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United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
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Table with columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.
Row 1: 13/975,251, 08/23/2013, Se-Yoon Jeong, 022096.0037C2, 9070
Row 2: 89980, 7590, 10/11/2019, NSIP LAW, P.O. Box 65745, Washington, DC 20035
Row 3: EXAMINER, FIELDS, COURTNEY D
Row 4: ART UNIT, PAPER NUMBER, 2496
Row 5: NOTIFICATION DATE, DELIVERY MODE, 10/11/2019, ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto.nsip@gmail.com
pto@nsiplaw.com



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
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In re Patent No. 9,225,982 :
Issue Date: December 29, 2015 :
Application No. 13/975,251 : NOTICE
Filed: August 23, 2013 :
Attorney Docket No. 022096.0037C2 :

This is a notice regarding the request for acceptance of a fee deficiency submission under 37 CFR 1.28(c) filed March 21, 2019.

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.

The fee deficiency submission under 37 CFR 1.28(c) is hereby **ACCEPTED**.

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

Telephone inquiries concerning this decision should be directed to Jonya Smalls, Paralegal Specialist at 571-272-1619.

/JONYA SMALLS/
Jonya Smalls
Paralegal Specialist, OPET



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :C48879

Sale Accounting Date:10/08/2019

Sale Item Reference Number
13975251

Effective Date
03/21/2019

| Document Number | Fee Code | Fee Code Description | Amount Paid | Payment Method |
|------------------|----------|------------------------------------------|-------------|-----------------|
| I201908930448868 | 1461 | 1.28(C) SUBMISSIONS - APPLIC FILE FEE | \$520.00 | Deposit Account |



UNITED STATES PATENT AND TRADEMARK OFFICE

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Alexandria, Virginia 22313-1450
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Table with 5 columns: APPLICATION NUMBER, FILING OR 371(C) DATE, FIRST NAMED APPLICANT, ATTY.DOCKET NO./TITLE, REQUEST ID. Values: 13/975,251, 08/23/2013, Se-Yoon Jeong, 022096.0037C2, 84163

Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 03/21/2019 has been accepted.

CERTIFICATIONS:

Change of Entity Status:
X Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Table with 2 columns: Label, Value. Rows: Signature: /Randall S. Svihla/, Name: Randall S. Svihla, Registration Number: 56273

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent of:

Se-Yoon Jeong et al.

Patent No. 9,225,982

Issued: December 29, 2015

Application No. 13/975,251

Art Unit: 2496

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Courtney D. Fields

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

**PETITION UNDER 37 CFR 1.28(c) TO ACCEPT PAYMENT OF DEFICIENCY
OWED FOR FEES ERRONEOUSLY PAID AS SMALL ENTITY**

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

Sir:

Pursuant to instructions provided by the Office of Petitions, this paper filed via EFS-Web has been coded as "Petition for review by the Office of Petitions."

Small-entity status was claimed in good faith when the application from which this patent issued was filed, and small-entity fees have been paid in good faith up to the date this paper is being filed. However, the applicant has discovered that the entitlement to small-entity status was lost after the application was filed, but the applicant did not recognize this at the time, so the applicant continued paying small-entity fees in good faith after the entitlement to small-entity status was lost. Accordingly, on March 21, 2019, the law firm indicated below changed the entity status of this patent from "small" to "undiscounted" using the entity status update function in Private PAIR. Furthermore, pursuant to 37 CFR 1.28(c)(2)(ii)(D), the applicant owes a total deficiency payment of \$520 for all of the small-entity fees that were paid after the entitlement to small-entity status was lost.

Pursuant to 37 CFR 1.28(c)(2)(ii)(A)-(C), the table following this paragraph itemizes the total deficiency payment of \$520 that is owed by listing each particular type of fee that was erroneously paid as a small entity, the current large-entity fee (including the fee code, the fee amount, the fee quantity, and the total amount), the small-entity fee that was actually paid (including the fee code, the fee amount, the fee quantity, and the total amount), the date the small-entity fee was paid, and the deficiency amount that is owed for each small-entity fee that was erroneously paid.

| Fee Type | Current Large-Entity Fee | | | | Small-Entity Fee Actually Paid | | | | | Def Amt |
|-------------------|--------------------------|---------|---------|--------------|--------------------------------|---------|---------|------------|---------------|------------|
| | Fee Code | Fee Amt | Fee Qty | Total Amt | Fee Code | Fee Amt | Fee Qty | Total Amt | Mailroom Date | |
| Utility issue fee | 1501 | 1,000 | 1 | 1,000 | 2501 | 480 | 1 | 480 | 11/17/2015 | 520 |
| TOTAL | | | | 1,000 | | | | 480 | | 520 |

Pursuant to 37 CFR 1.28(c)(2), please charge the total deficiency payment of \$520 that is owed to Deposit Account No. 50-5113 in the name of North Star Intellectual Property Law, PC. Should the Office decide to refund the small-entity fees and charge the large-entity fees, the refund must also be credited to Deposit Account No. 50-5113, rather than to any other form of payment that may have been used to pay the small-entity fees.

Respectfully submitted,

Date: February 1, 2019

/Randall S. Svihla/
 Randall S. Svihla
 Registration No. 56,273

NSIP Law
 P.O. Box 65745
 Washington, DC 20035
 Telephone (202) 429-0020
 Facsimile (202) 315-3758
 CYP/RSS

Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 35490580 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Randall Scott Svihla/Mark Gambriel |
| Filer Authorized By: | Randall Scott Svihla |
| Attorney Docket Number: | 022096.0037C2 |
| Receipt Date: | 21-MAR-2019 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 13:36:36 |
| 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 | MISC20190129_0220960037C2_PetitionAcceptPaymentDeficiencyOwed_Patent_LostAfterFiling.pdf | 19342 <small>05d391777fd1961eb128a1f0a72801b2ea9beb63</small> | no | 2 |

| | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Information: | |
| Total Files Size (in bytes): | 19342 |
| <p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p> | |



| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|------------|------------|---------------------|------------------|
| 13/975,251 | 12/29/2015 | 9225982 | 022096.0037C2 | 9070 |

89980 7590 12/09/2015
 NSIP LAW
 P.O. Box 65745
 Washington, DC 20035

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 88 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):

- Electronics and Telecommunications Research Institute, Daejeon, KOREA, REPUBLIC OF;
- Kwangwoon University Research Institute for Industry Cooperation, Seoul, KOREA, REPUBLIC OF;
- Industry-Academia Cooperation Group of Sejong University, Seoul, KOREA, REPUBLIC OF;
- Se-Yoon Jeong, Daejeon, KOREA, REPUBLIC OF;
- Hae-Chul Choi, Daejeon, KOREA, REPUBLIC OF;
- Jeong-II Seo, Daejeon, KOREA, REPUBLIC OF;
- Seung-Kwon Beack, Seoul, KOREA, REPUBLIC OF;
- In-Seon Jang, Gunpo-si, KOREA, REPUBLIC OF;
- Jae-Gon Kim, Daejeon, KOREA, REPUBLIC OF;
- Kyung-Ae Moon, Daejeon, KOREA, REPUBLIC OF;
- Dae-Young Jang, Daejeon, KOREA, REPUBLIC OF;
- Jin-Woo Hong, Daejeon, KOREA, REPUBLIC OF;
- Jin-Woong Kim, Daejeon, KOREA, REPUBLIC OF;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

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)

89980
 NSIP LAW
 P.O. Box 65745
 Washington, DC 20035

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. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 13/975,251 | 08/23/2013 | Se-Yoon JEONG | 022096.0037C2 | 9070 |

TITLE OF INVENTION:

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|----------------|--------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL | \$480 | \$0 | \$0 | \$480 | 12/22/2015 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|----------|----------|----------------|
| | | |

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</p> <p><input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.</p> <p><input type="checkbox"/> "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.</p> | <p>2. For printing on the patent front page, list</p> <p>(1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 <u>NSIP Law</u></p> <p>(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. 2 _____</p> <p>3 _____</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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.

| | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>(A) NAME OF ASSIGNEE</p> <p>Electronics and Telecommunications Research Institute Kwangwoon University Research Institute for Industry Cooperation Industry-Academia Cooperation Group of Sejong University</p> | <p>(B) RESIDENCE: (CITY and STATE OR COUNTRY)</p> <p>Daejeon, Republic of Korea Seoul, Republic of Korea Seoul, Republic of Korea</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Please check the appropriate assignee category or categories (will not be printed on the patent): Individual Corporation or other private group entity Government

| | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>4a. The following fee(s) are submitted:</p> <p><input checked="" type="checkbox"/> Issue Fee</p> <p><input checked="" type="checkbox"/> Publication Fee (No small entity discount permitted)</p> <p><input type="checkbox"/> Advance Order - # of Copies _____</p> | <p>4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)</p> <p><input type="checkbox"/> A check is enclosed.</p> <p><input checked="" type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input checked="" type="checkbox"/> The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number <u>50-5413</u> (enclose an extra copy of this form).</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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 /Jeanne A. Di Grazio/ Date November 17, 2015

Typed or printed name Jeanne A. Di Grazio Registration No. 58,633

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.

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.

Electronic Patent Application Fee Transmittal

| | | | | |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|-----------------------------|
| Application Number: | 13975251 | | | |
| Filing Date: | 23-Aug-2013 | | | |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | | | |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong | | | |
| Filer: | Jeanne Andrea Di Grazio/Yuri Kang | | | |
| Attorney Docket Number: | 022096.0037C2 | | | |
| Filed as Small Entity | | | | |
| Filing Fees for Utility under 35 USC 111(a) | | | | |
| 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: | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|----------------------------------------|----------|----------|--------|----------------------|
| Utility Appl Issue Fee | 2501 | 1 | 480 | 480 |
| Publ. Fee- Early, Voluntary, or Normal | 1504 | 1 | 0 | 0 |
| Extension-of-Time: | | | | |
| Miscellaneous: | | | | |
| Total in USD (\$) | | | | 480 |

Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 24105234 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Jeanne Andrea Di Grazio/Yuri Kang |
| Filer Authorized By: | Jeanne Andrea Di Grazio |
| Attorney Docket Number: | 022096.0037C2 |
| Receipt Date: | 17-NOV-2015 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 13:11:50 |
| Application Type: | Utility under 35 USC 111(a) |

Payment information:

| | |
|------------------------------------------|-------------------|
| Submitted with Payment | yes |
| Payment Type | Deposit Account |
| Payment was successfully received in RAM | \$480 |
| RAM confirmation Number | 11048 |
| Deposit Account | 505113 |
| Authorized User | DI'GRAZIO, JEANNE |

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

| | | | | | |
|--|--|--|--|--|--|
| | | | | | |
|--|--|--|--|--|--|

File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|-----------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------|------------------|------------------|
| 1 | Issue Fee Payment (PTO-85B) | NOA20150922_0220960037C2_IssueFeeTransmittal_1.pdf | 1902740 2e086f1f2caac99a16a029b70c3475d8289d bc2b | no | 1 |

Warnings:

Information:

| | | | | | |
|---|----------------------|--------------|-------------------------------------------------------|----|---|
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 32598 564004b18784177aa09d1fbd92b1dc78a02 0fc87 | no | 2 |
|---|----------------------|--------------|-------------------------------------------------------|----|---|

Warnings:

Information:

| | | | | | |
|-------------------------------------|--|--|---------|--|--|
| Total Files Size (in bytes): | | | 1935338 | | |
|-------------------------------------|--|--|---------|--|--|

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.



NOTICE OF ALLOWANCE AND FEE(S) DUE

89980 7590 09/22/2015
NSIP LAW
P.O. Box 65745
Washington, DC 20035

Table with 2 columns: EXAMINER (FIELDS, COURTNEY D), ART UNIT (2496), PAPER NUMBER (9070)

DATE MAILED: 09/22/2015

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.

13/975,251 08/23/2013 Se-Yoon Jeong 022096.0037C2 9070
TITLE OF INVENTION: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR

Table with 7 columns: APPLN. TYPE, ENTITY STATUS, ISSUE FEE DUE, PUBLICATION FEE DUE, PREV. PAID ISSUE FEE, TOTAL FEE(S) DUE, DATE DUE

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.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.
If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.
If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".
For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

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

**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)

89980 7590 09/22/2015
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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.

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|--------------------|
| (Depositor's name) |
| (Signature) |
| (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 13/975,251 | 08/23/2013 | Se-Yoon Jeong | 022096.0037C2 | 9070 |

TITLE OF INVENTION: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL | \$480 | \$0 | \$0 | \$480 | 12/22/2015 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|--------------------|----------|----------------|
| FIELDS, COURTNEY D | 2496 | 375-240200 |

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</p> <p><input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.</p> <p><input type="checkbox"/> "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.</p> | <p>2. For printing on the patent front page, list</p> <p>(1) The names of up to 3 registered patent attorneys or agents OR, alternatively, _____ 1</p> <p>(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. _____ 2</p> <p>_____ 3</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>4a. The following fee(s) are submitted:</p> <p><input type="checkbox"/> Issue Fee</p> <p><input type="checkbox"/> Publication Fee (No small entity discount permitted)</p> <p><input type="checkbox"/> Advance Order - # of Copies _____</p> | <p>4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)</p> <p><input type="checkbox"/> A check is enclosed.</p> <p><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input type="checkbox"/> The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

5. **Change in Entity Status** (from status indicated above)

Applicant certifying micro entity status. See 37 CFR 1.29

Applicant asserting small entity status. See 37 CFR 1.27

Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



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Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.
13/975,251 08/23/2013 Se-Yoon Jeong 022096.0037C2 9070

89980 7590 09/22/2015
NSIP LAW
P.O. Box 65745
Washington, DC 20035

EXAMINER

FIELDS, COURTNEY D

ART UNIT PAPER NUMBER

2496

DATE MAILED: 09/22/2015

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B 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. 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.

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 disclosure of these records is required by the Freedom of Information Act.
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 inspection 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.

| | | | |
|-------------------------------|--------------------------------------|-------------------------------------|--------------------------------------------------|
| Notice of Allowability | Application No. 13/975,251 | Applicant(s) JEONG ET AL. | |
| | Examiner COURTNEY FIELDS | Art Unit 2496 | AIA (First Inventor to File) Status No |

-- 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 08 September 2015.
 A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. The allowed claim(s) is/are 1 and 2. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/oph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- 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.

5. CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 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)

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) 2. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____ 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material 4. <input type="checkbox"/> Interview Summary (PTO-413), Paper No./Mail Date _____. | <ol style="list-style-type: none"> 5. <input type="checkbox"/> Examiner's Amendment/Comment 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance 7. <input type="checkbox"/> Other _____. |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

/ANDREW NALVEN/
Supervisory Patent Examiner, Art Unit 2496

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.
2. This communication is in response to Applicant's amendment filed on 08 September 2015. Claims 1-2 remain pending.

Terminal Disclaimer

1. The terminal disclaimer filed on 08 September 2015 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of prior patent number 8,548,060 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Response to Arguments

2. Applicant's arguments filed 08 September 2015 have been fully considered and they are persuasive.

Allowable Subject Matter

3. Claims **1-2** are allowed.
4. The following is an examiner's statement of reasons for allowance: The present invention is directed towards an encoding/decoding apparatus and method using an adaptive Discrete Cosine Transform (DCT) coefficient scanning based on pixel similarity. Claim 1 identifies the uniquely distinct features "**performing entropy**

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decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values”.

The closest prior art, Park (Pub No. 2006/0002466) discloses a prediction encoder/decoder and a prediction encoding/decoding method. The prediction encoder includes a prediction encoding unit starting prediction from an origin macroblock of an area of interest of a video frame, continuing prediction in a direction of ripple scanning with respect to a square ring that includes macroblocks and surrounds the origin macroblock, and encoding video by performing intra-prediction in 8.times.8 block units using information about a macroblock that has been just coded in a square ring including a macroblock to be coded and at least one of macroblocks that are adjacent to the macroblock to be coded in a square ring that has been just coded.

However, either singularly or in combination, Park fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

The closest prior art, Boon et al. (US Patent No. 7,995,654) discloses image predictive coding method. When dividing inputted image data to be coded into image data of a plurality of small regions which are adjacent to each other and coding the image data of an objective small region to be processed among the image data of the

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plurality of divided small regions which are adjacent to each other, reconstructed image data of a reproduction small region adjacent to the image data of the objective small region to be processed is used as image data of an intra-frame prediction small region of the objective small region to be processed, the image data of the intra-frame prediction small region is used as image data of an optimum prediction small region and image data of a difference small region which are differences between the image data of the objective small region to be processed and the image data of the optimum prediction small region is generated. Then, the generated image data of the difference small region is coded and outputted, and then the coded image data of the difference small region is decoded, so that the reconstructed image data of the reproduction small region is generated by adding the decoded image data of the difference small region to the image data of the optimum prediction small region.

However, either singularly or in combination, Boon et al. fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

The closest prior art, Gaedke (US Patent No. 8,107,532) discloses method and apparatus for generating/evaluating in a picture signal encoding/decoding one or more prediction information items. Advanced Video Coding uses intra prediction for 4*4 pixel blocks whereby reconstructed samples from adjacent pixel blocks are used to predict a current block. Nine different intra prediction modes are available in AVC. In order to

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save bits for signaling the prediction modes, a flag and a 3-bit parameter are used. If this flag is set the most probable prediction mode, which is calculated from previous predictions, is used by the encoder and the decoder to reconstruct the actual prediction mode. If the flag is cleared, the 3-bit parameter is sent to select the prediction mode independently. According to the invention, the flag is applied more frequently, based on a prediction error threshold, instead of applying the optimum prediction mode for a current pixel block.

However, either singularly or in combination, Gaedke fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

The closest prior art, Kanehara (US Patent No. 7,933,334) discloses image encoder and method thereof, computer program of image encoder, and mobile terminal. The present invention provides an image coding method comprising: selecting prediction modes from among prescribed plurality of prediction modes based on processed blocks, the number of selected prediction modes being less than the number of said prescribed plurality of prediction modes; predicting a pixel of a block in an input frame image based on selected prediction modes; calculating a difference between said predicted pixel value and a pixel value of a block in an input frame; determining a coding mode based on the result of said calculation process, said determined coding mode being used for said image coding method. And the present invention also

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provides an encoding circuit, encoding program, a mobile terminal, an encoding and decoding circuit relevant to the image encoding method above.

However, either singularly or in combination, Kanehara fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

The closest prior art, Wang et al. (US Patent No. 7,817,718) discloses macroblock level adaptive frame/field coding for digital video content. A method and system of encoding and decoding digital video content. The digital video content comprises a stream of pictures which can each be intra, predicted, or bi-predicted pictures. Each of the pictures comprises macroblocks that can be further divided into smaller blocks. The method entails encoding and decoding each of the smaller blocks in each picture in said stream of pictures in either frame mode or in field mode.

However, either singularly or in combination, Wang et al. fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

The closest prior art, Karczewicz et al. (Pub No. 2003/0081850) discloses a method and system for image coding, wherein an image is divided into a plurality of blocks for scanning. The pixels values in the scanned block are represented by a

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plurality of level-run value pairs, wherein the level value is indicative of a non-zero pixel value and the run value is indicative of the number of consecutive zero pixel values preceding the non-zero pixel value. A plurality of contexts indicative of the level-run value pairs are conveyed to a decoder for allowing the decoder to reconstruct the image based on the contexts. The assignment of the contexts is also based on the level value of a preceding level-run pair. Additionally, instead of an end-of-block symbol, the number of non-zero coefficients is provided to the decoder prior to conveying the contexts thereto.

However, either singularly or in combination, Karczewicz et al. fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

The closest prior art, Gharavi (US Patent No. 4,821,119) discloses a method and apparatus for low bit-rate interframe video coding. An improved low bit-rate interframe video encoder is disclosed of the type known as a hybrid coder. The hybrid coder includes a block subdivider circuit and achieves image compression by using a two-dimensional signal transformation on blocks of differential pel data in the forward loop of a DPCM coder. The transform coefficients of each block are then quantized and entropy coded for transmission. Coding efficiency is in part determined by the size of the transform block. Larger blocks are more bit efficient because of the lower quantity of overhead data required, but require a complex transformer hardware implementation.

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In addition, larger blocks produce annoying block distortion. After differential combination (307) with a corresponding block from the previous frame, each $m \times m$ block of pel data is sub-divided (309) into smaller $n \times n$ ($n \sim m$) blocks of data which are individually transformed by a two-dimensional discrete cosine transformer (311). After the coefficients of each sub-block are quantized (312), the main block is reconstructed (314). An entropy encoder (315) scans the sub-blocks and codes the resultant string of scanned coefficients in such a way that the inter-sub-block correlation is efficiently exploited.

However, either singularly or in combination, Gharavi fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

The closest prior art, He (Pub No. 2007/0274385) discloses a method of increasing coding efficiency and reducing power consumption by on-line scene change detection while encoding inter-frame. A system and method for on-the-fly detection of scene changes within a video stream through statistical analysis of a portion of the macroblocks comprising each video frame as they are processed using inter-frame coding. If the statistical analysis of the selected macroblocks of the current frame differs from the previous frame by exceeding predetermined thresholds, the current video frame is assumed to be a scene change. Once a scene change is detected,

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the remainder of the video frame is encoded as an intra-frame, intra-macroblocks, or intra slices, through implementation of one or more predetermined or adaptively adjusted quantization parameters to reduce computational complexity, decrease power consumption, and increase the resulting video image quality. As decoding is the inverse of encoding, these improvements are similarly recognized by a decoder as it decodes a resulting encoded video stream.

However, either singularly or in combination, He fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

The closest prior art, Sung et al. (Pub No. 2005/0074062) discloses fast DCT method and apparatus for digital video compression. The present invention provides method and apparatus of a fast DCT implementation. DCT calculation is combined with quantization scales by a procedure of pre-processing. During DCT coefficient calculation, only non-zero coefficients are calculated. If pixel variance range is smaller than a first predetermined threshold, a predetermined lookup table is compared to decide the DCT coefficients. When a pixel variance range of a block pixels is within the second threshold, coupled with the quantization scales, the pre-processing determines the amount of non-zero DCT coefficients need to be calculated. Only a limited amount of LSB bits within a block is applied in the calculation of DCT coefficients. A previously

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saved pixel with equal or closest pixel value is used to replace the operation of current pixel's multiplication.

However, either singularly or in combination, Sung et al. fail to anticipate or render obvious the claimed limitations of performing entropy decoding of encoded video information to obtain transform coefficients, wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

5. Therefore, **claim 1** and the respective **dependent claim 2** are in condition for allowance.

Conclusion

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 COURTNEY FIELDS whose telephone number is (571)272-3871. The examiner can normally be reached on Mon - Fri. 7:00 - 4:00 pm; IFP.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Nalven can be reached on 571-272-3839. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2496

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). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COURTNEY FIELDS/
Examiner, Art Unit 2496
September 16, 2015

/ANDREW NALVEN/
Supervisory Patent Examiner, Art Unit 2496

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|-----------------------------------|---------------------------------------|---------------------------------------------------------|-------------|
| Notice of References Cited | Application/Control No. 13/975,251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. | |
| | Examiner COURTNEY FIELDS | Art Unit 2496 | Page 1 of 1 |

U.S. PATENT DOCUMENTS

| * | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | CPC Classification | US Classification |
|---|--------------------------------------------------|-----------------|------|--------------------|-------------------|
| | A | US- | | | |
| | B | US- | | | |
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FOREIGN PATENT DOCUMENTS

| * | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification | |
|---|--------------------------------------------------|------------------|---------|------|--------------------|------------|
| | N | WO 2012161444 A2 | 11-2012 | KR | KWON JAE CHEOL | H04N19/176 |
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| | R | | | | | |
| | S | | | | | |
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NON-PATENT DOCUMENTS

| * | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | U Haitham Habli, Johan Ersfolk, Johan Lilius, Tomi Westerlund, Jari Nurmi; "Optimizing off-chip memory access costs in low power MPEG-4 decoder"; April 2012; ICICS '12: Proceedings of the 3rd International Conference on Information and Communication Systems; Publisher: ACM; pp. 1-5 |
| | V |
| | W |
| | X |

*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.

(12) 특허협력조약에 의하여 공개된 국제출원

(19) 세계지식재산권기구
국제사무국



(10) 국제공개번호

WO 2012/161444 A2

(43) 국제공개일
2012년 11월 29일 (29.11.2012)

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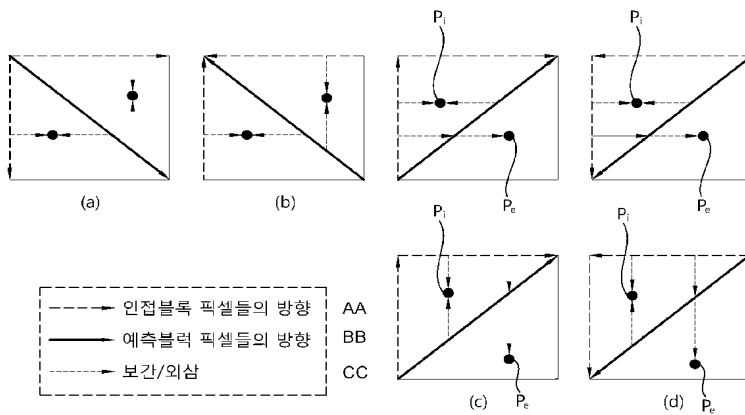
공개:

— 국제조사보고서 없이 공개하며 보고서 접수 후 이를 별도 공개함 (규칙 48.2(g))

(54) Title: METHOD AND APPARATUS FOR INTRA PREDICTION WITHIN DISPLAY SCREEN

(54) 발명의 명칭 : 화면 내 예측 방법 및 장치

[Fig. 7]



AA ... Direction of pixels in neighboring block
 BB ... Direction of pixels in prediction block
 CC ... Interpolation/extrapolation

(57) Abstract: The present invention relates to a method and apparatus for intra prediction. The intra prediction method for a decoder, according to the present invention, comprises the steps of: entropy-decoding a received bit-stream; generating reference pixels to be used in the intra prediction of a prediction unit; generating a prediction block from the reference pixels on the basis of a prediction mode for the prediction unit; and reconstructing an image from the prediction block and a residual block, which is obtained as a result of entropy encoding, wherein the reference pixels and/or the prediction block pixels are predicted on the basis of a base pixel, and the predicted pixel value can be the sum of the pixel value of the base pixel and the difference between the pixel values of the base pixel and the generated pixel.

(57) 요약서: 본 발명은 인트라 예측 방법 및 장치에 관한 것으로서, 본 발명에 따른 복호화기의 인트라 예측 방법은 수신한 비트스트림을 엔트로피 복호화하는 단계, 예측 유닛의 인트라 예측에 이용할 참조 화소를 생성하는 단계, 예측 유닛에 대한 예측

모드를 기반으로 상기 참조 화소로부터 예측 블록을 생성하는 단계 및 엔트로피 복호화를 통해 구한 잔차 블록과 상기 예측 블록으로부터 영상을 재구성(reconstruction)하는 단계를 포함하며, 상기 참조 화소들 및 상기 예측 블록의 화소들 중 적어도 어느 하나의 화소들은 기준 화소를 기반으로 예측되고, 상기 예측되는 화소값은 상기 기준 화소의 화소값에 및 상기 기준 화소로부터 상기 생성되는 화소까지의 화소값 변화량을 더한 값일 수 있다.

