respectivement), on peut considérer en particulier une petite matrice de 3 lignes et de 3 colonnes dont l'élément central de ses 9 éléments est justement le pixel $\underline{e}$ de coordonnées $x = 8$, $y = 8$. Soit

$$\begin{matrix} a & b & c \\ d & \underline{e} & f \\ g & h & i \end{matrix} \quad (M3)$$

cette petite matrice, dont l'élément central $\underline{e}$ a été souligné.

A cette matrice de 3×3 éléments, comportant 8 emplacements *a, b, c, d, f, g, h, i* tout autour de l'élément ou emplacement central $\underline{e}$, on peut faire correspondre 8 directions orientées partant chacune de l'emplacement central $\underline{e}$ et aboutissant à l'un des 8 autres.

A cet effet, on peut repérer les 8 directions au moyen du code de Freeman illustré sur la Fig. 6, les directions étant codées de 0 à 7, à partir de l'axe des x, de 45° en 45°. En code de Freeman, les 8 directions orientées possibles numérotées de 0 à 7, sont représentables par un nombre à 3 bits, car $2^3 = 8$, à savoir 8 possibilités.

Si on reprend la petite matrice précédente M3, les 8 directions selon le code de Freeman à partir de la position centrale $\underline{e}$ sont les suivantes

$$\begin{matrix} 3 & 2 & 1 \\ 4 & \underline{e} & 0 \\ 5 & 6 & 7 \end{matrix}$$

comme explicité sur la Fig. 6.

Revenant à la matrice 21 de la Fig. 4 à 17×17 points d'image ou pixels, on va exposer d'abord comment on y repère une zone en déplacement relatif par rapport à un environnement sensiblement immobile dans la scène, observée par la caméra vidéo 13 et donc représentée dans le signal numérique vidéo S composé de pixels PI_{ijt}, et comment on détermine la vitesse et la direction orientée d'un déplacement effectif par rapport à un environnement sensiblement immobile.

Entre deux trames successives, telles que TR_1 et TR_2 (Fig. 5), les PI_{ij} pixels du signal S seront caractérisés, en ce qui concerne leur variation entre l'instant t_1 (première trame) et l'instant t_2 (deuxième trame) par les deux signaux DP_{ij} et CO_{ij} repartis par balayage suivant la matrice 21.

Il existe une variation significative de la valeur de pixel en un point de cette matrice si DP = 1 pour ce point. Donc une zone en déplacement effectif est repérée par la zone de la matrice à l'intérieur de laquelle DP = 1 en chaque point.

En fait on examine simultanément, dans une unité de calcul 17a, à l'intérieur de la matrice 21 à 17 x 17 emplacements, les différentes matrices carrées emboîtées centrées sur <u>e</u> de dimensions 15 x 15, 13 x 13, 11 x 11, 9 x 9, 7 x 7, 5 x 5 et 3 x 3, cette dernière étant la matrice M3 précitée. On détermine quelle est la matrice parmi celles-ci qui est celle de plus petite dimension à posséder des DP = 1 alignés suivant une droite qui détermine la direction du déplacement de la zone dans laquelle DP = 1 et qui détermine une variation de + 1 et - 1 autour de CO. Pour une variation de + 1 et - 1 autour de CO, il faut que DP = 1 à chaque valeur, pour accepter le test. C'est la matrice la plus petite participant au test qui est choisie (ligne de plus grande pente).

Ensuite à l'intérieur de cette zone en déplacement dans une des matrices emboîtées, par exemple dans la petite matrice M3 de 3 x 3 éléments, on détermine si CO varie de chaque coté de la position centrale, dans une direction donnée, de + 1 dans une direction orientée et de - 1 dans la même direction mais de sens opposé. Par exemple si on a - 1, 0, + 1 dans la direction (orientée) 1, c'est-à-dire dans les positions *g*, *e*, *c* respectivement de la petite matrice M3, alors le déplacement existe dans cette matrice de droite à gauche dans la direction (orientée) 1 du code de Freeman (Fig. 6). Bien entendu simultanément dans cette direction de la petite matrice DP = 1. Plus CO varie de + 1 ou - 1 entre deux positions voisines suivant une direction dans une matrice de plus grande taille parmi les matrices emboîtées de 3 x 3 à 15 x 15, plus la vitesse du déplacement est grande. Par exemple si on a - 1, 0, + 1 dans la direction orientée 1, c'est-à-dire *g*, *e*, *c*, dans la matrice de 9 x 9, référencée M_9 le déplacement sera plus rapide que dans le cas où l'on a - 1, 0, + 1 dans la matrice M_3 de 3 x 3 (Fig. 7).

Du fait que CO est une puissance de 2 et est représentée par cette puissance dans les modes de réalisation préférés, on peut repérer une gamme étendue de vitesses en utilisant quelques bits seulement pour la puissance de 2, tout en repérant même une vitesse relativement faible (qu'on peut choisir en augmentant l'écart pour le test ; par exemple - 2, 0, + 2 dans la matrice M3 de 3 x 3 indique une vitesse deux fois plus faible par rapport à la vitesse correspondante à la matrice M3 de - 1, 0, + 1, et ce pour les mêmes positions *g* ,*e* ,*c*).

Il y a lieu de prévoir en outre deux tests pour lever les incertitudes :

- un premier test choisit la variation la plus forte, c'est-à-dire la constante de temps la plus élevée, dans le cas où l'on a dans une des matrices emboîtées, par exemple dans la petite matrice M3 de 3 x 3 éléments, des variations de CO suivant plusieurs directions ;
- un second test choisit, arbitrairement, une direction parmi deux (ou plusieurs) directions suivant lesquelles la variation de CO est identique, par exemple en choisissant la valeur la plus faible du code de Freeman ; en fait un tel cas se produit la plupart du temps lorsque la direction (orientée) réelle du déplacement se trouve sensiblement entre deux directions codées successives dans le code de Freeman, par exemple entre les directions 1 et 2, ce qui correspond à une direction (orientée) pouvant être notée 1, 5 (Fig. 6), faisant environ 67,5° avec celle de l'axe des x (direction 0 dans le code de Freeman).

La détermination de la direction orientée et de la vitesse d'une zone en déplacement effectif de la manière qui vient d'être décrite est réalisée par l'unité de calcul 17a (Fig. 4) associée à l'unité 17 et qui reçoit les 17 x 17 sorties précitées de la matrice 21, tant pour CO que pour DP (deux sorties de 21, à savoir $s_{0.1}$ et $s_{0.16}$. sont représentées). L'unité 17a traite les valeurs de CO et DP pour les matrices emboîtées successives et détermine d'après ces valeurs la direction orientée (dans le code de Freeman) et la vitesse du déplacement (suivant la matrice à retenir parmi les matrices emboîtées), en appliquant éventuellement les tests précités.

Le défilement de la totalité d'une trame du signal vidéo numérique à travers la matrice 21 a lieu

- d'abord pour le groupe des 17 premières lignes, lignes 1 à 17, de la trame : de la gauche vers la droite de la trame en considérant le mouvement relatif, comme illustré pour la trame TR_2 sur la Fig. 5 : de la portion TM_1 à l'extrême gauche, puis TM_2 décalée d'une colonne par rapport à TM_1 et ceci jusqu'à TM_M (M étant le nombre de pixels par ligne de trame) à l'extrême droite ;
- ensuite, de manière analogue de la gauche vers la droite de colonne en colonne, pour les lignes 2 à 18 de la trame ; et
- ainsi de suite en descendant chaque fois d'une ligne : ligne 3 à 19... jusqu'au dernier groupe en bas de la trame, à savoir celui des lignes L - 16 ... L (L étant le nombre de lignes par trame).

En considérant les Fig. 2 et 4 on voit que les sorties des unités 17, 18 et 19, c'est-à-dire de l'ensemble de traitements spatial, sont :

- un signal V représentant la vitesse du déplacement, d'après l'amplitude de la variation maximale de CO dans la zone repérée, dont la valeur peut être par exemple représentée par une échelle de huit nombres entiers de 0 à 7 si la vitesse est sous la forme numérique de puissances de 2, donc comporte 3 bits ;

- un signal DI représentant la direction de ce déplacement, d'après la direction de cette variation maximale, la valeur de DI pouvant également être représentée par une parmi les huit valeurs de 0 à 7 dans le code de Freeman, donc comporter 3 bits ;
- un signal de validation VL précisant que le résultat pour la vitesse et la direction (orientée) est valide, afin de pouvoir distinguer une sortie valide avec $V = 0$ et $DI = 0$, de l'absence de sortie due à un incident, ce signal étant soit 1 (sortie valide) soit O (sortie absente) ; donc un seul bit est nécessaire pour VL ;
- avantageusement un signal CO de constante de temps, donc de 3 bits par exemple ;
- (les 3 ou 4 signaux V, DI, VL et éventuellement CO étant débités par l'unité 17 de traitement spatial et son électronique associée)
- un signal vidéo retardé SR constitué par le signal vidéo d'entrée S retardé dans l'unité à retards 18 des 16 durées consécutives de lignes TR et donc de la durée de la répartition du signal S dans la matrice 21 de 17 x 17, de manière à disposer du signal vidéo numérique contemporain de la représentation matricielle dans la matrice 21, signal dont le contenu peut être affiché en clair sur l'écran d'un téléviseur ou d'un moniteur ;
- l'ensemble des trois signaux de sortie de l'unité 19, à savoir les signaux d'horloge HP, de séquence ligne SL et de séquence de colonne SC.

Aux matrices rectangulaires emboîtées des Fig. 4 et 7, on peut substituer des matrices hexagonales emboîtées (Fig. 8) ou une matrice en forme de L renversé (Fig. 9).

Dans le cas de la Fig. 8, les matrices emboîtées (dont on n'a représenté que les matrices MR1 et MR2 les plus centrales) sont toutes centrées sur le point MR0 qui correspond au point central (en lequel le signal binaire est «0») des matrices M3, M9 de la Fig. 7. L'avantage d'un système de matrices hexagonales c'est qu'il permet, d'une part, d'utiliser des axes de coordonnées obliques, x_a, y_a et, d'autre part, une décomposition en triangles ayant des cotés identiques, ce qui réalise le calcul des vitesses isotropes.

La matrice de la Fig. 9 est composée d'une seule ligne L_u et d'une seule colonne C_u à partir de la case centrale MR_u dans laquelle les deux signaux DP et CO valent respectivement «1» pour DP et augmente ou diminue d'une unité pour CO, en cas de déplacement.

On détermine ainsi si la direction du déplacement (relatif) est

- dans le sens de la coordonnée x : le signal CO est identique dans toutes les cases de la colonne C_u,et le signal binaire DP est égal à 1 dans les cases de la ligne L_u , de l'origine MR_u à la valeur CO_u jusqu'à la case où CO vaut CO_u + 1 ou - 1 inclus ;

- dans le sens de la coordonnée y : le signal CO est identique dans toutes les cases de la ligne L_u , et le signal binaire DP est égal à 1 dans les cases de la colonne C_u , de l'origine MR_u à la valeur CO_u jusqu'à la case où CO vaut CO_u + 1 ou - 1 inclus ;
- ou enfin oblique relativement à x et y : le signal binaire DP est égal à 1 et CO vaut CO_u dans les cases de L_u et dans les cases de C_u, la pente étant déterminée par la perpendiculaire à la ligne passant par les deux cases dans lesquelles le signal CO_u change de valeur d'une unité, le signal DP étant toujours égal à 1.

Sur la Fig. 9 on a illustré le cas où DP = 1 et CO_u change de valeur d'une unité dans deux cases particulières L_{u3} et C_{u5} et indiqué la pente correspondante P_p.

Dans tous les cas, la vitesse du déplacement est fonction de la case dans laquelle CO change de valeur d'une unité.

Si CO change d'une unité que dans L_u ou C_u , elle correspond à la valeur de la case de variation de CO.

Si CO change d'une unité dans une case de L_u et dans une case de C_u, la vitesse est proportionnelle à la distance entre MR_u et E_x (intersection de la ligne perpendiculaire à C_u -L_u passant par MR_u).

Le système décrit jusqu'à présent avec référence aux Fig. 1 à 9 est avantageusement complété par un système complémentaire qui va être décrit avec référence aux Fig. 11 à 16 pour constituer un système global 22 illustré sur la Fig. 10, sur laquelle on a représenté, d'une part, l'ensemble 11a de la Fig. 2 avec indication des signaux V, DI, VL, C, SR et composite F (HP, SL, SC) envoyés par l'ensemble 11 (qui reçoit le signal vidéo numérique d'entrée S) à l'ensemble 22a (qui débite une sortie composite ZH).

La ligne d'assemblage $Z - Z_1$ entre les ensembles 11a et 22a est illustrée sur les Fig. 2, 10 et 11, les sorties de l'ensemble 11a étant connectées aux entrées de l'ensemble 22a suivant $Z - Z_1$ pour transmettre les signaux précités.

La sortie de l'unité 22a et donc du dispositif global 22 est constituée par un signal composite ZH fournissant l'information désirée sur la zone en déplacement relatif de la scène 13a surveillée par la caméra vidéo 13.

L'unité complémentaire 22a, connectée aux sorties de l'unité 11a, est illustrée sur la Fig. 11 sous la forme de blocs fonctionnels, en rappelant que cette figure se raccorde suivant la ligne $Z - Z_1$ (à sa partie supérieure) à la Fig. 2 suivant la ligne $Z - Z_1$ (à la partie inférieure de cette dernière figure).

L'unité de la Fig. 11 constitue essentiellement un dispositif de formation et d'utilisation d'histogrammes et elle comporte :

- une micro-ligne bus 23 qui véhicule un certain nombre de signaux numériques, détaillés ci-après ;
- six blocs ou unités de formation et de traitement d'histogrammes, référencés 24, 25, 26, 27, 28, 29, respectivement pour les histogrammes de signaux vidéo numériques retardés SR, de vitesses V, de directions orientées (en code de Freeman) D1, de constantes de temps CO, de premiers axes $x(m)$ et de seconds axes $y(m)$;
- six blocs ou unités de combinaison linéaire 30, 31, 32, 33, 34, 35 associant leurs entrées en provenance du bus 23 pour former chacune un signal de validation V_1, V_2, V_3, V_4, V_5, V_6 pour les six blocs 24, 25, 26, 27, 28, 29 respectivement, 30 étant associée à 24, 31 étant associé à 25, 32 étant associé à 26, 33 étant associé à 27, 34 étant associé à 28 et 35 étant associé à 29 ;
- un bloc ou unité de zone en mouvement 36 coordonnant les sorties des blocs 28 et 29 pour les axes $x(m)$ et $y(m)$; et
- un bloc ou unité de changement de repère 37 recevant des signaux $x(m)_0$ et $y(m)_0$ d'orientation des axes $x(m)$ et $y(m)$, ainsi que des signaux d'horloge de pixel HP, de séquence ligne SL et de séquence colonne SC (ces trois signaux étant groupés dans le faisceau F des Fig. 2, 4, 10 et 11) en provenance de l'unité 19 des Fig. 2 et 4, et formant les signaux $x(m)_1$ et $y(m)_1$ envoyés respectivement aux unités 28 et 29.

Les unités 24, 25, 26, et 27 débitent chacune sa sortie SSR, SV, SDI, SDO sur le bus 23, alors que les unités 28 et 29 débitent chacune un signal $x(m)_2$, $y(m)_2$ sur une des deux entrées de l'unité de zone en mouvement 36, qui combine ces deux signaux en provenance des unités 28 et 29 et débite en sortie un signal composite $xy(m)$ sur le bus 23.

Le fonctionnement de chacune des unités 24 à 29 de formation et de traitement d'histogramme, qui reçoit en entrée, d'une part, un signal de validation V_1, V_2, V_3, V_4, V_5 ou V_6 de l'unité de combinaison linéaire 30 à 35 associée et, d'autre part, un signal SR, V, DI, CO, $x(m)_1$ ou $y(m)_1$ à traiter, est le même et c'est pourquoi, on exposera le fonctionnement d'une seule de ces unités, à savoir l'unité 25 concernant la formation et le traitement des histogrammes de vitesse V, prise à titre d'exemple ; seule la variable traitée est différente pour les autres unités analogues 24, 26, 27, 28 et 29, en notant que les différants signaux d'entrée pour les six unités 24 à 29 sont tous des signaux numériques, ce qui permet une analogie de structure et de fonctionnement des ces six unités.

Sur la Fig. 12, on a représenté schématiquement, chacun par son enveloppe, les histogrammes 38 et 39, respectivement en x et en y (axes de coordonnées cartésiennes de la matrice 21 à 17 x 17 éléments de la Fig. 4), des vitesses V de la zone en déplacement (sur la Fig. 14, on a indiqué les éléments tels que C_1, C_2 de l'histogramme à enveloppe 38) ; x_M et y_M

représentent les coordonnées en x et en y des maxima des deux enveloppes 38 et 39, respectivement, tandis que l_a et l_b, pour l'axe des x et l_c et l_d, pour l'axe des y représentent les limites du domaine des vitesses significatives ou intéressantes, l_a et l_c étant les limites inférieures et l_b et l_d les limites supérieures des portions significatives des histogrammes.

Les droites verticales L_a et L_b, d'abscisses l_a et l_b, et les droites horizontales L_c et L_d, d'ordonnées l_c et l_d, forment un rectangle qui encadre la zone hachurée 40 de vitesses significatives (pour l'ensemble des directions x et y), quelques microzones 41, de vitesses plus faibles et dont on ne tiendra pas compte, existant au voisinage de la zone principale 40.

Il suffit donc de repérer les coordonnées des quatre limites l_a, l_b, l_c, l_d et des deux maximas x_M et y_M pour caractériser la zone de plus grande variation du paramètre mis en histogramme, la vitesse V dans le cas particulier considéré. C'est cette information concernant V que le bloc 25 débite en sortie en permanence sur le micro-bus 23.

De même les blocs similaires 24, 26 et 27 débitent en sortie en permanence sur ce micro-bus 23 les informations concernant la zone de valeur maximale pour SR, DI et CO, respectivement.

Enfin les blocs similaires 28 et 29 débitent en sortie en permanence à l'unité 36 les informations concernant la zone de valeur maximale de $x(m)_1$ et $y(m)_1$ respectivement, l'unité 36 combinant ces informations d'abscisses et d'ordonnées, référencés $x(m)_2$ et $y(m)_2$ respectivement, en un signal composite $xy(m)$ qui est envoyé par la sortie de l'unité 36 sur le bus 23.

En définitive le bus 23 véhicule les informations concernant la zone de valeurs maximales de SR, V, DI, CO et $xy(m)$, c'est-à-dire $x(m)_1$ et $x(m)_2$, ce qui permet de déterminer l'existence d'une zone en déplacement dans la scène observée par la caméra vidéo 13, de localiser cette zone et d'en déterminer la vitesse et la direction (orientée) de déplacement.

Sur la Fig. 11 on a référencé ZH le signal composite de sortie disponible sur le bus 23. Les composantes précitées de ce signal ZH peuvent, notamment en ce qui concerne V et DI, c'est-à-dire la vitesse et la direction orientée de la zone en déplacement, être affichées sous forme numérique ou analogique, déclencher un signal lumineux et/ou sonore, notamment en cas de dépassement d'un seuil par la vitesse V, ou bien être transmis par câble, fibre optique ou voie hertzienne aux fins d'utilisation à distance, dans une unité de contrôle, telle que l'unité 10a de la Fig. 1, situé au voisinage ou à distance du dispositif 11 selon l'invention.

La portion des unités de la Fig. 12 au-dessus du bus 23 sert, à la suite du traitement point par point de toute une trame et l'association des points d'une trame pour en déduire une valeur globale externe, à déterminer l'existence et la localisation d'une zone de la scène observée en mouvement relatif et, en outre, s'il y a effectivement déplacement de cette zone, la vitesse et la direction orientée de ce déplacement. Le repérage dans le plan d'observation de cette zone en mouvement relatif suivant deux directions *x*, *y*, qui peuvent ne pas être orthogonales (cas de l'application des Fig. 15 et 16 par exemple) est réalisé par la portion des unités de la Fig. 12 au-dessous du bus 23.

On va maintenant exposer plus en détail, avec référence aux Fig. 12, 13 et 14, la structure et le fonctionnement d'un bloc de formation et traitement d'histogramme, tel que 25, et de son bloc de combinaison linéaire associé, tel que 31.

Le bloc 25 (Fig. 13) comporte une portion 25a formant l'histogramme et une portion 25b constituant un classifieur pour l'histogramme, ces deux portions fonctionnent sous le contrôle d'un logiciel, matérialisé en une portion de circuit intégré 25c, qui réalise l'extraction des limites l_a, l_b, l_c, l_d de l'histogramme (Fig. 11).

Le classifieur 25b alimente, ainsi que les classifieurs des autres blocs de formation et traitement d'histogramme 24, 26, 27, 28, 29 (pour ces deux derniers à travers l'unité 36 de combinaison en $x(m)$ et $y(m)$), le bus 23 et, par l'intermédiaire de celui-ci, l'unité de combinaison linéaire 31 qui reçoit donc en parallèle des informations de tous les classifieurs des unités 24, 25, 26, 27, 28, 29 et qui, en fonction de ces informations, débite ou non le signal de validation V_2 à l'unité 25.

Grâce au logiciel de 25c, le classifieur 25b détermine les différentes classes (chacune comportant le même nombre de valeurs de la vitesse dans le cas envisagé) qui définiront l'enveloppe telle que 38 ou 39 (Fig. 12).

Sur la Fig. 14, on a illustré, suivant l'axe des *x*, les classes successives C_1, C_2 ... C_{n-1}, C_n et leur enveloppe 38 pour la vitesse V qui sont déterminées dans le classifieur 25b.

Les Fig. 15 et 16 illustrent le rôle des histogrammes pour $x(m)$ et $y(m)$ formés par les unités 28 et 29 et combinés dans l'unité 36 afin d'obtenir une pente.

A titre d'exemple on a considéré le cas de l'observation d'une route au moyen d'une caméra vidéo à sortie numérique embarquée dans un véhicule avec son dispositif selon l'invention associé.

Sur la Fig. 15 a représenté les deux bords de gauche B_g et de droite B_d d'une route R, ainsi que les pentes numérotées du 0 à 7 par exemple (suivant une convention autre que le code de Freeman) de la projection P_x en $x(m)$ réalisée par l'unité 28 et de la projection P_y en $y(m)$ réalisée par l'unité 29.

Pour assurer la précision la meilleure en ce qui concerne le bord de droite B_d, c'est-à-dire une sensibilité maximale des indications, par exemple de vitesse, concernant ce bord, il faut que la projection P_x ait la pente la plus voisine de la pente optimale P_0 qui est perpendiculaire à B_d, en particulier la pente 5 dans la représentation de la Fig. 15. La valeur maximale de l'histogramme de vitesses sera donc obtenue pour la pente 5 déterminée par l'unité 28 (Fig. 11).

Le même raisonnement s'applique au bord gauche B_g en ce qui concerne la pente de la projection P_y et donc du rôle de l'unité 29.

L'unité 36 de combinaison des deux pentes optimales fournit l'information d'optimalisation pour l'ensemble des deux bords B_d et B_g.

La Fig. 16 illustre l'application de la détermination de la pente optimale P_o de la projection P_x, prise à titre d'exemple, pour assurer une conduite correcte d'un véhicule Vh en Europe continentale à conduite à droite de la route (cas a), au Royaume-Uni à conduite à gauche de la route (cas b) et enfin d'un avion Va pour un atterrissage correct au milieu de la piste d'un aéroport (cas c).

Par conséquent, pour aider la conduite d'un véhicule terrestre (auto, camion) sur une route ou d'un véhicule aérien (avion, navette spatiale) au voisinage d'une piste d'aéroport, le dispositif selon l'invention comporte en outre des moyens de représentation des bords droit B*d* et gauche B*g* de la route, respectivement de la piste, et des moyens pour orienter au moins un des axes, à pente variable, de coordonnées pour qu'il se maintienne sensiblement orthogonal au bord correspondant (position P_0).

Jusqu'à présent on a surtout décrit, les moyens pour déterminer une zone en déplacement effectif dans un environnement sensiblement immobile, grâce au repérage d'une région dans laquelle $DP = 1$. Pour déterminer une zone en repos dans un environnement dans l'ensemble en mouvement (cas de l'arrêt d'un véhicule en panne ou d'une collision sur une autoroute par exemple), c'est au contraire les zones dans lesquelles $DP = 0$ qui doivent être localisées par rapport à l'environnement pour lequel $DP = 1$. Bien entendu dans ce cas, les vitesses seront nulles dans une zone et la notion de direction n'a pas de signification. Les calculs dans 17a seront donc différents.

Le dispositif, selon l'invention, s'il ne doit servir qu'à déterminer une zone immobile peut être simplifié avec suppression des unités ou blocs traitant les vitesses et les directions, notamment les blocs 25, 26, 31, 32, et réduction du nombre des sorties de l'unité 11a et des entrées de l'unité 17.

Dans l'unité d'exploitation 10a du dispositif selon l'invention, on peut prévoir des moyens d'affichage, sur écran de moniteur, des histogrammes et/ou des valeurs des signaux DP ou CO.

Quant au signal SR, c'est-à-dire le signal vidéo numérique retardé, il est en général appliqué à un téléviseur ou moniteur 10 afin de visualiser, localement ou à distance sur l'écran de celui-ci, ce signal à l'instant où un mouvement relatif est signalé afin de vérifier la nature de ce mouvement relatif. Il suffira donc d'observer l'écran du téléviseur ou moniteur 10 uniquement lorsqu'une zone en déplacement relatif a été signalée, par une alarme visuelle et/ou sonore par exemple.

On peut avantageusement faciliter le repérage d'une zone en mouvement relatif sur l'écran en imposant des couleurs arbitraires au signal vidéo numérique retardé SR, chaque couleur ou nuance de couleur représentant une vitesse et/ou une direction du mouvement.

Les différentes unités qui viennent d'être décrites avec référence aux Fig. 2, 3, 4, 11 et 13 sont réalisables chacune par des circuits électroniques de type connu, notamment des microprocesseurs effectuant des calculs et/ou des comparaisons ou utilisant : des signaux de balayage ; des mémoires ; des unités à retards ; des registres à décalage ; des unités formant des histogrammes linéaires et associant dans le plan de tels histogrammes ; des microbus.

La combinaison de ces circuits électroniques en unités 11a et 22a séparées ou en un ensemble 22 constitué par 11a et 22a peut être réalisée en deux circuits intégrés ou en un seul circuit intégré de très petite dimension, de l'ordre de 10 mm x 10 mm par exemple en technologie 0,7 µm, l'ensemble des deux unités intégrées interconnectées ou le circuit intégré unique étant connecté par son entrée à la sortie vidéo numérique d'une caméra vidéo ou autre dispositif d'observation et par leurs sorties à un ou plusieurs dispositifs d'utilisation sur place ou à distance. Dans une variante si on met en oeuvre seulement le dispositif simplifié de l'unité 11a, celui-ci, de préférence sous la forme d'un circuit intégré unique, est disposé entre ladite sortie numérique et un ou plusieurs dispositifs d'utilisation sur place ou à distance.

On va donner maintenant à titre d'exemples, nullement limitatifs, des applications supplémentaires d'un dispositif selon l'invention, notamment du dispositif selon les Fig. 1 et 10, c'est-à-dire selon l'ensemble des Fig. 2 et 11 raccordées suivant la ligne $Z - Z^1$.

Une première application supplémentaire, illustrée sur la Fig. 17, est constituée par le cadrage automatique d'une personne se déplaçant dans une pièce, par exemple dans le cadre d'une vidéoconférence. Le cadrage automatique permet d'éliminer les mouvements de la personne se déplaçant, ce qui accroît la définition de l'image de cette personne observée par une caméra vidéo à sortie numérique et aussi, en cas de compression du signal vidéo numérique, simplifie cette compression.

Sur la Fig. 17, on retrouve la caméra vidéo 13 qui observe la personne P pouvant se déplacer. Le signal vidéo numérique S de la caméra vidéo est non seulement transmis par câble, fibre optique ou voie hertzienne à un écran de téléviseur ou moniteur 10b, mais également reçu par le dispositif 11 selon l'invention, dont la sortie ZH agit sur une unité 42 qui, en réponse aux signaux reçus du dispositif 11 concernant la localisation et le déplacement de la personne P, commande les moteurs 43 de la caméra 13 pour diriger l'axe optique de la caméra vers la personne, notamment son visage F, en fonction de la localisation de son mouvement et de la vitesse et de la direction de celui-ci et éventuellement pour agir sur le réglage du zoom, de la distance focale et/ou de la mise au point de la caméra en cas d'avance ou du recul de la personne P.

On peut aussi commander le suivi par au moins un spot lumineux d'un personnage (acteur, chanteur) sur une scène, le dispositif selon l'invention centrant le personnage au centre de l'image par déplacement de l'orientation de la caméra vidéo et commandant la direction du spot, par exemple par un ou deux miroirs orientables, pour chaque spot.

Une autre application, donnée à titre d'exemple, du dispositif selon invention est illustrée sur la Fig. 18 sur laquelle on retrouve la caméra 13 ou autre dispositif d'observation qui débite un signal vidéo numérique S dans un dispositif 11 selon invention. Dans cette application, la caméra 13 surveille une portion d'autoroute afin de détecter l'arrêt inopiné d'un véhicule, en particulier sur la bande d'arrêt d'urgence, ou un arrêt de voiture à la suite d'une collision.

Il s'agit donc dans ce cas de déterminer l'immobilité d'un objet (le véhicule) dans un environnement en déplacement (les autres véhicules), c'est-à-dire de localiser dans la matrice 21 à 17 x 17 éléments la zone dans laquelle DP = 0. Normalement la caméra 13 observe un flot des véhicules qui produisent des réponses DP = 1, avec des valeurs de vitesse et de direction de déplacement. Par contre, si un véhicule s'arrête, il est signalé par une réponse DP = 0 dans sa zone d'observation.

Une unité 44 recevant ZH, ainsi que SR, détecte l'apparition d'une zone dans laquelle DP = 0 dans ZH et débite en sortie un signal d'anomalie NL qui, d'une part, déclenche une alarme sonore et/ou lumineuse dans un dispositif 45 et, d'autre part, commande un commutateur 46 qui applique le signal vidéo S (ou plutôt le signal vidéo retardé SR) sur l'écran d'un téléviseur ou moniteur 10 qui permet au surveillant, alerté par l'alarme sonore et/ou visuelle, d'observer l'autoroute à l'instant où un véhicule s'arrête ou de collision afin de pouvoir prendre les mesures nécessaires, par exemple suivant la réaction de conducteur du véhicule qui s'est arrêté.

Grâce à l'invention, dans un poste de surveillance, un surveillant peut facilement contrôler un grand nombre de tronçons sur une autoroute (ou une route) dans chacun desquels est disposé une caméra 13 et un dispositif 11 selon l'invention, les sorties ZH et SR de chaque dispositif 11 étant transmises par câble, fibre optique ou voie hertzienne à un seul poste de surveillance où se trouve une unité commune 44 ; en effet l'observateur n'a besoin de regarder l'écran de 10 qu'en cas d'incident ou accident, signalé par l'alarme, et il est rare que plusieurs incidents et/ou accidents en des emplacements différents se produisent simultanément.

En particulier l'unité 44 peut comporter, en entrée, un commutateur de type rotatif (non représenté) envoyant successivement et cycliquement les signaux ZH (et SR) des différents ensembles 13 - 11 disposés le long de l'autoroute sur la portion de cette unité 44 produisant le signal NL.

Le même système permet de déceler non seulement, comme indiqué, l'arrêt, ou la collision entraînant un arrêt de véhicules, mais également un ralentissement du flot des véhicules (en cas de circulation très ralentie) par diminution de la vitesse dans les différentes zones dans lesquelles D = 1 et inversement un véhicule à vitesse excessive, la vitesse dans une zone observée dépassant alors la vitesse limitée autorisée.

Enfin sur la Fig. 19 on a illustré une autre application de l'invention, à savoir à l'interaction homme - machine, le déplacement de la main M, ou plus particulièrement des doigts DG, à l'intérieur d'une surface SF décomposée en rectangles par un système de coordonnées C_x et C_y.

Une caméra vidéo 13 à sortie numérique associée à un dispositif 11 selon l'invention, tel qu'illustré sur la Fig. 1, permet de reconnaître le mouvement d'une main M et des doigts DG et de l'utiliser pour contrôler un ordinateur (à la manière d'une «souris») ou pour commander certaines fonctions dans une machine. Par exemple l'ensemble 13 - 11 pourrait servir à un sourd-muet, utilisant le code standard du langage des sourds-muets à base de mouvements des mains, pour entrer en ordinateur des données alphanumériques, donc un texte, sans avoir à utiliser le clavier habituel ; cette opération peut, bien entendu être également effectuée par une personne parlante, ayant appris le langage des sourds-muets, afin d'entrer un texte en ordinateur sans avoir à utiliser un clavier. Un tel système n'est pas sensible aux écarts temporels et n'exige pas une signalisation précise du début et de la fin du geste.

Les Fig. 20 et 21 illustrent schématiquement l'application de l'invention à la surveillance d'un conducteur automobile afin de signaler l'endormissement de celui-ci.

La caméra vidéo 13 est dans ce cas placée contre la portion de carrosserie à l'intérieur du véhicule, au-dessus du rétroviseur par exemple, et observe le conducteur.

L'opération préliminaire consiste à cadrer celui-ci comme dans le cas de l'application de la Fig. 17. Sur la Fig. 20, on a représenté symboliquement l'image 1C du conducteur sur l'écran vidéo. On supprime d'abord les portions inutiles de droite et de gauche (hachures horizontales de l'image et on se limite ainsi à la portion centrale de l'image entre ces deux portions.

Ensuite dans cette portion centrale il suffit de surveiller la zone non hachurée AA de la Fig. 21 dans laquelle est cadrée la tête.

Les déplacements intéressants qui sont détectés par le dispositif selon l'invention sont constituées par les clignements des paupières du conducteur (signalés par des mouvements verticaux dans la zone AA) dont la cadence se modifie en préliminaire à l'endormissement. Si la cadence ou et la vitesse de ces clignements devient inférieure à un certain seuil, une alarme sonore est déclenchée et le conducteur est réveillé.

Sur la Fig. 22, on a indiqué un moyen pour pallier, lorsque cela est nécessaire, au nombre limité de bits p représentatifs de la constante de temps CO pour permettre de prendre en compte une plus large gamme de vitesses de déplacement.

A cet effet on prévoit l'utilisation du diagramme de Mallat (voir article de S. Mallat «A Theory for multiresolution signal decomposition» in IEEE Transactions on Pattern Analysis and Machine Intelligence, Juillet 1989 p. 674-693). qui consiste à décomposer successivement la totalité de l'image vidéo en moitié successives, repérées 1, 2, 3, 4, 5, 6, 7. On réalise ainsi une compression en ne traitant que des portions d'images. On peut ainsi avec p = 4, c'est-à-dire $2^p = 16$ déterminer une vitesse dans une gamme plus étendue.

Si au début, dans le cadre de l'image totale, le dispositif selon invention indique que la vitesse de l'objet (au sens large) mobile dépasse la vitesse maximale déterminable avec $2^p = 16$ pour la constante de temps, il suffit de passer successivement par les images partielles observées 1, 2, 3, 4,... jusqu'à ce que la vitesse de l'objet mobile ne dépasse pas ladite vitesse maximale dans le cadre de l'image partielle après compression.

Pour mettre en oeuvre la composition de Mallat par ondelettes, il suffit d'intercaler sur le schéma de la Fig. 1 une unité 13A (illustrée sur la Fig. 22) qui réalise cette compression du signal vidéo. Cette unité peut par exemple être constituée par le composant «ADV 601 Low Cost Multiformat Vidéo Codec» de la société américaine ANALOG DEVICES faisant l'objet de la notice «ADV 601 Preliminary Data Sheet» de Janvier 1996. Sur la Fig. 2, une telle unité de compression optionnelle 13a.

Enfin sur les Fig. 2 et 3, on a indiqué sur certains microbus le nombre de bits (1, 3 (dans le cas où p = 3), 8, 15) véhiculés, ce qui montre l'économie de taille possible pour les différents blocs fonctionnels ayant à traiter un nombre réduit de bits.

On voit en définitive que l'invention permet de détecter un mouvement relatif dans une scène observée par un dispositif optoélectronique, tel qu'une caméra vidéo, qui transmet la scène observée sous la forme d'un signal vidéo numérique constitué par une succession de trames, elles-mêmes constituées par une succession de lignes composées d'une succession de pixels, ce signal numérique étant analysé afin de repérer une zone en déplacement relatif, avec indication de la vitesse et de la direction (orientée) de ce déplacement si la zone est en mouvement effectif par rapport à un environnement sensiblement immobile.

Etant donné que le dispositif selon l'invention détermine la direction orientée et la vitesse de déplacement d'un objet (au sens le plus large), on peut lui adjoindre des moyens pour déduire de ces deux parametres une position future de l'objet à un instant déterminé et des moyens pour orienter d'avance la caméra vidéo d'entrée 13 sur cette position future.

Il y a lieu de noter que les résultats obtenus avec le dispositif selon invention n'exigent nullement que la caméra soit immobile, ce qui permet d'embarquer la caméra et le dispositif associé sur un véhicule terrestre, aérien ou nautique (pour la mise en oeuvre du procédé illustré sur la Fig. 16 par exemple).

Après une très courte période d'initialisation égale à N (de l'ordre de moins de dix trames successives correspondantes), le dispositif selon l'invention détermine les paramètres du déplacement relatif instantanément après la fin de chaque trame ayant subi les traitements temporel et spatial, du fait de la récursivité des calculs selon l'invention.

On a décrit un mode de réalisation préféré du dispositif selon l'invention et quelques applications de celui-ci. Bien entendu ce mode de réalisation et ces applications ont été donnés à titre d'exemples non limitatifs et de nombreuses variantes et adaptations, qui apparaîtront facilement à l'homme de l'art, peuvent être envisagées sans sortir du cadre de l'invention tel que défini dans les revendications ci-après.

On pourrait par exemple mettre en oeuvre des moyens d'utilisation des signaux débités par l'unité 11 de la Fig. 2 autres que ceux illustrés sur la Fig. 11 sans s'écarter de l'invention.

Quant aux applications d'un dispositif selon l'invention, elles ne sont nullement limitées à celles données à titre d'exemple dans la description précitée. Ainsi un montage analogue à celui de la Fig. 17 peut être associé directement à un caméscope pour le stabiliser relativement aux déplacements causés par les mouvements involontaires de l'utilisateur.

On peut également utiliser un ou, de préférence, plusieurs dispositifs, selon l'invention, associés respectivement à un ou, de préférence, plusieurs caméscopes à sortie vidéo numérique placés dans une pièce d'immeuble pour constituer une «pièce intelligente» grâce à un tel système permettant de détecter et localiser la présence et le mouvement d'une ou plusieurs personnes dans la pièce, d'analyser ce mouvement, aux fins de sécurité, d'identification et/ou pour aider dans les tâches à accomplir, par exemple, ou à surveiller des enfants dans une autre pièce ou les clients d'un supermarché.

On a supposé essentiellement l'utilisation d'un signal vidéo à paires de trames entrelacées successives, notamment lors de la discussion de la capacité de la mémoire 16, avec traitement des deux trames d'une paire dans le dispositif selon l'invention. Il est toutefois possible de n'utiliser qu'une trame sur deux (l'impaire par exemple) en réduisant la capacité de la mémoire, mais avec réduction de moitié environ de la vitesse d'obtention des informations désirées. Il est également possible de mettre en oeuvre une camera vidéo ou autre dispositif d'observation dont la sortie numérique ne comporte qu'une seule trame par image.

Il est possible, dans certaines applications d'associer, au dispositif selon l'invention, des capteurs spécialisés, par exemple un ou plusieurs capteurs d'accélération, pour pouvoir traiter des parametres supplémentaires du déplacement.

Bien entendu l'invention n'est pas limitée aux modes de réalisation particulières ni aux applications décrits, mais elle en embrasse toutes les variantes et modifications entrant dans la définition générale de l'invention.

REVENDICATIONS

1. Procédé, en temps réel, pour le repérage et la localisation d'une zone en mouvement relatif dans une scène observée par un système d'observation à sortie constituée par un signal vidéo numérique du type comportant une succession de trames correspondantes, chacune composée d'une succession de lignes, composées chacune d'une succession de pixels, ainsi que pour la détermination de la vitesse et de la direction orientée du déplacement, ledit procédé étant caractérisé en ce qu'il consiste à effectuer sur le signal vidéo numérique de sortie successivement :

- un traitement de lissage dudit signal vidéo numérique de sortie mettant en oeuvre une constante de temps numérique dont la valeur numérique peut être modifiée pour chacun des pixels dudit signal de sortie, indépendamment pour chacun d'entre eux ;
- une mise en mémoire d'une trame dudit signal de sortie après le lissage, d'une part, et de la constante de temps de lissage associée à la dite trame, d'autre part ;
- un traitement temporel consistant, pour chaque position de pixel, à déterminer l'existence, d'une part, et l'amplitude, d'autre part, d'une variation significative de l'amplitude du signal de pixel entre la trame actuelle et la trame juste antérieure lissée, mise en mémoire, et à générer deux signaux numériques, le premier signal étant un signal binaire ou monobit à deux valeurs possibles dont l'une représente l'existence d'une telle variation significative et l'autre l'absence d'une telle variation entre deux trames successives, la valeur dudit signal binaire modifiant la valeur mémorisée de ladite constante de temps afin de la diminuer si ledit signal représente une variation significative et afin de l'augmenter si ce signal respectivement ne représente pas une telle variation , la diminution ou l'augmentation étant réalisée d'une manière quantifiée, tandis que le second signal numérique, dit d'amplitude, est un signal multibits à nombre limité de bits, quantifiant l'amplitude de cette variation ; et
- un traitement spatial consistant, pour chaque trame de signal vidéo numérique d'entrée,
  - à répartir, afin de caractériser les valeurs des pixels, en une matrice à nombre de lignes et nombre de colonnes réduits, par rapport respectivement au nombre de lignes et au nombre de pixels par ligne dans le signal vidéo, uniquement les valeurs, au même instant d'observation, pour une fraction des pixels d'une trame - fraction qui défile par balayage à travers ladite matrice pendant la durée d'une trame - dudit signal binaire, d'une part, et dudit signal numérique d'amplitude, d'autre part,
  - à déterminer, dans cette double représentation matricielle instantanée, une zone particularisée. dans laquelle à la fois ledit signal binaire a la valeur recherchée

représentant la présence, ou respectivement l'absence, de variation significative et ledit signal numérique d'amplitude varie, ou respectivement ne varie pas, d'une valeur significative entre pixels voisins dans la matrice suivant une direction orientée à partir d'un pixel d'origine, et ceci pour une même portion de trame, donc à un même instant d'observation, et

- à engendrer des signaux représentatifs de l'existence et de la localisation de la zone en déplacement relatif, ainsi que la vitesse relative intertrames et la direction orientée de ce déplacement, s'il existe, relativement à son environnement, à partir de la répartition matricielle instantanée de ces deux signaux numériques, binaire et d'amplitude

2. Procédé selon la revendication 1, caractérisé en ce qu'il consiste, en outre,
   - à former les histogrammes des valeurs des signaux répartis matriciellement d'une part, et les histogrammes des valeurs des inclinaisons de deux axes, à pente variable, de coordonnées dans un plan, d'autre part,
   - à repérer, dans chaque histogramme formé, un domaine de variation significative de la valeur traitée et
   - à déduire, de chaque domaine repéré, l'existence et la localisation, ainsi que la vitesse et la direction orientée, d'une zone en mouvement relatif.
3. Procédé selon la revendication 1 ou 2, caractérisé en ce que ladite matrice est une matrice carrée à même nombre impair $(2l + 1)$ de lignes et de colonnes, et que l'on considère les matrices emboîtées de 3×3, 5×5, 7×7, ... $(2l + 1) \times (2l + 1)$ éléments centrées sur le centre de cette matrice carrée afin de déterminer la matrice emboîtée de plus petite taille dans laquelle ledit signal numérique varie dans une direction orientée à partir dudit centre, la valeur dudit signal binaire représentant un dépassement du seuil selon cette direction.
4. Procédé selon la revendication 1 ou 2, caractérisé en ce que ladite matrice est une matrice hexagonale et que l'on considère les matrices hexagonales emboîtées de taille croissante centrées sur le centre de cette matrice hexagonale afin de déterminer la matrice emboîtée de plus petite taille dans laquelle ledit signal numérique varie dans une direction orientée à partir dudit sommet, la valeur dudit signal binaire représentant un dépassement du seuil selon cette direction.
5. Procédé selon les revendications 1 ou 2, caractérisé en ce qui ladite matrice est une matrice en L renversé à une seule ligne et une seule colonne et en ce que l'on considère les matrices emboîtées de 3×3 pixels, 5×5 pixels, 7×7 pixels... $(2l + 1) \times (2l + 1)$ pixels, pour la ligne et la colonne uniques, afin de déterminer la matrice de plus petite taille dans laquelle le

signal varie dans une direction orientée, à savoir la ligne de plus grande pente à quantification constante.

6. Procédé l'une quelconque des revendications précédentes, caractérisé en ce que ladite constante de temps est de la forme 2^p, p étant un nombre inférieur à 16, pouvant donc être exprimé par pas plus de 4 bits, la diminution ou l'augmentation de la constante de temps étant réalisée par la soustraction ou l'addition d'une unité à p.
7. Procédé selon la revendication 6, caractérisé en ce que l'on considère des portions successives décroissantes de trames complètes suivant l'algorithme temps - échelle de Mallat et sélectionne la plus grande de ces portions, qui donne des indications de déplacement, vitesse et orientation, compatible avec la valeur de p.
8. Dispositif fonctionnant en temps réel, pour le repérage et la localisation d'une zone en mouvement relatif dans une scène observée par un système d'observation à sortie constituée par un signal vidéo numérique, du type comportant une succession de trames correspondantes, des lignes successives dans chaque trame correspondante et des pixels successifs dans chaque ligne, ainsi que pour la détermination de la vitesse et de la direction orienté de ce déplacement, par mise en oeuvre du procédé selon la revendication 1, le dispositif recevant, en entrée, ledit signal vidéo numérique de sortie, caractérisé en ce qu'il comporte en combinaison :
   - des moyens de lissage (15) dudit signal vidéo numérique de sortie mettant en oeuvre une constante de temps numérique (CO) dont la valeur numérique peut être modifiée pour chacun des pixels dudit signal de sortie, indépendamment pour chacun d'entre eux ;
   - des moyens de mémorisation (16) d'une trame dudit signal de sortie après lissage (LI), d'une part, et de la constante de temps de lissage (CI) associée à ladite trame, d'autre part ;
   - une unité de traitement temporel (15) pour analyser les variations temporelles de l'amplitude du signal de pixel, pour une même position de pixel, entre la trame actuelle et la trame juste antérieure lissée, mise en mémoire, dudit signal vidéo numérique, ladite unité comportant, en association avec une mémoire apte à recevoir, stocker et restituer des informations relatives à la trame correspondante précédente lissée, des moyens de comparaison (15a) pour déterminer, pour chaque position de pixel dans la trame du signal vidéo entrant, si la valeur absolue de la différence entre le signal de pixel actuel et une valeur représentative du signal de pixel, pour la même position de pixel, dans la trame antérieure, valeur représentative stockée dans ladite mémoire, dépasse ou non un seuil, en générant un signal binaire ou monobit (DP) à deux valeurs, dont l'une représente l'existence d'un dépassement et dont l'autre représente l'absence d'un dépassement, et des moyens de calcul (15c) aptes à déterminer un signal numérique d'amplitude multibits, à nombre réduit

de bits, dont la valeur est fonction de l'amplitude de la variation de la valeur du même pixel entre la trame actuelle et la trame juste antérieure lissée, mise en mémoire, du signal vidéo numérique ; et

– un ensemble de traitement spatial (11), dont les entrées reçoivent, de l'unité de traitement temporel, lesdits signaux binaire et numérique d'amplitude successifs pour les pixels d'une même trame, ladite unité comportant des moyens aptes à caractériser les valeurs d'amplitude des pixels, ces moyens répartissant, suivant une matrice (21) à nombre de lignes et nombre de colonnes réduits par rapport respectivement au nombre de lignes et au nombre de pixels par ligne dans une trame dudit signal vidéo numérique, afin de caractériser les valeurs des pixels uniquement lesdits signaux binaire et numérique d'amplitude relatif à un même instant, c'est-à-dire à une même trame, celle-ci défilant par balayage à travers ladite matrice pendant la durée d'une trame, des moyens de repérage pour déterminer, dans ladite matrice, une zone de pixels dans laquelle, à cet instant, le signal binaire a la valeur recherchée et des moyens pour déterminer, dans ladite matrice, une zone de pixels dans laquelle, à ce même instant, le signal numérique d'amplitude varie d'une quantité significative entre pixels voisins, et des moyens qui, en réponse aux indications des deux derniers moyens précédents, génèrent des signaux représentatifs de cette zone de pixels, donc de l'existence et de la localisation d'une zone en mouvement relatif dans la scène observée, ainsi que de la vitesse relative intertrames et de la direction orientée de cette zone lorsqu'elle se déplace effectivement relativement à son environnement.

9. Dispositif selon la revendication 7, caractérisé en ce que l'ensemble de traitement spatial (17, 18) comporte des premiers moyens de retard (*r*) en cascade dont chacun impose un retard égal à l'écart temporel entre deux lignes successives et des seconds moyens de retard (*d*) en cascade pour chaque ligne imposant chacun un retard égal à l'écart temporel entre deux pixels successifs d'une ligne, les sorties de chacun desdits seconds moyens de retard (*d*) et l'entrée de la cascade desdits seconds moyens de retard (*d*) de chaque ligne débitant à un instant donné les valeurs dudit signal binaire et dudit signal numérique d'amplitude, à un même instant, vers lesdits moyens de repérage (17a).

10. Dispositif selon la revendication 8, ou 9, caractérisé en ce qu'il comporte également des moyens (24 - 29) formant les histogrammes des valeurs de sortie de ladite unité de traitement spatial, ainsi que les histogrammes des inclinaisons de deux axes, à pente variable, de coordonnées dans un plan, des moyens pour repérer, dans chaque histogramme, un domaine de variation significative de la valeur traitée, afin de valider ce domaine en leur sortie et de déduire, pour l'ensemble des histogrammes, des signaux de sortie qui signalent et localisent

une zone de la scène observée en mouvement relatif, si elle existe, ainsi que la vitesse et la direction orientée de ce mouvement si ladite zone se déplace effectivement par rapport à son environnement.

11. Dispositif selon la revendication 8, 9, ou 10, caractérisé en ce lesdits moyens de lissage (15c, 15d) comportent une entrée qui reçoit ledit signal vidéo numérique S(PI) et calculent, pour les pixels successifs d'une trame de ce signal vidéo, un signal lissé (LO), dans lequel les variations temporelles du signal vidéo numérique d'entrée sont diminuées, par mise en oeuvre d'un signal de seuil (N) reçu sur une autre entrée et d'une constante de temps (CO) relative à chaque position de pixel d'une trame, dont la valeur est successivement modifiée afin que le lissage conserve, tout en la réduisant, la tendance de variation du signal vidéo numérique entrant, ces moyens de lissage coopérant avec l'unité de mémoire (16) qui reçoit, stocke et restitue les valeurs actualisées, pour chaque portion de pixel d'une trame, du signal lissé et de ladite constante de temps et débitent, sur leurs sorties, au moins la succession, pour chaque position de pixel, des valeurs de la constante de temps actualisée et des valeurs d'un signal binaire de dépassement ou non-dépassement dudit seuil par la valeur absolue de la différence entre la valeur du pixel et sa valeur lissée.

12. Dispositif selon l'une quelconque des revendications 8 à 11, caractérisé en ce que ladite unité de traitement spatial (17, 18) réalisant la répartition matricielle, par lignes et par colonnes en nombre réduit, des sorties desdits moyens de lissage, à savoir des valeurs successives de la constante de temps (CO) et dudit signal binaire, comporte des moyens de repérage (17a) pour repérer, dans ladite répartition matricielle, une zone de pixels dans laquelle, à la fois, soit la valeur dudit signal binaire correspond à un dépassement de seuil et ladite constante de temps varie entre pixels voisins d'une valeur significative dans une direction, et pour produire des signaux de sortie indiquant la localisation de ladite zone et la vitesse et la direction orientée du déplacement dans ladite zone, soit la valeur dudit signal binaire correspond à un non-dépassement du seuil et ladite constante de temps ne varie pas entre pixels voisins.

13. Application du dispositif selon la revendication 10, 11 ou 12, pour aider la conduite d'un véhicule terrestre sur une route, respectivement d'un véhicule aérien au voisinage d'une piste d'aéroport, caractérisé en ce que le dispositif comporte en outre des moyens de représentation des bords droit B*d* et gauche B*g* de la route, respectivement de la piste, et des moyens pour orienter au moins un des axes, à pente variable, de coordonnées pour qu'il se maintienne sensiblement orthogonal au bord correpondant (position P_0).

REVENDICATIONS MODIFIEES

[reçues par le Bureau International le 16 janvier 1998 (16.01.98); revendications 1-13 remplacées par les revendications 1-14 modifiées (10 pages)]

1. Procédé, opérant en temps réel, pour le repérage et la localisation d'une zone en mouvement relatif dans une scène observée par un système d'observation à sortie constituée par un signal vidéo numérique du type comportant, d'une manière classique, une succession de trames correspondantes de même nature, chacune composée d'une succession de lignes, composées chacune d'une succession de pixels, ainsi que pour la détermination de la vitesse et de la direction orientée du mouvement de déplacement relatif , ledit procédé

consistant à effectuer sur ledit signal vidéo numérique successivement

- un traitement temporel qui consiste, pour chaque position de pixel, à déterminer la différence entre l'amplitude du signal de pixel dans la trame actuelle et l'amplitude d'un signal de pixel représentatif de ses valeurs dans les trames antérieures, et

- un traitement spatial, qui consiste, pour chaque trame dudit signal vidéo numérique, à répartir, en une matrice à nombre de lignes et nombre de colonnes réduits par rapport respectivement au nombre de lignes et au nombre de pixels par ligne dans ledit signal vidéo numérique, uniquement les valeurs, au même instant d'observation, pour une fraction des pixels d'une trame - fraction qui défile par balayage à travers ladite matrice pendant la durée d'une trame -, des signaux représentatifs des variations des valeurs de pixels et à déduire, à partir de l'ensemble des représentations matricielles relatives à un instant d'observation donné, c'est-à-dire à une trame donnée dudit signal vidéo ou numérique, la localisation d'une zone éventuelle en mouvement relatif et l'estimation de ce mouvement s'il existe,

et étant caractérisée en ce que

- il comporte un double traitement préliminaire consistant en

- un lissage adaptatif dudit signal vidéo numérique en mettant en oeuvre une constante de temps numérique dont la valeur numérique, pour chacun des pixels dudit signal vidéo numérique et indépendamment pour chacun d'eux, est modifiée en réponse à la variation ou non variation temporelle de la valeur du pixel, et
- à une mise en mémoire d'une trame entière dudit signal de sortie après lissage, d'une part, et de ladite constante de temps pour chaque position de pixel de ladite trame, d'autre part;

- ledit traitement temporel consiste, pour chaque position de pixel, à déterminer l'existence, d'une part, et l'amplitude, d'autre part, d'une variation significative éventuelle de l'amplitude du signal de pixel entre la trame actuelle et la trame juste antérieure lissée, mise en mémoire, et à générer deux signaux numériques , le premier étant un signal binaire, donc monobit, à deux valeurs possibles dont la première représente l'existence d'une telle variation significative et la seconde l'absence d'une telle variation significative entre les deux dites trames actuelle et juste antérieure lissée, la valeur dudit signal binaire modifiant la valeur mémorisée de ladite constante de temps pour le pixel en cause afin respectivement de la diminuer si ledit signal binaire a ladite première valeur et de l'augmenter si ledit signal binaire a ladite seconde valeur, la diminution ou l'augmentation étant réalisée d'une manière quantifiée, tandis que le second signal numérique, dit d'amplitude, est un signal multibits, à nombre limité de bits, quantifiant l'amplitude, de cette variation; et

- ledit traitement spatial consiste, pour chaque trame dudit signal vidéo de sortie,

- à répartir, en ladite matrice et pendant la durée d'une trame, ledit signal binaire, d'une part, et ledit signal numérique d'amplitude, d'autre part, à déterminer, dans cette double représentation matricielle instantanée dudit signal binaire et dudit signal numérique d'amplitude pour le même pixel, une zone particularisée, dans laquelle à la fois ledit signal binaire a la valeur recherchée représentant la présence, ou respectivement l'absence, de variation significative et ledit signal numérique d'amplitude varie, ou respectivement ne varie pas, d'une valeur significative entre pixels voisins dans ladite matrice suivant une direction orientée à partir d'un pixel d'origine, et ceci pour une même portion de trame, donc à un même instant d'observation, et

- à engendrer des signaux représentatifs de l'existence et de la localisation de la zone de déplacement relatif éventuel, de la valeur de la vitesse relative inter-trames et de la direction orientée parmi plusieurs directions orientées possibles dans le plan d'observation, de ce déplacement relatif éventuel, dans son environnement, à partir de ladite répartition matricielle instantanée de ces deux signaux, binaire et d'amplitude.

2. Procédé selon la revendication 1, caractérisé en ce qu'il consiste, en outre:

- à former les histogrammes des valeurs des signaux répartis matriciellement, d'une part, et les histogrammes de valeurs des inclinaisons de deux axes, à pente variable, de coordonnées dans un plan, d'autre part,
- à repérer, dans chaque histogramme formé, un domaine de variation significative de la valeur traitée et
- à déduire, de chaque domaine repéré, l'existence et la localisation, ainsi que la vitesse et la direction orientée, d'une zone en mouvement relatif.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce que ladite matrice est une matrice carrée à même nombre impair ($2l + 1$) de

lignes et de colonnes, et que l'on considère les matrices emboîtées de 3 x 3, 5 x 5, 7 x 7, ...(2l + 1) x (2l + 1) éléments centrées sur le centre de cette matrice carrée afin de déterminer la matrice emboîtée de plus petite taille dans laquelle ledit signal numérique varie dans une direction orientée à partir dudit centre, la valeur dudit signal binaire représentant un dépassement du seuil selon cette direction.

4. Procédé selon la revendication 1 ou 2, caractérisé en ce que ladite matrice est une matrice hexagonale et que l'on considère les matrices hexagonales emboîtées de taille croissante centrées sur le centre de cette matrice hexagonale afin de déterminer la matrice emboîtée de plus petite taille dans laquelle ledit signal numérique varie dans une direction orientée à partir dudit sommet, la valeur dudit signal binaire représentant un dépassement du seuil selon cette direction.

5. Procédé selon les revendications 1 ou 2, caractérisé en ce que ladite matrice est une matrice en L renversé à une seule ligne et une seule colonne et en ce que l'on considère les matrices emboîtées de 3 x 3 pixels, 5 x 5 pixels, 7 x 7 pixels....(2l + 1) x (2l + 1) pixels, pour la ligne et la colonne uniques, afin de déterminer la matrice de plus petite taille dans laquelle le signal varie dans une direction orientée, à savoir la ligne de plus grande pente à quantification constante.

6. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que ladite constante de temps est de la forme 2^p, p étant un nombre inférieur à 16, pouvant donc être exprimé par pas plus de 4 bits, la diminution ou l'augmentation de la constante de temps étant réalisée par la soustraction ou l'addition d'une unité à p.

7. Procédé selon la revendication 6, caractérisé en ce que l'on considère des portions successives décroissantes de trames complètes suivant l'algorithme temps - échelle de Mallat et sélectionne la plus

grande de ces portions, qui donne des indications de déplacement, vitesse et orientation, compatible avec la valeur de *p*.

8. Dispositif, fonctionnant en temps réel, pour le repérage et la localisation d'une zone en mouvement relatif dans une scène observée, ainsi que pour la détermination de la vitesse et de la direction orientée du mouvement de déplacement relatif, par mise en oeuvre du procédé selon la revendication 1,

comportant:

- un système d'observation à sortie constituée par un signal vidéo numérique du type comportant, d'une manière classique, une succession de trames correspondantes de même nature, chacune composée d'une succession de lignes, composées chacune d'une succession de pixels,

- un ensemble de traitement temporel déterminant, pour chaque position de pixel, la différence entre l'amplitude du signal de pixel dans la trame actuelle et l'amplitude d'un signal de pixel représentatif de ses valeurs dans les trames antérieures,

- un ensemble de traitement spatial qui, pour chaque trame dudit signal vidéo numérique, répartit en une matrice à nombre de lignes et nombre de colonnes réduits par rapport respectivement au nombre de lignes et au nombre de pixels par ligne dans ledit signal vidéo numérique, uniquement les valeurs, au même instant d'observation, pour une fraction des pixels d'une trame - fraction qui défile par balayage à travers ladite matrice pendant la durée d'une trame -, des signaux représentatifs des variations des valeurs de pixels, et qui déduit, à partir de l'ensemble des représentations matricielles relatives à un instant d'observation donné, c'est-à-dire à une trame donnée dudit signal vidéo numérique, la localisation d'une zone éventuelle en mouvement relatif et l'estimation de ce mouvement s'il existe,

et étant caractérisée en ce qu'il comporte en combinaison:

- des moyens de lissage adaptatif (15) dudit signal vidéo numérique en mettant en oeuvre une constante de temps numérique (CO) dont la valeur numérique, pour chacun des pixels dudit signal vidéo numérique et indépendamment pour chacun d'eux, est modifiée en réponse à la variation ou non variation temporelle de la valeur du pixel;

- des moyens de mémorisation (16) pour une trame entière dudit signal de sortie après lissage (LI), d'une part, et de ladite constante de temps pour chaque position de pixel de ladite trame, d'autre part;

- dans l'ensemble de traitement temporel (15),

- des moyens de comparaison (15) pour déterminer l'existence, d'une part, et l'amplitude, d'autre part, d'une variation significative éventuelle de l'amplitude du signal de pixel entre la trame actuelle et la trame juste antérieure lissée, mise en mémoire, et pour générer un premier signal numérique (DP) , qui est un signal binaire, donc monobit, à deux valeurs possibles dont la première représente l'existence d'une telle variation significative et la seconde l'absence d'une telle variation significative entre les deux dites trames actuelle et juste antérieure lissée, la valeur dudit signal binaire modifiant la valeur mémorisée de ladite constante de temps pour le pixel en cause afin respectivement de la diminuer si ledit signal binaire a ladite première valeur et de l'augmenter si ledit signal binaire a ladite seconde valeur, la diminution ou l'augmentation étant réalisée d'une manière quantifiée, et
- des moyens de calcul (15c) aptes à générer un second signal numérique (CO), dit d'amplitude, qui est un signal multibits, à nombre limité de bits, quantifiant l'amplitude de cette variation; et

- dans l'ensemble de traitement spatial (11), dont les entrées reçoivent de ladite unité de traitement lesdits signaux numériques, binaire et d'amplitude, successifs pour les pixels d'une même trame:

- des moyens pour répartir, en ladite matrice (21) et pendant la durée d'une trame, ledit signal binaire, d'une part, et ledit signal numérique d'amplitude, d'autre part,
- des moyens pour déterminer, dans cette double représentation matricielle instantanée dudit signal binaire et dudit signal numérique d'amplitude pour le même pixel, une zone particularisée, dans laquelle à la fois ledit signal binaire a la valeur recherchée représentant la présence, ou respectivement l'absence, de variation significative et ledit signal numérique d'amplitude varie, ou respectivement ne varie pas, d'une valeur significative entre pixels voisins dans ladite matrice suivant une direction orientée à partir d'un pixel d'origine, et ceci pour une même portion de trame, donc à un même instant d'observation, et
- des moyens pour engendrer des signaux représentatifs de l'existence et de la localisation de la zone de déplacement relatif éventuel, de la valeur de la vitesse relative inter-trames et de la direction orientée parmi plusieurs directions orientées possibles dans le plan d'observation, de ce déplacement relatif éventuel, dans son environnement, à partir de ladite répartition matricielle instantanée de ces deux signaux, binaire et d'amplitude.

9. Dispositif selon la revendication 8, caractérisé en ce que l'ensemble de traitement spatial (17, 18) comporte des premiers moyens de retard (r) en cascade dont chacun impose un retard égal à l'écart temporel entre deux lignes successives et des seconds moyens de retard (d) en cascade pour chaque ligne imposant chacun un retard égal à l'écart temporel entre deux pixels successifs d'une ligne, les sorties de chacun desdits seconds moyens de retard (d) et l'entrée de la cascade desdits seconds moyens de retard (d) de chaque ligne débitant à un instant donné les valeurs dudit signal binaire et dudit signal numérique d'amplitude, à un même instant, vers lesdits moyens de repérage (17a).

10. Dispositif selon la revendication 8 ou 9, caractérisé en ce qu'il comporte également des moyens (24-29) formant les histogrammes des valeurs de sortie de ladite unité de traitement spatial, ainsi que les histogrammes des inclinaisons de deux axes, à pente variable, de coordonnées dans un plan, des moyens pour repérer, dans chaque histogramme, un domaine de variation significative de la valeur traitée, afin de valider ce domaine en leur sortie et de déduire, pour l'ensemble des histogrammes, des signaux de sortie qui signalent et localisent une zone de la scène observée en mouvement relatif, si elle existe, ainsi que la vitesse et la direction orientée de ce mouvement si ladite zone se déplace effectivement par rapport à son environnement.

11. Dispositif selon la revendication 8, 9 ou 10, caractérisé en ce que lesdits moyens de lissage (15c, 15d) comportent une entrée qui reçoit ledit signal vidéo numérique S (PI) et calculent, pour les pixels successifs d'une trame de ce signal vidéo, un signal lissé (LO), dans lequel les variations temporelles du signal vidéo numérique d'entrée sont diminuées, par mise en oeuvre d'un signal de seuil (N) reçu sur une autre entrée et d'une constante de temps (CO) relative à chaque position de pixel d'une trame, dont la valeur est successivement modifiée afin que le lissage conserve, tout en la réduisant, la tendance de variation du signal vidéo numérique entrant, ces moyens de lissage coopérant avec l'unité de mémoire (16) qui reçoit, stocke et restitue les valeurs actualisées, pour chaque position de pixel d'une trame, du signal lissé et de ladite constante de temps et débitent, sur leurs sorties, au moins la succession, pour chaque position de pixel, des valeurs de la constante de temps actualisée et des valeurs d'un signal binaire de dépassement ou non-dépassement dudit seuil par la valeur absolue de la différence entre la valeur du pixel et sa valeur lissée.