WO 2012/161444 A2

명세서

발명의 명칭: 화면 내 예측 방법 및 장치

기술분야

- [0001] 본 발명은 영상 처리 기술에 관한 것으로서, 더 구체적으로는 영상 정보의 부호화/복호화에 있어서, 화면 내 예측 방법에 관한 것이다.

배경기술

- [0002] 최근, 고해상도, 고품질의 영상에 대한 요구가 다양한 응용 분야에서 증가하고 있다. 하지만, 영상의 고해상도, 고품질이 될수록 해당 영상에 관한 정보량도 함께 증가한다. 따라서 기존의 유무선 광대역 회선과 같은 매체를 이용하여 영상 정보를 전송하거나 기존의 저장 매체를 이용해 영상 정보를 저장하는 경우, 정보의 전송 비용과 저장 비용이 증가하게 된다.
- [0003] 고해상도, 고품질 영상의 정보를 효과적으로 전송하거나 저장하고, 재생하기 위해 고효율의 영상 압축 기술을 이용할 수 있다.

발명의 요약

기술적 과제

- [0004] 본 발명은 방향성이 있는 텍스처에 대하여 인접 블럭 참조 화소들의 변화량을 고려함으로써 효과적인 인트라 예측을 수행하는 방법을 제공하는 것을 목적으로 한다.
- [0005] 본 발명은 인트라 예측을 수행함에 있어서, 예측 블럭에 인접한 블럭의 화소값의 변화량을 고려하여 플래너 예측을 수행하는 방법을 제공하는 것을 목적으로 한다.
- [0006] 본 발명은 CIP(Constrained Intra Prediction)이 적용되는 경우, 인터 모드의 인접 화소 위치에 인트라 모드의 인접 블럭을 기반으로 참조 화소를 생성하여, 인트라 예측에 이용하는 방법을 제공하는 것을 특징으로 한다.
- [0007] 본 발명은 인터 모드의 인접 화소 위치에 인트라 모드의 인접 블럭을 기반으로 참조 화소를 생성하는 경우에, 화소값의 변화량을 반영하여 참조 화소를 생성하는 방법을 제공하는 것을 목적으로 한다.

과제 해결 수단

- [0008] 본 발명의 일 실시형태는 입력된 예측 유닛에 대하여 인트라 예측을 위한 참조 화소들을 생성하는 단계, 예측 유닛에 대한 인트라 모드를 결정하는 단계, 참조 화소와 상기 인트라 모드를 기반으로 예측 블럭을 생성하는 단계 및 예측 유닛과 상기 예측 블럭에 대한 잔차 블럭을 생성하는 단계를 포함하는 부호화기의 인트라 예측 방법으로서, 참조 화소들 및 예측 블럭의 화소들 중 적어도 어느 하나의 화소들은 기준 화소를 기반으로 예측되고, 상기 예측되는 화소값은 기준 화소의 화소값에 상기 기준 화소로부터 상기 생성되는 화소까지의 화소값 변화량을 더한 값을 화소값일 수 있다.

- [0009] 본 실시형태에서는 상기 예측 블럭의 좌상측 코너에 위치하는 인접 블럭의 참조 화소를 제1 기준 화소로 할 수 있으며, 제1 기준 화소로부터, 상기 예측 블럭과의 좌측 경계에 위치하는 인접 블럭의 참조 화소 중 가장 아래 화소까지의 화소값 변화량과, 제1 기준 화소로부터, 상기 예측 블럭과의 상측 경계에 위치하는 인접 블럭의 참조 화소 중 가장 오른쪽 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 블럭의 우하측 코너의 대각선 화소인 제2 기준 화소의 화소값으로 설정할 수 있고, 제1 기준 화소와 제2 기준 화소로부터 상기 예측 블럭의 대각선 화소값들을 예측할 수 있다.
- [0010] 이때, 상기 예측 블럭의 비 대각선 화소들은 상기 대각선 화소들과 상기 예측 블럭과의 상측 및/또는 좌측 경계에 있는 인접 블럭의 화소들을 보간 또는 외삽하여 예측될 수 있다.
- [0011] 또한, 본 실시형태에서는, 상기 예측 블럭의 좌상측 코너에 위치하는 인접 블럭의 참조 화소를 기준 화소로 할 수 있고, 상기 기준 화소로부터, 상기 예측 블럭의 좌측 경계에 위치하는 인접 블럭의 참조 화소 중 예측 대상 화소와 동일한 행에 위치하는 인접 화소까지의 화소값 변화량과, 상기 기준 화소로부터, 상기 예측 블럭의 상측 경계에 위치하는 인접 블럭의 참조 화소 중 상기 예측 대상 화소와 동일한 열에 위치하는 인접 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 대상 화소의 화소값으로 예측할 수 있다.
- [0012] 또한, 본 실시형태에서는, 상기 예측 블럭과의 좌측 또는 상측 경계에 위치하는 인접 블럭의 화소들 중 예측 대상 화소와 동일한 행 또는 동일한 열에 위치하는 화소를 기준 화소로 할 수 있고, 상기 기준 화소로부터, 상기 예측 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 대상 화소의 화소값으로 예측할 수 있다.
- [0013] 이때, 상기 예측 대상 화소는 상기 예측 블럭의 대각선 화소일 수 있고, 상기 예측 블럭의 비 대각선 화소는 상기 대각선 화소와 상기 인접 블럭의 화소들을 이용한 보간을 통해서 예측될 수 있다.
- [0014] 본 실시형태에서는, 상기 예측 유닛과 인접한 블럭이 인터 모드 블럭인 경우에, 상기 인터 모드 블럭과 상기 예측 유닛과의 경계에 위치하는 참조 화소를 생성하는 단계를 더 포함할 수 있으며, 상기 참조 화소의 좌측 또는 하측에 위치하는 인트라 모드 블럭의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소를 제1 기준 화소로 하고, 상기 참조 화소의 우측 또는 상측에 위치하는 인트라 모드 블럭의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소를 제2 기준 화소로 하여, 상기 제1 기준 화소로부터 상기 참조 화소까지의 거리와, 상기 제2 기준 화소로부터 상기 참조 화소까지의 거리를 기초로 상기 참조 화소를 생성할 수 있다.
- [0015] 이때, 상기 제1 기준 화소의 화소값은 제1 기준 화소가 속하는 인트라 모드 블럭의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소들의 평균 화소 값일 수 있고, 상기 제2 기준 화소의 화소값은 제2 기준 화소가 속하는 인트라 모드

블럭의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소들의 평균 화소 값일 수 있다. 또한, 상기 참조 화소의 좌측 또는 하측에만 인트라 모드 블럭이 위치하는 경우에는 상기 제1 기준 화소 값을 상기 참조 화소 값으로 할 수도 있고, 상기 참조 화소의 우측 또는 상측에만 인트라 모드 블럭이 위치하는 경우에는, 상기 제2 기준 화소 값을 상기 참조 화소 값으로 할 수도 있다.

- [0016] 본 발명의 다른 실시형태는 수신한 비트스트림을 엔트로피 복호화하는 단계, 예측 유닛의 인트라 예측에 이용할 참조 화소를 생성하는 단계, 예측 유닛에 대한 예측 모드를 기반으로 상기 참조 화소로부터 예측 블럭을 생성하는 단계 및 엔트로피 복호화를 통해 구한 잔차 블럭과 상기 예측 블럭으로부터 영상을 재구성(reconstruction)하는 단계를 포함하는 복호화기에서의 인트라 예측 방법으로서, 상기 참조 화소들 및 상기 예측 블럭의 화소들 중 적어도 어느 하나의 화소들은 기준 화소를 기반으로 예측되고, 상기 예측되는 화소값은 상기 기준 화소의 화소값에 및 상기 기준 화소로부터 상기 생성되는 화소까지의 화소값 변화량을 더한 값일 수 있다.
- [0017] 본 실시형태에서는 상기 예측 블럭의 좌상측 코너에 위치하는 인접 블럭의 참조 화소를 제1 기준 화소로 할 수 있으며, 상기 제1 기준 화소로부터, 상기 예측 블럭과의 좌측 경계에 위치하는 인접 블럭의 참조 화소 중 가장 아래 화소까지의 화소값 변화량과, 상기 제1 기준 화소로부터, 상기 예측 블럭과의 상측 경계에 위치하는 인접 블럭의 참조 화소 중 가장 오른쪽 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 블럭의 우하측 코너의 대각선 화소인 제2 기준 화소의 화소값으로 설정할 수 있고, 상기 제1 기준 화소와 상기 제2 기준 화소로부터 상기 예측 블럭의 대각선 화소값들을 예측할 수 있다.
- [0018] 이때, 상기 예측 블럭의 비 대각선 화소들은 상기 대각선 화소들과 상기 예측 블럭과의 상측 및/또는 좌측 경계에 있는 인접 블럭의 화소들을 보간 또는 외삽하여 예측할 수 있다.
- [0019] 본 실시형태에서는 상기 예측 블럭의 좌상측 코너에 위치하는 인접 블럭의 참조 화소를 기준 화소로 할 수 있고, 상기 기준 화소로부터, 상기 예측 블럭의 좌측 경계에 위치하는 인접 블럭의 참조 화소 중 예측 대상 화소와 동일한 행에 위치하는 인접 화소까지의 화소값 변화량과, 상기 기준 화소로부터, 상기 예측 블럭의 상측 경계에 위치하는 인접 블럭의 참조 화소 중 상기 예측 대상 화소와 동일한 열에 위치하는 인접 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 대상 화소의 화소값으로 예측할 수 있다.
- [0020] 또한 본 실시형태에서는, 상기 예측 블럭과의 좌측 또는 상측 경계에 위치하는 인접 블럭의 화소들 중 예측 대상 화소와 동일한 행 또는 동일한 열에 위치하는 화소를 기준 화소로 할 수 있고, 상기 기준 화소로부터, 상기 예측 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 대상 화소의 화소값으로 예측할 수 있다.
- [0021] 이때, 상기 예측 대상 화소는 상기 예측 블럭의 대각선 화소일 수 있으며, 상기

예측 블록의 비 대각선 화소는 상기 대각선 화소와 상기 인접 블록의 화소들을 이용한 보간을 통해서 예측될 수 있다.

- [0022] 본 실시형태에 있어서, 상기 예측 유닛과 인접한 블록이 인터 모드 블록인 경우에, 상기 인터 모드 블록과 상기 예측 유닛과의 경계에 위치하는 참조 화소를 생성하는 단계를 더 포함할 수 있으며, 상기 참조 화소의 좌측 또는 하측에 위치하는 인트라 모드 블록의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소를 제1 기준 화소로 할 수 있고, 상기 참조 화소의 우측 또는 상측에 위치하는 인트라 모드 블록의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소를 제2 기준 화소로 할 수 있으며, 상기 제1 기준 화소로부터 상기 참조 화소까지의 거리와, 상기 제2 기준 화소로부터 상기 참조 화소까지의 거리에 기초하여 상기 참조 화소를 생성할 수 있다.
- [0023] 이때, 상기 제1 기준 화소의 화소값은 제1 기준 화소가 속하는 인트라 모드 블록의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소들의 평균 화소 값일 수 있고, 상기 제2 기준 화소의 화소값은 제2 기준 화소가 속하는 인트라 모드 블록의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소들의 평균 화소 값일 수 있다. 또한, 상기 참조 화소의 좌측 또는 하측에만 인트라 모드 블록이 위치하는 경우에는 상기 제1 기준 화소 값을 상기 참조 화소 값으로 할 수 있고, 상기 참조 화소의 우측 또는 상측에만 인트라 모드 블록이 위치하는 경우에는, 상기 제2 기준 화소 값을 상기 참조 화소 값으로 할 수 있다.
- [0024] 본 실시형태에 있어서, 복호화기는 상기 엔트로피 복호화를 통해 상기 예측 블록의 화소들을 상기 기준 화소를 기반으로 생성하라는 지시를 획득할 수 있다. 또한, 복호화기는 상기 엔트로피 복호화를 통해 상기 참조 화소들을 상기 기준 화소를 기반으로 생성하라는 지시를 획득할 수 있다.

발명의 효과

- [0025] 본 발명에 의하면, 방향성이 있는 텍스처에 대하여 인접 블록 참조 화소들의 변화량을 고려함으로써 효과적인 인트라 예측이 이루어질 수 있다.
- [0026] 또한, 본 발명에 의하면, 플래너 예측을 수행함에 있어서 예측 블록에 인접한 블록의 화소값의 변화량이 고려될 수 있으므로, 예측 효율을 향상시킬 수 있다.
- [0027] 또한, 본 발명에 의하면, CIP(Constrained Intra Prediction)이 적용되는 경우, 인터 모드의 인접 화소 위치에 인트라 모드의 인접 블록을 기반으로 참조 화소를 생성하여 인트라 예측에 이용할 수 있으며, 이때 화소값의 변화량을 반영하여 참조 화소를 생성함으로써 예측 효율을 향상시킬 수 있다.

도면의 간단한 설명

- [0028] 도 1은 본 발명이 적용되는 비디오 부호화기의 일 실시예에 따른 구성을 나타내는 블록도이다.
- [0029] 도 2는 본 발명의 일 실시예에 따른 인트라 예측부의 구성을 개략적으로 나타내는 블록도이다.

- [0030] 도 3은 본 발명이 적용되는 비디오 복호화기의 일 실시예에 따른 구성을 나타내는 블럭도이다.
- [0031] 도 4는 플래너 예측의 한 방법을 개략적으로 설명하는 도면이다.
- [0032] 도 5는 플래너 예측의 다른 방법을 개략적으로 설명하는 도면이다.
- [0033] 도 6은 현재 예측 블럭의 대각선 화소를 먼저 예측하는 것을 개략적으로 나타낸 것이다.
- [0034] 도 7은 대각선 화소를 기준으로 예측 블럭 내의 다른 화소값들을 구하는 방법을 개략적으로 도시한 것이다.
- [0035] 도 8은 기준 화소값 및 기준 화소로부터의 변화량을 고려하여 화소값을 예측하는 다른 예를 개략적으로 도시한 것이다.
- [0036] 도 9는 예측 블럭의 대각선 화소를 먼저 구한 뒤 나머지 화소값들을 구하는 다른 예를 개략적으로 설명하는 도면이다.
- [0037] 도 10은 대각선 화소를 먼저 구한 뒤, 대각선 화소 이외의 화소들도 대각선 화소와 동일한 방법으로 구하는 예를 개략적으로 설명하는 도면이다.
- [0038] 도 11은 CIP의 한 방법을 개략적으로 설명하는 도면이다.
- [0039] 도 12는 CIP의 다른 방법을 개략적으로 설명하는 도면이다.
- [0040] 도 13은 본 발명이 적용되는 시스템에서 화소값의 변화량을 고려하여 CIP를 수행하는 것을 개략적으로 설명하는 도면이다.
- [0041] 도 14는 상술한 본 발명이 적용되는 시스템에서 부호화기에서의 동작을 개략적으로 설명하는 순서도이다.
- [0042] 도 15는 인트라 예측 모드의 예측 방향을 나타낸 것이다.
- [0043] 도 16은 상술한 본 발명이 적용되는 시스템에서 복고화 장치에서의 동작을 개략적으로 설명하는 순서도이다.

발명의 실시를 위한 형태

- [0044] 본 명세서에서 설명되는 도면상의 각 구성들은 영상 부호화/복호화기에서 서로 다른 특징적인 기능들에 관한 설명의 편의를 위해 독립적으로 도시된 것으로서, 각 구성들이 서로 별개의 하드웨어나 별개의 소프트웨어로 구현된다는 것을 의미하지는 않는다. 예컨대, 각 구성 중 두 개 이상의 구성이 합쳐져 하나의 구성을 이룰 수도 있고, 하나의 구성이 복수의 구성으로 나뉘어질 수도 있다. 각 구성이 통합 및/또는 분리된 실시에도 본 발명의 본질에서 벗어나지 않는 한 본 발명의 권리범위에 포함된다.
- [0045] 이하, 첨부한 도면들을 참조하여, 본 발명의 바람직한 실시예를 보다 상세하게 설명하고자 한다. 이하, 도면상의 동일한 구성 요소에 대해서는 동일한 참조부호를 사용하고 동일한 구성 요소에 대해서 중복된 설명은 생략한다.
- [0046] 도 1은 본 발명이 적용되는 비디오 부호화기의 일 실시예에 따른 구성을 나타내는 블럭도이다. 도 1을 참조하면, 상기 비디오 부호화기는 픽처 분할부(110), 인트라 예측부(120), 인트라 예측부(125), 변환부(130), 양자화부(135),

역양자화부(140), 역변환부(145), 디블럭킹 필터(deblocking filter)(150), 메모리(160), 재정렬부(165) 및 엔트로피 부호화부(170)를 포함한다.

- [0047] 픽처 분할부(110)에는 현재 픽처가 입력되며, 이를 하나 이상의 부호화 단위로 분할할 수 있다. 부호화 단위는 비디오 부호화기에서 부호화가 수행되는 하나의 단위를 말하며, CU(Coding Unit)라고도 할 수 있다. 부호화 단위는 쿼드 트리 구조(Quad Tree Structure)를 기초로 깊이(depth) 정보를 가지고 계층적으로 분할될 수 있다. 가장 큰 크기의 부호화 단위는 최대 부호화 단위(LCU: Largest Coding Unit), 가장 작은 크기의 부호화 단위는 최소 부호화 단위(SCU: Smallest Coding Unit)이라 한다. 또한 부호화 단위는 8×8, 16×16, 32×32, 64×64 크기를 가질 수 있다. 또한 픽처 분할부(110)는 부호화 단위를 분할하여 예측 단위 및 변환 단위를 생성할 수 있다. 예측 단위는 PU(Prediction Unit), 변환 단위는 TU(Transform Unit)이라고도 할 수 있다.
- [0048] 인터 예측 모드에 있는 경우, 인터 예측부(120)는 움직임 추정(ME: Motion Estimation) 및 움직임 보상(MC: Motion Compensation)을 수행할 수 있다. 인터 예측부(120)는 현재 픽처의 이전 픽처 또는 이후 픽처 중 적어도 하나의 픽처 정보를 기초로 예측 블럭을 생성하며 이를 화면 간 예측이라고도 할 수 있다.
- [0049] 인터 예측부(120)에는 분할된 예측 대상 블럭 및 메모리부(160)에 저장된 적어도 하나의 참조 블럭이 제공된다. 인터 예측부(120)는 상기 예측 대상 블럭 및 참조 블럭을 이용하여 움직임 추정을 수행한다. 인터 예측부(120)는 움직임 추정의 결과로 움직임 벡터(MV: Motion Vector), 참조 블럭 인덱스(index) 및 예측 모드 등을 포함한 움직임 정보(motion information)를 생성한다.
- [0050] 또한 인터 예측부(120)는 상기 움직임 정보 및 참조 블럭을 이용하여 움직임 보상을 수행한다. 이 때, 인터 예측부(120)는 상기 참조 블럭으로부터 입력 블럭에 대응하는 예측 블럭을 생성하여 출력한다.
- [0051] 상기 움직임 정보는 엔트로피 부호화되어 압축된 비트 스트림을 형성하여 비디오 부호화기에서 비디오 복호화기로 전송된다.
- [0052] 인트라 예측 모드의 경우, 인트라 예측부(125)는 현재 픽처 내의 화소 정보를 기초로 예측 블럭을 생성할 수 있다. 인트라 예측은 화면 내 예측이라고도 할 수 있다. 인트라 예측 모드의 경우, 인트라 예측부(125)에는 예측 대상 블럭 및 이전에 부호화되고 복호화되어 복원된 복원 블럭이 입력된다. 다만, 입력되는 상기 복원 블럭은 디블럭킹 필터부를 거치기 전의 영상이다. 상기 복원 블럭은 이전 예측 블럭일 수 있다.
- [0053] 도 2는 본 발명의 일 실시예에 따른 인트라 예측부의 구성을 개략적으로 나타내는 블럭도이다. 도 2를 참조하면, 도 2는 참조 화소 생성부(210), 인트라 예측 모드 결정부(220) 및 예측 블럭 생성부(230)를 포함한다.
- [0054] 참조 화소 생성부(210)는 인트라 예측에 필요한 참조 화소를 생성한다. 예측 대상 블럭에 인접한 좌측 블럭의 맨 오른쪽 수직 라인상의 화소들과 예측 블럭에 인접한 상단 블럭의 맨 아래쪽 수평 라인상의 화소들이 참조 화소 생성에

사용된다. 예를 들어 예측 대상 블록의 크기가 N이라면, 좌측 및 상단 각 방향에서 2N개의 화소를 참조 화소로 사용한다. 참조 화소는 그대로 사용될 수도 있고, AIS(Adaptive Intra Smoothing) 필터링된 후 사용될 수도 있다. AIS 필터링되는 경우에는 AIS 필터링에 관련된 정보가 시그널링(signaling)된다.

- [0055] 인트라 예측 모드 결정부(220)는 상기 예측 대상 블록 및 상기 복원 블록이 입력된다. 인트라 예측 모드 결정부(220)는 상기 입력된 영상을 이용하여, 예측 모드 중에서 부호화될 정보의 양을 최소화시키는 모드를 선택하여 그 예측 모드 정보를 출력한다. 이 때 소정의 비용 함수(cost function) 또는 하다마드(Hadamard) 변환 등이 이용될 수 있다.
- [0056] 예측 모드 생성부(230)에는 상기 예측 모드 정보 및 상기 참조 화소가 입력된다. 상기 예측 모드 생성부(230)는 예측 모드 정보 및 참조 화소값을 사용함으로써, 예측 대상 블록의 화소값을 공간상 예측, 보상하여 예측 블록을 생성한다.
- [0057] 예측 모드 정보는 엔트로피 부호화되어 영상 데이터 등과 함께 압축된 비트 스트림을 형성하여 비디오 부호화기에서 비디오 복호화기로 전송된다. 비디오 복호화기는 인트라 예측 블록을 생성할 때 상기 예측 모드 정보를 사용한다.
- [0058] 다시 도 1을 참조하면, 예측 대상 블록 및 인터 또는 인트라 예측 모드에서 생성된 예측 블록의 차분에 의해 차분 블록이 생성되고, 이는 변환부(130)에 입력된다. 변환부(130)는 변환 단위(TU)로 차분 블록에 대해 변환을 수행하여 변환 계수를 생성한다.
- [0059] 변환 단위를 가지는 변환 블록은 최대 및 최소 크기 내에서 쿼드 트리 구조(quad tree structure)를 가지므로, 정해진 하나의 크기에 종속되지 않는다. 변환 블록마다 현재 블록이 하위 블록(sub-block)으로 나누어지는지 여부를 가리키는 지시자(flag)를 가지며, 지시자가 1의 값을 가지는 경우, 현재 변환 블록은 동일한 크기의 네 개의 하위 블록으로 나누어질 수 있다. 변환에는 이산 여현 변환(DCT: Discrete Cosine Transform)이 사용될 수 있다.
- [0060] 양자화부(135)는 변환부(130)에서 변환된 값들을 양자화할 수 있다. 블록에 따라 또는 영상의 중요도에 따라 양자화 계수는 변할 수 있다. 양자화된 변환 계수 값은 재정렬부(165) 및 역양자화부(140)에 제공될 수 있다.
- [0061] 재정렬부(165)는, 엔트로피 부호화의 효율을 높이기 위해, 스캔(scan)을 통하여 상기 양자화된 2차원의 블록 형태의 변환 계수를 1차원의 벡터 형태의 변환 계수로 변경할 수 있다. 재정렬부(165)는 확률적 통계를 기초로 스캔 순서를 달리 하여 엔트로피 부호화 효율을 높일 수 있다.
- [0062] 엔트로피 부호화부(170)는 재정렬부(165)에서 얻어진 값들을 엔트로피 부호화하며, 부호화된 정보들은 압축된 비트 스트림을 형성하여 네트워크 추상 계층(NAL: Network Abstraction Layer)을 통해 전송되거나 저장된다.
- [0063] 역양자화부(140)에는 양자화부(135)에서 양자화된 변환 계수가 입력되어 역양자화가 수행되며, 이는 역변환부(145)에서 역변환되어, 복원된 차분 블록이 생성된다. 복원된 차분 블록은 인터 예측부(120) 또는 인트라 예측부(125)에서

생성된 예측 블럭과 합쳐져 복원 블럭이 생성될 수 있다. 복원 블럭은 인트라 예측부(125) 및 디블럭킹 필터(150)에 제공된다.

- [0064] 디블럭킹 필터(150)는 부호화 및 복호화 과정에서 발생하는 블럭 경계 사이의 왜곡을 제거하기 위해, 복원 블럭을 필터링하며, 필터링된 결과는 ALF(Adaptive Loop Filter)(155)에 제공된다.
- [0065] ALF(155)는 예측 대상 블럭과 최종 복원 블럭 사이의 에러를 최소화하기 위해 필터링을 수행한다. ALF(155)는 디블럭킹 필터(150)를 통해 필터링된 복원 블럭과 현재의 예측 대상 블럭을 비교한 값을 기초로 필터링을 수행하며, ALF(155)의 필터 계수 정보는 슬라이스 헤더(slice header)에 실려 부호화기로부터 복호화기로 전송된다.
- [0066] 메모리(160)는 ALF(155)를 통해 얻어진 최종 복원 블럭을 저장할 수 있고, 저장된 최종 복원 블럭은 화면 간 예측을 수행하는 인터 예측부(120)에 제공될 수 있다.
- [0067] 도 3은 본 발명이 적용되는 비디오 복호화기의 일 실시예에 따른 구성을 나타내는 블럭도이다. 도 3을 참조하면, 상기 비디오 복호화기는 엔트로피 복호화부(310), 재정렬부(315), 역양자화부(320), 역변환부(325), 인터 예측부(330), 인트라 예측부(335), 디블럭킹 필터(340), ALF(345) 및 메모리(350)를 포함한다.
- [0068] 엔트로피 복호화부(310)는 NAL로부터 압축된 비트 스트림을 수신한다. 엔트로피 복호화부(310)는 수신된 비트 스트림을 엔트로피 복호화하며, 예측 모드, 움직임 벡터 정보 등이 비트 스트림에 포함되는 경우 이를 함께 엔트로피 복호화한다. 엔트로피 복호화된 변환 계수 또는 차분 신호는 재정렬부(315)에 제공된다. 재정렬부(315)는 이를 역스캔(inverse scan)하여 2차원 블럭 형태의 변환 계수를 생성한다.
- [0069] 역양자화부(320)에는 엔트로피 복호화 및 재정렬된 변환 계수가 입력되며 역양자화부(320)는 이를 역양자화한다. 역변환부(325)는 역양자화된 변환 계수를 역변환하여 차분 블럭을 생성한다.
- [0070] 차분 블럭은 인터 예측부(330) 또는 인트라 예측부(335)에서 생성된 예측 블럭과 합쳐져 복원 블럭이 생성될 수 있다. 복원 블럭은 인트라 예측부(335) 및 디블럭킹 필터(340)에 제공된다. 인터 예측부(330) 및 인트라 예측부(335)의 동작은 각각 비디오 부호화기에서의 인터 예측부(120) 및 인트라 예측부(125)의 동작과 동일할 수 있다.
- [0071] 디블럭킹 필터(340)는 부호화 및 복호화 과정에서 발생하는 블럭 경계 사이의 왜곡을 제거하기 위해, 복원 블럭을 필터링하며, 필터링된 결과는 ALF(Adaptive Loop Filter)(345)에 제공된다. ALF(345)는 예측 대상 블럭과 최종 복원 블럭 사이의 에러를 최소화하기 위해 필터링을 수행한다. 메모리(160)는 ALF(345)를 통해 얻어진 최종 복원 블럭을 저장할 수 있고, 저장된 최종 복원 블럭은 화면 간 예측을 수행하는 인터 예측부(330)에 제공될 수 있다.

- [0072] 한편, 하늘이나 바다 등을 단조로운 배경으로 이용하는 경우와 같이, 텍스처의 변화가 적은 영역의 경우에는 플래너 인트라 예측을 사용함으로써 부호화 효율을 더 높일 수 있다.
- [0073] 인트라 예측은 방향성 예측과 DC 예측, 플래너 예측으로 구분될 수 있는데, 플래너 예측은 DC 예측을 확장한 개념이라고도 할 수 있다. 크게 보면, 플래너 예측은 DC 예측에 포함된다고도 할 수 있지만, DC 예측이 커버하지 못하는 예측 방법을 플래너 예측이 커버할 수도 있다. 예컨대, 균일한 텍스처의 경우에는 DC 예측을 사용하는 것이 바람직할 수 있으나, 화소 값에 방향성이 있는 경우에는 플래너 예측을 사용하여 블럭 예측을 수행하는 것이 효과적일 수 있다.
- [0074] 본 명세서에서는 인접 블럭 참조 화소들의 화소값의 변화량을 이용하여, 방향성이 있는 텍스처에 대해서 플래너 예측 효율을 향상시키는 방법을 제공한다.
- [0075] 도 4는 플래너 예측의 한 방법을 개략적으로 설명하는 도면이다.
- [0076] 먼저 도 4(a)를 참조하면, 현재 블럭의 우하측 코너의 화소값(425)를 예측한다. 현재 블럭의 우하측 코너 화소값(425)은 DC 값으로 예측될 수 있다.
- [0077] 도 4(b)를 참조하면, 현재 블럭의 우측 경계에 위치하는 화소값들과 현재 블럭의 하측 경계에 위치하는 화소값들을 예측한다. 예컨대, 현재 블럭의 우측 경계에 위치하는 화소값(445)는 상측 블럭의 화소값(450)과 DC 값(425)을 선형 보간(interpolation)하여 예측할 수 있다. 또한, 현재 블럭의 하측 경계에 위치하는 화소값(435)는 좌측 블럭의 화소값(430)과 DC 값(425)을 선형 보간하여 예측할 수 있다.
- [0078] 도 4(c)를 참조하면, 현재 블럭의 우하측 코너 화소, 우측 경계 화소, 하측 경계 화소를 제외한 나머지 화소들은, 상측 블럭 및 좌측 블럭의 화소값과 이미 예측한 현재 블럭의 화소값을 이용해서 쌍선형(bi-linear) 보간을 통해 예측할 수 있다. 예컨대, 현재 블럭 내의 화소값(475)는 상측 블럭의 화소값(460), 좌측 블럭의 화소값(455), 현재 블럭의 우측 경계에 있는 이미 예측된 화소값(445) 및 현재 블럭의 하측 경계에 있는 이미 예측된 화소값(435)를 이용한 보간을 통해서 예측될 수 있다.
- [0079] 이어서, 도 4(d)를 참조하면, 상술한 과정을 통해 얻은 예측 샘플들을 개선(refine)할 수도 있다. 예컨대, 현재 블럭의 화소값 X(485)를 상측 샘플값 T(480), 좌측 샘플값 L(490)을 이용하여 개선할 수 있다. 일 예로서, X를 개선한 X'은 $X' = \{(X \ll 1) + L + T + 1\} \gg 2$ 와 같이 구해질 수 있다. 여기서, " $x \ll y$ "는 x의 2의 보수(two's complement integer) 표현을 이진수 단위 y만큼 산술적으로 좌측 이동하는 것이며, " $x \gg y$ "는 x의 2의 보수 표현을 이진수 단위 y만큼 산술적으로 우측 이동하는 것을 나타낸다.
- [0080] 도 5는 플래너 예측의 다른 방법을 개략적으로 설명하는 도면이다.
- [0081] 도 5의 방법에서는 현재 블럭의 대각선에 위치하는 화소값들을 먼저 예측하고, 예측된 화소값들을 이용하여 현재 블럭의 나머지 화소값들을 예측한다. 이하,

설명의 편의를 위해 블럭을 구성하는 화소들 중, 블럭내 좌상측으로부터 우하측으로 이어지는 대각선상에 위치하는 화소를 대각선 화소라고 한다.

- [0082] 도 5(a)를 참조하면, 현재 블럭(510)의 대각선 화소들(540)을 상측 참조 블럭의 화소값(510)과 좌측 화소 블럭의 화소값(530)을 이용하여 예측한다. 예컨대, 현재 블럭의 대각선 화소(P)는 상측 블럭의 화소들 중 현재 블럭과의 경계에 위치하는 화소(AboveRef)와 좌측 블럭의 화소들 중 현재 블럭과의 경계에 위치하는 화소(LeftRef)를 통해서 $P=(LeftRef+AboveRef+1) \gg 1$ 와 같이 얻어질 수 있다.
- [0083] 다음으로 도 5(b)를 참조하면, 현재 블럭(510)의 대각선 화소들(540) 이외의 화소들은 도 5(a)에서 설명한 바와 같이 얻어진 화소들과 상측, 좌측 블럭의 경계에 있는 화소들을 이용하여 선형 보간을 통해 얻어질 수 있다. 예컨대, P1은 상측 블럭의 화소 AboveRef와 이미 구한 현재 블럭의 대각선 화소 P를 이용하여 $P1 = (AboveRef*d2 + P*d1)/(d1+d2)$ 로 얻어질 수 있다. 또한, 예를 들어, P2는 $P2 = (LeftRef*d3 + P*d4)/(d3+d4)$ 로 얻어질 수 있다.
- [0084] 한편, 상술한 도 4 및 도 5의 플래너 예측 방법은 방향성이 없는 균일한 텍스처에 대해서는 효과적일 수 있지만, 텍스처에 방향성이 있는 경우, 예컨대 휘도 화소에 대하여 어느 한 방향(이를 테면 수평 방향)으로는 밝기의 변화가 크고, 다른 방향(이를 테면 수직 방향)으로는 변화가 거의 없는 경우에는 예측의 효율이 떨어질 수 있다.
- [0085] 따라서, 화소값의 변화량을 고려한 플래너 인트라 예측(planar intra prediction) 방법을 고려할 필요가 있다. 본 발명에 따른 플래너 인트라 예측 방법에서는 기준 화소값을 선택하거나 예측하고, 기준 화소값에 해당 기준 화소로부터 대상 화소까지 화소값의 변화량을 반영하여 대상 화소의 화소값을 예측한다.
- [0086] 이하, 도면을 참조하여 본 발명의 실시예들을 설명한다.
- [0087] **실시예 1**
- [0088] 도 6은 현재 예측 블럭의 대각선 화소(Pii)를 먼저 예측하는 것을 개략적으로 나타낸 것이다. 도 6에서는 설명의 편의를 위해 8x8 예측 블럭을 예로서 설명하지만, 본 발명은 이에 한정되지 않으며, 소정의 NxN 예측 블럭에 동일하게 적용될 수 있다.
- [0089] 실시예 1에서는 도 6과 같이 현재 예측 블럭에 인접하는 참조 블럭의 참조 화소(Ri0 및/또는 R0j, 8x8 예측 블럭의 경우, $0 \leq i, j \leq 8$)를 기반으로 현재 예측 블럭의 대각선 화소를 먼저 예측한다.
- [0090] 즉, 대각선 화소 Pii를 먼저 구한 뒤에, 예측 블럭 내의 다른 화소값들은 인접 블럭의 참조 화소값(Rij)과 이미 구한 Pii를 이용한 보간(interpolation) 또는 외삽(extrapolation)을 통해서 구할 수 있다.
- [0091] 도 7은 대각선 화소를 기준으로 예측 블럭 내의 다른 화소값들을 구하는 방법을 개략적으로 도시한 것이다.
- [0092] 본 발명에서는 화소값의 변화를 고려하여 플래너 예측을 수행한다. 예컨대, 도 7(a)와 같이, 참조 화소값이 x(우측) 및 y(하측) 방향으로 모두 증가하는 경우에는,

예측 블럭의 화소값들 역시 우하측 방향으로 증가할 가능성이 크다. 이 경우, 예측 블럭 내의 우하측 코너 화소값 P88을 먼저 예측하고, 이를 기반으로 나머지 화소들을 예측할 수 있다.

[0093] P88의 값을 예측하기 위해, 현재 예측 블럭의 좌상측 코너에 위치하는 참조 화소값(R00)을 기준 화소로 하고, 기준 화소로부터 예측 블럭 내의 예측 대상 화소(P88)까지의 변화량을 기준 화소값에 반영할 수 있다. 예컨대, 대상 화소값 P88은 수학식 1과 같이 구해질 수 있다. 이하, 설명의 편의를 위해, 도면과 명세서 상에서 Rij 또는 Pij로 나타내던 화소의 표현을 수학식에서는 $R_{i,j}$ 및 $P_{i,j}$ 로 나타낸다.

[0094] [수학식 1]

$$[0095] \quad P_{8,8} = R_{0,0} + \sqrt{\left(R_{0,8} - R_{0,1}\right)^2 + \left(R_{8,0} - R_{1,0}\right)^2}$$

[0096]

[0097] P88의 값이 구해지면, 나머지 대각선 화소값 Pii는 수학식 2와 같이 구해질 수 있다.

[0098] [수학식 2]

$$[0099] \quad P_{i,i} = R_{0,0} + \frac{i}{8} \cdot \left(P_{8,8} - R_{0,0}\right)$$

[0100]

[0101] 여기서, i는, 본 실시예가 8x8 예측 블럭을 예로서 설명하는 것이므로, 1, 2, ..., 8의 값을 갖는다. 실시예 1은 설명의 편의를 위해 8x8 예측 블럭을 예로서 설명하고 있으나, NxN 예측 블럭의 경우에는 $P_{ii} = R_{00} + (i/N)P_{88}$ 과 같이 구해질 수도 있다.

[0102] 도 7(b)와 같이, 참조 화소값이 x(우측) 및 y(하측) 방향으로 모두 감소하는 경우에도, 감소하는 화소값의 변화량을 고려하여 예측 블럭 내 우하측 코너의 화소(P88)를 구하고, 이를 기반으로 나머지 화소값들을 예측할 수 있다. 이 경우, P88은 수학식 3과 같이 산출될 수 있다.

[0103] [수학식 3]

$$[0104] \quad P_{8,8} = R_{0,0} - \sqrt{\left(R_{0,8} - R_{0,1}\right)^2 + \left(R_{8,0} - R_{1,0}\right)^2}$$

[0105]

[0106] P88이 구해지면, 예측 블럭 내의 나머지 대각선 화소들은 수학식 4와 같이 구해질 수 있다.

[0107] [수학식 4]

$$[0108] \quad P_{i,i} = R_{0,0} + \frac{i}{8} \cdot \left(P_{8,8} - R_{0,0}\right)$$

[0109]

[0110] 상술한 바와 같이, 여기서, i 는 1, 2, ..., 8의 값을 갖는다.

[0111] 도 7(c)와 같이, 참조 화소값이 우상측 방향으로 증가하는 경우에는, 화소값의 변화량을 고려하여, 도 7(a) 및 7(b)와는 달리, 예측 블록 내의 좌하측과 우상측을 잇는 대각선 화소를 먼저 산출한다. 예컨대, 예측 블록 내 좌하측 코너의 화소(P81)을 구하고, 이를 기반으로 나머지 화소값들을 예측할 수 있다. 이 경우, P81은 수학식 5와 같이 산출될 수 있다.

[0112] [수학식 5]

$$P_{8,1} = R_{0,9} - \sqrt{\left(R_{0,8} - R_{0,1}\right)^2 + \left(R_{8,0} - R_{1,0}\right)^2}$$

[0114]

[0115] P81이 구해지면, 예측 블록 내의 나머지 대각선 화소들(좌하측-우상측)은 수학식 6과 같이 산출될 수 있다.

[0116] [수학식 6]

$$P_{i,9-i} = R_{0,9} + \frac{i}{8} \cdot \left(P_{8,1} - R_{0,9}\right)$$

[0118]

[0119] 여기서, i 는 1, 2, ..., 8의 값을 갖는다.

[0120] 또한, 도 7(d)와 같이, 참조 화소값이 좌하측 방향으로 증가하는 경우에도, 화소값의 변화량을 고려하여, 예측 블록 내의 좌하측과 우상측을 잇는 대각선 화소를 먼저 산출한다. 예컨대, 예측 블록 내 좌하측 코너의 화소(P81)을 구하고, 이를 기반으로 나머지 화소값들을 예측할 수 있다. 이 경우, P81은 수학식 7와 같이 산출될 수 있다.

[0121] [수학식 7]

$$P_{8,1} = R_{0,9} + \sqrt{\left(R_{0,8} - R_{0,0}\right)^2 + \left(R_{8,0} - R_{0,0}\right)^2}$$

[0123]

[0124] P81이 구해지면, 예측 블록 내의 나머지 대각선 화소들(좌하측-우상측)은 수학식 8과 같이 산출될 수 있다.

[0125] [수학식 8]

$$P_{i,9-i} = R_{0,9} + \frac{i}{8} \cdot \left(P_{8,1} - R_{0,9}\right)$$

[0127]

[0128] 여기서, i 는 1, 2, ..., 8의 값을 갖는다.

[0129] 상술한 수학식 대각선 화소들을 산출하기 위한 제공된 연산에 대해서는, 연산 부하를 고려하여 수학식 9와 같은 근사를 고려할 수 있다.

[0130] [수학식 9]

$$[0131] \Delta x + \Delta y \approx \sqrt{\Delta x^2 + \Delta y^2}$$

[0132]

[0133] 이어서, 대각선 화소의 예측값과 상측 참조 화소값, 좌측 참조 화소값을 이용하여 예측 블럭 내의 다른 화소값들을 보간 또는 외삽을 통해 구할 수 있다.

[0134] 도 7의 (a)와 (b)의 경우에, 예측 블럭 내의 화소(P_{ij})는 대각선 화소(P_{ii})들과 인접 블럭의 참조 화소(R)들을 이용한 보간을 통해 산출될 수 있다. 이때, 적용되는 보간의 일 예는 수학식 10과 같다.

[0135] [수학식 10]

$$[0136] P_{i,j} = \left(R_{0,j} * d_2 + P_{i,i} * d_1 \right) / \left(d_1 + d_2 \right)$$

또는

$$P_{i,j} = \left(R_{i,0} * d_2 + P_{i,i} * d_1 \right) / \left(d_1 + d_2 \right)$$

[0137]

[0138] 여기서, d₁은 보간에 이용되는 인접 블럭 화소 R_{0j} 또는 R_{j0}으로부터 예측 대상 화소 P_{ij}까지의 거리를 나타내며, d₂는 보간에 이용되는 대각선 화소 P_{ii}로부터 예측 대상 화소 P_{ij}까지의 거리를 나타낸다.

[0139] 또한, 도 7의 (c)와 (d)의 경우에, 예측 블럭의 화소 중 보간을 통해 산출되는 화소(P_i)는 수학식 11과 같이 구해질 수 있다.

[0140] [수학식 11]

$$[0141] P_{i,j} = \left(R_{0,j} * d_2 + P_{9-i,j} * d_1 \right) / \left(d_1 + d_2 \right)$$

또는

$$P_{i,j} = \left(R_{i,0} * d_2 + P_{i,9-i} * d_1 \right) / \left(d_1 + d_2 \right)$$

[0142]

[0143] 여기서, i+j<9 이며, d₁은 보간에 이용되는 인접 블럭 화소 R_{0j} 또는 R_{j0}으로부터 예측 대상 화소 P_{ij}까지의 거리를 나타내며, d₂는 보간에 이용되는 대각선 화소 P_{ii}로부터 예측 대상 화소 P_{ij}까지의 거리를 나타낸다. 여기서, 예측 블럭의 화소 P_{ij}를 산출하는 보간의 방법으로서 수학식 11을 예로 들었으나, 본 발명은 이에 한정되지 않으며, 다양한 보간 방법이 적용될 수 있다.

[0144] 한편, 도 7의 (c)와 (d)의 경우에는, 예측 블럭의 화소 중 외삽을 통해 산출되는 화소(P_e)가 존재한다. 이때, 예측 블럭의 화소를 산출하기 위한 외삽의 일 예로 수학식 12가 이용될 수 있다.

[0145] [수학식 12]

[0146]

$$P_{i,j} = R_{i,0} + (P - R_{i,0}) * \left(1 + \frac{d_2}{d_1} \right)$$

또는

$$P_{i,j} = R_{0,j} + (P - R_{0,j}) * \left(1 + \frac{d_2}{d_1} \right)$$

[0147]

[0148] 이 경우에, $i+j > 9$ 이며, P는 외삽에 사용되는 대각선 화소를 나타낸다. 또한, d_1 과 d_2 는 상술한 바와 같이, 외삽에 이용되는 참조 화소와 Pii로부터 예측 대상 화소 Pij까지의 거리를 각각 나타낸다.

[0149]

[0150] **실시예 2**

[0151] 도 8은 기준 화소값 및 기준 화소로부터의 변화량을 고려하여 화소값을 예측하는 다른 예를 개략적으로 도시한 것이다. 도 8에서는 설명의 편의를 위해 8x8 예측 블럭을 예로서 설명하지만, 본 발명은 이에 한정되지 않으며, 소정의 NxN 예측 블럭에 동일하게 적용될 수 있다.

[0152] 도 8에서는 예측 블럭의 좌상단 코너에 위치하는 참조 화소 R00를 기준 화소로 하는 예를 설명하고 있다. 실시예 2에 따르면, 예측 대상 화소 Pij는 기준 화소값에, 기준 화소로부터의 수직 및 수평 방향 변화량을 반영함으로써 얻어진다.

[0153] 예컨대, 대상 화소 Pij는 수학식 13과 같이 산출된다.

[0154] [수학식 13]

$$P_{ij} = R_{00} + \Delta x + \Delta y$$

[0156]

[0157] 여기서, $\Delta y = R_{i0} - R_{00}$ 이며, $\Delta x = R_{0j} - R_{00}$ 이고, 본 실시예와 같이 8X8 예측 블럭의 경우에 $1 \leq i, j \leq 8$ 이다.

[0158] 예컨대, 도 8을 참조하면, 수학식 7을 적용할 때, 화소 P33은 $P_{33} = R_{00} + \Delta x + \Delta y$ 와 같이 구해진다. 이때, Δx 와 Δy 는 각각 기준 화소 R00으로부터 P33까지 x 방향 및 y 방향으로의 화소값 변화량을 나타낸다.

[0159] 또 다른 예로서, 수학식 13을 적용할 때, 화소 P76은, 도 8을 참조하면, $P_{76} = R_{00} + \Delta x' + \Delta y'$ 와 같이 구해진다. 이때, $\Delta x'$ 와 $\Delta y'$ 는 각각 기준 화소 R00으로부터 P76까지 x 방향 및 y 방향으로의 화소값 변화량을 나타낸다.

[0160]

[0161] **실시예 3**

- [0162] 도 9는 예측 블록의 대각선 화소를 먼저 구한 뒤 나머지 화소값들을 구하는 다른 예를 개략적으로 설명하는 도면이다.
- [0163] 상술한 도 5에서는, 대각선 화소를 현재 예측 블록에 인접한 블록의 수평/수직 방향에 있는 두 개 화소들에 대한 일종의 평균값으로 구했으나, 실시예 3의 도 9에서는 변화량을 반영하여 대각선 화소를 산출한다.
- [0164] 예컨대 도 9(a)를 참조하면, 예측 블록의 대각선 화소를 인접 블록의 화소값들 중 예측 블록과의 상측 및/또는 좌측 경계에 있는 화소값들을 이용하여 예측한다. 예컨대, 대각선 화소 P_{ii} 는 수학적 식 14와 같이 예측된다.
- [0165] [수학적 식 14]
- [0166]
$$P_{i,j} = R_{0,i} + \Delta y$$
- 또는
- $$P_{i,j} = R_{i,0} + \Delta x$$
- [0167]
- [0168] 예컨대, 수학적 식 14을 적용하면, 도 9(a)를 참조할 때, P_{33} 은 $P_{33}=R_{03}+\Delta y$ 또는 $P_{33}=R_{30}+\Delta x$ 와 같이 예측될 수 있다. Δx 와 Δy 는 각각 기준 화소 R_{30} 으로부터 P_{33} 까지 x 방향으로의 화소값 변화량 및 기준 화소 R_{03} 으로부터 P_{33} 까지 y 방향으로의 화소값 변화량을 나타낸다.
- [0169] 도 9(b)를 참조하면, 현재 블록에서 대각선 화소 이외의 화소(P_{ij})들은, 대각선 화소의 예측값들과 인접 블록의 화소들 중 현재 블록과의 상측과 좌측 경계에 있는 참조 화소(R_{00} , $R_{10}\sim R_{80}$, $R_{01}\sim R_{08}$)를 이용하여 선형 보간을 통해 예측될 수 있다.
- [0170] 예컨대, 화소값(P_{ij})는 수학적 식 15와 같이 예측될 수 있다.
- [0171] [수학적 식 15]
- [0172]
$$P_{ij} = \frac{R_{0j} \times d_2 + P_{ii} \times d_1}{d_1 + d_2}$$
- 또는
- $$P_{ij} = \frac{R_{i0} \times d_2 + P_{ii} \times d_1}{d_1 + d_2}$$
- [0173]
- [0174] d_1 은 보간에 이용되는 인접 블록 화소 R_{0j} 또는 P_{i0} 로부터 예측 대상 화소 P_{ij} 까지의 거리를 나타내며, d_2 는 보간에 이용되는 대각선 화소 P_{ii} 로부터 예측 대상 화소 P_{ij} 까지의 거리를 나타낸다.
- [0175]
- [0176] **실시예 4**
- [0177] 도 10은 대각선 화소를 먼저 구한 뒤, 대각선 화소 이외의 화소들도 대각선

화소와 동일한 방법으로 구하는 예를 개략적으로 설명하는 도면이다.

[0178] 도 10에서는, 대각선 화소를 도 9의 경우와 동일한 방법으로 예측할 수 있다. 따라서, 도 10(a)를 참조하면, 예컨대, 현재 예측 블록의 대각선 화소 P33은 $P33=R03+\Delta y$ 또는 $P33=R30+\Delta x$ 와 같이 예측될 수 있다.

[0179] 이어서, 현재 블록에서 대각선 화소 이외의 화소(P_{ij})들은, 대각선 화소의 예측값들과 인접 블록의 화소들 중 현재 블록과의 상측과 좌측 경계에 있는 참조 화소($R00, R10\sim R80, R01\sim R08$)를 이용하여 선형 보간을 통해 예측될 수 있다.

[0180] 이때, 대각선 화소를 계산하는 방법과 동일한 방법을 적용할 수 있다. 예컨대, 화소 P_{ij} 는 수학적 식 16과 같이 예측될 수 있다.

[0181] [수학적 식 16]

$$[0182] P_{ij} = R0j + \Delta y$$

또는

$$P_{ij} = Ri0 + \Delta x$$

[0183]

[0184] 이때, $\Delta y = Ri0 - R00$ 이며, $\Delta x = R0j - R00$ 이고, 본 실시예와 같이 8X8 예측 블록의 경우에 $1 \leq ij \leq 8$ 이다.

[0185] 수학적 식 16을 적용하는 경우, 예를 들면, 도 10에서 P37은 $P37=R07+\Delta y$ 또는 $P37=R70+\Delta x$ 와 같이 구해질 수 있다.

[0186]

[0187] 한편, 부호화기나 복호화기에서 정수 연산에 의해 발생하는 작은 에러들이 오랫동안 계속 누적되는 경우에는 큰 오차를 발생시킬 수 있다. 또한, 현재 블록에 인접한 블록에 전송 에러가 난 경우에는 부호화기나 복호화기 간의 미스매치가 발생하거나 에러가 전파되게 된다. 예컨대, 인접 블록에 에러가 발생한 경우에, 인접 블록의 경계면 화소값이 변하게 되는데, 복호화기에서 변화된 화소값을 갖는 화소를 참조 화소로 사용하게 되면, 현재 블록에 에러가 전파되게 된다. 따라서, 이런 문제를 방지하기 위한 틀이 필요한데, 그 중 한 방법이 CIP(Constrained Intra Prediction)과 같은 부호화 틀이다.

[0188] 도 11은 CIP의 한 방법을 개략적으로 설명하는 도면이다.

[0189] 도 11의 방법에서는, 현재 매크로 블록(T)의 인접 블록에 하나라도 인터 모드의 블록이 있으면, DC 인트라 모드만을 사용하고, DC 예측값을 128로 고정한다.

[0190] 이때, 인접 블록에서 인터 모드로 예측된 블록의 화소값은 참조 화소로 사용하지 않는다. 따라서, 이 방법에서는 사용 가능한 정보(예컨대, 인접하는 인트라 모드의 화소)까지 모두 배제하고 예측 모드를 DC 모드로 강제하게 된다.

[0191] 도 12는 CIP의 다른 방법을 개략적으로 설명하는 도면이다.

[0192] 도 12의 방법에서는, 인접 블록에서 인트라 모드로 예측된 블록의 화소값을 참조 화소값으로 사용하고, 인터 모드로 예측된 블록의 화소값은 주변에 있는

인트라 모드의 블럭을 이용하여 계산한다. 따라서, DC 모드뿐만 아니라, 다른 인트라 예측 모드를 모두 사용할 수 있다.

[0193] 도 12를 참조하면, 현재 예측 블럭(T) 주변의 블럭들 중에서, 인터 모드로 예측된 블럭(A, B, D, E, F, H, I)의 화소값(1210, 1220, 1230)을 인트라 모드로 예측된 블럭의 화소를 이용하여 계산한다.

[0194] 예컨대, 대상 인터 예측 샘플의 좌우에 모두 인트라 모드의 예측 화소가 있는 경우에는 수학적 식 17과 같이 인터 모드로 예측된 블럭 위치의 화소값(P_T)를 계산해 낸다.