12. Dispositif selon l'une quelconque des revendications 8 à 11, caractérisé en ce que ladite unité de traitement spatial (17, 18) réalisant la répartition matricielle, par lignes et par colonnes en nombre réduit, des sorties desdits moyens de lissage, à savoir des valeurs successives de la constante de temps (CO) et dudit signal binaire, comporte des moyens de repérage (17a) pour repérer, dans ladite répartition matricielle, une zone de pixels dans laquelle, à la fois, soit la valeur dudit signal binaire correspond à un dépassement de seuil et ladite constante de temps varie entre pixels voisins d'une valeur significative dans une direction, et pour produire des signaux de sortie indiquant la localisation de ladite zone et la vitesse et la direction orientée du déplacement dans ladite zone, soit la valeur dudit signal binaire correspond à un non-dépassement du seuil et ladite constante de temps ne varie pas entre pixels voisins.

13. Application du dispositif selon la revendication 10, 11 ou 12, pour aider la conduite d'un véhicule terrestre sur une route, respectivement d'un véhicule aérien au voisinage d'une piste d'aéroport, caractérisé en ce que le dispositif comporte en outre des moyens de représentation des bords droit Bd et gauche Bg de la route, respectivement de la piste, et des moyens pour orienter au moins un des axes, à pente variable, de coordonnées pour qu'il se maintienne sensiblement orthogonal au bord correspondant (position Po).

14. Application du dispositif selon l'une quelconque des revendications 1 à 12, pour surveiller l'état de vigilance du conducteur d'un véhicule automobile, afin de détecter une tendance éventuelle à la somnolence de celui-ci, consistant à:

- générer un signal vidéo numérique représentant

- initialement les images successives de la face du conducteur et

- ensuite, d'une manière continue et en temps réel, les images successives de seulement les yeux du conducteur;

- traiter ledit signal vidéo relatif seulement aux yeux, du conducteur afin de, successivement et en temps réel,

- détecter, dans lesdites images de seulement les yeux, les mouvements verticaux des paupières représentant le clignement de celles-ci,
- déterminer les cadences successives de ces mouvements et
- détecter les cadences qui sont inférieures à un seuil de clignement des paupières qui correspond à la transition entre l'état éveillé et l'état de somnolence du conducteur, et

- déclencher un signal d'alarme apte à alerter le conducteur dès que lesdites cadences franchissent ledit seuil.

DECLARATION SELON L'ARTICLE 19

Pour mieux se distinguer du brevet US N° 5.488.430 cité dans la catégorie X contre les revendications 1 et 8 antérieures, la demanderesse dépose un nouveau jeu de revendications, avec de nouvelles revendications 1 et 8 dans lesquelles on a placé dans le préambule avant les mots « caractérisé en ce que » l'admission que ce brevet US prévoit un traitement temporel de comparaison entre trame actuelle et des trames antérieures et un traitement spatial avec une matrice défilante.

Dans la partie caractérisante, on a laissé les caractéristiques nouvelles et inventives de la présente demande de brevet à savoir:

- une double opération préalable de
  - lissage adaptatif avec mise en oeuvre d'une constante de temps pour chaque pixel qui est modifiée en fonction des variations du signal de pixel, et
  - mémorisation et utilisation de la trame entière antérieure et des constantes de temps pour l'ensemble d'une trame;
- la mise en oeuvre, dans le traitement temporel, de deux signaux numériques, l'un binaire de variation DP et l'autre d'amplitude CO; et
- la mise en oeuvre, dans le traitement spatial, de ces deux signaux binaires défilant en simultané, et par roulement, dans la matrice, pour représenter l'évolution du signal vidéo numérique représentant la scène observée;

ceci permet d'obtenir, d'une part, une détermination relativement précise, et non simplement une évaluation, de la vitesse de déplacement et, d'autre part, la détermination de la direction orientée du déplacement selon de nombreuses directions orientées du plan et non pas seulement selon les directions Ox et Oy.

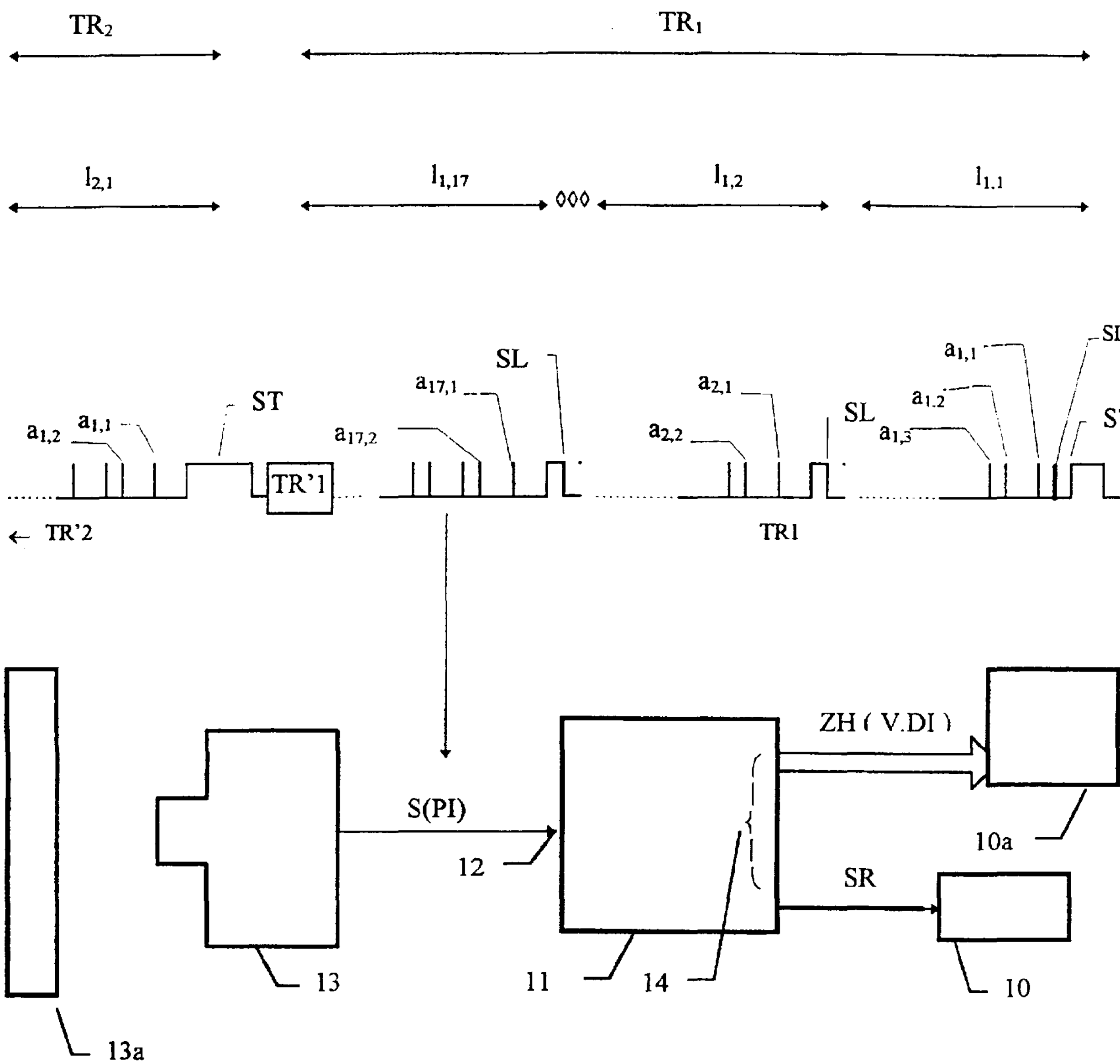

TR2
TR1
l2,1
l1,17
l1,2
l1,1
SL
a17,1
a2,1
a1,1
SL
a1,2
a1,1
ST
a17,2
a2,2
SL
a1,2
a1,3
ST
TR'1
← TR'2
TR1
ZH (V.DI)
S(PI)
10a
12
SR
13
11
14
10
13a

FIG. 1

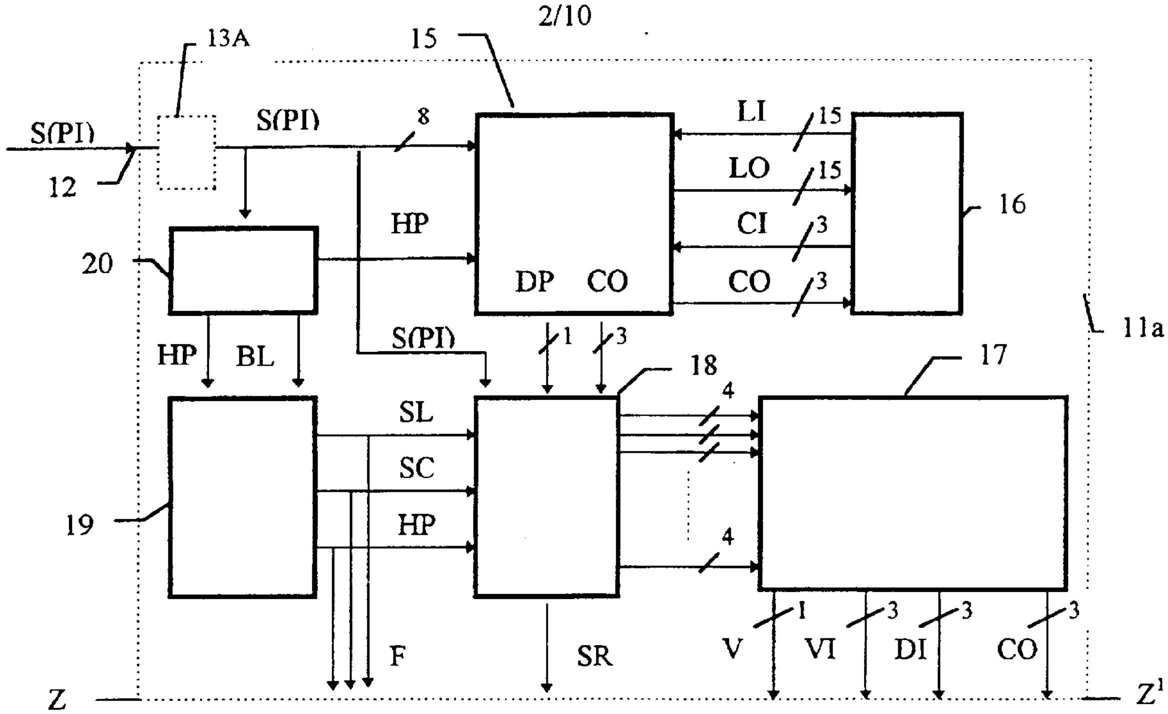
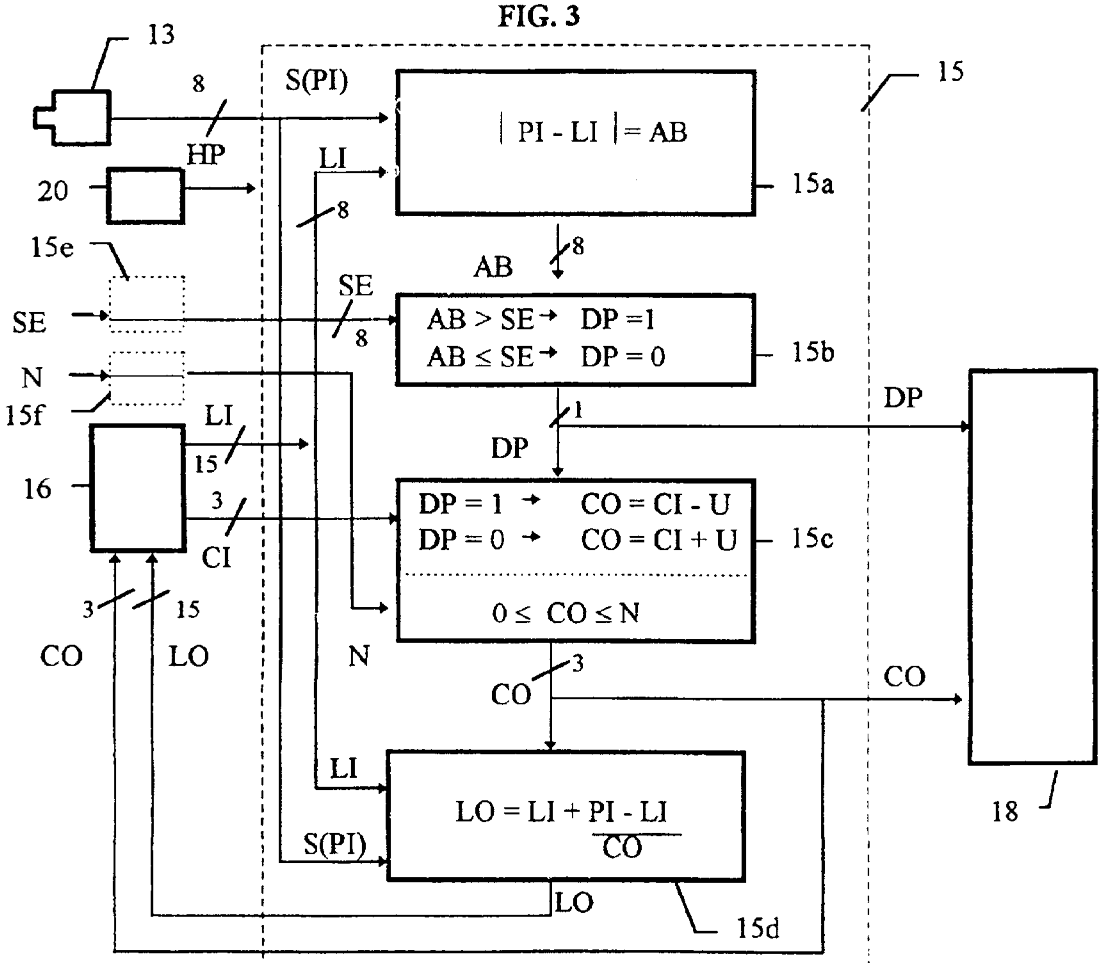

13A
15
S(PI)
12
S(PI)
8
LI
15
LO
15
CI
3
CO
3
16
20
HP
DP CO
11a
HP
BL
S(PI)
1
3
18
17
4
SL
SC
HP
19
4
1
3
3
3
V
VI
DI
CO
F
SR
Z
Z1

FIG. 2

FIG. 3


13
8
S(PI)
15
| PI - LI | = AB
HP
20
LI
8
15a
15e
AB
8
SE
SE
AB > SE → DP = 1
AB ≤ SE → DP = 0
8
15b
N
15f
LI
DP
1
DP
15
16
3
DP = 1 → CO = CI - U
DP = 0 → CO = CI + U
15c
CI
0 ≤ CO ≤ N
3
15
CO
LO
N
3
CO
CO
LI
LO = LI + (PI - LI) / CO
S(PI)
18
LO
15d

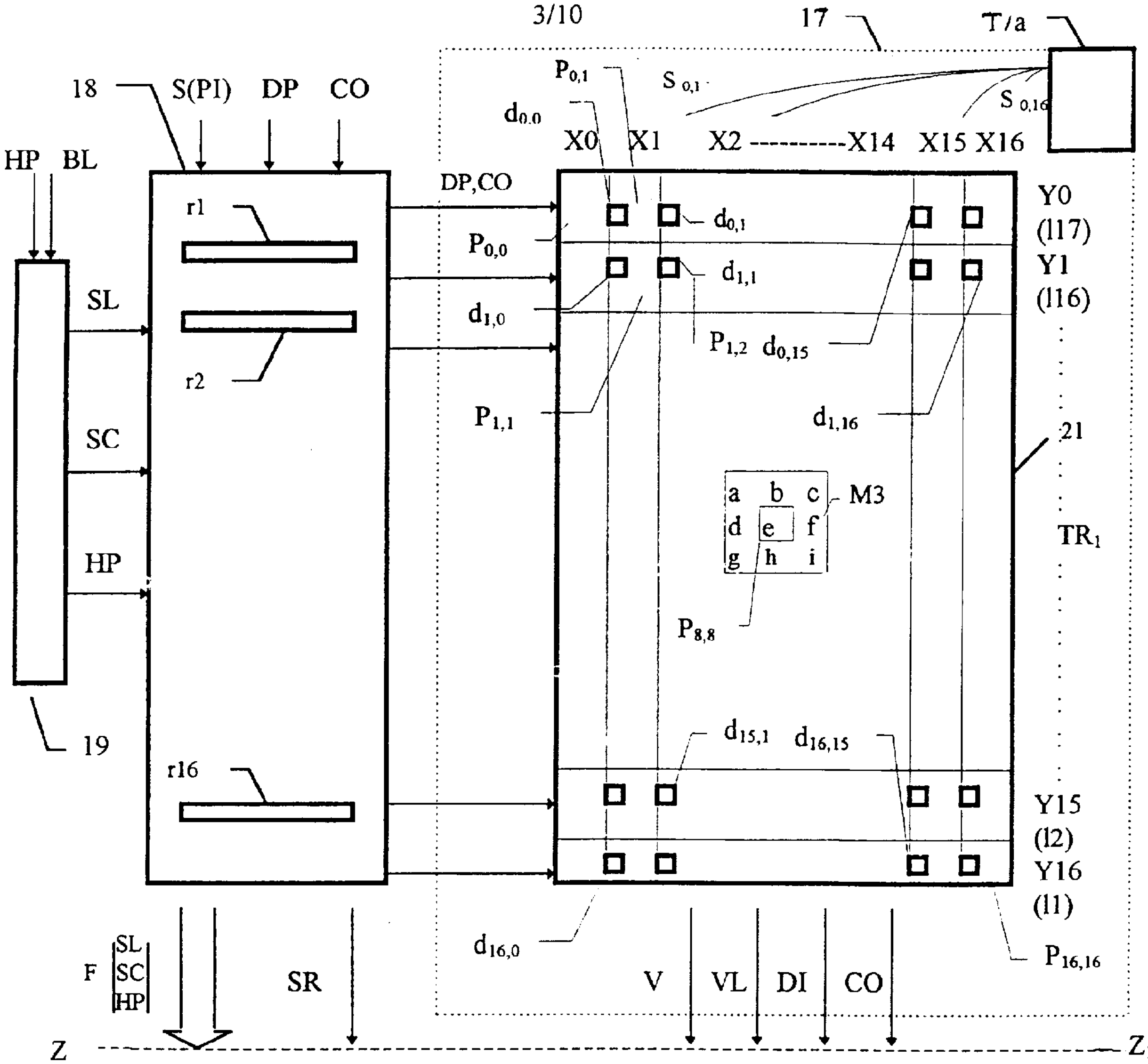


FIG. 4

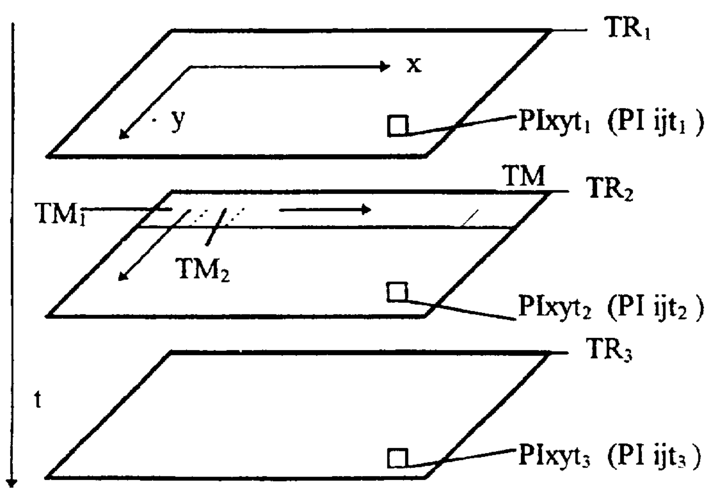


FIG. 5

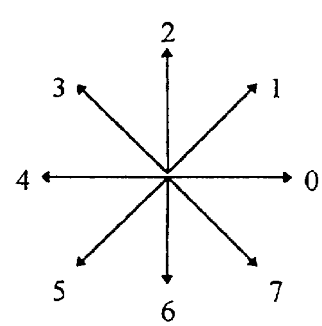
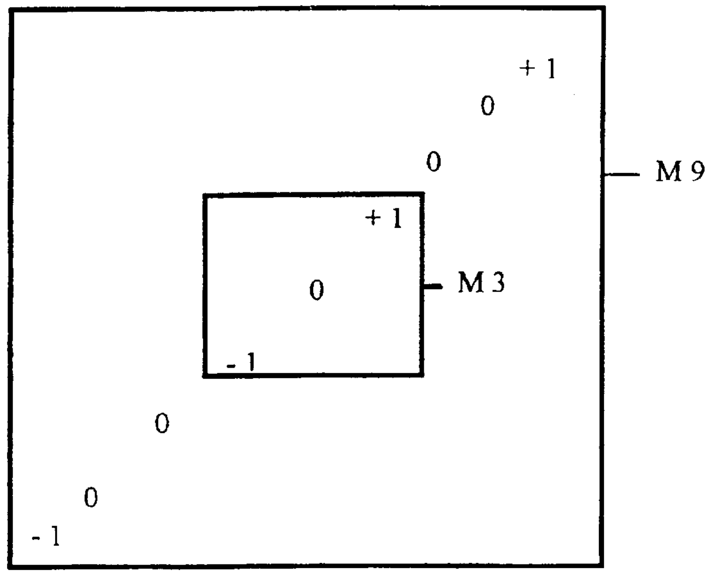


FIG. 6

FIG. 7



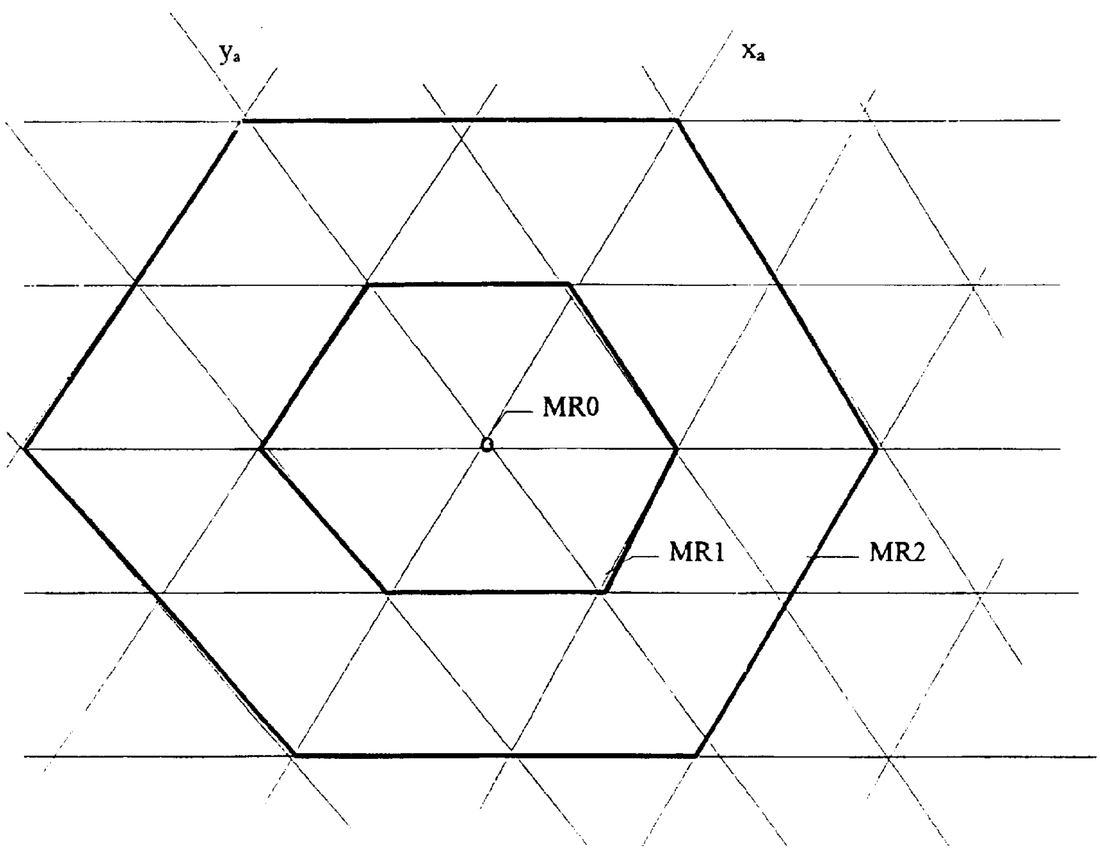


FIG. 8

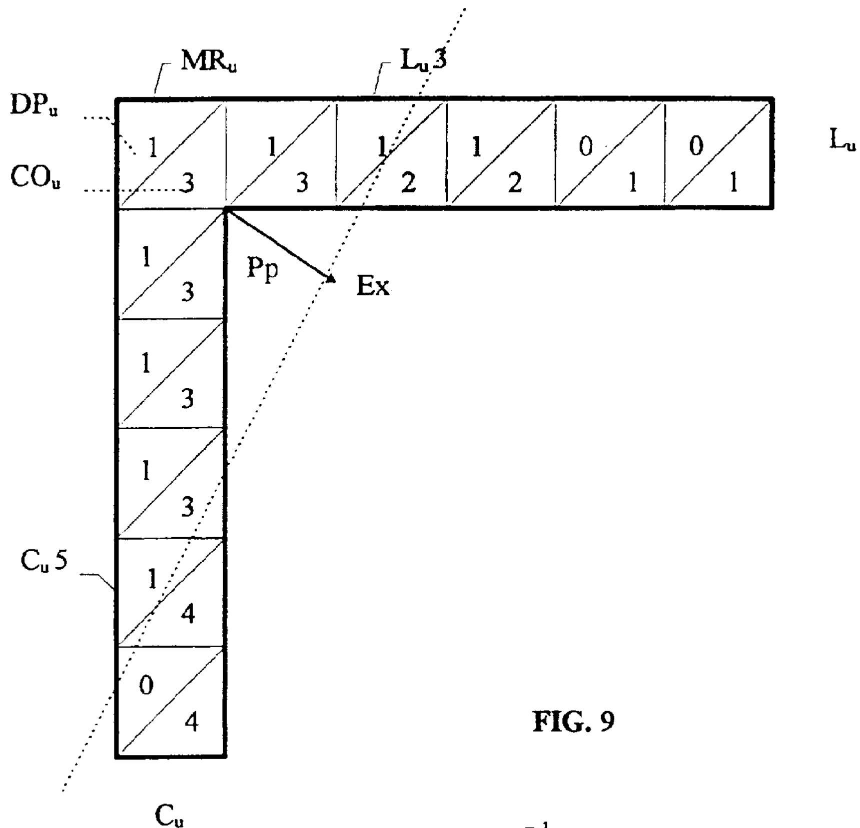

MRu
Lu3
DPu
COu
Lu
1 3
1 3
1 2
1 2
0 1
0 1
1 3
1 3
1 3
1 4
0 4
Pp
Ex
Cu5
Cu

FIG. 9

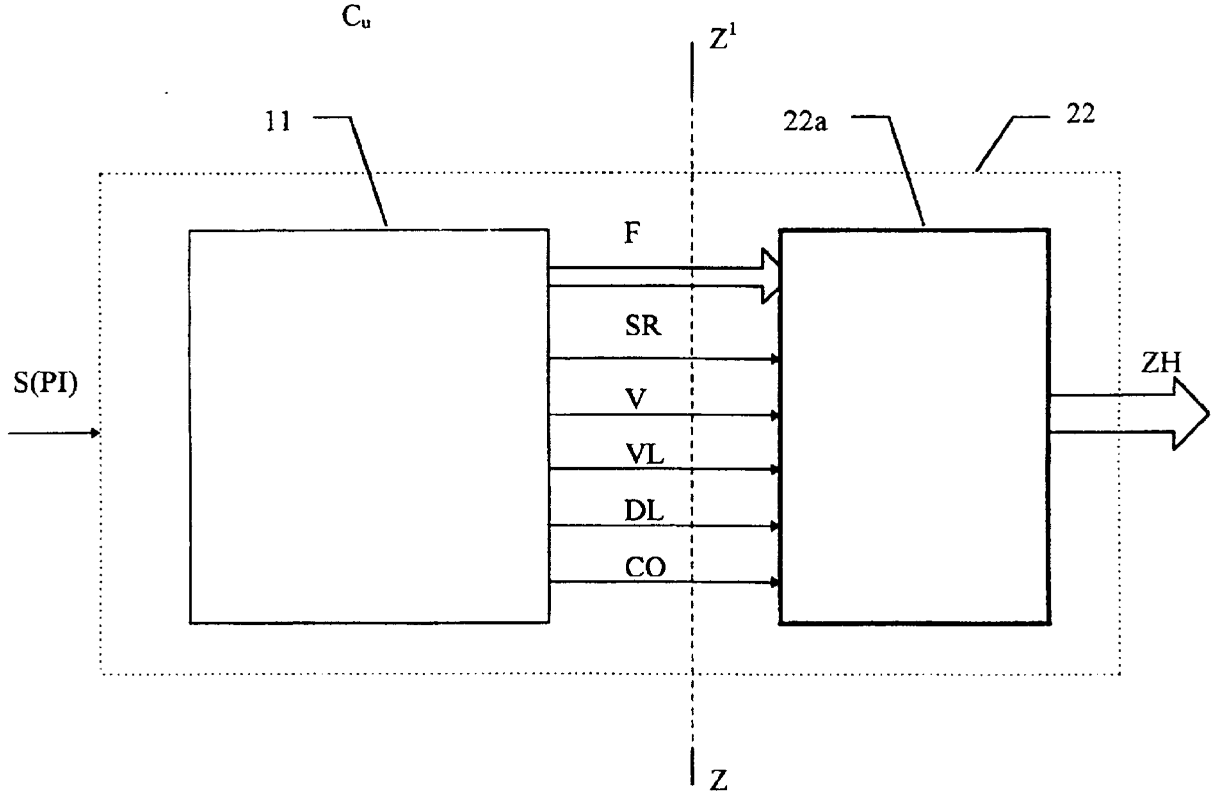
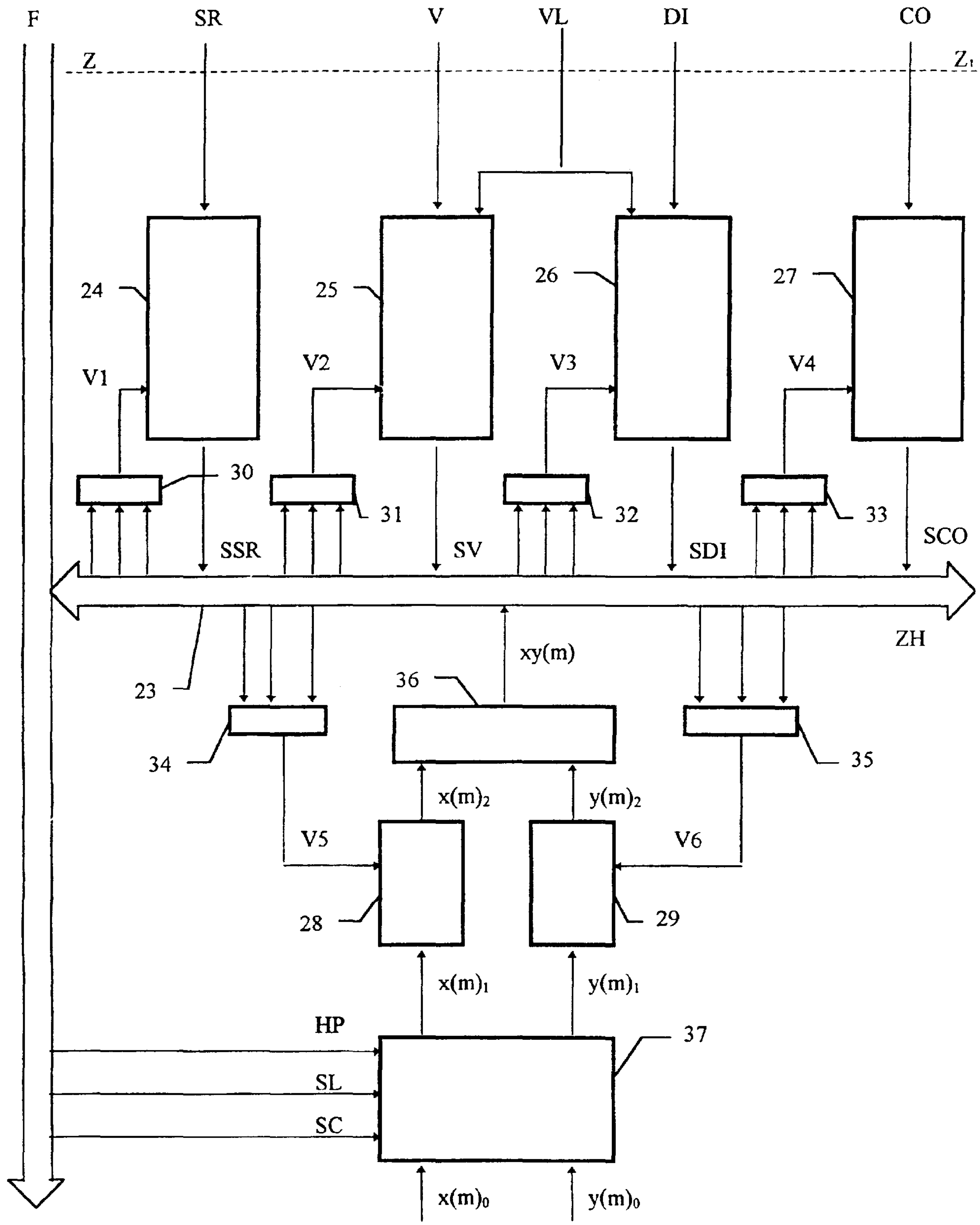

Z1
11
22a
22
F
SR
V
VL
DL
CO
S(PI)
ZH
Z

FIG. 10


F
SR
V
VL
DI
CO
Z
Z1
24
25
26
27
V1
V2
V3
V4
30
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SSR
SV
SDI
SCO
ZH
23
xy(m)
36
34
35
x(m)2
y(m)2
V5
V6
28
29
x(m)1
y(m)1
HP
SL
SC
37
x(m)0
y(m)0

FIG. 11

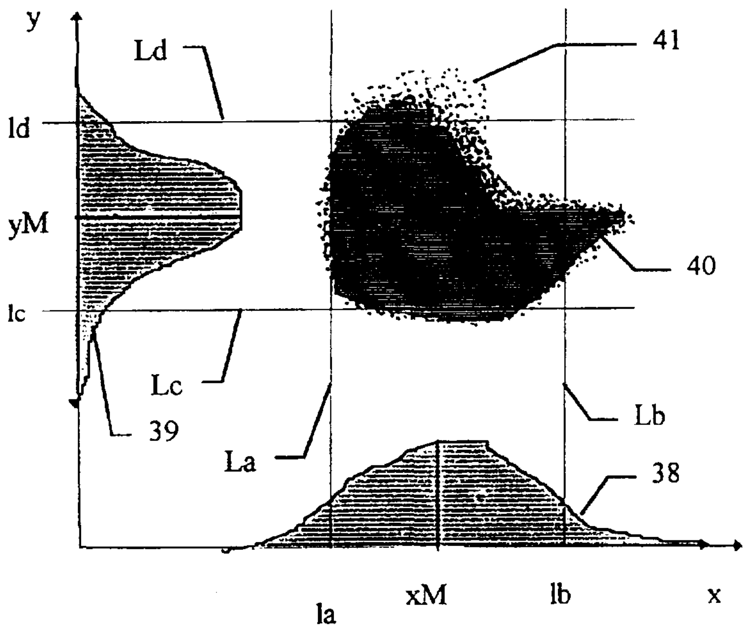
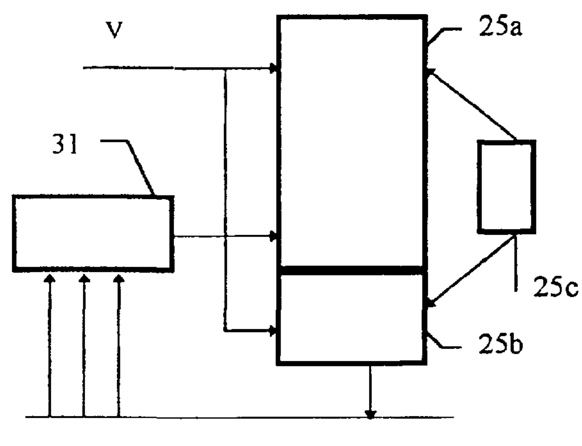


FIG. 12

FIG. 13



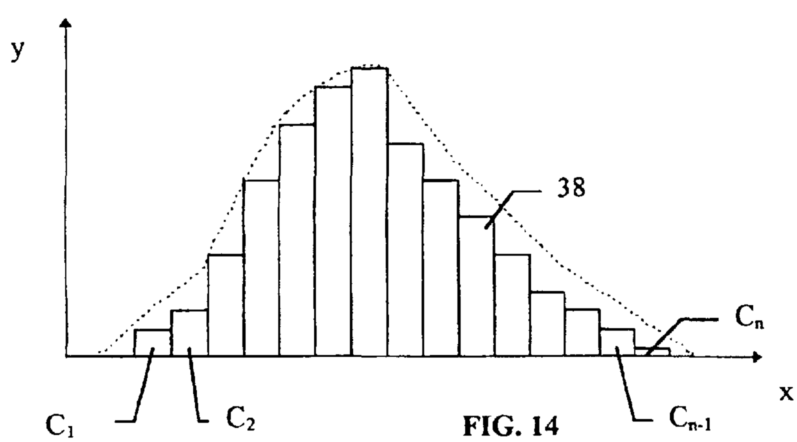
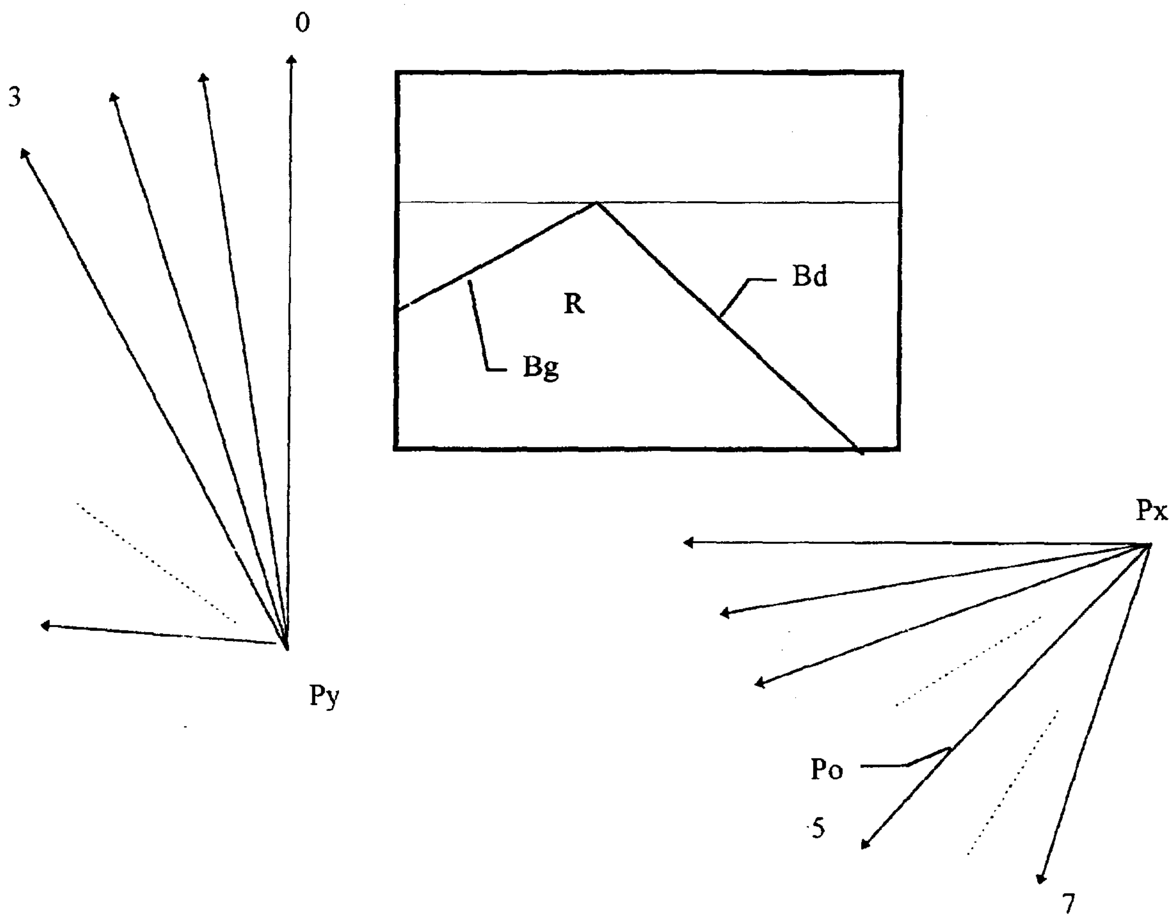
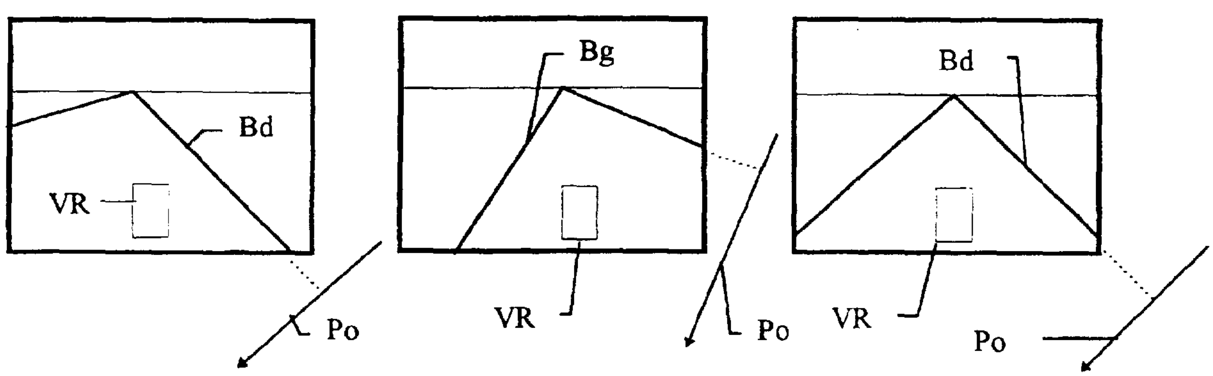


FIG. 14

FIG. 15

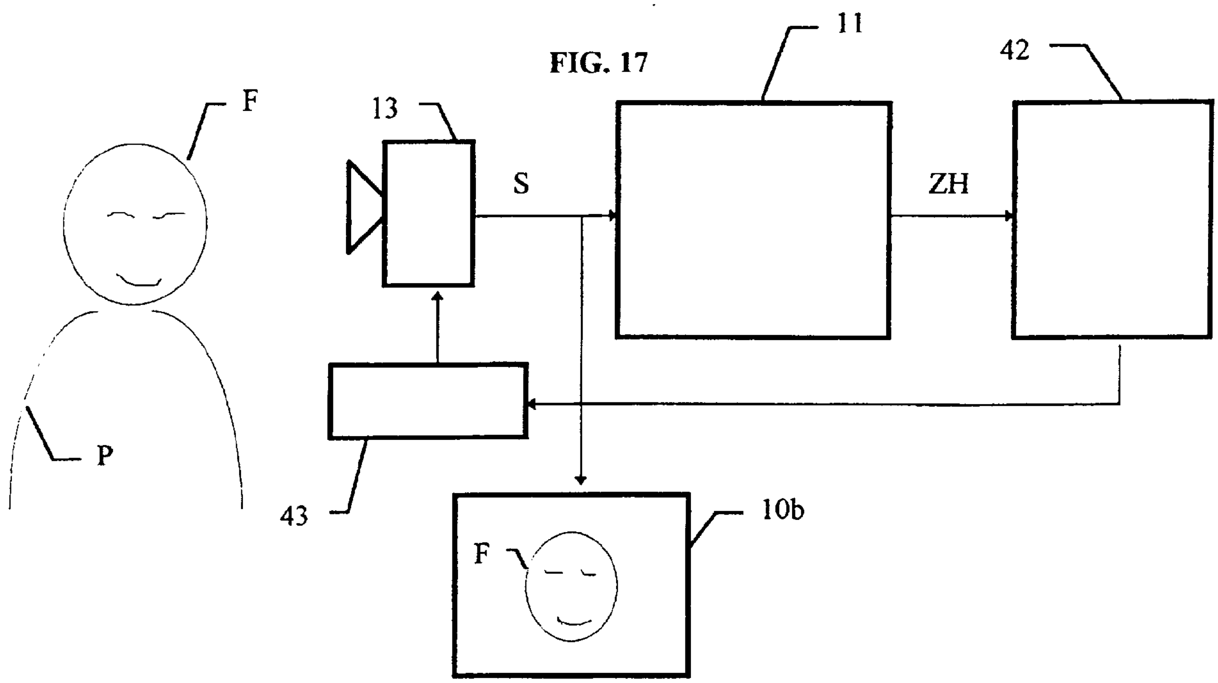




(a) (b) (c)

FIG. 16

FIG. 17



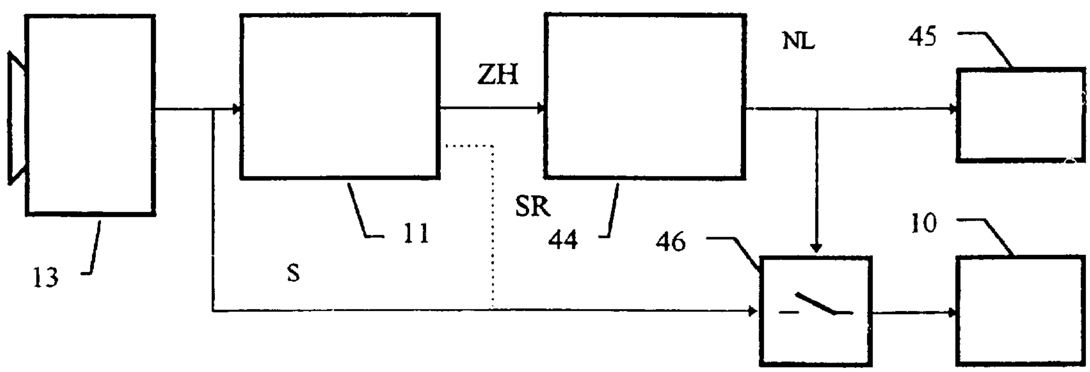


FIG. 18

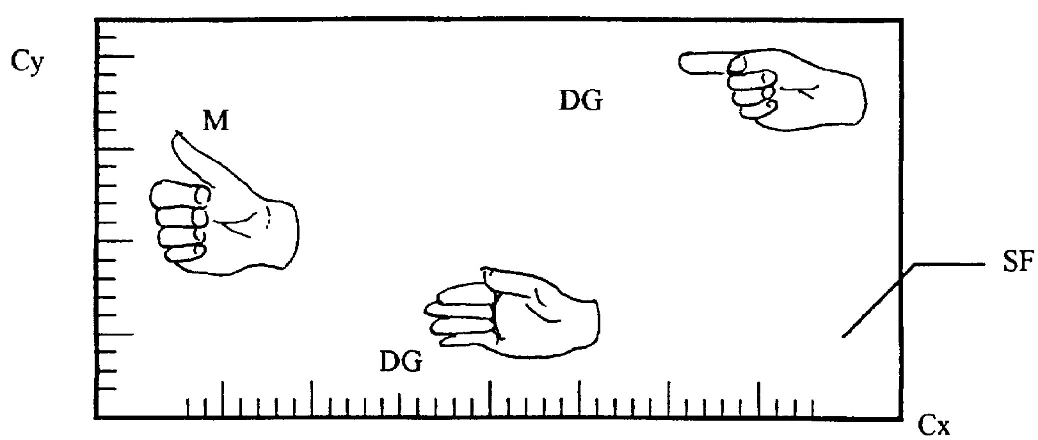


FIG. 19

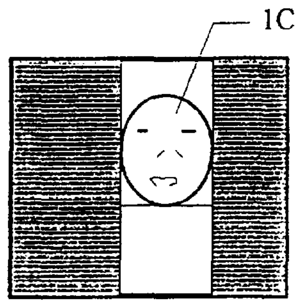


FIG.20

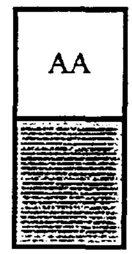


FIG.21

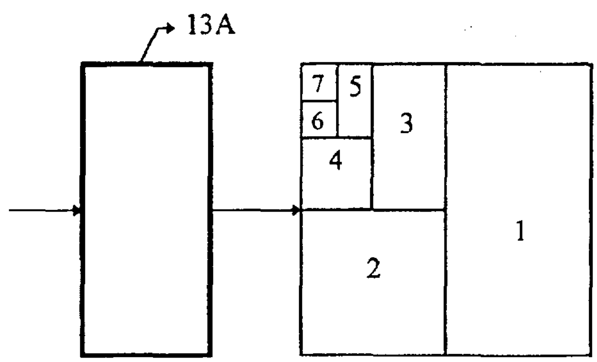


FIG.22

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/FR 97/01354

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06T7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 488 430 A (SUNG H. HONG) 30 January 1996 see column 2, line 14 - column 3, line 20 ---	1,8
A	TOMITA A ET AL: "HAND SHAPE EXTRACTION FROM A SEQUENCE OF DIGITIZED GRAY-SCALE IMAGES" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON INDUSTRIAL ELECTRONI CONTROL AND INSTRUMENTATION. (IECON), BOLOGNA, SEPT. 5 - 9, 1994 SPECIAL SESSIONS, SIGNAL PROCESSING AND CONTROL, vol. 3 OF 3, 5 September 1994, INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, pages 1925-1930, XP000526830 see page 1927, right-hand column, paragraph 2.2.2 - page 1928, right-hand column, paragraph 3 -----	2,10

☐ Further documents are listed in the continuation of box C.

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1

Date of the actual completion of the international search	Date of mailing of the international search report
13 November 1997	19.11.97
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Chateau, J-P

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/FR 97/01354

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5488430 A	30-01-96	KR 9411881 B	27-12-94
		EP 0549471 A	30-06-93

Form PCT/ISA/210 (patent family annex) (July 1992)

RAPPORT DE RECHERCHE INTERNATIONALE

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PCT/FR 97/01354

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CIB 6 G06T7/20

Selon la classification internationale des brevets (CIB) ou à la fois selon la classification nationale et la CIB

B. DOMAINES SUR LESQUELS LA RECHERCHE A PORTE

Documentation minimale consultée (système de classification suivi des symboles de classement)
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Base de données électronique consultée au cours de la recherche internationale (nom de la base de données, et si cela est réalisable, termes de recherche utilisés)

C. DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie °	Identification des documents cités, avec, le cas échéant, l'indication des passages pertinents	no. des revendications visées
X	US 5 488 430 A (SUNG H. HONG) 30 janvier 1996 voir colonne 2, ligne 14 - colonne 3, ligne 20 ---	1,8

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Date à laquelle la recherche internationale a été effectivement achevée	Date d'expédition du présent rapport de recherche internationale
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Dem: nternationale No
PCT/FR 97/01354

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Catégorie °	Identification des documents cités, avec, le cas échéant, l'indication des passages pertinents	no. des revendications visées
A	TOMITA A ET AL: "HAND SHAPE EXTRACTION FROM A SEQUENCE OF DIGITIZED GRAY-SCALE IMAGES" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON INDUSTRIAL ELECTRONI CONTROL AND INSTRUMENTATION. (IECON), BOLOGNA, SEPT. 5 - 9, 1994 SPECIAL SESSIONS, SIGNAL PROCESSING AND CONTROL, vol. 3 OF 3, 5 septembre 1994, INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, pages 1925-1930, XP000526830 voir page 1927, colonne de droite, alinéa 2.2.2 - page 1928, colonne de droite, alinéa 3 -----	2,10

1

RAPPORT DE RECHERCHE INTERNATIONALE

Renseignements relatifs au, membres de familles de brevets

Dem: Internationale No
PCT/FR 97/01354

Document brevet cité au rapport de recherche	Date de publication	Membre(s) de la famille de brevet(s)	Date de publication
US 5488430 A	30-01-96	KR 9411881 B	27-12-94
		EP 0549471 A	30-06-93

Formulaire PCT/ISA/210 (annexe familles de brevets) (juillet 1992)

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **G06T 7/20**	A1	(11) International Publication Number: **WO 00/11610** (43) International Publication Date: 2 March 2000 (02.03.00)

(21) International Application Number: PCT/EP98/05383

(22) International Filing Date: 25 August 1998 (25.08.98)

(63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application
US PCT/FR97/01354 (CIP)
Filed on 22 July 1997 (22.07.97)

(71) Applicant *(for all designated States except US)*: HOLDING BEV S.A. [LU/LU]; 69, route de d'Esch, L-2953 Luxemburg (LU).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: PIRIM, Patrick [FR/FR]; 56, rue Patay, F-75013 Paris (FR).

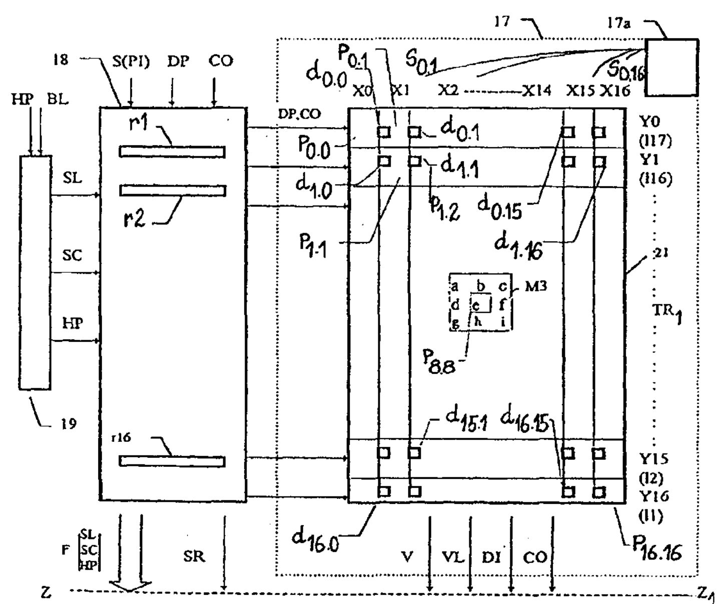
(74) Agent: PHELIP, Bruno; Cabinet Harlé & Phélip, 7, rue de Madrid, F-75008 Paris (FR).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) **Title:** IMAGE PROCESSING APPARATUS AND METHOD

(57) **Abstract**



A method and apparatus for localizing an area in relative movement and for determining the speed and direction thereof in real time is disclosed. Each pixel of an image is smoothed using its own time constant. A binary value corresponding to the existence of a significant variation in the amplitude of the smoothed pixel from the prior frame, and the amplitude of the variation, are determined, and the time constant for the pixel is updated. For each particular pixel, two matrices are formed that include a subset of the pixels spatially related to the particular pixel. The first matrix contains the binary values of the subset of pixels. The second matrix contains the amplitude of the variation of the subset of pixels. In the first matrix, it is determined whether the pixels along an oriented direction relative to the particular pixel have binary values representative of significant variation, and, for such pixels, it is determined in the second matrix whether the amplitude of these pixels varies in a known manner indicating movement in the oriented direction. In each of several domains, histogram of the values in the first and second matrices falling in such domain is formed. Using the histograms, it is determined whether there is an area having the characteristics of the particular domain. The domains include luminance, hue, saturation, speed (V), oriented direction (D1), time constant (CO), first axis (x(m)), and second axis (y(m)).

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IMAGE PROCESSING APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to an image processing apparatus, and more particularly to a method and apparatus for identifying and localizing an area in relative movement in a scene and determining the speed and oriented direction of the area in real time.

2. Description of the Related Art

The human or animal eye is the best known system for identifying and localizing an object in relative movement, and for determining its speed and direction of movement. Various efforts have been made to mimic the function of the eye. One type of device for this purpose is referred to as an artificial retina, which is shown, for example, in Giocomo Indiveri et. al, Proceedings of MicroNeuro, 1996, pp. 15-22 (analog artificial retina), and Pierre-François Rüedii, Proceedings of MicroNeuro, 1996, pp. 23-29, (digital artificial retina which identifies the edges of an object). However, very fast and high capacity memories are required for these devices to operate in real time, and only limited information is obtained about the moving areas or objects observed Other examples of artificial retinas and similar devices are shown in U S. Patent Nos. 5,694,495 and 5,712,729.

Another proposed method for detecting objects in an image is to store a frame from a video camera or other observation sensor in a first two-dimensional memory. The frame is composed of a sequence of pixels representative of the scene observed by the camera at time t_0. The video signal for the next frame, which represents the scene at time t_1, is stored in a second two-dimensional memory. If an object has moved between times t_0 and t_1, the distance d by which the object, as represented by its pixels, has moved in the scene between t_1 and t_0 is determined. The displacement speed is then equal to d/T, where

$T = t_1 - t_0$. This type of system requires a very large memory capacity if it is used to obtain precise speed and oriented direction. Information for the movement of the object. There is also a delay in obtaining the speed and displacement direction information corresponding to $t_1 + R$, where R is the time necessary for the calculations for the period $t_0 - t_1$ system. These two disadvantages limit applications of this type of system.

Another type of prior image processing system is shown in French Patent No. 2,611,063, of which the inventor hereof is also an inventor. This patent relates to a method and apparatus for real time processing of a sequenced data flow from the output of a camera in order to perform data compression. A histogram of signal levels from the camera is formed using a first sequence classification law. A representative Gaussian function associated with the histogram is stored, and the maximum and minimum levels are extracted. The signal levels of the next sequence are compared with the signal levels for the first sequence using a fixed time constant identical for each pixel. A binary classification signal is generated that characterizes the next sequence with reference to the classification law An auxiliary signal is generated from the binary signal that is representative of the duration and position of a range of significant values. Finally, the auxiliary signal is used to generate a signal localizing the range with the longest duration, called the dominant range. These operations are repeated for subsequent sequences of the sequenced signal.

This prior process enables data compression, keeping only interesting parameters in the processed flow of sequenced data. In particular, the process is capable of processing a digital video signal in order to extract and localize at least one characteristic of at least one area in the image. It is thus possible to classify, for example, brightness and/or chrominance levels of the signal and to characterize and localize an object in the image.

U.S. Patent No. 5,488,430 detects and estimates a displacement by separately determining horizontal and vertical changes of the observed area. Difference signals are used to detect movements from right to left or from left to right, or from top to bottom or bottom to top, in the horizontal and vertical directions respectively. This is accomplished by carrying out an EXCLUSIVE OR function on horizontal/vertical difference signals and on frame difference signals, and by using a ratio of the sums of the horizontal/vertical signals and the sums of frame difference signals with respect to a K x 3 window. Calculated values of the image along orthogonal horizontal and vertical directions are used with an identical repetitive difference K in the orthogonal directions, this difference K being defined as a function of the displacement speeds that are to be determined. The device determines the direction of movement along each of the two orthogonal directions by applying a set of calculation operations to the difference signals, which requires very complex computations. Additional complex computations are also necessary to obtain the speed and oriented direction of displacement (extraction of a square root to obtain the amplitude of the speed, and calculation of the arctan function to obtain the oriented direction), starting from projections on the horizontal and vertical axes. This device also does not smooth the pixel values using a time constant, especially a time constant that is variable for each pixel, in order to compensate for excessively fast variations in the pixel values.

Finally, Alberto Tomita Sales Representative. and Rokuva Ishii, "Hand Shape Extraction from a Sequence of Digitized Gray-Scale Images," Institute of Electrical and Electronics Engineers, Vol. 3, 1994, pp. 1925-1930, detects movement by subtracting between successive images, and forming histograms based upon the shape of a human hand in order to extract the shape of a human hand in a digitized scene. The histogram analysis is based upon a gray scale inherent to the human hand. It does not include any means of forming histograms in the plane coordinates . The sole purpose of the method is to detect the displacement of a human hand, for example, in order to replace the normal computer mouse by a hand, the movements of which are identified to control a computer.

It would be desirable to have an image processing system which has a relatively simple structure and requires a relatively small memory capacity, and by which information on the movement of objects within an image can be obtained in real-time. It would also be desirable to have a method and apparatus for detecting movements that are not limited to the hand, but to any object (in the widest sense of the term) in a scene, and which does not use histograms based on the gray values of a hand, but rather the histograms of different variables representative of the displacement and histograms of plane coordinates. Such a system would be applicable to many types of applications requiring the detection of moving and non-moving objects.

SUMMARY OF THE INVENTION

The present invention is a process for identifying relative movement of an object in an input signal, the input signal having a succession of frames, each frame having a succession of pixels. For each pixel of the input signal, the input signal is smoothed using a time constant for the pixel in order to generate a smoothed input signal. For each pixel in the smoothed input signal, a binary value corresponding to the existence of a significant variation in the amplitude of the pixel between the current frame and the immediately previous smoothed input frame, and the amplitude of the variation, are determined.

Using the existence of a significant variation for a given pixel, the time constant for the pixel, which is to be used in smoothing subsequent frames of the input signal, is modified. The time constant is preferably in the form 2^P, and is increased or decreased by incrementing or decrementing p. For each particular pixel of the input signal, two matrices are then formed: a first matrix comprising the binary values of a subset of the pixels of the frame spatially related to the particular pixel; and a second matrix comprising the amplitude of the variation of the subset of the pixels of the frame spatially related to the particular pixel. In the first matrix, it is determined whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and, for such pixels, it is determined in the second matrix whether the amplitude of the pixels along the oriented direction relative to the particular pixel varies in a known manner indicating movement in the oriented direction of the particular pixel and the pixels along the oriented direction relative to the particular pixel. The amplitude of the variation of the pixels along the oriented direction determines the velocity of movement of the particular pixel and the pixels along the oriented direction relative to the particular pixel.

In each of one or more domains, a histogram of the values distributed in the first and second matrices falling in each such domain is formed. For a particular domain, an area of significant variation is determined from the histogram for that domain. Histograms of the area of significant variation along coordinate axes are then formed. From these histograms, it is determined whether there is an area in movement for the particular domain. The domains are preferably selected from the group consisting of i) luminance, ii) speed (V), iii) oriented direction (D1), iv) time constant (CO), v) hue, vi) saturation, and vii) first axis (x(m)), and viii) second axis (y(m)).

In one embodiment, the first and second matrices are square matrices, with the same odd number of rows and columns, centered on the particular pixel. In this embodiment, the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested n x n matrices, where n is odd, centered on the particular pixel to the pixels within each of the first and second matrices. The process then includes the further step of determining the smallest nested matrix in which the amplitude signal varies along an oriented direction around the particular pixel.

In an alternative embodiment, the first and second matrices are hexagonal matrices centered on the particular pixel. In this embodiment, the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested hexagonal matrices of varying size centered on the particular pixel to the pixels within each of the first and second matrices. The process then further includes determining the smallest nested matrix in which the amplitude signal varies along an oriented direction around the particular pixel.

In a still further embodiment of the invention, the first and second matrices are inverted L-shaped matrices with a single row and a single column. In this embodiment, the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested n x n matrices, where n is odd, to the single line and the single column to determine the smallest matrix in which the amplitude varies on a line with the steepest slope and constant quantification.

If desired, successive decreasing portions of frames of the input signal may be considered using a Mallat time-scale algorithm, and the largest of these portions, which provides displacement, speed and orientation indications compatible with the value of p, is selected.

In a process of smoothing an input signal, for each pixel of the input signal, i) the pixel is smoothed using a time constant (CO) for that pixel, thereby generating a smoothed pixel value (LO), ii) it is determined whether there exists a significant variation between such pixel and the same pixel in a previous frame, and iii) the time constant (CO) for such pixel to be used in smoothing the pixel in subsequent frames of the input signal is modified based upon the existence or non-existence of a significant variation.

The step of determining the existence of a significant variation for a given pixel preferably comprises determining whether the absolute value of the difference (AB) between the given pixel value (PI) and the value of such pixel in a smoothed prior frame (LI) exceeds a threshold (SE). The step of smoothing the input signal preferably comprises, for each pixel, i) modifying the time constant (CO) for pixel such based upon the existence of a significant variation as determined in the prior step, and ii) determining a smoothed value for the pixel (LO) as follows:

$$LO = LI + \frac{PI - LI}{CO}$$

Time constant (CO) is preferably in the form 2^P, and p is incremented in the event that AB<SE and decremented in the event AB≥SE.

In this process, the system generates an output signal comprising, for each pixel, a binary value (DP) indicating the existence or non-existence of a significant variation, and the value of the time constant (CO). The binary values (DP) and the time constants (CO) are preferably stored in a memory sized to correspond to the frame size.

A process for identifying an area in relative movement in an input signal includes the steps of:

generating a first array indicative of the existence of significant variation in the magnitude of each pixel between a current frame and a prior frame;

generating a second array indicative of the magnitude of significant variation of each pixel between the current frame and a prior frame;

establishing a first moving matrix centered on a pixel under consideration and comprising pixels spatially related to the pixel under consideration, the first moving matrix traversing the first array for consideration of each pixel of the current frame; and

determining whether the pixel under consideration and each pixel of the pixels spatially related to the pixel under consideration along an oriented direction relative thereto within the first matrix are a particular value representing the presence of significant variation, and if so, establishing in a second matrix within the first matrix, centered on the pixel under consideration, and determining whether the amplitude of the pixels in the second matrix spatially related to the pixel under consideration along an oriented direction relative thereto are indicative of movement along such oriented direction, the amplitude of the variation along the oriented direction being indicative of the velocity of movement, the size of the second matrix being varied to identify the matrix size most indicative of movement.

The process further comprises, in at least one domain selected from the group consisting of i) luminance, ii) speed (V), iii) oriented direction (D1), iv) time constant (CO), v) hue, vi) saturation, and vii) first axis (x(m)), and viii) second axis (y(m)), and ix) data characterized by external inputs, forming a first histogram of the values in such domain for pixels indicative of movement along an oriented direction relative to the pixel under consideration. If desired, for the pixels in the first histogram, histograms of the position of such pixels along coordinate axes may be formed, and from such histograms, an area of the image meeting criteria of the at least one domain may be determined.

A process for identifying pixels in an input signal in one of a plurality of classes in one of a plurality of domains comprises, on a frame-by-frame basis:

for each pixel of the input signal, analyzing the pixel and providing an output signal for each domain containing information to identify each domain in which the pixel is classified ;

providing a classifier for each domain, the classifier enabling classification of pixels within each domain to selected classes within the domain;

providing a validation signal for the domains, the validation signal selecting one or more of the plurality of domains for processing; and

forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal.

The process further includes the steps of forming histograms along coordinate axes for the pixels within the classes selected by the classifier within each domain selected by the validation signal, and forming a composite signal corresponding to the spatial position of such pixels within the frame. Pixels falling within limits l_a, l_b, l_c, l_d in the histograms along the coordinate axes are then identified, and a composite signal from the pixels falling within these limits is formed.

A process for identifying the velocity of movement of an area of an input signal comprises:

for each particular pixel of the input signal, forming a first matrix comprising binary values indicating the existence or non-existence of a significant variation in the amplitude of the pixel signal between the current frame and a prior frame for a subset of the pixels of the frame spatially related to such particular pixel, and a second matrix comprising the amplitude of such variation;

determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and, for such pixels, determining in the second matrix whether the amplitudes of the pixels along an oriented direction relative to the particular pixel vary in a known manner indicating movement of the pixel and the pixels along an oriented direction relative to the particular pixel, the amplitude of the variation along the oriented direction determining the velocity of movement of the particular pixel.

A process for identifying a non-moving area in an input signal comprises:

forming histograms along coordinate axes for pixels of the input signal without significant variation between the current frame and a prior frame; and

forming a composite signal corresponding to the spatial position of such pixels within the frame.

An apparatus for identifying relative movement in an input signal comprises: means for smoothing the input signal using a time constant for each pixel, thereby generating a smoothed input signal;

means for determining for each pixel in the smoothed input signal a binary value corresponding to the existence of a significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame, and for determining the amplitude of the variation;

means for using the existence of a significant variation for a given pixel to modify the time constant for the pixel to be used in smoothing subsequent frames of the input signal;

means for forming a first matrix comprising the binary values of a subset of the pixels of the frame spatially related to each particular pixel, and for forming a second matrix comprising the amplitude of the variation of the subset of the pixels of the frame spatially related to such particular pixel;

means for determining in the first matrix a particular area in which the binary value for each pixel is a particular value representing significant variation, and, for such particular area, for determining in the second matrix whether the amplitude varies along an oriented direction relative to the particular pixel in a known manner indicating movement of the pixel in the oriented direction, the amplitude of the variation along the oriented direction determining the velocity of movement of the pixel.

An apparatus for smoothing an input signal comprises:

means for smoothing each pixel of the input signal using a time constant (CO) for such pixel, thereby generating a smoothed pixel value (LO) ;

means for determining the existence of a significant variation for a given pixel, and modifying the time constant (CO) for the pixel to be used in smoothing the pixel in subsequent frames of the input signal based upon the existence of such significant variation.

An apparatus for identifying an area in relative movement in an input signal comprises:

means for generating a first array indicative of the existence of significant variation in the magnitude of each pixel between a current frame and a prior frame;

means for generating a second array indicative of the magnitude of significant variation of each pixel between the current frame and a prior frame;

means for establishing a first moving matrix centered on a pixel under consideration and comprising pixels spatially related to the pixel under consideration, the first moving matrix traversing the first array for consideration of each pixel of the current frame;

means for determining whether the pixel under consideration and each pixel along an oriented direction relative to the pixel under consideration within the first matrix is a particular value representing the presence of significant variation, and if so, for establishing a second matrix within the first matrix, centered on the pixel under consideration, and for determining whether the amplitude of the pixels in the second matrix are indicative of movement along an oriented direction relative to the pixel under consideration, the amplitude of the variation along the oriented direction being indicative of the velocity of movement, the size of the second matrix being varied to identify the matrix size most indicative of movement.

An apparatus for identifying pixels in an input signal in one of a plurality of classes in one of a plurality of domains comprises:

means for analyzing each pixel of the input signal and for providing an output signal for each domain containing information to identify each domain in which the pixel is classified;

a classifier for each domain, the classifier classifying pixels within each domain in selected classes within the domain;

a linear combination unit for each domain, the linear combination unit generating a validation signal for the domain, the validation signal selecting one or more of the plurality of domains for processing; and

means for forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal.

An apparatus for identifying the velocity of movement of an area of an input signal comprises:

means for determining for each pixel in the input signal a binary value corresponding to the existence of a significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame, and for determining the amplitude of the variation,

means for forming, for each particular pixel of the input signal, a first matrix comprising the binary values of a subset of the pixels spatially related to such particular pixel, and a second matrix comprising the amplitude of the variation of the subset of the pixels spatially related to such particular pixel; and

means for determining in the first matrix whether for a particular pixel, and other pixels along an oriented direction relative to the particular pixel, the binary value for each pixel is a particular value representing significant variation, and, for such particular pixel and other pixels, determining in the second matrix whether the amplitude varies along an oriented direction relative to the particular pixel in a known manner indicating movement of the pixel and the other pixels, the amplitude of the variation along the oriented direction determining the velocity of movement of the pixel and the other pixels.

An apparatus for identifying a non-moving area in an input signal comprises:

means for forming histograms along coordinate axes for pixels of a current frame without a significant variation from such pixels in a prior frame; and

means for forming a composite signal corresponding to the spatial position of such pixels within the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. I is a diagrammatic illustration of the system according to the invention.

Fig. 2 is a block diagram of the temporal and spatial processing units of the invention.

Fig. 3 is a block diagram of the temporal processing unit of the invention.

Fig. 4 is a block diagram of the spatial processing unit of the invention.

Fig. 5 is a diagram showing the processing of pixels in accordance with the invention.

Fig. 6 illustrates the numerical values of the Freeman code used to determine movement direction in accordance with the invention.

Fig. 7 illustrates two nested matrices as processed by the temporal processing unit.

Fig.8 illustrates hexagonal matrices as processed by the temporal processing unit.

Fig.9 illustrates reverse-L matrices as processed by the temporal processing unit.

Fig.9a illustrates angular sector shaped matrices as processed by the temporal processing unit.

Fig. 10 is a block diagram showing the relationship between the temporal and spatial processing units, and the histogram formation units.

Fig. 11 is a block diagram showing the interrelationship between the various histogram formation units.

Fig. 12 shows the formation of a two-dimensional histogram of a moving area from two one-dimensional histograms.

Fig. 13 is a block diagram of an individual histogram formation unit.

Fig.14 illustrates the use of the classifier for finding an alignment of points relative to the direction of an analysis axis.

Fig.14a illustrates a one-dimensional histogram.

Fig. 15 illustrates the use of the system of the invention for video-conferencing.

Fig.16 is a top view of the system of the invention for video-conferencing.

Fig.17 is a diagram illustrating histograms formed on the shape of the head of a participant in a video conference.

Fig. 18 illustrates the system of the invention eliminating unnecessary information in a video-conferencing application.

Fig. 19 is a block diagram showing use of the system of the invention for target tracking.

Fig. 20 is an illustration of the system of the invention selecting a target for tracking.

Figs. 21-23 illustrate the system of the invention locking on to a selected target.

Fig. 24 illustrates the processing of the system using a Mallat diagram.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a method and apparatus for detection of relative movement or non-movement of an area within an image. Relative movement, as used herein, means movement of an area, which may be an "object" in the broadest sense of the term, e.g., a person, a portion of a person, or any animals or inanimate object, in an approximately motionless environment, or approximate immobility of an area in an environment that is at least partially in movement.

Referring to Fig. 1, image processing system 11 includes an input 12 that receives a digital video signal S originating from a video camera or other imaging device 13 which monitors a scene 13a. Imaging device 13 is preferably a conventional CMOS type CCD camera. It is, however, foreseen that the system of the invention may be used with any appropriate sensor e. g. , ultrasound, IR, Radar, tactile array, etc. , that generates an output in the form of an array of information corresponding to information observed by the imaging device. Imaging device 13 may have a direct digital output, or an analog output that is converted by an A/D convertor into digital signal S.

While signal S may be a progressive signal, in a preferred embodiment, in which imaging device 13 is a conventional video camera, signal S is composed of a succession of pairs of interlaced frames, TR_1 and TR'_1, and TR_2 and TR'_2, each consisting of a succession of horizontal scanned lines, e.g., $l_{1.1}$, $l_{1.2}$,...,$l_{1.17}$ in TR_1, and $l_{2.1}$ in TR_2 Each line consists of a succession of pixels or image-points PI, e.g., $a_{1.1}$, $a_{1.2}$ and $a_{1.3}$ for line $l_{1.1}$; $al_{17.1}$ and $a1_{7.22}$ for line $l_{1.17}$; $al_{1.1}$ and $a_{1.2}$ for line $l_{2.1}$. Signal S(PI) represents signal S composed of pixels PI.

As known in the art, S(PI) includes a frame synchronization signal (ST) at the beginning of each frame, a line synchronization signal (SL) at the beginning of each line, and a blanking signal (BL). Thus, S(PI) includes a succession frames, which are representative of the time domain, and within each frame, a series of lines and pixels, which are representative of the spatial domain.

In the time domain, "successive frames" shall refer to successive frames of the same type (i. e. , odd frames such as TR_1, or even frames such as TR'_1), and "successive pixels in the same position" shall denote successive values of the pixels (PI) in the same location in successive frames of the same type, e.g., $a_{1.1}$ of $l_{1.1}$ in frame TR_1 and $a_{1.1}$ of $l_{1.1}$ in the next corresponding frame TR_2.

Image processing system 11 generates outputs ZH and SR 14, which are preferably digital signals. Complex signal ZH comprises a number of output signals generated by the system, preferably including signals indicating the existence and localization of an area or object in motion, and the speed V and the oriented direction of displacement DI of pixels of the image. Also output from the system, if desired, is input digital video signal S, which is delayed (SR) to make it synchronous with the output ZH for the frame, taking into account the calculation time for the data in composite signal ZH (one frame). The delayed signal SR is used to display the image received by camera 13 on a monitor or television screen 10, which may also be used to display the information contained in composite signal ZH. Composite signal ZH may also be transmitted to a separate processing assembly 10a in which further processing of the signal may be accomplished.

Referring to Fig. 2, image processing system 11 includes a first assembly 11a, which consists of a temporal processing unit 15 having an associated memory 16, a spatial processing unit 17 having a delay unit 18 and sequencing unit 19, and a pixel clock 20, which generates a clock signal HP, and which serves as a clock for temporal processing unit 15 and sequencing unit 19. Clock pulses HP are generated by clock 20 at the pixel rate of the image, which is preferably 13.5 MHZ.

Fig. 3 shows the operation of temporal processing unit 15, the function of which is to smooth the video signal and generate a number of outputs that are utilized by spatial processing unit 17. During processing, temporal processing unit 15 retrieves from memory 16 the smoothed pixel values LI of the digital video signal from the immediately prior frame, and the values of a smoothing time constant CI for each pixel. As used herein, LO and CO shall be used to denote the pixel values (L) and time constants (C) stored in memory 16 from temporal processing unit 15, and LI and CI shall denote the pixel values (L) and time constants (C) respectively for such values retrieved from memory 16 for use by temporal processing unit 15. Temporal processing unit 15 generates a binary output signal DP for each pixel, which identifies whether the pixel has undergone significant variation, and a digital signal CO, which represents the updated calculated value of time constant C.

Referring to Fig. 3, temporal processing unit 15 includes a first block 15a which receives the pixels PI of input video signal S. For each pixel PI, the temporal processing unit retrieves from memory 16 a smoothed value LI of this pixel from the immediately preceding corresponding frame, which was calculated by temporal processing unit 15 during processing of the immediately prior frame and stored in memory 16 as LO. Temporal processing unit 15 calculates the absolute value AB of the difference between each pixel value PI and LI for the same pixel position (for example $a_{1,1}$, of $l_{1,1}$ in TR_1 and of $l_{1,1}$ in TR_2 :

$$AB = |PI-LI|$$

Temporal processing unit 15 is controlled by clock signal HP from clock 20 in order to maintain synchronization with the incoming pixel stream. Test block 15b of temporal processing unit 15 receives signal AB and a threshold value SE. Threshold SE may be constant, but preferably varies based upon the pixel value PI, and more preferably varies with the pixel value so as to form a gamma correction. Known means of varying SE to form a gamma correction is represented by the optional block 15e shown in dashed lines. Test block 15b compares, on a pixel-by-pixel basis, digital signals AB and SE in order to determine a binary signal DP. If AB exceeds threshold SE, which indicates that pixel value PI has undergone significant variation as compared to the smoothed value LI of the same pixel in the prior frame, DP is set to "1" for the pixel under consideration. Otherwise, DP is set to "0" for such pixel.

When DP = 1, the difference between the pixel value PI and smoothed value LI of the same pixel in the prior frame is considered too great, and temporal processing unit 15 attempts to reduce this difference in subsequent frames by reducing the smoothing time constant C for that pixel. Conversely, if DP = 0, temporal processing unit 15 attempts to increase this difference in subsequent frames by increasing the smoothing time constant C for that pixel. These adjustments to time constant C as a function of the value of DP are made by block 15c. If DP = 1, block 15c reduces the time constant by a unit value U so that the new value of the time constant CO equals the old value of the constant CI minus unit value U.

$$CO = CI - U$$

If DP = 0, block 15c increases the time constant by a unit value U so that the new value of the time constant CO equals the old value of the constant CI plus unit value U.

$$CO=CI+U$$

Thus, for each pixel, block 15c receives the binary signal DP from test unit 15b and time constant CI from memory 16, adjusts CI up or clown by unit value U, and generates a new time constant CO which is stored in memory 16 to replace time constant CI.

In a preferred embodiment, time constant C, is in the form 2^P, where p is incremented or decremented by unit value U, which preferably equals 1, in block 15c. Thus, if DP = 1, block 15c subtracts one (for the case where U=1) from p in the time constant 2^P which becomes 2^{P-1}. If DP = 0, block 15c adds one to p in time constant 2^P, which becomes 2^{P+1}. The choice of a time constant of the form 2^P facilitates calculations and thus simplifies the structure of block 15c.

Block 15c includes several tests to ensure proper operation of the system. First, CO must remain within defined limits. In a preferred embodiment, CO must not become negative ($CO \geq 0$) and it must not exceed a limit N ($CO \leq N$), which is preferably seven. In the instance in which CI and CO are in the form 2^P, the upper limit N is the maximum value for p.

The upper limit N may either be constant or variable. If N is variable, an optional input unit 15f includes a register or memory that enables the user, or another controller to vary N. The consequence of increasing N is to increase the sensitivity of the system to detecting displacement of pixels, whereas reducing N improves detection of high speeds. N may be made to depend on PI (N may vary on a pixel-by-pixel basis, if desired) in order to regulate the variation of LO as a function of the lever of PI, i.e., $N_{ijt} = f(PI_{ijt})$, the calculation of which is done in block 15f, which in this case would receive the value of PI from video camera 13.

Finally, a calculation block 15d receives, for each pixel, the new time constant CO generated in block 15c, the pixel values PI of the incoming video signal S, and the smoothed pixel value LI of the pixel in the previous frame from memory 16. Calculation block 15d then calculates a new smoothed pixel value LO for the pixel as follows:

$$LO = LI + (PI - LI) / CO$$

If $CO = 2^P$, then

$$LO = LI + (PI - LI) / 2^{PO}$$

where "po", is the new value of p calculated in unit 15c and which replaces previous value of "pi" in memory 16.

The purpose of the smoothing operation is to normalize variations in the value of each pixel PI of the incoming video signal for reducing the variation differences. For each pixel of the frame, temporal processing unit 15 retrieves LI and CI from memory 16, and generates new values LO (new smoothed pixel value) and CO (new time constant) that are stored in memory 16 to replace LI and CI respectively. As shown in Fig. 2, temporal processing unit 15 transmits the CO and DP values for each pixel to spatial processing unit 17 through the delay unit 18.

The capacity of memory 16 assuming that there are R pixels in a frame, and therefore 2R pixels per complete image, must be at least 2R(e+f) bits, where e is the number of bits required to store a single pixel value LI (preferably eight bits), and f is the number of bits required to store a single time constant CI (preferably 3 bits). If each video image is composed of a single frame (progressive image), it is sufficient to use R(e+f) bits rather than 2R(e+f) bits.

Spatial processing unit 17 is used to identify an area in relative movement in the images from camera 13 and to determine the speed and oriented direction of the movement. Spatial processing unit 17, in conjunction with delay unit 18, cooperates with a control unit 19 that is controlled by clock 20, which generates clock pulse HP at the pixel frequency. Spatial processing unit 17 receives signals DP_{ij} and CO_{ij} (where i and j correspond to the x and y coordinates of the pixel) from temporal processing unit 15 and processes these signals as discussed below. Whereas temporal processing unit 15 processes pixels within each frame, spatial processing unit 17 processes groupings of pixels within the frames.

Fig. 5 diagrammatically shows the temporal processing of successive corresponding frame sequences TR_1, TR_2, TR_3 and the spatial processing in the these frames of a pixel PI with coordinates x, y, at times t_1, t_2, and t_3. A plane in Fig. 5 corresponds to the spatial processing of a frame, whereas the superposition of frames corresponds to the temporal processing of successive frames.

Signals DP_{ij} and CO_{ij} from temporal processing unit 15 are distributed by spatial processing unit 17 into a first matrix 21 containing a number of rows and columns much smaller than the number of lines L of the frame and the number of pixels M per line. Matrix 21 preferably includes 2l + 1 lines along the y axis and 2m+1 columns along the x axis (in Cartesian coordinates), where l and m are small integer numbers. Advantageously, l and m are chosen to be powers of 2, where for example l is equal to 2^a and m is equal to 2^b, a and b being integer numbers of about 2 to 5, for example. To simplify the drawing and the explanation, m will be taken to be equal to l (although it may be different) and $m = l = 2^3 = 8$. In this case, matrix 21 will have 2 x 8 + 1 = 17 rows and

17 columns. Fig. 4 shows a portion of the 17 rows Y_0, Y_1,... Y_{15}, Y_{16} and 17 columns X_0, X_1 ...X_{15}, X_{16} which form matrix 21.

Spatial processing unit 17 distributes into l x m matrix 21 the incoming flows of DP_{ijt} and CO_{ijt} from temporal processing unit 15. It will be appreciated that only a subset of all DP_{ijt} and CO_{ijt} values will be included in matrix 21, since the frame is much larger, having L lines and M pixels per row (e.g., 312.5 lines and 250-800 pixels), depending upon the TV standard used.

In order to distinguish the L x M matrix of the incoming video signal from the l x m matrix 21 of spatial processing unit 17, the indices i and j will be used to represent the coordinates of the former matrix (which will only be seen when the digital video signal is displayed on a television screen or monitor) and the indices x and y will be used to represent the coordinates of the latter. At a given instant, a pixel with an instantaneous value PI_{ijt} is characterized at the input of the spatial processing unit 17 by signals DP_{ijt} and Co_{ijt}. The $(2l+1)$ x $(2m + 1)$ matrix 2l is formed by scanning each of the L x M matrices for DP and CO.

In matrix 21, each pixel is defined by a row number between 0 and 16 (inclusive), for rows Y_0 to Y_{16} respectively, and a column number between 0 and 16 (inclusive), for columns X_0 to X_{16} respectively, in the case in which $l = m = 8$. In this case, matrix 21 will be a plane of 17 x 17 = 289 pixels.

In Fig. 4, elongated horizontal rectangles Y_0 to Y_{16} (only four of which have been shown, i.e., Y_0, Y_1,Y_{15} and Y_{16}) and vertical lines X_0 to X_{16} (of which only four have been shown, i.e., X_0, X_1,X_{15} and X_{16}) illustrate matrix 21 with 17 x 17 image points or pixels having indices defined at the intersection of an ordinate row and an abscissa column. For example, the P_{88} is at the intersection of column 8 and row 8 as illustrated in Fig. 4 at position e, which is the center of matrix 21.

In response to the HP and BL signals from clock 20 (Fig. 2), a rate control or sequencing unit 19: i) generates a line sequence signal SL at a frequency equal to the quotient of 13 5 MHZ (for an image with a corresponding number of pixels) divided by the number of columns per frame (for example 400) to delay unit 18, ii) generates a frame signal SC, the frequency of which is equal to the quotient 13.5/400 MHZ divided by the number of rows in the video image, for example 312.5, iii) and outputs the HP clock signal. Blanking signal BL is used to render sequencing unit 19 non-operational during synchronization signals in the input image.

A delay unit 18 carries out the distribution of portions of the L x M matrix into matrix 21. Delay unit 18 receives the DP, CO, and incoming pixel S(PI) signals, and distributes these into matrix 21 using clock signal HP and line sequence and column sequence signals SL and SC.

In order to form matrix 21 from the incoming stream of DP and CO signals, the successive rows Y_0 to Y_{16} for the DP and CO signals must be delayed as follows:

row Y_0 - not delayed ;

row Y_1 - delayed by the duration of a frame line TP;

row Y_2 - delayed by 2 TP;

and so on until

row Y_{16} - delayed by 16 TP.

The successive delays of the duration of a frame row TP, are carried out in a cascade of sixteen delay circuits $r_1, r_2, \ldots r_{16}$ that serve rows $Y_1, Y_2 \ldots Y_{16}$, respectively, row Y_0 being served directly by the DP and CO signals without any delay upon arriving from temporal processing unit 15. All delay circuits $r_1, r_2, \ldots r_{16}$ may be built up by a delay line with sixteen outputs, the delay imposed by any section thereof between two successive outputs being constant and equal to TP.

Rate control unit 19 controls the scanning of the entire L x M frame matrix over matrix 21. The circular displacement of pixels in a row of the frame matrix on the 17 x 17 matrix, for example from X_0 to X_{16} on row Y_0, is done by a cascade of sixteen shift registers d on each of the 17 rows from Y_0 to Y_{16} (giving a total of 16 x 17 = 272 shift registers) placed in each row between two successive pixel positions, namely the register d_{01} between positions PI_{00} and PI_{01}, register d_{02} between positions PI_{01} and PI_{02}, etc. Each register imposes a delay TS equal to the time difference between two successive pixels in a row or line, using column sequence signal SC. Because rows $l_1, l_2 \ldots l_{17}$ in a frame TR_1 (Fig.1), for S(PI) and for DP and CO, reach delay unit 18 shifted by TP (complete duration of a row) one after the other, and delay unit 18 distributes them with gradually increasing delays of TP onto rows Y_0, $Y_1 \ldots Y_{17}$, these rows display the DP and CO signals at a given time for rows l_1, $l_2, \ldots l_{17}$ in the same frame portion. Similarly in a given row, e.g., $l1$, successive pixel signals $a_{1,1}$, $a_{1,2}$ . . arrive shifted by TS and shift registers d impose a delay also equal to TS. As a result, the pixels of the DP and CO signals in a given row Y_0 to Y_{16} in matrix 21, are contemporary, i.e., they correspond to the same frame portion.

The signals representing the COs and DPs in matrix 21 are available at a given instant on the 16 x 17 = 272 outputs of the shift registers, as well as upstream of the registers ahead of the 17 rows, i.e. registers $d_{0.1}$, $d_{1.1}$ .... $d_{16.1}$, which makes a total of 16 x 17 + 17 = 17 x 17 outputs for the 17 x 17 positions $P_{0.0}$, $P_{0.1}$,...$P_{8.8}$...$P_{16.16}$.

In order to better understand the process of spatial processing, the system will be described with respect to a small matrix M3 containing 3 rows and 3 columns where the central element of the 9 elements thereof is pixel e with coordinates x = 8, y = 8 as illustrated below:

a	b	c	
d	e	f	(M3)
g	h	i	

In matrix M3, positions a, b, c, d, f, g, h, i around the central pixel e correspond to eight oriented directions relative to the central pixel The eight directions may be identified using the Freeman code illustrated in Fig. 6, the directions being coded 0 to 7 starting from the x axis, in steps of 45 °. In the Freeman code, the eight possible oriented directions, may be represented by a 3-bit number since $2^3 = 8$.

Considering matrix M3. the 8 directions of the Freeman code are as follows:

3	2	1
4	e	0
5	6	7

Returning to matrix 21 having 17 x 17 pixels, a calculation unit 17a examines at the same time various nested square second matrices centered on e, with dimensions 15 x 15, 13 x 13, 11 x 11, 9 x 9, 7 x 7, 5 x 5 and 3 x 3, within matrix 21, the 3 x 3 matrix being the M3 matrix mentioned above. Spatial processing unit 17 determines which matrix is the smallest in which pixels with DP = 1 are aligned along a straight line which determines the direction of movement of the aligned pixels.

For the aligned pixels in the matrix, the system determines if CO varies on each side of the central position in the direction of alignment, from +a in an oriented direction and -a in the opposite oriented direction, where I <a<N. For example, if

positions g, e, and c of M3 have values -1, 0, +1, then a displacement exists in this matrix from right to left in the (oriented) direction 1 in the Freeman code (Fig. 6). However, positions g, e, and c must at the same time have DP = 1. The displacement speed of the pixels in motion is greater when the matrix, among the 3 x 3 to 15 x 15 nested matrices, in which CO varies from +1 or -1 between two adjacent positions along a direction is larger. For example, if positions g, e, and c in the 9 x 9 matrix denoted M9 have values -1, 0, +1 in oriented direction 1, the displacement will be faster than for values -1, 0, +1 in 3 x 3 matrix M3 (Fig. 7). The smallest matrix for which a line meets the test of DP=1 for the pixels in the line and CO varies on each side of the central position in the direction of alignment, from +a in an oriented direction and -a in the opposite oriented direction, is chosen as the principal line of interest.

In a further step in the smallest matrix 3x3, the validity of the calculation with a variation of plus or minus two units (Co) with DP=1 determines a subpixel movement i.e. one half of pixel per image.

In the same way if the variation is of plus or minus 3, the movement is still slower i.e. one third of pixel per image.

One improvement for reducing the power of calculation is to test only the values which are symetrical relative to the central value. The test DP=1 and CO=±1 or CO=±2 and ±3 in the smallest matrix allows to simplify the hardware.

Since CO is represented as a power of 2 in a preferred embodiment, an extended range of speeds may be identified using only a few bits for CO, while still enabling identification of relatively low speeds. Varying speed may be detected because, for example -2, 0, +2 in positions g, e, c in 3 x 3 matrix M3 indicates a speed half as fast as the speed corresponding to 1, 0, +1 for the same positions in matrix M3.

Two tests are preferably performed on the results to remove uncertainties. The first test chooses the strongest variation, in other words the highest time constant, if there are variations of CO along several directions in one of the nested matrices. The second test arbitrarily chooses one of two (or more) directions along which the variation of CO is identical, for example by choosing the smallest value of the Freeman code, in the instance when identical lines of motion are directed in a single matrix in different directions This usually arises when the actual direction of displacement is approximately between two successive coded directions in the Freeman code, for example between directions 1 and 2 corresponding to an (oriented) direction that can be denoted 1.5 (Fig. 6) of about 67.5° with the x axis direction (direction 0 in the Freeman code).

The scanning of an entire frame of the digital video signal S preferably occurs in the following sequence. The first group of pixels considered is the first 17 rows or lines of the frame, and the first 17 columns of the frame. Subsequently, still for the first 17 rows of the frame, the matrix is moved column by column from the left of the frame to the right, as shown in Fig. 5, i.e. from portion TM_1 at the extreme left, then TM_2 offset by one column with respect to TM_1, until TM_M (where M is the number of pixels per frame line or row) at the extreme right. Once the first 17 rows have been considered for each column from left to right, the process is repeated for rows 2 to 18 in the frame. This process continues, shifting down one row at a time until the last group of lines at the bottom of the frame, i.e., lines L - 16 ... L (where L is the number of lines per frame) are considered.

Spatial processing unit 17 generates the following output signals for each pixel: i) a signal V representing the displacement speed for the pixel, based upon the amplitude of the maximum variation of CO surrounding the pixel, the value of which may be, for example, represented by an integer in the range 0 - 7 if the speed is in the form of a power of 2, and therefore may be stored in 3 bits, ii) a signal DI representing the direction of displacement of the pixel, which is calculated from the direction of maximum variation, the value of DI being also preferably represented by an integer in the range 0 - 7 corresponding to the Freeman code, stored in 3 bits, iii) a binary validation signal VL which indicates whether the result of the speed and oriented direction is valid, in order to be able to distinguish a valid output with V = 0 and DI = 0, from the lack of an output due to an incident, this signal being 1 for a valid output or 0 for an invalid output, iv) a time constant signal CO, stored in 3 bits, for example, and v) a delayed video signal SR consisting of the input video signal S delayed in the delay unit 18 by 16 consecutive line durations TR and therefore by the duration of the distribution of the signal S in the 17x 17 matrix 21, in order to obtain a video signal timed to matrix 21, which may be displayed on a television set or monitor. Also output are the clock signal HP, line sequence signal SL and column sequence signal SC from control unit 19.

An improvement in the calculation of the motion where several directions are responsive at the same time consists in testing by group of 3 contiguous directions the validity of the operations and to select only the central value.

Nested hexagonal matrices (Fig 8) or an inverted L-shaped matrix (Fig. 9) may be substituted for the nested rectangular matrices in Figs. 4 and 7. In the case shown in Fig. 8, the nested matrices (in which only the most central matrices MR1 and MR2 have been shown) are all centered on point MR0 which corresponds to the central point of matrices M3, M9 in Fig. 7. The advantage of a hexagonal matrix system is that it allows the use of oblique coordinate axes x_a, y_a, and a breakdown into triangles with identical sides, to carry out an isotropic speed calculation.

The matrix in Fig. 9 is composed of a single row (L_u) and a single column (C_u) starting from the central position MR_u in which the two signals DP and CO respectively are equal to "1" for DP and increase or decrease by one unit for CO, if movement occurs.

If movement is in the direction of the x coordinate, the CO signal is identical in all positions (boxes) in column C_u, and the binary signal DP is equal to 1 in all positions in row L_u, from the origin MR_u, with the value CO_u, up to the position in which CO is equal to CO_u +1 or -1 inclusive. If movement is in the direction of the y coordinate, the CO signal is identical in all positions (boxes) in row L_u, and the binary signal DP is equal to 1 in all positions in column C_u, from the origin MR_u, with the value CO_u, up to the position in which CO is equal to CO_u +1 or -1 inclusive. If movement is oblique relative to the x and y coordinates, the binary signal DP is equal to 1 and CO is equal to CO_u in positions (boxes) of L_u and in positions (boxes) of C_u, the slope being determined by the perpendicular to the line passing through the two positions in which the signal CO_u changes by the value of one unit, the DP signal always being equal to 1.

Fig 9 shows the case in which DP = 1 and CO_u changes value by one unit in the two specific positions L_{u3} and C_{u5} and indicates the corresponding slope P_p. In all cases, the displacement speed is a function of the position in which CO changes value by one unit. If CO changes by one unit in L_u or C_u only, it corresponds to the value of the CO variation position. If CO changes by one unit in a position in L_u and in a position in C_u, the speed is proportional to the distance between MR_u and E_x (intersection of the line perpendicular to C_u-L_u passing through MR_u).

Fig.9a shows an imaging device with sensors located at the crossings of concentric lines c and radial lines d, said lines corresponding to the rows and columns of a rectangular matrix imaging device.

An angular sector shaped odd matrix nxn Mc is associated to said imaging device.

The operation of such imaging arrangement is controlled by a circular scanning sequencer.

Except the sequencing differences, the operation of this arrangement is identical to that of the square matrix arrangement.

As shown in Figs 10 - 14, image processing system 11 is used in connection with a histogram processor 22a for identifying objects within the input signal based upon userspecified criteria for identifying such objects. A bus Z-Z_1 (See Figs. 2, 10 and 11) transfers the output signals of image processing system 11 to histogram processor 22a. Histogram processor 22a generates composite output signal ZH which contains information on the areas in relative movement in the scene.

Referring to Fig. 11, histogram processor 22a includes a bus 23 for communicating signals between the various components thereof. Histogram formation and processing blocks 24 - 29 receive the various input signals, i.e., delayed digital video signal SR, speed V, oriented directions (in Freeman code) DI, time constant CO, first axis x(m) and second axis y(m), which are discussed in detail below. The function of each histogram formation block is to enable a histogram to be formed for the domain associated with that block. For example, histogram formation block 24 receives the delayed digital video signal SR and enables a histogram to be formed for the luminance values of the video signal. Since the luminance of the signal will generally be represented by a number in the range of 0-255, histogram formation block 24 is preferably a memory addressable with 8 bits, with each memory location having a sufficient number of bits to correspond to the number of pixels in a frame.

Histogram formation block 25 receives speed signal V and enables a histogram to be formed for the various speeds present in a frame. In a preferred embodiment, the speed is an integer in the range 0-7. Histogram formation block 25 is then preferably a memory addressable with 3 bits, with each memory location having a sufficient number of bits to correspond to the number of pixels in a frame.

Histogram formation block 26 receives oriented direction signal D1 and enables a histogram to be formed for the oriented directions present in a frame. In a preferred embodiment, the oriented direction is an integer in the range 0-7, corresponding to the Freeman code. Histogram formation block 26 is then preferably a memory addressable with 3 bits, with each memory location having a sufficient number of bits to correspond to the number of pixels in a frame.

Histogram formation block 27 receives time constant signal CO and enables a histogram to be formed for the time constants of the pixels in a frame In a preferred embodiment, the time constant is an integer in the range 0-7. Histogram formation block 27 is then preferably a memory addressable with 3 bits, with each memory location having a sufficient number of bits to correspond to the number of pixels in a frame.

Histogram formation blocks 28 and 29 receive the x and y positions respectively of pixels for which a histogram is to be formed, and form histograms for such pixels, as discussed in greater detail below. Histogram formation block 28 is preferably addressable with the number of bits corresponding to the number of pixels in a line, with each memory location having a sufficient number of bits to correspond to the number of lines in a frame, and histogram formation block 29 is preferably addressable with the number of bits corresponding to the number of lines in a frame, with each memory location having a sufficient number of bits to correspond to the number of pixels in a line.

Referring to Figs. 12 and 13, each of the histogram formation blocks 24 - 29 has an associated validation block 30 - 35 respectively, which generates a validation signal Vl - V6 respectively. In general, each of the histogram formation blocks 24-29 is identical to the others and functions in the same manner. For simplicity, the invention will be described with respect to the operation of histogram formation block 25, it being appreciated that the remaining histogram formation blocks operate in a like manner. Histogram formation block 25 includes a histogram forming portion 25a, which forms the histogram for that block, and a classifier 25b, for selecting the criteria of pixels for which the histogram is to be formed. Histogram forming portion 25a and classifier 25b operate under the control of computer software in an integrated circuit 25c, which extracts certain limits of the histogram generated by the histogram formation block.

Referring to Fig. 13, histogram forming portion 25a includes a memory 100, which is preferably a conventional digital memory. In the case of histogram formation block 25 which forms a histogram of speed, memory 100 is sized to have addresses 0-7, each of which may store up to the number of pixels in an image. Between frames, memory 100 is initiated, i.e., cleared of all memory, by setting *init*=1 in multiplexors 102 and 104. This has the effect, with respect to multiplexor 102 of selecting the "0" input, which is output to the Data In line of memory 100. At the same time, setting *init*=1 causes multiplexor 104 to select the Counter input, which is output to the Address line of memory 100. The Counter input is connected to a counter (not shown) that counts through all of the addresses for memory 100, in this case O≤address≤7. This has the effect of placing a zero in all memory addresses of memory 100. Memory 100 is preferably cleared during the blanking interval between each frame. After memory 100 is cleared, the *init* line is set to zero, which in the case of multiplexor 102 results in the content of the Data line being sent to memory 100, and in the case of multiplexor 104 results in the data from spatial processing unit 117, i.e., the V data, being sent to the Address line of memory 100.

Classifier 25b enables only data having selected classification criteria to be considered further, meaning to possibly be included in the histograms formed by histogram formation blocks 24-29. For example, with respect to speed, which is preferably a value in the range of 0-7, classifier 25b may be set to consider only data within a particular speed category or categories, e.g., speed 1, speeds 3 or 5, speed 3-6, etc. Classifier 25b includes a register 106 that enables the classification criteria to be set by the user, or by a separate computer program. By way of example, register 106 will include, in the case of speed, eight registers numbered 0-7. By setting a register to "1", e.g., register number 2, only data that meets the criteria of the selected class, e.g., speed 2, will result in a classification output of "l". Expressed mathematically, for any given register in which R(k) = b, where k is the register number and b is the boolean value stored in the register:

$$0\text{utput}= R(\text{data}(V))$$

So for a data point V of magnitude 2, the output of classifier 25b will be "1" only if R(2)=1. The classifier associated with histogram formation block 24 preferably has 256 registers, one register for each possible luminance value of the image. The classifier associated with histogram formation block 26 preferably has 8 registers, one register for each possible direction value. The classifier associated with histogram formation block 27 preferably has 8 registers, one register for each possible value of CO. The classifier associated with histogram formation block 28 preferably has the same number of registers as the number of pixels per line. Finally, the classifier associated with histogram formation block 29 preferably has the same number of registers as the number of lines per frame. The output of each classifier is communicated to each of the validation blocks 30-35 via bus 23, in the case of histogram formation blocks 28 an 29, through combination unit 36, which will be discussed further below.

Validation units 30-35 receive the classification information in parallel from all classification units in histogram formation blocks 24 - 29. Each validation unit generates a validation signal which is communicated to its associated histogram formation block 24 - 29. The validation signal determines, for each incoming pixel, whether the histogram formation block will utilize that pixel in forming it histogram. Referring again to Fig. 13, which shows histogram formation block 25, validation unit 31 includes a register block 108 having a register associated with each histogram formation block, or more generally, a register associated with each data domain that the system is capable of processing, in this case, luminance, speed, direction, CO, and x and y position. The content of each register in register block 108 is a binary value that may be set by a user or by a computer controller. Each validation unit receive via bus 23 the output of each of the classifiers, in this case numbered 0 ... p, keeping in mind that for any data domain, e.g., speed, the output of the classifier for that data domain will only be "1" if the particular data point being considered is in the class of the registers set to " 1 " in the classifier for that data domain. The validation signal from each validation unit will only be "1" if for each register in the validation unit that is set to "1", an input of "1" is received from the classifier for the domain of that register. This may be expressed as follows:

$$out = (\overline{in}_0 + \mathrm{Reg}_0).(\overline{in}_1 + \mathrm{Reg}_1)...(\overline{in}_n + \mathrm{Reg}_n)(in_0 + in_1 + ...in_n)$$

where Reg_0 is the register in the validation unit associated with input in_0. Thus, using the classifiers in combination with validation units 30 - 35, the system may select for processing only data points in any selected classes within any selected domains. For example, the system may be used to detect only data points having speed 2, direction 4, and luminance 125 by setting each of the following registers to " 1 ": the registers in the validation units for speed, direction, and luminance, register 2 in the speed classifier, register 4 in the direction classifier, and register 125 in the luminance classifier. In order to form those pixels into a block, the registers in the validation units for the x and y directions would be set to " 1 " as well.

Referring again to Fig. 13, validation signal V2 is updated on a pixel-by-pixel basis. If, for a particular pixel, validation signal V2 is "1", adder 110 increments the output of memory 100 by one. If, for a particular pixel, validation signal V2 is "0", adder

100 does not increments the output of memory. In any case, the output of adder 100 is stored in memory 100 at the address corresponding to the pixel being considered. For example, assuming that memory 100 is used to form a histogram of speed, which may be categorized as speeds 0-7, and where memory 100 will include 0-7 corresponding memory locations, if a pixel with speed 6 is received, the address input to multiplexor 104 through the data line will be 6. Assuming that validation signal V2 is " 1", the content in memory at location 6 will be incremented. Over the course of an image, memory 100 will contain a histogram of the pixels for the image in the category associated with the memory. If, for a particular pixel, validation signal V2 is "0" because that pixel is not in a category for which pixels are to be counted (e g., because that pixel does not have the correct direction, speed, or luminance), that pixel will not be used in forming the histogram.

For the histogram formed in memory 100, key characteristics for that histogram are simultaneously computed in a unit 112. Unit 112 includes memories for each of the key characteristics, which include the minimum (MIN) of the histogram, the maximum (MAX) of the histogram, the number of points (NBPTS) in the histogram, the position (POSRMAX) of the maximum of the histogram, and the number of points (RMAX) at the maximum of the histogram. These characteristics are determined in parallel with the formation of the histogram as follows:

For each pixel with a validation signal V2 of "1":

(a) if the data value of the pixel < MIN (which is initially set to the maximum possible value of the histogram), then write data value in MIN,

(b) if the data value of the pixel > MAX (which is initially set to the minimum possible value of the histogram), then write data value in MAX;

(c) if the content of memory 100 at the address of the data value of the pixel > RMAX (which is initially set to the minimum possible value of the histogram), then i) write data value in POSRMAX and ii) write the memory output in RMAX.

(d) increment NBPTS (which is initially set to zero).

At the completion of the formation of the histogram in memory 100 at the end of each frame, unit 112 will contain important data characterizing the histogram. The histogram in each memory 100, and the characteristics of the histogram in units 112 are read during the scanning spot of each frame by a separate processor, and the memories 100 are cleared and units 112 are re-initialized for processing the next frame.

Figure 14 shows the determination of the orientation of an alignment of points relative to the direction of an analysis axis.

In this figure, the analysis axis extends with an angle relative to the horizontal side of the screen and the histogram built along the analysis axis refers to points concerned by the analysis appearing on the screen.

For the histogram calculation device five particular values are calculated:

MIN, MAX, NBPTS, RAMX, POSRMAX

The use of these values allows to obtain some rapid results.

For example, the calculation of the ratio NBPTS/RMAX i.e. the number of points involved in the histogram and the number of points in the maximal line allows to find an alignment of points perpendicular to the scanning axis.

The smaller is R and the most the alignment is perpendicular to the scanning axis.

One improvement of the calculation for example for positioning a vehicle on the road is to carryout for each pixel simultaneously an analysis according all the possible analysis axis. In an analysis region, the calculation of the ration R for all the analysis axes and the search of the smallest value of R allows to find the axis perpendicular of the analysed points and consequently to know the alignment with a positioning, from the value POSRMAX.

Presently the map is divided by 16 (180°/16).

The use of the moving pixels histogram, direction histogram and velocity histograms allows to find by reading POSRMAX the overall motion of the scene (moving camera) and in the classifying unit to inhibit these preponderant classes.

The device thus becomes responsive to elements which are subject to relative motion in the image. The use of histograms according to two perpendicular axes with these elements in relative motion as validation element allows to detect and track and objet in relative motion.

The calculation of the histogram according to a projection axis is carried out in a region delimited by the associated classifier between points a and b on the analysis axis.

An important improvement is to associate anticipation by creating an histogram of the same points with orientation and intensity of motion as input parameters.

The nominal values O-MVT corresponding to orientation of the movement and I-MVT corresponding to intensity of movement allow to modify the values a and b of the classifier of the unit connected to the calculation of the analysis axis for the calculation for the next frame. This is anticipation.

The result is greatly improved.

Fig.14a shows an example of the successive classes $C_1, C_2 \ldots C_{n-1}, C_n$, each representing a particular velocity, for a hypothetical velocity histogram, with their being categorization for up to 16 velocities (15 are shown) in this example. Also shown is envelope 38, which is a smoothed representation of the histogram.

In order to locate the position of an object having user specified criteria within the image, histogram blocks 28 and 29 are used to generate histograms for the x and y positions of pixels with the selected criteria. These are shown in Fig. 12 as histograms along the x and y coordinates. These x and y data are output to moving area formation block 36 which combines the abscissa and ordinale information $x(m)_2$ and $y(m)_2$ respectively into a composite signal xy(m) that is output onto bus 23. A sample composite histogram 40 is shown in Fig. 12. The various histograms and composite signal xy(m) that are output to bus 23 are used to determine if there is a moving area in the image, to localize this area, and/or to determine its speed and oriented direction. Because the area in relative movement may be in an observation plane along directions x and y which are not necessarily orthogonal, (e. g. , as discussed below with respect to Figs. 15 and 16), a data change block 37 may be used to convers the x and y data to orthogonal coordinates. Data change block 37 receives orientation signals $x(m)_0$ and $y(m)_0$ for $x(m)_0$ and $y(m)_0$ axes, as well as pixel clock signals HP, line sequence and column sequence signals SL and SC (these three signals being grouped together in bundle F in Figs. 2, 4, and 10) and generates the orthogonal $x(m)_1$ and $y(m)_1$ signals that are output to histogram formation blocks 28 and 29 respectively.

In order to process pixels only within a user-defined area, the x-direction histogram formation unit may be set to process pixels only in a class of pixels defined by boundaries, i.e. XMIN and XMAX. Any pixels outside of this class will not be processed. Similarly, the y-direction histogram formation unit may be set to process pixels only in a class of pixels defined by boundaries YMIN and YMAX. Thus, the system can process pixels only in a defined rectangle by setting the XMIN and XMAX, and YMIN and YMAX values as desired. Of course, the classification criteria and validation criteria from the other histogram formation units may be set in order to form histograms of only selected classes of pixels in selected domains in selected areas.

Fig 12 diagrammatically represents the envelopes of histograms 38 and 39, respectively in x and y coordinates, for velocity data. In this example, x_M and y_M represent the x and y coordinates of the maxima of the two histograms 38 and 39, whereas l_a and l_b for the x axis and l_c and l_d for the y axis represent the limits of the range of significant or interesting speeds, l_a and l_c being the longer limits and l_b and l_d being the upper limited of the significant portions of the histograms. Limits l_a, l_b, l_c and l_d may be set by the user or by an application program using the system, may be set as a ratio of the maximum of the histogram, e.g., $x_M/2$, or may be set as otherwise desired for the particular application.

The vertical lines L_a and L_b of abscisses l_a and l_b and the horizontal lines L_c and L_d of ordinales l_c and l_d form a rectangle that surrounds the cross hatched area 40 of significant speeds (for all x and y directions). A few smaller areas 41 with longer speeds, exist close to the main area 40, and are typically ignored. In this example, all that is necessary to characterize the area with the largest variation of the parameter for the histogram, the speed V in this particular case, is to identify the coordinates of the limits l_a, l_b, l_c and l_d and the maxima x_M and y_M, which may be readily derived for each histogram from memory 100, the data in units 112, and the xy(m) data block.

Thus, the system of the invention generates in real time, histograms of each of the parameters being detected. Assuming that it were desired to identify an object with a speed of "2" and a direction of "4", the validation units for speed and direction would be set to "l", and the classifiers for speed "2" and direction "4" would be set to "l". In addition, since it is desired to locate the object(s) with this speed and direction on the video image, the validation signals for histogram formation blocks 28 and 29, which correspond to the x and y coordinates, would be set to "1" as well. In this way, histogram formation blocks 28 and 29 would form histograms of only the pixels with the selected speed and direction, in real-time. Using the information in the histogram, and especially POSRMAX, the object with the greatest number of pixels at the selected speed and direction could be identified on the video image in real-time. More generally, the histogram formation blocks can localize objects in real-time meeting user-selected criteria, and may produce an output signal, e.g., a light or a buzzer if an object is detected. Alternatively, the information may be transmitted, e.g., by wire, optical fiber or radio relay for remote applications, to a control unit, such as unit 10a in Fig. 1, which may be near or remote from image processing system 11.

Fig. 15 shows an example of use of the system of the invention to perform automatic framing of a person moving, for example, during a video conference. A video camera 13 observes the subject P, who may or may not be moving. A video signal S from the video camera is transmitted by wire, optical fiber, radio relay, or other communication means to a monitor 10b and to the image processing system of the invention 11 . The image processing system determines the position and movement of the subject P, and controls servo motors 43 of camera 13 to direct the optical axis of the camera towards the subject and particularly towards the face of the subject, as a function of the location, speed and direction of the subject, and may vary the zoom, focal distance and/or the focus of the camera to provide the best framing and image of the subject.

Referring to Fig. 18, the system of the invention may be used to center the face of the subject in the video signal while eliminating superfluous portions of the image received by the camera 13 above, below, and to the right and left of the head of the subject. Camera 13 has a field of view 123, which is defined between directions 123a and 123b. The system rotates camera 13 using servomotors 43 so that the head T of the subject is centered on central axis 2a within cortical field 123, and also adjusts the zoom of camera 13 to ensure that the head T of the subject occupies a desired amount of the frames of the video signal, preferably as represented by a desired ratio of the number of pixels comprising head T to the total number of pixels per frame.

In order to accomplish this, the system of the invention may focus on the head using its luminance or motion. By way of example only, the system will be described with respect to detecting the head of the user based upon its motion. The peripheral edges of the head of the user are detected using the horizontal movements of the head, in other words, movements right and left, and the vertical movements, in other words, movements up and down. As the horizontal and vertical motion of the head is determined by the system, it is analyzed using preferred coordinate axes, preferably Cartesian coordinates Ox and Oy, in moving, area block 36 (Fig.11).

The pixels with greatest movement within the image will normally occur at the peripheral edges of the head of the subject, where even due to slight movements, the pixels will vary between the luminance of the head of the subject and the luminance of the background. Thus, if the system of the invention is set to identify only pixels with DP=1, and to form a histogram of these pixels, the histogram will detect movement peaks along the edges of the face where variations in brightness, and therefore in pixel value, are the greatest, both in the horizontal projection along Ox and in the vertical projection along Oy.

This is illustrated in Fig.17 m which axes Ox and Oy are shown, as are histograms 124x, along Ox, and 124y, along Oy, i.e., in horizontal and vertical projections, respectively. Histograms 124x and 124y would be output from histogram formation units 28 and 29 respectively (Fig. 11).Peaks 125a and 125b of histogram 124x, and 125c and 125d of histogram 124y, delimit, by their respective coordinates 126a, 126b, 126c and 126d, a frame bounded by straight lines Ya, Yb, Xc, and Xd, which encloses the face V of the video-conference participant, and which denote areas 127a, 127b, 127c and 127d, which are areas of slight movement of the head T, which will be the areas of greatest variation in pixel intensity during these movements.

Location of the coordinates 126a, 126b, 126c and 126d, corresponding to the four peaks 125a, 125b, 125c and 125d, is preferably determined by computer software reading the x and y coordinate histograms during the spot scanning sequence of each frame. The location of the coordinates 126a, 126b, 126c and 126d of peaks 125a, 125b, 125c and 125d of histograms 124x and 124y make it possible to better define and center the position of the face V of the subject in the image. In a video conferencing system, the remainder of the image, i.e. the top bottom, right and left portions of the image, as illustrated in Fig. 18 by the cross-hatched areas surrounding the face V, may be eliminated to reduce the bandwidth required to transmit the image. The center of face V may be determined, for example, by locating the pixel position of the center of the box bounded by Ya, Yb, Xc, and Xd ((Xc + (Xd - Xc)/2), (Ya + (Yb - Ya)/2)) and by comparing this position to a desired position of face V on the screen. Servomotors 43 (Fig.13 are then actuated to move camera 13 to better center face V on the screen. Similarly, if face V is in movement, the system may detect the position of face V on the screen as it moves, and follow the movement by generating commands to servomotors 43.

If desired, the center position of face V may be determined at regular intervals, and preferably in each frame, and the average value (over time) of coordinates 126a, 126b, 126c and 126d used to modify the movement of camera 13 to center face V.

With face V centered, the system may adjust the zoom of camera 13 so that face V covers a desired amount of the image. The simples method to accomplish this zoom function is to determine the dimensions of (or number of pixels in) the box bounded by Ya, Yb, Xc, and Xd. Camera 13 may then be zoomed in or out until desired dimensions (or pixel count) are achieved.

Another application of the invention relates to automatic tracking of a target by, for example, a spotlight or a camera. Using a spotlight, the invention might be used on a helicopter to track a moving target on the ground, or to track a performer on a stage during an exhibition. The invention would similarly be applicable to weapons targeting systems. Referring to Fig. 19, the system includes a camera 200, which is preferably a conventional CCD camera which communicates an output signal 202 to image processing system 204 of the invention. Especially for covert and military applications, it will be appreciated that the system may be used with sensor such as Radar and IR, in lieu of, or in combination with, camera 200. A controller 206, which is preferably a conventional microprocessor-based controller, is used to control the various elements of the system and to enable user input of commands and controls, such as with computer mouse 210, a keyboard (not shown), or other input device. As in the prior embodiment, the system includes one or more servomotors 208 that control movement of camera 200 to track the desired target. It will be appreciated that any appropriate means may be used to control the area of interest of camera 200, including use of moving mirrors relative to a fixed camera, and the use of a steered beam, for example in a Radar system, to track the target without physically moving the sensor.

In the example shown in Fig. 20, monitor 212 is shown with five simulated objects, which may be, for example, vehicles, or performers on a stage, including four background targets 216, and one target to be tracked 218. Computer mouse 210 is used to control an icon 220 on monitor 212. The user of the system selects the target for tracking by moving icon 220 over target 218, and depressing a predetermined button on mouse 210. The pixel position of icon 220 is then used as a starting position for tracking target 216.

Referring to Fig. 21, the initial pixel starting position is shown as x_c, y_c In order to process the pixels surrounding the starting position, image processing system 204 will process the pixels in successively larger areas surrounding the pixel, adjusting the center of the area based upon the shape of the object, until substantially the entire target area is being tracked. The initial area is set by controller 206 to include an area bounded by x_A, x_B, y_C, y_D This is accomplished by setting these boundaries in the classification units of x and y histogram formation units 28 and 29. Thus, the only pixels that will be processed by the system are those falling within the bounded area. Assuming that in the example given, the target is in motion. the system may be set to track pixels with DP=1. Those pixels with DP=1 would normally be located on the peripheral edges of target 218, unless the target had a strong color or luminance variation throughout, in which case, many of the pixels of the target would have DP=1. In any case, in order to locate pixels with DP=1, the validation units would be set to detect pixels with DP=l. Thus, the only pixels that will be considered by the system are those in the bounded area with DP=1. Alternatively, the system may be set to detect a velocity greater than zero, or any other criteria that define the edges of the object.

Histograms are then formed by x and y histogram formation units 28 and 29. In the example shown in Fig. 21, an insignificant number of pixels would be identified as having DP=1, since the selected area does not include the border of target 218, so no histogram would be formed. The size of the area under consideration is then successively increased, preferably by a constant size K, so that in subsequent iterations, the pixels considered would be in the box bounded by x_{A-nK}, x_{B+nK}, y_{A-nK}, y_{B+nK}, where n is the number of the current iteration.

This process is continued until the histogram formed by either of histogram formation units 28 and 29 contains meaningful information, i. e. , until the box overlaps the boundary of the target. Referring to Fig. 22, when the area under consideration begins to cross the borders of target 218, the histograms 222 and 224 for the x and y projections will begin to include pixels in which DP=1 (or any other selected criteria to detect the target edge). Prior to further enlarging the area under consideration, the center of the area under consideration, which until this point has been the pixel selected by the user, will be adjusted based upon the content of histograms 222 and 224. In a preferred embodiment, the new center of the area is determined to be $(x_{MIN} + x_{MAX})/2$, $(y_{MIN} + y_{MAX})/2$, where x_{MIN} and x_{MAX} are the positions of the minima and maxima of the x projection histogram, and where y_{MIN} and y_{MAX} are the positions of the minima and maxima of the y projection histogram. This serves to adjust the area under consideration for the situation in which the initial starting position is nearer to one edge of the target than to another. Other methods of relocating the center of the target box may be used if desired.

After additional iterations, as shown in Fig. 23, it being understood that the center of the box bounding the area of consideration may have moved from the prior iteration, the box will be larger than the target in that $x_{A-nK}<x_{MIN}$, $x_{A+nK}>x_{MAX}$, $y_{A-nK}<y_{MIN}$, and $y_{A+nK}>y_{MAX}$. When this occurs, the entire target is bounded, and the constant K may then be reduced, to thereby reduce the size of the tracking box. In a preferred embodiment, when initially tracking a target, constant K is preferably relatively large, e.g., 10-20 pixels or more, in order that the system may lock on the target expeditiously. Once a target has been locked onto, K may be reduced. It will be appreciated that in the course of tracking a target, the tracking box will be enlarged and reduced as appropriate to maintain a track of the target, and is preferably adjusted on a frame by-frame basis.

Assuming that the system is to be used to train a spotlight on the target, for example from an airborne vehicle or in a theater, the camera is preferably synchronized with the spotlight so that each is pointing at the same location. In this way, when the camera has centered the target on its image, the spotlight will be centered on the target. Having acquired the target, controller 206 controls servomotors 208 to maintain the center of the target in the center of the image. For example, if the center of the target is below and to the left of the center of the image, the camera is moved downward and to the left as required to center the target. The center of the target may be determining in real time from the contents of POSRMAX for the x and histogram formation units.

It will be appreciated that as the target moves, the targeting box will move with the target, constantly adjusting the center of the targeting box based upon the movement of the target, and enlarging and reducing the size of the targeting box. The targeting box may be displayed on monitor 212, or on another monitor as desired to visually track the target.

A similar tracking box may be used to track an object in an image based upon its characteristics. For example, assuming it is desired to track a target moving only to the right in the image. The histogram formation units are set up so that the only validation units set to "1" are for direction and for the x and y projections. The classification unit for direction is set so that only direction "right" is set to "1". The histograms for the x and y projections will then classify only pixels moving to the right. Using these histograms, a box bounding the target may be established. For example, referring to Fig. 12, the box surrounding the target may be established using l_a, l_b, l_c, and l_d as the bounds of the box. The target box may be displayed on the screen using techniques known in the art.

After a very short initialization period on the order of about 10 frames, the invention determines the relative displacement parameters instantaneously after the end of each frame on which the temporal and spatial processing was performed due to the recursiveness of calculations according to the invention.

The invention, including components 11a and 22a is preferably formed on a single integrated circuit, or on two integrated circuits. If desired, a microcontroller, for enabling user-input to the system, e.g., to program the validation and classification units, may be integrated on the same integrated circuit.

It will be appreciated that the present invention is subject to numerous modifications. In an embodiment in which a color camera is used, the system of the invention preferably includes histogram formation units for hue and saturation. This enables classification of targets to be made using these characteristics as well. In fact, the invention may be modified by adding histogram formation units for any possible other measurable characteristics of the pixels. Moreover, while the invention has been described with respect to tracking a single target, it is foreseen that multiple targets may be tracked, each with user-defined classification criteria, by replicating the various elements of the invention. For example, assuming the system of the invention included additional histogram formation units for hue and saturation, the system could be programmed, using a common controller attached to two histogram formation processors of the type shown in Fig. 11, to track a single target by its velocity, and/or color, and/or direction, etc. In this manner, the system could continue to track a target if, for example, the target stopped and the track based upon velocity and direction was lost, since the target could still be tracked by color.

It will also be appreciated that the limitation of eight speeds may be increased by using a greater bit count to represent the speeds. Moreover, while the invention has been described with respect to detection of eight different directions, it may be applied to detect 16 or more directions by using different size matrices, e.g., sixteen directions may be detected in a 5x5matrix, to detect a greater number of directions.

Finally, Fig. 24 shows a method of tracking a wider range of speeds V if the limited number provided by p bits for time constant CO is insufficient. Using Mallat's diagram (see article by S. Mallat "A Theory for multi-resolution signal decomposition" in IEEE Transactions on Pattern Analysis and Machine Intelligence, July 1989 p. 674-693), the video image is successively broken down into halves, identified as 1, 2, 3, 4, 5, 6, 7. This creates a compression that only processes portions of the image. For example, with p= 4 ($2^P = 16$), the system may determine speeds within a wider range.

If initially, while processing the entire image, the system determines that the speed of an object exceeds the maximum speed determinable with $2^P=16$ for the time constant, the system uses partial observed images 1, 2, 3, 4,.... until the speed of the object does not exceed the maximum speed within the partial image after compression. To use Mallat compression with wavelets, a unit 13A (Fig. 24) is inserted into the system shown in Fig. 1 to perform the compression. For example, this unit could be composed of the "DV 601 Low Cost Multiformat Video Codec" by Analog Devices. Fig. 2 shows an optional compression unit 13a of this type.

Although the present invention has been described with respect to certain embodiments and examples, variations exist that are within the scope of the invention as described in the following claims.

CLAIMS

1. A process for identifying pixels in an input signal in one of a plurality of classes in one of a plurality of domains, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the process comprising, on a frame-by-frame basis:

for each pixel of the input signal, analyzing the pixel and providing an output signal for each domain containing information to identify each domain in which the pixel is classified;

providing a classifier for each domain, the classifier enabling classification of pixels within each domain to selected classes within the domain;

providing a validation signal for the domains, the validation signal selecting one or more of the plurality of domains for processing; and

forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal.

2. The process according to claim 1 further comprising:

forming histograms along coordinate axes for the pixels within the classes selected by the classifier within each domain selected by the validation signal; and forming a composite signal corresponding to the spatial position of such pixels within the frame.

3. The process according to claim 1 comprising identifying the velocity of movement of an area of an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, said identifying of the velocity of movement comprising :

for each particular pixel of the input signal, forming a first matrix comprising binary values indicating the existence or non-existence of a significant variation in the amplitude of the pixel signal between the current frame and a prior frame for a subset of the pixels of the frame spatially related to such particular pixel, and a second matrix comprising the amplitude of such variation;

determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and, for such pixels, determining in the second matrix whether, the amplitudes of the pixels along an oriented direction relative to the particular pixel vary in a known manner indicating movement of the pixel and the pixels along an oriented direction relative to the particular pixel, the amplitude of the variation along the oriented direction determining the velocity of movement of the particular pixel.

4. The process according to claim 3 further comprising:

prior to determining the binary values for each pixel, smoothing each pixel of the input signal using a time constant for such pixel, thereby generating a smoothed input signal, the determination of the existence of a significant variation in the amplitude of the pixel being performed for each pixel of the smoothed input signal; and using the existence of a significant variation for a given pixel to modify the time constant for the pixel to be used in smoothing subsequent frames of the input signal.

5. A process according to claim 1 for identifying a non-moving area in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the process comprising

forming histograms along coordinate axes for pixels of the input signal without significant variation between the current frame and a prior frame; and

forming a composite signal corresponding to the spatial position of such pixels within the frame.

6. The process according to claim 2 or 5 further comprising identifying pixels falling within limits l_a, l_b, l_c, l_d, in the histograms along the coordinate axes, and forming the composite signal from the pixels falling within such limits.

7. The process according to claim 4 further comprising:

prior to the histogram forming step i) smoothing the input signal for each pixel thereof using a time constant for such pixel, thereby generating a smoothed input signal, and ii) determining for each pixel in the smoothed input signal a binary value corresponding to the non-existence of a significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame.

8. The process according to claim 6 further comprising using the existence of a significant variation for a given pixel to modify the time constant for the pixel to be used in smoothing subsequent frames of the input signal.

9. A process according to claim 1 comprising identifying relative movement in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, wherein the identifying of relative movement comprises :

for each pixel of the input signal, smoothing the input signal using a time constant for such pixel, thereby generating a smoothed input signal;

determining for each pixel in the smoothed input signal a binary value corresponding to the existence of a significant variation in the amplitude of the pixel between the current frame and the immediately previous smoothed input frame, and the amplitude of the variation:

using the existence of a significant variation for a given pixel, modifying the time constant for the pixel to be used in smoothing subsequent frames of the input signal;

for each particular pixel of the input signal, forming a first matrix comprising the binary values of a subset of the pixels of the frame spatially related to such particular pixel, and a second matrix comprising the amplitude of the variation of the subset of the pixels of the frame spatially related to such particular pixel;

determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and, for such pixels, determining in the second matrix whether the amplitude of the pixels along the oriented direction relative to the particular pixel varies in a known manner indicating movement in the oriented direction of the particular pixel and the pixels along the oriented direction relative to the particular pixel, the amplitude of the variation of the pixels along the oriented direction determining the velocity of movement of the pixel and the pixels along the oriented direction relative to the particular pixel,

in each of one or more domains, forming a histogram of the values distributed in the first and second matrices falling in each such domain,

for a particular domain, determining from the histogram for such domain an area of significant variation;

forming histograms of the area of significant variation along coordinate axes; and determining from the histograms along the coordinate axes, whether there is an area in movement for the particular domain.

10. The process according to one of claims 1 and 9 wherein the domains are selected from the group consisting of i) luminance, ii) speed (V), iii) oriented direction (D1), iv) time constant (CO), v) hue, vi) saturation, vii) first axis (x(m)), and viii) second axis (y(m)) and ix) data characterized by external inputs.

11. The process according to claim 9 wherein the first and second matrices are square matrices with the same odd number of rows and columns, centered on the particular pixel.

12. The process according to claim 11 wherein the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested n x n matrices, where n is odd, centered on the particular pixel to the pixels within each of the first and second matrices, the process further comprising:

determining the smallest nested matrix in which the amplitude signal varies of predetermined values symetrical relative to the particular pixel along an oriented direction around said particular pixel.

13. The process according to claim 9 wherein the first and second matrices are hexagonal matrices centered on the particular pixel.

14. The process according to claim 13 wherein the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested hexagonal matrices of varying size centered on the particular pixel to the pixels within each of the first and second matrices, the process further comprising

determining the smallest nested matrix in which the amplitude signal varies of predetermined values symetrical relative to the particular pixel along an oriented direction around said particular pixel.

15. The process according to claim 9 wherein the first and second matrices are inverted L-shaped matrices with a single row and a single column.