[0195] [수학적 식 17]

$$[0196] P_T = (P_{LB} + P_{RA} + 1) \gg 1$$

[0197]

[0198] 여기서, P_T 는 대상 인터 예측 샘플이며, P_{LB} 는 좌측 혹은 하측 인트라 예측 샘플이고, P_{RA} 는 우측 또는 상측 인트라 예측 샘플이다. 또한, 대상 인터 예측 샘플의 한 쪽에만 인트라 예측 샘플이 있으면, 수학적 식 18와 같이 인터 모드로 예측된 블럭 위치의 화소값(P_T)를 계산해 낸다.

[0199] [수학적 식 18]

$$[0200] P_T = P_{RA} \quad \text{또는} \quad P_T = P_{LB}$$

[0201]

[0202] 도 12의 방법은 도 11의 방법과 비교할 때, 인트라 예측 모드를 더 적절하게 활용하고 있으나, 인터 모드로 예측된 인접 블럭의 화소값을 이용 가능한 인트라 모드 화소값의 평균으로 하거나 혹은 이용 가능한 인트라 모드 화소값을 그대로 사용함으로써, 화소값의 변화량을 고려하고 있지는 않다.

[0203] 따라서, 화소값의 변화량을 고려하여 CIP를 수행하는 방법을 고려할 필요가 있다.

[0204]

[0205] 실시예 5

[0206] 도 13은 본 발명이 적용되는 시스템에서 화소값의 변화량을 고려하여 CIP를 수행하는 것을 개략적으로 설명하는 도면이다.

[0207] 도 12에서와 같이, 산출할 화소값을 양쪽 화소값의 평균값으로 하는 것보다, 도 13에서와 같이 양쪽 화소값들의 변화량을 이용하여 보간하는 것이 대상 화소값을 더 정확하게 예측할 수 있는 방법이다. 예컨대, 산출할 화소값(1310, 1320, 1330) 중 대상 화소 P_T 는 수학적 식 19을 통해 산출할 수 있다.

[0208] [수학적 식 19]

$$[0209] P_T = \frac{P_{LB} \times d2 + P_{RA} \times d1}{d1 + d2}$$

[0210]

- [0211] 여기서, P_T 는 대상 예측 샘플이며, P_{LB} 는 좌측 혹은 하측 인트라 예측 샘플이고, P_{RA} 는 우측 또는 상측 인트라 예측 샘플이다. 또한, 도 13에 도시된 바와 같이, d_1 은 P_{LB} 로부터 P_T 까지의 거리, d_2 는 P_{RA} 로부터 P_T 까지의 거리를 나타낸다.
- [0212] 예를 들어, 도 13을 참조하면, P_{T1} 은 $(P_{LB1} * d_{21} + P_{RA1} * d_{11}) / (d_{11} + d_{21})$ 와 같이 산출될 수 있고, P_{T2} 는 $(P_{LB2} * d_{22} + P_{RA2} * d_{12}) / (d_{12} + d_{22})$ 와 같이 산출될 수 있다.
- [0213] 만약에 대상 예측 샘플(P_T)의 좌우 또는 상하의 어느 한쪽 방향에만 보간에 사용할 인트라 예측 샘플이 있는 경우에는, $P_T = P_{LB}$, $P_T = P_{RA}$ 로 설정한다. 또한, 대상 예측 블록(T)의 인접 블록에 인트라 모드로 예측된 블록이 하나도 없는 경우에는 이전 픽처의 동일 위치에 있는 화소값을 복사하여 참조 화소값으로 이용할 수 있다.
- [0214] 상술한 P_{LB} , P_{RA} 값으로 경계면 인트라 화소들의 평균값을 사용할 수도 있다. 예컨대, 도 13에서 P_T 가 E 블록 또는 D 블록의 아래쪽 화소열(1320)에 위치하는 경우에는 인트라 모드인 C 블록의 가장 아래에 있는 4개 화소의 평균값을 P_{RA} 값으로 사용하고, G 블록의 가장 오른쪽 8개 화소의 평균값을 P_{LB} 값으로 사용할 수 있다. 이 경우에, d_1 의 기준점은 G 블록의 가장 오른쪽 화소들 중 가장 위쪽 화소가 되고, d_2 의 기준점은 C 블록의 가장 아래쪽 화소들 중 가장 왼쪽 화소가 될 수 있다.
- [0215] 또한, 선형 보간은 경계면 화소들에 대한 스무딩 효과가 있으므로, AIS(Adaptive Intra Smoothing)을 오프(Off) 시킬 수도 있다. 다만, DC 예측 모드의 경우에는 예측 블록 경계면 화소들에 대한 필터링은 온(ON) 시킬 수도 있다.
- [0216]
- [0217] 도 14는 상술한 본 발명이 적용되는 시스템에서 부호화기에서의 동작을 개략적으로 설명하는 순서도이다.
- [0218] 도 14를 참조하면, 우선 현재 픽처의 새로운 예측 유닛이 입력된다(S1410). 예측 유닛(Prediction Unit: PU)은 인트라(intra) 예측과 인터(inter) 예측을 위한 기반 단위이다. 예측 유닛은 부호화 유닛(Coding Unit: CU)보다 작은 블록이며, 반드시 정사각형일 필요는 없고, 직사각형일 수도 있다. 예측 유닛의 인트라 예측은 기본적으로 $2N \times 2N$ 또는 $N \times N$ 의 블록 단위로 수행된다.
- [0219] 이어서, 인트라 예측에 필요한 참조 화소가 생성된다(S1420). 현재 예측 블록에 인접한 좌측 블록의 가장 오른쪽 수직 라인상의 화소들과 현재 예측 블록에 인접한 상측 블록의 가장 아래쪽 수평 라인상의 화소들이 참조 화소의 생성에 이용된다. 예측 블록의 크기가 N이면, 상측과 좌측에서 모두 2N개의 화소가 참조 화로서 이용될 수 있다.
- [0220] 이때, 참조 화소는 현재 예측 블록에 인접한 좌측 블록의 가장 오른쪽 수직 라인상의 화소들과 현재 예측 블록에 인접한 상측 블록의 가장 아래쪽 수평 라인상의 화소들을 그대로 사용할 수도 있고, 인접 블록의 화소들을 스무딩해서 사용할 수도 있다.
- [0221] 스무딩을 하는 경우에는, 스무딩에 관한 정보 역시 부호화기에 시그널링 한다.

예컨대, 스무딩을 하는 경우에는 적응적 인트라 스무딩(Adaptive Intra Smoothing) 필터를 적용할 수 있는데, 필터 계수로서 [1, 2, 1] 또는 [1, 1, 4, 1, 1] 등을 사용할 수 있다. 두 필터 계수 중에서 후자가 더 샤프(sharp)한 경계면을 제공할 수 있다. 필터를 사용할 건지, 필터를 사용하는 경우에는 어떤 필터를 사용하며 필터 계수는 무엇인지 등의 정보가 상술한 바와 같이 복호화기로 시그널링된다.

- [0222] 한편, 참조 화소를 생성하기 위해 CIP를 적용하는 경우에는 CIP_flag의 값을 1로 설정한다. CIP가 적용되면, 인접 블록의 화소들 중에서 인트라 모드로 부호화된 화소들만 참조 화소로 사용되고, 인터 모드로 부호화된 인접 블록의 화소들은 참조 화소로 사용되지 않는다. 이 경우에, 도 13에 관해서 상술한 바와 같이, 근처에 있는 인트라 모드로 부호화된 참조 화소들을 보간하여 인터 모드로 부호화된 인접 블록의 화소 위치에 대응하는 화소(대상 예측 샘플)들을 참조 화소로 생성하거나, 근처에 있는 인트라 모드로 부호화된 참조 화소를 복사하여 인터 모드로 부호화된 인접 블록의 화소 위치에 대응하는 참조 화소로 사용할 수 있다.
- [0223] 예컨대, 대상 인터 예측 샘플의 좌우 또는 상하 양쪽에 모두 인트라 모드의 예측 화소가 있는 경우에는 수학적 식 11과 같이 인터 모드로 예측된 블록 위치의 대상 예측 샘플(P_T)를 계산해 낸다. 또한, 대상 예측 샘플의 한쪽에만 인트라 예측 샘플이 있으면, 수학적 식 12와 같이 인터 모드로 예측된 블록 위치의 대상 예측 샘플(P_T)를 계산해 낸다. 수학적 식 11 및/또는 수학적 식 12에서 P_{LB} , P_{RA} 값으로 해당 인트라 모드 화소들의 평균값을 사용할 수도 있다. 만일 인접 블록에 인트라 모드로 예측된 블록이 하나도 없는 경우에는 이전 픽처의 동일 위치에서 화소값을 복사하여 참조 화소값으로 사용할 수 있다.
- [0224] 선형 보간은 경계면 화소들에 대한 스무딩 효과가 있으므로, CIP를 적용하는 경우에 AIS는 오프시키는 것이 더 효과적일 수도 있다.
- [0225] 이어서, 인트라 예측 모드가 결정된다(S1430).
- [0226] 인트라 예측 모드는 예측 유닛(PU) 단위로 결정되는데, 소요 비트율과 왜곡량의 관계를 고려하여 최적의 예측 모드를 결정한다.
- [0227] 예컨대, RDO(Rate Distortion Optimization)이 온(On)된 경우, 코스트 $J = R+rD$ (R 은 비트량, D 는 왜곡량, r 은 라그랑지 변수)를 최소화하는 모드를 선택할 수 있다. 다만, 로컬 복호화를 완전하게 해야 하므로, 이 경우에는 복잡도가 증가할 수 있다.
- [0228] ROD가 오프(off)된 경우, 예측 오차를 하다마드(Hadamard) 변환하여 MAD(Mean Absolute Difference)가 최소가 되는 예측 모드를 선택할 수도 있다.
- [0229] 표 1은 휘도 성분에 대한 예측 모드의 개수를 예측 유닛 블록의 크기에 따라 나타낸 일 예이다.
- [0230] [표 1]
- [0231]

| 블록크기 | 예측모드의 수 |
|---------|---------|
| 4 x 4 | 17 |
| 8 x 8 | 34 |
| 16 x 16 | 34 |
| 32 x 32 | 34 |
| 64 x 64 | 3 |

[0232]

[0233] 도 15는 인트라 예측 모드의 예측 방향을 나타낸 것이다. 도 15를 참조하면, 0번 모드는 수직 모드(vertical mode)로서 인접 블록 화소값을 사용하여 수직 방향으로 예측이 수행된다. 1번 모드는 수평 모드(horizontal mode)로서 인접 블록 화소값을 사용하여 수평 방향으로 예측이 수행된다. 또한, 2번 모드는 DC 모드로서 현재 예측 대상 블록의 평균 화소값(예컨대 휘도 화소인 경우에는 휘도값, 색차 화소의 경우에는 색차값)에 의해 예측 블록을 생성한다. 도 15의 나머지 모드들에 대해서는 해당 각도에 따라 인접 블록 화소값을 이용하여 예측을 수행한다.

[0234] DC 모드인 경우에는 예측 효율을 높이기 위해, 가장 위쪽의 예측 화소와 가장 좌측의 예측 화소들을 필터링할 수 있다. 이때, 필터링의 강도는 블록의 크기가 작을수록 강할 수 있다. 현재 예측 블록의 나머지 내부 화소들은 필터링하지 않는다.

[0235] 한편, DC 모드 대신에 방향성을 반영할 수 있는 플래너 모드를 사용할 수도 있다. 플래너 모드를 사용하는 경우에, 부호화기에서 복호화기로 전송되는 정보 중 Planar_flag의 값은 1로 설정한다. 플래너 모드를 사용하는 경우에는 DC 모드를 사용하지 않는다. 따라서, 플래너 모드 대신에 DC 모드를 사용하는 경우에, Planar_flag의 값은 0으로 설정한다.

[0236] 플래너 모드를 적용하는 경우에, 플래너 모드에서 사용되는 예측 방법은 도 6 내지 도 10에서 상술한 방법과 동일하다. 이때, 가장 적합한 방법을 선택하기 위해서, 복호기는 상술한 ROD와 같은 동작을 수행할 수도 있다. 필요한 경우에는 상술한 방법들 중에서 둘 이상의 방법을 함께 사용할 수도 있다. 도 6 내지 도 10에서 설명한 플래너 모드에서의 예측 방법들 중 어떤 방법을 선택하였는지에 관하여, 복호기는 부호화기에 관련된 정보를 복호화기에 시그널링 한다.

[0237] 한편, 색차 성분의 참조 화소에 대하여는, 모드 번호가 4인 경우, 루마(luma) 블록의 UDI(Unified Directional Intra)가 그대로 채용될 수 있으며, 이러한 모드를

DM 모드라 한다. 모드 번호가 0인 경우, 루마와 크로마 간의 선형 관계를 이용하여 예측 블록이 생성되며, 이를 선형 예측 모드(LM mode: Linear Model Mode)라 한다. 모드 번호가 1인 경우는 수직(vertical) 모드이며, 예측 방향이 수직 방향이고 루마의 0번 모드에 해당한다. 모드 번호가 2인 경우 수평(horizontal) 모드이며, 예측 방향이 수평 방향이고 루마의 1번 모드에 해당한다. 모드 번호가 3인 경우는 DC 모드이며, 현재 예측 대상 블록의 평균 색차값에 의해 예측 블록이 생성되고, 루마의 2번 모드에 해당한다.

- [0238] 다시, 도 14로 돌아와, 부호화기는 현재 블록의 예측 모드를 부호화한다(S1440). 현재 예측 블록의 휘도 성분 블록과 색차 성분 블록에 대한 예측 모드를 부호화하는데, 현재 예측 대상 블록의 예측 모드는 인접 블록의 예측 모드와 상관성이 크기 때문에, 인접 블록의 예측 모드를 이용해 현재 예측 대상 블록을 부호화함으로써 비트량을 절감할 수 있다. 또한 현재 예측 대상 블록의 MPM(Most Probable Mode)가 결정되고, MPM을 이용하여 현재 예측 대상 블록의 예측 모드가 부호화할 수 있다.
- [0239] 이어서, 현재 예측 블록의 화소값과 예측 블록의 화소값에 대하여 화소 단위로 차분값을 구하여 잔차 신호를 생성한다(S1450).
- [0240] 생성한 잔차 신호를 변환하고 부호화한다(S1460). 잔차 신호는 변환 커널(kernel)을 적용하여 부호화할 수 있는데, 변환 부호화 커널의 크기는 2x2, 4x4, 8x8, 16x16, 32x32 또는 64x64이 될 수 있다.
- [0241] 변환에 대한 변환 계수 C가 생성되는데, 변환 계수는 2차원의 블록 형태를 가질 수 있다. 예를 들어, nxn 블록에 대해, 변환 계수는 수학식 20과 같이 계산될 수 있다.
- [0242] [수학식 20]
- [0243]
$$C(n,n) = T(n,n) \times B(n,n) \times T(n,n)^T$$
- [0244]
- [0245] 여기서, C(n,n)은 n*n 크기의 변환 계수에 대한 행렬이고, T(n,n)은 n*n 크기의 변환 커널 행렬이고, B(n,n)은 n*n 크기의 예측 대상 블록에 대한 행렬이다.
- [0246] $m=hN$, $n=2N$, $h=1/2$ 이라고 할 때, $m*n$ 또는 $n*m$ 크기의 차분 블록에 대한 변환 계수 C는 두 가지 방법으로 계산될 수 있다. 하나는 $m*n$ 또는 $n*m$ 크기의 차분 블록을 4개의 $m*m$ 블록으로 분할한 후 각각에 대해 변환 커널을 적용하여 변환 계수를 생성하는 방법이다. 다른 하나의 방법은 $m*n$ 또는 $n*m$ 크기의 차분 블록 자체에 대해 변환 커널을 적용하여 변환 계수를 생성하는 방법이다.
- [0247] 부호화기는 잔차 신호와 변환 계수 중에서 어떤 것을 전송할 지를 결정한다(S1470). 예컨대, 예측이 잘된 경우에는 변환 부호화를 하지 않고, 잔차 신호를 그대로 전송할 수 있다.
- [0248] 잔차 신호와 변환 계수 중에서 어떤 것을 전송할 지는 상술한 RDO 등을 통해서 결정할 수 있다. 변환 부호화 전후의 비용(cost) 함수를 비교하여 비용이

최소화되도록 결정할 수 있다. 현재 예측 블럭에 대하여 전송할 신호의 타입(잔차 신호 또는 변환 계수)이 결정되면, 전송 되는 신호의 타입 역시 복호화기로 시그널링 한다.

- [0249] 이어서, 부호화기는 변환 계수가 스캔(scan) 된다(S1480). 스캔에 의해 양자화된 2차원의 블럭 형태의 변환 계수가 1차원의 벡터 형태의 변환 계수로 변경될 수 있다.
- [0250] 스캔된 변환 계수와 인트라 예측 모드를 엔트로피 부호화 한다(S1490). 부호화된 정보들은 압축된 비트 스트림을 형성하여 네트워크 추상 계층(NAL: Network Abstraction Layer)을 통해 전송되거나 저장될 수 있다.
- [0251] 도 16은 상술한 본 발명이 적용되는 시스템에서 복고화 장치에서의 동작을 개략적으로 설명하는 순서도이다.
- [0252] 도 16을 참조하면, 복호화기는 수신한 비트스트림을 엔트로피 복호화한다(S1610). 이 때, VLC(variable length coding) 테이블로부터 블럭 타입이 얻어지고, 현재 복호화 대상 블럭의 예측 모드가 산출될 수 있다. 수신된 비트 스트림에 복호화에 필요한 보조 정보(side information), 예를 들어 부호화 단위, 예측 단위, 변환 단위에 관한 정보, AIS 필터링에 관련된 정보, 예측 모드 개수 제한 정보, 사용되지 않는 예측 모드에 대한 정보, 예측 모드 재배치 정보, 변환 방법에 관한 정보, 스캔 방법에 관한 정보 등이 포함되는 경우, 비트스트림과 함께 상기 보조 정보도 엔트로피 복호화된다.
- [0253] 또한 복호화된 정보를 통해 현재 복호화 대상 블럭에 대해 전송되어 온 신호가 차분 블럭에 대한 잔차 신호인지, 아니면 변환 계수인지를 확인할 수 있다. 그리고 현재 복호화 대상 블럭에 대해, 차분 블럭에 대한 잔차 신호나 1차원 벡터 형태의 변환 계수가 얻어진다.
- [0254] 이어서, 복호화기는 잔차 블럭을 생성한다(S1620).
- [0255] 복호화기는 엔트로피 복호화된 잔차 신호나 변환 계수를 역스캔(inverse scan)하여 2차원 블럭을 생성한다. 이 때, 잔차 신호의 경우 잔차 블럭이 생성되고, 변환 계수의 경우, 2차원 블럭 형태의 변환 계수가 생성된다.
- [0256] 변환 계수가 생성된 경우 역양자화가 수행된다. 역양자화된 변환 계수는 역변환되고, 역변환을 통해 잔차(residual) 신호에 대한 잔차 블럭이 생성된다. $n \times n$ 크기의 블럭에 대한 역변환은 수학적 식 11에 의해 표현될 수 있다.
- [0257] 이어서, 복호화기는 참조 화소를 생성한다(S1630). 이 때, 부호화기에서 시그널링되어 전송된 AIS 필터링 적용 여부 및 어떤 타입의 필터가 사용되었는지 여부에 대한 정보가 참조되어 복호화기 측에서 참조 화소가 생성된다. 또한 부호화 단계에서와 마찬가지로, 현재 복호화 대상 블럭에 인접한, 이미 복호화되어 복원된 좌측 블럭의 맨 오른쪽 수직라인상의 화소들과 복호화 대상 블럭에 인접한 상단 블럭의 맨 아래쪽 수평라인상의 화소들이 참조 화소 생성에 사용된다.
- [0258] 한편, 복호화기가 수신한 CIP_flag의 값이 1로 설정되어 있는 경우에는,

부호화기에서 대상 픽처에 CIP를 사용한 것이므로, 이에 따라서 참조 화소를 생성한다. 예컨대, 인접 블록의 화소들 중에서 인트라 모드로 부호화된 화소들만 참조 화소로 사용되고, 인터 모드로 부호화된 인접 블록의 화소들은 참조 화소로 사용되지 않는다. 이 경우에, 도 16에서 상술한 바와 같이, 근처에 있는 인트라 모드로 부호화된 참조 화소들을 보간하여 인터 모드로 부호화된 인접 블록의 화소 위치에 대응하는 화소(대상 예측 샘플)들을 참조 화소로 생성하거나, 근처에 있는 인트라 모드로 부호화된 참조 화소를 복사하여 인터 모드로 부호화된 인접 블록의 화소 위치에 대응하는 참조 화소로 사용할 수 있다.

- [0259] 예컨대, 대상 인터 예측 샘플의 좌우 또는 상하 양쪽에 모두 인트라 모드의 예측 화소가 있는 경우에는 수학적 식 17과 같이 인터 모드로 예측된 블록 위치의 대상 예측 샘플(P_T)를 계산해 낸다. 또한, 대상 예측 샘플의 한쪽에만 인트라 예측 샘플이 있으면, 수학적 식 18와 같이 인터 모드로 예측된 블록 위치의 대상 예측 샘플(P_T)를 계산해 낸다. 수학적 식 17 및/또는 수학적 식 18에서 P_{LB} , P_{RA} 값으로 해당 인트라 모드 화소들의 평균값을 사용할 수도 있다. 만일 인접 블록에 인트라 모드로 예측된 블록이 하나도 없는 경우에는 이전 픽처의 동일 위치에서 화소값을 복사하여 참조 화소값으로 사용할 수 있다.
- [0260] 참조 화소 생성시, 부호화기 측에서 사용된 참조 화소 생성 방법에 따라, 부호화기 측에서 AIS 필터링이 적용된 경우, 즉 스무딩이 적용되어 AIS가 온(on)인 경우에는 복호화기 측에서도 AIS(Adaptive Intra Smoothing) 필터링이 수행된다. 복호화기는 수신한 정보 중 필터 타입 정보를 기반으로 필터 계수를 정할 수 있다. 예컨대, 적용하는 필터 계수가 [1, 2, 1], [1, 1, 4, 1, 1] 인 경우에는 두 필터 계수 중에서 필터 타입 정보가 지시하는 필터 계수를 적용할 수 있다.
- [0261] 다음으로, 참조 화소 및 현재 복호화 대상 블록의 엔트로피 복호화된 예측 모드를 사용하여 복호화 대상 블록에 대한 예측 블록이 생성된다(S1640).
- [0262] 예측 블록의 생성 과정은 부호화기 측에서 예측 모드 결정 및 예측 블록 생성에 사용된 과정과 동일하다. 현재 블록의 예측 모드가 플래너 모드인 경우에, 예측 블록을 생성하기 위해 어떤 플래너 예측 방법을 사용하였는지를 시그널링된 정보를 분석해서 파악할 수 있다. 이때, 복호화기는 파악한 내용에 따라서, 도 6 내지 10에서 설명한 플래너 모드 중 어떤 모드가 사용되었는지에 따라서, 예측 블록을 생성할 수 있다.
- [0263] 다음으로, 예측 블록의 화소값과 차분 블록의 화소값이 화소 단위로 더해져서 재생된 블록, 즉 복원 블록이 생성된다(S1670).

청구범위

- [청구항 1] 입력된 예측 유닛에 대하여 인트라 예측을 위한 참조 화소들을 생성하는 단계;
 상기 예측 유닛에 대한 인트라 모드를 결정하는 단계;
 상기 참조 화소와 상기 인트라 모드를 기반으로 예측 블럭을 생성하는 단계; 및
 상기 예측 유닛과 상기 예측 블럭에 대한 잔차 블럭을 생성하는 단계를 포함하며,
 상기 참조 화소들 및 상기 예측 블럭의 화소들 중 적어도 어느 하나의 화소들은 기준 화소를 기반으로 예측되고,
 상기 예측되는 화소값은 상기 기준 화소의 화소값에, 상기 기준 화소로부터 상기 생성되는 화소까지의 화소값 변화량을 더한 값인 것을 특징으로 하는 부호화기의 인트라 예측 방법.
- [청구항 2] 제1항에 있어서,
 상기 예측 블럭의 좌상측 코너에 위치하는 인접 블럭의 참조 화소를 제1 기준 화소로 하며,
 상기 제1 기준 화소로부터, 상기 예측 블럭과의 좌측 경계에 위치하는 인접 블럭의 참조 화소 중 가장 아래 화소까지의 화소값 변화량과,
 상기 제1 기준 화소로부터, 상기 예측 블럭과의 상측 경계에 위치하는 인접 블럭의 참조 화소 중 가장 오른쪽 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 블럭의 우하측 코너의 대각선 화소인 제2 기준 화소의 화소값으로 설정하고,
 상기 제1 기준 화소와 상기 제2 기준 화소로부터 상기 예측 블럭의 대각선 화소값들을 예측하는 것을 특징으로 하는 부호화기의 인트라 예측 방법.
- [청구항 3] 제2항에 있어서, 상기 예측 블럭의 비 대각선 화소들은 상기 대각선 화소들과 상기 예측 블럭과의 상측 및/또는 좌측 경계에 있는 인접 블럭의 화소들을 보간 또는 외삽하여 예측되는 것을 특징으로 하는 부호화기의 인트라 예측 방법.
- [청구항 4] 제1항에 있어서,
 상기 예측 블럭의 좌상측 코너에 위치하는 인접 블럭의 참조 화소를 기준 화소로 하고,
 상기 기준 화소로부터, 상기 예측 블럭의 좌측 경계에 위치하는 인접 블럭의 참조 화소 중 예측 대상 화소와 동일한 행에 위치하는 인접 화소까지의 화소값 변화량과,

상기 기준 화소로부터, 상기 예측 블록의 상측 경계에 위치하는 인접 블록의 참조 화소 중 상기 예측 대상 화소와 동일한 열에 위치하는 인접 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 대상 화소의 화소값으로 예측하는 것을 특징으로 하는 부호화기의 인트라 예측 방법.

[청구항 5]

제1항에 있어서,

상기 예측 블록과의 좌측 또는 상측 경계에 위치하는 인접 블록의 화소들 중 예측 대상 화소와 동일한 행 또는 동일한 열에 위치하는 화소를 기준 화소로 하고,

상기 기준 화소로부터, 상기 예측 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 대상 화소의 화소값으로 예측하는 것을 특징으로 하는 부호화기의 인트라 예측 방법.

[청구항 6]

제5항에 있어서, 상기 예측 대상 화소는 상기 예측 블록의 대각선 화소이고, 상기 예측 블록의 비 대각선 화소는 상기 대각선 화소와 상기 인접 블록의 화소들을 이용한 보간을 통해서 예측되는 것을 특징으로 하는 부호화기의 인트라 예측 방법.