16. The process according to claim 15 wherein the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal

varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested n x n matrices, where n is odd, to the single line and the single column to determine the smallest matrix in which the amplitude varies on a line with the steepest slope and constant quantification.

17. The process according to claim 9 wherein the first and second matrices are angular sector shaped matrices reproducing a portion of an eye.

18. The process according to claim 17 wherein the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested angular sector shaped matrices of varying size centered on the particular pixel to the pixels within each of the first and second matrices, the process further comprising

determining the smallest nested matrix in which the amplitude signal varies of predeterminal values symetrical relative to the particular pixel along an oriented direction around said particular pixel.

19. The process according to claim 9 wherein the time constant is in the form 2^p, the time constant being reduced or increased by incrementing or decrementing p.

20. The process according to claim 19 wherein successive decreasing portions of complete frames of the input signal are considered using a Mallat time-scale algorithm and the largest of these portions, which provides displacement, speed and orientation indications compatible with the value of p, is selected.

21. The process according to claim 4, comprising:

for each pixel of the input signal, i) smoothing the pixel using a time constant (CO) for such pixel, thereby generating a smoothed pixel value (LO), ii) determining whether there exists a significant variation between such pixel and the same pixel in a previous frame, and iii) modifying the time constant (CO) for such pixel to be used in smoothing the pixel in subsequent frames of the input signal based upon the existence or non-existence of a significant variation.

22. The process according to claim 21 wherein:

(a) the step of determining the existence of a significant variation for a given pixel comprises determining whether the absolute value of the difference (AB) between the given pixel value (PI) and the value of such pixel in a smoothed prior frame (LI) exceeds a threshold (SE); and

(b) the step of smoothing the input signal comprises, for each pixel, i) modifying a time constant (CO) for pixel such based upon the existence of a significant variation as determined in step (a), and ii) determining a smoothed value for the pixel (LO) as follows:

$$LO = LI + \frac{PI - LI}{CO}$$

23. The process according to claim 21 wherein the time constant (CO) is in the form 2^p, and wherein p is incremented in the event that AB<SE, and wherein p is decremented in the event AB≥SE.

24. The process according to claim 23 wherein p is incremented or decremented by one.

25. The process according to claim 22 further comprising generating an output signal comprising, for each pixel, a binary value (DP) indicating the existence or nonexistence of a significant variation, and the value of the time constant (CO).

26. The process according to claim 25 wherein the binary values (DP) and the time constants (CO) are stored in a memory sized to correspond to the frame size.

27. The process according to claim 1 comprising identifying an area in relative movement in said input signal, through :

generating a first array indicative of the existence of significant variation in the magnitude of each pixel between a current frame and a prior frame;

generating a second array indicative of the magnitude of significant variation of each pixel between the current frame and a prior frame, establishing a first moving matrix centered on a pixel under consideration and comprising pixels spatially related to the pixel under consideration, the first moving matrix traversing the first array for consideration of each pixel of the current frame; and

determining whether the pixel under consideration and each pixel of the pixels spatially related to the pixel under consideration along an oriented direction relative thereto within the first matrix are a particular value representing the presence of significant variation, and if so, establishing in a second matrix within the first matrix, centered on the pixel under consideration, and determining whether the amplitude of the pixels in the second matrix spatially related to the pixel under consideration along an oriented direction relative thereto are indicative of movement along such oriented direction, the amplitude of the variation along the oriented direction being indicative of the velocity of movement, the size of the second matrix being varied to identify the matrix size most indicative of movement.

28. The process according to claim 27 further comprising:

in at least one domain selected from the group consisting of i) luminance, ii) speed (V), iii) oriented direction (D1), iv) time constant (CO), v) hue, vi) saturation, and vii) first axis (x(m)), and viii) second axis (y(m)), and ix) data characterized by external inputs, forming at least one histogram of the values in such domain for pixels indicative of movement along an oriented direction relative to the pixel under consideration.

29. The process according to claim 28 further comprising:

for the pixels in said at least one histogram, forming histograms of the position of such pixels along coordinate axes.

30. The process according to claim 29 further comprising determining from the histograms along the coordinate axes an area of the image meeting criteria of the at least one domain.

31. The process according to claim 27 wherein the first and second matrices are square, and the sizes of the second matrix are nested n x n matrices, where n is odd.

32. The process according to claim 31 wherein the matrix most indicative of movement is the smallest nested matrix containing pixels indicative of movement along an oriented direction relative to the pixel under consideration.

33. The process according to claim 27 wherein the first and second matrices are selected from the group consisting of hexagonal matrices and inverted L-shaped matrices.

34. An apparatus for identifying pixels in an input signal in one of a plurality of classes in one of a plurality of domains, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the apparatus comprising:

means for analyzing each pixel of the input signal and for providing an output signal for each domain containing information to identify each domain in which the pixel is classified;

a classifier for each domain, the classifier classifying pixels within each domain in selected classes within the domain;

a linear combination unit for each domain, the linear combination unit generating a validation signal for the domain, the validation signal selecting one or more of the plurality of domains for processing; and

means for forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal.

35. The apparatus according to claim 34 further comprising:

means for forming histograms along coordinate axes for the pixels within the classes selected by the classifier within each domain selected by the validation signal; and

means for forming a composite signal corresponding to the spatial position of such pixels within the frame.

36. The apparatus according to claim 34 wherein the domains are selected from the groups consisting of i) luminance, ii) speed (V), iii) oriented direction (D1), iv) time constant (CO), v) hue, vi) saturation, and vii) first axis (x(m)), and viii) second axis (y(m)) and ix) data characterized by external inputs.

37. The apparatus according to claim 34 for identifying the velocity of movement of an area of an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels the apparatus, comprising:

means for determining for each pixel in the input signal a binary value corresponding to the existence of a significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame, and for determining the amplitude of the variation;

means for forming, for each particular pixel of the input signal, a first matrix comprising the binary values of a subset of the pixels spatially related to such particular pixel, and a second matrix comprising the amplitude of the variation of the subset of the pixels spatially related to such particular pixel; and

means for determining in the first matrix whether for a particular pixel, and other pixels along an oriented direction relative to the particular pixel, the binary value for each pixel is a particular value representing significant variation, and, for such particular pixel and other pixels, determining in the second matrix whether the amplitude varies along an oriented direction relative to the particular pixel in a known manner indicating movement of the pixel and the other pixels, the amplitude of the variation along the oriented direction determining the velocity of movement of the pixel and the other pixels.

38. The apparatus according to claim 37 further comprising means for smoothing each pixel of the input signal using a time constant for such pixel prior to determining a binary value for each pixel, the binary values being determined on the smoothed pixels.

39. The apparatus according to claim 34 for identifying a non-moving area in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the apparatus comprising:

means for forming histograms along coordinate axes for pixels of a current frame without a significant variation from such pixels in a prior frame; and

means for forming a composite signal corresponding to the spatial position of such pixels within the frame.

40. The apparatus according to any one of claims 34 and 39 further comprising means for identifying pixels falling within limits l_a, l_b, l_c, l_d, in the histograms along the coordinate axes, and forming the composite signal from the pixels falling within such limits.

41. The apparatus according to claim 39 further comprising:

means for smoothing the input signal using a time constant for each pixel, thereby generating a smoothed input signal; and

means for determining for each pixel in the smoothed input signal a binary value corresponding to the existence or non-existence of the significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame.

42. The apparatus according to claim 41 further comprising means for using the existence of a significant variation for a given pixel to modify the time constant for the pixel to be used in smoothing subsequent frames of the input signal.

43. A process according to any one of claims 1-33 for tracking a target in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process comprising:

selecting a pixel of the target as a starting pixel;

on a frame-by-frame basis:

forming a tracking box around the starting pixel and for each pixel of the input signal in the tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

successively increasing the size of the tracking box and for each pixel of the input signal, in each successive tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

determining when the target is substantially within the tracking box, stopping the size increasing of said tracking box, and adjusting the center of the tracking box based upon the histograms.

44. A process of tracking a target in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process comprising, on a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target, and identifying the target from said at least one histogram.

45. The process according to claim 44 further comprising drawing a tracking box around the target.

46. The process according to claims 43 and 45, comprising centering the tracking box relative to the optical axis of the image.

47. The apparatus according any one of claims 33-42, comprising a histogram formation block forming histograms of speed, a memory storing up to the number of pixels in an image, multiplexors controlling setting an clearing of said memory, a classifier enabling only data having selected classification criteria to be considered further, meaning to possibly be included in histograms formed by corresponding histogram formation block.

48. The apparatus of claim 47 wherein the classifier includes a register that enables the classification criteria to be set by the user or by a separate program.

49. The apparatus according to claim 47, comprising a computing unit for comprising the key characteristics for histograms formed in said memory said computing unit including memories for each of the key characteristics which include the minimum (MIN) of the histogram, the maximum (MAX) of the histogram, the number of points

(NBPTS) in the histogram, the position (POSRMAX) of the maximum of the histogram and the number of points (RMAX) at the maximum of the histogram.

50. The apparatus according to claims 47-49 further comprising an adder incrementing output of said memory, said adder being controlled by a validation signal from a corresponding validation unit receiving via a bus the output of said classifier so as to select only data points in any selected classes within any selected domains.

51. The process according to claims 43-46 comprising calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame.

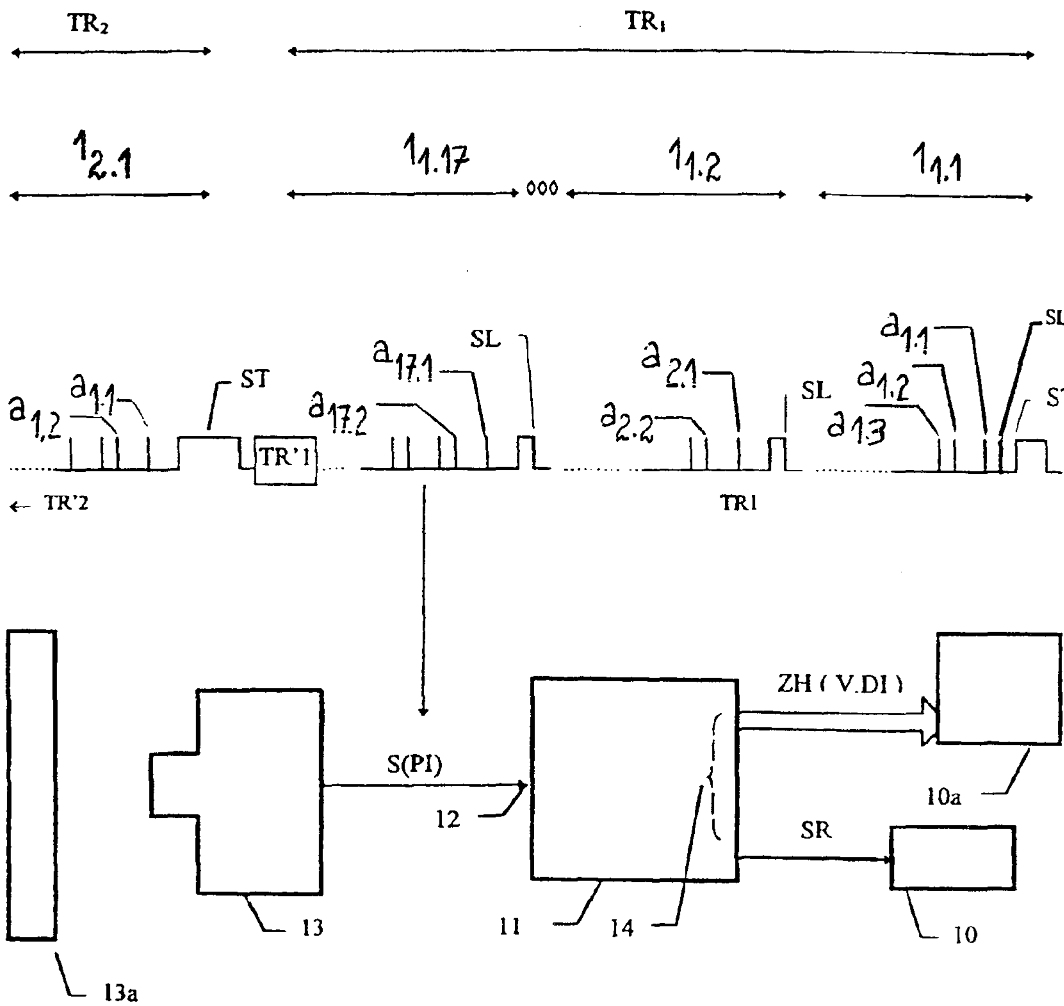

TR₂
TR₁
1 2.1
1 1.17
1 1.2
1 1.1
a 1,2
a 1.1
ST
TR'1
a 17.2
a 17.1
SL
a 2.2
a 2.1
SL
a 1.3
a 1.2
a 1.1
SL
ST
TR'2
TR1
ZH (V.DI)
S(PI)
12
SR
10a
13
11
14
10
13a

FIG. 1

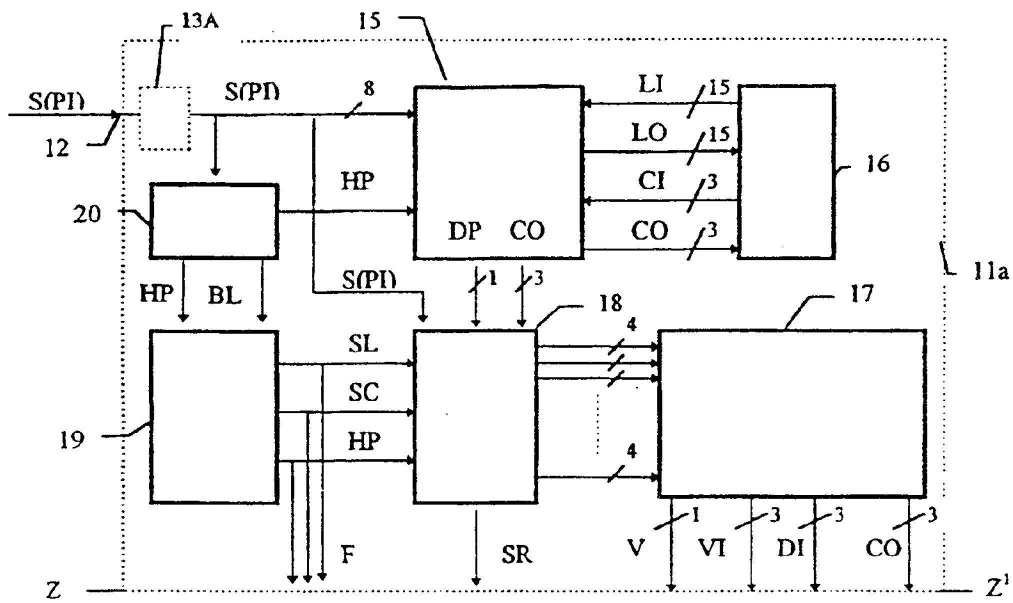
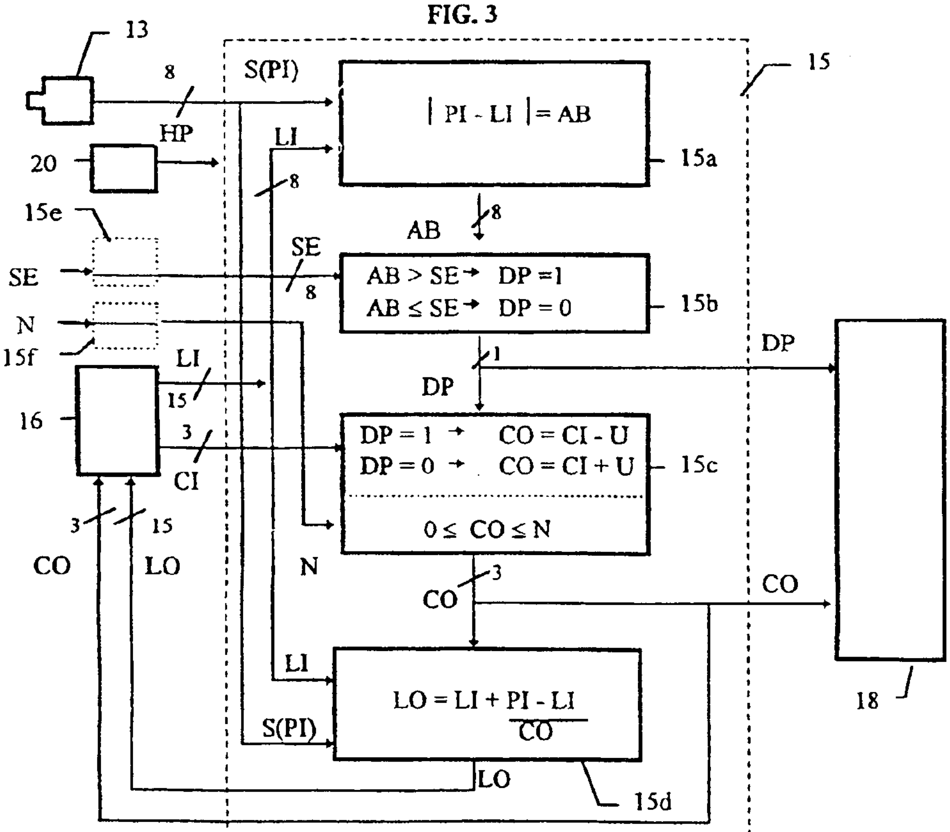

13A
15
S(PI)
12
S(PI)
8
LI
15
LO
15
CI
3
CO
3
16
20
HP
DP CO
11a
HP
BL
S(PI)
1
3
18
17
4
SL
SC
HP
4
19
F
SR
V
1
VI
3
DI
3
CO
3
Z
Z'

FIG. 2

FIG. 3


13
8
S(PI)
15
HP
| PI - LI | = AB
20
LI
15a
8
15e
AB
8
SE
SE
AB > SE → DP = 1
AB ≤ SE → DP = 0
8
15b
N
15f
DP
LI
1
15
DP
16
3
DP = 1 → CO = CI - U
DP = 0 → CO = CI + U
15c
CI
3
15
0 ≤ CO ≤ N
CO
LO
N
3
CO
CO
LI
18
LO = LI + PI - LI / CO
S(PI)
LO
15d

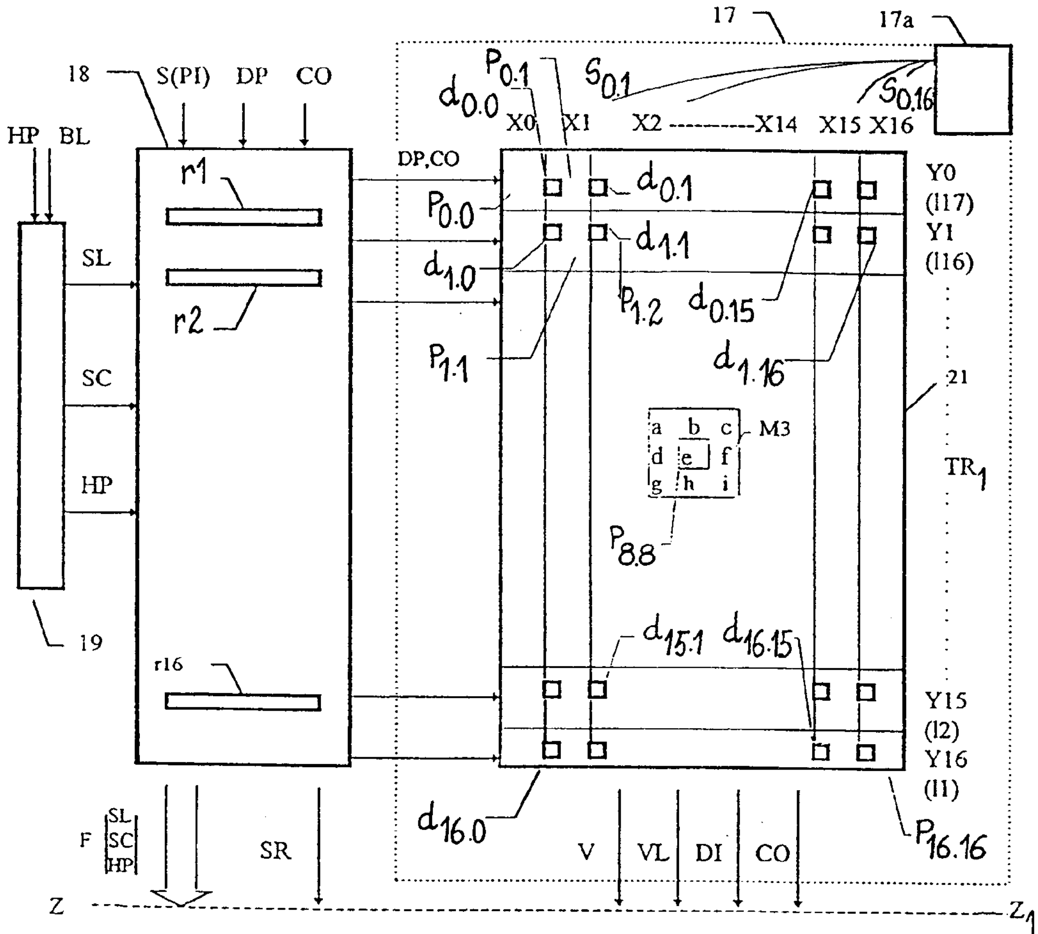


FIG. 4

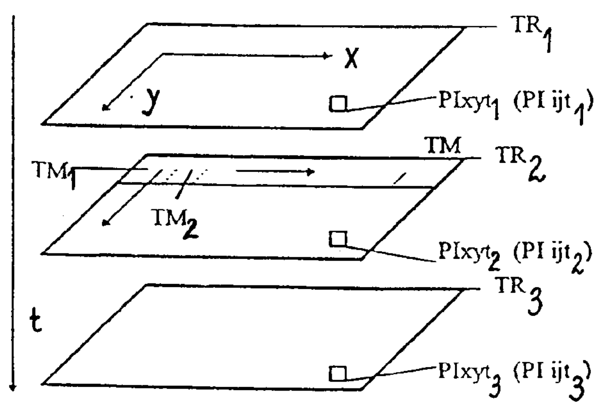


FIG. 5

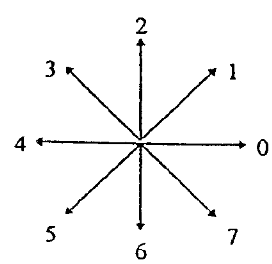
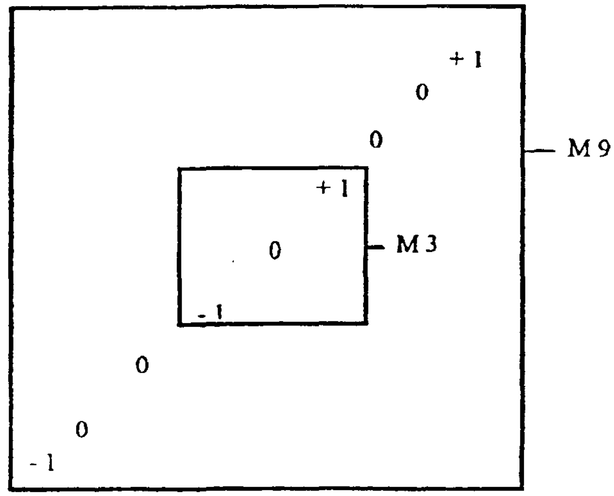


FIG. 6

FIG. 7



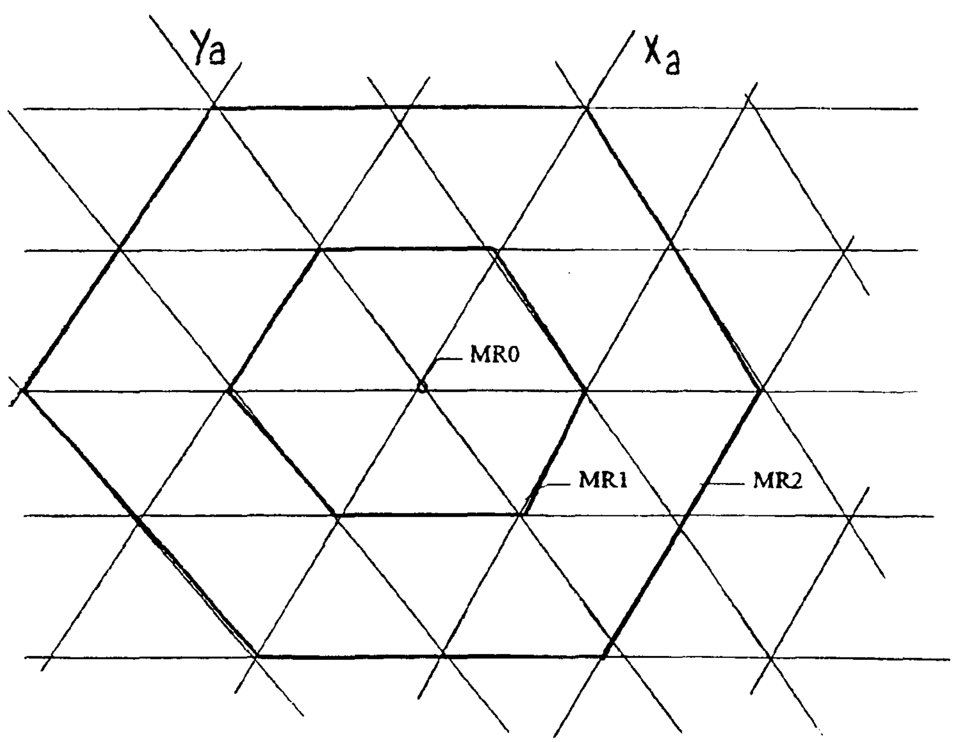


FIG. 8

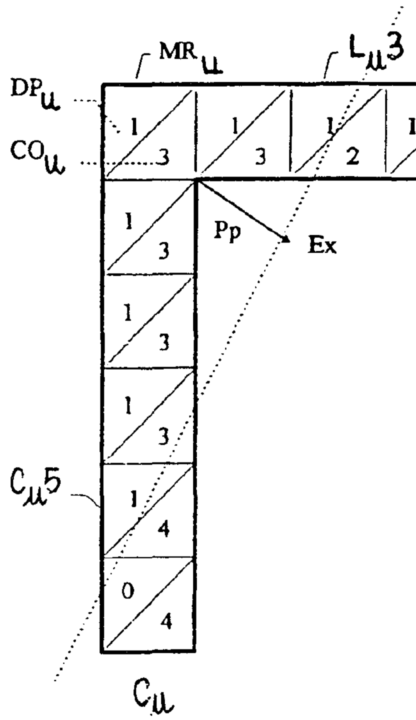


FIG. 9

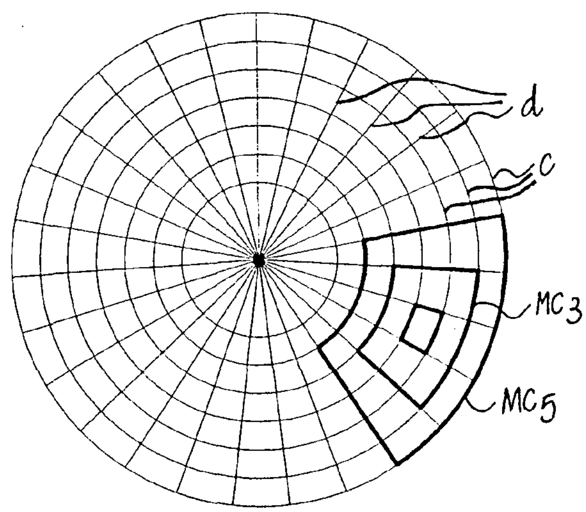


FIG. 9a

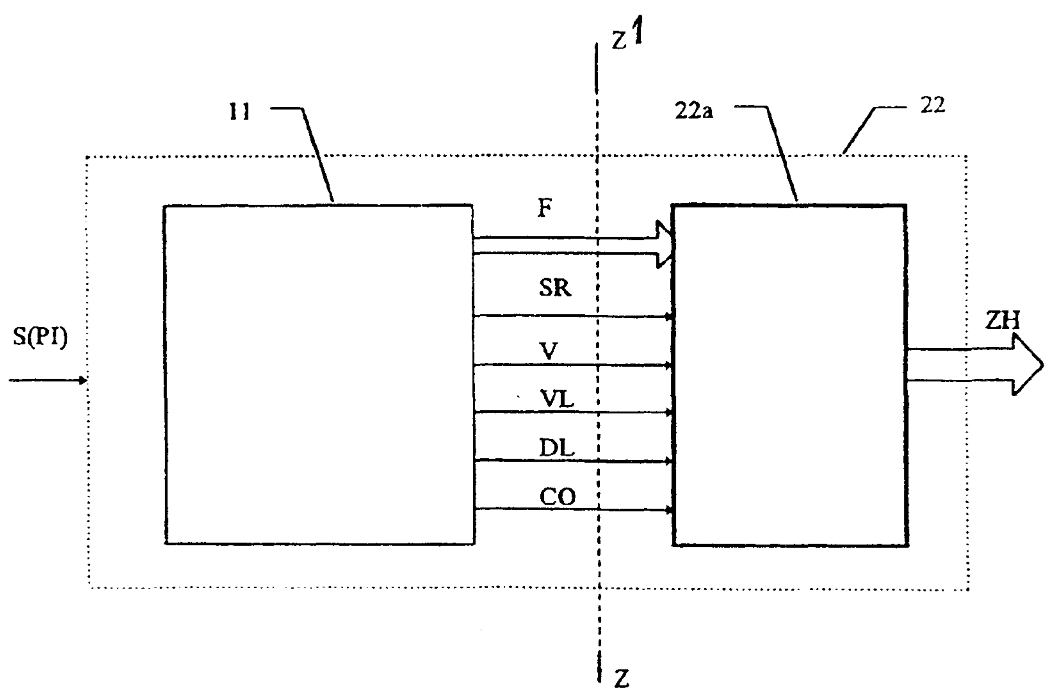


FIG. 10

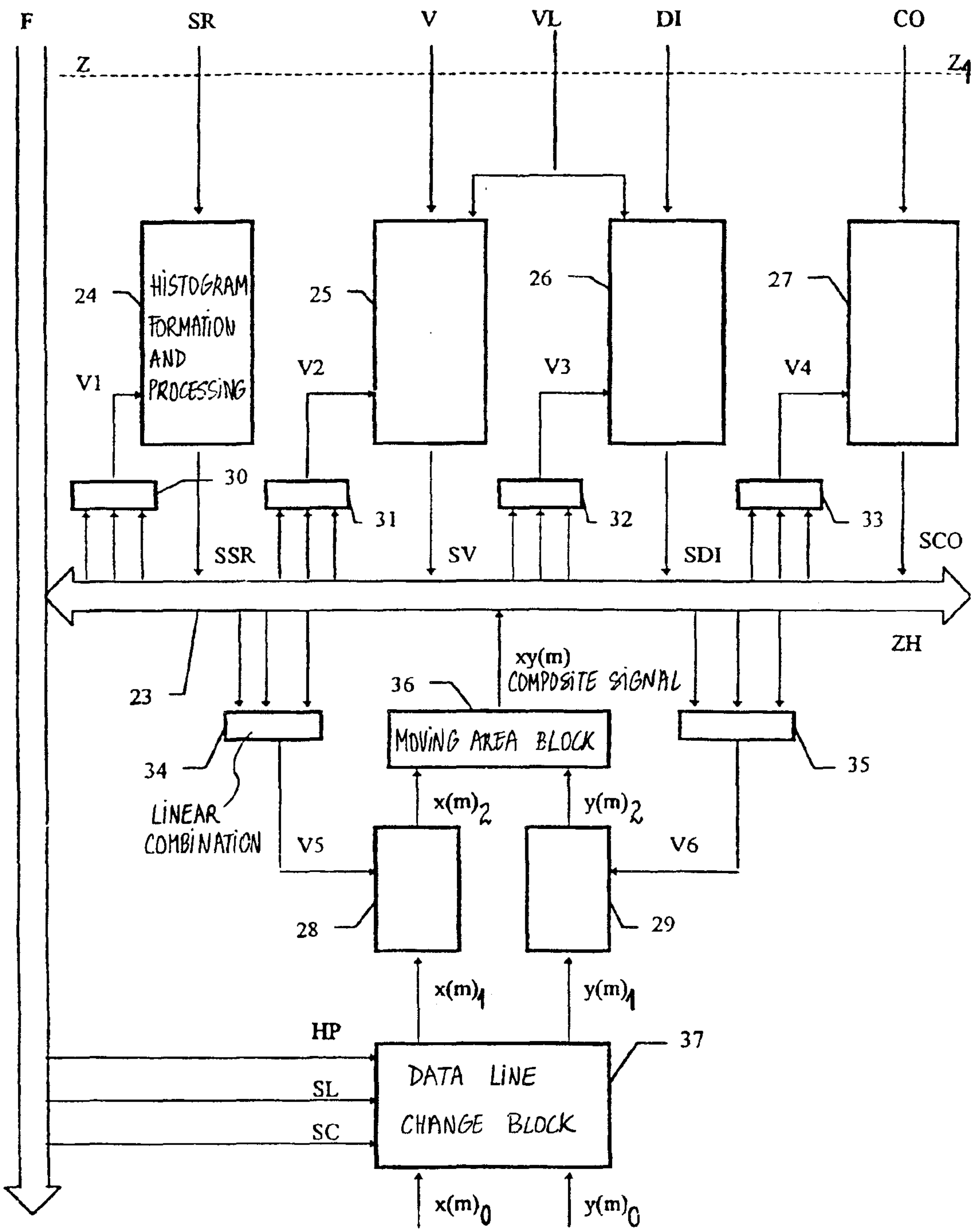

F
SR
V
VL
DI
CO
Z
Z1
24
HISTOGRAM FORMATION AND PROCESSING
25
26
27
V1
V2
V3
V4
30
31
32
33
SSR
SV
SDI
SCO
ZH
23
xy(m) COMPOSITE SIGNAL
36
MOVING AREA BLOCK
34
35
LINEAR COMBINATION
x(m)2
y(m)2
V5
V6
28
29
x(m)1
y(m)1
HP
37
DATA LINE CHANGE BLOCK
SL
SC
x(m)0
y(m)0

FIG. 11

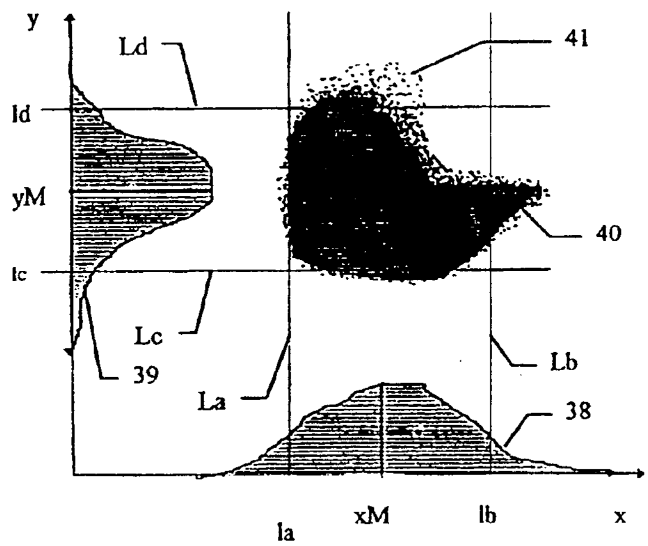


FIG. 12

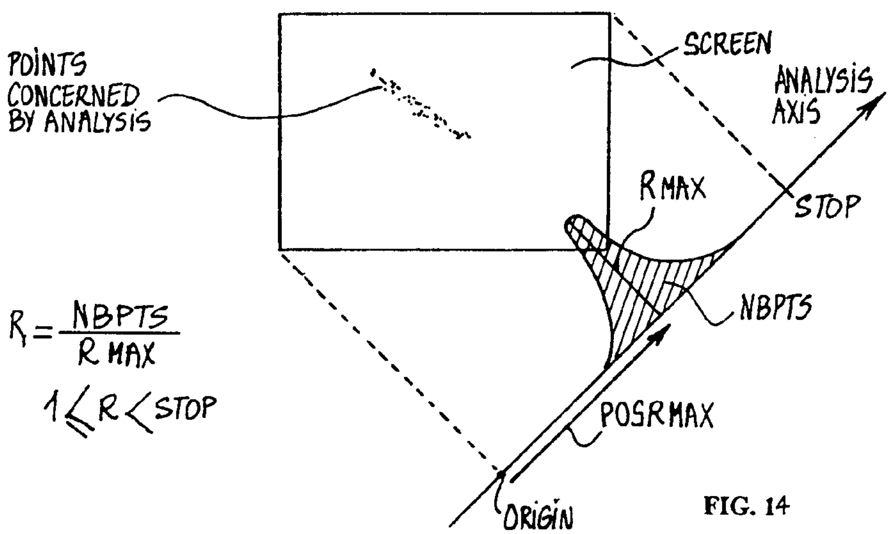


FIG. 14

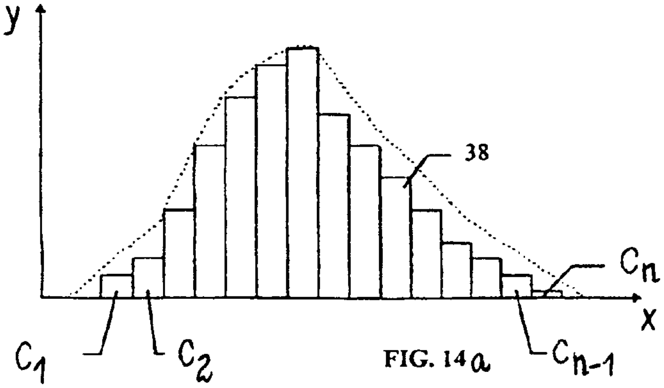
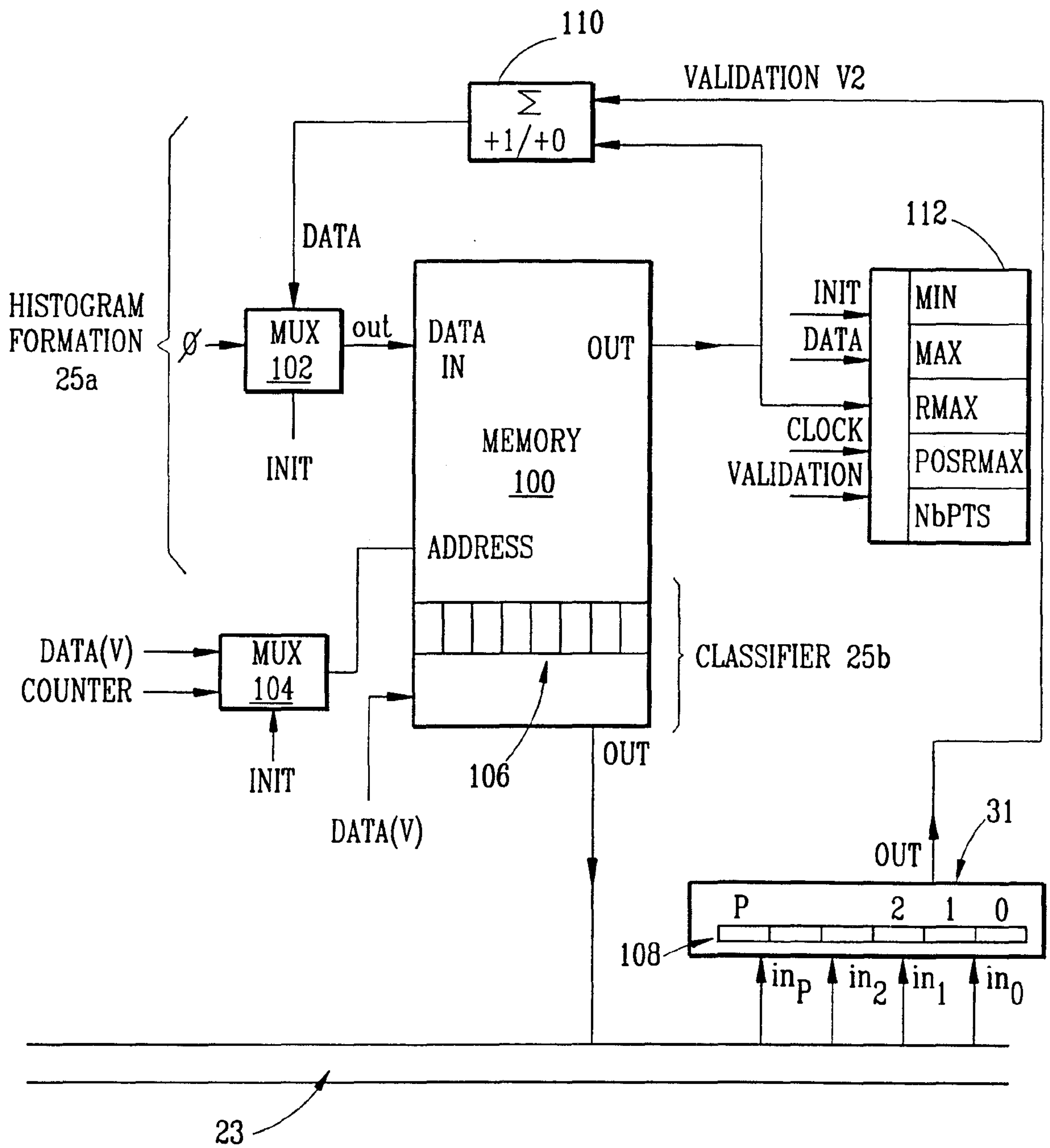


FIG. 14a


110
VALIDATION V2
Σ
+1/+0
DATA
112
HISTOGRAM
FORMATION
25a
Ø
MUX
102
out
DATA
IN
OUT
INIT
DATA
CLOCK
VALIDATION
MIN
MAX
RMAX
POSRMAX
NbPTS
INIT
MEMORY
100
ADDRESS
DATA(V)
COUNTER
MUX
104
CLASSIFIER 25b
INIT
106
OUT
DATA(V)
31
OUT
P
2
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1
in
0
23

FIG.13

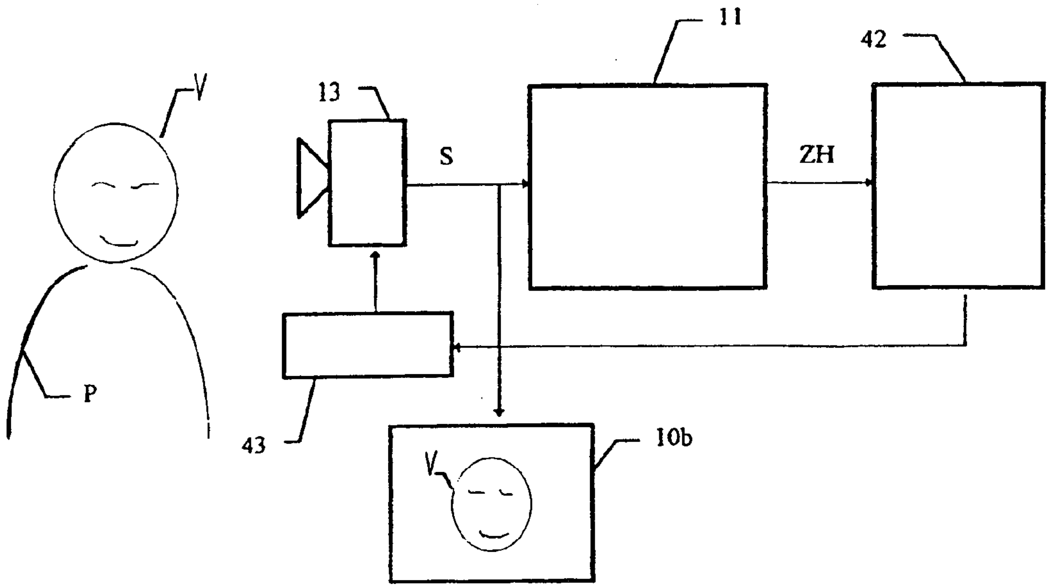


FIG.15

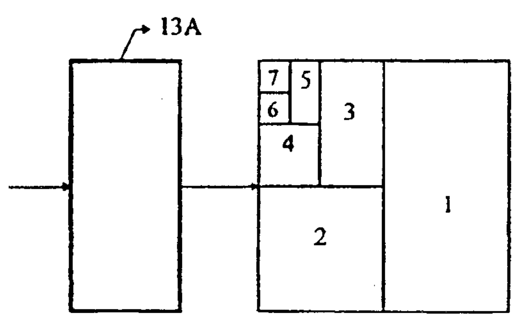


FIG.24

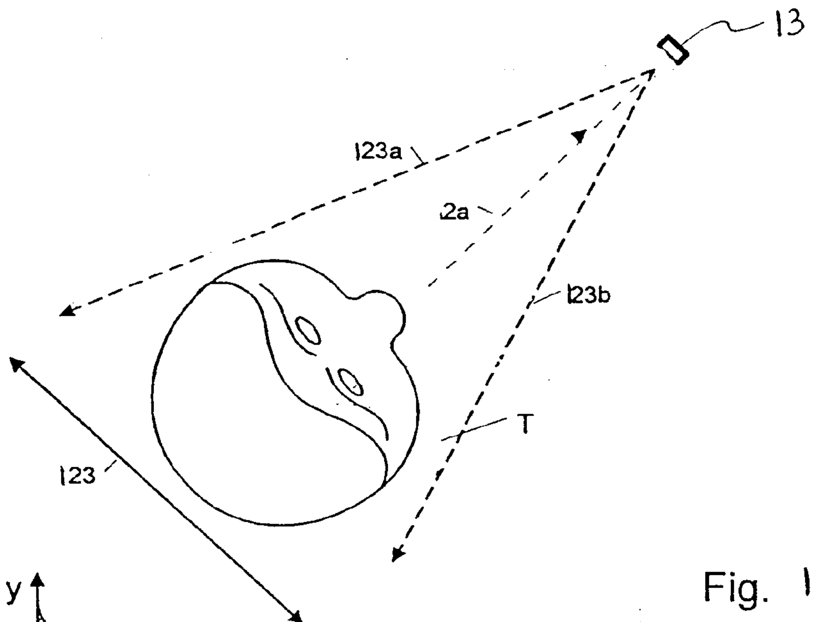

13
123a
2a
123b
T
123

Fig. 16

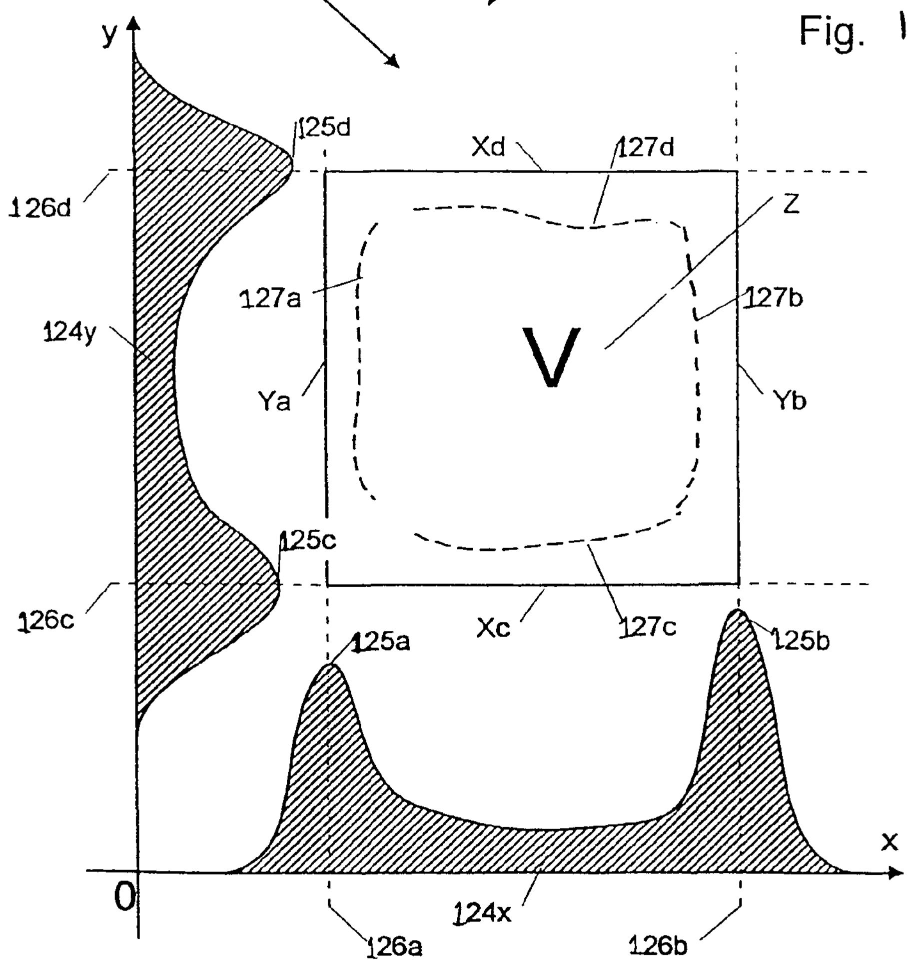
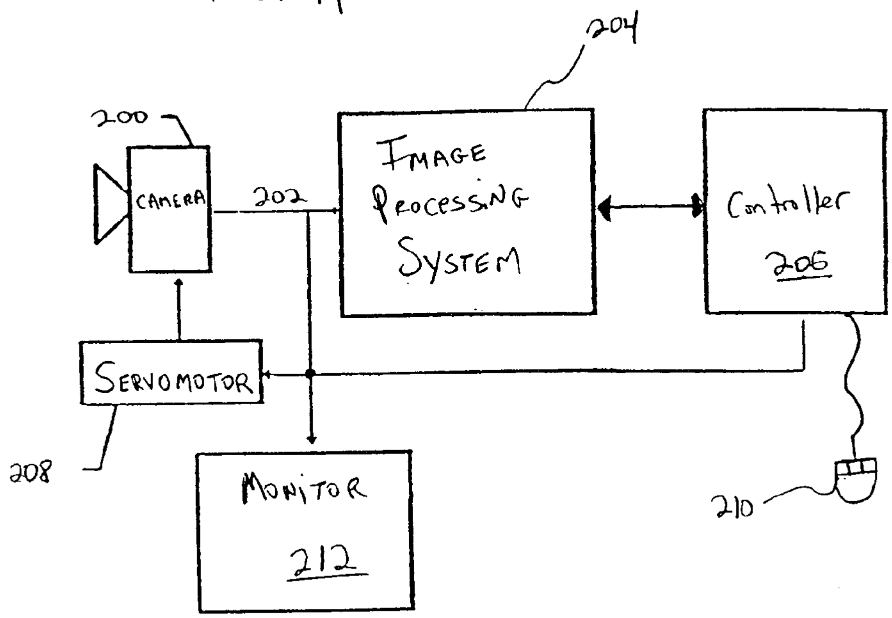

y
125d
Xd
127d
126d
Z
127a
127b
124y
V
Ya
Yb
125c
126c
Xc
127c
125a
125b
x
0
124x
126a
126b

Fig. 17

FIG. 19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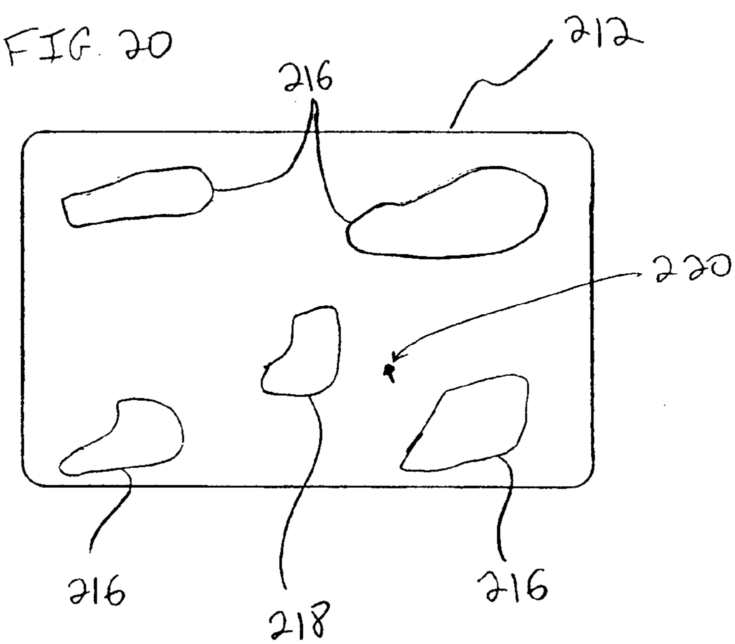
CAMERA
202
IMAGE PROCESSING SYSTEM
Controller
206
SERVOMOTOR
208
MONITOR
212
210

FIG. 20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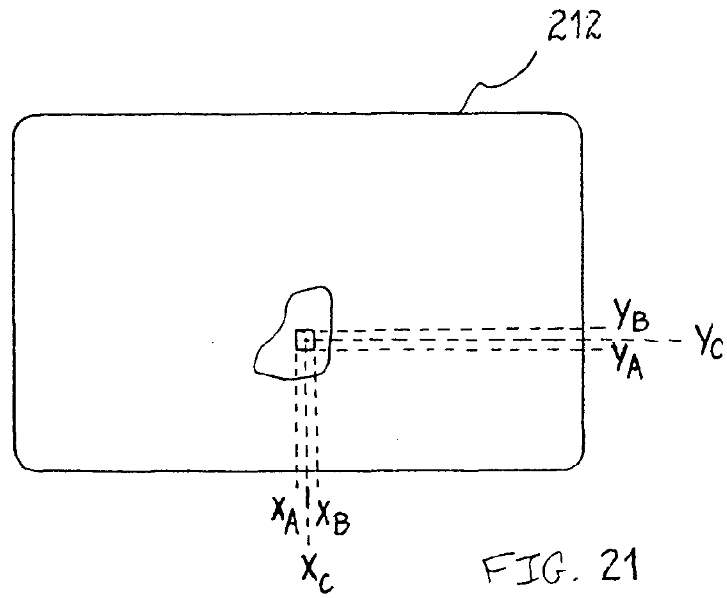
212
Y_B
Y_C
Y_A
X_A
X_B
X_C

FIG. 21

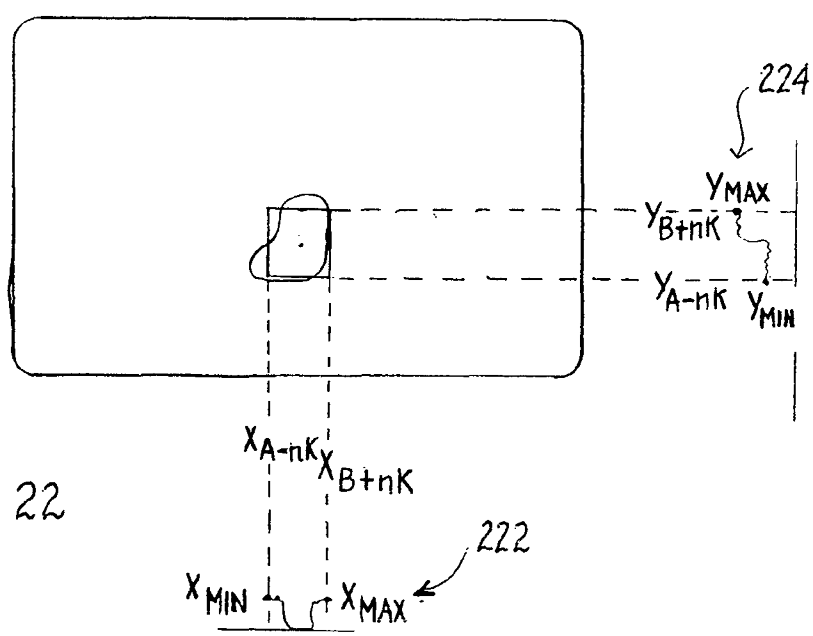
224
Y_{MAX}
Y_{B+nK}
Y_{A-nK}
Y_{MIN}
X_{A-nK}
X_{B+nK}
222
X_{MIN}
X_{MAX}

FIG. 22

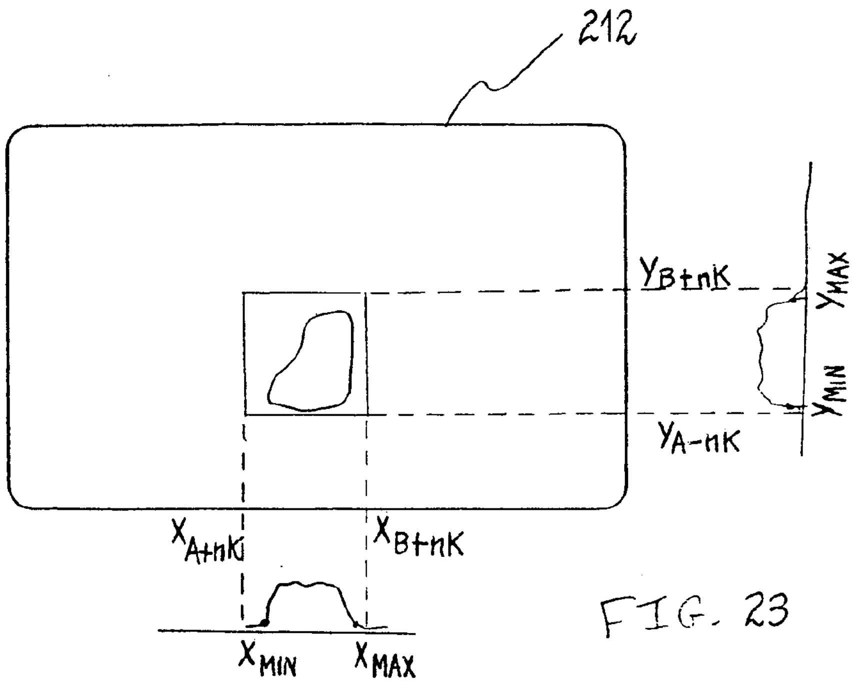

FIG. 23

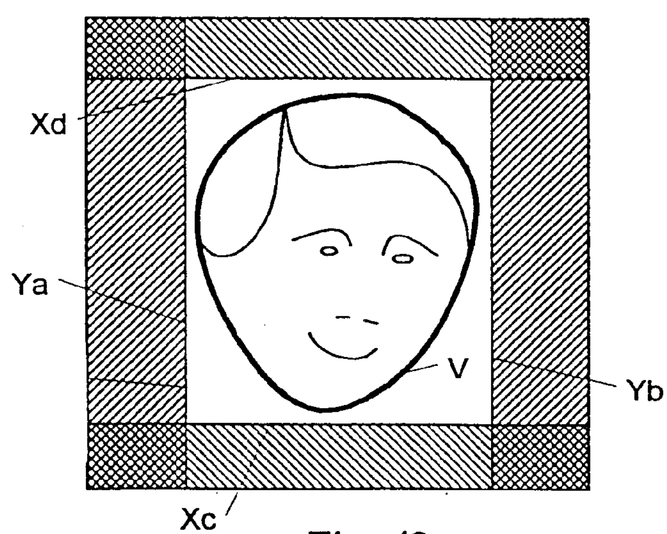

Fig. 18

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 98/05383

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06T7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 05002 A (CARLUS MAGNUS LIMITED) 5 February 1998 see the whole document -----	1-51

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 May 1999	19/05/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Chateau, J-P

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

national Application No
PCT/EP 98/05383

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9805002 A	05-02-1998	FR 2751772 A	30-01-1998
		AU 3775397 A	20-02-1998
		EP 0912964 A	06-05-1999

Form PCT/ISA/210 (patent family annex) (July 1992)

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 9051

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/676,926	02/20/2007 RULE	382	2624	8042-2-1

APPLICANTS

PATRICK PIRIM, Paris, FRANCE;

** CONTINUING DATA *************************

** FOREIGN APPLICATIONS ********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 03/12/2007

	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☐ yes ☐ no 35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance Verified and Acknowledged ____ Examiner's Signature ____ Initials	FRANCE	13	7	2

ADDRESS

86002

TITLE

IMAGE PROCESSING METHOD

FILING FEE RECEIVED		
725	FEES: Authority has been given in Paper No. ________ to charge/credit DEPOSIT ACCOUNT No. ________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________ ☐ Credit

US006486909B1

(12) **United States Patent**
Pirim

(10) **Patent No.:** **US 6,486,909 B1**
(45) **Date of Patent:** **Nov. 26, 2002**

(54) **IMAGE PROCESSING APPARATUS AND METHOD**

(75) Inventor: **Patrick Pirim**, Paris (FR)

(73) Assignee: **Holding B.E.V.**, D'Esch (LU)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/230,502**

(22) PCT Filed: **Jul. 22, 1997**

(86) PCT No.: **PCT/FR97/01354**

§ 371 (c)(1),
(2), (4) Date: **Sep. 13, 1999**

(87) PCT Pub. No.: **WO98/05002**

PCT Pub. Date: **Feb. 5, 1998**

(30) **Foreign Application Priority Data**

Jul. 26, 1996 (FR) 96 09420

(51) **Int. Cl.**⁷ **G06K 9/00**
(52) **U.S. Cl.** **348/143**; 382/262
(58) **Field of Search** 348/143; 382/262, 382/107, 236

(56) **References Cited**

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FR	2 751 772 A1	1/1998
WO	WO 98/05002	2/1998
WO	WO 00/11610	3/2000

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Stephane G. Mallat, "A Theory for Multiresolution Signal Decomposition: The Wavelet Representation", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 11, No. 7, Jul. 1989, pp. 674–693.

John G. Daugman, "Complete Discrete 2–D Gabor Transforms by Neural Networks for Image Analysis and Compression", IEEE Transaction on Acoustics, Speech and Signal Processing, vol. 36, No. 7, Jul. 1988, pp. 1169–1179.

Giacomo Indiveri et al., "System Implementations of Analog VLSI Velocity Sensors", 1996 IEEE Proceedings of MicroNeuro '96, pp. 15–22.

(List continued on next page.)

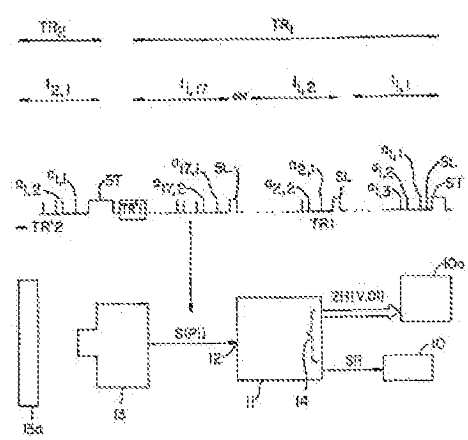
Primary Examiner—Chris Kelley
Assistant Examiner—George A Bugg
(74) *Attorney, Agent, or Firm*—Townsend and Townsend and Crew LLP

(57) **ABSTRACT**

The purpose of this invention is a process and a device operating in real time for identifying and localizing an area in relative movement in a scene and determining the speed and oriented direction of this relative movement in real time.

The process carries out temporal processing of the digital video input signal S(PI) that consists in deducing, from the variations between the value of each pixel in a frame and in the immediately preceding frame, a binary signal DP identifying whether or not there was a significant variation and a digital signal CO representing the magnitude of this variation, and a spatial processing consisting in distributing in a matrix these two signals successively for a single frame that is scanned through the matrix, and deducing the required relative movement and its parameters from this matrix distribution. The device achieves this by including a temporal processing unit **15** associated with a memory **16** and a spatial processing unit **17** associated with a delay unit **18**; the clock unit **20** and the control unit **19** control the rate of operation of units **15** and **17**.

36 Claims, 10 Drawing Sheets



PTO/SB/44 (09-07)
Approved for use through 08/31/2010. OMB 0651-0033
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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,650,015 B2

APPLICATION NO.: 11/676,926

ISSUE DATE : January 19, 2010

INVENTOR(S) : Patrick Pirim

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

To the first page of the patent, below the Prior Publication Data section, please add the following sections:--

Related U.S. Application Data

(63) Divisional of application No. 09/792,294, filed on Feb. 23, 2001, now Pat. No. 7,181,047, which is a continuation-in-part of application No. 09/230,502, filed on Sept. 13, 1999, now Pat. No. 6,486,909, which is a national stage of PCT/FR97/01354, filed on Jul. 22, 1997.

(30) Foreign Application Priority Data

Jul. 26, 1996 (FR) .... 96 09420--.

Column 1, in the Cross-Reference to Related Applications Section, please replace the entire first paragraph (lines 6-12) with the following:--

The present application claims the priority as a divisional of U.S. Application Ser. No. 09/792,294, filed Feb. 23, 2001, now U.S. Pat. No. 7,181,047, which claims priority as a continuation-in-part to U.S. Application Ser. No. 09/230,502, filed Jan. 26, 1999, now U.S. Pat. No. 6,486,909, which is a national stage of International Application No. PCT/FR97/01354, filed Jul. 22, 1997; U.S. Application Ser. No. 09/792,294 also claims priority as a continuation-in-part to International Application No. PCT/EP98/05383, filed Aug. 25, 1998; all of which are incorporated herein by reference in their entirety. --

Column 26, lines 42-43, please begin "on a frame-by-frame basis:" on a new line; lines 44-57, please further indent each paragraph; line 49, please delete the comma in "input signal, in" to read --input signal in--; line 67, please replace "and calculate an" with --and calculating an--.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

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525 Okeechobee Boulevard, 15th Floor
West Palm Beach, FL 33401

PTO/SB/44 (09-07)
Approved for use through 08/31/2010. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,650,015 B2

APPLICATION NO.: 11/676,926

ISSUE DATE : January 19, 2010

INVENTOR(S) : Patrick Pirim

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 27, line 19, please change the comma to a semi-colon after "target," to read --target;--; line 20, please change the comma to a semi-colon after "histogram," to read --histogram;--; line 20, please change the comma to a semi-colon after "target," to read --target;--.

Column 28, lines 19-20, please replace "and calculate an" with --and calculating an--.