[청구항 7]

제1항에 있어서, 상기 예측 유닛과 인접한 블록이 인터 모드

블록인 경우에, 상기 인터 모드 블록과 상기 예측 유닛과의 경계에 위치하는 참조 화소를 생성하는 단계를 더 포함하며,

상기 참조 화소의 좌측 또는 하측에 위치하는 인트라 모드 블록의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소를 제1 기준 화소로 하고,

상기 참조 화소의 우측 또는 상측에 위치하는 인트라 모드 블록의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소를 제2 기준 화소로 하여,

상기 참조 화소까지의 거리와, 상기 제2 기준 화소로부터 상기 참조 화소까지의 거리에 기초하여 상기 참조 화소를 생성하는 것을 특징으로 하는 부호화기의 인트라 예측 방법.

[청구항 8]

제7항에 있어서, 상기 제1 기준 화소의 화소값은 제1 기준 화소가 속하는 인트라 모드 블록의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소들의 평균 화소 값이고,

상기 제2 기준 화소의 화소값은 제2 기준 화소가 속하는 인트라 모드 블록의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소들의 평균 화소 값인 것을 특징으로 하는 부호화기의 인트라 예측 방법.

[청구항 9]

제7항에 있어서, 상기 참조 화소의 좌측 또는 하측에만 인트라 모드 블록이 위치하는 경우에는 상기 제1 기준 화소 값을 상기 참조 화소 값으로 하고,

- [청구항 10] 상기 참조 화소의 우측 또는 상측에만 인트라 모드 블록이 위치하는 경우에는, 상기 제2 기준 화소 값을 상기 참조 화소 값으로 하는 것을 특징으로 하는 부호화기의 인트라 예측 방법. 수신한 비트스트림을 엔트로피 복호화하는 단계; 예측 유닛의 인트라 예측에 이용할 참조 화소를 생성하는 단계; 상기 예측 유닛에 대한 예측 모드를 기반으로 상기 참조 화소로부터 예측 블록을 생성하는 단계; 및 상기 엔트로피 복호화를 통해 구한 잔차 블록과 상기 예측 블록으로부터 영상을 재구성(reconstruction)하는 단계를 포함하며, 상기 참조 화소들 및 상기 예측 블록의 화소들 중 적어도 어느 하나의 화소들은 기준 화소를 기반으로 예측되고, 상기 예측되는 화소값은 상기 기준 화소의 화소값에, 상기 기준 화소로부터 상기 생성되는 화소까지의 화소값 변화량을 더한 값인 것을 특징으로 하는 복호화기의 인트라 예측 방법.
- [청구항 11] 제10항에 있어서, 상기 예측 블록의 좌상측 코너에 위치하는 인접 블록의 참조 화소를 제1 기준 화소로 하며, 상기 제1 기준 화소로부터, 상기 예측 블록과의 좌측 경계에 위치하는 인접 블록의 참조 화소 중 가장 아래 화소까지의 화소값 변화량과, 상기 제1 기준 화소로부터, 상기 예측 블록과의 상측 경계에 위치하는 인접 블록의 참조 화소 중 가장 오른쪽 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 블록의 우하측 코너의 대각선 화소인 제2 기준 화소의 화소값으로 설정하고, 상기 제1 기준 화소와 상기 제2 기준 화소로부터 상기 예측 블록의 대각선 화소값들을 예측하는 것을 특징으로 하는 복호화기의 인트라 예측 방법.
- [청구항 12] 제11항에 있어서, 상기 예측 블록의 비 대각선 화소들은 상기 대각선 화소들과 상기 예측 블록과의 상측 및/또는 좌측 경계에 있는 인접 블록의 화소들을 보간 또는 외삽하여 예측되는 것을 특징으로 하는 복호화기의 인트라 예측 방법.
- [청구항 13] 제10항에 있어서, 상기 예측 블록의 좌상측 코너에 위치하는 인접 블록의 참조 화소를 기준 화소로 하고, 상기 기준 화소로부터, 상기 예측 블록의 좌측 경계에 위치하는 인접 블록의 참조 화소 중 예측 대상 화소와 동일한 행에 위치하는 인접 화소까지의 화소값 변화량과, 상기 기준 화소로부터, 상기 예측 블록의 상측 경계에 위치하는

인접 블럭의 참조 화소 중 상기 예측 대상 화소와 동일한 열에 위치하는 인접 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 대상 화소의 화소값으로 예측하는 것을 특징으로 하는 복호화기의 인트라 예측 방법.

[청구항 14]

제10항에 있어서,
상기 예측 블럭과의 좌측 또는 상측 경계에 위치하는 인접 블럭의 화소들 중 예측 대상 화소와 동일한 행 또는 동일한 열에 위치하는 화소를 기준 화소로 하고,
상기 기준 화소로부터, 상기 예측 화소까지의 화소값 변화량을 상기 기준 화소에 반영한 값을 상기 예측 대상 화소의 화소값으로 예측하는 것을 특징으로 하는 복호화기의 인트라 예측 방법.

[청구항 15]

제14항에 있어서, 상기 예측 대상 화소는 상기 예측 블럭의 대각선 화소이고, 상기 예측 블럭의 비 대각선 화소는 상기 대각선 화소와 상기 인접 블럭의 화소들을 이용한 보간을 통해서 예측되는 것을 특징으로 하는 복호화기의 인트라 예측 방법.

[청구항 16]

제10항에 있어서, 상기 예측 유닛과 인접한 블럭이 인터 모드 블럭인 경우에, 상기 인터 모드 블럭과 상기 예측 유닛과의 경계에 위치하는 참조 화소를 생성하는 단계를 더 포함하며,
상기 참조 화소의 좌측 또는 하측에 위치하는 인트라 모드 블럭의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소를 제1 기준 화소로 하고,
상기 참조 화소의 우측 또는 상측에 위치하는 인트라 모드 블럭의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소를 제2 기준 화소로 하여,
상기 제1 기준 화소로부터 상기 참조 화소까지의 거리와, 상기 제2 기준 화소로부터 상기 참조 화소까지의 거리에 기초하여 참조 화소를 생성하는 것을 특징으로 하는 복호화기의 인트라 예측 방법.

[청구항 17]

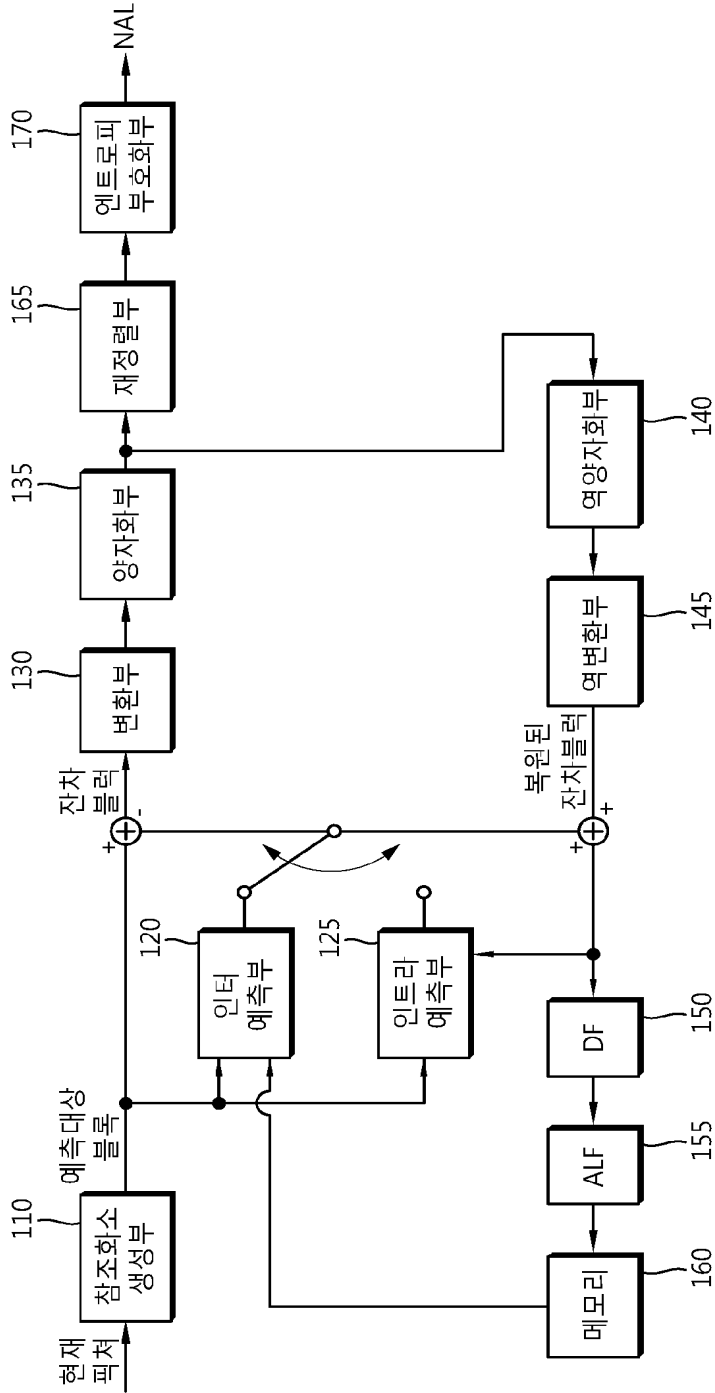
제16항에 있어서, 상기 제1 기준 화소의 화소값은 제1 기준 화소가 속하는 인트라 모드 블럭의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소들의 평균 화소 값이고,
상기 제2 기준 화소의 화소값은 제2 기준 화소가 속하는 인트라 모드 블럭의 화소 중 상기 예측 유닛과의 경계에 위치하는 화소들의 평균 화소 값인 것을 특징으로 하는 복호화기의 인트라 예측 방법.

[청구항 18]

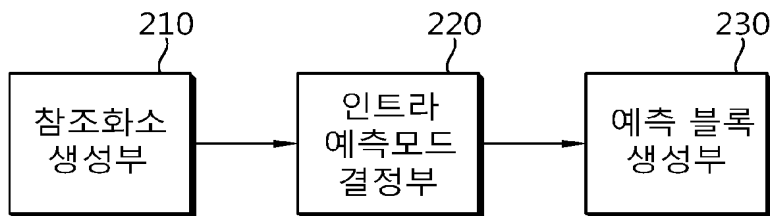
제16항에 있어서, 상기 참조 화소의 좌측 또는 하측에만 인트라 모드 블럭이 위치하는 경우에는 상기 제1 기준 화소 값을 상기 참조 화소 값으로 하고,

- 상기 참조 화소의 우측 또는 상측에만 인트라 모드 블록이
 위치하는 경우에는, 상기 제2 기준 화소 값을 상기 참조 화소
 값으로 하는 것을 특징으로 하는 복호화기의 인트라 예측 방법.
- [청구항 19] 제10항에 있어서, 상기 엔트로피 복호화를 통해 상기 예측 블록의
 화소들을 상기 기준 화소를 기반으로 생성하라는 지시를 획득하는
 것을 특징으로 하는 복호화기의 인트라 예측 방법.
- [청구항 20] 제10항에 있어서, 상기 엔트로피 복호화를 통해 상기 참조
 화소들을 상기 기준 화소를 기반으로 생성하라는 지시를 획득하는
 것을 특징으로 하는 복호화기의 인트라 예측 방법.

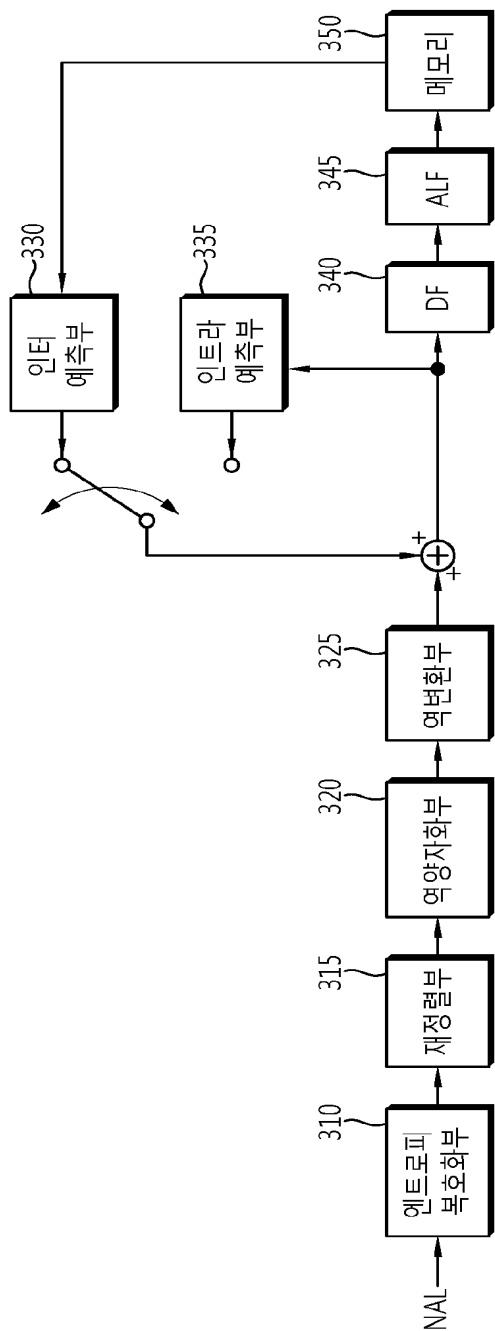
[Fig. 1]



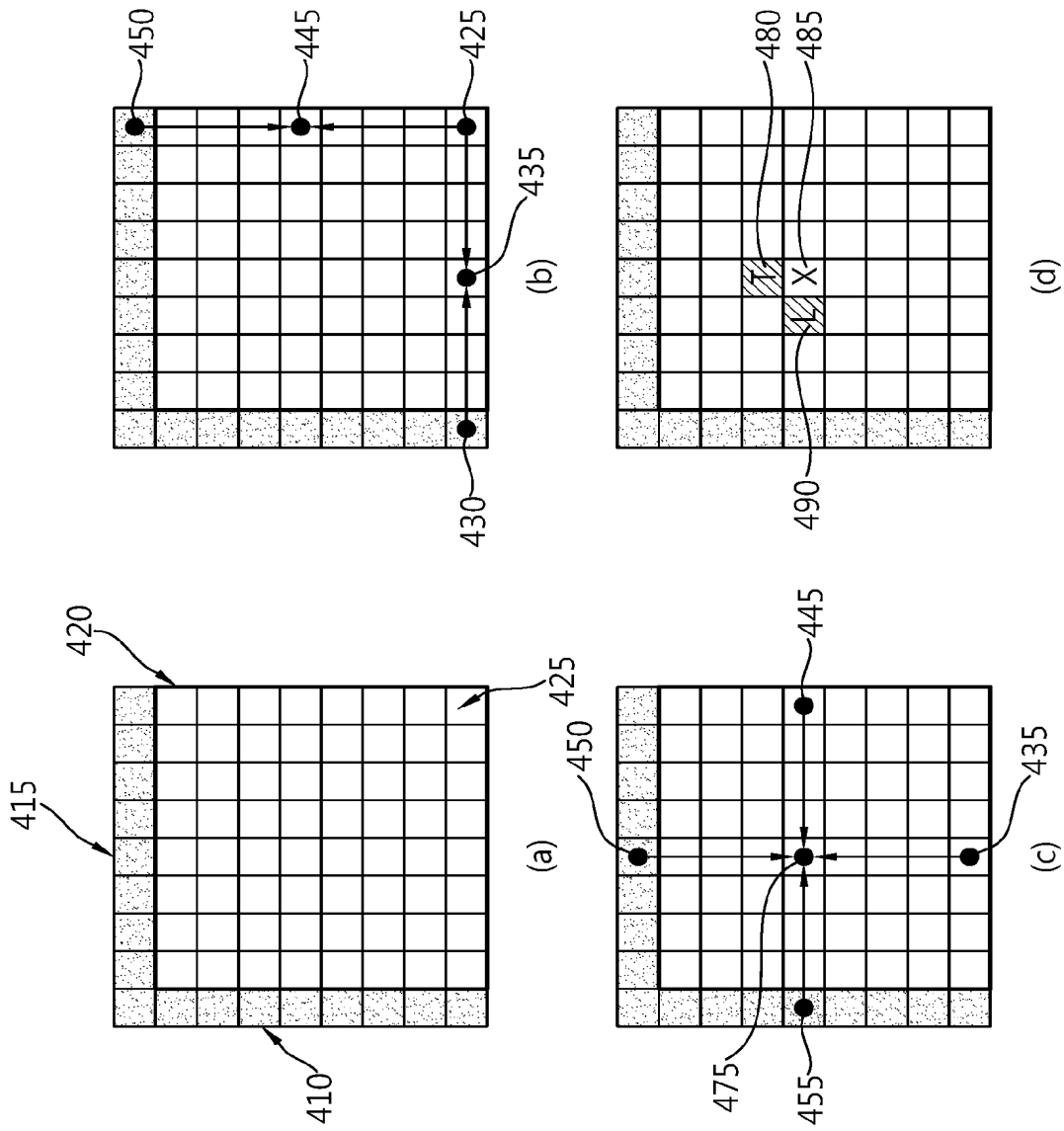
[Fig. 2]



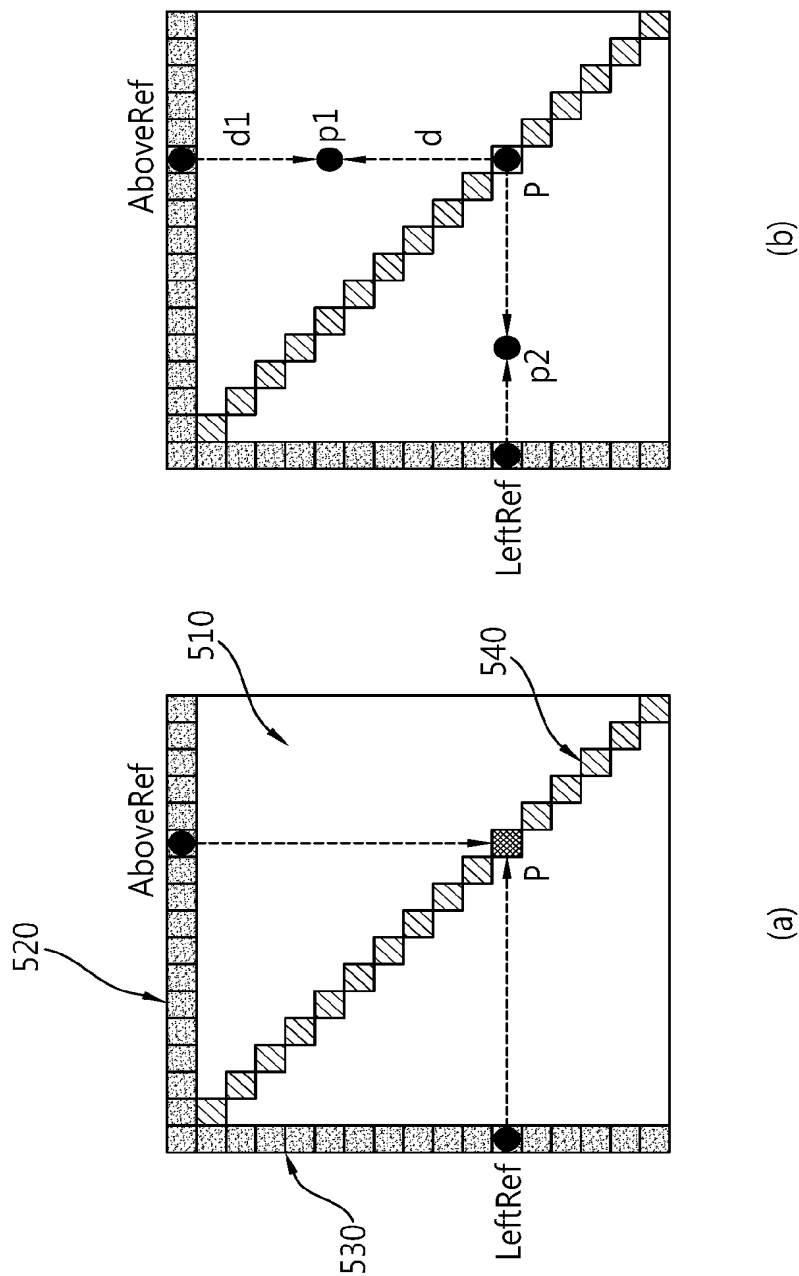
[Fig. 3]



[Fig. 4]



[Fig. 5]



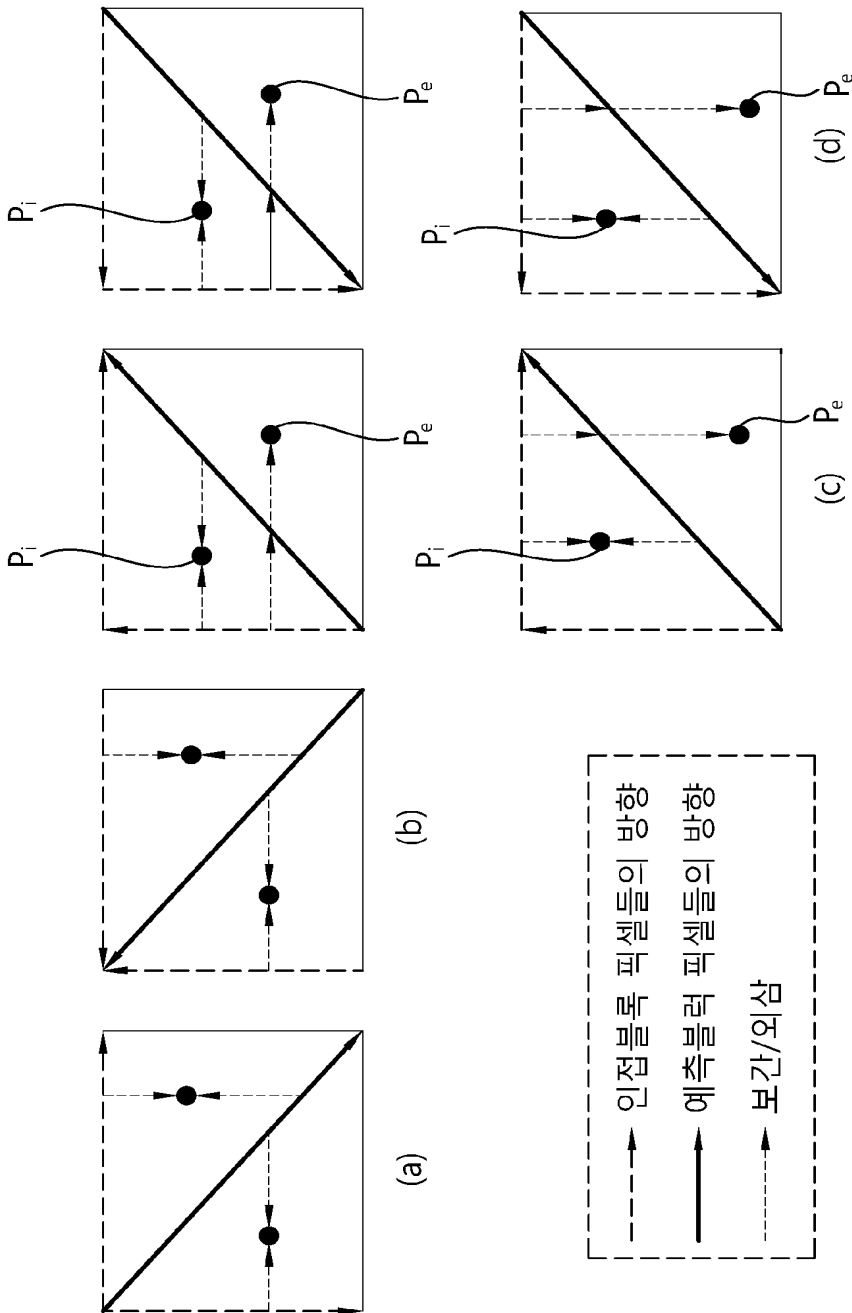
(b)

(a)

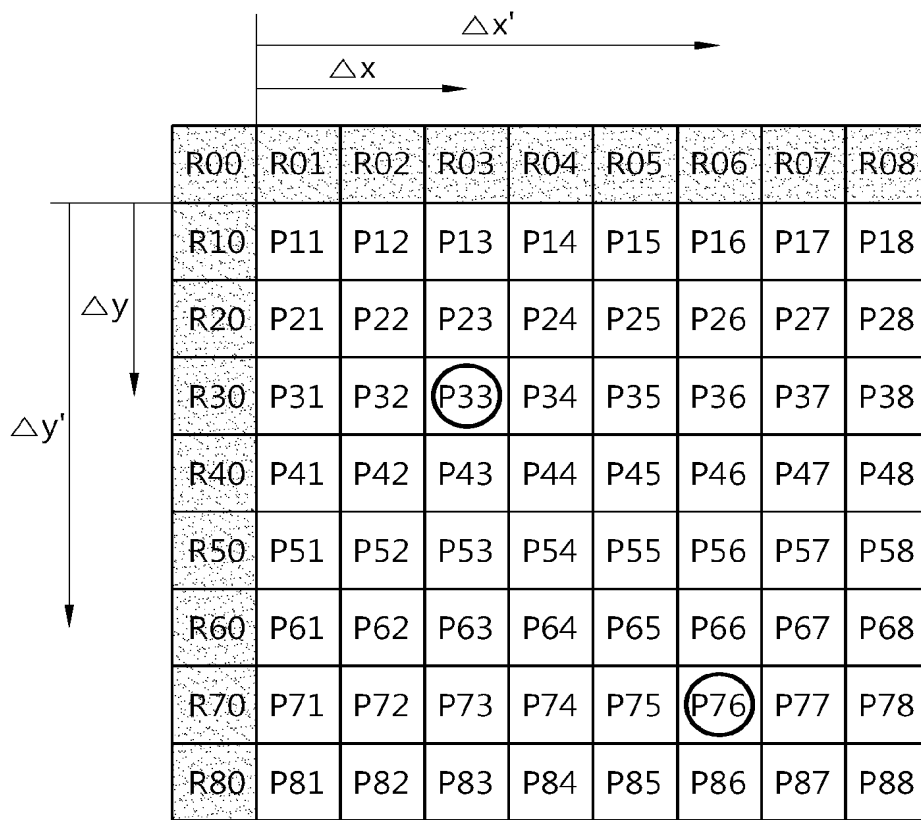
[Fig. 6]

| R00 | R01 | R02 | R03 | R04 | R05 | R06 | R07 | R08 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| R10 | P11 | | | | | | | |
| R20 | | P22 | | | | | | |
| R30 | | | P33 | | | | | |
| R40 | | | | P44 | | | | |
| R50 | | | | | P55 | | | |
| R60 | | | | | | P66 | | |
| R70 | | | | | | | P77 | |
| R80 | | | | | | | | P88 |