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/676,926	01/19/2010	7650015	8042-2-1	9051

86002 7590 12/30/2009

J. Rodman Steele
Novak Druce & Quigg LLP
525 Okeechobee Blvd
Suite 1500
West Palm Beach, FL 33401

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 134 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

PATRICK PIRIM, Paris, FRANCE;

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 9051

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/676,926	02/20/2007 RULE	382	2624	8042-2-1

APPLICANTS
PATRICK PIRIM, Paris, FRANCE;

** **CONTINUING DATA** *************************

** **FOREIGN APPLICATIONS** ********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 03/12/2007

Foreign Priority claimed ☐ yes ☐ no 35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance Verified and Acknowledged ______ Examiner's Signature Initials	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
	FRANCE	13	7	2

ADDRESS
86002

TITLE
IMAGE PROCESSING METHOD

FILING FEE RECEIVED	FEES	
725	FEES: Authority has been given in Paper No. _________ to charge/credit DEPOSIT ACCOUNT No. _________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ____________ ☐ Credit

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

30448 7590 11/12/2009

AKERMAN SENTERFITT
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WEST PALM BEACH, FL 33402-3188

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/676,926	02/20/2007	PATRICK PIRIM	8042-2-1	9051

TITLE OF INVENTION: IMAGE PROCESSING METHOD

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	02/12/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
SETH, MANAV	2624	382-103000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   ☒ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 Novak Druce+Quigg
   2 J.Rodman Steele,Jr.
   3 Gregory M.Lefkowitz

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Image Processing Technologies. LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Suffern, New York

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies ______

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☒ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 14-1437 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☒ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature [signature]

Date December 4, 2009

Typed or printed name Gregory M. Lefkowitz

Registration No. 56,216

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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PTO/SB/122 (09-04)
Approved for use through 07/31/2006. OMB 0651-0035
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Application

Address to:
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Application Number	11/676,926
Filing Date	February 20, 2007
First Named Inventor	PIRIM, Patrick
Art Unit	2624
Examiner Name	SETH, Manav
Attorney Docket Number	8042-2-1

Please change the Correspondence Address for the above-identified patent application to:

☑ The address associated with Customer Number: 86002

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I am the:

☐ Applicant/Inventor

☐ Assignee of record of the entire interest.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

☑ Attorney or agent of record. Registration Number 56,216.

☐ Registered practitioner named in the application transmittal letter in an application without an executed oath or declaration. See 37 CFR 1.33(a)(1). Registration Number______________.

Signature [signature]

Typed or Printed Name: Gregory M. Lefkowitz

Date: December 4, 2009 | Telephone: 561.847-7800

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of ___________forms are submitted.

This collection of information is required by 37 CFR 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal

Application Number:	11676926
Filing Date:	20-Feb-2007
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Filer:	Gregory Marc Lefkowitz/Gail Ochocki
Attorney Docket Number:	8042-2-1

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	2501	1	755	755
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1055**

Electronic Acknowledgement Receipt

EFS ID:	6575923
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	30448
Filer:	Gregory Marc Lefkowitz/Gail Ochocki
Filer Authorized By:	Gregory Marc Lefkowitz
Attorney Docket Number:	8042-2-1
Receipt Date:	04-DEC-2009
Filing Date:	20-FEB-2007
Time Stamp:	15:01:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1055
RAM confirmation Number	1411
Deposit Account	141437
Authorized User	LEFKOWITZ,GREGORY

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Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		8042-2-1_cute.pdf	457230 4862211ba831419bb0db65d0312fa15877edacb2	yes	2

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Issue Fee Payment (PTO-85B)	1	1
Change of Address	2	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (PTO-875)	fee-info.pdf	32016 4eea3329da2a0247db13bdd801a42112de452e35	no	2

Warnings:

Information:

Total Files Size (in bytes): 489246

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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Bib Data Sheet

CONFIRMATION NO. 9051

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/676,926	02/20/2007 RULE	382	2624	8042-2-1

APPLICANTS
PATRICK PIRIM, Paris, FRANCE;

** **CONTINUING DATA** *************************

** **FOREIGN APPLICATIONS** ********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 03/12/2007

cwc 12/1/9

Foreign Priority claimed / 35 USC 119 (a-d) conditions met / Verified and Acknowledged	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☒ yes ☐ no 35 USC 119 (a-d) conditions met ☐ yes ☒ no ☐ Met after Allowance Verified and Acknowledged ______ Examiner's Signature ______ Initials	FRANCE	13	7	2

ADDRESS
30448

TITLE
IMAGE PROCESSING METHOD

FILING FEE RECEIVED		
425	FEES: Authority has been given in Paper No. ________ to charge/credit DEPOSIT ACCOUNT No. ________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________ ☐ Credit

Please enter the above amendment after final. MAS 10/30/2009

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Patrick PIRIM *et al.***

Application No.: **11/676,926** Examiner: **Seth MANAV**

Filed: **February 20, 2007** Group Art Unit: **2624**

Attorney Docket No.: **8042-2-3** Confirmation No.: **9083**

For: **IMAGE PROCESSING METHOD**

AMENDMENT B

Mail Stop AF
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

These amendments and remarks are being filed in response to the final Office Action mailed May 28, 2009. This Response is accompanied by a credit card authorization for the Commissioner to charge the $245 small entity fee for a retroactive two-month extension of time. Although no additional fees are believed due, the Commissioner is hereby authorized to charge any deficiency or credit any surplus to Deposit Account No. 14-1437. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of the claims, which begins at page 2 of this paper.

Remarks/Arguments begin at page 6 of this paper.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11676926	PIRIM, PATRICK
	Examiner	**Art Unit**
	MANAV SETH	2624

SEARCHED

Class	Subclass	Date	Examiner
382	100,103,107,128-132,168-180,199-206,224,291	11/10/2008	ms
Above	updated	10/30/2009	ms

SEARCH NOTES

Search Notes	Date	Examiner
East Search	11/10/2008	ms
IDS Search	11/10/2008	ms
Inventor Search	11/10/2008	ms
IEEE Search	11/10/2008	ms
STIC PLUS Search	11/10/2008	ms
Inventor Search updated	10/30/2009	ms
East search updated	10/30/2009	ms
Interference Search	10/30/2009	ms

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
	PGPUB Text Search	10/30/2009	ms

Index of Claims	Application/Control No. 11676926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK
	Examiner MANAV SETH	Art Unit 2624

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/10/2008	05/24/2009	10/30/2009						
	1	-	-	-						
	2	-	-	-						
	3	-	-	-						
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	34	-	-	-						
	35	-	-	-						
	36	-	-	-						

Index of Claims	Application/Control No. 11676926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK
	Examiner MANAV SETH	Art Unit 2624

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE									
Final	Original	11/10/2008	05/24/2009	10/30/2009							
	37	-	-	-							
	38	-	-	-							
	39	-	-	-							
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	49	-	-	-							
	50	-	-	-							
1	51	✓	=	=							
2	52	✓	=	=							
3	53	✓	=	=							
	54	✓	✓	-							
	55	✓	✓	-							
6	56	✓	O	=							
7	57	✓	O	=							
4	58		=	=							
5	59		=	=							
	60		✓	-							
	61		✓	-							

Issue Classification

Application/Control No.	Applicant(s)/Patent Under Reexamination
11676926	PIRIM, PATRICK
Examiner	**Art Unit**
MANAV SETH	2624

ORIGINAL		INTERNATIONAL CLASSIFICATION					
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED
382	103	G	0	6	K	9 / 00 (2006.01.01)	

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
382	128	168			

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	51														
2	52														
3	53														
	54														
	55														
6	56														
7	57														
4	58														
5	59														
	60														
	61														

(Assistant Examiner)	(Date)	**Total Claims Allowed:** 7	
/MANAV SETH/ Primary Examiner.Art Unit 2624 (Primary Examiner)	11/01/2009 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 15

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NOTICE OF ALLOWANCE AND FEE(S) DUE

30448 7590 11/12/2009

AKERMAN SENTERFITT
P.O. BOX 3188
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EXAMINER	
SETH, MANAV	
ART UNIT	PAPER NUMBER
2624	

DATE MAILED: 11/12/2009

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/676,926	02/20/2007	PATRICK PIRIM	8042-2-1	9051

TITLE OF INVENTION: IMAGE PROCESSING METHOD

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	02/12/2010

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

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B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

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III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

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Alexandria, Virginia 22313-1450
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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

30448 7590 11/12/2009

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P.O. BOX 3188
WEST PALM BEACH, FL 33402-3188

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Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/676,926	02/20/2007	PATRICK PIRIM	8042-2-1	9051

TITLE OF INVENTION: IMAGE PROCESSING METHOD

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	02/12/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
SETH, MANAV	2624	382-103000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 ____________________
   2 ____________________
   3 ____________________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number ________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature ____________________ Date ____________________

Typed or printed name ____________________ Registration No. ____________________

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/676,926	02/20/2007	PATRICK PIRIM	8042-2-1	9051

30448 7590 11/12/2009

AKERMAN SENTERFITT
P.O. BOX 3188
WEST PALM BEACH, FL 33402-3188

EXAMINER	
SETH, MANAV	
ART UNIT	PAPER NUMBER
2624	

DATE MAILED: 11/12/2009

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 134 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 134 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

Notice of Allowability	Application No. 11/676,926	Applicant(s) PIRIM, PATRICK	
	Examiner MANAV SETH	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to _10/23/2009_.
2. ☒ The allowed claim(s) is/are _51-53, 58-59 and 56-57 (renumbered as 1-7)_ .
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

Response to Amendment after Final

1. Applicant's amendment after final filed on October 23, 2009 has been considered and entered in full.

2. Applicant's amendments and arguments with respect to the claims have been considered and are persuasive; therefore all the rejections on the respective claims have been withdrawn.

Allowable Subject Matter

Reasons of Allowance:

3. Claims 51-53, 58-59 and 56-57 (renumbered as 1-7) are allowed.

The following is an examiner's statement of reasons of allowance:

The reasons of allowance for claims 51-53, 58-59 and 56-57 (renumbered as 1-7) should be evident from previous office action mailed on 05/28/2009 and applicant's arguments with respect to the amended claims as filed in the amendment filed on 10/23/2009 in view of the previous office action.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (571) 272-7456. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali, can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Manav Seth/
Primary Examiner, Art Unit 2624
October 31, 2009

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	0	patrick near prim	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:22
S2	46	patrick near pirim	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:22
S3	25145	(track$3 or target$3 or segment$5) near4 (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:48
S4	32247	(track$3 or target$3 or segment$5) near4 (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:49
S5	9647	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:49
S6	805	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2 and histogram$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:49
S7	1567	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and histogram$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:55
S8	115	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 near histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 20:18

S9	312	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 near4 histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 20:19
S10	816	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 same histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 20:19
S11	104330	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (segment$ or track$3) and (region$2 or area$3 or homogen$6 or similar) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:11
S12	21439	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:14
S13	5373	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:15
S14	2293	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:15
S15	2293	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:16

S16	779	(image$2 or picture$2 or frame$2 or video$2) same ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:17
S17	167	(image$2 or picture$2 or frame$2 or video$2) same ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5)) and (pixel$2 same histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:18
S18	0	382/100,103,107,128-132,168-180,199-206, 224, "291".ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 22:54
S19	21662	382/100,103,107,128-132,168-180,199-206, 224,291.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 22:54
S20	2293	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 22:55
S21	254	S19 and S20	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 22:55

S22	192	("7181047" "20020071595" "20070140526" "6196662" "5008657" "5255331" "5537615" "6147671" "6173089" "6339417" "5003618" "5267065" "5815130" "5815131" "6384831" "6587111" "20020033827" "5838292" "6486909" "7190725" "20030067978" "6291148" "6468709" "6173084" "4882629" "4949391" "5195144" "5335019" "5365429" "5416615" "5600143" "5809169" "6191769" "6317700" "20060251335" "5440652" "5790126" "5867173" "6088041" "6175372" "5394523" "5684510" "5796454" "5831627" "6296187" "5625756" "5748164" "5818405" "5177406" "5339092" "5600459" "5608551" "5642129" "5673059" "5870500" "6137589" "6204834" "4270127" "4322716" "4395699" "4398256" "4414685" "4783649" "4798448" "4839722" "4860375" "4862510" "4891750" "4901365" "4956801" "4958223" "5177501" "5177704" "5191640" "5220616" "5278542" "5299041" "5302966" "5319724" "5325108" "5371519" "5398123" "5404150" "5459818" "5461503" "5469198" "5481301" "5500748" "5502792" "5523864" "5530457" "5555001" "5559930" "5572236" "5574832" "5594812" "5600369" "5600344" "5644328" "5644340").pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/07 12:15
S23	9821	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3)) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segment$)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 14:58
S24	472	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3)) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 14:59
S25	21662	382/100,103,107,128-132,168-180,199-206, 224,291.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:00

EAST Search History (Prior Art)

S26	124	S24 and S25	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:00
S27	5829	382/100,103,107.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:25
S28	12994	(pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:26
S29	493	S27 and S28	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:26
S30	5805	(pel$2 or pixel$2 or (picture near element$2)) same histogram$3 and frame$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:26
S31	331	S27 and S30	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:27
S32	16	("5031049" | "5187585" | "5412487" | "5422828" | "5434617" | "5473369" | "5546125" | "5552823" | "5610653" | "5631697" | "5696503" | "5714999" | "5745126" | "5798787" | "5912994" | "5982909").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:08
S33	7	("5109425" | "5587927" | "5600731" | "5633728" | "5657402" | "5777690" | "6008865").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:19

S34	27	("4644582" | "4821029" | "4851616" | "4984072" | "5048103" | "5067015" | "5105186" | "5280610" | "5376947" | "5440744" | "5551027" | "5581758" | "5630017" | "5640558" | "5652880" | "5652882" | "5657426" | "5864630" | "5930379" | "5969766" | "5974192" | "5986671" | "5999651" | "6072889" | "6130960" | "6141434" | "6184926").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:23
S35	5	("4959714" | "5218414" | "5243418" | "5267329" | "5606376").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:29
S36	4	("4803735" | "4906940" | "5159667" | "5271067").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:36
S37	9	("5280530" | "5473369" | "5592228" | "5625715" | "5684715" | "5732155" | "5969764" | "5969772" | "5974183").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:41
S38	5	("5164992" | "5909249" | "6148092" | "6292575" | "6493041").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:44
S39	56	"4783828"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 09:42
S40	9	"5774581"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 09:50
S41	2	("4847786" | "5239596").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 09:54
S42	17	("4847786").URPN.	USPAT	OR	OFF	2008/11/09 10:53
S43	1031	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3 or plane$2 or helicopt$3) same (track$3)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 11:00
S44	372	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3 or plane$2 or helicopt$3) near (track$3)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 11:00

S45	4	("5280530" | "5323470" | "5430809" | "5473369").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 11:29
S46	69	("5430809").URPN.	USPAT	OR	OFF	2008/11/09 11:38
S47	17	("4975960" | "5103484" | "5130789" | "5130935" | "5164992" | "5187574" | "5280530" | "5412738" | "5430809" | "5450504" | "5497430" | "5557688" | "5629752" | "5642431" | "5680481" | "5719951" | "5781650").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 11:45
S48	20	("3769598" | "3772465" | "4642682" | "4694329" | "4755870" | "4782384" | "4823184" | "4984072" | "5093717" | "5260787" | "5430809" | "5459517" | "5565998" | "5731846" | "5767922" | "5874988" | "5912980" | "5930445" | "6049363" | "6055025").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 12:04
S49	11	("3947833" | "4047205" | "4393394" | "4989164" | "5034811" | "5065251" | "5563652" | "5613032" | "5638116" | "5732146" | "5808664").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 12:07
S50	27	("4644582" | "4821029" | "4851616" | "4984072" | "5048103" | "5067015" | "5105186" | "5280610" | "5376947" | "5440744" | "5551027" | "5581758" | "5630017" | "5640558" | "5652880" | "5652882" | "5657426" | "5864630" | "5930379" | "5969766" | "5974192" | "5986671" | "5999651" | "6072889" | "6130960" | "6141434" | "6184926").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 12:23
S51	0	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3)) near ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segmenting or segmentation$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:37
S52	4	(track$3) near ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segmenting or segmentation$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:38
S53	12	("3394246" | "3564509" | "3569938" | "3686637" | "3696335" | "3771135" | "3810105" | "3909798" | "3938097" | "4008460").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 22:39

S54	8	(track$3) near ((box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:40
S55	2611	(track$3) near (box$2 or square$2 or rectang$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:40
S56	780	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:41
S57	149	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:41
S58	105	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:45
S59	9	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same optical same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:08
S60	9	(track$3) near (box$2 or square$2 or rectang$5) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same optical same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:10
S61	11	(track$3) near (box$2 or square$2 or rectang$5) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:11

S62	57	(track$3) near (box$2 or square$2 or rectang$5) and (track$3) and center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:13
S63	10	(track$3) near (box$2 or square$2 or rectang$5) same center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:21
S64	27	(track$3) near (box$2 or square$2 or rectang$5) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:22
S65	210	(track$3 or bound$3) near (box$2 or square$2 or rectang$5) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:31
S66	333	(track$3 or bound$3) near (box$2 or square$2 or rectang$5 or fram$3) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/10 00:09
S67	0	patrick near prim	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S68	46	patrick near pirim	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S69	28173	(track$3 or target$3 or segment$5) near4 (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43

S70	36099	(track$3 or target$3 or segment$5) near4 (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S71	10732	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S72	934	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2 and histogram$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S73	1830	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and histogram$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S74	142	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 near histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S75	374	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 near4 histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S76	975	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 same histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S77	114485	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (segment$ or track$3) and (region$2 or area$3 or homogen$6 or similar) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43

S78	23870	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S79	6156	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S80	2661	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S81	2661	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S82	905	(image$2 or picture$2 or frame$2 or video$2) same ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S83	189	(image$2 or picture$2 or frame$2 or video$2) same ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5)) and (pixel$2 same histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S84	0	382/100,103,107,128-132,168-180,199-206, 224, "291".ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43

S85	25056	382/100,103,107,128-132,168-180,199-206, 224,291.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S86	2661	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S87	303	S85 and S86	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S88	194	("7181047" "20020071595" "20070140526" "6196662" "5008657" "5255331" "5537615" "6147671" "6173089" "6339417" "5003618" "5267065" "5815130" "5815131" "6384831" "6587111" "20020033827" "5838292" "6486909" "7190725" "20030067978" "6291148" "6468709" "6173084" "4882629" "4949391" "5195144" "5335019" "5365429" "5416615" "5600143" "5809169" "6191769" "6317700" "20060251335" "5440652" "5790126" "5867173" "6088041" "6175372" "5394523" "5684510" "5796454" "5831627" "6296187" "5625756" "5748164" "5818405" "5177406" "5339092" "5600459" "5608551" "5642129" "5673059" "5870500" "6137589" "6204834" "4270127" "4322716" "4395699" "4398256" "4414685" "4783649" "4798448" "4839722" "4860375" "4862510" "4891750" "4901365" "4956801" "4958223" "5177501" "5177704" "5191640" "5220616" "5278542" "5299041" "5302966" "5319724" "5325108" "5371519" "5398123" "5404150" "5459818" "5461503" "5469198" "5481301" "5500748" "5502792" "5523864" "5530457" "5555001" "5559930" "5572236" "5574832" "5594812" "5600369" "5600344" "5644328" "5644340").pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S89	11048	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3)) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segment$)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43

EAST Search History (Prior Art)

S90	561	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3)) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S91	25056	382/100,103,107,128-132,168-180,199-206, 224,291.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S92	147	S90 and S91	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S93	7071	382/100,103,107.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S94	14782	(pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S95	604	S93 and S94	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S96	6743	(pel$2 or pixel$2 or (picture near element$2)) same histogram$3 and frame$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S97	416	S93 and S96	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43

EAST Search History (Prior Art)

S98	16	("5031049" | "5187585" | "5412487" | "5422828" | "5434617" | "5473369" | "5546125" | "5552823" | "5610653" | "5631697" | "5696503" | "5714999" | "5745126" | "5798787" | "5912994" | "5982909").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S99	7	("5109425" | "5587927" | "5600731" | "5633728" | "5657402" | "5777690" | "6008865").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S100	27	("4644582" | "4821029" | "4851616" | "4984072" | "5048103" | "5067015" | "5105186" | "5280610" | "5376947" | "5440744" | "5551027" | "5581758" | "5630017" | "5640558" | "5652880" | "5652882" | "5657426" | "5864630" | "5930379" | "5969766" | "5974192" | "5986671" | "5999651" | "6072889" | "6130960" | "6141434" | "6184926").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S101	5	("4959714" | "5218414" | "5243418" | "5267329" | "5606376").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S102	4	("4803735" | "4906940" | "5159667" | "5271067").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S103	9	("5280530" | "5473369" | "5592228" | "5625715" | "5684715" | "5732155" | "5969764" | "5969772" | "5974183").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S104	5	("5164992" | "5909249" | "6148092" | "6292575" | "6493041").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S105	56	"4783828"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S106	9	"5774581"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S107	2	("4847786" | "5239596").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S108	17	("4847786").URPN.	USPAT	OR	OFF	2009/10/29 23:43

S109	1218	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3 or plane$2 or helicopt$3) same (track$3)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S110	433	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3 or plane$2 or helicopt$3) near (track$3)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S111	4	("5280530" | "5323470" | "5430809" | "5473369").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S112	74	("5430809").URPN.	USPAT	OR	OFF	2009/10/29 23:43
S113	17	("4975960" | "5103484" | "5130789" | "5130935" | "5164992" | "5187574" | "5280530" | "5412738" | "5430809" | "5450504" | "5497430" | "5557688" | "5629752" | "5642431" | "5680481" | "5719951" | "5781650").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S114	20	("3769598" | "3772465" | "4642682" | "4694329" | "4755870" | "4782384" | "4823184" | "4984072" | "5093717" | "5260787" | "5430809" | "5459517" | "5565998" | "5731846" | "5767922" | "5874988" | "5912980" | "5930445" | "6049363" | "6055025").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S115	11	("3947833" | "4047205" | "4393394" | "4989164" | "5034811" | "5065251" | "5563652" | "5613032" | "5638116" | "5732146" | "5808664").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S116	27	("4644582" | "4821029" | "4851616" | "4984072" | "5048103" | "5067015" | "5105186" | "5280610" | "5376947" | "5440744" | "5551027" | "5581758" | "5630017" | "5640558" | "5652880" | "5652882" | "5657426" | "5864630" | "5930379" | "5969766" | "5974192" | "5986671" | "5999651" | "6072889" | "6130960" | "6141434" | "6184926").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43

S117	0	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3)) near ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segmenting or segmentation$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S118	4	(track$3) near ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segmenting or segmentation$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S119	12	("3394246" | "3564509" | "3569938" | "3686637" | "3696335" | "3771135" | "3810105" | "3909798" | "3938097" | "4008460").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/10/29 23:43
S120	8	(track$3) near ((box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S121	2794	(track$3) near (box$2 or square$2 or rectang$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S122	841	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S123	166	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S124	118	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43

S125	9	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same optical same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S126	9	(track$3) near (box$2 or square$2 or rectang$5) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same optical same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S127	11	(track$3) near (box$2 or square$2 or rectang$5) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S128	63	(track$3) near (box$2 or square$2 or rectang$5) and (track$3) and center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S129	10	(track$3) near (box$2 or square$2 or rectang$5) same center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S130	27	(track$3) near (box$2 or square$2 or rectang$5) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S131	238	(track$3 or bound$3) near (box$2 or square$2 or rectang$5) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43
S132	371	(track$3 or bound$3) near (box$2 or square$2 or rectang$5 or fram$3) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/10/29 23:43

EAST Search History (Interference)

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S133	2179	(track$3 and target and histogram$2 and pixel$2 and box$2 and domain$2)".clm"	US-PGPUB; USPAT; UPAD	OR	OFF	2009/10/30 15:04
S134	2	(track$3 and target and histogram$2 and pixel$2 and box$2 and domain$2).clm.	US-PGPUB; USPAT; UPAD	OR	OFF	2009/10/30 15:05

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of **Patrick PIRIM** ***et al.***

Application No.: **11/676,926** Examiner: **Seth MANAV**

Filed: **February 20, 2007** Group Art Unit: **2624**

Attorney Docket No.: **8042-2-1** Confirmation No.: **9051**

For: **IMAGE PROCESSING METHOD**

AMENDMENT B

Mail Stop AF
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

These amendments and remarks are being filed in response to the final Office Action mailed May 28, 2009. This Response is accompanied by a credit card authorization for the Commissioner to charge the $245 small entity fee for a retroactive two-month extension of time. Although no additional fees are believed due, the Commissioner is hereby authorized to charge any deficiency or credit any surplus to Deposit Account No. 14-1437. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of the claims, which begins at page 2 of this paper.

Remarks/Arguments begin at page 6 of this paper.

AMENDMENTS TO THE CLAIMS

This listing of the claims will replace all prior versions, and listings, of claims in the application:

We claim:

1.-50. (Cancelled)

51. (Previously presented) A process for tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising:

selecting a pixel of the target as a starting pixel; on a frame-by-frame basis:

forming a tracking box around the starting pixel and for each pixel of the input signal in the tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

successively increasing the size of the tracking box and for each pixel of the input signal, in each successive tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

determining when the target is substantially within the tracking box;

stopping the size increasing of said tracking box; and adjusting the center of the tracking box based upon the histograms.

52. (Previously presented) The process according to claim 51, comprising centering the tracking box relative to an optical axis of the frame.

53. (Previously presented) The process according to claim 51, comprising calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame.

54-55. (Cancelled)

56. (Currently amended) ~~The process according to claim 55,~~ A process of tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising, on a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at

least one histogram referring to classes defining said target, identifying the target from said at least one histogram, drawing a tracking box around the target, and ~~comprising~~ centering the tracking box relative to an optical axis of the frame.

57. (Currently amended) ~~The process according to claim 54,~~ A process of tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising, on a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target, and identifying the target from said at least one histogram, and

~~comprising~~ calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame.

58. (Previously presented) The process according to claim 51, wherein said image processing system comprises at least one component selected from a memory, a temporal processing unit, and a spatial processing unit.

59. (Previously presented) The process according to claim 51, wherein said image processing system comprises at least two components selected from a memory, a temporal processing unit, and a spatial processing unit.

60-61. (Cancelled)

REMARKS

These amendments and remarks are being filed in response to the final Office Action mailed May 28, 2009 (the "Office Action"). This Response is accompanied by a credit card authorization for the Commissioner to charge the $245 small entity fee for a retroactive two-month extension of time. Although no additional fees are believed due, the Commissioner is hereby authorized to charge any deficiency or credit any surplus to Deposit Account No. 14-1437.

At the time of the Office Action, claims 51-61 were pending. In the Office Action, claims 51-53, 58 and 59 were allowed; claims 56-57 were objected to, and claims 54, 55, 60 and 61 were rejected. By this Amendment, claims 54, 55, 60 and 61 are cancelled and claims 56 and 57 are amended to overcome the objections be incorporating the subject matter of the claim(s) on which they previously depended. No new matter is added.

The amendments presented herein have been made solely to expedite prosecution of the instant application to allowance and should not be construed as an indication of Applicant's agreement with or acquiescence to the Examiner's position. Accordingly, Applicants expressly maintain the right to pursue broader subject matter through subsequent amendments, continuation or divisional applications, reexamination or reissue proceedings, and all other available means. The rejections and responses thereto are set forth fully below.

Claim Rejections – 35 U.S.C. § 102

In the Office Action, claims 54-55 and 60-61 are rejected under 35 U.S.C. 102(e) as being unpatentable over U.S. Patent No. 5,912,980 issued to Hunke (hereinafter "Hunke"). Claims 54-55 and 60-61 have been cancelled rending the rejection moot.

Conclusion

For at least the reasons set forth above, the independent claims are believed to be allowable. In addition, the dependent claims are believed to be allowable due to their dependence on an allowable base claim and for further features recited therein. The application is believed to be in condition for immediate allowance. If any issues remain outstanding, Applicant invites the Examiner to call the undersigned (direct line: 561-838-5229 x228) if it is believed that a telephone interview would expedite the prosecution of the application to an allowance.

Respectfully submitted,

NOVAK DRUCE + QUIGG LLP

Date: **October 23, 2009**

Gregory A. Nelson, Reg. No. 30,577
Gregory M. Lefkowitz, Reg. No. 56,216
CityPlace Tower
525 Okeechobee Blvd, Fifteenth Floor
West Palm Beach, FL 33401
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Telefax: 561-838-5578

Electronic Patent Application Fee Transmittal

Application Number:	11676926
Filing Date:	20-Feb-2007
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Filer:	Gregory Marc Lefkowitz/Gail Ochocki
Attorney Docket Number:	8042-2-1

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 2 months with $0 paid	2252	1	245	245

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**245**

Electronic Acknowledgement Receipt

EFS ID:	6321773
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	30448
Filer:	Gregory Marc Lefkowitz/Gail Ochocki
Filer Authorized By:	Gregory Marc Lefkowitz
Attorney Docket Number:	8042-2-1
Receipt Date:	23-OCT-2009
Filing Date:	20-FEB-2007
Time Stamp:	15:50:34
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$245
RAM confirmation Number	2174
Deposit Account	141437
Authorized User	LEFKOWITZ,GREGORY

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		8042-2-1_cute.pdf	865798 f5e23508ffe9455a0269f0a99bfd0f72a40bf4e0	yes	8

Multipart Description/PDF files in .zip description

Document Description	Start	End
Extension of Time	1	1
Amendment After Final	2	2
Claims	3	6
Applicant Arguments/Remarks Made in an Amendment	7	8

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (PTO-875)	fee-info.pdf	30471 eaf0975c72a7ea7e42d15c1885809821b57404c6	no	2

Warnings:

Information:

Total Files Size (in bytes):	896269

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) **FY 2009** ***(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)***	Docket Number (Optional) 8042-2-1
Application Number 11/676,926	Filed February 20, 2007
For IMAGE PROCESSING METHOD	
Art Unit 2624	Examiner Seth MANAV

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$130	$65	$
☑ Two months (37 CFR 1.17(a)(2))	$490	$245	$ 245.00
☐ Three months (37 CFR 1.17(a)(3))	$1110	$555	$
☐ Four months (37 CFR 1.17(a)(4))	$1730	$865	$
☐ Five months (37 CFR 1.17(a)(5))	$2350	$1175	$

☑ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

☑ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 14-1437.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the ☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☐ attorney or agent of record. Registration Number ____________

☑ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 56,216

/Gregory M. Lefkowitz/	October 23, 2009
Signature	Date
GREGORY M. LEFKOWITZ	561 838-5229
Typed or printed name	Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ____________ forms are submitted.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 11/676,926	Filing Date 02/20/2007	☐ To be Mailed

APPLICATION AS FILED – PART I

(Column 1) (Column 2) SMALL ENTITY ☒ OR OTHER THAN SMALL ENTITY

FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

(Column 1) (Column 2) (Column 3) SMALL ENTITY OR OTHER THAN SMALL ENTITY

AMENDMENT 10/23/2009	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 7	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

(Column 1) (Column 2) (Column 3)

AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/DEBRA a. SAVOY/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/676,926	02/20/2007	PATRICK PIRIM	8042-2-1	9051

30448 7590 05/28/2009
AKERMAN SENTERFITT
P.O. BOX 3188
WEST PALM BEACH, FL 33402-3188

EXAMINER	
SETH, MANAV	

ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
05/28/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	11/676,926	PIRIM, PATRICK	
	Examiner	**Art Unit**	
	MANAV SETH	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 March 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *51-61* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *51-53,58 and 59* is/are allowed.

6)☒ Claim(s) *54,55,60 and 61* is/are rejected.

7)☒ Claim(s) *56 and 57* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendment received on March 10, 2009 has been entered in full.

2. Applicant's amendment to the claims has been entered and based on the amendments claim rejections under 35 USC 101 and 35 USC 112 on the respective claims have been withdrawn.

3. Applicant's arguments with respect to rejected claims 54-55 as presented in the amendment filed have been fully considered but are not persuasive.

Response to Arguments

4. Applicant's arguments regarding the prior art rejections under Hunke on pages 7-9 of the amendment filed on March 10, 2009 have been fully considered but are not persuasive. Applicant argues in substance "Hunke fails to disclose each and every limitation of the subject matter of claims 54 and 55". Examiner respectfully disagrees. In the rejection presented before in the previous action and the rejection presented here in this action, all the limitations of the respective claims were and are properly addressed with proper citations in the prior art reference (Hunke). Clearly, applicant has failed to provide the difference between the instant invention and the prior art Hunke and therefore, the respective claims still stand rejected under Hunke.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claims 54-55 and 60-61 are rejected under 35 U.S.C. 102(e) as being anticipated by Hunke, U.S. Patent No. 5,912,980.

Regarding claim 54, Hunke discloses a process of tracking a target in an input signal implemented using a system comprising an image processing system (col. 4, lines 14-42; col. 5, lines 1-35 – any system that performs operations on the images is an image processing system), the input signal comprising a succession of frames, (Abstract, last few lines – "the method allows tracking of target objects in subsequent frames of the video image stream based upon the colors in the target objects; col. 5, lines 1-13), Hunke further discloses "each frame comprising a succession of pixels (col. 8, lines 1-3 – images obtained from the video camera are represented as a **pixel matrix** RGB values where pixel matrix represents succession of pixels), Hunke further discloses "the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains" (col. 8, lines 17-20 – the domain being the color domain as the image frame pixels are classified into the target color pixels and non-target color pixels, and target pixels further comprise a target class having a specific color, where target classes, for example, being human faces with different skin colors (col. 9, lines 50-65); the other domain being the time domain since the tracking is being done at different times (col. 10, lines 42-60)), the process comprising, on-a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target, and identifying the target from said at least one histogram (col. 10, lines 45-51 – the normalized color distribution (histogram) of the image of the tracked target is computed in each image frame during tracking the target, where the histogram refers to the classes defining (as discussed before) said target (col. 10, lines 25-55), thus identifying the target in each frame using histogram).

Regarding claim 55, Hunke discloses drawing a tracking box around the target (col. 5, lines 25-35 – rectangular box around the target).

Regarding claims 60 and 61, claims 60 and 61 recites “wherein said image processing system comprises components selected from a memory, a temporal processing unit, and a spatial processing unit". As discussed in the rejection of claim 54, Hunke discloses a digital system which tracks the object in multiple digital frames of a video, and memory, a temporal processing unit and a spatial processing unit are inherent components of a digital system that performs operations on the video, where video has a time component in it. (see Hunke – col. 5, lines 1-35; col. 10, lines 42-67).

7. Claim 51-53 and 58-59 would be allowable for the following reason: The instant invention and the closest prior art (Hunke, U.S. Patent No. 5,912,980) as discussed above, are directed to tracking the object in a sequence of frames where in the frame the object or target is bound in a tracking box. The instant invention further recites the limitation such as "successively increasing the size of the tracking box and for each pixel of the input signal, in each successive tracking box

forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains" in claim 51, which is not taught by the closest prior art of record. Claims 52-53 would be allowable for at least by dependency on the claim 51.

8. Claims 56-57 are objected to as being dependent upon a rejected base claim, but would be allowable, if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The reasons of allowance would be: The closest prior art of record (Hunke) does not teach centering the tracking box relative to the optical axis of the frame as recited in claim 56 and further does not teach "calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame" as recited in claim 57.

Examiner note: Examiner has cited particular columns and line numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings for the art and are applied to the specific limitations within the individual claim, other passages and figures may be applied as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references entirely as potential teachings all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner.

Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (571) 272-7456. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali, can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Manav Seth/
Examiner, Art Unit 2624
May 24, 2009

/DANIEL G MARIAM/
Primary Examiner, Art Unit 2624

Index of Claims	Application/Control No. 11676926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK
	Examiner MANAV SETH	Art Unit 2624

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/10/2008	05/24/2009							
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
	6	-	-							
	7	-	-							
	8	-	-							
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	31	-	-							
	32	-	-							
	33	-	-							
	34	-	-							
	35	-	-							
	36	-	-							

Index of Claims	Application/Control No. 11676926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK
	Examiner MANAV SETH	Art Unit 2624

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/10/2008	05/24/2009							
	37	-	-							
	38	-	-							
	39	-	-							
	40	-	-							
	41	-	-							
	42	-	-							
	43	-	-							
	44	-	-							
	45	-	-							
	46	-	-							
	47	-	-							
	48	-	-							
	49	-	-							
	50	-	-							
	51	✓	=							
	52	✓	=							
	53	✓	=							
	54	✓	✓							
	55	✓	✓							
	56	✓	O							
	57	✓	O							
	58		=							
	59		=							
	60		✓							
	61		✓							

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of **Patrick PIRIM *et al.***

Application No.: **11/676,926** Examiner: **Seth MANAV**

Filed: **February 20, 2007** Group Art Unit: **2624**

Attorney Docket No.: **8042-2-1** Confirmation No.: **9051**

For: **IMAGE PROCESSING METHOD**

RESPONSE TO NON-FINAL OFFICE ACTION

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

These amendments and remarks are being filed in response to the non-final Office Action mailed November 17, 2009. This Response is accompanied by a credit card authorization form authorizing the Commissioner to charge the $65 small entity fee for a retroactive one-month extension of time. Although no additional fees are believed due, the Commissioner is hereby authorized to charge any deficiency or credit any surplus to Deposit Account No. 14-1437. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of the claims, which begins at page 2 of this paper.

Remarks/Arguments begin at page 6 of this paper.

AMENDMENTS TO THE CLAIMS

This listing of the claims will replace all prior versions, and listings, of claims in the application:

We claim:

1.-50. (Cancelled)

51. (Currently amended) A process for tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising:

selecting a pixel of the target as a starting pixel; on a frame-by-frame basis:

forming a tracking box around the starting pixel and for each pixel of the input signal in the tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

successively increasing the size of the tracking box and for each pixel of the input signal, in each successive tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

determining when the target is substantially within the tracking box;

stopping the size increasing of said tracking box; and adjusting the center of the tracking box based upon the histograms.

52. (Currently amended) The process according to claim 51, comprising centering the tracking box relative to ~~the~~ an optical axis of the frame ~~image~~.

53. (Previously presented) The process according to claim 51, comprising calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame.

54. (Currently amended) A process of tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising, on a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target, and identifying the target from said at least one histogram.

55. (Previously presented) The process according to claim 54 further comprising drawing a tracking box around the target.

56. (Currently amended) The process according to claim 55 ~~54~~, comprising centering the tracking box relative to an optical axis of the frame ~~image~~.

57. (Previously presented) The process according to claim 54, comprising calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame.

58. (New) The process according to claim 51, wherein said image processing system comprises at least one component selected from a memory, a temporal processing unit, and a spatial processing unit.

59. (New) The process according to claim 51, wherein said image processing system comprises at least two components selected from a memory, a temporal processing unit, and a spatial processing unit.

60. (New) The process according to claim 54, wherein said image processing system comprises at least one components selected from a memory, a temporal processing unit, and a spatial processing unit.

61. (New) The process according to claim 54, wherein said image processing system comprises at least two components selected from a memory, a temporal processing unit, and a spatial processing unit.

REMARKS

These amendments and remarks are being filed in response to the non-final Office Action mailed November 11, 2008 (the "Office Action"). At the time of the Office Action, claims 51-57 were pending, with all claims rejected under one or more of 35 U.S.C. §101, 35 U.S.C. §102, and 35 U.S.C. §112, second paragraph. Claims 51-53 and 56-67 were indicated as being free of any prior art rejections.

By this Amendment, claims 51, 52, 54 and 56 are amended and claims 58-61 are added. No new matter is added.

The amendments presented herein have been made solely to expedite prosecution of the instant application to allowance and should not be construed as an indication of Applicant's agreement with or acquiescence to the Examiner's position. Accordingly, Applicants expressly maintain the right to pursue broader subject matter through subsequent amendments, continuation or divisional applications, reexamination or reissue proceedings, and all other available means. The rejections and responses thereto are set forth fully below.

Claim Rejections – 35 U.S.C. § 101

In the Office Action, claims 51-57 were rejected under 35 U.S.C. § 101, as not falling within one of the four statutory categories of invention. In particular, the Office Action asserts that the claims are a series of steps that (1) are not tied to another statutory category, and (2) do not transform underlying subject matter to a different state or thing.

The amended claims are specifically drawn to a method "implemented using a system comprising an image processing system" where the claimed process is "performed by said system." Accordingly, Applicants submit that the amended claims meet the requirements of 35 U.S.C. § 101 and respectfully request that the rejection based thereon be withdrawn.

Claim Rejections – 35 U.S.C. § 112, second paragraph

In the Office Action, claims 52 and 56 were rejected under 35 U.S.C. § 112, second paragraph, as failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Office Action asserts that the phrase "the optical axis of the image" lacks antecedent basis. Claims 52 and 56 have been amended to recite "an optical axis of the frame," which finds antecedent basis in claims 51 and 54 respectively. Accordingly, applicants respectfully request that the rejection under 35 U.S.C. § 112, second paragraph, be withdrawn.

Claim Rejections – 35 U.S.C. § 102

Claims 54-55 are rejected under 35 U.S.C. 102(e) as being unpatentable over U.S. Patent No. 5,912,980 issued to Hunke (hereinafter "Hunke"). In order to anticipate a claim, the cited reference must disclose each and every limitation of the claim. Prior to addressing the cited reference, Applicants will review the subject matter of amended claim 54, which recites:

54. (Currently amended) A process of tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising, on a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target, and identifying the target from said at least one histogram.

Thus, the claimed process of tracking a target in an input signal must be implemented by a system comprising an image processing system. In addition, the input signal must include a succession of frames, where each frame includes a succession of pixels and the target includes pixels in one or more of a plurality of classes in one or more of a plurality of domains. The process includes a frame-by-frame analysis that includes (1) forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, where the at least one histogram refers to classes defining said target, and (2) identifying the target from said at least one histogram.

In contrast, Hunke is drawn to a method for automatically locating a predetermined target class of object in a video image stream. The method includes: (a) determining typical colors found in objects of the predetermined target class, (b) detecting a moving area in the video image stream, (c) determining the colors in the moving area, and (d) determining whether the moving area contains colors similar to the pre-determined target class typical colors. *See* Hunke, Abstract.

Applicants respectfully submit that Hunke fails to disclose each and every limitation of the subject matter of claims 54 and 55. Accordingly, Applicants respectfully request that the rejection based on Hunke be withdrawn.

Conclusion

For at least the reasons set forth above, the independent claims are believed to be allowable. In addition, the dependent claims are believed to be allowable due to their dependence on an allowable base claim and for further features recited therein. The application is believed to be in condition for immediate allowance. If any issues remain outstanding, Applicant invites the Examiner to call the undersigned (direct line: 561-838-5229 x228) if it is believed that a telephone interview would expedite the prosecution of the application to an allowance.

Respectfully submitted,

NOVAK DRUCE + QUIGG LLP

Date: **March 10, 2009**

/ Gregory M. Lefkowitz /

Gregory A. Nelson, Reg. No. 30,577
Gregory M. Lefkowitz, Reg. No. 56,216
CityPlace Tower
525 Okeechobee Blvd, Fifteenth Floor
West Palm Beach, FL 33401
Tel: 561-828-5229 x228
Telefax: 561-838-5578

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) **FY 2009** (***Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).***)	Docket Number (Optional) 8042-2-1
Application Number 11/676,926	Filed February 20, 2007
For IMAGE PROCESSING METHOD	
Art Unit 2624	Examiner SETH MANAV

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☑ One month (37 CFR 1.17(a)(1))	$130	$65	$ 65.00
☐ Two months (37 CFR 1.17(a)(2))	$490	$245	$
☐ Three months (37 CFR 1.17(a)(3))	$1110	$555	$
☐ Four months (37 CFR 1.17(a)(4))	$1730	$865	$
☐ Five months (37 CFR 1.17(a)(5))	$2350	$1175	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

☑ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☐ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number ______________.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 56,216

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 ______________

/Gregory M. Lefkowitz/	March 10, 2009
Signature	Date
GREGORY M. LEFKOWITZ	561 653-5000
Typed or printed name	Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ______________ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal

Application Number:	11676926
Filing Date:	20-Feb-2007
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Filer:	Gregory Marc Lefkowitz/Gail Ochocki
Attorney Docket Number:	8042-2-1

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	2251	1	65	65

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**65**

Electronic Acknowledgement Receipt

EFS ID:	4936093
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	30448
Filer:	Gregory Marc Lefkowitz/Gail Ochocki
Filer Authorized By:	Gregory Marc Lefkowitz
Attorney Docket Number:	8042-2-1
Receipt Date:	10-MAR-2009
Filing Date:	20-FEB-2007
Time Stamp:	12:56:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$65
RAM confirmation Number	8730
Deposit Account	141437
Authorized User	LEFKOWITZ,GREGORY

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		8042-2-1.pdf	134055 872715a6f27d7ac56e952c564afb5366747f523f	yes	9

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Claims	2	5
Applicant Arguments/Remarks Made in an Amendment	6	9

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Extension of Time	8042-2-1XOT_cute.pdf	48150 3a62ba8ce99d912e77a0cdc70f37c33c4c72b746	no	1

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Fee Worksheet (PTO-06)	fee-info.pdf	30447 b9c9564296fa695b7e93382dc54ccd70483cf219	no	2

Warnings:

Information:

Total Files Size (in bytes): 212652

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	
11/676,926	02/20/2007	☐ To be Mailed

APPLICATION AS FILED – PART I

SMALL ENTITY ☒ OR OTHER THAN SMALL ENTITY

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)		OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

SMALL ENTITY OR OTHER THAN SMALL ENTITY

AMENDMENT

03/10/2009	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 11	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	**0**	OR	TOTAL ADD'L FEE	

AMENDMENT

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/ANNETTE SMITH/

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/676,926	02/20/2007	PATRICK PIRIM	8042-2-1	9051

30448 7590 11/17/2008

AKERMAN SENTERFITT
P.O. BOX 3188
WEST PALM BEACH, FL 33402-3188

EXAMINER	
SETH, MANAV	
ART UNIT	**PAPER NUMBER**
2624	
MAIL DATE	**DELIVERY MODE**
11/17/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	11/676,926	PIRIM, PATRICK
	Examiner	**Art Unit**
	MANAV SETH	2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 February 2007*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *51-57* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *51-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 February 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/5/2007*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 51-57 are rejected under 35 U.S.C. 101 as not falling within one of the four statutory categories of invention. While the claims recite a series of steps or acts to be performed, a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory category (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing (Reference the May 15, 2008 memorandum issued by Deputy Commissioner for Patent Examining Policy, John J. Love, titled "Clarification of 'Processes' under 35 U.S.C. 101"). The instant claims neither transform underlying subject matter nor positively tie to another statutory category that accomplishes the claimed method steps, and therefore do not qualify as a statutory process.

The memorandum issued can be found at:

http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/section_101_05_15_2008.pdf

Or,

from uspto.gov, click "Policy and Law", "Patents", "Memorandum to the Examining Corps", "Clarification of "processes" under … 101".

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 52 and 56 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 52 and 56 recites the phrase "the optical axis of the image". There is insufficient antecedent basis for this phrase in these claims. Claims 52 and 56 depend from claims 51 and 54 and claims 51 and 54 do not provide any support for the word "image". For examining purposes, examiner interprets the word "image" as the frame. Further, claim 56 recites "centering the tracking box relative to the optical axis of the image", there is insufficient antecedent basis for this limitation as claim 56 depends on claim 54 and claim 54 do not recite any tracking box and the image. Proper correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claims 54-55 are rejected under 35 U.S.C. 102(e) as being anticipated by Hunke, U.S. Patent No. 5,912,980.

Regarding claim 54, Hunke discloses a process of tracking a target in an input signal, the input signal comprising a succession of frames, (Abstract, last few lines – "the method allows tracking of target objects in subsequent frames of the video image stream based upon the colors in the target objects; col. 5, lines 1-13), Hunke further discloses "each frame comprising a succession of pixels (col. 8, lines 1-3 – images obtained from the video camera are represented as a **pixel matrix** RGB values where pixel matrix represents succession of pixels), Hunke further discloses "the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains" (col. 8, lines 17-20 – the domain being the color domain as the image frame pixels are classified into the target color pixels and non-target color pixels, and target pixels further comprise a target class having a specific color, where target classes, for example, being human faces with different skin colors (col. 9, lines 50-65); the other domain being the time domain since the tracking is being done at different times (col. 10, lines 42-60)), the process comprising, on-a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target, and identifying the target from said at least one histogram (col. 10, lines 45-51 – the normalized color distribution (histogram) of the image of the tracked target is computed in each image frame during tracking the target, where the histogram refers to the classes defining (as discussed before) said target (col. 10, lines 25-55), thus identifying the target in each frame using histogram).

Regarding claim 55, Hunke discloses drawing a tracking box around the target (col. 5, lines 25-35 – rectangular box around the target).

7. Claims 51- 53 would be allowable, after all the 35 USC 101 and 35 USC 112 rejection issues are resolved. Claim 51 would be allowable for the following reason: The instant invention and the closest prior art (Hunke, U.S. Patent No. 5,912,980) as discussed above, are directed to tracking the object in a sequence of frames where in the frame the object or target is bound in a tracking box. The instant invention further recites the limitation such as "successively increasing the size of the tracking box and for each pixel of the input signal, in each successive tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains" in claim 51, which is not taught by the closest prior art of record. Claims 52-53 would be allowable for at least by dependency on the claim 51.

8. Claims 56-57 are objected to as being dependent upon a rejected base claim, but would be allowable, after all the 35 USC 101 and 112 rejection issues have been resolved, if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The reasons of allowance would be: The closest prior art of record (Hunke) does not teach centering the tracking box relative to the optical axis of the image as recited in claim 56 and further does not teach "calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with

orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame" as recited in claim 57.

Examiner note: Examiner has cited particular columns and line numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings for the art and are applied to the specific limitations within the individual claim, other passages and figures may be applied as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references entirely as potential teachings all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (571) 272-7456. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt Bella, can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Manav Seth/
Examiner, Art Unit 2624
November 10, 2008

Notice of References Cited

Application/Control No.	Applicant(s)/Patent Under Reexamination	
11/676,926	PIRIM, PATRICK	
Examiner	Art Unit	
MANAV SETH	2624	Page 1 of 5

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-3,725,576 A	04-1973	Crawford et al.	348/170
*	B	US-3,760,377 A	09-1973	Attridge et al.	382/103
*	C	US-4,364,089 A	12-1982	Woolfson, Martin G.	348/169
*	D	US-4,386,848 A	06-1983	Clendenin et al.	356/5.01
*	E	US-4,847,786 A	07-1989	Wang et al.	382/171
*	F	US-4,868,871 A	09-1989	Watson, III, Thomas M.	382/103
*	G	US- H,000,713 H	11-1989	May et al.	382/103
*	H	US-4,906,940 A	03-1990	Greene et al.	382/100
*	I	US-5,059,796 A	10-1991	Nakamura, Tetsuya	382/103
*	J	US-5,164,992 A	11-1992	Turk et al.	382/118
*	K	US-5,181,254 A	01-1993	Schweizer et al.	382/100
*	L	US-5,247,583 A	09-1993	Kato et al.	382/164
*	M	US-5,280,530 A	01-1994	Trew et al.	382/103

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	JP 11150676 A	06-1999	Japan	HARANISHI, MASAKI	H04N 05/232
	O					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Notice of References Cited	Application/Control No. 11/676,926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK	
	Examiner MANAV SETH	Art Unit 2624	Page 2 of 5

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,323,470 A	06-1994	Kara et al.	382/103
*	B	US-5,426,684 A	06-1995	Gaborski et al.	378/62
*	C	US-5,430,809 A	07-1995	Tomitaka, Tadafusa	382/173
*	D	US-5,452,367 A	09-1995	Bick et al.	382/128
*	E	US-5,473,369 A	12-1995	Abe, Keiko	348/169
*	F	US-5,481,622 A	01-1996	Gerhardt et al.	382/103
*	G	US-5,500,904 A	03-1996	Markandey et al.	382/103
*	H	US-5,574,498 A	11-1996	Sakamoto et al.	348/169
*	I	US-5,604,822 A	02-1997	Pearson et al.	382/199
*	J	US-5,631,697 A	05-1997	Nishimura et al.	348/172
*	K	US-5,644,386 A	07-1997	Jenkins et al.	356/4.01
*	L	US-5,684,715 A	11-1997	Palmer, Douglas L.	348/473
*	M	US-5,717,784 A	02-1998	Yanagishita et al.	382/180

FOREIGN PATENT DOCUMENTS

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Notice of References Cited	Application/Control No. 11/676,926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK	
	Examiner MANAV SETH	Art Unit 2624	Page 3 of 5

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,781,650 A	07-1998	Lobo et al.	382/118
*	B	US-5,798,787 A	08-1998	Yamaguchi et al.	348/152
*	C	US-5,812,193 A	09-1998	Tomitaka et al.	348/369
*	D	US-5,825,922 A	10-1998	Pearson et al.	382/199
*	E	US-5,883,969 A	03-1999	Le Gouzouguec et al.	382/103
*	F	US-5,912,994 A	06-1999	Norton et al.	382/283
*	G	US-5,912,980 A	06-1999	Hunke, H. Martin	382/103
*	H	US-5,930,379 A	07-1999	Rehg et al.	382/107
*	I	US-5,982,909 A	11-1999	Erdem et al.	382/103
*	J	US-6,005,493 A	12-1999	Taniguchi et al.	340/990
*	K	US-6,037,976 A	03-2000	Wixson, Lambert Ernest	348/122
*	L	US-6,049,363 A	04-2000	Courtney et al.	348/700
*	M	US-6,084,989 A	07-2000	Eppler, Walter G.	382/293

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
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Notice of References Cited	Application/Control No. 11/676,926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK	
	Examiner MANAV SETH	Art Unit 2624	Page 4 of 5

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,148,092 A	11-2000	Qian, Richard	382/118
*	B	US-6,226,388 B1	05-2001	Qian et al.	382/103
*	C	US-6,263,088 B1	07-2001	Crabtree et al.	382/103
*	D	US-6,263,089 B1	07-2001	Otsuka et al.	382/107
*	E	US-6,295,367 B1	09-2001	Crabtree et al.	382/103
*	F	US-6,301,370 B1	10-2001	Steffens et al.	382/103
*	G	US-6,335,985 B1	01-2002	Sambonsugi et al.	382/190
*	H	US-6,339,651 B1	01-2002	Tian et al.	382/105
*	I	US-6,381,363 B1	04-2002	Murching et al.	382/164
*	J	US-2002/0071595 A1	06-2002	Pirim, Patrick	382/107
*	K	US-6,400,830 B1	06-2002	Christian et al.	382/103
*	L	US-6,434,254 B1	08-2002	Wixson, Lambert Ernest	382/103
*	M	US-6,453,069 B1	09-2002	Matsugu et al.	382/173

FOREIGN PATENT DOCUMENTS

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Notice of References Cited	Application/Control No. 11/676,926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK	
	Examiner MANAV SETH	Art Unit 2624	Page 5 of 5

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,486,909 B1	11-2002	Pirim, Patrick	348/143
*	B	US-2003/0067978 A1	04-2003	Pirim, Patrick	375/240.03
*	C	US-6,714,665 B1	03-2004	Hanna et al.	382/117
*	D	US-6,704,045 B1	03-2004	Brett, Stephen	348/222.1
*	E	US-7,181,047 B2	02-2007	Pirim, Patrick	382/107
*	F	US-7,190,725 B2	03-2007	Pirim, Patrick	375/240.27
	G	US-			
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FOREIGN PATENT DOCUMENTS

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	**Application/Control No.** 11676926	**Applicant(s)/Patent Under Reexamination** PIRIM, PATRICK
	Examiner MANAV SETH	**Art Unit** 2624

✓	**Rejected**	-	**Cancelled**	N	**Non-Elected**	A	**Appeal**
=	**Allowed**	÷	**Restricted**	I	**Interference**	O	**Objected**

☐ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

CLAIM		**DATE**								
Final	Original	11/10/2008								
	1	-								
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Index of Claims	Application/Control No. 11676926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK
	Examiner MANAV SETH	Art Unit 2624

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/10/2008								
	37	-								
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	46	-								
	47	-								
	48	-								
	49	-								
	50	-								
	51	✓								
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	54	✓								
	55	✓								
	56	✓								
	57	✓								

Search Notes	Application/Control No. 11676926	Applicant(s)/Patent Under Reexamination PIRIM, PATRICK
	Examiner MANAV SETH	**Art Unit** 2624

SEARCHED

Class	Subclass	Date	Examiner
382	100,103,107,128-132,168-180,199-206,224,291	11/10/2008	ms

SEARCH NOTES

Search Notes	Date	Examiner
East Search	11/10/2008	ms
IDS Search	11/10/2008	ms
Inventor Search	11/10/2008	ms
IEEE Search	11/10/2008	ms
STIC PLUS Search	11/10/2008	ms

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

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CONFIRMATION NO. 9051

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/676,926	02/20/2007 RULE	382	2624	8042-2-1

APPLICANTS
PATRICK PIRIM, Paris, FRANCE;

** **CONTINUING DATA** *************************
This application is a DIV of 09/792,294 02/23/2001 PAT 7,181,047
which is a CIP of 09/230,502 09/13/1999 PAT 6,486,909
which is a 371 of PCT/FR97/01354 07/22/1997

** **FOREIGN APPLICATIONS** *************************
EUROPEAN PATENT OFFICE (EPO) PCT/EP98/05383 08/25/1998
FRANCE 96 09420 07/26/1996

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** ** ** SMALL ENTITY **
03/12/2007

Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /MANAV SETH/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		FRANCE	13	7	2

ADDRESS

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WEST PALM BEACH, FL 33402-3188
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TITLE

IMAGE PROCESSING METHOD

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
425	No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

BIB (Rev. 05/07).

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/U.S.)

In re: Application of	PIRIM	Confirmation:	9051
Application No.	11/676,926	Group:	2624
Filing Date:	February 20, 2007	Examiner:	Seth, Manav
For:	IMAGE PROCESSING METHOD		

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Dear Sir:

In accordance with the duty of disclosure under 37 C.F.R. §1.56, Applicant hereby notifies the U.S. Patent Office of the documents which are listed on the attached Forms PTO/SB/08A and PTO/SB/08B. These references were cited during prosecution of the parent applications, U.S. Application No. 09/792,294, now U.S. Patent No. 7,181,047; and U.S. Application No. 09/230,502, now U.S. Patent No. 6,486,909. As copies of the cited references were previously submitted to or cited by the U.S. Patent and Trademark Office in one or more of these parent applications, copies of these references are not being provided in accordance with 37 CFR §1.98(d).

Applicant submits that the present invention is patentable over the cited references. Submission of the listed documents is not intended as an admission that such documents constitute prior art against the present application. Applicant does not waive any right to take

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any action that would be appropriate to antedate or otherwise remove any of the listed documents as competent references against the present application.

Applicant respectfully requests that the listed documents be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08B be returned in accordance with MPEP §609.

Although no fee is believed to be due, the Commissioner is hereby authorized to charge any underpayment to Deposit Account No. 50-0951.

Respectfully submitted,

AKERMAN SENTERFITT

Date: July 5, 2007

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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	11/676,925
Filing Date	February 20, 2007
First Named Inventor	
Art Unit	
Examiner Name	
Attorney Docket Number	8042-2-1

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Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-4,783,828	11-08-1988	Sadjadi	
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		WO	00/11609	A1	03-02-2000	Holding B.E.V. S.A.		☐
		WO	00/11610	A1	03-02-2000	Holding B.E.V. S.A.		☐
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		EP	0046110	A1	02/17/1982			☐
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{WP411510;1}

PTO/SB/08A (03-06)
Approved for use through 03/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 2 of 3

Complete if Known	
Application Number	11/676,926
Filing Date	February 20, 2007
First Named Inventor	
Art Unit	
Examiner Name	
Attorney Docket Number	8042-2-1

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-			
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Examiner Initials*	Cite No.[1]	Foreign Patent Document: Country Code[3]	Number[4]	Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	AU	WO	99/36894		07/22/99	Patrick Pirim		☐
	AV	EP	0 380 659	A1	08/08/90	Makoto Nagao et al.		☐
	AW	EP	0 394 959	A2	10/31/90	Axel Korn		☐
	AX	WO	99/36893		07/22/99	Patrick Pirim et al.		☐

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{WP411510;1}

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	11/676,926
Filing Date	February 20, 2007
First Named Inventor	
Art Unit	
Examiner Name	
Attorney Docket Number	8042-2-1

Sheet 3 of 3

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Stephane G. Mallat, "A Theory for Multiresolution Signal Decomposition: The Wavelet Representation", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 11, No. 7, July 1989, pages 674-693.	
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Examiner Signature	/Manav Seth/	Date Considered	11/10/2008

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

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EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	0	patrick near prim	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:22
S2	46	patrick near pirim	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:22
S3	25145	(track$3 or target$3 or segment$5) near4 (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:48
S4	32247	(track$3 or target$3 or segment$5) near4 (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:49
S5	9647	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:49
S6	805	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4) and image$2 and histogram$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:49
S7	1567	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and histogram$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 19:55
S8	115	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 near histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 20:18

S9	312	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 near4 histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 20:19
S10	816	(track$3 or target$3 or segment$5) near (box$3 or loop$4 or rectang$5 or squar$4 or descriptor$3 or mask$4 or fram$4) and image$2 and (pixel$2 same histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 20:19
S11	104330	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (segment$ or track$3) and (region$2 or area$3 or homogen$6 or similar) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:11
S12	21439	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:14
S13	5373	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:15
S14	2293	(image$2 or picture$2 or frame$2 or video$2) and (object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$) and (track$3) and (region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:15
S15	2293	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:16

S16	779	(image$2 or picture$2 or frame$2 or video$2) same ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:17
S17	167	(image$2 or picture$2 or frame$2 or video$2) same ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5)) and (pixel$2 same histogram$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 21:18
S18	0	382/100,103,107,128-132,168-180, 199-206,224, "291".ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 22:54
S19	21662	382/100,103,107,128-132,168-180, 199-206,224,291.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 22:54
S20	2293	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near3 (segment$)) and (track$3) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 22:55
S21	254	S19 and S20	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/06 22:55

S22	192	("7181047" "20020071595" "20070140526" "6196662" "5008657" "5255331" "5537615" "6147671" "6173089" "6339417" "5003618" "5267065" "5815130" "5815131" "6384831" "6587111" "20020033827" "5838292" "6486909" "7190725" "20030067978" "6291148" "6468709" "6173084" "4882629" "4949391" "5195144" "5335019" "5365429" "5416615" "5600143" "5809169" "6191769" "6317700" "20060251335" "5440652" "5790126" "5867173" "6088041" "6175372" "5394523" "5684510" "5796454" "5831627" "6296187" "5625756" "5748164" "5818405" "5177406" "5339092" "5600459" "5608551" "5642129" "5673059" "5870500" "6137589" "6204834" "4270127" "4322716" "4395699" "4398256" "4414685" "4783649" "4798448" "4839722" "4860375" "4862510" "4891750" "4901365" "4956801" "4958223" "5177501" "5177704" "5191640" "5220616" "5278542" "5299041" "5302966" "5319724" "5325108" "5371519" "5398123" "5404150" "5459818" "5461503" "5469198" "5481301" "5500748" "5502792" "5523864" "5530457" "5555001" "5559930" "5572236" "5574832" "5594812" "5600369" "5600344" "5644328" "5644340").pn.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/07 12:15
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S24	472	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3)) and ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) near4 (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 14:59

S25	21662	382/100,103,107,128-132,168-180, 199-206,224,291.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:00
S26	124	S24 and S25	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:00
S27	5829	382/100,103,107.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:25
S28	12994	(pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:26
S29	493	S27 and S28	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:26
S30	5805	(pel$2 or pixel$2 or (picture near element$2)) same histogram$3 and frame$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:26
S31	331	S27 and S30	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/08 15:27
S32	16	("5031049" | "5187585" | "5412487" | "5422828" | "5434617" | "5473369" | "5546125" | "5552823" | "5610653" | "5631697" | "5696503" | "5714999" | "5745126" | "5798787" | "5912994" | "5982909").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:08
S33	7	("5109425" | "5587927" | "5600731" | "5633728" | "5657402" | "5777690" | "6008865").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:19

S34	27	("4644582" | "4821029" | "4851616" | "4984072" | "5048103" | "5067015" | "5105186" | "5280610" | "5376947" | "5440744" | "5551027" | "5581758" | "5630017" | "5640558" | "5652880" | "5652882" | "5657426" | "5864630" | "5930379" | "5969766" | "5974192" | "5986671" | "5999651" | "6072889" | "6130960" | "6141434" | "6184926").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:23
S35	5	("4959714" | "5218414" | "5243418" | "5267329" | "5606376").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:29
S36	4	("4803735" | "4906940" | "5159667" | "5271067").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:36
S37	9	("5280530" | "5473369" | "5592228" | "5625715" | "5684715" | "5732155" | "5969764" | "5969772" | "5974183").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:41
S38	5	("5164992" | "5909249" | "6148092" | "6292575" | "6493041").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/08 16:44
S39	56	"4783828"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 09:42
S40	9	"5774581"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 09:50
S41	2	("4847786" | "5239596").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 09:54
S42	17	("4847786").URPN.	USPAT	OR	OFF	2008/11/09 10:53
S43	1031	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3 or plane$2 or helicopt$3) same (track$3)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 11:00
S44	372	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3 or plane$2 or helicopt$3) near (track$3)) and (segment$) and (pel$2 or pixel$2 or (picture near element$2)) same histogram$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 11:00

S45	4	("5280530" | "5323470" | "5430809" | "5473369").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 11:29
S46	69	("5430809").URPN.	USPAT	OR	OFF	2008/11/09 11:38
S47	17	("4975960" | "5103484" | "5130789" | "5130935" | "5164992" | "5187574" | "5280530" | "5412738" | "5430809" | "5450504" | "5497430" | "5557688" | "5629752" | "5642431" | "5680481" | "5719951" | "5781650").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 11:45
S48	20	("3769598" | "3772465" | "4642682" | "4694329" | "4755870" | "4782384" | "4823184" | "4984072" | "5093717" | "5260787" | "5430809" | "5459517" | "5565998" | "5731846" | "5767922" | "5874988" | "5912980" | "5930445" | "6049363" | "6055025").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 12:04
S49	11	("3947833" | "4047205" | "4393394" | "4989164" | "5034811" | "5065251" | "5563652" | "5613032" | "5638116" | "5732146" | "5808664").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 12:07
S50	27	("4644582" | "4821029" | "4851616" | "4984072" | "5048103" | "5067015" | "5105186" | "5280610" | "5376947" | "5440744" | "5551027" | "5581758" | "5630017" | "5640558" | "5652880" | "5652882" | "5657426" | "5864630" | "5930379" | "5969766" | "5974192" | "5986671" | "5999651" | "6072889" | "6130960" | "6141434" | "6184926").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 12:23
S51	0	(image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3)) near ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segmenting or segmentation$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:37
S52	4	(track$3) near ((region$2 or area$3 or homogen$6 or similar or block$4 or box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4)) and (segmenting or segmentation$2)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:38
S53	12	("3394246" | "3564509" | "3569938" | "3686637" | "3696335" | "3771135" | "3810105" | "3909798" | "3938097" | "4008460").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2008/11/09 22:39

S54	8	(track$3) near ((box$2 or square$2 or rectang$5) same (grow$3 or increas$3 or enlarg$5 or cluster$4))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:40
S55	2611	(track$3) near (box$2 or square$2 or rectang$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:40
S56	780	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) same (track$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:41
S57	149	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:41
S58	105	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 22:45
S59	9	(track$3) near (box$2 or square$2 or rectang$5) and (image$2 or picture$2 or frame$2 or video$2) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same optical same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:08
S60	9	(track$3) near (box$2 or square$2 or rectang$5) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same optical same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:10
S61	11	(track$3) near (box$2 or square$2 or rectang$5) and ((object$2 or target$2 or human$2 or bod$3 or weapon$4 or missile$3) near (track$3)) and center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:11

S62	57	(track$3) near (box$2 or square$2 or rectang$5) and (track$3) and center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:13
S63	10	(track$3) near (box$2 or square$2 or rectang$5) same center$3 same (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:21
S64	27	(track$3) near (box$2 or square$2 or rectang$5) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:22
S65	210	(track$3 or bound$3) near (box$2 or square$2 or rectang$5) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/09 23:31
S66	333	(track$3 or bound$3) near (box$2 or square$2 or rectang$5 or fram$3) same center$3 and (optical$4 or lens$3) same (axis)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/11/10 00:09

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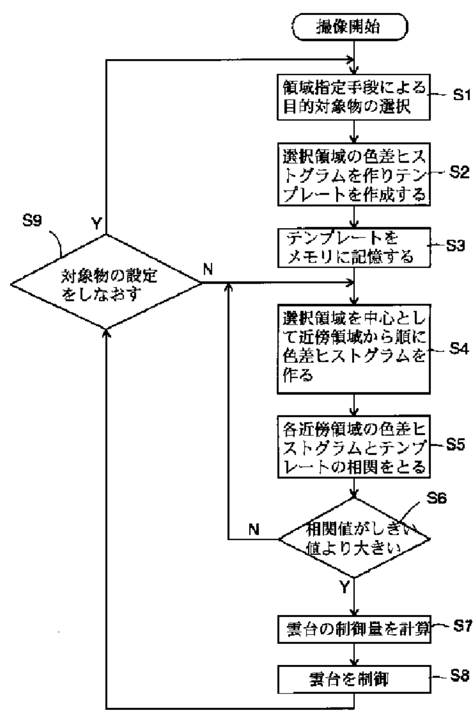
(54)【発明の名称】　画像処理装置及び追尾装置

(57)【要約】
【課題】　追尾したい対象物以外の対象物が撮像領域内に入っても、目的の対象物を追尾できるようにする。
【解決手段】　追尾したい被写体を画面上で矩形枠で囲んで特定する（Ｓ１）。指定された領域の色差データからヒストグラムを作成し（Ｓ２）、追尾したい被写体の色の特徴を示すテンプレートとして記憶する（Ｓ３）。近隣の探索領域について色差データのヒストグラムを作成し（Ｓ４）、テンプレートとの相互相関を計算する（Ｓ５）。相関値がしきい値より大きければ（Ｓ６）、追尾対象物を探知したことになり、対象物の移動量とその方向から雲台の制御量を計算し（Ｓ７）、雲台を制御して撮像部を追尾対象物に向ける（Ｓ８）。



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【特許請求の範囲】

【請求項１】　撮像部と、
前記撮像部の撮像方向を制御する制御部と、
前記撮像部から出力された画像信号を表示する画像表示部と、
前記画像表示部から追尾対象物を指定する領域指定手段と、
前記撮像部から出力された画像信号中より所定の色信号成分を検出する検出部と、
前記画像信号を記憶するメモリ部と、
前記メモリ部を制御するメモリ制御部と、
前記メモリ部に記憶された画像信号から色差信号の処理を行なう色差信号処理部と、
前記色差信号処理部の結果に基づき、前記領域指定手段によって指定された領域内の色差信号情報の特徴の画面内における位置の変化から前記制御部の制御量を計算するシステム制御部とを具備することを特徴とする画像処理装置。

【請求項２】　前記色信号成分は、色差信号である請求項１に記載の画像処理装置。

【請求項３】　前記色差信号処理部は、色差信号のヒストグラムを作成する処理を行なうように構成されている請求項２に記載の画像処理装置

【請求項４】　さらに画面内の任意の領域の画像を指定する領域指定手段を備え、前記システム制御部は、前記領域指定手段によって指定された領域の前記色差信号のヒストグラムを演算し、そのヒストグラムを特徴として前記撮像部より出力される画像との相関演算を行ない、最大の相関値の得られる位置の変化から前記特徴の位置の変化を検出するように構成されている請求項３に記載の画像処理装置。

【請求項５】　前記システム制御部は、画面内を複数のブロックに分割し、前記特徴を前記各ブロック内の画像とそれぞれ相関演算し、ブロック単位で特徴の移動を検出するように構成されている請求項４に記載の画像処理装置。

【請求項６】　入力画像信号から追尾対象物を領域指定する領域指定手段と、
前記入力画像信号の指定の領域の色情報のヒストグラムを作成するヒストグラム作成手段と、
前記領域指定手段により指定された領域の色情報のヒストグラムを追尾対象物のテンプレートして記憶する記憶手段と、
所定の１以上の探索領域について前記ヒストグラム作成手段により作成されるヒストグラムと前記テンプレートとしてのヒストグラムの相関をとり、追尾対象物を探知する探知手段と、
前記探知手段の演算結果に従い撮像方向を制御する制御手段とからなることを特徴とする追尾装置。

【請求項７】　前記探知手段が、前画面での前記追尾対象物の位置の近傍の探索領域について前記ヒストグラムの相関をとり、所定しきい値以上の相関値のとき、追尾対象物を探知したと判断し、所定しきい値未満の相関値のときには次の近傍の探索領域について同様の処理を繰り返す請求項６に記載の追尾装置。

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【請求項８】　前記探知手段が、前画面での前記追尾対象物の位置の近傍の複数の探索領域について前記ヒストグラムの相関をとり、最大の相関値を検索する請求項６に記載の追尾装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、画像処理装置及び追尾装置に関し、より具体的には、撮像装置において所定の対象物を追尾する画像処理装置及び追尾装置に関する。

【０００２】

【従来の技術】従来、画像処理により対象物を追尾する追尾システムでは、以下のように、撮影方向を制御して特定の被写体を追尾するようにしていた。図２は、従来例の概略構成ブロック図を示す。撮像装置１１０は、撮像部１１２と雲台１１４とからなり、撮像部１１２から出力される画像信号は、画像処理装置１２２のデコーダ１１８に入力され、輝度信号（Ｙ）と色差信号（ＵＶ）に分離される。Ａ／Ｄ変換器１２０はデコーダ１１８の出力をディジタル信号に変換してメモリ１２２に格納する。メモリ制御回路１２４がメモリ１２２の書込みと読み出しを制御する。動き検出回路１２６は、撮影画像を逐次的に比較して、指定の被写体の動きを検出する。動き検出回路１２６により検出された動き情報は、システム制御回路１２８に供給され、システム制御回路１２８はその動き情報に従って雲台１１４を駆動して、撮像部１１２が指定の被写体を追尾するように撮像部１１２の向きを調整する。

【０００３】

【発明が解決しようとする課題】従来例では、動いている対象物を追尾できるが、例えば撮影視野内に、追尾したい対象物とは別の対象物が入ってきた場合、誤って別の対象物を追尾してしまうという問題点があった。

【０００４】本発明は、このような問題点を解決した画像処理装置及び追尾装置を提示することを目的とする。

【０００５】

【課題を解決するための手段】本発明に係る画像処理装置は、撮像部と、前記撮像部の撮像方向を制御する制御部と、前記撮像部から出力された画像信号を表示する画像表示部と、前記画像表示部から追尾対象物を指定する領域指定手段と、前記撮像部から出力された画像信号中より所定の色信号成分を検出する検出部と、前記画像信号を記憶するメモリ部と、前記メモリ部を制御するメモリ制御部と、前記メモリ部に記憶された画像信号から色差信号の処理を行なう色差信号処理部と、前記色差信号

処理部の結果に基づき、前記領域指定手段によって指定された領域内の色差信号情報の特徴の画面内における位置の変化から前記制御部の制御量を計算するシステム制御部とを具備することを特徴とする。

【０００６】本発明に係る追尾装置は、入力画像信号から追尾対象物を領域指定する領域指定手段と、前記入力画像信号の指定の領域の色情報のヒストグラムを作成するヒストグラム作成手段と、前記領域指定手段により指定された領域の色情報のヒストグラムを追尾対象物のテンプレートして記憶する記憶手段と、所定の１以上の探索領域について前記ヒストグラム作成手段により作成されるヒストグラムと前記テンプレートとしてのヒストグラムの相関をとり、追尾対象物を探知する探知手段と、前記探知手段の演算結果に従い撮像方向を制御する制御手段とからなることを特徴とする。

【０００７】従来例の動き検出手段に代わって色情報のヒストグラムにより対象物を特定するので、追尾したい対象物以外の対象物が撮像領域内に入っても誤認しにくくなり、目的の対象物だけを追尾できるようになる。

【０００８】

【発明の実施の形態】以下、図面を参照して、本発明の実施例を詳細に説明する。

【０００９】図１は、本発明の一実施例の概略構成ブロック図を示す。撮像装置１０は、撮像部１２と撮像部１２の撮影方向を変更する支持部としての雲台１４とからなる。画像処理装置１６のデコーダ１８は、撮像部１２から出力される画像信号を輝度信号（Ｙ）と色差信号（ＵＶ）に分離し、Ａ／Ｄ変換器２０は、デコーダ１８の色差信号出力をディジタル信号に変換して、メモリ２２に格納する。メモリ制御回路２４はメモリ２２の書込みと読み出しを制御する。

【００１０】画像表示装置２６は撮像部１２から出力される画像信号をモニタディスプレイ等に映像表示する。領域指定装置２８はマウスなどのポインティング・デバイスからなり、画像表示装置２６の画面上の任意の領域を指定可能である。領域指定装置２８による指定データはシステム制御回路３０に印加される。システム制御回路３０は、詳細は後述するが、領域指定装置２８により指定された領域内の対象物を色差信号処理装置３２に記憶させ、その記憶情報をテンプレートとして、以後、画面内において同じ色調の対象物をサーチし、色差信号処理装置３２に追尾させる。

【００１１】図３は、本実施例の動作フローチャートを示す。追尾したい被写体を画像表示装置２６の画面上で領域指定装置２８により矩形枠で囲んで特定する（Ｓ１）。領域指定装置２８により指定された領域の位置情報が、領域指定装置２８からシステム制御回路３０に転送される。システム制御回路３０は、メモリ制御回路２４を制御して、指定された領域の画像データをメモリ２２から色差信号処理装置３２に読み出す。色差信号処理装置３２は、メモリ２２からの色差データのヒストグラムを作成し（Ｓ２）、追尾したい被写体の色の特徴を示すテンプレートとして記憶する（Ｓ３）。

【００１２】作成される色差ヒストグラムは、図４（ｂ）に示すように、追尾領域の各画素での色差データとその頻度を３次元的に表現したものである。図４（ａ）は図４（ｂ）に示す色差ヒストグラムを真上から見た図を示し、図４（ｃ）は画像表示装置２６の画面例を示す。図４（ａ）のＰ点の座標（ｕ，ｖ）は、図４（ｃ）の追尾領域にあるＰ点の色差データを示す。

【００１３】これまでは準備段階であり、以後、追尾を開始する。先ず、テンプレートを作成したのと同じ位置の領域の色差データをメモリ２２から色差信号処理装置３２に読み出し、色差信号処理装置３２がその色差ヒストグラムを作成する（Ｓ４）。なお、メモリ２２の画像データは、時事刻々と更新されている。作成した色差ヒストグラムと前述のテンプレートとの相互相関を計算する（Ｓ５）。追尾しようとする対象物が動いていなければ、相互相関値は高くなる。

【００１４】例えば、図５に示すように、図５（１）に示す第１フレームで追尾対象物のテンプレートを作成し、図５（２）に示す第２フレームで追尾対象物を探索する場合を想定する。図５（２）の探索位置０が最初の選択領域であり、これを中心として近傍領域である探索位置１の領域の色差ヒストグラムを新たに作成し、これをｈ１（ｕ，ｖ）とする。テンプレートの色差ヒストグラムをｈｏｒｇ（ｕ，ｖ）とすれば、これら２つの領域の相関関数Ｒ（ｕ，ｖ）は、次の式で表現される。

【００１５】

【数１】　Ｒ（ｕ，ｖ）＝ｈ１（ｕ，ｖ）ｈｏｒｇ（ｕ，ｖ）

その相関値は、

【００１６】

【数２】

$$\sum_{u=-128}^{127}\sum_{v=-128}^{127} R(u,v) = \sum_{u=-128}^{127}\sum_{v=-128}^{127} h1(u,v)\,horg(u,v)$$

【００１７】と表現され、簡単な積和演算で算出できる。

【００１８】得られた相関値が、ある経験的に決められたしきい値よりも大きければ（Ｓ６）、探索領域に追尾対象物が存在することになり、対象物の移動量とその方向から雲台１４の制御量を計算し（Ｓ７）、雲台１４を制御して撮像部１２を追尾対象物に向ける（Ｓ８）。

【００１９】もし探索領域１の相関値がしきい値を超えなければ（Ｓ６）、次に、図５（２）に示すフレームの探索領域２の色差ヒストグラムｈ２（ｕ、ｖ）を作成し（Ｓ４）、先ほどと同様に相関値を計算して、しきい値と比較する（Ｓ６）。以下同様にして、探索領域に追尾対象物が見つかるまで、順次、図５（２）の探索領域３，４，５・・・を探索する。

【００２０】追尾対象物を変更したい場合には（Ｓ９）、領域指定手装置２８により新たな追尾対象物を含む領域を指定し（Ｓ４）、これまでと同様なプロセスを繰り返して追尾対象物を探索する。

【００２１】図６は、本実施例の別の動作フローチャートを示す。領域指定装置２８により追尾対象物を選択し（Ｓ１１）、その選択領域の色差ヒストグラムを作成し（Ｓ１２）、これを追尾対象物の特徴を示すテンプレートとしてメモリに記憶する（Ｓ１３）。撮像領域を図７に示すように適当な幅の短形領域に区切り、左端の矩形領域から順に色差ヒストグラムを作成する（Ｓ１４）。各矩形領域の色差ヒストグラムとテンプレートの色差ヒストグラムとの相互相関をとり（Ｓ１５）、各相関値をメモリに記憶する（Ｓ１６）。この時、どの場所の相関値かが後でも分るように、探索領域の位置座標も記憶する。全部の探索領域について相関値を計算し、その探索領域の位置情報と共にメモリに記憶したら（Ｓ１７）、一番大きな相関値を持つ探索領域を検索し（Ｓ１８）、その探索領域に撮像１２を向けるのに必要な雲台１４の移動量と方向を計算する（Ｓ１９）。そして、計算結果に基づき雲台１４を制御する（Ｓ２０）。

【００２２】追尾対象物を再設定したい場合（Ｓ２１）、領域指定装置２８により再度、追尾対象物を設定し（Ｓ１１）、上述のプロセスを繰り返せばよい。

【００２３】上記実施例では、テンプレート画像と入力画像との間の相関演算をするにあたり、色差信号のヒストグラムで特徴を比較しているので、ノイズや移動による形状のわずかな変位などによって精度が低下することがなく、他の被写体との識別能力も高くなり、常に安定、且つ高精度の追尾を行なうことができる。

【００２４】また、画面を複数のブロックに分割し、ブロック毎の相関演算を行なっているので、処理が容易になり、演算規模を小さくすることができ、結果として演算時間を短縮できる。

【００２５】

【発明の効果】以上の説明から容易に理解できるように、本発明によれば、色差ヒストグラムで追尾対象物を特定し、色差ヒストグラムの相互相関により追尾対象物を探索するので追尾対象物を正確に追尾できる。また、追尾したい対象物以外の対象物が撮像範囲内に入っても、誤認せずに目的の対象物だけを追尾できる。

【図面の簡単な説明】

【図１】　本発明の一実施例の概略構成ブロック図である。

【図２】　従来例の概略構成ブロック図である。

【図３】　本実施例の動作フローチャートである。

【図４】　色差信号処理装置３２で作成される色差ヒストグラムの説明図である。

【図５】　追尾対象物と探索領域の関係の説明図である。

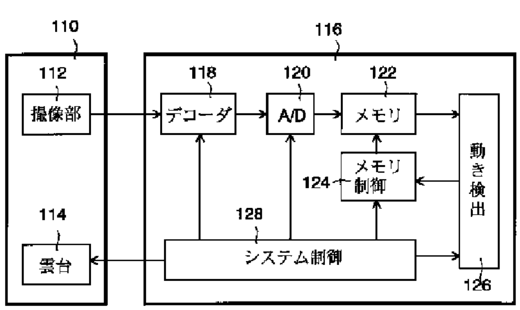
【図６】　本実施例の別の動作フローチャートである。

【図７】　図６に示すフローチャートにおける追尾対象物と探索領域の関係の説明図である。

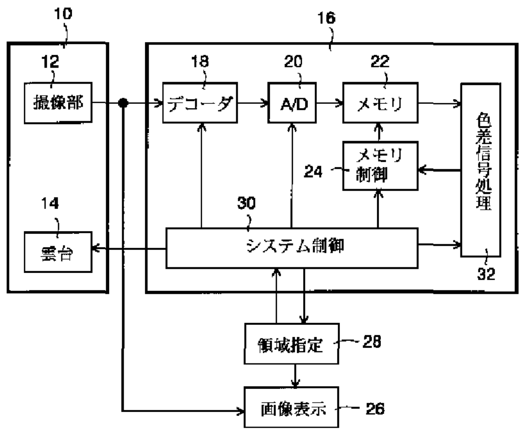
【符号の説明】

１０：撮像装置
１２：撮像部
１４：雲台部
１６：画像処理装置
１８：デコーダ
２０：Ａ／Ｄ変換器
２２：メモリ
２４：メモリ制御回路
２６：画像表示装置
２８：領域指定装置
３０：システム制御回路
３２：色差信号処理装置
１１０：撮像装置
１１２：撮像部
１１４：雲台部
１１６：画像処理う装置
１１８：デコーダ
１２０：Ａ／Ｄ変換器
１２２：メモリ
１２４：メモリ制御回路
１２６：動き検出回路
１２８：システム制御回路

【図２】

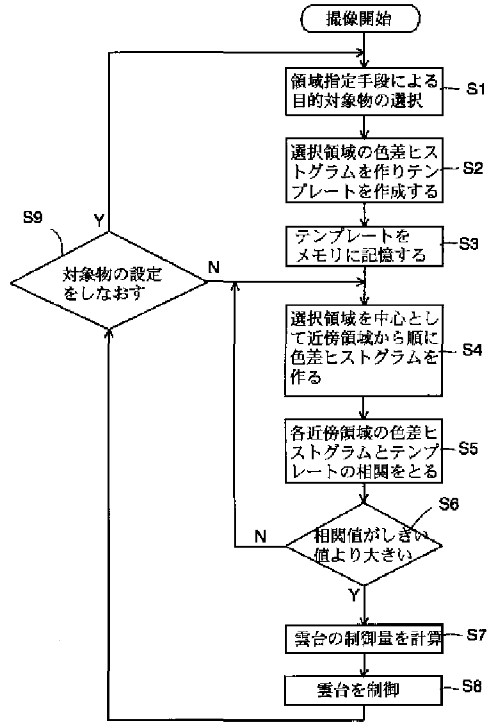


【図1】



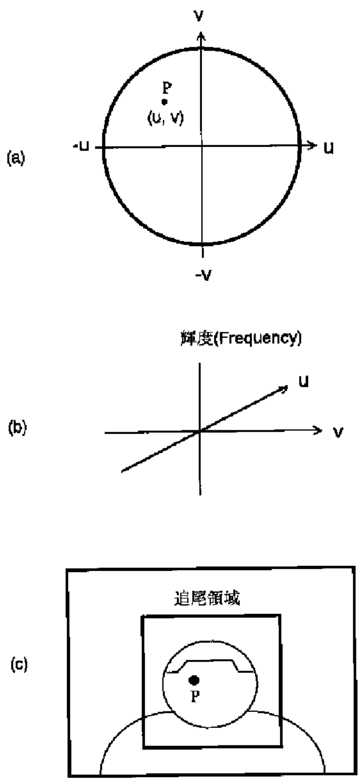
10
16
12
18
20
22
撮像部
デコーダ
A/D
メモリ
色差信号処理
24
メモリ制御
14
30
雲台
システム制御
32
領域指定
28
画像表示
26

【図3】



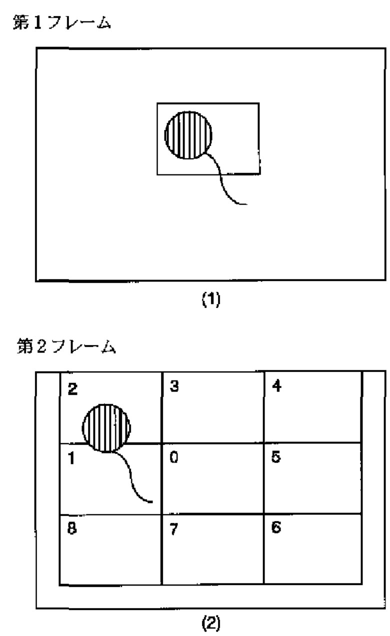
撮像開始
領域指定手段による目的対象物の選択
S1
選択領域の色差ヒストグラムを作りテンプレートを作成する
S2
テンプレートをメモリに記憶する
S3
S9
Y
対象物の設定をしなおす
N
選択領域を中心として近傍領域から順に色差ヒストグラムを作る
S4
各近傍領域の色差ヒストグラムとテンプレートの相関をとる
S5
S6
N
相関値がしきい値より大きい
Y
雲台の制御量を計算
S7
雲台を制御
S8

【図4】



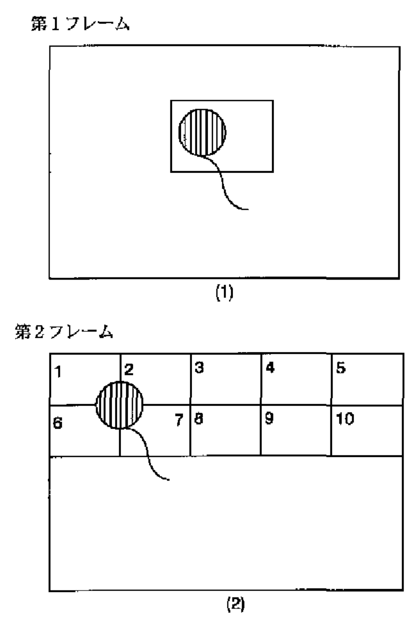
V
P
(u, v)
(a)
-u
u
-v
輝度(Frequency)
u
(b)
v
追尾領域
(c)
P

【図5】



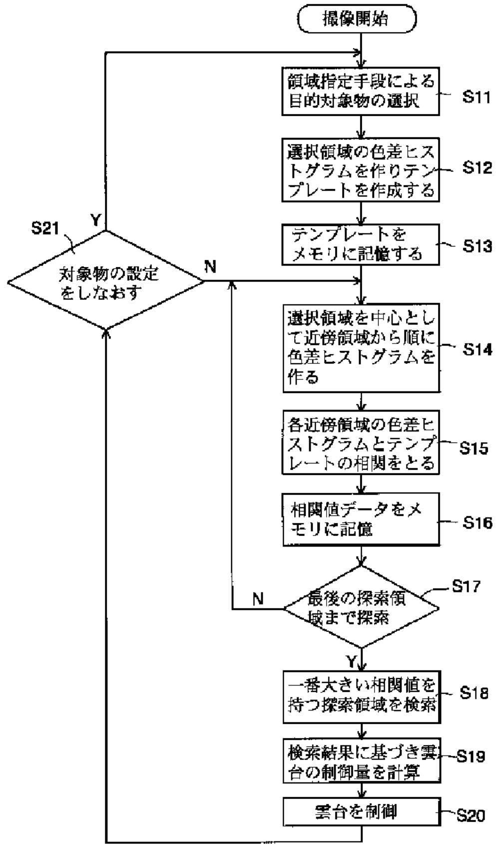
第１フレーム
(1)
第２フレーム
2
3
4
1
0
5
8
7
6
(2)

【図7】



第１フレーム
(1)
第２フレーム
1
2
3
4
5
6
7
8
9
10
(2)

【図6】


撮像開始
領域指定手段による目的対象物の選択
S11
選択領域の色差ヒストグラムを作りテンプレートを作成する
S12
テンプレートをメモリに記憶する
S13
選択領域を中心として近傍領域から順に色差ヒストグラムを作る
S14
各近傍領域の色差ヒストグラムとテンプレートの相関をとる
S15
相関値データをメモリに記憶
S16
最後の探索領域まで探索
S17
N
Y
一番大きい相関値を持つ探索領域を検索
S18
検索結果に基づき雲台の制御量を計算
S19
雲台を制御
S20
対象物の設定をしなおす
S21
Y
N

PLUS Search Results for S/N 11676926, Searched Fri Nov 07 08:58:48 EST 2008

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7181047 99
20020071595 99
20070140526 99
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
11/676,926	02/20/2007	2624	425	8042-2-1	7	2

CONFIRMATION NO. 9051

CORRECTED FILING RECEIPT

30448
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OC000000029491967

Date Mailed: 04/22/2008

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

PATRICK PIRIM, Paris, FRANCE;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a DIV of 09/792,294 02/23/2001 PAT 7,181,047
which is a CIP of 09/230,502 09/13/1999 PAT 6,486,909
which is a 371 of PCT/FR97/01354 07/22/1997

Foreign Applications

EUROPEAN PATENT OFFICE (EPO) PCT/EP98/05383 08/25/1998
FRANCE 96 09420 07/26/1996

If Required, Foreign Filing License Granted: 03/12/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 11/676,926**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****

Title

IMAGE PROCESSING METHOD

Preliminary Class

382

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	PIRIM et al.	Confirmation No:	9051
Application No.:	11/676,926	Group:	2624
Date Filed:	February 20, 2007	Examiner:	
Attn'y Docket No.:	8042-2-1		
For:	IMAGE PROCESSING METHOD		

REQUEST FOR CORRECTED FILING RECEIPT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

It is noted that in the PTO electronic file, there are two Official Filing Receipts of record, one mailed on March 13, 2007 and the other mailed on March 14, 2007. For the purposes of this Request, the undersigned refers to the most recent Official Filing Receipt which was mailed on March 14, 2007.

The Official Filing Receipt indicates the instant application is a divisional of U.S. Patent Application No. 09/792,294; however, there are additional priority applications which should be listed. As noted in the Official Filing Receipt, the instant application is a divisional of US 09/792,294. The '294 application claims priority to two applications: it is a §371 national phase application of PCT/EP98/05383 and a CIP application of US 09/230,502. The '502 application is a §371 national phase application of PCT/FR97/01354, which claims the priority benefit of FR 96/09420. Accordingly, it is respectfully requested that the Official Filing Receipt be revised as follows:

> This application is a DIV of 09/792,294, 02/23/2001, PAT 7,181,047, which is a §371 national stage entry of PCT/EP98/05383, 08/25/1998 and a CIP of 09/230,502, 09/13/1999, PAT 6,486,909, which is §371 national stage entry of PCT/FR97/01354, July 22, 1997, which claims the benefit of FR 96/09420, 07/26/1996.
>
> .

{WP423793;1}

Attached is a copy of the Official Filing Receipt indicating the requested revisions. Correction of the priority dates and prompt issuance of a corrected Filing Receipt is respectfully requested. Although no fee is believed to be due, the Commissioner is hereby authorized to charge any underpayment in fees to Deposit Account No. 50-0951. Please contact the undersigned if further clarification of the above is needed.

Respectfully submitted,

AKERMAN SENTERFITT

Date: Aug. 27, 2007

Gregory M. Lefkowitz
Registration No. 56,216
P.O. Box 3188
West Palm Beach, FL 33402-3188
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{WP423793;1}

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
11/676,926	02/20/2007	2624	425	8042-2-1	7	2

CONFIRMATION NO. 9051

30448
AKERMAN SENTERFITT
P.O. BOX 3188
WEST PALM BEACH, FL33402-3188

FILING RECEIPT

Date Mailed: 03/14/2007

Receipt is acknowledged of this regular Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please mail to the Commissioner for Patents P.O. Box 1450 Alexandria Va 22313-1450. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).**

Applicant(s)

PATRICK PIRIM, Paris, FRANCE;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a DIV of 09/792,294 02/23/2001 PAT 7,181,047, which is a §371 of PCT/EP98/05383, 08/25/1998 and a CIP of 09/230,502, 09/13/1999, PAT 6,486,909, which is a §371 of PCT/FR97/01354, July 22, 1997, which claims the benefit of FR 96/09420, 07/26/1996.

Foreign Applications

If Required, Foreign Filing License Granted: 03/12/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US11/676,926**

Projected Publication Date: 06/21/2007

Non-Publication Request: No

Early Publication Request: No

** SMALL ENTITY **

Title

IMAGE PROCESSING METHOD

Preliminary Class

382

Electronic Acknowledgement Receipt

EFS ID:	2128087
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	30448
Filer:	Gregory A. Nelson/TJ FATUM
Filer Authorized By:	Gregory A. Nelson
Attorney Docket Number:	8042-2-1
Receipt Date:	27-AUG-2007
Filing Date:	20-FEB-2007
Time Stamp:	16:36:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Corrected Filing Receipt	REQCORROFR_082707.pdf	154172 5057d5fe336b0acd15c0f2cba5ad29a904d9535b	no	3
Warnings:					

Information:	
Total Files Size (in bytes):	154172

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/U.S.)

In re: Application of	PIRIM	Confirmation:	9051
Application No.	11/676,926	Group:	2624
Filing Date:	February 20, 2007	Examiner:	Seth, Manav
For:	IMAGE PROCESSING METHOD		

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Dear Sir:

In accordance with the duty of disclosure under 37 C.F.R. §1.56, Applicant hereby notifies the U.S. Patent Office of the documents which are listed on the attached Forms PTO/SB/08A and PTO/SB/08B. These references were cited during prosecution of the parent applications, U.S. Application No. 09/792,294, now U.S. Patent No. 7,181,047; and U.S. Application No. 09/230,502, now U.S. Patent No. 6,486,909. As copies of the cited references were previously submitted to or cited by the U.S. Patent and Trademark Office in one or more of these parent applications, copies of these references are not being provided in accordance with 37 CFR §1.98(d).

Applicant submits that the present invention is patentable over the cited references. Submission of the listed documents is not intended as an admission that such documents constitute prior art against the present application. Applicant does not waive any right to take any action that would be appropriate to antedate or otherwise remove any of the listed documents as competent references against the present application.

Applicant respectfully requests that the listed documents be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08B be returned in accordance with MPEP §609.

Although no fee is believed to be due, the Commissioner is hereby authorized to charge any underpayment to Deposit Account No. 50-0951.

Respectfully submitted,

AKERMAN SENTERFITT

Date: July 5, 2007

J. Rodman Steele Jr.
Registration No. 25,931
Gregory M. Lefkowitz
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	11/676,925
Filing Date	February 20, 2007
First Named Inventor	
Art Unit	
Examiner Name	
Attorney Docket Number	8042-2-1

U.S. PATENT DOCUMENTS+

Examiner Initials*	Cite No.[1]	Document Number Number Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-4,783,828	11-08-1988	Sadjadi	
		US-5,278,921 A	01-11-1994	Nakamura et al.	
		US-5,774,581 A	06-30-1998	Fassnacht et al.	
		US-6,597,738 B1	07-22-2003	Park et al.	
		US-2003/0067978-A1	04-10 -2003	Pirim	
		US-2003-0152267-A1	08-14-2003	Pirim	
		US-6,717,518	04-06-2004	Pirim	
		US-5,565,920	10-15-1996	Lee et al.	
		US-5,592,226	01-07-1997	Lee et al.	
		US-6,256,608 B1	06-03-2001	Malvar	
		US-2002/0120594 A1	08-29-2002	Pirim	
		US-2002/0156753 A1	10-24-2002	Pirim	
		US-2002/0169732 A1	11-14-2002	Pirim	
		US-5,793,888	08-11-1998	Delanoy	
		US-5,712,729	01-27-1998	Hashimoto	
		US-5,694,495	12-02-1997	Hara et al.	
		US-5,488,430	01-30-1996	Hong	
		US-6,488,909	11-26-2002	Pirim	
		US-6,304,187	10-18-2001	Pirim	
		US-5,384,865	01-24-1995	Loveridge	
		US-5,109425	04-28-1992	Lawton	
		US-5,008,946	04-16-1991	Ando	
		US-5,088,488	02-18-1992	Markowitz et al.	
		US-5,163,095	11-10-1992	Kosaka	
		US-5,359,533	10-25-1994	Ricka et al.	
		US-5,592,237	01-07-1997	Greenway et al.	
		US-5,625,717	04-29-1997	Hashimoto et al.	
		US-2002/0101432 A1	08-01-2002	Ohara et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]	Number[4]	Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
		WO	00/11609	A1	03-02-2000	Holding B.E.V. S.A.		☐
		WO	00/11610	A1	03-02-2000	Holding B.E.V. S.A.		☐
		WO	01/63557	A2	08-30-2001	Holding B.E.V. S.A.		Abst.
		JP	06-205780	A	07-26-1994	Aloka Co. Ltd.		☐
		WO	98/05002		02/05/1998			☐
		EP	0046110	A1	02/17/1982			☐
		FR	2751772	A1	01/30/1998			☐
		FR	2611063	A1	08/19/1988			☐

{WP411510;1}

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 3

Complete if Known	
Application Number	11/676,926
Filing Date	February 20, 2007
First Named Inventor	
Art Unit	
Examiner Name	
Attorney Docket Number	8042-2-1

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]	Number[4]	Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	AU	WO	99/36894		07/22/99	Patrick Pirim		☐
	AV	EP	0 380 659	A1	08/08/90	Makoto Nagao et al.		☐
	AW	EP	0 394 959	A2	10/31/90	Axel Korn		☐
	AX	WO	99/36893		07/22/99	Patrick Pirim et al.		☐

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	11/676,926
Filing Date	February 20, 2007
First Named Inventor	
Art Unit	
Examiner Name	
Attorney Docket Number	8042-2-1

Sheet 3 of 3

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Stephane G. Mallat, "A Theory for Multiresolution Signal Decomposition: The Wavelet Representation", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 11, No. 7, July 1989, pages 674-693.	
		John G. Daugman, "Complete Discrete 2-D Gabor Transforms by Neural Networks for Image Analysis and Compression", IEEE Transaction on Acoustics, Speech and Signal Processing, Vol. 36, No. 7, July 1988, pages 1169-1179.	
		Alberto Tomita, Jr., et al., "Hand Shape Extraction from a Sequence of Digitized Gray-Scale Images", IECON '94, 20th International Conference on Industrial Electronics, Control and Instrumentation, Vol. 3 of 3, Special Sessions, Signal Processign and Control, pages 1925-1930	
		Giacomo Indiveri et al., "System Implementations of Analog VLSI Velocity Sensors", 1996 IEEE Proceedings of MicroNeuro '96, pages 15-22	
		Pierre-Francois Rüedi, "Motion Detection Silicon Retina Based on Event Correlations", 1996 IEEE Proceedings of MicroNeuro '96, pages 23-29	
		Revue Trimestrielle Des «Techniques de Lingenieur», "Instantanés Technique" Techniques De ingénieur, Mars 1997-N°5 (40F), ISSN 0994-0758,	
		Es Professionnels de Linformatique En Entreprise Magazine, "Objectif Securite Des Reseaux", N° 24, Janvier, 1997	
		Electroncique International Hebdo, 5 Decembre 1996-N° 245, "Premier... oeil", Francoise Gru svelet (with translation)	
		Nabeel Al Adsani, "For Immediate Release The Generic Visual Perception Processor", October 10, 1997, page 1	
		Colin Johnson, "Vision Chip's Circuitry Has Its Eye Out For You", http://192.215.107.74/wire/news/1997/09/0913vision.html, pages 1-3	
		The Japan Times, :"British firm has eye on the future", Business & Technology, Tuesday, November 18, 1997, 4th Edition	
		Inside the Pentagon's, Inside Missile Defense, an exclusive biweekly report on U.S. missile defense programs, procurement and policymaking, "Missile Technology" Vol. 3, No. 16-August 13, 1997, page 5	
		Electronique, "Le Mechanisme de la Vision Humaine Dans Le Silicium", Electronique Le Mensuel Des Ingenieurs De Conception, Number 68, Mars 1997, ISSN 1157-1151 (with translation)	
		"Elecktronik Revue" ER, Eine Elsevier-Thomas-Publikation, Jahrgang 8, Marz 1997, NR.3, ISSN0939-1134	
		"Un Processor de Perception Visuelle", LehAUT pARLEUR, 25F Des solutions électroniques pour tous, N° 1856, 15 janvier 1997 (with translation)	
		"Realiser Un Decodeur Pour TV Numberique", Electronique, Le Mensuel Des Ingenieurs De Conception, Number 66, Janvier 1997	
		KENICHI YAMADA, et al; "Image Understanding Based on Edge Histogram Method for Rear-End Collision Avoidance System", Vehicle Navigation & Information Systems Conference Proceedings; (1994), pp. 445 450 published 08/31/94; XP 000641348	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

Electronic Acknowledgement Receipt

EFS ID:	1940492
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	30448
Filer:	Gregory A. Nelson/TJ FATUM
Filer Authorized By:	Gregory A. Nelson
Attorney Docket Number:	8042-2-1
Receipt Date:	05-JUL-2007
Filing Date:	20-FEB-2007
Time Stamp:	12:05:10
Application Type:	Utility

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Filed	IDS_070507.pdf	371482	no	5
Warnings:					

Information:	
This is not an USPTO supplied IDS fillable form	
Total Files Size (in bytes):	371482

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New Applications Under 35 U.S.C. 111

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New International Application Filed with the USPTO as a Receiving Office

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/676,926	02/20/2007	PATRICK PIRIM	8042-2-1

CONFIRMATION NO. 9051

30448
AKERMAN SENTERFITT
P.O. BOX 3188
WEST PALM BEACH, FL33402-3188

Title: IMAGE PROCESSING METHOD

Publication No. US-2007-0140526-A1
Publication Date: 06/21/2007

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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Pre-Grant Publication Division, 703-605-4283

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
11/676,926	02/20/2007	2624	425	8042-2-1	7	2

CONFIRMATION NO. 9051

FILING RECEIPT

30448
AKERMAN SENTERFITT
P.O. BOX 3188
WEST PALM BEACH, FL33402-3188

Date Mailed: 03/14/2007

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Applicant(s)

PATRICK PIRIM, Paris, FRANCE;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a DIV of 09/792,294 02/23/2001 PAT 7,181,047

Foreign Applications

If Required, Foreign Filing License Granted: 03/12/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is
US11/676,926

Projected Publication Date: 06/21/2007

Non-Publication Request: No

Early Publication Request: No

** SMALL ENTITY **

Title

IMAGE PROCESSING METHOD

Preliminary Class

382

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO
11/676,926	02/20/2007	2624	425	8042-2-1

CONFIRMATION NO. 9051

FILING RECEIPT

30448
AKERMAN SENTERFITT
P.O. BOX 3188
WEST PALM BEACH, FL33402-3188

Date Mailed: 03/13/2007

Receipt is acknowledged of this regular Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please mail to the Commissioner for Patents P.O. Box 1450 Alexandria Va 22313-1450. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).**

Applicant(s)

PATRICK PIRIM, Paris, FRANCE;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a DIV of 09/792,294 02/23/2001 PAT 7,181,047
which is a CIP of 09/230,502 09/13/1999 PAT 6,486,909 *
which is a CIP of PCT/EP98/05383 08/25/1998
(*)Data provided by applicant is not consistent with PTO records.

Foreign Applications

If Required, Foreign Filing License Granted: 03/12/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is
US11/676,926

Projected Publication Date: 06/21/2007

Non-Publication Request: No

Early Publication Request: No

** SMALL ENTITY **

Title

IMAGE PROCESSING METHOD

Preliminary Class

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PTO/SB/05 (04-05)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	8042-2-1
First Inventor	PIRIM
Title	IMAGE PROCESSING APPARATUS AND METHOD
Express Mail Label No.	N/A

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

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1. ☐ **Fee Transmittal Form** (e.g., PTO/SB/17) *(Submit an original and a duplicate for fee processing)*
2. ☑ **Applicant claims small entity status.** See 37 CFR 1.27.
3. ☑ **Specification** [*Total Pages* 51] Both the claims and abstract must start on a new page *(For information on the preferred arrangement, see MPEP 608.01(a))*
4. ☑ **Drawing(s)** (*35 U.S.C. 113*) [*Total Sheets* 13]
5. **Oath or Declaration** [*Total Sheets* 1]
   a. ☐ Newly executed (original or copy)
   b. ☑ A copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional with Box 18 completed)*
      i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☑ **Application Data Sheet.** See 37 CFR 1.76
7. ☐ **CD-ROM or CD-R** in duplicate, large table or Computer Program *(Appendix)*
   ☐ Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission** *(if applicable, items a. – c. are required)*
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ Paper
   c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ **Assignment Papers** (cover sheet & document(s))
   Name of Assignee
10. ☐ **37 CFR 3.73(b) Statement** *(when there is an assignee)* ☐ **Power of Attorney**
11. ☐ **English Translation Document** *(if applicable)*
12. ☐ **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    ☐ Copies of citations attached
13. ☐ **Preliminary Amendment**
14. ☐ **Return Receipt Postcard** (MPEP 503) *(Should be specifically itemized)*
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16. ☐ **Nonpublication Request** under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. ☑ Other: CHANGE OF CORRESPONDENCE ADDRESS

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*

☐ Continuation ☑ Divisional ☐ Continuation-in-part (CIP) of prior application No.: 09/792,294

Prior application information: *Examiner* UPRETI, ASHUTOSH *Art Unit:* 2624

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Signature	[signature]	Date	FEBRUARY 20, 2007
Name (Print/Type)	GREGORY M. LEFKOWITZ	Registration No. (Attorney/Agent)	56,216

APPLICATION DATA SHEET

(1) Applicant Information

Inventor (1) name:	PIRIM, Patrick
Residence:	Paris, France
Mailing Address:	56 Rue Patay, Paris 75013, France
Citizenship:	France

(2) Correspondence Information

Correspondence Address:	***30448***

(3) Application Information

Title:	IMAGE PROCESSING METHOD
Total No. of Drawing Sheets:	13
Suggested Figure for Publication:	14
Attorney Docket Number:	8042-2-1
Type of Application:	Non-Provisional

(4) Representative Information

Representative Information:	***30448*** Gregory M. Lefkowitz, Registration No. 56,216 AKERMAN SENTERFITT P.O. Box 3188 West Palm Beach, FL 33402-3188 Telephone: (561) 653 5000

(5) Domestic Priority Information	U.S. Application No. 09/792,294, filed February 23, 2001, now US Patent No. 7,181,047; US Application No. 09/230,502, filed January 26, 1999, now US Patent No. 6,486,909
(6) Foreign Priority Information	International Application No. PCT/EP98/05383, filed August 25, 1998

A .ey Docket No.: 200461I-000310US
Client Referen... No.: 704K PCT 380 AM/XCDF/Mjb

JAN 0 9 2002 PE JC125 PATENT & TRADEMARK OFFICE

DECLARATION

As a below named inventor, I declare that:

My residence, post office address and citizenship are as stated below next to my name; I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **IMAGE PROCESSING APPARATUS AND METHOD** the specification of which ____ is attached hereto or _X_ was filed on February 23, 2001 as Application No. 09/792,294 and was amended on ______________ (if applicable).

I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56. I claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Country	Application No.	Date of Filing	Priority Claimed Under 35 USC 119

I claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application No.	Date of Filing	Status
09/230,502	01/26/1999	
PCT/EP98/05383	08/25/1998	

Full Name of Inventor 1:	Last Name: PIRIM	First Name: PATRICK	Middle Name or Initial:	
Residence & Citizenship:	City: Paris	State/Foreign Country: France	Country of Citizenship: France	
Post Office Address:	Post Office Address: 56 Rue Patay	City: Paris	State/Country: France	Postal Code: 75013

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature of Inventor 1

[signature]

Patrick Pirim

Date 2-11-2001

SF 1235314 v1

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Application

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Application Number	
Filing Date	FEBRUARY 20, 2007
First Named Inventor	PIRIM
Art Unit	
Examiner Name	
Attorney Docket Number	8042-2-1

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I am the:

☐ Applicant/Inventor

☐ Assignee of record of the entire interest.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

☑ Attorney or agent of record. Registration Number 56,216.

☐ Registered practitioner named in the application transmittal letter in an application without an executed oath or declaration. See 37 CFR 1.33(a)(1). Registration Number________.

Signature	[signature]
Typed or Printed Name	GREGORY M. LEFKOWITZ
Date FEBRUARY 20, 2007	Telephone 561-653-5000

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☑ *Total of 1 forms are submitted.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of PIRIM

Application No. Examiner:

Date Filed: February 20, 2007 Group Art Unit:

For: IMAGE PROCESSING APPARATUS AND METHOD

PRELIMINARY AMENDMENT

Commissioner for Patents
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Alexandria, VA 22313-1450

Sir:

Prior to examination on the merits, entry of the following amendments is respectfully requested.

Amendments to the Specification begin on page 2.

Amendments to the Claims appear in the Claim Listing which begins on page 3.

Remarks begin on page 6.

AMENDMENTS TO THE SPECIFICATION

On page 1, the title of the invention:

IMAGE PROCESSING ~~APPARATUS AND~~ METHOD

On page 1, before the section entitled "BACKGROUND OF THE INVENTION ", insert the following:

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the priority of U.S. Application No. 09/792,294, filed February 23, 2001, now US Patent No. 7,181,047; which claims priority to US Application No. 09/230,502, filed January 26, 1999, now US Patent No. 6,486,909; which claims priority to International Application No. PCT/EP98/05383, filed August 25, 1998; all of which are incorporated herein by reference in their entirety.

CLAIM LISTING

1.–50. (Cancelled)

51. (New) A process for tracking a target in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process comprising: selecting a pixel of the target as a starting pixel; on a frame-by-frame basis:

forming a tracking box around the starting pixel and for each pixel of the input signal in the tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

successively increasing the size of the tracking box and for each pixel of the input signal, in each successive tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

determining when the target is substantially within the tracking box;

stopping the size increasing of said tracking box; and

adjusting the center of the tracking box based upon the histograms.

52. (New) The process according to claim 51, comprising centering the tracking box relative to the optical axis of the image.

53. (New) The process according to claim 51, comprising calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and

intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame.

54. (New) A process of tracking a target in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process comprising, on a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target, and identifying the target from said at least one histogram.

55. (New) The process according to claim 54 further comprising drawing a tracking box around the target.

56. (New) The process according to claim 54, comprising centering the tracking box relative to the optical axis of the image.

57. (New) The process according to claim 54, comprising calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame.

REMARKS

By this Preliminary Amendment, Applicant has added the appropriate priority data. Additionally, claims 1-50 have been cancelled and claims 42-45 and 50 have been re-written as new claims 51-57 for clarity. No new matter has been added by virtue of this amendment.

The Examiner is invited to contact the undersigned if it is believed that a telephone conference would expedite the prosecution of the subject application. Although no fee is believed to be due, the Commissioner is hereby authorized to charge any underpayment to Deposit Account No. 50-0951.

Date: February 20, 2007

Respectfully submitted,

J. Rodman Steele, Jr.
Registration No. 25,931
Gregory M. Lefkowitz
Registration No. 56,216
Post Office Box 3188
West Palm Beach, FL 33402-3188
Telephone: (561) 653-5000

Docket No. 8042-2-1

IMAGE PROCESSING APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to an image processing apparatus, and more particularly to a method and apparatus for identifying and localizing an area in relative movement in a scene and determining the speed and oriented direction of the area in real time.

2. Description of the Related Art

The human or animal eye is the best known system for identifying and localizing an object in relative movement, and for determining its speed and direction of movement. Various efforts have been made to mimic the function of the eye. One type of device for this purpose is referred to as an artificial retina, which is shown, for example, in Giocomo Indiveri et. al, Proceedings of MicroNeuro, 1996, pp. 15-22 (analog artificial retina), and Pierre-Francois Ruedii, Proceedings of MicroNeuro, 1996, pp. 23-29, (digital artificial retina which identifies the edges of an object). However, very fast and high capacity memories are required for these devices to operate in real time, and only limited information is obtained about the moving areas or objects observed Other examples of artificial retinas and similar devices are shown in U S. Patent Nos. 5, 694, 495 and 5, 712, 729.

Another proposed method for detecting objects in an image is to store a frame from a video camera or other observation sensor in a first two-dimensional memory. The frame is composed of a sequence of pixels representative of the scene observed by the camera at time to. The video signal for the next frame, which represents the scene at time t0 is stored in a second two-dimensional memory. If an object has moved between times to and t0 the distance d by which the object, as represented by its pixels, has moved in the scene between t, and to is determined. The displacement speed is then equal to d/T, where T = t1 - t0. This type of system requires a very large memory capacity if it is used to obtain precise speed and oriented direction. Information for the movement of the object. There is also a delay in obtaining the speed and displacement direction information corresponding to t1 + R, where R is the time necessary for the calculations for the period t0 – t1 system.

These two disadvantages limit applications of this type of system.

Another type of prior image processing system is shown in French Patent No. 2, 611, 063, of which the inventor hereof is also an inventor. This patent relates to a method and apparatus for real time processing of a sequenced data flow from the output of a camera in order to perform data compression. A histogram of signal levels from the camera is formed using a first sequence classification law. A representative Gaussian function associated with the histogram is stored, and the maximum and minimum levels are extracted. The signal levels of the next sequence are compared with the signal levels for the first sequence using a fixed time constant identical for each pixel. A binary classification signal is generated that characterizes the next sequence with reference to the classification law An auxiliary signal is generated from the binary signal that is representative of the duration and position of a range of significant values. Finally, the auxiliary signal is used to generate a signal localizing the range with the longest duration, called the dominant range. These operations are repeated for subsequent sequences of the sequenced signal.

This prior process enables data compression, keeping only interesting parameters in the processed flow of sequenced data. In particular, the process is capable of processing a digital video signal in order to extract and localize at least one characteristic of at least one area in the image. It is thus possible to classify, for example, brightness and/or chrominance levels of the signal and to characterize and localize an object in the image.

Another system is also known from WO 98/05002, of which the inventor hereof is also an inventor. This system enables real time detection, location and determination of the speed and direction of movement of an area of relative movement in a scene. It includes a time processing unit of a spatial processing unit in order to determine said speed and direction of movement.

U. S. Patent No. 5, 488, 430 detects and estimates a displacement by separately determining horizontal and vertical changes of the observed area. Difference signals are used to detect movements from right to left or from left to right, or from top to bottom or bottom to top, in the horizontal and vertical directions respectively. This is accomplished by carrying out an EXCLUSIVE OR function on horizontal/vertical difference signals and on frame difference signals, and by using a ratio of the sums of the horizontal/vertical signals and the sums of frame difference signals with respect to a K x 3 window. Calculated values of the image along orthogonal horizontal and vertical directions are used with an identical repetitive difference K in the orthogonal directions, this difference K being defined as a function of the displacement speeds that are to be determined. The device determines the direction of movement along each of the two orthogonal directions by applying a set of calculation operations to the difference signals, which requires very complex computations. Additional complex computations are also necessary to obtain the speed and oriented direction of displacement (extraction of a square root to obtain the amplitude of the speed, and calculation of the arctan function to obtain the oriented direction), starting from projections on the horizontal and vertical axes. This device also does not smooth the pixel values using a time constant, especially a time constant that is variable for each pixel, in order to compensate for excessively fast variations in the pixel values.

Finally, Alberto Tomita Sales Representative. and Rokuva Ishii, "Hand Shape Extraction from a Sequence of Digitized Gray-Scale Images," Institute of Electrical and Electronics Engineers, Vol. 3,1994, pp. 1925-1930, detects movement by subtracting between successive images, and forming histograms based upon the shape of a human hand in order to extract the shape of a human hand in a digitized scene. The histogram analysis is based upon a gray scale inherent to the human hand. It does not include any means of forming histograms in the plane coordinates. The sole purpose of the method is to detect the displacement of a human hand, for example, in order to replace the normal computer mouse by a hand, the movements of which are identified to control a computer.

It would be desirable to have an image processing system which has a relatively simple structure and requires a relatively small memory capacity, and by which information on the movement of objects within an image can be obtained in real-time. It would also be desirable to have a method and apparatus for detecting movements that are not limited to the hand, but to any object (in the widest sense of the term) in a scene, and which does not use histograms based on the gray values of a hand, but rather the histograms of different variables representative of the displacement and histograms of plane coordinates. Such a system would be applicable to many types of applications requiring the detection of moving and non-moving objects.

SUMMARY OF THE INVENTION

The present invention is a process for identifying relative movement of an object in an input signal, the input signal having a succession of frames, each frame having a succession of pixels. For each pixel of the input signal, the input signal is smoothed using a time constant for the pixel in order to generate a smoothed input signal. For each pixel in the smoothed input signal, a binary value corresponding to the existence of a significant variation in the amplitude of the pixel between the current frame and the immediately previous smoothed input frame, and the amplitude of the variation, are determined.

Using the existence of a significant variation for a given pixel, the time constant for the pixel, which is to be used in smoothing subsequent frames of the input signal, is modified. The time constant is preferably in the form 2^p, and is increased or decreased by incrementing or decrementing p. For each particular pixel of the input signal, two matrices are then formed: a first matrix comprising the binary values of a subset of the pixels of the frame spatially related to the particular pixel; and a second matrix comprising the amplitude of the variation of the subset of the pixels of the frame spatially related to the particular pixel. In the first matrix, it is determined whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and, for such pixels, it is determined in the second matrix whether the amplitude of the pixels along the oriented direction relative to the particular pixel varies in a known manner indicating movement in the oriented direction of the particular pixel and the pixels along the oriented direction relative to the particular pixel. The amplitude of the variation of the pixels along the oriented direction determines the velocity of movement of the particular pixel and the pixels along the oriented direction relative to the particular pixel.

In each of one or more domains, a histogram of the values distributed in the first and second matrices falling in each such domain is formed. For a particular domain, an area of significant variation is determined from the histogram for that domain. Histograms of the area of significant variation along coordinate axes are then formed. From these histograms, it is determined whether there is an area in movement for the particular domain. The domains are preferably selected from the group consisting of i) luminance, ii) speed (V), iii) oriented direction (D1), iv) time constant (CO), v) hue, vi) saturation, and vii) first axis (x(m)), and viii) second axis (y(m)).

In one embodiment, the first and second matrices are square matrices, with the same odd number of rows and columns, centered on the particular pixel. In this embodiment, the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested n x n matrices, where n is odd, centered on the particular pixel to the pixels within each of the first and second matrices. The process then includes the further step of determining the smallest nested matrix in which the amplitude signal varies along an oriented direction around the particular pixel.

In an alternative embodiment, the first and second matrices are hexagonal matrices centered on the particular pixel. In this embodiment, the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested hexagonal matrices of varying size centered on the particular pixel to the pixels within each of the first and second matrices. The process then further includes determining the smallest nested matrix in which the amplitude signal varies along an oriented direction around the particular pixel.

In a still further embodiment of the invention, the first and second matrices are inverted L-shaped matrices with a single row and a single column. In this embodiment, the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested n x n matrices, where n is odd, to the single line and the single column to determine the smallest matrix in which the amplitude varies on a line with the steepest slope and constant quantification.

If desired, successive decreasing portions of frames of the input signal may be considered using a Mallat time-scale algorithm, and the largest of these portions, which provides displacement, speed and orientation indications compatible with the value of p, is selected.

In a process of smoothing an input signal, for each pixel of the input signal, i) the pixel is smoothed using a time constant (CO) for that pixel, thereby generating a smoothed pixel value (LO), ii) it is determined whether there exists a significant variation between such pixel and the same pixel in a previous frame, and iii) the time constant (CO) for such pixel to be used in smoothing the pixel in subsequent frames of the input signal is modified based upon the existence or non-existence of a significant variation.

The step of determining the existence of a significant variation for a given pixel preferably comprises determining whether the absolute value of the difference (AB) between the given pixel value (PI) and the value of such pixel in a smoothed prior frame (LI) exceeds a threshold (SE). The step of smoothing the input signal preferably comprises, for each pixel, i) modifying the time constant (CO) for pixel such based upon the existence of a significant variation as determined in the prior step, and ii) determining a smoothed value for the pixel (LO) as follows:

$$LO = LI + \frac{PI - LI}{CO}$$

Time constant (CO) is preferably in the form 2^p, and p is incremented in the event that AB < SE and decremented in the event AB >= SE.

In this process, the system generates an output signal comprising, for each pixel, a binary value (DP) indicating the existence or non-existence of a significant variation, and the value of the time constant (CO). The binary values (DP) and the time constants (CO) are preferably stored in a memory sized to correspond to the frame size.

A process for identifying an area in relative movement in an input signal includes the steps of:

generating a first array indicative of the existence of significant variation in the magnitude of each pixel between a current frame and a prior frame;

generating a second array indicative of the magnitude of significant variation of each pixel between the current frame and a prior frame;

establishing a first moving matrix centered on a pixel under consideration and comprising pixels spatially related to the pixel under consideration, the first moving matrix traversing the first array for consideration of each pixel of the current frame; and

determining whether the pixel under consideration and each pixel of the pixels spatially related to the pixel under consideration along an oriented direction relative thereto within the first matrix are a particular value representing the presence of significant variation, and if so, establishing in a second matrix within the first matrix, centered on the pixel under consideration, and determining whether the amplitude of the pixels in the second matrix spatially related to the pixel under consideration along an oriented direction relative thereto are indicative of movement along such oriented direction, the amplitude of the variation along the oriented direction being indicative of the velocity of movement, the size of the second matrix being varied to identify the matrix size most indicative of movement.

The process further comprises, in at least one domain selected from the group consisting of i) luminance, ii) speed (V), iii) oriented direction (DI), iv) time constant (CO), v) hue, vi) saturation, and vii) first axis (x(m)), and viii) second axis (y(m)), and ix) data characterized by external inputs, forming a first histogram of the values in such domain for pixels indicative of movement along an oriented direction relative to the pixel under consideration. If desired, for the pixels in the first histogram, histograms of the position of such pixels along coordinate axes may be formed, and from such histograms, an area of the image meeting criteria of the at least one domain may be determined.

A process for identifying pixels in an input signal in one of a plurality of classes in one of a plurality of domains comprises, on a frame-by-frame basis:

for each pixel of the input signal, analyzing the pixel and providing an output signal for each domain containing information to identify each domain in which the pixel is classified;

providing a classifier for each domain, the classifier enabling classification of pixels within each domain to selected classes within the domain;

providing a validation signal for the domains, the validation signal selecting one or more of the plurality of domains for processing; and

forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal.

The process further includes the steps of forming histograms along coordinate axes for the pixels within the classes selected by the classifier within each domain selected by the validation signal, and forming a composite signal corresponding to the spatial position of such pixels within the frame. Pixels falling within limits l_a, l_b, l_c, l_d in the histograms along the coordinate axes are then identified, and a composite signal from the pixels falling within these limits is formed.

A process for identifying the velocity of movement of an area of an input signal comprises:

for each particular pixel of the input signal, forming a first matrix comprising binary values indicating the existence or non-existence of a significant variation in the amplitude of the pixel signal between the current frame and a prior frame for a subset of the pixels of the frame spatially related to such particular pixel, and a second matrix comprising the amplitude of such variation;

determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and, for such pixels, determining in the second matrix whether the amplitudes of the pixels along an oriented direction relative to the particular pixel vary in a known manner indicating movement of the pixel and the pixels along an oriented direction relative to the particular pixel, the amplitude of the variation along the oriented direction determining the velocity of movement of the particular pixel.

A process for identifying a non-moving area in an input signal comprises:

forming histograms along coordinate axes for pixels of the input signal without significant variation between the current frame and a prior frame; and

forming a composite signal corresponding to the spatial position of such pixels within the frame.

An apparatus for identifying relative movement in an input signal comprises:

means for smoothing the input signal using a time constant for each pixel, thereby generating a smoothed input signal;

means for determining for each pixel in the smoothed input signal a binary value corresponding to the existence of a significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame, and for determining the amplitude of the variation;

means for using the existence of a significant variation for a given pixel to modify the time constant for the pixel to be used in smoothing subsequent frames of the input signal;

means for forming a first matrix comprising the binary values of a subset of the pixels of the frame spatially related to each particular pixel, and for forming a second matrix comprising the amplitude of the variation of the subset of the pixels of the frame spatially related to such particular pixel;

means for determining in the first matrix a particular area in which the binary value for each pixel is a particular value representing significant variation, and, for such particular area, for determining in the second matrix whether the amplitude varies along an oriented direction relative to the particular pixel in a known manner indicating movement of the pixel in the oriented direction, the amplitude of the variation along the oriented direction determining the velocity of movement of the pixel.

An apparatus for smoothing an input signal comprises:

means for smoothing each pixel of the input signal using a time constant (CO) for such pixel, thereby generating a smoothed pixel value (LO);

means for determining the existence of a significant variation for a given pixel, and modifying the time constant (CO) for the pixel to be used in smoothing the pixel in subsequent frames of the input signal based upon the existence of such significant variation.

An apparatus for identifying an area in relative movement in an input signal comprises:

means for generating a first array indicative of the existence of significant variation in the magnitude of each pixel between a current frame and a prior frame;

means for generating a second array indicative of the magnitude of significant variation of each pixel between the current frame and a prior frame;

means for establishing a first moving matrix centered on a pixel under consideration and comprising pixels spatially related to the pixel under consideration, the first moving matrix traversing the first array for consideration of each pixel of the current frame;

means for determining whether the pixel under consideration and each pixel along an oriented direction relative to the pixel under consideration within the first matrix is a particular value representing the presence of significant variation, and if so, for establishing a second matrix within the first matrix, centered on the pixel under consideration, and for determining whether the amplitude of the pixels in the second matrix are indicative of movement along an oriented direction relative to the pixel under consideration, the amplitude of the variation along the oriented direction being indicative of the velocity of movement, the size of the second matrix being varied to identify the matrix size most indicative of movement.

An apparatus for identifying pixels in an input signal in one of a plurality of classes in one of a plurality of domains comprises:

means for analyzing each pixel of the input signal and for providing an output signal for each domain containing information to identify each domain in which the pixel is classified;

a classifier for each domain, the classifier classifying pixels within each domain in selected classes within the domain;

a linear combination unit for each domain, the linear combination unit generating a validation signal for the domain, the validation signal selecting one or more of the plurality of domains for processing; and

means for forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal.

An apparatus for identifying the velocity of movement of an area of an input signal comprises:

means for determining for each pixel in the input signal a binary value corresponding to the existence of a significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame, and for determining the amplitude of the variation,

means for forming, for each particular pixel of the input signal, a first matrix comprising the binary values of a subset of the pixels spatially related to such particular pixel, and a second matrix comprising the amplitude of the variation of the subset of the pixels spatially related to such particular pixel; and

means for determining in the first matrix whether for a particular pixel, and other pixels along an oriented direction relative to the particular pixel, the binary value for each pixel is a particular value representing significant variation, and, for such particular pixel and other pixels, determining in the second matrix whether the amplitude varies along an oriented direction relative to the particular pixel in a known manner indicating movement of the pixel and the other pixels, the amplitude of the variation along the oriented direction determining the velocity of movement of the pixel and the other pixels.

An apparatus for identifying a non-moving area in an input signal comprises:

means for forming histograms along coordinate axes for pixels of a current frame without a significant variation from such pixels in a prior frame; and

means for forming a composite signal corresponding to the spatial position of such pixels within the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagrammatic illustration of the system according to the invention.

Fig. 2 is a block diagram of the temporal and spatial processing units of the invention.

Fig. 3 is a block diagram of the temporal processing unit of the invention.

Fig. 4 is a block diagram of the spatial processing unit of the invention.

Fig. 5 is a diagram showing the processing of pixels in accordance with the invention.

Fig. 6 illustrates the numerical values of the Freeman code used to determine movement direction in accordance with the invention.

Fig. 7 illustrates two nested matrices as processed by the temporal processing unit.

Fig. 8 illustrates hexagonal matrices as processed by the temporal processing unit.

Fig. 9 illustrates reverse-L matrices as processed by the temporal processing unit.

Fig. 9a illustrates angular sector shaped matrices as processed by the temporal processing unit.

Fig. 10 is a block diagram showing the relationship between the temporal and spatial processing units, and the histogram formation units.

Fig. 11 is a block diagram showing the interrelationship between the various histogram formation units.

Fig. 12 shows the formation of a two-dimensional histogram of a moving area from two one-dimensional histograms.

Fig. 13 is a block diagram of an individual histogram formation unit.

Fig. 14 illustrates the use of the classifier for finding an alignment of points relative to the direction of an analysis axis.

Fig. l4a illustrates a one-dimensional histogram.

Fig. 15 illustrates the use of the system of the invention for video-conferencing.

Fig. 16 is a top view of the system of the invention for video-conferencing.

Fig. 17 is a diagram illustrating histograms formed on the shape of the head of a participant in a video conference.