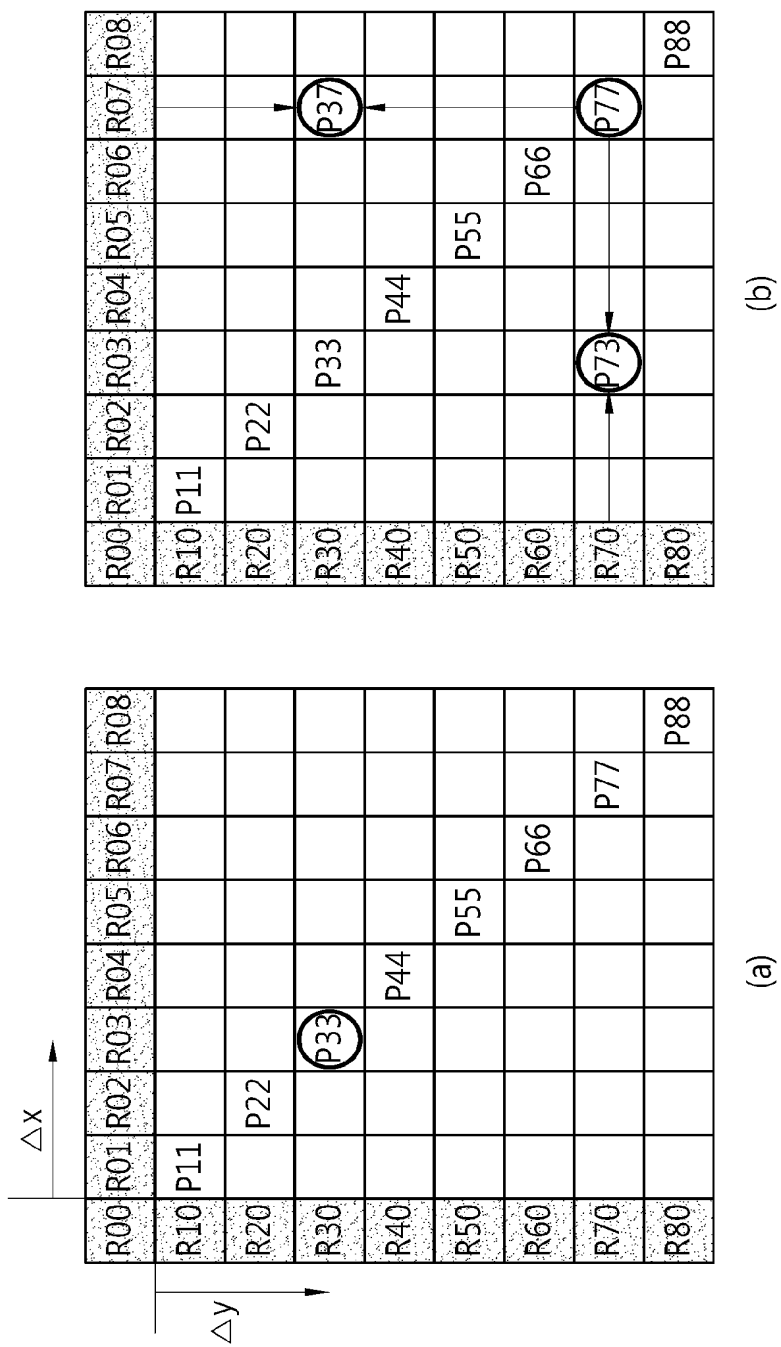
[Fig. 7]



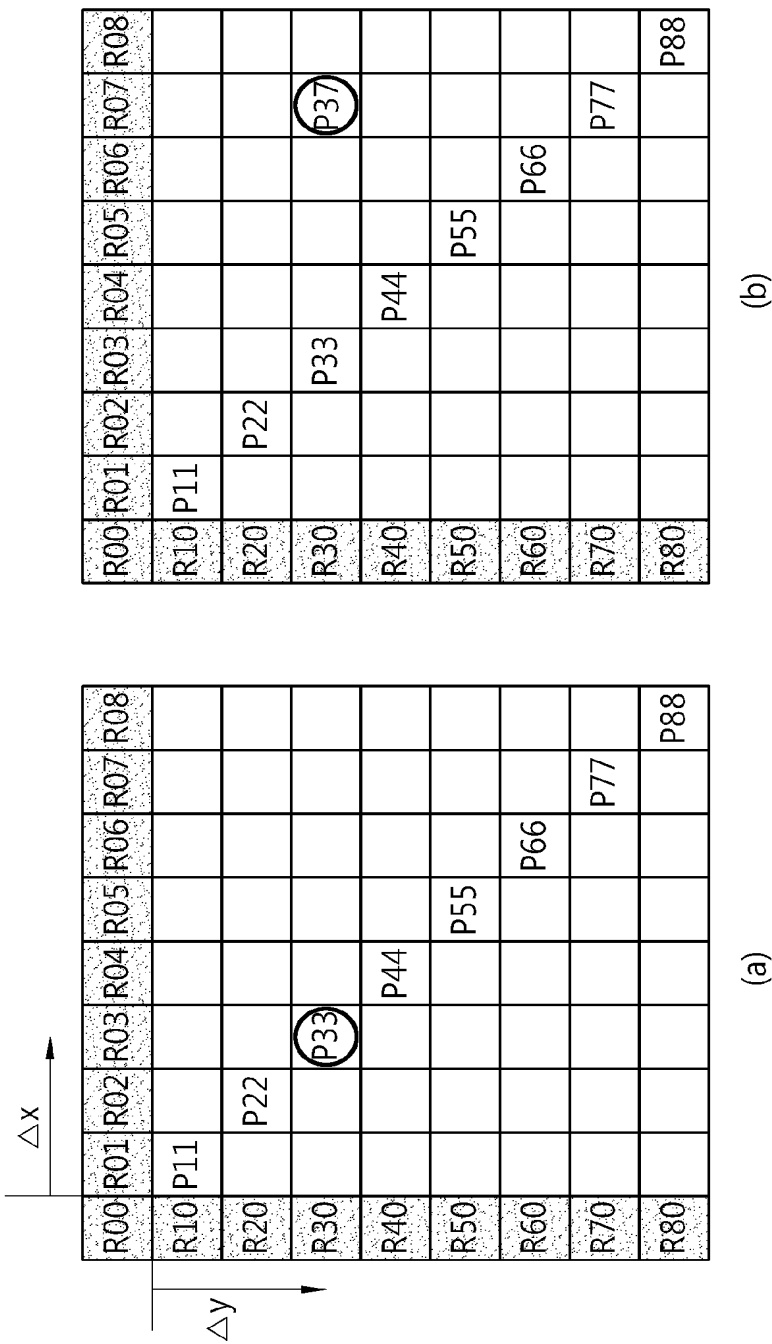
[Fig. 8]



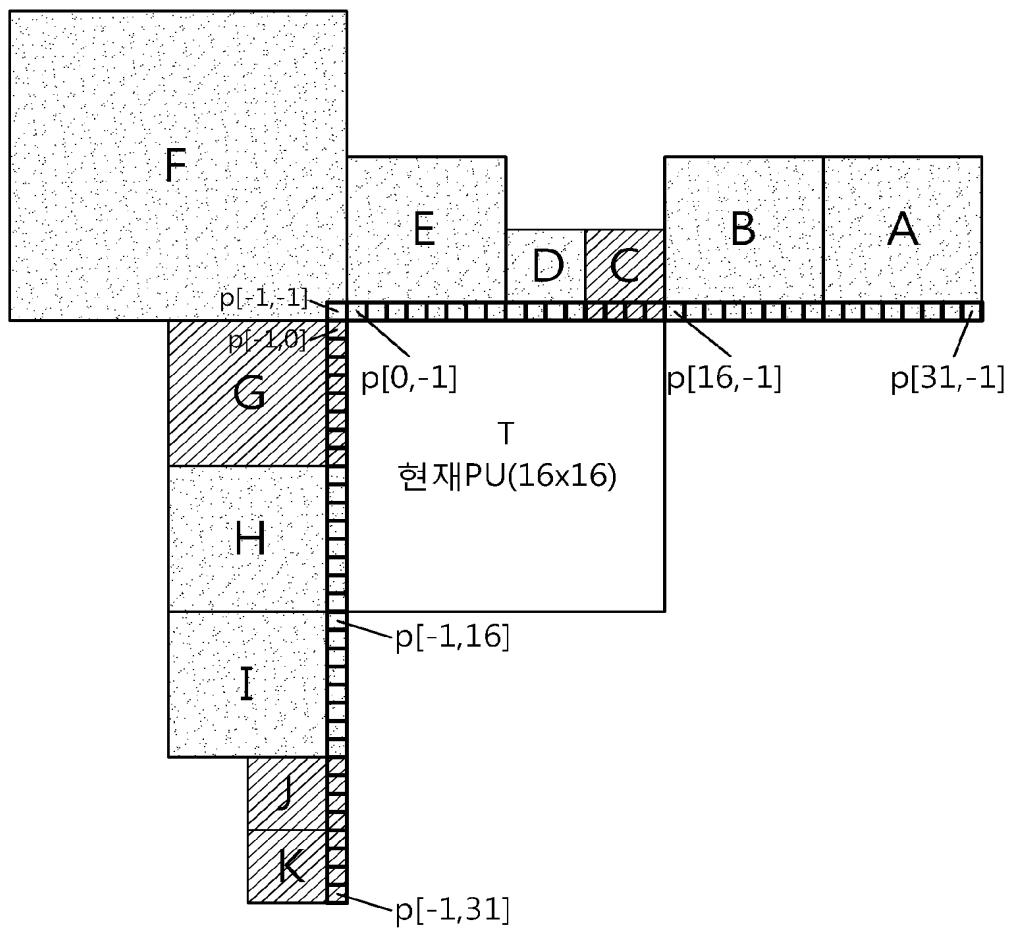
[Fig. 9]






[Fig. 10]

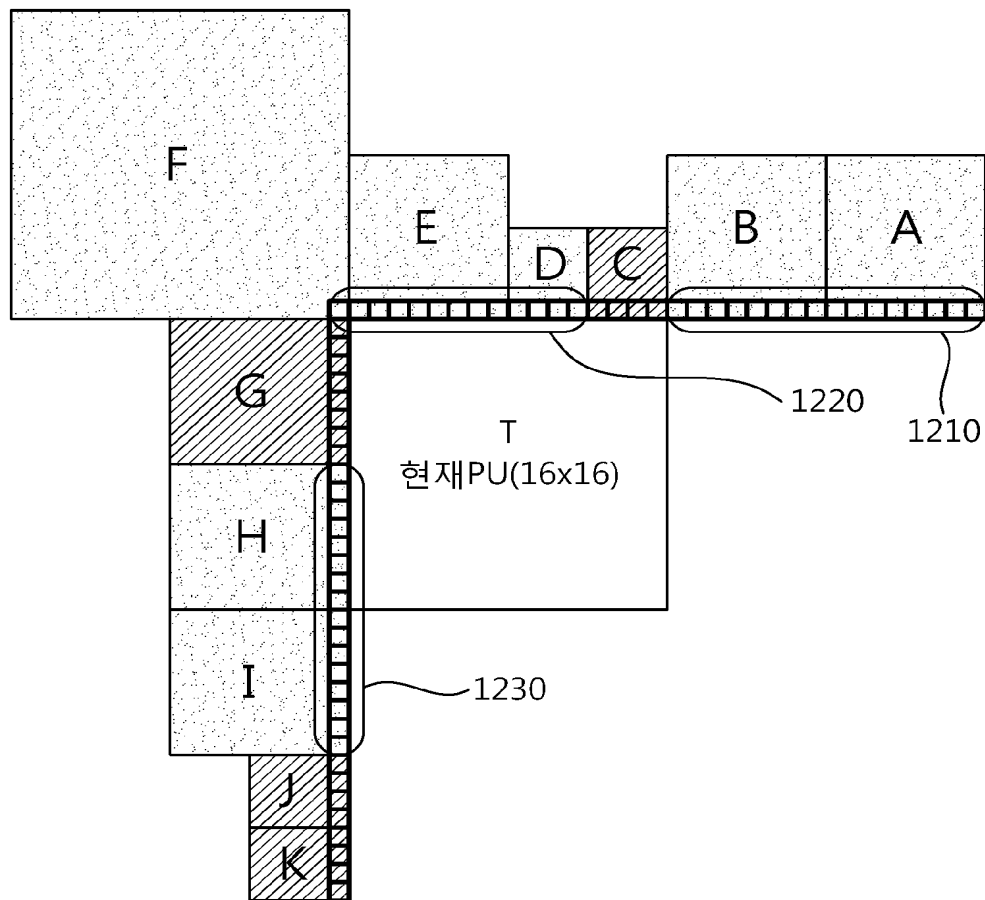





[Fig. 11]



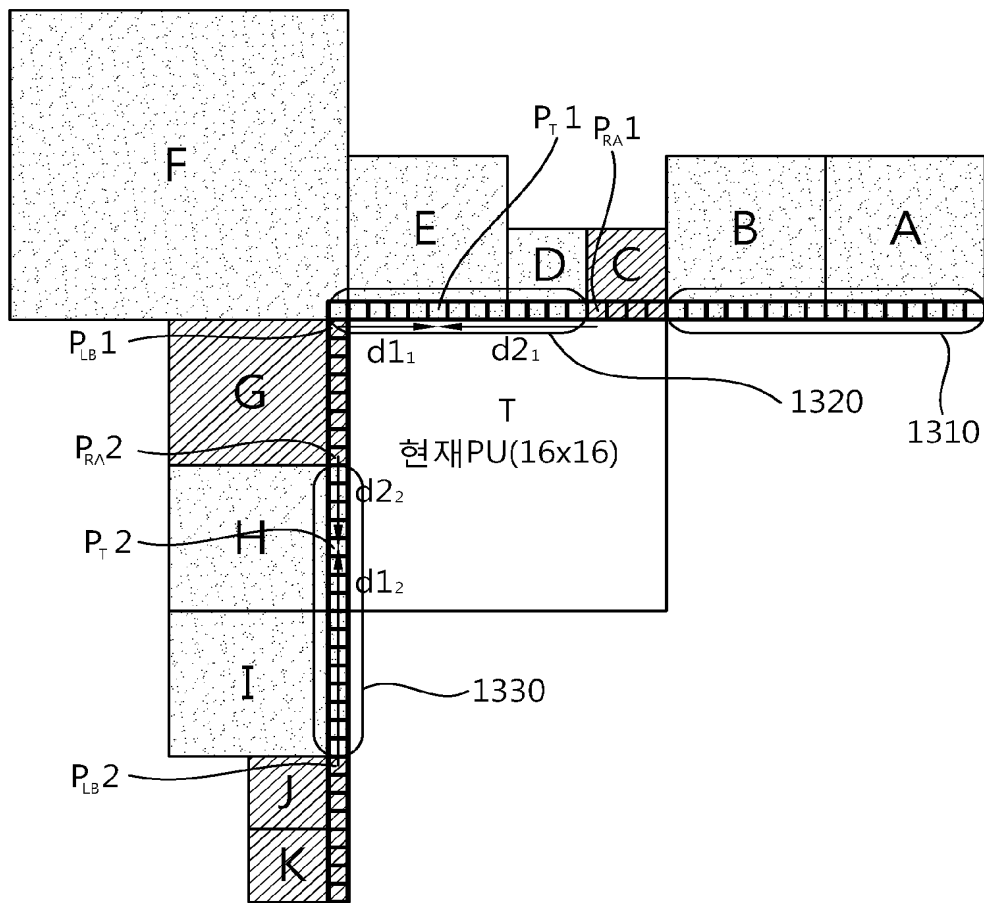
-  = 인트라 코딩된 이웃 PU들
-  = 인터 코딩된 이웃 PU들
-  = 인트라 예측에 필요한 참조 샘플들




[Fig. 12]



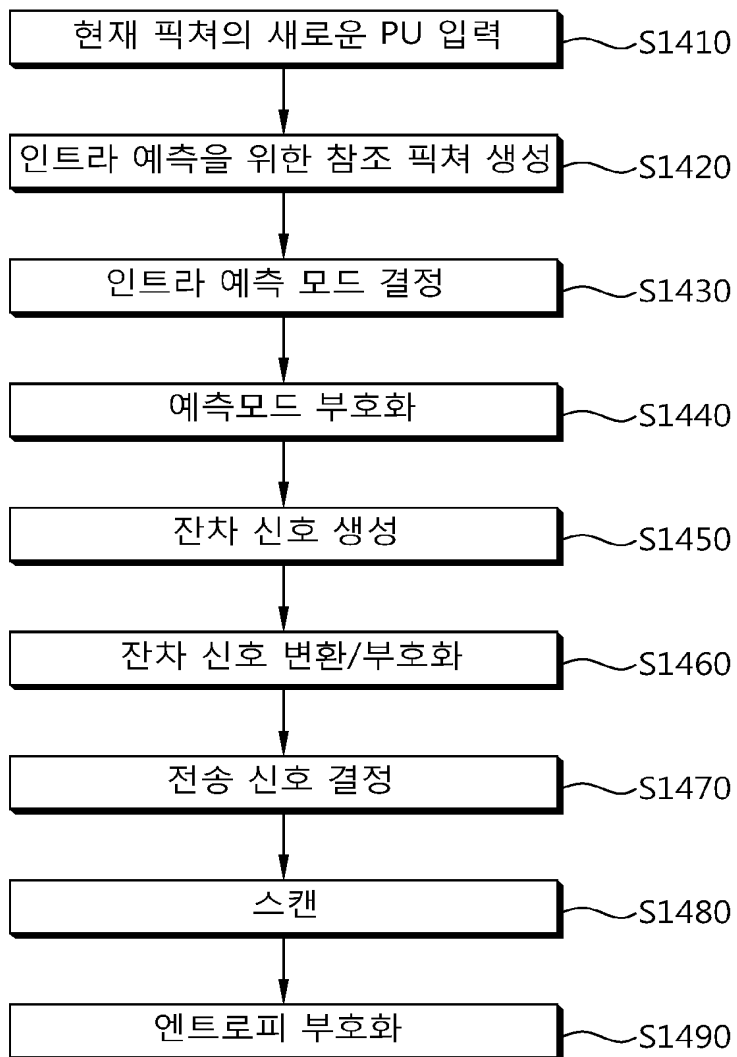
-  =인트라 코딩된 이웃PU들
-  =인터 코딩된 이웃 PU들
-  =인트라 예측에 필요한 참조 샘플들

[Fig. 13]

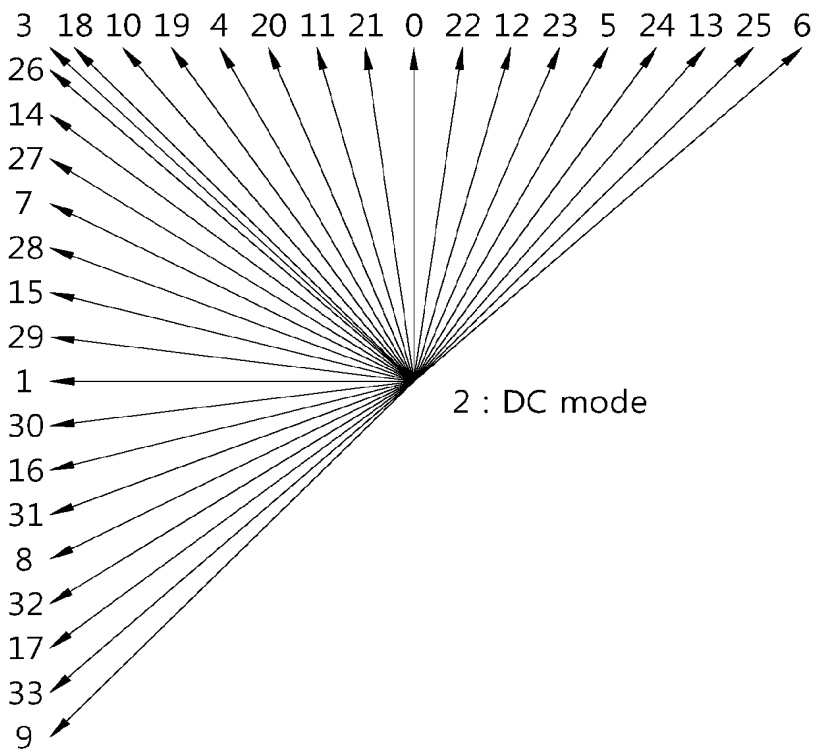


-  =인트라 코딩된 이웃 PU들
-  =인터 코딩된 이웃 PU들
-  =인트라 예측에 필요한 참조 샘플들

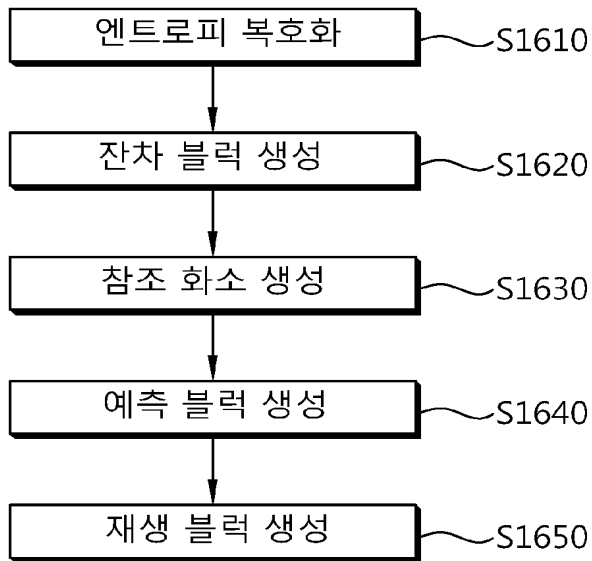
[Fig. 14]



[Fig. 15]



[Fig. 16]



DERWENT- 2012-Q73869**ACC-NO:****DERWENT-** 201553**WEEK:***Copyright ©2015 Thomson Reuters*

TITLE: Video information intra prediction method for encoder, involves generating prediction block from reference pixels based on prediction mode of prediction unit, and predicting reference pixels and/or prediction block pixels

INVENTOR: CHEOL K J; JAE C K ; JOO Y K ; KIM J ; KIM J Y ;
KWON J ; KWON J C ; YEONG K J

PATENT-ASSIGNEE: KT CORP[KTKT]

PRIORITY- 2011KR-065210 (June 30, 2011) , 2011KR-048130
DATA: (May 20, 2011)

PATENT-FAMILY:

| PUB-NO | PUB-DATE | LANGUAGE |
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| WO 2012161444 A2 | November 29, 2012 | KO 43 |
| WO 2012161444 A3 | January 17, 2013 | KO |
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| CA 2836888 A1 | November 29, 2012 | EN |
| KR 2014019457 A | February 14, 2014 | KO |
| GB 2506039 A | March 19, 2014 | EN |
| EP 2712192 A2 | March 26, 2014 | EN |
| SE 201351441 A1 | January 22, 2014 | SV |
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| US 20140105290 A1 | April 17, 2014 | EN |
| KR 1383775 B1 | April 14, 2014 | KO |
| VN 37059 A | February 25, 2014 | VI |
| CN 103703773 A | April 2, 2014 | ZH |
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| KR 2014135678 A | November 26, 2014 | KO |
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| KR 1508291 B1 | April 8, 2015 | KO |
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| KR 1508895 B1 | April 8, 2015 | KO |
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| US 20150139318 A1 | May 21, 2015 | EN |
| US 20150146781 A1 | May 28, 2015 | EN |
| PL 407846 A1 | May 25, 2015 | PL |
| ES 2450643 B1 | March 25, 2014 | ES |

DESIGNATED-STATES: AE AG AL AM AO AT AU AZ BA BB BG BH BR BW BY BZ
CA CH CL CN CO CR CU CZ DE DK DM DO DZ EC EE EG
ES FI GB GD GE GH GM GT HN HR HU ID IL IN IS JP
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PH PL PT QA RO RS RU RW SC SD SE SG SK SL SM ST
SV SY TH TJ TM TN TR TT TZ UA UG US UZ VC VN ZA
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EE EG ES FI GB GD GE GH GM GT HN H R HU ID IL IN
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R GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR

APPLICATION-DATA:

| PUB-NO | APPL-DESCRIPTOR | APPL-NO | APPL-DATE |
|----------------|------------------------|-----------------|------------------|
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| CA 2836888A1 | PCT Application | 2012WO- KR003744 | May 14, 2012 |
| GB 2506039A | PCT Application | 2012WO- KR003744 | May 14, 2012 |
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| US20140105290A1 | PCT Application | 2012WO- KR003744 | May 14, 2012 |
| VN 37059A | PCT Application | 2012WO- KR003744 | May 14, 2012 |
| CN 103703773A | PCT Application | 2012WO- KR003744 | May 14, 2012 |
| IN 201310077P1 | PCT Application | 2012WO- KR003744 | May 14, 2012 |
| PL 407846A1 | PCT Application | 2012WO- KR003744 | May 14, 2012 |
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| ES 2450643R1 | N/A | 2013ES-090093 | May 14, 2012 |
| ES 2450643B1 | N/A | 2013ES-090093 | May 14, 2012 |
| SE 201351441A1 | N/A | 2013SE-051441 | May 14, 2012 |
| VN 37059A | N/A | 2013VN-003880 | May 14, 2012 |
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| IN 201310077P1 | N/A | 2013IN-DN10077 | November 22, 2013 |
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| CN 104378645A | N/A | 2014CN- 10646265 | May 14, 2012 |
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| KR2014059177A | N/A | 2014KR-038230 | March 31, 2014 |
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| KR2014056200A | N/A | 2014KR-038232 | March 31, 2014 |
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| KR 1508894B1 | N/A | 2014KR-124085 | September 18, 2014 |
| KR2014128904A | N/A | 2014KR-124086 | September 18, 2014 |
| KR 1508291B1 | N/A | 2014KR-124086 | September 18, 2014 |
| KR2014135678A | N/A | 2014KR-135606 | October 8, 2014 |
| KR 1508292B1 | N/A | 2014KR-135606 | October 8, 2014 |
| KR2014135679A | N/A | 2014KR-135607 | October 8, 2014 |
| KR 1508486B1 | N/A | 2014KR-135607 | October 8, 2014 |
| KR2014135680A | N/A | 2014KR-135608 | October 8, 2014 |
| KR 1508895B1 | N/A | 2014KR-135608 | October 8, 2014 |
| KR2014135681A | N/A | 2014KR-135609 | October 8, 2014 |
| US20150146781A1 | N/A | 2015US-606007 | January 26, 2015 |
| US20150139318A1 | N/A | 2015US-606008 | January 26, 2015 |
| KR2015043278A | Based on | 2015KR-048599 | April 6, 2015 |

US-CL-CURRENT: 375/240.12

CPC-CURRENT:

CPC-INVENTIVE:

| TYPE | CPC | DATE |
|-------------|--------------|-------------|
| CPCI | H04N19/00763 | 20130101 |
| CPCI | H04N19/11 | 20141101 |
| CPCI | H04N19/176 | 20130101 |
| CPCI | H04N19/44 | 20141101 |
| CPCI | H04N19/44 | 20141101 |
| CPCI | H04N19/50 | 20130101 |
| CPCI | H04N19/593 | 20141101 |
| CPCI | H04N19/593 | 20141101 |

INT-CL-CURRENT:

| TYPE | IPC | DATE |
|-------------|------------|-------------|
| CIPP | H04N19/00 | 20140101 |
| CIPP | H04N19/00 | 20140101 |

| | | |
|------|------------|----------|
| CIPP | H04N19/11 | 20140101 |
| CIPP | H04N19/159 | 20140101 |
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| CIPP | H04N19/61 | 20140101 |
| CIPP | H04N7/34 | 20060101 |
| CIPS | H04N19/103 | 20140101 |
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| CIPS | H04N19/124 | 20140101 |
| CIPS | H04N19/13 | 20140101 |
| CIPS | H04N19/132 | 20140101 |
| CIPS | H04N19/176 | 20140101 |
| CIPS | H04N19/176 | 20140101 |
| CIPS | H04N19/44 | 20140101 |
| CIPS | H04N19/59 | 20140101 |
| CIPS | H04N19/59 | 20140101 |
| CIPS | H04N7/24 | 20110101 |
| CIPS | H04N7/24 | 20060101 |

ABSTRACTED-PUB-NO: WO 2012161444 A2

BASIC-ABSTRACT:

NOVELTY - The method involves entropy-decoding a received bit stream and generating reference pixels to be utilized in an intra prediction process of a prediction unit. A prediction block is generated from the reference pixels based on a prediction mode of the prediction unit. An image is reconstructed from the prediction block and a residual block, which is obtained as a result of an entropy-encoding process. The reference pixels and/or prediction block pixels are predicted based on the base pixel. A predicted pixel value is calculated by utilizing a sum of a pixel value of the base pixel.