Fig. 18 illustrates the system of the invention eliminating unnecessary information in a video-conferencing application.

Fig. 19 is a block diagram showing use of the system of the invention for target tracking.

Fig. 20 is an illustration of the system of the invention selecting a target for tracking.

Figs. 21-23 illustrate the system of the invention locking on to a selected target.

Fig. 24 illustrates the processing of the system using a Mallat diagram.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a method and apparatus for detection of relative movement or non-movement of an area within an image. Relative movement, as used herein, means movement of an area, which may be an "object" in the broadest sense of the term, e.g., a person, a portion of a person, or any animals or inanimate object, in an approximately motionless environment, or approximate immobility of an area in an environment that is at least partially in movement.

Referring to Fig. 1, image processing system 11 includes an input 12 that receives a digital video signal S originating from a video camera or other imaging device 13 which monitors a scene 13a. Imaging device 13 is preferably a conventional CMOS type CCD camera. It is, however, foreseen that the system of the invention may be used with any appropriate sensor e.g., ultrasound, IR, Radar, tactile array, etc., that generates an output in the form of an array of information corresponding to information observed by the imaging device. Imaging device 13 may have a direct digital output, or an analog output that is converted by an A/D converter into digital signal S.

While signal S may be a progressive signal, in a preferred embodiment, in which imaging device 13 is a conventional video camera, signal S is composed of a succession of pairs of interlaced frames, TR_1 and TR'_1 and TR_2 and TR'_2, each consisting of a succession of horizontal scanned lines, e.g. $l_{1.1}$, $l_{1.2}$, ...,$l_{1.17}$ in TR_1 and $l_{2.1}$ in TR_2. Each line consists of a succession of pixels or image-points PI, e.g., a1.1, a1.2 and a1.3, for line l1.1; al17.1 and al7.22 for line l1.17; al1.1 and a1.2 for line l2.1. Signal S(PI) represents signal S composed of pixels PI.

As known in the art, S(PI) includes a frame synchronization signal (ST) at the beginning of each frame, a line synchronization signal (SL) at the beginning of each line, and a blanking signal (BL). Thus, S(PI) includes a succession frames, which are representative of the time domain, and within each frame, a series of lines and pixels, which are representative of the spatial domain.

In the time domain, "successive frames" shall refer to successive frames of the same type (i. e. , odd frames such as TR1, or even frames such as TR'l), and "successive pixels in the same position" shall denote successive values of the pixels (PI) in the same location in successive frames of the same type, e.g., a1.1 of l1.1 in frame TR1 and a1.1 of l1.1 in the next corresponding frame TR2.

Image processing system 11 generates outputs ZH and SR 14, which are preferably digital signals. Complex signal ZH comprises a number of output signals generated by the system, preferably including signals indicating the existence and localization of an area or object in motion, and the speed V and the oriented direction of displacement DI of pixels of the image. Also output from the system, if desired, is input digital video signal S, which is delayed (SR) to make it synchronous with the output ZH for the frame, taking into account the calculation time for the data in composite signal ZH (one frame). The delayed signal SR is used to display the image received by camera 13 on a monitor or television screen 10, which may also be used to display the information contained in composite signal ZH. Composite signal ZH may also be transmitted to a separate processing assembly 10a in which further processing of the signal may be accomplished.

Referring to Fig. 2, image processing system 11 includes a first assembly 11a, which consists of a temporal processing unit 15 having an associated memory 16, a spatial processing unit 17 having a delay unit 18 and sequencing unit 19, and a pixel clock 20, which generates a clock signal HP, and which serves as a clock for temporal processing unit 15 and sequencing unit 19. Clock pulses HP are generated by clock 20 at the pixel rate of the image, which is preferably 13.5 MHZ.

Fig. 3 shows the operation of temporal processing unit 15, the function of which is to smooth the video signal and generate a number of outputs that are utilized by spatial processing unit 17. During processing, temporal processing unit 15 retrieves from memory 16 the smoothed pixel values LI of the digital video signal from the immediately prior frame, and the values of a smoothing time constant CI for each pixel. As used herein, LO and CO shall be used to denote the pixel values (L) and time constants (C) stored in memory 16 from temporal processing unit 15, and LI and CI shall denote the pixel values (L) and time constants (C) respectively for such values retrieved from memory 16 for use by temporal processing unit 15. Temporal processing unit 15 generates a binary output signal DP for each pixel, which identifies whether the pixel has undergone significant variation, and a digital signal CO, which represents the updated calculated value of time constant C.

Referring to Fig. 3, temporal processing unit 15 includes a first block 15a which receives the pixels PI of input video signal S. For each pixel PI, the temporal processing unit retrieves from memory 16 a smoothed value LI of this pixel from the immediately preceding corresponding frame, which was calculated by temporal processing unit 15 during processing of the immediately prior frame and stored in memory 16 as LO. Temporal processing unit 15 calculates the absolute value AB of the difference between each pixel value PI and LI for the same pixel position (for example $a_{1,1}$ of $I_{1,1}$ in TR_1 and of $I_{1,1}$ in TR_2:

$$AB = |PI - LI|$$

Temporal processing unit 15 is controlled by clock signal HP from clock 20 in order to maintain synchronization with the incoming pixel stream. Test block 15b of temporal processing unit 15 receives signal AB and a threshold value SE. Threshold SE may be constant, but preferably varies based upon the pixel value PI, and more preferably varies with the pixel value so as to form a gamma correction. Known means of varying SE to form a gamma correction is represented by the optional block 15e shown in dashed lines. Test block 15b compares, on a pixel-by-pixel basis, digital signals AB and SE in order to determine a binary signal DP. If AB exceeds threshold SE, which indicates that pixel value PI has undergone significant variation as compared to the smoothed value LI of the same pixel in the prior frame, DP is set to "1" for the pixel under consideration. Otherwise, DP is set to "0" for such pixel.

When DP = 1, the difference between the pixel value PI and smoothed value LI of the same pixel in the prior frame is considered too great, and temporal processing unit 15 attempts to reduce this difference in subsequent frames by reducing the smoothing time constant C for that pixel. Conversely, if DP = 0, temporal processing unit 15 attempts to increase this difference in subsequent frames by increasing the smoothing time constant C for that pixel. These adjustments to time constant C as a function of the value of DP are made by block 15c. If DP = 1, block 15c reduces the time constant by a unit value U so that the new value of the time constant CO equals the old value of the constant CI minus unit value U.

$$CO = CI - U$$

If DP = 0, block 15c increases the time constant by a unit value U so that the new value of the time constant CO equals the old value of the constant CI plus unit value U.

$$CO = CI + U$$

Thus, for each pixel, block 15c receives the binary signal DP from test unit 15b and time constant CI from memory 16, adjusts CI up or clown by unit value U, and generates a new time constant CO which is stored in memory 16 to replace time constant CI.

In a preferred embodiment, time constant C, is in the form 2^P, where p is incremented or decremented by unit value U, which preferably equals 1, in block 15c. Thus, if DP = 1, block 15c subtracts one (for the case where U=1) from p in the time constant 2^P which becomes 2^{P-1}. If DP = 0, block 15c adds one to p in time constant 2^P, which becomes 2^{P+1}. The choice of a time constant of the form 2^P facilitates calculations and thus simplifies the structure of block 15c.

Block 15c includes several tests to ensure proper operation of the system. First, CO must remain within defined limits. In a preferred embodiment, CO must not become negative (CO >= 0) and it must not exceed a limit N (CO <= N), which is preferably seven. In the instance in which CI and CO are in the form 2^P, the upper limit N is the maximum value for p.

The upper limit N may either be constant or variable. If N is variable, an optional input unit 15f includes a register or memory that enables the user, or another controller to vary N. The consequence of increasing N is to increase the sensitivity of the system to detecting displacement of pixels, whereas reducing N improves detection of high speeds. N may be made to depend on PI (N may vary on a pixel-by-pixel basis, if desired) in order to regulate the variation of LO as a function of the lever of PI, i.e., $N_{ijt} = f(PI_{ijt})$, the calculation of which is done in block 15f, which in this case would receive the value of PI from video camera 13.

Finally, a calculation block 15d receives, for each pixel, the new time constant CO generated in block 15c, the pixel values PI of the incoming video signal S, and the smoothed pixel value LI of the pixel in the previous frame from memory 16. Calculation block 15d then calculates a new smoothed pixel value LO for the pixel as follows:

$$LO = LI + (PI - LI)/CO$$

If $CO = 2^p$, then

$$LO = LI + (PI - LI)/2^{po}$$

where "po", is the new value of p calculated in unit 15c and which replaces previous value of "pi" in memory 16.

The purpose of the smoothing operation is to normalize variations in the value of each pixel PI of the incoming video signal for reducing the variation differences. For each pixel of the frame, temporal processing unit 15 retrieves LI and CI from memory 16, and generates new values LO (new smoothed pixel value) and CO (new time constant) that are stored in memory 16 to replace LI and CI respectively. As shown in Fig. 2, temporal processing unit 15 transmits the CO and DP values for each pixel to spatial processing unit 17 through the delay unit 18.

The capacity of memory 16 assuming that there are R pixels in a frame, and therefore 2R pixels per complete image, must be at least 2R(e+f) bits, where e is the number of bits required to store a single pixel value LI (preferably eight bits), and f is the number of bits required to store a single time constant CI (preferably 3 bits). If each video image is composed of a single frame (progressive image), it is sufficient to use R(e+f) bits rather than 2R(e+f) bits.

Spatial processing unit 17 is used to identify an area in relative movement in the images from camera 13 and to determine the speed and oriented direction of the movement. Spatial processing unit 17, in conjunction with delay unit 18, cooperates with a control unit 19 that is controlled by clock 20, which generates clock pulse HP at the pixel frequency. Spatial processing unit 17 receives signals DP_{ij} and CO_{ij} (where i and j correspond to the x and y coordinates of the pixel) from temporal processing unit 15 and processes these signals as discussed below. Whereas temporal processing unit 15 processes pixels within each frame, spatial processing unit 17 processes groupings of pixels within the frames.

Fig. 5 diagrammatically shows the temporal processing of successive corresponding frame sequences TR_1 TR_2, TR_3 and the spatial processing in the these frames of a pixel PI with coordinates x, y, at times t_1 t_2, and t_3. A plane in Fig. 5 corresponds to the spatial processing of a frame, whereas the superposition of frames corresponds to the temporal processing of successive frames.

Signals DP_{ij} and CO_{ij} from temporal processing unit 15 are distributed by spatial processing unit 17 into a first matrix 21 containing a number of rows and columns much smaller than the number of lines L of the frame and the number of pixels M per line. Matrix 21 preferably includes 2l+1 lines along the y axis and 2m+1 columns along the x axis (in Cartesian coordinates), where l and m are small integer numbers. Advantageously, l and m are chosen to be powers of 2, where for example 1 is equal to 2^a and m is equal to 2^b, a and b being integer numbers of about 2 to 5, for example. To simplify the drawing and the explanation, m will be taken to be equal to l (although it may be different) and m = l = 2^3 = 8. In this case, matrix 21 will have 2 x 8 + 1 = 17 rows and 17 columns. Fig. 4 shows a portion of the 17 rows Y_0, Y_1,... Y_{15}, Y_{16} and 17 columns X_0, X_1,... X_{15}, X_{16} which form matrix 21.

Spatial processing unit 17 distributes into 1 x m matrix 21 the incoming flows of DP_{ijt} and CO_{ijt} from temporal processing unit 15. It will be appreciated that only a subset of all DP_{ijt} and CO_{ijt} values will be included in matrix 21, since the frame is much larger, having L lines and M pixels per row (e.g., 312.5 lines and 250-800 pixels), depending upon the TV standard used.

In order to distinguish the L x M matrix of the incoming video signal from the l x m matrix 21 of spatial processing unit 17, the indices i and j will be used to represent the coordinates of the former matrix (which will only be seen when the digital video signal is displayed on a television screen or monitor) and the indices x and y will be used to represent the coordinates of the latter. At a given instant, a pixel with an instantaneous value PI_{ijt} is characterized at the input of the spatial processing unit 17 by signals DP_{ijt} and CO_{ijt}. The (2*l*+1)x(2m+1) matrix 21 is formed by scanning each of the L x M matrices for DP and CO.

In matrix 21, each pixel is defined by a row number between 0 and 16 (inclusive), for rows Y_0 to Y_{16} respectively, and a column number between 0 and 16 (inclusive), for columns X_0 to X_{16} respectively, in the case in which *l* = m = 8. In this case, matrix 21 will be a plane of 17 x 17 = 289 pixels.

In Fig. 4, elongated horizontal rectangles Y_0 to Y_{16} (only four of which have been shown, i.e., Y_0, Y_1, Y_{15} and Y_{16}) and vertical lines X_0 to X_{16} (of which only four have been shown, i.e., X_0, X_1, X_{15} and X_{16}) illustrate matrix 21 with 17 x 17 image points or pixels having indices defined at the intersection of an ordinate row and an abscissa column. For example, the P_{88} is at the intersection of column 8 and row 8 as illustrated in Fig. 4 at position e, which is the center of matrix 21.

In response to the HP and BL signals from clock 20 (Fig. 2), a rate control or sequencing unit 19: i) generates a line sequence signal SL at a frequency equal to the quotient of 13.5 MHZ (for an image with a corresponding number of pixels) divided by the number of columns per frame (for example 400) to delay unit 18, ii) generates a frame signal SC, the frequency of which is equal to the quotient 13.5/400 MHZ divided by the number of rows in the video image, for example 312. 5, iii) and outputs the HP clock signal. Blanking signal BL is used to render sequencing unit 19 non-operational during synchronization signals in the input image.

A delay unit 18 carries out the distribution of portions of the L x M matrix into matrix 21. Delay unit 18 receives the DP, CO, and incoming pixel S(PI) signals, and distributes these into matrix 21 using clock signal HP and line sequence and column sequence signals SL and SC.

In order to form matrix 21 from the incoming stream of DP and CO signals, the successive rows Y_0 to Y_{16} for the DP and CO signals must be delayed as follows:

row Y_0 - not delayed;

row Y_1 - delayed by the duration of a frame line TP;

row Y_2 - delayed by 2 TP;
and so on until
row Y_{16} - delayed by 16 TP.

The successive delays of the duration of a frame row TP, are carried out in a cascade of sixteen delay circuits $r_1, r_2, \ldots r_{16}$ that serve rows $Y_1, Y_2 \ldots Y_{16}$, respectively, row Y0 being served directly by the DP and CO signals without any delay upon arriving from temporal processing unit 15. All delay circuits r_1, r_2, ... r_{16} may be built up by a delay line with sixteen outputs, the delay imposed by any section thereof between two successive outputs being constant and equal to TP.

Rate control unit 19 controls the scanning of the entire L x M frame matrix over matrix 21. The circular displacement of pixels in a row of the frame matrix on the 17 x 17 matrix, for example from X_0 to X_{16} on row Y0, is done by a cascade of sixteen shift registers d on each of the 17 rows from Y_0 to Y_{16} (giving a total of 16 x 17 = 272 shift registers) placed in each row between two successive pixel positions, namely the register d_{01} between positions PI_{00} and PI_{01} register d_{02} between positions PI_{01} and PI_{02}, etc. Each register imposes a delay TS equal to the time difference between two successive pixels in a row or line, using column sequence signal SC. Because rows l_1, l_2 ... l_{17} in a frame TR1 (Fig. l), for S(PI) and for DP and CO, reach delay unit 18 shifted by TP (complete duration of a row) one after the other, and delay unit 18 distributes them with gradually increasing delays of TP onto rows Y_0, Y_1 ... Y_{17}, these rows display the DP and CO signals at a given time for rows l_1, l_2 ... l_{17} in the same frame portion. Similarly in a given row, e.g., l_1, successive pixel signals $a_{1.1}$, $a_{1.2}$ ... arrive shifted by TS and shift registers d impose a delay also equal to TS. As a result, the pixels of the DP and CO signals in a given row Y_0 to Y_{16} in matrix 21, are contemporary, i.e., they correspond to the same frame portion.

The signals representing the COs and DPs in matrix 21 are available at a given instant on the 16 x 17 = 272 outputs of the shift registers, as well as upstream of the registers ahead of the 17 rows, i.e. registers $d_{0\,1}$, $d_{1\,1}$ ... $d_{16\,1}$ which makes a total of 16 x 17 + 17 = 17 x 17 outputs for the 17 x 17 positions $P_{0\,0}$, $P_{0\,1}$ ... $P_{8.8}$ ... $P_{16.16}$.

In order to better understand the process of spatial processing, the system will be described with respect to a small matrix M3 containing 3 rows and 3 columns where the central element of the 9 elements thereof is pixel e with coordinates x = 8, y = 8 as illustrated below:

a b c
d e f (M3)
g h i

In matrix M3, positions a, b, c, d, f, g, h, i around the central pixel e correspond to eight oriented directions relative to the central pixel The eight directions may be identified using the Freeman code illustrated in Fig. 6, the directions being coded 0 to 7 starting from the x axis, in steps of 45°. In the Freeman code, the eight possible oriented directions, may be represented by a 3-bit number since $2^3 = 8$.

Considering matrix M3 the 8 directions of the Freeman code are as follows:

3 2 1
4 e 0
5 6 7

Returning to matrix 21 having 17 x 17 pixels, a calculation unit 17a examines at the same time various nested square second matrices centered on e, with dimensions 15 x 15, 13 x 13, 11 x 11, 9 x 9, 7 x 7, 5 x 5 and 3 x 3, within matrix 21, the 3 x 3 matrix being the M3 matrix mentioned above. Spatial processing unit 17 determines which matrix is the smallest in which pixels with DP = 1 are aligned along a straight line which determines the direction of movement of the aligned pixels.

For the aligned pixels in the matrix, the system determines if CO varies on each side of the central position in the direction of alignment, from +a in an oriented direction and -a in the opposite oriented direction, where I < a < N. For example, if positions g, e, and c of M3 have values -1, 0, +1, then a displacement exists in this matrix from right to left in the (oriented) direction 1 in the Freeman code (Fig. 6). However, positions g, e, and c must at the same time have DP = 1. The displacement speed of the pixels in motion is greater when the matrix, among the 3 x 3 to 15 x 15 nested matrices, in which CO varies from +1 or -1 between two adjacent positions along a direction is larger. For example, if positions g, e, and c in the 9 x 9 matrix denoted M9 have values -1,0, +1 in oriented direction 1, the displacement will be faster than for values -1,0, +1 in 3 x 3 matrix M3 (Fig. 7). The smallest matrix for which a line meets the test of DP=1 for the pixels in the line and CO varies on each side of the central position in the direction of alignment, from +a in an oriented direction and -a in the opposite oriented direction, is chosen as the principal line of interest.

In a further step in the smallest matrix 3x3, the validity of the calculation with a variation of plus or minus two units (Co) with DP=1 determines a subpixel movement i.e. one half of pixel per image.

In the same way if the variation is of plus or minus 3, the movement is still slower i.e. one third of pixel per image.

One improvement for reducing the power of calculation is to test only the values which are symmetrical relative to the central value. The test DP=1 and CO=±l or CO=±2 and ±3 in the smallest matrix allows to simplify the hardware.

Since CO is represented as a power of 2 in a preferred embodiment, an extended range of speeds may be identified using only a few bits for CO, while still enabling identification of relatively low speeds. Varying speed may be detected because, for example -2,0, +2 in positions g, e, c in 3 x 3 matrix M3 indicates a speed half as fast as the speed corresponding to 1, 0, +1 for the same positions in matrix M3.

Two tests are preferably performed on the results to remove uncertainties. The first test chooses the strongest variation, in other words the highest time constant, if there are variations of CO along several directions in one of the nested matrices. The second test arbitrarily chooses one of two (or more) directions along which the variation of CO is identical, for example by choosing the smallest value of the Freeman code, in the instance when identical lines of motion are directed in a single matrix in different directions This usually arises when the actual direction of displacement is approximately between two successive coded directions in the Freeman code, for example between directions 1 and 2 corresponding to an (oriented) direction that can be denoted 1.5 (Fig. 6) of about 67.5° with the x axis direction (direction 0 in the Freeman code).

The scanning of an entire frame of the digital video signal S preferably occurs in the following sequence. The first group of pixels considered is the first 17 rows or lines of the frame, and the first 17 columns of the frame. Subsequently, still for the first 17 rows of the frame, the matrix is moved column by column from the left of the frame to the right, as shown in Fig. 5, i.e. from portion TM_1 at the extreme left, then TM_2 offset by one column with respect to

TM_1 until TM_M (where M is the number of pixels per frame line or row) at the extreme right. Once the first 17 rows have been considered for each column from left to right, the process is repeated for rows 2 to 18 in the frame. This process continues, shifting down one row at a time until the last group of lines at the bottom of the frame, i.e., lines L-16 ... L (where L is the number of lines per frame) are considered.

Spatial processing unit 17 generates the following output signals for each pixel: i) a signal V representing the displacement speed for the pixel, based upon the amplitude of the maximum variation of CO surrounding the pixel, the value of which may be, for example, represented by an integer in the range 0 - 7 if the speed is in the form of a power of 2, and therefore may be stored in 3 bits, ii) a signal DI representing the direction of displacement of the pixel, which is calculated from the direction of maximum variation, the value of DI being also preferably represented by an integer in the range 0 - 7 corresponding to the Freeman code, stored in 3 bits, iii) a binary validation signal VL which indicates whether the result of the speed and oriented direction is valid, in order to be able to distinguish a valid output with V = 0 and DI = 0, from the lack of an output due to an incident, this signal being 1 for a valid output or 0 for an invalid output, iv) a time constant signal CO, stored in 3 bits, for example, and v) a delayed video signal SR consisting of the input video signal S delayed in the delay unit 18 by 16 consecutive line durations TR and therefore by the duration of the distribution of the signal S in the 17x 17 matrix 21, in order to obtain a video signal timed to matrix 21, which may be displayed on a television set or monitor. Also output are the clock signal HP, line sequence signal SL and column sequence signal SC from control unit 19.

An improvement in the calculation of the motion where several directions are responsive at the same time consists in testing by group of 3 contiguous directions the validity of the operations and to select only the central value.

Nested hexagonal matrices (Fig 8) or an inverted L-shaped matrix (Fig. 9) may be substituted for the nested rectangular matrices in Figs. 4 and 7. In the case shown in Fig. 8, the nested matrices (in which only the most central matrices MR1 and MR2 have been shown) are all centered on point MR0 which corresponds to the central point of matrices M3, M9 in Fig. 7. The advantage of a hexagonal matrix system is that it allows the use of oblique coordinate axes x_a, y_a, and a breakdown into triangles with identical sides, to carry out an isotropic speed calculation.

The matrix in Fig. 9 is composed of a single row (L_u) and a single column (C_u) starting from the central position MR_U in which the two signals DP and CO respectively are equal to "1" for DP and increase or decrease by one unit for CO, if movement occurs.

If movement is in the direction of the x coordinate, the CO signal is identical in all positions (boxes) in column C_u, and the binary signal DP is equal to 1 in all positions in row L_u, from the origin MR_U, with the value CO_u, up to the position in which CO is equal to CO_u +1 or -1 inclusive. If movement is in the direction of the y coordinate, the CO signal is identical in all positions (boxes) in row L_u, and the binary signal DP is equal to 1 in all positions in column C_u, from the origin MR_U, with the value CO_u, up to the position in which CO is equal to CO_u +1 or -1 inclusive. If movement is oblique relative to the x and y coordinates, the binary signal DP is equal to 1 and CO is equal to CO_u in positions (boxes) of L_u and in positions (boxes) of C_u, the slope being determined by the perpendicular to the line passing through the two positions in which the signal CO_u changes by the value of one unit, the DP signal always being equal to 1.

Fig 9 shows the case in which DP = 1 and CO_u changes value by one unit in the two specific positions L_{u3} and C_{u5} and indicates the corresponding slope P_p. In all cases, the displacement speed is a function of the position in which CO changes value by one unit. If CO changes by one unit in L_u or C_u only, it corresponds to the value of the CO variation position. If CO changes by one unit in a position in L_u and in a position in C_u, the speed is proportional to the distance between MR_u and E_x (intersection of the line perpendicular to C_u - L_u passing through MR_u).

Fig. 9a shows an imaging device with sensors located at the crossings of concentric lines c and radial lines d, said lines corresponding to the rows and columns of a rectangular matrix imaging device.

An angular sector shaped odd matrix n x n Mc is associated to said imaging device.

The operation of such imaging arrangement is controlled by a circular scanning sequencer.

Except the sequencing differences, the operation of this arrangement is identical to that of the square matrix arrangement.

As shown in Figs 10 - 14, image processing system 11 is used in connection with a histogram processor 22a for identifying objects within the input signal based upon user specified criteria for identifying such objects. A bus Z-Z_1 (See Figs. 2, 10 and 11) transfers the output signals of image processing system 11 to histogram processor 22a. Histogram processor 22a generates composite output signal ZH which contains information on the areas in relative movement in the scene.

Referring to Fig. 11, histogram processor 22a includes a bus 23 for communicating signals between the various components thereof. Histogram formation and processing blocks 24 - 29 receive the various input signals, i.e., delayed digital video signal SR, speed V, oriented directions (in Freeman code) DI, time constant CO, first axis x(m) and second axis y(m), which are discussed in detail below. The function of each histogram formation block is to enable a histogram to be formed for the domain associated with that block. For example, histogram formation block 24 receives the delayed digital video signal SR and enables a histogram to be formed for the luminance values of the video signal. Since the luminance of the signal will generally be represented by a number in the range of 0-255, histogram formation block 24 is preferably a memory addressable with 8 bits, with each memory location having a sufficient number of bits to correspond to the number of pixels in a frame.

Histogram formation block 25 receives speed signal V and enables a histogram to be formed for the various speeds present in a frame. In a preferred embodiment, the speed is an integer in the range 0-7. Histogram formation block 25 is then preferably a memory addressable with 3 bits, with each memory location having a sufficient number of bits to correspond to the number of pixels in a frame.

Histogram formation block 26 receives oriented direction signal D1 and enables a histogram to be formed for the oriented directions present in a frame. In a preferred embodiment the oriented direction is an integer in the range 0-7, corresponding to the Freeman code. Histogram formation block 26 is then preferably a memory addressable with 3 bits, with each memory location having a sufficient number of bits to correspond to the number of pixels in a frame.

Histogram formation block 27 receives time constant signal CO and enables a histogram to be formed for the time constants of the pixels in a frame In a preferred embodiment, the time constant is an integer in the range 0-7. Histogram formation block 27 is then preferably a memory addressable with 3 bits, with each memory location having a sufficient number of bits to correspond to the number of pixels in a frame.

Histogram formation blocks 28 and 29 receive the x and y positions respectively of pixels for which a histogram is to be formed, and form histograms for such pixels, as discussed in greater detail below. Histogram formation block 28 is preferably addressable with the number of bits corresponding to the number of pixels in a line, with each memory location having a sufficient number of bits to correspond to the number of lines in a frame, and histogram formation block 29 is preferably addressable with the number of bits corresponding to the number of lines in a frame, with each memory location having a sufficient number of bits to correspond to the number of pixels in a line.

Referring to Figs. 12 and 13, each of the histogram formation blocks 24 - 29 has an associated validation block 30 - 35 respectively, which generates a validation signal VI - V6 respectively. In general, each of the histogram formation blocks 24-29 is identical to the others and functions in the same manner. For simplicity, the invention will be described with respect to the operation of histogram formation block 25, it being appreciated that the remaining histogram formation blocks operate in a like manner. Histogram formation block 25 includes a histogram forming portion 25a, which forms the histogram for that block, and a classifier 25b, for selecting the criteria of pixels for which the histogram is to be formed. Histogram forming portion 25a and classifier 25b operate under the control of computer software in an integrated circuit 25c, which extracts certain limits of the histogram generated by the histogram formation block.

Referring to Fig. 13, histogram forming portion 25a includes a memory 100, which is preferably a conventional digital memory. In the case of histogram formation block 25 which forms a histogram of speed, memory 100 is sized to have addresses 0-7, each of which may store up to the number of pixels in an image. Between frames, memory 100 is initiated, i.e., cleared of all memory, by setting *init*=1 in multiplexors 102 and 104. This has the effect, with respect to multiplexor 102 of selecting the "0" input, which is output to the Data In line of memory 100. At the same time, setting *init*=1 causes multiplexor 104 to select the Counter input, which is output to the Address line of memory 100. The Counter input is connected to a counter (not shown) that counts through all of the addresses for memory 100, in this case 0 <= address <= 7. This has the effect of placing a zero in all memory addresses of memory 100. Memory 100 is preferably cleared during the blanking interval between each frame. After memory 100 is cleared, the *init* line is set to zero, which in the case of multiplexor 102 results in the content of the Data line being sent to memory 100, and in the case of multiplexor 104 results in the data from spatial processing unit 117, i.e., the V data, being sent to the Address line of memory 100.

Classifier 25b enables only data having selected classification criteria to be considered further, meaning to possibly be included in the histograms formed by histogram formation blocks 24-29. For example, with respect to speed, which is preferably a value in the range of 0-7, classifier 25b may be set to consider only data within a particular speed category or categories, e.g., speed 1, speeds 3 or 5, speed 3-6, etc. Classifier 25b includes a register 106 that enables the classification criteria to be set by the user, or by a separate computer program. By way of example, register 106 will include, in the case of speed, eight registers numbered 0-7. By setting a register to "1", e.g., register number 2, only data that meets the criteria of the selected class, e.g., speed 2, will result in a classification output of "1". Expressed mathematically, for any given register in which R(k) = b, where k is the register number and b is the Boolean value stored in the register:

Output= R(data(V))

So for a data point V of magnitude 2, the output of classifier 25b will be "1" only if R(2)=1. The classifier associated with histogram formation block 24 preferably has 256 registers, one register for each possible luminance value of the image. The classifier associated with histogram formation block 26 preferably has 8 registers, one register for each possible direction value. The classifier associated with histogram formation block 27 preferably has 8 registers, one register for each possible value of CO. The classifier associated with histogram formation block 28 preferably has the same number of registers as the number of pixels per line. Finally, the classifier associated with histogram formation block 29 preferably has the same number of registers as the number of lines per frame. The output of each classifier is communicated to each of the validation blocks 30-35 via bus 23, in the case of histogram formation blocks 28 an 29, through combination unit 36, which will be discussed further below.

Validation units 30-35 receive the classification information in parallel from all classification units in histogram formation blocks 24 - 29. Each validation unit generates a validation signal which is communicated to its associated histogram formation block 24 - 29. The validation signal determines, for each incoming pixel, whether the histogram formation block will utilize that pixel in forming it histogram. Referring again to Fig. 13, which shows histogram formation block 25, validation unit 31 includes a register block 108 having a register associated with each histogram formation block, or more generally, a register associated with each data domain that the system is capable of processing, in this case, luminance, speed, direction, CO, and x and y position. The content of each register in register block 108 is a binary value that may be set by a user or by a computer controller. Each validation unit receive via bus 23 the output of each of the classifiers, in this case numbered 0 ... p, keeping in mind that for any data domain, e.g., speed, the output of the classifier for that data domain will only be "1" if the particular data point being considered is in the class of the registers set to "1" in the classifier for that data domain. The validation signal from each validation unit will only be "1" if for each register in the validation unit that is set to "1", an input of "l" is received from the classifier for the domain of that register. This may be expressed as follows:

$$out = (\overline{in_0} + Reg_0).(\overline{in_1} + Reg_1) \ldots (\overline{in_n} + Reg_n).(in_0 + in_1 + \ldots in_n)$$

where Reg_0 is the register in the validation unit associated with input in_0. Thus, using the classifiers in combination with validation units 30 - 35, the system may select for processing only data points in any selected classes within any selected domains. For example, the system may be used to detect only data points having speed 2, direction 4, and luminance 125 by setting each of the following registers to "1": the registers in the validation units for speed, direction, and luminance, register 2 in the speed classifier, register 4 in the direction classifier, and register 125 in the luminance classifier. In order to form those pixels into a block, the registers in the validation units for the x and y directions would be set to "1" as well.

Referring again to Fig. 13, validation signal V2 is updated on a pixel-by-pixel basis. If, for a particular pixel, validation signal V2 is "1", adder 110 increments the output of memory 100 by one. If, for a particular pixel, validation signal V2 is "0", adder 100 does not increments the output of memory. In any case, the output of adder 100 is stored in memory 100 at the address corresponding to the pixel being considered. For example, assuming that memory 100 is used to form a histogram of speed, which may be categorized as speeds 0-7, and where memory 100 will include 0-7 corresponding memory locations, if a pixel with speed 6 is received, the address input to multiplexor 104 through the data line will be 6. Assuming that validation signal V2 is "1", the content in memory at location 6 will be incremented. Over the course of an image, memory 100 will contain a histogram of the pixels for the image in the category associated with the memory. If, for a particular pixel, validation signal V2 is "0" because that pixel is not in a category for which pixels are to be counted (e.g., because that pixel does not have the correct direction, speed, or luminance), that pixel will not be used in forming the histogram.

For the histogram formed in memory 100, key characteristics for that histogram are simultaneously computed in a unit 112. Unit 112 includes memories for each of the key characteristics, which include the minimum (MIN) of the histogram, the maximum (MAX) of the histogram, the number of points (NBPTS) in the histogram, the position (POSRMAX) of the maximum of the histogram, and the number of points (RMAX) at the maximum of the histogram. These characteristics are determined in parallel with the formation of the histogram as follows:

For each pixel with a validation signal V2 of "1":

(a) if the data value of the pixel < MIN (which is initially set to the maximum possible value of the histogram), then write data value in MIN,

(b) if the data value of the pixel > MAX (which is initially set to the minimum possible value of the histogram), then write data value in MAX;

(c) if the content of memory 100 at the address of the data value of the pixel > RMAX (which is initially set to the minimum possible value of the histogram), then i) write data value in POSRMAX and ii) write the memory output in RMAX.

(d) increment NBPTS (which is initially set to zero).

At the completion of the formation of the histogram in memory 100 at the end of each frame, unit 112 will contain important data characterizing the histogram. The histogram in each memory 100, and the characteristics of the histogram in units 112 are read during the scanning spot of each frame by a separate processor, and the memories 100 are cleared and units 112 are re-initialized for processing the next frame.

Figure 14 shows the determination of the orientation of an alignment of points relative to the direction of an analysis axis.

In this figure, the analysis axis extends with an angle relative to the horizontal side of the screen and the histogram built along the analysis axis refers to points concerned by the analysis appearing on the screen.

For the histogram calculation device five particular values are calculated: MIN, MAX, NBPTS, RMAX, POSRMAX

The use of these values allows to obtain some rapid results.

For example, the calculation of the ratio NBPTS/RMAX i.e. the number of points involved in the histogram and the number of points in the maximal line allows to find an alignment of points perpendicular to the scanning axis.

The smaller is R and the most the alignment is perpendicular to the scanning axis.

One improvement of the calculation for example for positioning a vehicle on the road is to carryout for each pixel simultaneously an analysis according all the possible analysis axis. In an analysis region, the calculation of the ration R for all the analysis axes and the search of the smallest value of R allows to find the axis perpendicular of the analyzed points and consequently to know the alignment with a positioning, from the value POSRMAX.

Presently the map is divided by 16 (180°/16).

The use of the moving pixels histogram, direction histogram and velocity histograms allows to find by reading POSRMAX the overall motion of the scene (moving camera) and in the classifying unit to inhibit these preponderant classes.

The device thus becomes responsive to elements which are subject to relative motion in the image. The use of histograms according to two perpendicular axes with these elements in relative motion as validation element allows to detect and track an object in relative motion.

The calculation of the histogram according to a projection axis is carried out in a region delimited by the associated classifier between points a and b on the analysis axis.

An important improvement is to associate anticipation by creating an histogram of the same points with orientation and intensity of motion as input parameters. The nominal values O-MVT corresponding to orientation of the movement and I-MVT corresponding to intensity of movement allow to modify the values a and b of the classifier of the unit connected to the calculation of the analysis axis for the calculation for the next frame.

The result is greatly improved. Fig. l4a shows an example of the successive classes C_1 C_2 ... C_{n-1} C_n, each representing a particular velocity, for a hypothetical velocity histogram, with their being categorization for up to 16 velocities (15 are shown) in this example. Also shown is envelope 38, which is a smoothed representation of the histogram.

In order to locate the position of an object having user specified criteria within the image, histogram blocks 28 and 29 are used to generate histograms for the x and y positions of pixels with the selected criteria. These are shown in Fig. 12 as histograms along the x and y coordinates. These x and y data are output to moving area formation block 36 which combines the abscissa and ordinal information $x(m)_2$ and $y(m)_2$ respectively into a composite signal xy(m) that is output onto bus 23. A sample composite histogram 40 is shown in Fig. 12. The various histograms and composite signal xy(m) that are output to bus 23 are used to determine if there is a moving area in the image, to localize this area, and/or to determine its speed and oriented direction. Because the area in relative movement may be in an observation plane along directions x and y which are not necessarily orthogonal, (e.g., as discussed below with respect to Figs. 15 and 16), a data change block 37 may be used to converts the x and y data to orthogonal coordinates. Data change block 37 receives orientation signals $x(m)_0$ and $y(m)_0$ for $x(m)_0$ and $y(m)_0$ axes, as well as pixel clock signals HP, line sequence and column sequence signals SL and SC (these three signals being grouped together in bundle F in Figs. 2,4, and 10) and generates the orthogonal $x(m)_1$ and $y(m)_1$ signals that are output to histogram formation blocks 28 and 29 respectively.

In order to process pixels only within a user-defined area, the x-direction histogram formation unit may be set to process pixels only in a class of pixels defined by boundaries, i.e. XMIN and XMAX. Any pixels outside of this class will not be processed. Similarly, the y-direction histogram formation unit may be set to process pixels only in a class of pixels defined by boundaries YMIN and YMAX. Thus, the system can process pixels only in a defined rectangle by setting the XMIN and XMAX, and YMIN and YMAX values as desired. Of course, the classification criteria and validation criteria from the other histogram formation units may be set in order to form histograms of only selected classes of pixels in selected domains in selected areas.

Fig 12 diagrammatically represents the envelopes of histograms 38 and

39, respectively in x and y coordinates, for velocity data. In this example, x_M and y_M represent the x and y coordinates of the maxima of the two histograms 38 and 39, whereas l_a and l_b for the x axis and l_c and l_d for the y axis represent the limits of the range of significant or interesting speeds, l_a and l_c being the longer limits and l_b and l_d being the upper limited of the significant portions of the histograms. Limits l_a, l_b, l_c and l_d may be set by the user or by an application program using the system, may be set as a ratio of the maximum of the histogram, e.g., $x_M/2$, or may be set as otherwise desired for the particular application.

The vertical lines L_a and L_b, of abscises l_a and l_b and the horizontal lines L_c and L_d of ordinals l_c and l_d form a rectangle that surrounds the cross hatched area 40 of significant speeds (for all x and y directions). A few smaller areas 41 with longer speeds, exist close to the main area 40, and are typically ignored. In this example, all that is necessary to characterize the area with the largest variation of the parameter for the histogram, the speed V in this particular case, is to identify the coordinates of the limits l_a, l_b, l_c and l_d and the maxima x_M and y_M, which may be readily derived for each histogram from memory 100, the data in units 112, and the xy(m) data block.

Thus, the system of the invention generates in real time, histograms of each of the parameters being detected. Assuming that it were desired to identify an object with a speed of "2" and a direction of "4", the validation units for speed and direction would be set to "1", and the classifiers for speed "2" and direction "4" would be set to "1". In addition, since it is desired to locate the object (s) with this speed and direction on the video image, the validation signals for histogram formation blocks 28 and 29, which correspond to the x and y coordinates, would be set to "1" as well. In this way, histogram formation blocks 28 and 29 would form histograms of only the pixels with the selected speed and direction, in real-time. Using the information in the histogram, and especially POSRMAX, the object with the greatest number of pixels at the selected speed and direction could be identified on the video image in real-time. More generally, the histogram formation blocks can localize objects in real-time meeting user-selected criteria, and may produce an output signal, e.g., a light or a buzzer if an object is detected. Alternatively, the information may be transmitted, e.g., by wire, optical fiber or radio relay for remote applications, to a control unit, such as unit 10a in Fig. 1, which may be near or remote from image processing system 11.

Fig. 15 shows an example of use of the system of the invention to perform automatic framing of a person moving, for example, during a video conference. A video camera 13 observes the subject P, who may or may not be moving. A video signal S from the video camera is transmitted by wire, optical fiber, radio relay, or other communication means to a monitor 10b and to the image processing system of the invention 11. The image processing system determines the position and movement of the subject P, and controls servo motors 43 of camera 13 to direct the optical axis of the camera towards the subject and particularly towards the face of the subject, as a function of the location, speed and direction of the subject, and may vary the zoom, focal distance and/or the focus of the camera to provide the best framing and image of the subject.

Referring to Fig. 18, the system of the invention may be used to center the face of the subject in the video signal while eliminating superfluous portions of the image received by the camera 13 above, below, and to the right and left of the head of the subject. Camera 13 has a field of view 123, which is defined between directions 123a and 123b. The system rotates camera 13 using servomotors 43 so that the head T of the subject is centered on central axis 2a within cortical field 123, and also adjusts the zoom of camera 13 to ensure that the head T of the subject occupies a desired amount of the frames of the video signal, preferably as represented by a desired ratio of the number of pixels comprising head T to the total number of pixels per frame.

In order to accomplish this, the system of the invention may focus on the head using its luminance or motion. By way of example only, the system will be described with respect to detecting the head of the user based upon its motion. The peripheral edges of the head of the user are detected using the horizontal movements of the head, in other words, movements right and left, and the vertical movements, in other words, movements up and down. As the horizontal and vertical motion of the head is determined by the system, it is analyzed using preferred coordinate axes, preferably Cartesian coordinates Ox and Oy, in moving, area block 36 (Fig.11).

The pixels with greatest movement within the image will normally occur at the peripheral edges of the head of the subject, where even due to slight movements, the pixels will vary between the luminance of the head of the subject and the luminance of the background. Thus, if the system of the invention is set to identify only pixels with DP=1, and to form a histogram of these pixels, the histogram will detect movement peaks along the edges of the face where variations in brightness, and therefore in pixel value, are the greatest, both in the horizontal projection along Ox and in the vertical projection along Oy.

This is illustrated in Fig. 17 m which axes Ox and Oy are shown, as are histograms 124x, along Ox, and 124y, along Oy, i.e., in horizontal and vertical projections, respectively. Histograms 124x and 124y would be output from histogram formation units 28 and 29 respectively (Fig. 11). Peaks 125a and 125b of histogram 124x, and 125c and 125d of histogram 124y, delimit, by their respective coordinates 126a, 126b, 126c and 126d, a frame bounded by straight lines Ya, Yb, Xc, and Xd, which encloses the face V of the video-conference participant, and which denote areas 127a, 127b, 127c and 127d, which are areas of slight movement of the head T, which will be the areas of greatest variation in pixel intensity during these movements.

Location of the coordinates 126a, 126b, 126c and 126d, corresponding to the four peaks 125a, 125b, 125c and 125d, is preferably determined by computer software reading the x and y coordinate histograms during the spot scanning sequence of each frame. The location of the coordinates 126a, 126b, 126c and 126d of peaks 125a, 125b, 125c and 125d of histograms 124x and 124y make it possible to better define and center the position of the face V of the subject in the image. In a video conferencing system, the remainder of the image, i.e. the top bottom, right and left portions of the image, as illustrated in Fig. 18 by the cross-hatched areas surrounding the face V, may be eliminated to reduce the bandwidth required to transmit the image. The center of face V may be determined, for example, by locating the pixel position of the center of the box bounded by Ya, Yb, Xc, and Xd ((Xc + (Xd - Xc)/2), (Ya + (Yb - Ya)/2)) and by comparing this position to a desired position of face V on the screen. Servomotors 43 (Fig. 13) are then actuated to move camera 13 to better center face V on the screen. Similarly, if face V is in movement, the system may detect the position of face V on the screen as it moves, and follow the movement by generating commands to servomotors 43.

If desired, the center position of face V may be determined at regular intervals, and preferably in each frame, and the average value (over time) of coordinates 126a, 126b, 126c and 126d used to modify the movement of camera 13 to center face V.

With face V centered, the system may adjust the zoom of camera 13 so that face V covers a desired amount of the image. The simples method to accomplish this zoom function is to determine the dimensions of (or number of pixels in) the box bounded by Ya, Yb, Xc, and Xd. Camera 13 may then be zoomed in or out until desired dimensions (or pixel count) are achieved.

Another application of the invention relates to automatic tracking of a target by, for example, a spotlight or a camera. Using a spotlight, the invention might be used on a helicopter to track a moving target on the ground, or to track a performer on a stage during an exhibition. The invention would similarly be applicable to weapons targeting systems. Referring to Fig. 19, the system includes a camera 200, which is preferably a conventional CCD camera which communicates an output signal 202 to image processing system 204 of the invention. Especially for covert and military applications, it will be appreciated that the system may be used with sensor such as Radar and IR, in lieu of, or in combination with, camera 200. A controller 206, which is preferably a conventional microprocessor-based controller, is used to control the various elements of the system and to enable user input of commands and controls, such as with computer mouse 210, a keyboard (not shown), or other input device. As in the prior embodiment, the system includes one or more servomotors 208 that control movement of camera 200 to track the desired target. It will be appreciated that any appropriate means may be used to control the area of interest of camera 200, including use of moving mirrors relative to a fixed camera, and the use of a steered beam, for example in a Radar system, to track the target without physically moving the sensor.

In the example shown in Fig. 20, monitor 212 is shown with five simulated objects, which may be, for example, vehicles, or performers on a stage, including four background targets 216, and one target to be tracked 218. Computer mouse 210 is used to control an icon 220 on monitor 212. The user of the system selects the target for tracking by moving icon 220 over target 218, and depressing a predetermined button on mouse 210. The pixel position of icon 220 is then used as a starting position for tracking target 216.

Referring to Fig. 21, the initial pixel starting position is shown as x_c, y_c. In order to process the pixels surrounding the starting position, image processing system 204 will process the pixels in successively larger areas surrounding the pixel, adjusting the center of the area based upon the shape of the object, until substantially the entire target area is being tracked. The initial area is set by controller 206 to include an area bounded by X_A, X_B, Y_C, Y_D This is accomplished by setting these boundaries in the classification units of x and y histogram formation units 28 and 29. Thus, the only pixels that will be processed by the system are those falling within the bounded area. Assuming that in the example given, the target is in motion. the system may be set to track pixels with DP=1. Those pixels with DP=1 would normally be located on the peripheral edges of target 218, unless the target had a strong color or luminance variation throughout, in which case, many of the pixels of the target would have DP=1. In any case, in order to locate pixels with DP=1, the validation units would be set to detect pixels with DP=1. Thus, the only pixels that will be considered by the system are those in the bounded area with DP=1. Alternatively, the system may be set to detect a velocity greater than zero, or any other criteria that define the edges of the object.

Histograms are then formed by x and y histogram formation units 28 and 29. In the example shown in Fig. 21, an insignificant number of pixels would be identified as having DP=l, since the selected area does not include the border of target 218, so no histogram would be formed. The size of the area under consideration is then successively increased, preferably by a constant size K, so that in subsequent iterations, the pixels considered would be in the box bounded by x_{A-nK}, x_{B+nK}, y_{A-nk}, y_{B+nk}, where n is the number of the current iteration.

This process is continued until the histogram formed by either of histogram formation units 28 and 29 contains meaningful information, i.e., until the box overlaps the boundary of the target. Referring to Fig. 22, when the area under consideration begins to cross the borders of target 218, the histograms 222 and 224 for the x and y projections will begin to include pixels in which DP=1 (or any other selected criteria to detect the target edge). Prior to further enlarging the area under consideration, the center of the area under consideration, which until this point has been the pixel selected by the user, will be adjusted based upon the content of histograms 222 and 224. In a preferred embodiment, the new center of the area is determined to be $(X_{MIN} + X_{MAX})/2$, $(Y_{MIN} + Y_{MAX})/2$, where X_{MIN} and X_{MAX} are the positions of the minima and maxima of the x projection histogram, and Y_{MIN} and Y_{MAX} are the positions of the minima and maxima of the y projection histogram. This serves to adjust the area under consideration for the situation in which the initial starting position is nearer to one edge of the target than to another. Other methods of relocating the center of the target box may be used if desired.

After additional iterations, as shown in Fig. 23, it being understood that the center of the box bounding the area of consideration may have moved from the prior iteration, the box will be larger than the target in that $X_{A-nK} < X_{MIN}$, $X_{A+nK} > X_{MAX}$, $Y_{A-nK} < Y_{MIN}$, and $Y_{A+nK} > Y_{MAX}$. When this occurs, the entire target is bounded, and the constant K may then be reduced, to thereby reduce the size of the tracking box. In a preferred embodiment, when initially tracking a target, constant K is preferably relatively large, e.g., 10-20 pixels or more, in order that the system may lock on the target expeditiously. Once a target has been locked onto, K may be reduced. It will be appreciated that in the course of tracking a target, the tracking box will be enlarged and reduced as appropriate to maintain a track of the target, and is preferably adjusted on a frame by-frame basis.

Assuming that the system is to be used to train a spotlight on the target, for example from an airborne vehicle or in a theater, the camera is preferably synchronized with the spotlight so that each is pointing at the same location. In this way, where the camera has centered the target on its image, the spotlight will be centered on the target. Having acquired the target, controller 206 controls servomotors 208 to maintain the center of the target in the center of the image. For example, if the center of the target is below and to the left of the center of the image, the camera is moved downward and to the left as required to center the target. The center of the target may be determining in real time from the contents of POSRMAX for the x and histogram formation units.

It will be appreciated that as the target moves, the targeting box will move with the target, constantly adjusting the center of the targeting box based upon the movement of the target, and enlarging and reducing the size of the targeting box. The targeting box may be displayed on monitor 212, or on another monitor as desired to visually track the target.

A similar tracking box may be used to track an object in an image based upon its characteristics. For example, assuming it is desired to track a target moving only to the right in the image. The histogram formation units are set up so that the only validation units set to "1" are for direction and for the x and y projections. The classification unit for direction is set so that only direction "right" is set to "1". The histograms for the x and y projections will then classify only pixels moving to the right. Using these histograms, a box bounding the target may be established. For example, referring to Fig. 12, the box surrounding the target may be established using l_a, l_b, l_c, and l_d as the bounds of the box. The target box may be displayed on the screen using techniques known in the art.

After a very short initialization period on the order of about 10 frames, the invention determines the relative displacement parameters instantaneously after the end of each frame on which the temporal and spatial processing was performed due to the recursive ness of calculations according to the invention.

The invention, including components 11a and 22a is preferably formed on a single integrated circuit, or on two integrated circuits. If desired, a micro controller, for enabling user-input to the system, e.g., to program the validation and classification units, may be integrated on the same integrated circuit.

It will be appreciated that the present invention is subject to numerous modifications. In an embodiment in which a color camera is used, the system of the invention preferably includes histogram formation units for hue and saturation. This enables classification of targets to be made using these characteristics as well. In fact, the invention may be modified by adding histogram formation units for any possible other measurable characteristics of the pixels. Moreover, while the invention has been described with respect to tracking a single target, it is foreseen that multiple targets may be tracked, each with user-defined classification criteria, by replicating the various elements of the invention. For example, assuming the system of the invention included additional histogram formation units for hue and saturation, the system could be programmed, using a common controller attached to two histogram formation processors of the type shown in Fig. 11, to track a single target by its velocity, and/or color, and/or direction, etc. In this manner, the system could continue to track a target if, for example, the target stopped and the track based upon velocity and direction was lost, since the target could still be tracked by color.

It will also be appreciated that the limitation of eight speeds may be increased by using a greater bit count to represent the speeds. Moreover, while the invention has been described with respect to detection of eight different directions, it may be applied to detect 16 or more directions by using different size matrices, e.g., sixteen directions may be detected in a 5x5 matrix, to detect a greater number of directions.

Finally, Fig. 24 shows a method of tracking a wider range of speeds V if the limited number provided by p bits for time constant CO is insufficient. Using Mallat's diagram (see article by S. Mallat "A Theory for multi-resolution signal decomposition" in IEEE Transactions on Pattern Analysis and Machine Intelligence, July 1989 p. 674-693), the video image is successively broken down into halves, identified as 1, 2, 3, 4, 5, 6, 7. This creates a compression that only processes portions of the image. For example, with p=4 ($2^P = 16$), the system may determine speeds within a wider range.

If initially, while processing the entire image, the system determines that the speed of an object exceeds the maximum speed determinable with $2^P=16$ for the time constant, the system uses partial observed images 1, 2, 3, 4, ... until the speed of the object does not exceed the maximum speed within the partial image after compression. To use Mallat compression with wavelets, a unit 13A (Fig. 24) is inserted into the system shown in Fig. 1 to perform the compression. For example, this unit could be composed of the "DV 601 Low Cost Multiformat Video Codec "by Analog Devices. Fig. 2 shows an optional compression unit 13a of this type.

Although the present invention has been described with respect to certain embodiments and examples, variations exist that are within the scope of the invention as described in the following claims.

CLAIMS

1. A process for identifying pixels in an input signal in one of a plurality of classes in one of a plurality of domains, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the process comprising, on a frame-by-frame basis:

for each pixel of the input signal, analyzing the pixel and providing an output signal for each domain containing information to identify each domain in which the pixel is classified;

providing a classifier for each domain, the classifier enabling classification of pixels within each domain to selected classes within the domain;

providing a validation signal for the domains, the validation signal selecting one or more of the plurality of domains for processing; and

forming a histogram for pixels of the output signal within the classes selecte by the classifier within each domain selected by the validation signal.

2. The process according to claim 1 further comprising:

forming histograms along coordinate axes for the pixels within the classes selected by the classifier within each domain selected by the validation signal; and forming a composite signal corresponding to the spatial position of such pixels within the frame.

3. The process according to claim 1 comprising identifying the velocity of movement of an area of an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, said identifying of the velocity of movement comprising:

for each particular pixel of the input signal, forming a first matrix comprising binary values indicating the existence or non-existence of a significant variation in the amplitude of the pixel signal between the current frame and a prior frame for a subset of the pixels of the frame spatially related to such particular pixel, and a second matrix comprising the amplitude of such variation;

determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and, for such pixels, determining in the second matrix whether, the amplitudes of the pixels along an oriented direction relative to the particular pixel vary in a known manner indicating movement of the pixel and the pixels along an oriented direction relative to the particular pixel, the amplitude of the variation along the oriented direction determining the velocity of movement of the particular pixel.

4. The process according to claim 3 further comprising:

prior to determining the binary values for each pixel, smoothing each pixel of the input signal using a time constant for such pixel, thereby generating a smoothed input signal, the determination of the existence of a significant variation in the amplitude of the pixel being performed for each pixel of the smoothed input signal; and using the existence of a significant variation for a given pixel to modify the time constant for the pixel to be used in smoothing subsequent frames of the input signal.

5. A process according to claim 1 for identifying a non-moving area in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the process comprising

forming histograms along coordinate axes for pixels of the input signal without significant variation between the current frame and a prior frame; and

forming a composite signal corresponding to the spatial position of such pixels within the frame.

6. The process according to claim 2 or 5 further comprising identifying pixels falling within limits l_a,l_b,l_c,l_d in the histograms along the coordinate axes, and forming the composite signal from the pixels falling within such limits.

7. The process according to claim 4 further comprising:

prior to the histogram forming step i) smoothing the input signal for each pixel thereof using a time constant for such pixel, thereby generating a smoothed input signal, and ii) determining for each pixel in the smoothed input signal a binary value corresponding to the non-existence of a significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame.

8. The process according to claim 6 further comprising using the existence of a significant variation for a given pixel to modify the time

constant for the pixel to be used in smoothing subsequent frames of the input signal.

9. A process according to claim 1 comprising identifying relative movement in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, wherein the identifying of relative movement comprises:

for each pixel of the input signal, smoothing the input signal using a time constant for such pixel, thereby generating a smoothed input signal;

determining for each pixel in the smoothed input signal a binary value corresponding to the existence of a significant variation in the amplitude of the pixel between the current frame and the immediately previous smoothed input frame, and the amplitude of the variation:

using the existence of a significant variation for a given pixel, modifying the time constant for the pixel to be used in smoothing subsequent frames of the input signal; for each particular pixel of the input signal, forming a first matrix comprising the binary values of a subset of the pixels of the frame spatially related to such particular pixel, and a second matrix comprising the amplitude of the variation of the subset of the pixels of the frame spatially related to such particular pixel;

determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and, for such pixels, determining in the second matrix whether the amplitude of the pixels along the oriented direction relative to the particular pixel varies in a known manner indicating movement in the oriented direction of the particular pixel and the pixels along the oriented direction relative to the particular pixel, the amplitude of the variation of the pixels along the oriented direction determining the velocity of movement of the pixel and the pixels along the oriented direction relative to the particular pixel,

in each of one or more domains, forming a histogram of the values distributed in the first and second matrices falling in each such domain,

for a particular domain, determining from the histogram for such domain an area of significant variation;

forming histograms of the area of significant variation along coordinate axes; and determining from the histograms along the coordinate axes, whether there is an area in movement for the particular domain.

10. The process according to one of claims 1 and 9 wherein the domains are selected from the group consisting of i) luminance, ii) speed (V), iii) oriented direction (D1), iv) time constant (CO), v) hue, vi) saturation, vii) first axis (x(m)), and viii) second axis (y(m)) and ix) data characterized by external inputs.

11. The process according to claim 9 wherein the first and second matrices are square matrices with the same odd number of rows and columns, centered on the particular pixel.

12. The process according to claim 11 wherein the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested n x n matrices, where n is odd, centered on the particular pixel to the pixels within each of the first and second matrices, the process further comprising:

determining the smallest nested matrix in which the amplitude signal varies of predetermined values symmetrical relative to the particular pixel along an oriented direction around said particular pixel.

13. The process according to claim 9 wherein the first and second matrices are hexagonal matrices centered on the particular pixel.

14. The process according to claim 13 wherein the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested hexagonal matrices of varying size centered on the particular pixel to the pixels within each of the first and second matrices, the process further comprising

determining the smallest nested matrix in which the amplitude signal varies of predetermined values symmetrical relative to the particular pixel along an oriented direction around said particular pixel.

15. The process according to claim 9 wherein the first and second matrices are inverted L-shaped matrices with a single row and a single column.

16. The process according to claim 15 wherein the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested n x n matrices, where n is odd, to the single line and the single column to determine the smallest matrix in which the amplitude varies on a line with the steepest slope and constant quantification.

17. The process according to claim 9 wherein the first and second matrices are angular sector shaped matrices reproducing a portion of an eye.

18. The process according to claim 17 wherein the steps of determining in the first matrix whether the particular pixel and the pixels along an oriented direction relative to the particular pixel have binary values of a particular value representing significant variation, and the step of determining in the second matrix whether the amplitude signal varies in a predetermined criteria along an oriented direction relative to the particular pixel, comprise applying nested angular sector shaped matrices of varying size centered on the particular pixel to the pixels within each of the first and second matrices, the process further comprising

determining the smallest nested matrix in which the amplitude signal varies of predetermined values symmetrical relative to the particular pixel along an oriented direction around said particular pixel.

19. The process according to claim 9 wherein the time constant is in the form 2^P, the time constant being reduced or increased by incrementing or decrementing p.

20. The process according to claim 19 wherein successive

decreasing portions of complete frames of the input signal are considered using a Mallat time-scale algorithm and the largest of these portions, which provides displacement, speed and orientation indications compatible with the value of p, is selected.

21. The process according to claim 4, comprising:

for each pixel of the input signal, i) smoothing the pixel using a time constant (CO) for such pixel, thereby generating a smoothed pixel value (LO), ii) determining whether there exists a significant variation between such pixel and the same pixel in a previous frame, and iii) modifying the time constant (CO) for such pixel to be used in smoothing the pixel in subsequent frames of the input signal based upon the existence or non-existence of a significant variation.

22. The process according to claim 21 wherein:

(a) the step of determining the existence of a significant variation for a given pixel comprises determining whether the absolute value of the difference (AB) between the given pixel value (PI) and the value of such pixel in a smoothed prior frame (L1) exceeds a threshold (SE); and

(b) the step of smoothing the input signal comprises, for each pixel, i) modifying a time constant (CO) for pixel such based upon the existence of a significant variation as determined in step (a), and ii) determining a smoothed value for the pixel (LO) as follows:

$$LO = LI + \frac{PI - LI}{CO}$$

23. The process according to claim 21 wherein the time constant (CO) is in the form 2^P, and wherein p is incremented in the event that AB < SE, and wherein p is decremented in the event AB >= SE.

24. The process according to claim 23 wherein p is incremented or decremented by one. 25.

The process according to claim 22 further comprising generating an output signal comprising, for each pixel, a binary value (DP) indicating the existence or nonexistence of a significant variation, and the value of the time constant (CO).

25. The process according to claim 24 wherein the binary values (DP) and the time constants (CO) are stored in a memory sized to correspond to the frame size.

26. The process according to claim 1 comprising identifying an area in relative movement in said input signal, through:

generating a first array indicative of the existence of significant variation in the magnitude of each pixel between a current frame and a prior frame;

generating a second array indicative of the magnitude of significant variation of each pixel between the current frame and a prior frame, establishing a first moving matrix centered on a pixel under consideration and comprising pixels spatially related to the pixel under consideration, the first moving matrix traversing the first array for consideration of each pixel of the current frame; and

determining whether the pixel under consideration and each pixel of the pixels spatially related to the pixel under consideration along an oriented direction relative thereto within the first matrix are a particular value representing the presence of significant variation, and if so, establishing in a second matrix within the first matrix, centered on the pixel under consideration, and determining whether the amplitude of the pixels in the second matrix spatially related to the pixel under consideration along an oriented direction relative thereto are indicative of movement along such oriented direction, the amplitude of the variation along the oriented direction being indicative of the velocity of movement, the size of the second matrix being varied to identify the matrix size most indicative of movement.

27. The process according to claim 26 further comprising:

in at least one domain selected from the group consisting of i) luminance, ii) speed (V), iii) oriented direction (D1), iv) time constant (CO), v) hue, vi) saturation, and vii) first axis (x(m)), and viii) second axis (y(m)), and ix) data characterized by external inputs, forming at least one histogram of the values in such domain for pixels indicative of movement along an oriented direction relative to the pixel under consideration.

28. The process according to claim 27 further comprising:

for the pixels in said at least one histogram, forming histograms of the position of such pixels along coordinate axes.

29. The process according to claim 28 further comprising determining from the histograms along the coordinate axes an area of the image meeting criteria of the at least one domain.

30. The process according to claim 26 wherein the first and second matrices are square, and the sizes of the second matrix are nested n x n matrices, where n is odd.

31. The process according to claim 30 wherein the matrix most indicative of movement is the smallest nested matrix containing pixels indicative of movement along an oriented direction relative to the pixel under consideration.

32. The process according to claim 26 wherein the first and second matrices are selected from the group consisting of hexagonal matrices and inverted L-shaped matrices.

33. An apparatus for identifying pixels in an input signal in one of a plurality of classes in one of a plurality of domains, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the apparatus comprising:

means for analyzing each pixel of the input signal and for providing an output signal for each domain containing information to identify each domain in which the pixel is classified;

a classifier for each domain, the classifier classifying pixels within each domain in selected classes within the domain;

a linear combination unit for each domain, the linear combination unit generating a validation signal for the domain, the validation signal selecting one or more of the plurality of domains for processing; and

means for forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal.

34. The apparatus according to claim 34 further comprising:

means for forming histograms along coordinate axes for the pixels within the classes selected by the classifier within each domain selected by the validation signal; and

means for forming a composite signal corresponding to the spatial position of such pixels within the frame.

35. he apparatus according to claim 33 wherein the domains are selected from the groups consisting of i) luminance, ii) speed (V), iii) oriented direction (DI), iv) time constant (CO), v) hue, vi) saturation, and vii) first axis (x(m)), and viii) second axis (y(m)) and ix) data characterized by external inputs.

36. The apparatus according to claim 33 for identifying the velocity of movement of an area of an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels the apparatus, comprising:

means for determining for each pixel in the input signal a binary value corresponding to the existence of a significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame, and for determining the amplitude of the variation;

means for forming, for each particular pixel of the input signal, a first matrix comprising the binary values of a subset of the pixels spatially related to such particular pixel, and a second matrix comprising the amplitude of the variation of the subset of the pixels spatially related to such particular pixel; and

means for determining in the first matrix whether for a particular pixel, and other pixels along an oriented direction relative to the particular pixel, the binary value for each pixel is a particular value representing significant variation, and, for such particular pixel and other pixels, determining in the second matrix whether the amplitude varies along an oriented direction relative to the particular pixel in a known manner indicating movement of the pixel and the other pixels, the amplitude of the variation along the oriented direction determining the velocity of movement of the pixel and the other pixels.

37. The apparatus according to claim 36 further comprising means for smoothing each pixel of the input signal using a time constant for such pixel prior to determining a binary value for each pixel, the binary values being determined on the smoothed pixels.

38. The apparatus according to claim 33 for identifying a non-moving area in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the apparatus comprising:

means for forming histograms along coordinate axes for pixels of a current frame without a significant variation from such pixels in a prior frame; and

means for forming a composite signal corresponding to the spatial position of such pixels within the frame.

39. The apparatus according to any one of claims 33 and 38 further comprising means for identifying pixels falling within limits l_a, l_b, l_c, l_d in the histograms along the coordinate axes, and forming the composite signal from the pixels falling within such limits.

40. The apparatus according to claim 38 further comprising:

means for smoothing the input signal using a time constant for each pixel, thereby generating a smoothed input signal; and

means for determining for each pixel in the smoothed input signal a binary value corresponding to the existence or non-existence of the significant variation in the amplitude of the pixel signal between the current frame and the immediately previous smoothed input frame.

41. The apparatus according to claim 40 further comprising means for using the existence of a significant variation for a given pixel to modify the time constant for the pixel to be used in smoothing subsequent frames of the input signal.