DESCRIPTION - An INDEPENDENT CLAIM is also included for a video information intra prediction method for decoder.

USE - Video information intra prediction method for an encoder.

ADVANTAGE - The method enables improving prediction efficiency by changing amount of the pixel value of the block which is adjacent to the predictive block using planner prediction.

DESCRIPTION OF DRAWING(S) - The drawing shows a schematic view illustrating a video information intra prediction method.'(Drawing includes non-English language text)'


CHOSEN-DRAWING: Dwg.7/16

TITLE- VIDEO INFORMATION INTRA PREDICT METHOD ENCODE

TERMS: GENERATE BLOCK REFERENCE PIXEL BASED MODE UNIT

DERWENT-CLASS: W04


EPI-CODES: W04-P01A4J; W04-P01A5;

| | | |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------------------------------------|
| Issue Classification  | Application/Control No. 13975251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. |
| | Examiner COURTNEY FIELDS | Art Unit 2496 |

| CPC | | | | | | |
|--------|--|----|--|-------|------|------------|
| Symbol | | | | | Type | Version |
| H04N | | 19 | | 00218 | F | 2013-01-01 |
| H04N | | 19 | | 159 | I | 2014-11-01 |
| H04N | | 19 | | 176 | I | 2014-11-01 |
| H04N | | 19 | | 129 | I | 2014-11-01 |
| H04N | | 19 | | 61 | I | 2014-11-01 |
| H04N | | 19 | | 11 | I | 2014-11-01 |
| H04N | | 19 | | 103 | I | 2014-11-01 |
| H04N | | 19 | | 136 | I | 2014-11-01 |
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| CPC Combination Sets | | | | |
|----------------------|------|-----|---------|---------|
| Symbol | Type | Set | Ranking | Version |
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|-----------------------------------------------------------------------------------------|--------------------------|---------------------------------------|----------------------------|
| /COURTNEY FIELDS/ Examiner, Art Unit 2496 (Assistant Examiner) | 09/15/2015 (Date) | Total Claims Allowed: 2 | |
| /ANDREW NALVEN/ Supervisory Patent Examiner, Art Unit 2496 (Primary Examiner) | (Date) | O.G. Print Claim(s) 1 | O.G. Print Figure 1 |

| | | |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------|
| Search Notes  | Application/Control No. 13975251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. |
| | Examiner COURTNEY FIELDS | Art Unit 2496 |

| CPC- SEARCHED | | |
|----------------------|------------|----------|
| Symbol | Date | Examiner |
| H04N 19/00218 | 09/15/2015 | CDF |
| H04N 19/159 | 09/15/2015 | CDF |
| H04N 19/136 | 09/15/2015 | CDF |
| H04N 19/61 | 09/15/2015 | CDF |
| H04N 19/129 | 09/15/2015 | CDF |
| H04N 19/103 | 09/15/2015 | CDF |
| H04N 19/11 | 09/15/2015 | CDF |
| H04N 19/176 | 09/15/2015 | CDF |

| CPC COMBINATION SETS - SEARCHED | | |
|----------------------------------------|------|----------|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|-----------------------------------|----------|------|----------|
| Class | Subclass | Date | Examiner |
| | | | |

| SEARCH NOTES | | |
|-----------------------------------------------------------------|------------|----------|
| Search Notes | Date | Examiner |
| EAST Search (USPAT, USPGPUB, EPO, JPO, DERWENT, IBM) | 09/15/2015 | CDF |
| Assignee Search | 09/15/2015 | CDF |
| Inventorship/Double Patenting Search | 09/15/2015 | CDF |
| Interference Search (USPAD, USPGPUB) | 09/15/2015 | CDF |
| NPL Search (Google Scholar, ACM, IEEE) | 09/15/2015 | CDF |
| "Every claim has been reviewed for 35 USC non-statutory matter" | 09/15/2015 | CDF |
| Consulted with SPE Naiven | 09/15/2015 | CDF |

| INTERFERENCE SEARCH |
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| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
|-------------------------|---------------------------------------------------------------|------------|----------|
| | General Interference and Search of Claims (USPAD, USPGPUB) | 09/15/2015 | CDF |

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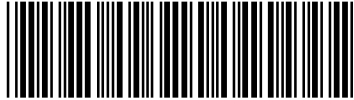
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CONFIRMATION NO. 9070

| SERIAL NUMBER | FILING or 371(c) DATE RULE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------|----------------------------|-------------------------|-------------------------------|
| 13/975,251 | 08/23/2013 | 375 | 2496 | 022096.0037C2 | | |
| APPLICANTS | | | | | | |
| Electronics and Telecommunications Research Institute, Daejeon, KOREA, REPUBLIC OF; Kwangwoon University Research Institute for Industry Cooperation, Seoul, KOREA, REPUBLIC OF; Industry-Academia Cooperation Group of Sejong University, Seoul, KOREA, REPUBLIC OF; | | | | | | |
| INVENTORS | | | | | | |
| Se-Yoon Jeong, Daejeon, KOREA, REPUBLIC OF; Hae-Chul Choi, Daejeon, KOREA, REPUBLIC OF; Jeong-II Seo, Daejeon, KOREA, REPUBLIC OF; Seung-Kwon Beack, Seoul, KOREA, REPUBLIC OF; In-Seon Jang, Gunpo-si, KOREA, REPUBLIC OF; Jae-Gon Kim, Daejeon, KOREA, REPUBLIC OF; Kyung-Ae Moon, Daejeon, KOREA, REPUBLIC OF; Dae-Young Jang, Daejeon, KOREA, REPUBLIC OF; Jin-Woo Hong, Daejeon, KOREA, REPUBLIC OF; Jin-Woong Kim, Daejeon, KOREA, REPUBLIC OF; Yung-Lyul Lee, Seoul, KOREA, REPUBLIC OF; Dong-Gyu Sim, Seoul, KOREA, REPUBLIC OF; Seoung-Jun Oh, Seongnam-si, KOREA, REPUBLIC OF; Chang-Beom Ahn, Seoul, KOREA, REPUBLIC OF; Dae-Yeon Kim, Seoul, KOREA, REPUBLIC OF; Dong-Kyun Kim, Seoul, KOREA, REPUBLIC OF; | | | | | | |
| ** CONTINUING DATA ***** | | | | | | |
| This application is a CON of 12/377,617 02/16/2009 PAT 8548060 which is a 371 of PCT/KR07/01433 03/23/2007 | | | | | | |
| ** FOREIGN APPLICATIONS ***** | | | | | | |
| REPUBLIC OF KOREA 10-2006-0077851 08/17/2006 REPUBLIC OF KOREA 10-2007-0008247 01/26/2007 | | | | | | |
| ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 10/28/2013 | | | | | | |
| Foreign Priority claimed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 35 USC 119(a-d) conditions met <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Met after Allowance CDF | STATE OR COUNTRY | SHEETS DRAWINGS | TOTAL CLAIMS | INDEPENDENT CLAIMS |
| Verified and /COURTNEY D FIELDS/ Acknowledged Examiner's Signature | Initials | KOREA, REPUBLIC OF | 6 | 2 | 1 | |
| ADDRESS | | | | | | |
| NSIP LAW P.O. Box 65745 Washington, DC 20035 UNITED STATES | | | | | | |
| TITLE | | | | | | |

| | | |
|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------|
| <i>Index of Claims</i>  | Application/Control No. 13975251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. |
| | Examiner COURTNEY FIELDS | Art Unit 2496 |

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|---|-----------------|---|-------------------|---|---------------------|---|-----------------|
| ✓ | 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 | 01/24/2015 | 05/28/2015 | 09/15/2015 | | | | | |
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2001

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Author

Affiliation

Publication Title

Publisher

Conference Location

Standard Status

 Low complexity H.264/AVC spatial resolution transcoding in the transform domainBacquet, A.-S.; Deknudt, C.; Coriay, P.; Coudoux, F.-X.; Gazelet, M.G.
Electronics, Circuits, and Systems (ICECS), 2010 17th IEEE International
Conference on

Year: 2010

Pages: 491 - 494, DOI: 10.1109/ICECS.2010.5724556

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Petjanski, B.; Kalva, H.

Consumer Electronics, 2006. ICCE '06. 2006 Digest of Technical Papers.
international Conference on

Year: 2006

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P1857/D1+1, July 2012

Year: 2012

Pages: 1 - 190

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Sogaard, J.; Forchhammer, S.; Korhonen, J.

Circuits and Systems for Video Technology, IEEE Transactions on

Year: 2015, Volume: PP, Issue: 99

Pages: 1 - 1, DOI: 10.1109/TCSVT.2015.2397207

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 Fast Mode Decision for Intra Prediction in H.264/AVC Encoder

Byeongdu La; Minyoung Eom; Yoonsik Choe

Image Processing, 2007. ICIP 2007. IEEE International Conference on

Year: 2007, Volume: 5

Pages: V - 321 - V - 324, DOI: 10.1109/ICIP.2007.4379830

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
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Pages: 1 - 178, DOI: 10.1109/IEEESTD.2013.6522104

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Abstract (1639 Kb)

 **Hardware architecture for fast intra mode and direction prediction in real-time MPEG-2 to H.264/AVC transcoder**

Etarabi, T.A.; Ayoubi, R.; Mahmoud, H.; Bayoumi, M.


World of Wireless, Mobile and Multimedia Networks (WoWMoM), 2012 IEEE International Symposium on a

Year: 2012

Pages: 1 - 6, DOI: 10.1109/WoWMoM.2012.6283798

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 **Restricted H.264/AVC video coding for privacy region scrambling**

Lingling Tong; Feng Dai; Yongdong Zhang; Jintao Li

Image Processing (ICIP), 2010 17th IEEE International Conference on


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 **Exploiting the directional features in MPEG-2 for H.264 intra transcoding**

Kaiva, H.; Petljanski, B.

Consumer Electronics, IEEE Transactions on


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 **Robust decoding for reduced error propagation of DC/AC prediction errors**

Ximin Zhang; Vetro, A.; Huifang Sun; Yun-Qing Shi

MPEG-4, 2001 Proceedings of Workshop and Exhibition on

Year: 2001

Pages: 91 - 94, DOI: 10.1109/MPEG.2001.996456

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 **Scalable Video Coding Extension for HEVC**

Jianle Chen; Rapaka, K.; Xiang Li; Seregin, V.; Liwei Guo; Karczewicz, M.;

Auwera, G.V.D.; Sole, J.; Xianglin Wang; Chengjie Tu; Ying Chen; Joshi, R.

Data Compression Conference (DCC), 2013


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Pages: 191 - 200, DOI: 10.1109/DCC.2013.27

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 **Two-Step Coding for High Definition Video Compression**

Wenfai Jiang; Wenyu Liu; Latecki, L.J.; Hui Liang; Changqing Wang; Bing Feng


Data Compression Conference (DCC), 2010
Year: 2010
Pages: 535 - 535, DOI: 10.1109/DCC.2010.54
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 **Statistical Analysis and Derivation of Intra MB Mode Decision Rules for MPEG-2 to H.264/AVC Transcoding**


Xingang Liu; Kook-Yeol Yoo
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 **Effect of quantization on video compression**


Nanda, B.S.; Kaulgud, N.
Industrial Technology, 2002. IEEE ICIT '02. 2002 IEEE International Conference on
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 **Improved h.264 intra coding based on bi-directional intra prediction, directional transform, and adaptive coefficient scanning**


Yan Ye; Karczewicz, M.
Image Processing, 2008. ICIP 2008. 15th IEEE International Conference on
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 **A Fast Intra MB Mode Decision Method for the MPEG-2 to H.264 Transcoder**


Xingang Liu; Kook-Yeol Yoo
Intelligent Pervasive Computing, 2007. IPC. The 2007 International Conference on
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Pages: 19 - 22, DOI: 10.1109/IPC.2007.47
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 **Distributed video coding using wavelet**


Xun Guo; Yan Lu; Feng Wu; Wen Gao
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Year: 2006
Pages: 4 pp. - 5430, DOI: 10.1109/ISCAS.2006.1693861
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 **A fast mode decision algorithm of 4x4 block intra prediction for H.264/AVC**


Yun Cheng; Min Wu
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 **Lossless video coding using wavelet packet and subband domain motion estimation**


Oguri, T.; Indou, Y.; Ikehara, M.
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 **Fast Intra mode selection algorithm for MPEG-2-to-AVS transcoding**

Han, Z.; Zhang, X.C.; Hu, R.M.; Zhu, L.; Liu, Q.
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 Pages: 1 - 4
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 **H.264 Intra Frame Coding and JPEG 2000-based Predictive Multiple Description Image Coding**


Jing Wang; Jie Liang
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 Year: 2007
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
 **Wyner-Ziv-Based Multiview Video Coding**

Xun Guo; Yan Lu; Feng Wu; Debin Zhao; Wen Gao
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 **4K Real Time HEVC Decoder on FPGA**
 Abeydeera, M.; Karunaratne, M.; Karunaratne, G.; De Silva, K.; Pasqual, A
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 Pages: 1 - 1, DOI: 10.1109/TCSVT.2015.2469113
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Abstract (14847 Kb)

 **H.264/AVC compressed domain data hiding algorithm based on in-loop compensation**
 Jian Tang; Jianfeng Zheng; Li Guo
 Image and Signal Processing (CISP), 2011 4th International Congress on
 Year: 2011, Volume: 1
 Pages: 371 - 375, DOI: 10.1109/CISP.2011.6099964
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Abstract (698 Kb)

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Digital image coding using random scanning

T Savatier, A Delpuch - US Patent 5,136,371, 1992 - Google Patents

... motion compensation vectors obtained by using source images are easier to **encode** efficiently, because of ... The Huffman code for **encoding** the runs of zeros with a maximum efficiency ... random address information from address generator 10 to generate the **encoded** video data ...

Cited by 131 Related articles All 2 versions Cite Save

Adaptive DCT/DPCM video signal coding method

LY Hui - US Patent 5,260,782, 1993 - Google Patents

... 1. An input frame to the video signal **encoder** is first digitized and partitioned into ... step controlled by the rate-controller 11, zig-zag **scanning** (run-length **encoding**) of the ... by an inverse zig-zag **scanner** 21, which demultiplexes and **decodes** the variable length **encoded** run-length ...

Cited by 119 Related articles All 2 versions Cite Save

Digital watermarking of raw and compressed video

FH Hartung, B Girod - Advanced ... , 1996 - proceedings.spiedigitallibrary.org

... domain of MPEG-2 coded video (that is, without **decoding** and full re-**encoding**) and can ... It is not feasible to **decode** and re-**encode** the video for the purpose of watermarking it ... order to avoid drift, which otherwise might occur because we partly alter a previously **encoded** bitstream ...

Cited by 288 Related articles All 10 versions Cite Save

H. 263+: Video coding at low bit rates

G Cote, B Erol, M Gallant ... - Circuits and Systems for ... , 1998 - ieeexplore.ieee.org

... frames—the difference between original frames and motion-compensated predicted frames—need be **encoded**. ... to the reference picture, an **encoder** can also choose not to **encode** it, and ... an H.263+ framework, new reversible VLC's (RVLC's) are used for **encoding** the difference ...

Cited by 533 Related articles All 16 versions Cite Save

Modeling DCT coefficients for fast video encoding

I Pao, MT Sun - Circuits and Systems for Video Technology, ... , 1999 - ieeexplore.ieee.org

... Page 8. PAO AND SUN: MODELING DCT COEFFICIENTS FOR FAST VIDEO **ENCODING** 615 (a) (b) Fig. ... Also, in the zig-zag **scanning** and VLC stage, the **encoder** only needs to **scan** and **encode** to the last of the lower 4 4 DCT coefficients, since the other 48 coefficients ...

Cited by 196 Related articles All 7 versions Cite Save

A fast MPEG video encryption algorithm

C Shi, B Bhargava - Proceedings of the sixth ACM international ... , 1998 - dl.acm.org

... During MPEG coding (**decoding**), our **encoder** [**decoder**] uses the secret key instead of the standard Huffman codeword list. ... A . *@ (a) **encoding** (b) decodinS ... We modified the Berkeley mpeg-pkg[14] and mpeg-**encode**[9] programs and used them to test VEA algo- rithm. ...

Cited by 289 Related articles All 2 versions Cite Save

Digital video compression system utilizing vector adaptive transform

FJ Chu, CL Yeh - US Patent 5,367,629, 1994 - Google Patents

... the best use of the bandwidth available so that satisfactory video images may be **encoded** and transmitted ... to video changes over time, the number of bits that is allocated to **encode** a frame ... as the prediction block will result in a smaller mean square error for **encoding** the new ...

Cited by 208 Related articles All 2 versions Cite Save

A survey of multimedia compression techniques and standards. Part I: JPEG standard

B Furht - Real-Time Imaging, 1995 - Elsevier

... SIZE is the number of bits used to **encode** AMPLITUDE ... JPEG **Decoder** In the JPEG sequential **decoding**, all the steps from the **encoding** process are inverted and implemented ... the total number of bits in the compressed image divided by the number of **pixels**: **Encoded** number of ...

Cited by 81 Related articles All 6 versions Cite Save

H. 264 and MPEG-4 video compression: video coding for next-generation multimedia

IE Richardson - 2004 - books.google.com

... of video coding if they think from the perspective of the **encoder**, and nearly ... despite completely leaving out key information such as how to **encode** video using ... compensation Context-based Adaptive Binary Arithmetic Coding Context-based Arithmetic **Encoding** Context Adaptive ...

Cited by 3059 Related articles All 10 versions Cite Save More

MPEG-2 video compression

PN Tudor - Electronics & communication engineering journal, 1995 - IET

... MPEG-2 decoders will also **decode** MPEG-1 bitstreams. ... noise introduced by the coder is not reversible in the **decoder**, making the coding and **decoding** process 'lossy ... the source pictures because the bit-rate reduction process introduces small distortions into the **decoded** picture ...

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EAST Search History (Prior Art)

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| S198 | 10 | "entropy decoding" same "video" and "pixel values" | FPRS; EPO; JPO; DERWENT | OR | ON | 2015/09/16 16:31 |
| S197 | 9 | "entropy decoding" same "video" same "pixel values" | FPRS; EPO; JPO; DERWENT | OR | ON | 2015/09/16 16:30 |
| S196 | 373 | "entropy decoding" same "video" | FPRS; EPO; JPO; DERWENT | OR | ON | 2015/09/16 16:30 |
| S195 | 61229 | (entropy decoding) and (video) | FPRS; EPO; JPO; DERWENT | OR | ON | 2015/09/16 16:29 |
| S194 | 12 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra prediction" and "vertical intra prediction" and "coefficients" and "encoded video" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/05/28 12:34 |
| S193 | 24 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra prediction" and "vertical intra prediction" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/05/28 12:34 |
| S192 | 26 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra prediction" and "vertical intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/05/28 12:34 |
| S191 | 29 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra" and "vertical intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/05/28 12:33 |
| S190 | 0 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra" and "vertical intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/05/28 12:33 |

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| S189 | 30 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/05/28 12:33 |
| S188 | 1161 | "entropy decoding" and "scanning" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/05/28 12:33 |
| S187 | 2 | "7995654".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/01/24 23:28 |
| S186 | 26 | "2006002466" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/01/24 23:12 |
| S185 | 53 | "entropy decoding" and "encoded video" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" and "pixel values" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| S184 | 72 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" and "pixel values" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| S183 | 73 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| S182 | 78 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| S181 | 80 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | ON | 2015/01/24 22:38 |

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| | | | DERWENT; IBM_TDB | | | |
| S180 | 4305 | "entropy decoding" and "video" and "encoding" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:38 |
| S179 | 4 | (H04N19/00218 and H04N19/159 and H04N19/136 and H04N19/61 and H04N19/129 and H04N19/103 and H04N19/11 and H04N19/176).CPC. and "entropy decoding" and "video" and "encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:37 |
| S178 | 24 | (H04N19/00218 and H04N19/159 and H04N19/136 and H04N19/61 and H04N19/129 and H04N19/103 and H04N19/11 and H04N19/176).CPC. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:33 |
| S170 | 105 | 375/240.2.ccls. and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:08 |
| S169 | 291 | 375/240.2.ccls. and "entropy" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:08 |
| S168 | 1000 | 375/240.2.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:07 |
| S167 | 0 | 375/240.20.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:07 |
| S166 | 0 | 375/240.200.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:06 |
| S165 | 0 | 375/240.2.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; | OR | OFF | 2013/05/13 14:06 |

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| | | | FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S164 | 0 | 375/240.200.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:06 |
| S163 | 4 | "20070274385" "20050074062" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 13:09 |
| S162 | 0 | 382/247.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:39 |
| S161 | 0 | 375/240.03.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:39 |
| S160 | 2 | 375/240.16.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S159 | 0 | 375/240.27.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S158 | 3 | 375/240.24.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S157 | 6 | 375/240.12.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S156 | 0 | 375/240.20.ccls. and "entropy | US-PGPUB; | OR | OFF | 2013/05/13 |

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| | | encoding" same "optimal" same "intra prediction" same "coefficients" | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 12:38 |
| S146 | 24 | encoder and decoder and "intra prediction" and "entropy" | EPO; JPO; DERWENT | OR | OFF | 2013/05/13 12:21 |
| S145 | 152 | encoder and decoder and "intra prediction" | EPO; JPO; DERWENT | OR | OFF | 2013/05/13 12:18 |
| S144 | 1 | S139 and S143 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:17 |
| S143 | 1 | "video recovery" and "scanning mode" and "decoded" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:17 |
| S142 | 0 | "video recovery" near5 "scanning mode" near5 "decoded" near5 "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:16 |
| S141 | 1 | "video recovery" near5 "scanning mode" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:15 |
| S140 | 3134865 | "video recovery" near5 scanning mode | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:14 |
| S139 | 3 | "entropy encoding" same "optimal" same "intra prediction" same "coefficients" same scan\$4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:11 |
| S138 | 8 | "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:09 |
| S137 | 13 | "entropy encoding" same "optimal" | US-PGPUB; | OR | OFF | 2013/05/13 |

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| | | same "intra prediction" | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 12:07 |
| S136 | 4 | "entropy encoding" near5 "zigzag" same "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:41 |
| S135 | 29 | "entropy encoding" near5 "zigzag" and "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:41 |
| S134 | 0 | "entropy encoding" near5 "zigzag" near5 "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:41 |
| S133 | 41 | "entropy encoding" near5 "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S132 | 75 | "entropy encoding" with "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S131 | 152 | "entropy encoding" same "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S130 | 5 | "mode selection" with "intra prediction" with "DCT" with "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:14 |
| S129 | 138 | "mode selection" and "intra prediction" and "DCT" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | OFF | 2012/11/07 19:14 |

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| | | | IBM_TDB | | | |
| S128 | 1 | S97 and "plane" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:07 |
| S127 | 1 | S97 and "direct current" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:52 |
| S126 | 6 | S97 and "pixels" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S125 | 8 | S97 and "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S124 | 0 | S97 and "pixel prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S123 | 3 | "20050157797" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:41 |
| S122 | 1 | "video recovery" same "entropy decoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:37 |
| S121 | 1 | "video recovery" with "entropy decoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:37 |
| S120 | 4 | "video recovery" and "decoding" and "entropy" | US-PGPUB; USPAT; USOCR; FPRS; | OR | OFF | 2012/11/07 18:33 |

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| | | | EPO; JPO; DERWENT; IBM_TDB | | | |
| S119 | 0 | S97 and "recover" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:33 |
| S118 | 0 | S97 and "recovering" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:33 |
| S117 | 0 | S97 and "video recovery" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:32 |
| S116 | 4 | S97 and (multipl\$7) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:31 |
| S115 | 1 | S97 and "dispersion" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:30 |
| S114 | 3 | S97 and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:14 |
| S113 | 0 | S97 and "zig zag" and "intra prediction" and "video" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S112 | 0 | S97 and "zig zag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S111 | 1 | S97 and "zigzag" and "intra prediction" and "video" and "entropy | US-PGPUB; USPAT; | OR | OFF | 2012/11/07 18:13 |

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| | | encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S110 | 0 | S97 and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" and (multipl\$7) and "dispersion" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S109 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" and (multipl\$7) and "dispersion" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S108 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" and (multipl\$7) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:12 |
| S107 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S106 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S105 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S104 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | OFF | 2012/11/07 18:11 |

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| | | "DCT" and "quantization" and "coefficients" | DERWENT; IBM_TDB | | | |
| S103 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S102 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S101 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S100 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S99 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S98 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zig zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S97 | 16 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:59 |
| S96 | 4 | encod\$3 with "9 prediction modes" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:58 |
| S95 | 0 | encod\$3 with "intra prediction" with "DCT" with "quantization" with "9 prediction modes" | US-PGPUB; USPAT; USOCR; | OR | OFF | 2012/11/07 17:58 |

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| | | | FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S94 | 0 | encod\$3 with "intra prediction" with "DCT" with "quantization" with "9 prediction modes" with (entropy encod\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:57 |
| S93 | 7 | encod\$3 with "intra prediction" with "DCT" with "quantization" with scan\$4 with (entropy encod\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S92 | 7 | encod\$3 with "intra prediction" with "DCT" with "quantization" with scan\$4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S91 | 50 | encod\$3 with "intra prediction" with "DCT" with "quantization" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S90 | 112 | encod\$3 with "intra prediction" with "DCT" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S89 | 1984 | encod\$3 with "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S88 | 2 | "8199819".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:33 |
| S87 | 5 | "20030081850" "4821119".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/06 15:18 |
| S86 | 23 | "vertical scanning" and "entropy | US-PGPUB; | OR | OFF | 2012/08/16 |