42. A process according to any one of claims 1-32 for tracking a target in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process comprising:

selecting a pixel of the target as a starting pixel;

on a frame-by-frame basis:

forming a tracking box around the starting pixel and for each pixel of the input signal in the tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

successively increasing the size of the tracking box and for each pixel of the input signal, in each successive tracking box forming a histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains;

determining when the target is substantially within the tracking box, stopping the size increasing of said tracking box, and adjusting the center of the tracking box based upon the histograms.

43. A process of tracking a target in an input signal, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process comprising, on a frame-by-frame basis: forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target, and identifying the target from said at least one histogram.

44. The process according to claim 43 further comprising drawing a tracking box around the target.

45. The process according to claims 42 and 44, comprising centering the tracking box relative to the optical axis of the image.

46. The apparatus according any one of claims 32-41, comprising a histogram formation block forming histograms of speed, a memory storing up to the number of pixels in an image, multiplexors controlling setting an clearing of said memory, a classifier enabling only data having selected classification criteria to be considered further, meaning to possibly be included in histograms formed by corresponding histogram formation block.

47. The apparatus of claim 46 wherein the classifier includes a register that enables the classification criteria to be set by the user or by a separate program.

48. The apparatus according to claim 46, comprising a computing unit for comprising the key characteristics for histograms formed in said memory said computing unit including memories for each of the key characteristics which include the minimum (MIN) of the histogram, the maximum (MAX) of the histogram, the number of points (NBPTS) in the histogram, the position (POSRMAX) of the maximum of the histogram and the number of points (RMAX) at the maximum of the histogram.

49. The apparatus according to claims 46-48 further

comprising an adder incrementing output of said memory, said adder being controlled by a validation signal from a corresponding validation unit receiving via a bus the output of said classifier so as to select only data points in any selected classes within any selected domains.

50. The process according to claims 42-45 comprising calculating a histogram according to a projection axis in a region delimited by an associated classifier, between two points on the projection axis, creating a histogram of the same points with orientation and intensity of motion as input parameters and modifying the values corresponding to said two points of the classifier and calculate an anticipated next frame.

ABSTRACT OF THE DISCLOSURE

IMAGE PROCESSING APPARATUS AND METHOD

A method and apparatus for localizing an area in relative movement and for determining the speed and direction thereof in real time is disclosed. Each pixel of an image is smoothed using its own time constant. A binary value corresponding to the existence of a significant variation in the amplitude of the smoothed pixel from the prior frame, and the amplitude of the variation, are determined, and the time constant for the pixel is updated. For each particular pixel, two matrices are formed that include a subset of the pixels spatially related to the particular pixel. The first matrix contains the binary values of the subset of pixels. The second matrix contains the amplitude of the variation of the subset of pixels. In the first matrix, it is determined whether the pixels along an oriented direction relative to the particular pixel have binary values representative of significant variation, and, for such pixels, it is determined in the second matrix whether the amplitude of these pixels varies in a known manner indicating movement in the oriented direction. In each of several domains, histogram of the values in the first and second matrices falling in such domain is formed. Using the histograms, it is determined whether there is an area having the characteristics of the particular domain. The domains include luminance, hue, saturation, speed (V), oriented direction (D1), time constant (CO), first axis (x(m)), and second axis (y(m)).

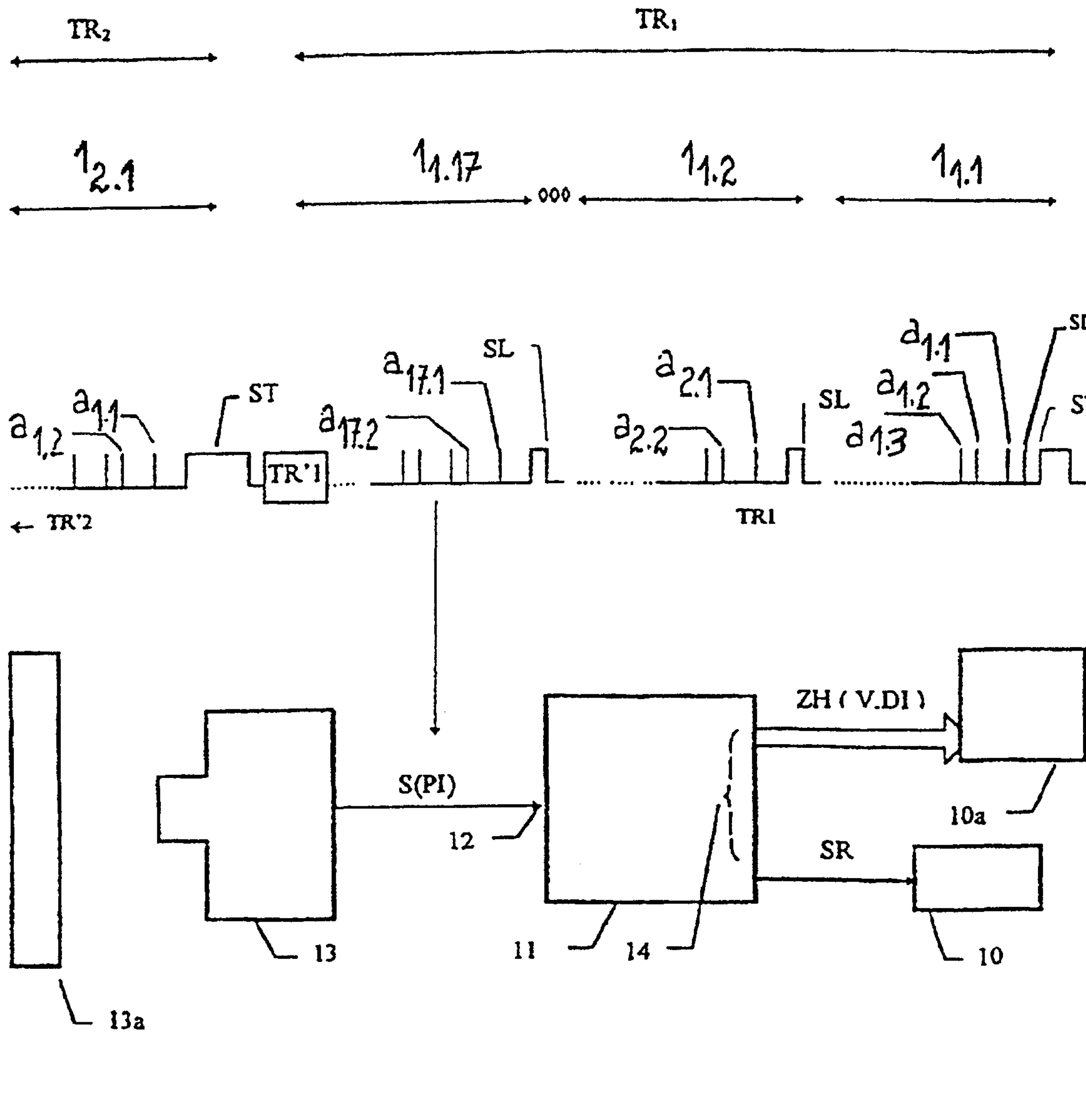

TR2
TR1
12.1
11.17
11.2
11.1
a1,2
a1.1
ST
TR'1
a17.2
a17.1
SL
a2.2
a2.1
SL
a1.3
a1.2
a1.1
SL
ST
TR'2
TR1
S(PI)
12
ZH (V.DI)
10a
SR
13a
13
11
14
10

FIG. 1

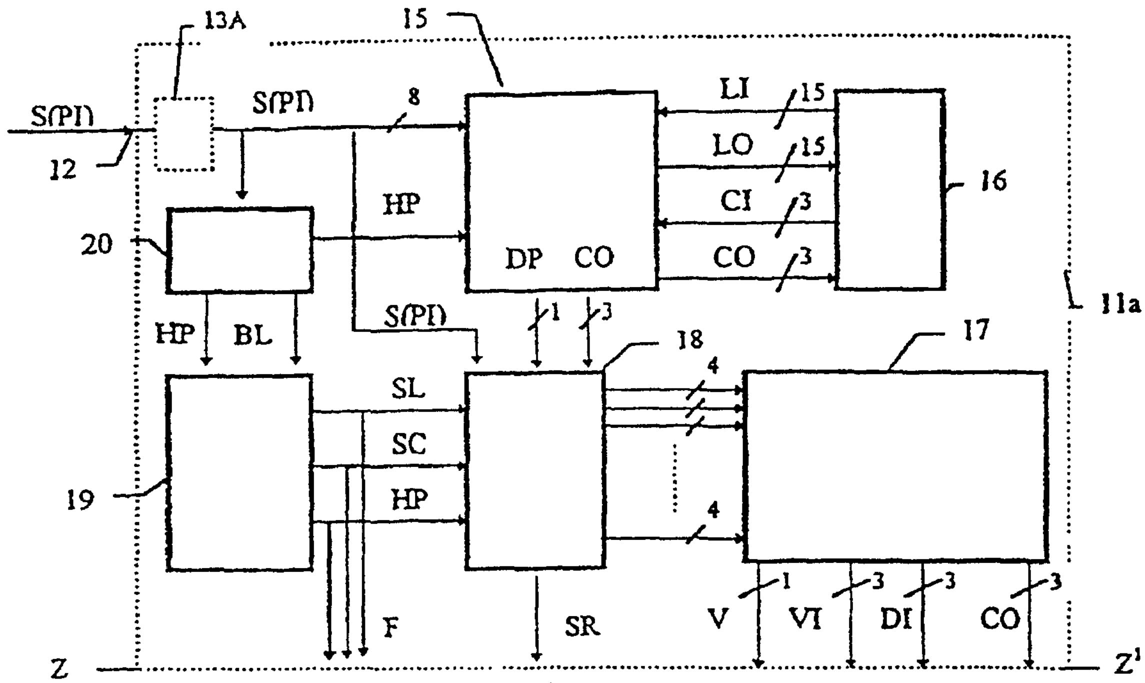
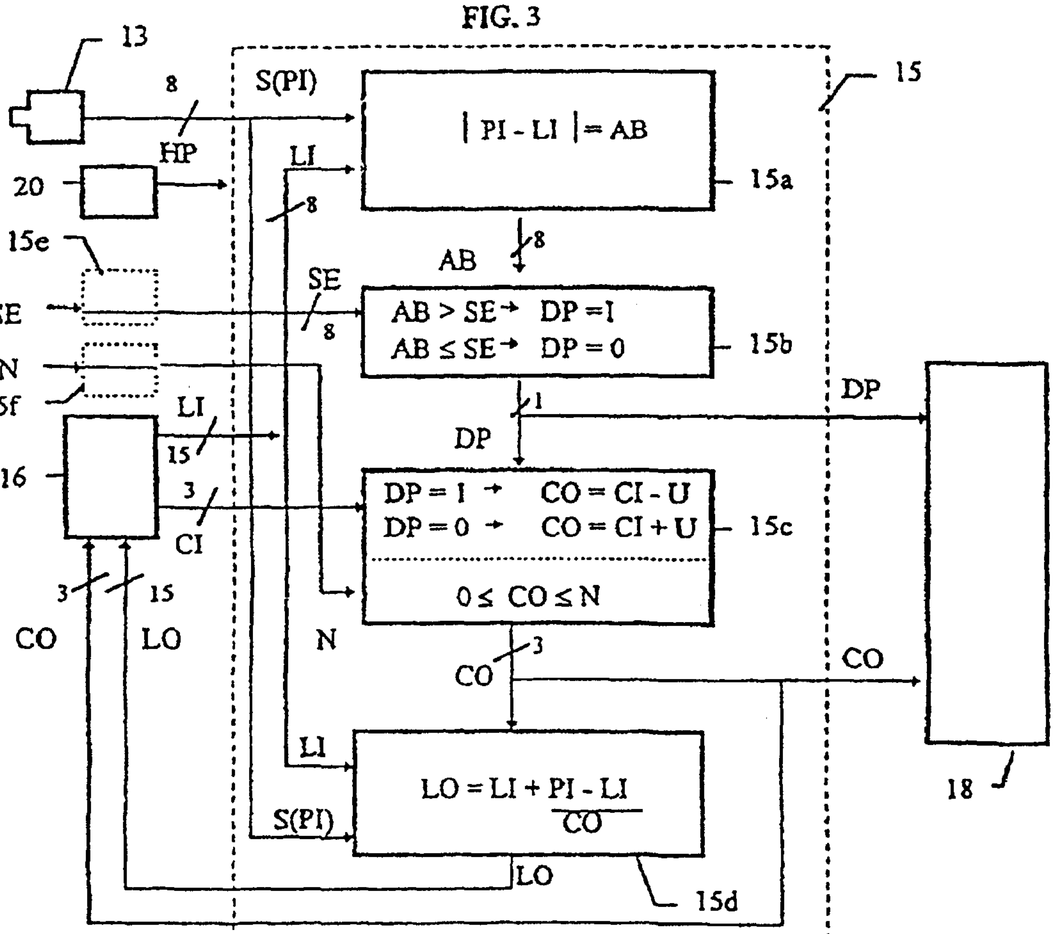

13A
15
S(PI)
S(PI)
8
12
LI
15
LO
15
CI
3
CO
3
16
20
HP
DP
CO
11a
HP
BL
S(PI)
1
3
18
17
4
SL
SC
HP
19
4
F
SR
V
1
VI
3
DI
3
CO
3
Z
Z'

FIG. 2

FIG. 3


13
8
S(PI)
| PI - LI | = AB
15
HP
20
LI
8
15a
15e
8
AB
SE
SE
AB > SE → DP = I
AB ≤ SE → DP = 0
8
15b
N
15f
LI
DP
1
DP
15
16
3
DP = I → CO = CI - U
DP = 0 → CO = CI + U
15c
CI
0 ≤ CO ≤ N
3
15
CO
LO
N
3
CO
CO
LI
LO = LI + PI - LI / CO
18
S(PI)
LO
15d

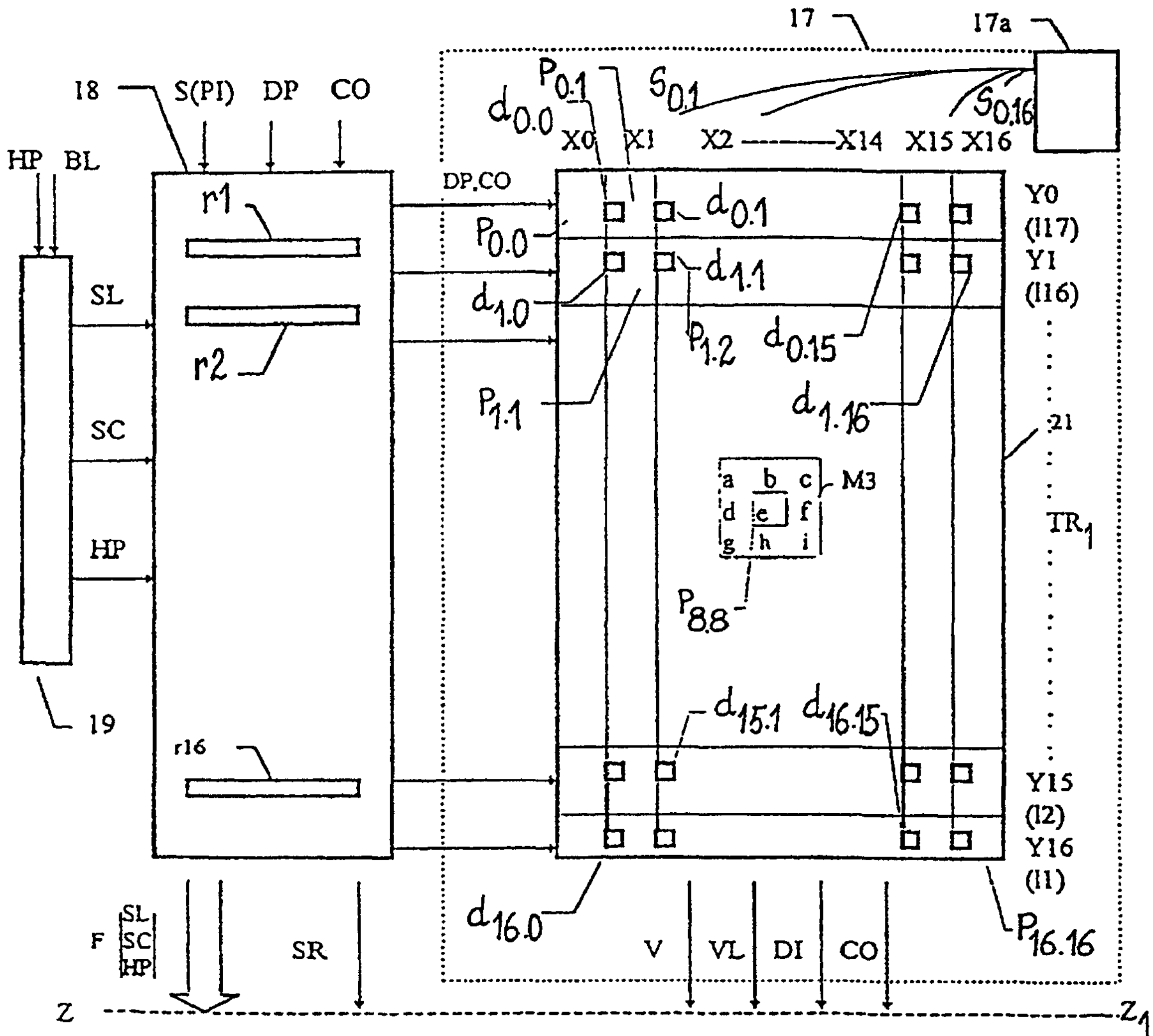


FIG. 4

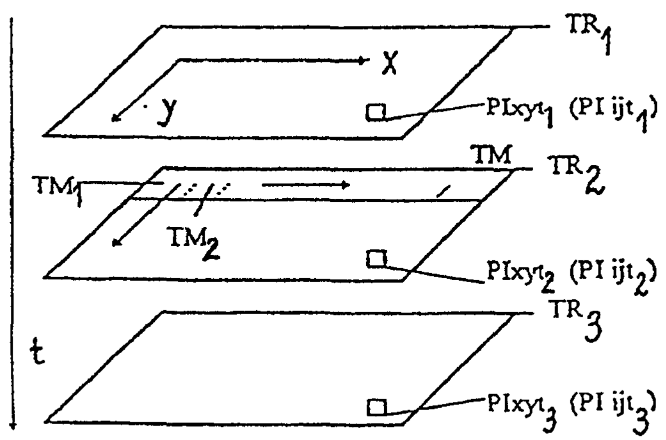


FIG. 5

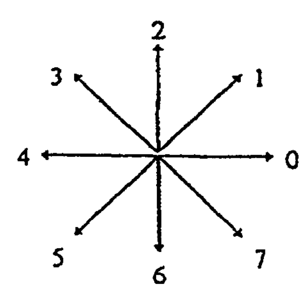
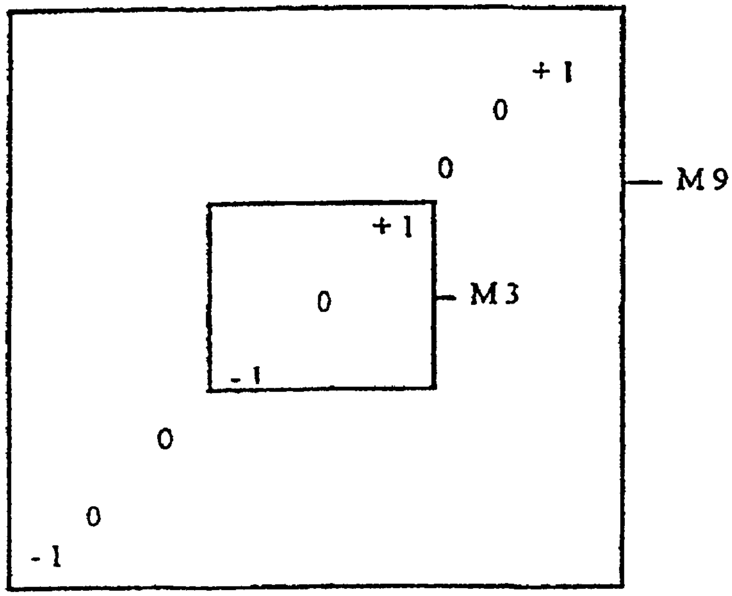


FIG. 6

FIG. 7



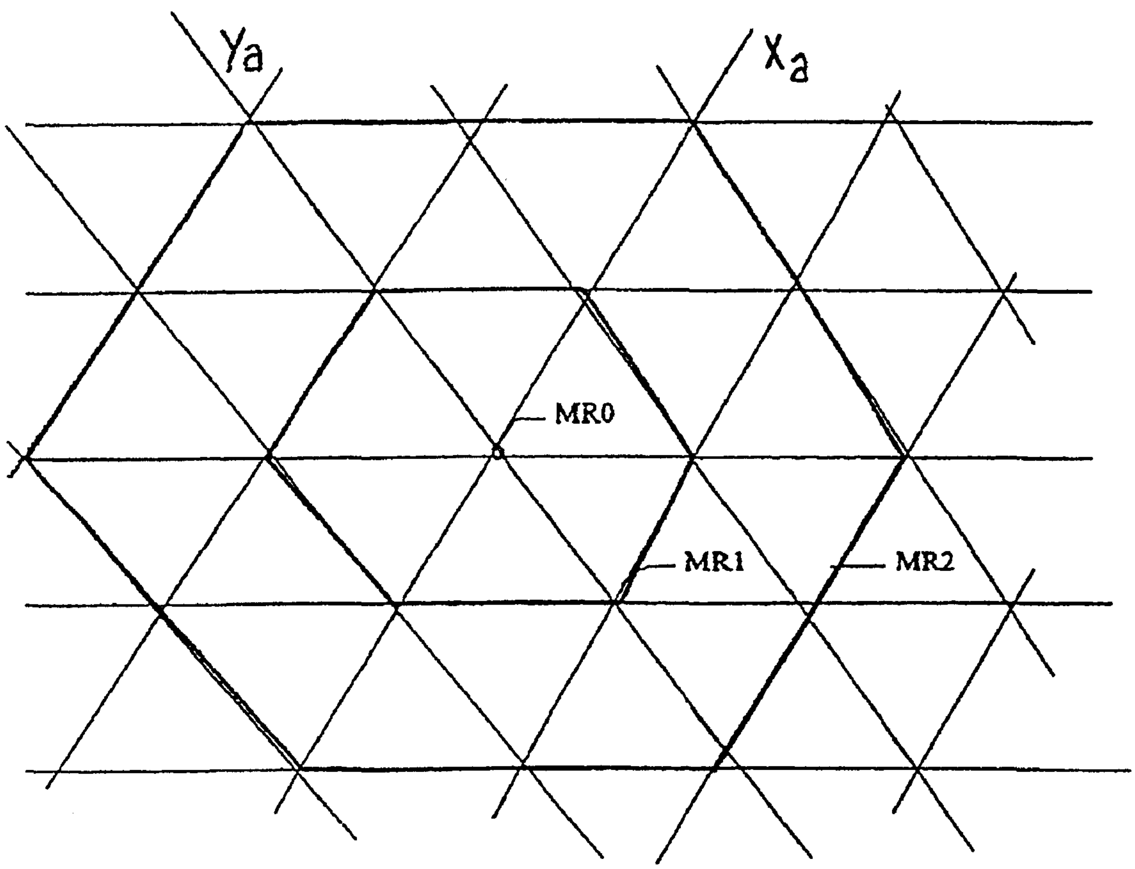


FIG. 8

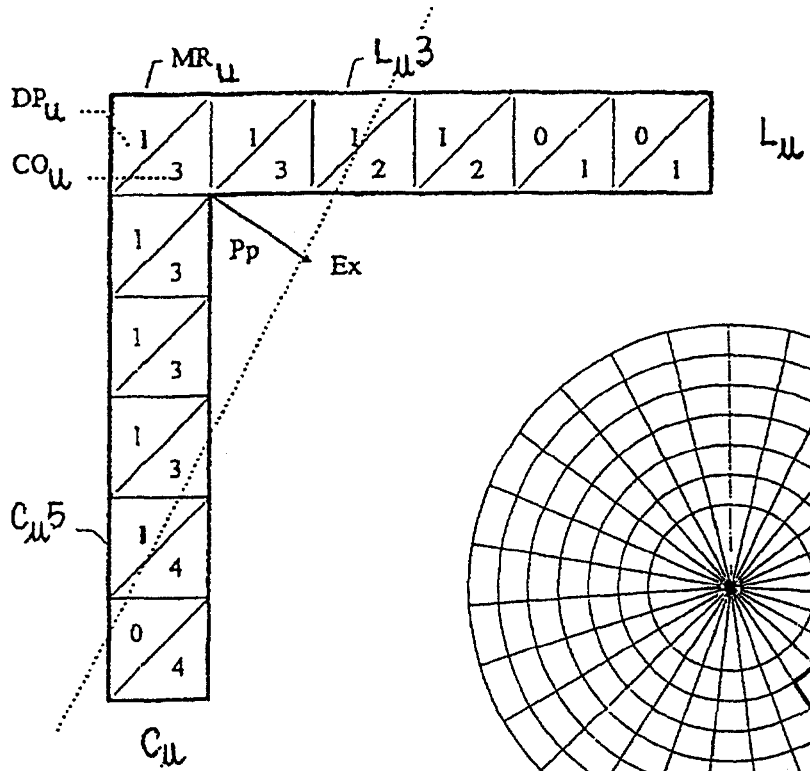


FIG. 9

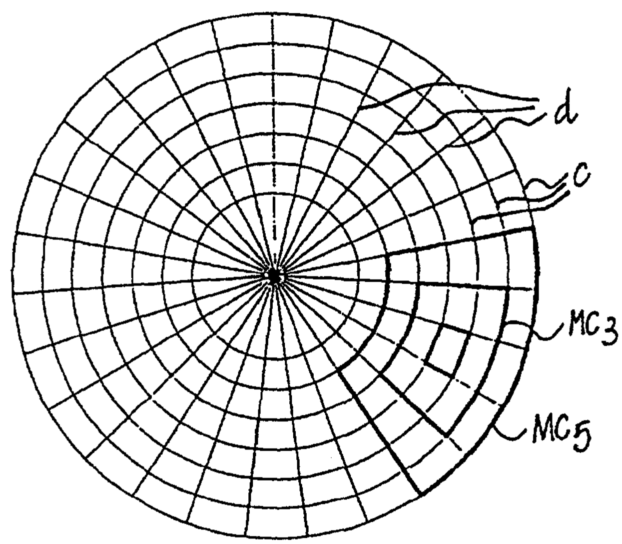


FIG. 9a

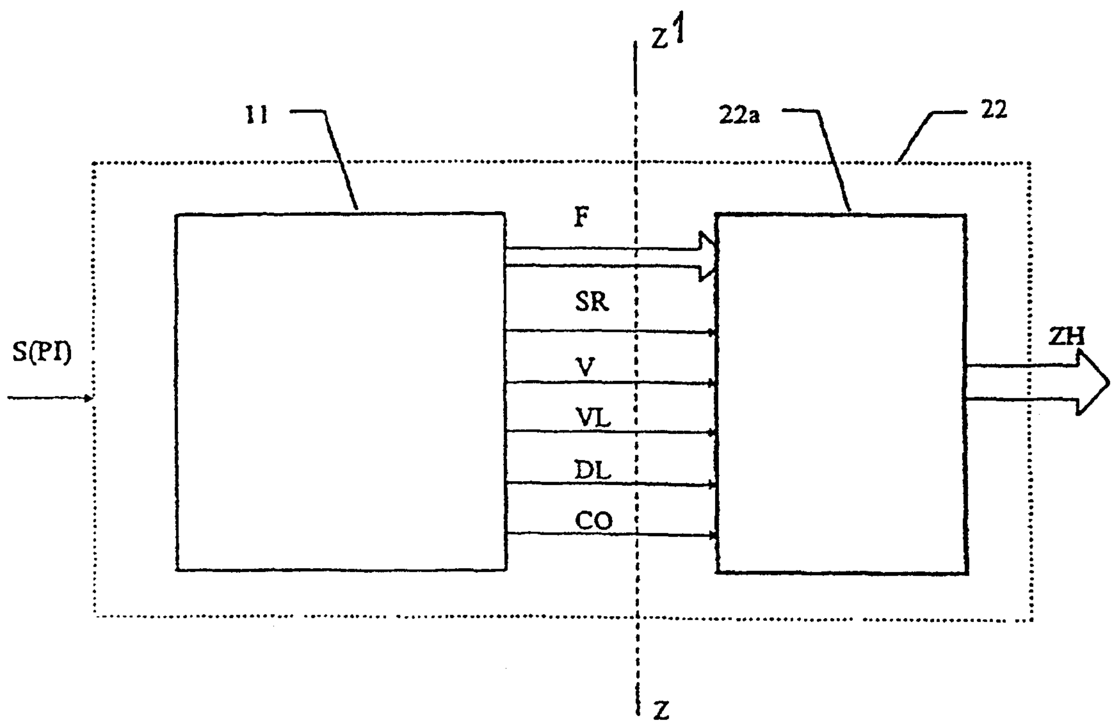


FIG. 10

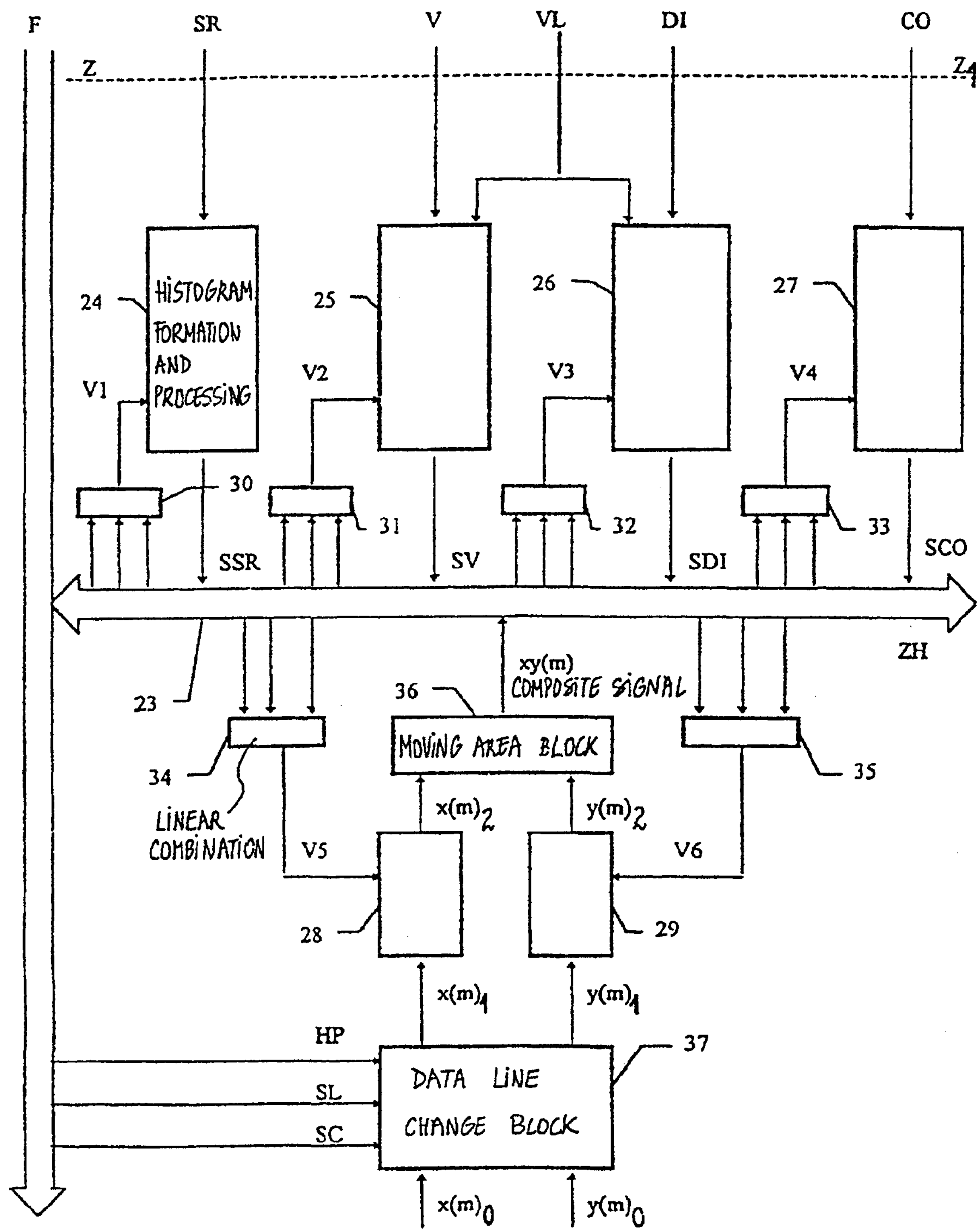

F
SR
V
VL
DI
CO
Z
Z1
24
HISTOGRAM FORMATION AND PROCESSING
25
26
27
V1
V2
V3
V4
30
31
32
33
SSR
SV
SDI
SCO
ZH
23
xy(m)
COMPOSITE SIGNAL
36
MOVING AREA BLOCK
34
35
LINEAR COMBINATION
V5
V6
x(m)2
y(m)2
28
29
x(m)1
y(m)1
HP
37
DATA LINE CHANGE BLOCK
SL
SC
x(m)0
y(m)0

FIG. 11

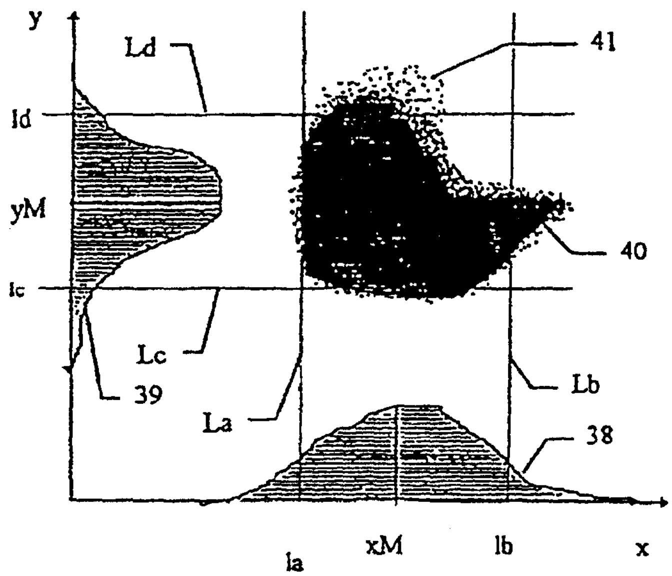


FIG. 12

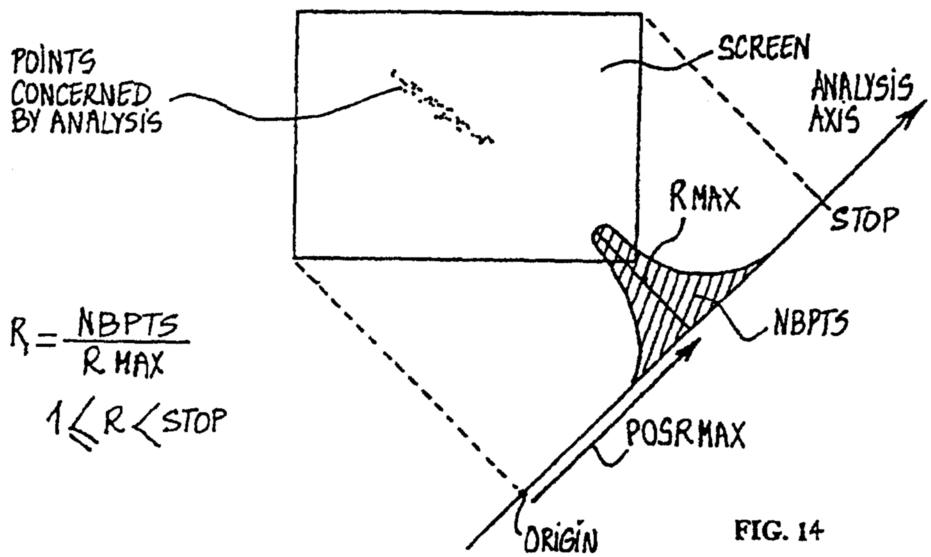


FIG. 14

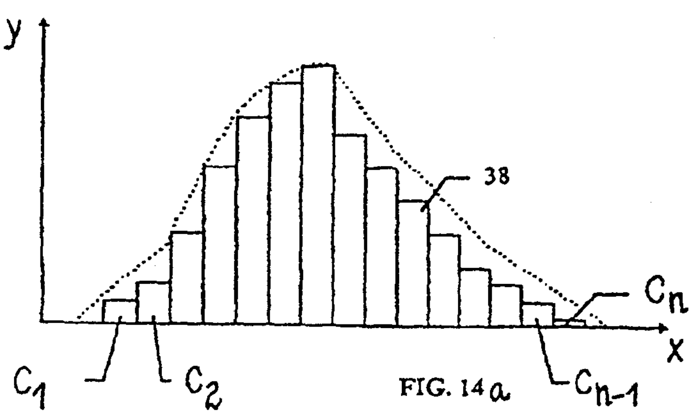


FIG. 14a

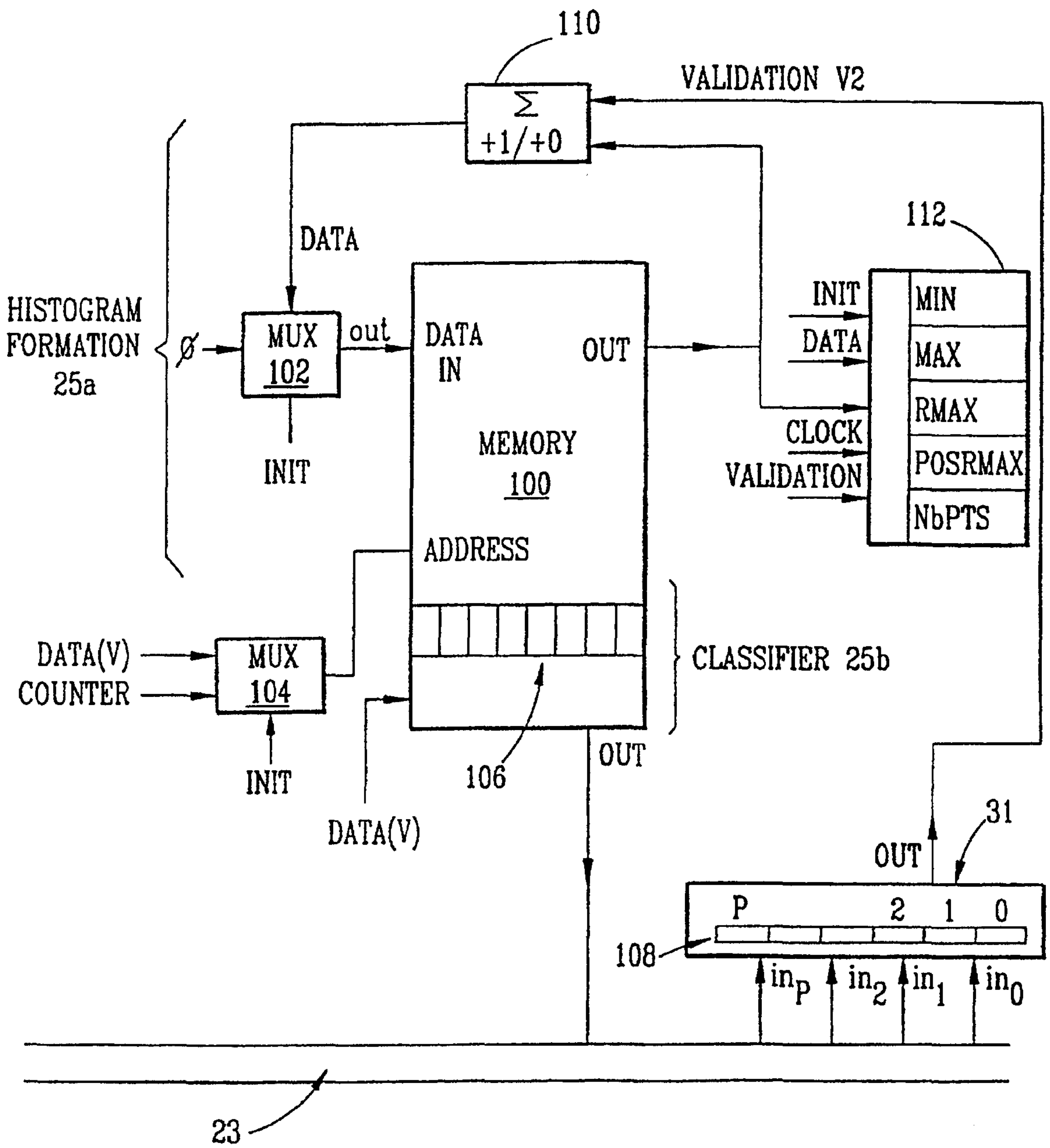

110
VALIDATION V2
Σ
+1/+0
112
DATA
HISTOGRAM
FORMATION
25a
Ø
MUX
102
out
DATA
IN
OUT
INIT
DATA
MIN
MAX
RMAX
POSRMAX
NbPTS
CLOCK
VALIDATION
MEMORY
100
INIT
ADDRESS
DATA(V)
COUNTER
MUX
104
CLASSIFIER 25b
INIT
106
OUT
DATA(V)
31
OUT
P
2
1
0
108
in_P
in_2
in_1
in_0
23

FIG.13

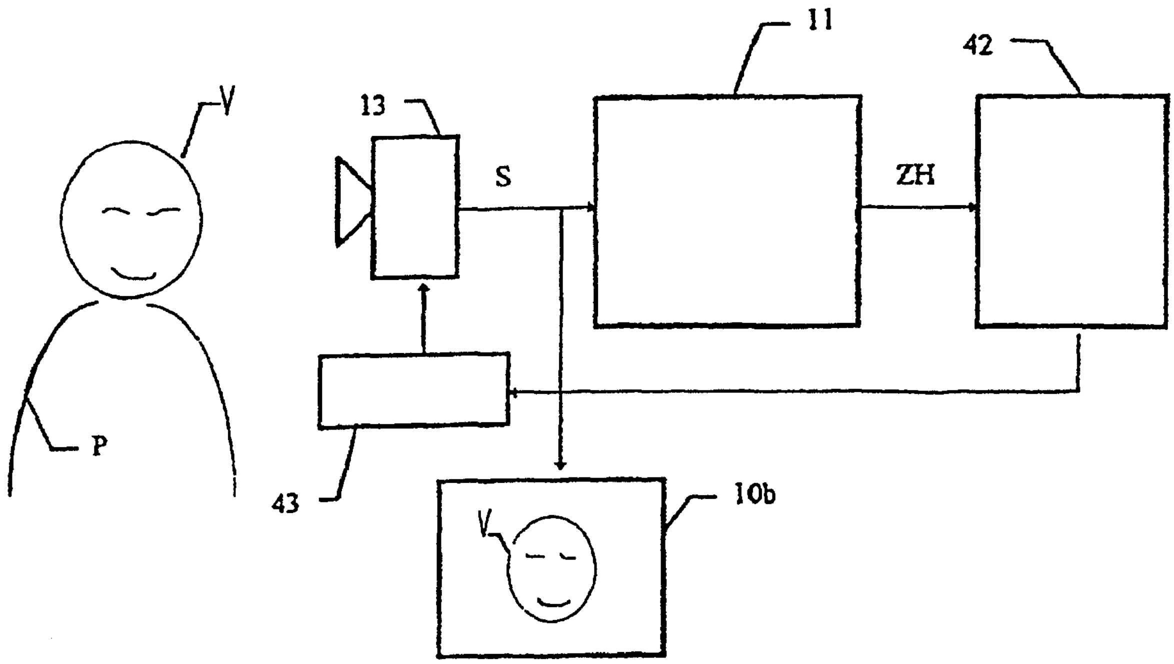


FIG. 15

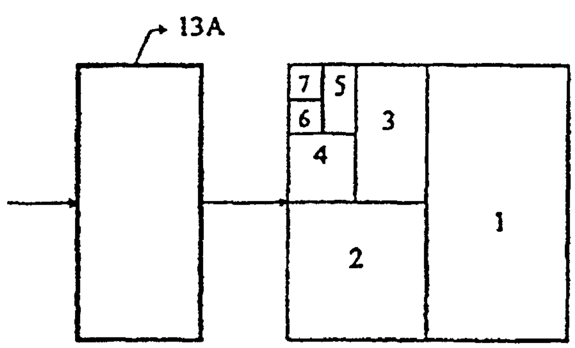


FIG. 24

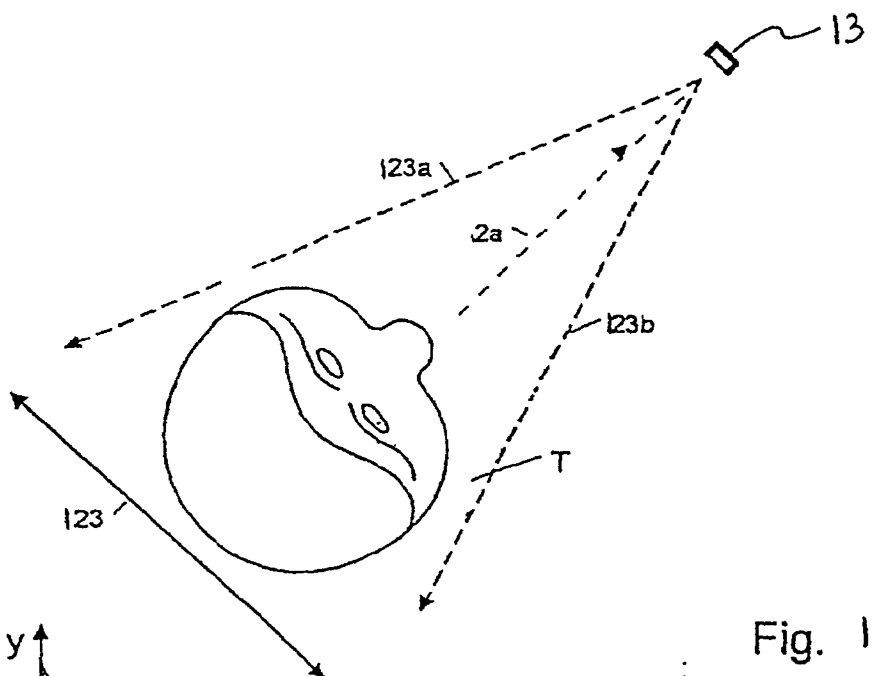

13
123a
2a
123b
T
123

Fig. 16

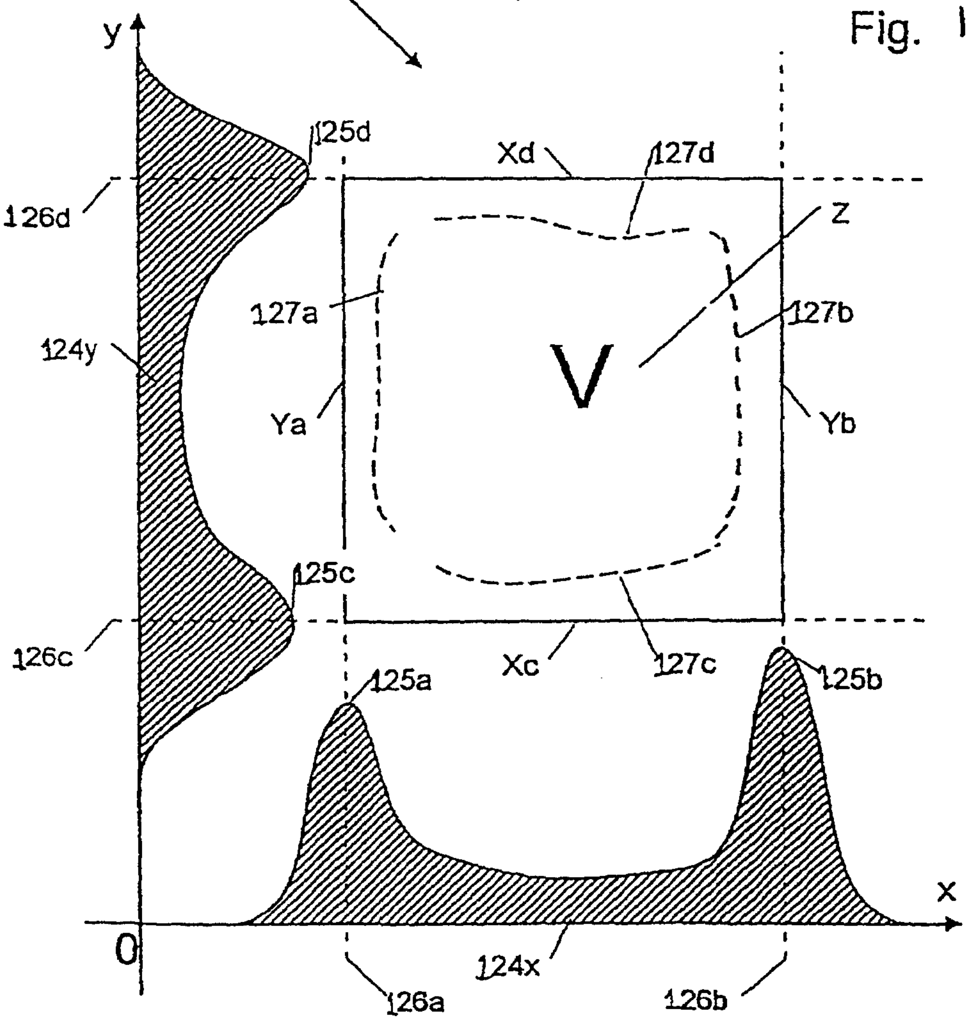

y
125d
Xd
127d
126d
Z
127a
127b
124y
V
Ya
Yb
125c
126c
Xc
127c
125a
125b
x
0
124x
126a
126b

Fig. 17

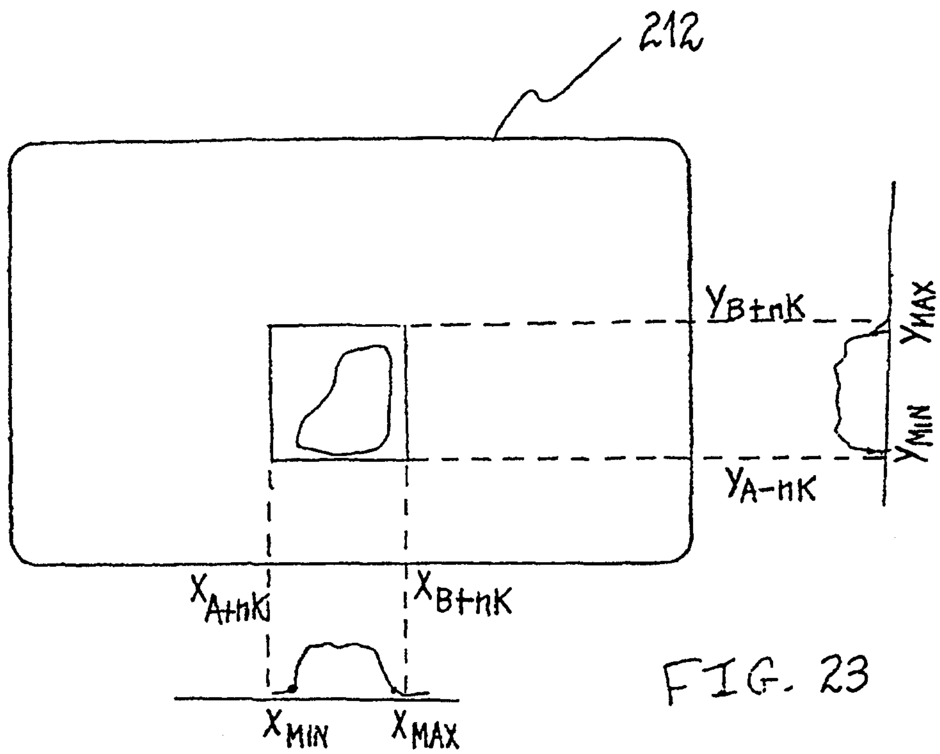


FIG. 23

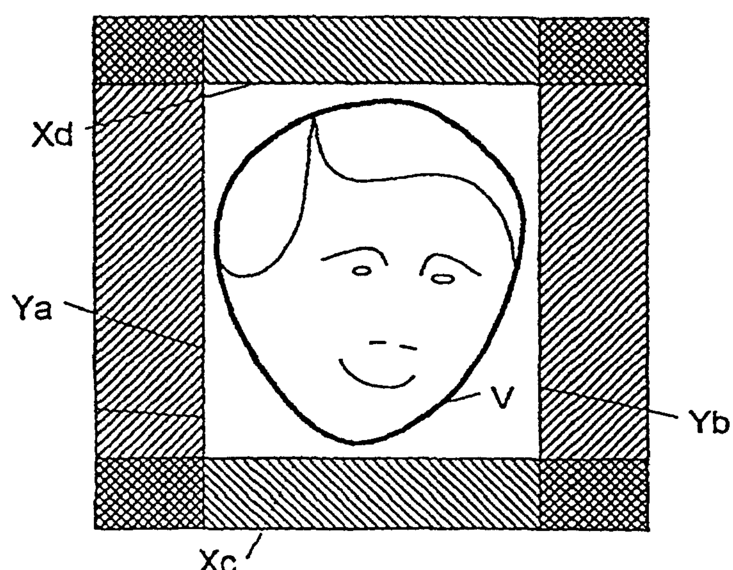


Fig. 18

FIG. 19

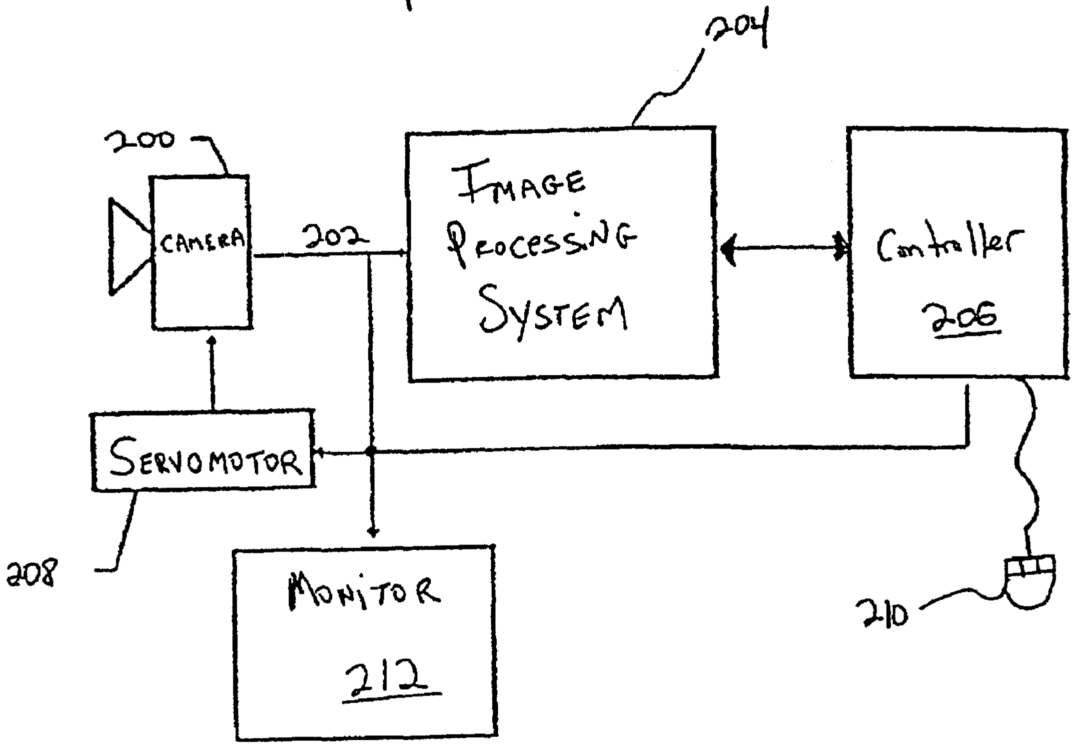
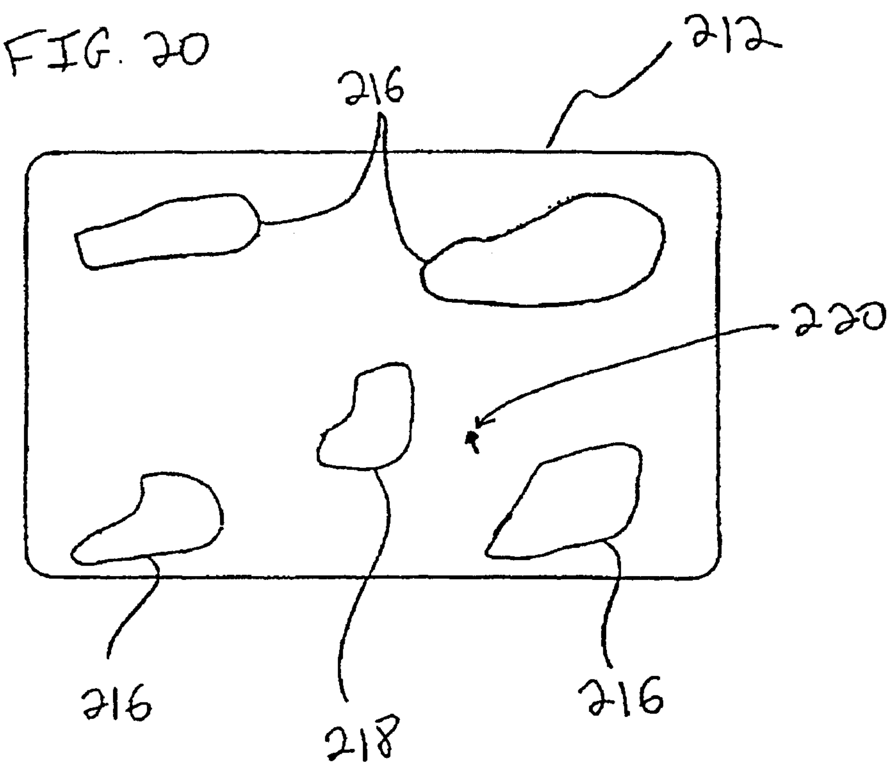

204
200
CAMERA
202
IMAGE PROCESSING SYSTEM
Controller
206
SERVOMOTOR
208
MONITOR
212
210

FIG. 20


212
216
220
216
218
216

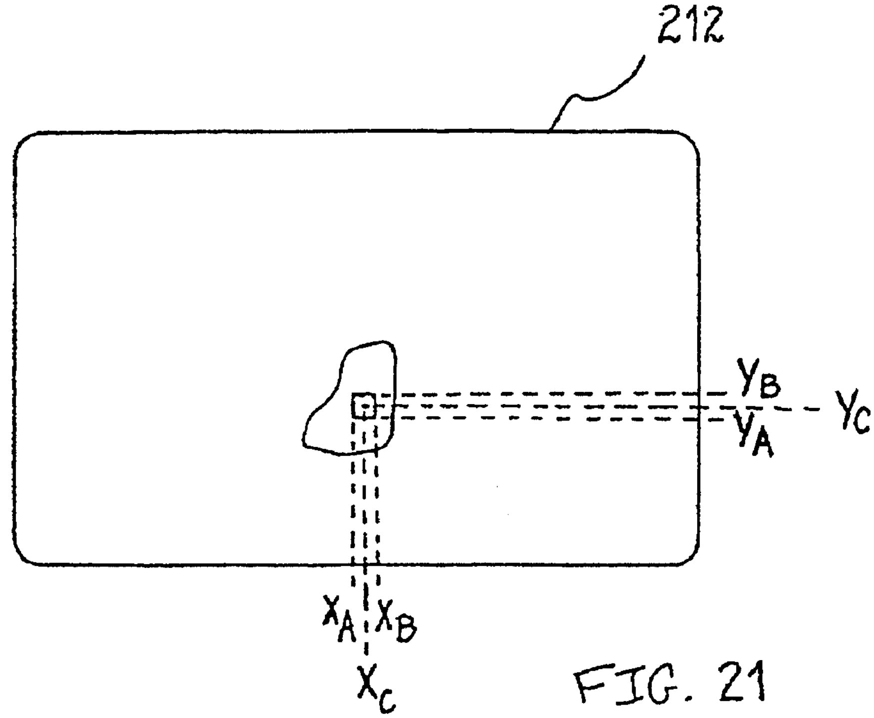

212
YB
YC
YA
XA
XB
XC

FIG. 21

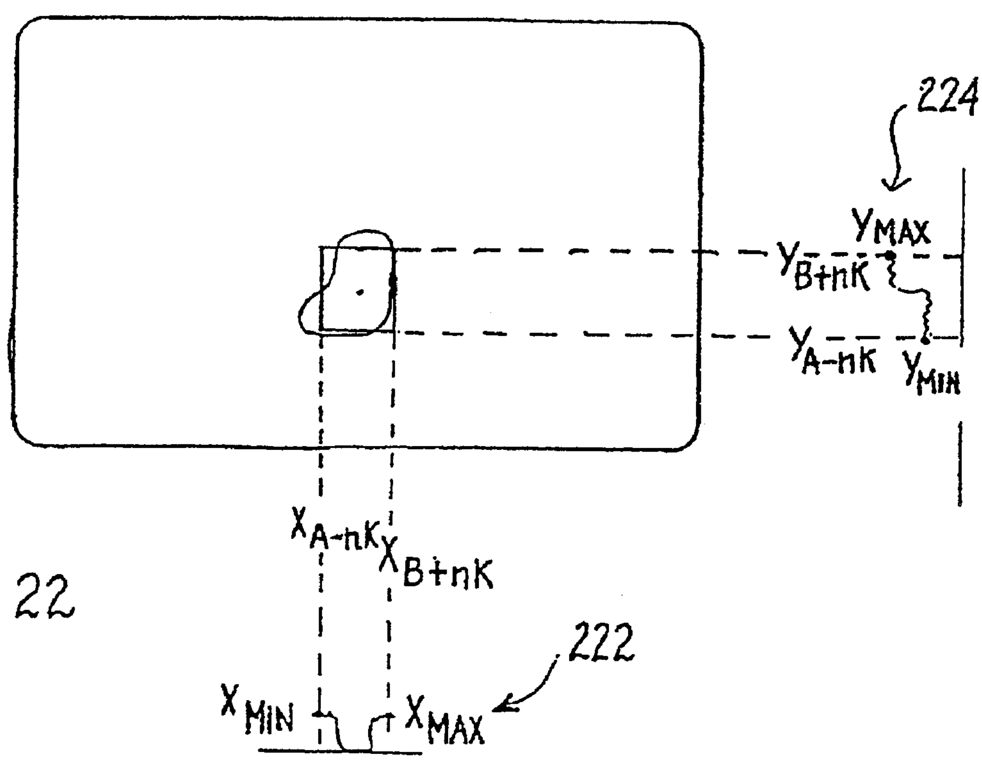

224
YMAX
YB+nK
YA-nK
YMIN
XA-nK
XB+nK
222
XMIN
XMAX

FIG. 22

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Filer:	Gregory A. Nelson/TJ FATUM
Attorney Docket Number:	8042-2-1

Filed as Small Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	75	75
Utility Search Fee	2111	1	250	250
Utility Examination Fee	2311	1	100	100
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
	Total in USD ($)			**425**

Electronic Acknowledgement Receipt

EFS ID:	1530710
Application Number:	11676926
International Application Number:	
Confirmation Number:	9051
Title of Invention:	IMAGE PROCESSING METHOD
First Named Inventor/Applicant Name:	PATRICK PIRIM
Customer Number:	30448
Filer:	Gregory A. Nelson/TJ FATUM
Filer Authorized By:	Gregory A. Nelson
Attorney Docket Number:	8042-2-1
Receipt Date:	20-FEB-2007
Filing Date:	
Time Stamp:	18:23:20
Application Type:	Utility

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$425
RAM confirmation Number	1118
Deposit Account	500951

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1		APPLNPAPERS.pdf	3424758	yes	73

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal of New Application	1	1
Application Data Sheet	2	2
Oath or Declaration filed	3	3
Change of Address	4	4
Preliminary Amendment	5	5
Specification	6	6
Claims	7	8
Applicant Arguments/Remarks Made in an Amendment	9	9
Specification	10	47
Claims	48	59
Abstract	60	60
Drawings	61	73

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (PTO-06)	fee-info.pdf	8358	no	2

Warnings:

Information:

Total Files Size (in bytes):	3433116

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (12-04)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

11/676,926

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)		OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))				75			
SEARCH FEE (37 CFR 1.16(k), (i), or (m))				250			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))				100			
TOTAL CLAIMS (37 CFR 1.16(i))	7 minus 20 =		X$25=		OR	X$50	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =		X$100=			X$200=	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			N/A			N/A	
			TOTAL	425		TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDI-TIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDI-TIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDI-TIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDI-TIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

CLAIMS ONLY

Application Number 11/676926

Filing Date

Applicant(s)

2/20/07

* May be used for additional claims or amendments

CLAIMS	AS FILED Indep	AS FILED Depend	AFTER FIRST AMENDMENT Indep	AFTER FIRST AMENDMENT Depend	AFTER SECOND AMENDMENT Indep	AFTER SECOND AMENDMENT Depend	CLAIMS	Indep	Depend	Indep	Depend	Indep	Depend
1							51	1					
2							52		1				
3							53		1				
4							54	1					
5							55		1				
6							56		1				
7							57		1				
8							58						
9							59						
10							60						
11							61						
12							62						
13							63						
14							64						
15							65						
16							66						
17							67						
18							68						
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38							88						
39							89						
40							90						
41							91						
42							92						
43							93						
44							94						
45							95						
46							96						
47							97						
48							98						
49							99						
50							100						
Total Indep							Total Indep	2					
Total Depend							Total Depend	5					
Total Claims							Total Claims	7					

PTO/SB/06 (12-04)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

11/676,926

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))				75			
SEARCH FEE (37 CFR 1.16(k), (i), or (m))				250			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))				100			
TOTAL CLAIMS (37 CFR 1.16(i))	7 minus 20 =	*	X$25=		OR	X$50	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	X$100=			X$200=	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			N/A			N/A	
			TOTAL	425		TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

Pre Amend 2/20/07

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 7	Minus	** 20	=	X =		OR	X =	
Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	=	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.