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| | | encoding" and "horizontal" and "zigzag" | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 16:51 |
| S85 | 23 | "vertical scanning" and "entropy encoding" and "horizontal" and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S84 | 44 | "vertical scanning" and "entropy encoding" and "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S83 | 46 | "vertical scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S82 | 0 | "vertical scanning" near "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S81 | 1 | "vertical scanning" near5 "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:50 |
| S80 | 9 | "vertical scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:50 |
| S79 | 22 | "coefficient scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:47 |
| S78 | 77 | "coefficient scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | OFF | 2012/08/16 16:47 |

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| | | | IBM_TDB | | | |
| S77 | 159 | "horizontal" and "vertical" and "entropy encoding" and "zig-zag" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:46 |
| S76 | 10 | "horizontal scan" and "vertical scan" and "entropy encoding" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:46 |
| S75 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:46 |
| S74 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:45 |
| S73 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" and "residual" and "high" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:44 |
| S72 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" and "residual" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:44 |
| S71 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S70 | 0 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "residual signal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S69 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; | OR | OFF | 2012/08/16 16:43 |

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| | | | EPO; JPO; DERWENT; IBM_TDB | | | |
| S68 | 33 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S67 | 0 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intraframe prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S66 | 39 | "horizontal scanning" and "vertical scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S65 | 8 | "horizontal scanning" same "vertical scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:41 |
| S64 | 8607 | "horizontal scanning" same "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:41 |
| S63 | 10754 | "horizontal scanning" and "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:40 |
| S62 | 14 | "horizontal directional" and "vertical" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:43 |
| S61 | 1 | "horizontal-directional" and "vertical" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:43 |
| S60 | 1 | "horizontal-directional" same "vertical" and "intra prediction" | US-PGPUB; USPAT; | OR | OFF | 2012/08/15 16:43 |

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| | | | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S59 | 1 | "horizontal-directional" same "vertical intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:42 |
| S58 | 1 | "horizontal-directional scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:42 |
| S57 | 9 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "vertical" and "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:36 |
| S56 | 0 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "selected mode" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:34 |
| S55 | 2 | "difference values" same "DCT" same "quantization" same "intra" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:32 |
| S54 | 2 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:31 |
| S53 | 15 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S52 | 17 | "difference values" same "DCT" same "quantization" same "intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |

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| S51 | 1 | "difference values" same "DCT" same "quantization" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S50 | 0 | "difference values" same "DCT" same "quantization" same "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S49 | 51 | "difference values" same "DCT" same "quantization" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:29 |
| S48 | 5 | "scanning mode" and "difference values" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:24 |
| S47 | 0 | "scanning mode" same "difference values" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:24 |
| S46 | 1 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.27.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S45 | 5 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.12.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S44 | 1 | "DCT coefficient" near5 "scanning" near5 "pixel" and 375/240.24.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S43 | 5 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.12 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | OFF | 2012/03/18 13:45 |

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| | | | DERWENT; IBM_TDB | | | |
| S42 | 5 | "DCT coefficient" near5 "scanning" near5 "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:40 |
| S41 | 52 | "DCT coefficient" same "scanning" same "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:40 |
| S40 | 12 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S39 | 14 | "DCT" same "scan" same "intra prediction" same "video" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S38 | 19 | "DCT" same "scan" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S37 | 0 | "DCT scan" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S36 | 0 | "discrete cosine transform scanning" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S35 | 0 | "DCT scanning" same "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S34 | 0 | "DCT scanning" same "intra- prediction" | US-PGPUB; USPAT; USOCR; | OR | OFF | 2012/03/18 13:34 |

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| | | | FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S33 | 2 | "DCT scanning" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S32 | 0 | "DCT scanning" same "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S31 | 4 | (discrete cosine transform or (DCT)) near (scan\$4) same "intra-prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S30 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intra-prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S29 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S28 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S27 | 1173383 | (discrete cosine transform) or (DCT) near (scan\$4) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S26 | 2299 | (discrete cosine transform or (DCT)) near (scan\$4) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:31 |
| S25 | 11577 | (discrete cosine transform or (DCT)) | US-PGPUB; | OR | OFF | 2012/03/18 |

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| | | near5 (scan\$4) | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 13:31 |
| S24 | 23869 | (discrete cosine transform or (DCT)) same "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:31 |
| S23 | 900 | 375/240.2.ccls. and (discrete cosine transform or (DCT)) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:30 |
| S22 | 0 | 375/240.200.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:30 |
| S21 | 921 | 375/240.2.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:30 |
| S20 | 0 | 375/240.20.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S19 | 0 | S17 and S18 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S18 | 7919 | electronics and telecommunications.asn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S17 | 2 | S1 and S2 and S3 and S4 and S5 and S6 and S7 and S8 and S9 and S10 and S11 and S12 and S13 and S14 and S15 and S16 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | OFF | 2012/03/18 13:29 |

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| | | | IBM_TDB | | | |
| S16 | 79 | dong-kyun.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S15 | 55 | dae-yeon.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S14 | 18 | chang-beom.in. and ahn.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S13 | 19 | seoung-jun.in. and oh.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S12 | 32 | dong-gyu.in. and sim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S11 | 141 | yung-lyul.in. and lee.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S10 | 204 | jin-woong.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S9 | 580 | jin-woo.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S8 | 52 | dae-young.in. and jang.in. | US-PGPUB; USPAT; USOCR; FPRS; | OR | OFF | 2012/03/18 13:26 |

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| | | | EPO; JPO; DERWENT; IBM_TDB | | | |
| S7 | 15 | kyung-ae.in. and moon.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S6 | 115 | jae-gon.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S5 | 21 | in-seon.in. and jang.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S4 | 23 | seung-kwon.in. and beack.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S3 | 64 | jeong-il.in. and seo.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S2 | 33 | hae-chul.in. and choi.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S1 | 27 | se-yoon.in. and jeong.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |

EAST Search History (Interference)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|-------|------|-------------------------------------------------------------------------------------------------------|-------------------|------------------|---------|---------------------|
| L7 | 0 | ((selecting) near2 (horizontal) near2 (scanning mode) near2 (vertical) near2 (intra prediction)).CLM. | US-PGPUB; UPAD | OR | ON | 2015/09/16 16:50 |

| | | | | | | |
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| L6 | 2 | ((selecting) near2 (scanning mode) near2 (intra prediction) near2 (difference values) near2 (predicted pixel values)).CLM. | US-PGPUB; UPAD | OR | ON | 2015/09/16 16:49 |
| L5 | 2 | ((selecting) near2 (scanning mode) near2 (intra prediction) near2 (difference values) near2 (pixel values)).CLM. | US-PGPUB; UPAD | OR | ON | 2015/09/16 16:48 |
| L4 | 5 | ((selecting) near2 (scanning mode) near2 (intra prediction) near2 (difference values)).CLM. | US-PGPUB; UPAD | OR | ON | 2015/09/16 16:48 |
| L3 | 2 | ((selecting) near2 (scanning mode) near2 (transform) near2 (coefficients)).CLM. | US-PGPUB; UPAD | OR | ON | 2015/09/16 16:46 |
| L2 | 2 | ((entropy decoding) near2 (encoded video) near2 (information) near2 (transform) near2 (coefficients)).CLM. | US-PGPUB; UPAD | OR | ON | 2015/09/16 16:45 |
| L1 | 754 | ((entropy decoding) near2 (encoded video) near2 (information)).CLM. | US-PGPUB; UPAD | OR | ON | 2015/09/16 16:45 |
| S177 | 0 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients AND entropy AND encoding AND scanning AND mode AND decoding AND video AND recovery AND encoded AND video AND quantization AND vertical AND scanning AND horizontal AND scanning.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:43 |
| S176 | 1 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients AND entropy AND encoding AND scanning AND mode AND decoding AND video AND recovery.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:40 |
| S175 | 66 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients AND entropy AND encoding AND scanning AND mode AND decoding.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:39 |
| S174 | 40 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients AND entropy AND encoding AND scanning AND mode.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:38 |
| S173 | 109 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:38 |
| S172 | 67 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:37 |
| S171 | 572 | encoding AND mode AND selection AND optimal AND intra AND prediction.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:37 |

9/ 16/ 2015 4:53:06 PM

**C:\Users\cfields\Documents\EAST\Workspaces\encoding and decoding image using
adaptive DCT coefficient scanning continuation allowance.wsp**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Art Unit: 2496

Application No. 13/975,251

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Courtney D. FIELDS

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

AMENDMENT
37 C.F.R. §1.116

Mail Stop: AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Final Office Action mailed June 5, 2015, and having a period for response set to expire, on September 8, 2015, September 5, 2015 being a Saturday and September 7, 2015 being a Federal holiday.

The following remarks are respectfully submitted. Reconsideration of the claims is respectfully requested.

Listing of the claims are reflected in the listing of the claims that begins on page 2 of this Paper.

Remarks begin on page 3 of this Paper.

OK TO ENTER: /C.F./

09/16/2015



SIGN IN SIGN UP

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Searching for: (DCT and coefficient, and decoding, and entropy, and video, and pixels) ([start a new search](#))Found **560** within *The ACM Guide to Computing Literature* (Bibliographic citations from major publishers in computing)Limit your search to [Publications from ACM and Affiliated Organizations](#) (Full-Text collection: **449,340** items)

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Sort by [relevance](#) in [expanded form](#)Result page: [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [next](#) [>](#)1 [FGS-MR: MPEG4 fine grained scalable multi-resolution layered video encoding](#)[Siddhartha Chattopadhyay, Suchendra M. Bhandarkar, Kang Li](#)

May 2006

NOSSDAV '06: Proceedings of the 2006 international workshop on Network and operating systems support for digital audio and video**Publisher:** ACM [Request Permissions](#)Full text available: [PDF](#) (167.59 KB)**Bibliometrics:** Downloads (6 Weeks): 2, Downloads (12 Months): 7, Downloads (Overall): 115, Citation Count: 3

The MPEG-4 Fine Grained Scalability (FGS) profile aims at scalable video encoding, in order to ensure efficient video streaming in networks with fluctuating bandwidth. In order to allow very low bit rate streaming, the Base Layer of an FGS video is encoded ...

Keywords: MPEG-4 FGS, multi-resolution, scalable video2 [SMART: an efficient, scalable, and robust streaming video system](#)[Feng Wu, Honghui Sun, Guobin Shen, Shipeng Li, Ya-Qin Zhang, Bruce Lin, Ming-Chieh Lee](#)

January 2004

EURASIP Journal on Applied Signal Processing, Volume 2004**Publisher:** Hindawi Publishing Corp.Full text available: [PDF](#) (1.04 MB)**Bibliometrics:** Downloads (6 Weeks): 2, Downloads (12 Months): 4, Downloads (Overall): 77, Citation Count: 3

SMART, the acronym of scalable media adaptation and robust transport, is a suite of compression and transmission technologies for efficient, scalable, adaptive, and robust video streaming over the best-effort Internet. It consists of two indispensable ...

Keywords: bandwidth estimation, error resilience, fine granularity scalability, unequal error protection, video streaming, video transmission3 [Distributed video coding](#)[Catarina Brites, Fernando Pereira](#)

March 2015

Image Communication, Volume 32 Issue C**Publisher:** Elsevier Science Inc.**Bibliometrics:** Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 0

In the distributed video coding (DVC) context, predictive Intra coding plays an important role not only as one of the most meaningful (low encoding complexity) benchmarks but also as the adopted coding mode for the so-called key frames used in the most ...

Keywords: Benchmarking, Compression efficiency, Computational complexity analysis, Distributed video coding, HEVC standard, Wyner-Ziv video coding4 [Statistical tools for digital forensics](#)[Alin C. Popescu, Hany Farid](#)

May 2004

IH'04: Proceedings of the 6th international conference on Information Hiding**Publisher:** Springer-VerlagFull text available: [Publisher Site](#)**Bibliometrics:** Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 35

A digitally altered photograph, often leaving no visual clues of having been tampered with, can be indistinguishable from an authentic photograph. As a result, photographs no longer hold the unique stature as a definitive recording of events. We describe ...

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MPEG-2 Coded Video Traces Transmitted Over a Satellite Link: Scalable and Non-Scalable Solutions in Rain Fading Conditions

Nedo Celandroni, Erika Ferro, Francesco Potorti, Antonio Chimienti, Maurizio Lucenteforte, Roruaiko Picca

January 2000

Multimedia Tools and Applications, Volume 10 Issue 1

Publisher: Kluwer Academic Publishers

Full text available:  [Publisher Site](#)

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 1

The literature is poor in the analyses of the effects produced by corrupted bits in compressed video bitstreams. This paper presents the results of a transmission experiment of MPEG-2 coded video data over a satellite link affected by noise, in order ...

Keywords: MPEG video, fading, quality factor, satellite, scalability

6 A study of 3D Network-on-Chip design for data parallel H.264 coding

Thomas Canhao Xu, Alexander Wei Yin, Pasi Lilieberg, Hannu Tenhunen

October 2011

Microprocessors & Microsystems, Volume 35 Issue 7

Publisher: Elsevier Science Publishers B. V.

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count:

In this paper, we implement, analyze and compare different Network-on-Chip (NoC) architectures aiming at higher efficiencies for MPEG-4/H.264 coding. Two-dimensional (2D) and three-dimensional (3D) NoCs based on Non-Uniform Cache Access (NUCA) are analyzed. ...

Keywords: 3D IC design, Coding, Data parallel, H.264, Network-on-Chip

7 New method of image retrieval using fractal code on the compression domain

Jiangbin Zhang, Yi Wang, Lifeng Xi, Kun Gao, Jianyun Hu

December 2008

WSEAS TRANSACTIONS on SYSTEMS, Volume 7 Issue 12

Publisher: World Scientific and Engineering Academy and Society (WSEAS)

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count:

Image retrieval and indexing techniques are important for efficient management of visual database. Many techniques are generally developed based on the associated compression domain. In the fractal domain, a fractal code is a contractive affine mapping ...

Keywords: compression domain, fractal code, image retrieval, iterated function system


8 MPEG-4 Video and Image Coding on Digital Signal Processors

Madhukar Budagavi, Jennifer Webb, Minhua Zhou, He Liang, Raj Talluri

October 1999

Journal of VLSI Signal Processing Systems, Volume 23 Issue 1

Publisher: Kluwer Academic Publishers

Full text available:  [Publisher Site](#)

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 2

The emerging MPEG-4 standard encompasses a wide variety of applications, many of which are suitable for implementation on a Digital Signal Processor (DSP). In particular, consumer products with embedded multimedia capability, such as set-top boxes ...


9 image tampering detection using methods based on JPEG compression artifacts: a real-life experiment

Babak Mahdian, Stanislav Saic



October 2011 **ISABEL '11: Proceedings of the 4th International Symposium on Applied Sciences in Biomedical and Communication Technologies**

Publisher: ACM  [Request Permissions](#)

Full text available:  PDF (631.16 KB)

Bibliometrics: Downloads (6 Weeks): 6, Downloads (12 Months): 27, Downloads (Overall): 168, Citation Count:

In this paper we analyze the synergy between forensic image head data consistency analysis and detection of double JPEG compression artifacts. We show that image head consistency testing is an effective method for detecting digital images that have ...

Keywords: EXIF analysis, JPEG forensics, digital forensics, double JPEG, image retrieval, tampering detection

10 Cache modeling and optimization for portable devices running MPEG-4 video decoder

Abu Asaduzzaman, Imad Mahgoub

January 2006

Multimedia Tools and Applications, Volume 28 Issue 1

Publisher: Kluwer Academic Publishers

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 2

There are increasing demands on portable communication devices to run multimedia applications. ISO (an International Organization for Standardization) standard MPEG-4 is an important and demanding multimedia application. To satisfy the growing consumer ...

Keywords: Cache modeling, Cache optimization, MPEG-4, Portable devices, Video decoder

11 [Context based medical image compression for ultrasound images with contextual set partitioning in hierarchical trees algorithm](#)

[M. A. Ansari, R. S. Anand](#)

July 2009

Advances in Engineering Software, Volume 40 Issue 7

Publisher: Elsevier Science Ltd.

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 2

The basic goal of medical image compression is to reduce the bit rate and enhance the compression efficiency for the transmission and storage of the medical imagery while maintaining an acceptable diagnostic image quality. Because of the storage, transmission ...

Keywords: CR (compression ratio), CoC (correlation coefficient), EBCOT (embedded block coding with optimized truncation), JPEG2K (JPEG 2000), MSE (mean square error), PSNR (peak signal to noise ratio)

12 [Error-resilient scalable compression based on distributed video coding](#)

[Mourad Ouaret, Frédéric Dufaux, Touradj Ebrahimi](#)

July 2009

Image Communication, Volume 24 Issue 6

Publisher: Elsevier Science Inc.

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 1

Distributed Video Coding (DVC) is a new paradigm for video compression based on the information theoretical results of Slepian-Wolf (SW) and Wyner-Ziv (WZ). In this work, a performance analysis of image and video coding schemes based on DVC is presented, ...

Keywords: Codec-independent scalability, Distributed video coding, Error-resilience, Scalable coding

13 [A robust without intra-frame distortion drift data hiding algorithm based on H.264/AVC](#)

[Yunxia Liu, Zhitang Li, Xiaojing Ma, Jian Liu](#)

September 2014

Multimedia Tools and Applications, Volume 72 Issue 1

Publisher: Kluwer Academic Publishers

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 0

This paper presents an improved robust data hiding algorithm based on BCH syndrome code (BCH code) technique and without distortion drift technique. The BCH code technique, which can correct the error bits caused by network transmission, packet loss, ...

Keywords: BCH code, Data hiding, H.264/advanced video coding (AVC), Intra-frame distortion drift

14 [An Efficient Picture-Rate Up-Converter](#)

[Aleksandar Berić, Gerard De Haan, Ramanathan Sethuraman, Jef Van Meerbergen](#)

August 2005

Journal of VLSI Signal Processing Systems, Volume 41 Issue 1

Publisher: Kluwer Academic Publishers

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 1

The importance of low-power design is not just critical to portable devices but also to line powered equipment like TV products. Power dissipation strongly influences the price of the chip, since the packaging and cooling costs increase dramatically ...

Keywords: low-power, motion compensation, motion estimation, picture-rate up-converter

15 [Stream weight estimation for multistream audio-visual speech recognition in a multispeaker environment](#)

[Xu Shao, Jon Barker](#)

April 2008

Speech Communication, Volume 50 Issue 4

Publisher: Elsevier Science Publishers B. V.

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 4

The paper considers the problem of audio-visual speech recognition in a simultaneous (target/masker) speaker environment. The paper follows a conventional multistream approach and examines the specific problem of estimating reliable time-varying audio ...

Keywords: Artificial neural networks, Audio-visual speech recognition, Likelihood, Multispeaker, Multistream

- 16 [Parallel blind digital image watermarking in spatial and frequency domains](#)
Piotr Lenarczyk, Zbigniew Pietrowski

November 2013 **Telecommunications Systems**, Volume 54 Issue 3

Publisher: Kluwer Academic Publishers

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 0

The protection of copyrights of digital images authors is one of the most important tasks set before watermarking. What is especially important is to ensure the high robustness of a watermarked images against attacks, preventing the reading of additional ...

Keywords: 2D DCT, 2D cepstrum, Hiding information, Watermarking

- 17 [Fast Inter Mode Decision Algorithm Based on Mode Mapping and Decision Tree for P Frames in MPEG-2 to H.264/AVC Transcoding](#)

Ping Wang, Xiaodan Zhang, Hua Huang

April 2015 **Journal of Signal Processing Systems**, Volume 79 Issue 1

Publisher: Kluwer Academic Publishers

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count: 0


There is an inevitable requirement of transcoding from MPEG-2 to H.264/AVC in many video applications. Due to the use of variable block sizes and rate-distortion optimization techniques in H.264, there is extremely high computational complexity in the ...

Keywords: Decision tree, H.264/AVC, MPEG-2, Mode decision, Mode mapping, Transcoding

- 18 [Content-aware scalability-type selection for rate adaptation of scalable video](#)
Emrah Akyol, A. Murat Tekalp, M. Reha Civanlar

January 2007 **EURASIP Journal on Applied Signal Processing**, Volume 2007 Issue 1

Publisher: Hindawi Publishing Corp.

Full text available:  PDF (3.71 MB)

Bibliometrics: Downloads (6 Weeks): 1, Downloads (12 Months): 10, Downloads (Overall): 160, Citation Count: 6

Scalable video coders provide different scaling options, such as temporal, spatial, and SNR scalabilities, where rate reduction by discarding enhancement layers of different scalability-type results in different kinds and/or levels of visual distortion ...

- 19 [Novel wavelet-based GIM data hiding technique for tamper detection and correction of digital images](#)
Amit Phadikar, Santi P. Maiti, Mrinal Mandal

April 2012 **Journal of Visual Communication and Image Representation**, Volume 23 Issue 3

Publisher: Academic Press, Inc.

Bibliometrics: Downloads (6 Weeks): n/a, Downloads (12 Months): n/a, Downloads (Overall): n/a, Citation Count:


This paper proposes a tamper detection and correction technique using semi-fragile data hiding that aims to achieve high perceptual quality of images at the user-end even after malicious modifications. A binary signature and an image digest are embedded ...

Keywords: Data hiding, Image half-toning, Integer wavelets, Quantization index modulation, Semi-fragile watermarking, Tamper correction, Tamper detection, Wavelets

- 20 [A SystemC-based design methodology for digital signal processing systems](#)
Christian Haubelt, Joachim Falk, Joachim Keinert, Thomas Schlichter, Martin Streubühr, Andreas Devhle, Andreas Hadert, Jürgen Teich

January 2007 **EURASIP Journal on Embedded Systems**, Volume 2007 Issue 1





Publisher: Hindawi Publishing Corp.

Full text available:  PDF (1.30 MB)

Bibliometrics: Downloads (6 Weeks): 3, Downloads (12 Months): 25, Downloads (Overall): 326, Citation Count: 22

Digital signal processing algorithms are of big importance in many embedded systems. Due to complexity reasons and due to the restrictions imposed on the implementations, new design methodologies are needed. In this paper, we present a System C-based ...

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Art Unit: 2496

Application No. 13/975,251

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Courtney D. FIELDS

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

AMENDMENT
37 C.F.R. §1.116

Mail Stop: AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Final Office Action mailed June 5, 2015, and having a period for response set to expire, on September 8, 2015, September 5, 2015 being a Saturday and September 7, 2015 being a Federal holiday.

The following remarks are respectfully submitted. Reconsideration of the claims is respectfully requested.

Listing of the claims are reflected in the listing of the claims that begins on page 2 of this Paper.

Remarks begin on page 3 of this Paper.

IN THE CLAIMS:

This listing of the claims replaces all prior versions and listings of the claims in this application.

The text of all pending claims (including any withdrawn claims) is set forth below. Canceled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~striketrough~~. The status of each claim is listed with one of (Original), (Currently amended), (Canceled), (Withdrawn), (Previously presented), (New), and (Not entered).

1. (Previously presented) A decoding method comprising:
performing entropy decoding of encoded video information to obtain transform coefficients;
selecting a scanning mode for the transform coefficients; and
scanning the transform coefficients based on the selected scanning mode;
wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.

2. (Previously presented) The decoding method of claim 1, wherein the selecting of the scanning mode based on an intra prediction mode comprises:
selecting a horizontal scanning mode in response to the intra prediction mode being a vertical intra prediction mode; and
selecting a vertical scanning mode in response to the intra prediction mode being a horizontal intra prediction mode.

REMARKS

In accordance with the foregoing, no claims have been amended. Claims 1 and 2 are pending, with claim 1 being independent. No new matter is added.

Preliminary Remarks

The Office is thanked for the indication that drawings filed on October 1, 2013 are acceptable and that the Preliminary Amendments filed on October 1, 2013 and August 1, 2014 have been considered by the Examiner.

Applicants also thank the Office for the withdrawal of the rejection of claim 1 as being anticipated by US Patent Application No. 2006/0002466 to Park ("Park") and the rejection of claim 2 as unpatentable over Park in view of US Patent No. 7,995,654 to Boon et al. ("Boon").

Double Patenting Rejection

Claims 1 and 2 have been rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 1 and 2 of U.S. Patent No. 8,548,060, which issued from Application No. 12/377,617, the parent application of this continuation application.

This rejection is believed moot in view of the Terminal Disclaimer filed along with the present Response.

Conclusion

Applicant respectfully submits that a full and complete response has been made to the outstanding Office Action, and, as such, there being no other objections or rejections, this application is in condition for allowance and a notice of the same is earnestly solicited.

In the event this paper is not being timely filed, the Applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees only associated with the processing of this Response and any other documents filed concurrently with this Response may be charged to Counsel's Deposit Account 50-5113.

If the Office has any questions, or believes for any reason that personal communication will expedite prosecution of this application, the Office is hereby invited to telephone the undersigned at the number provided below.

Respectfully submitted,

Dated: September 8, 2015

By: /Jeanne A. Di Grazio/
Jeanne A. Di Grazio
Reg. No. 58,633

North Star Intellectual Property (NSIP) Law
1120 Connecticut Ave., NW
Suite # 304
Washington, DC 20036
(202) 429-0020 (ext. 345)

CYP/JDG/jdg

Attachment: e Terminal Disclaimer and fees paid via eFS web

Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 23420579 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Jeanne Andrea Di Grazio |
| Filer Authorized By: | |
| Attorney Docket Number: | 022096.0037C2 |
| Receipt Date: | 08-SEP-2015 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 10:49:21 |
| Application Type: | Utility under 35 USC 111(a) |

Payment information:

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| Response After Final Action | 1 | 1 | |
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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.

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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.

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|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|

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| Electronic Petition Request | TERMINAL DISCLAIMER TO OBIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT |
| Application Number | 13975251 |
| Filing Date | 23-Aug-2013 |
| First Named Inventor | Se-Yoon Jeong |
| Attorney Docket Number | 022096.0037C2 |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |

- Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action
- This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

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| Industry-Academia Cooperation Group of Sejong University | 100% |
| Electronics and Telecommunications Research Institute | 100% |
| Kwangwoon University Research Institute for Industry Cooperation | 100% |

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I hereby 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 issued thereon.

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Registration Number 58633
- A sole inventor
- A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application
- A joint inventor; all of whom are signing this request

| | |
|-----------|---------------------|
| Signature | /Jeanne A DiGrazio/ |
| Name | Jeanne A DiGrazio |

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Application Number: | 13975251 |
| Filing Date: | 23-Aug-2013 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Filer: | Jeanne Andrea Di Grazio |
| Attorney Docket Number: | 022096.0037C2 |

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

| Description | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
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Patent-Appeals-and-Interference:

Post-Allowance-and-Post-Issuance:

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| Extension-of-Time: | | | | |
| Miscellaneous: | | | | |
| Total in USD (\$) | | | | 160 |

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 13975251

Filing Date: 23-Aug-2013

Applicant/Patent under Reexamination: Jeong et al.

Electronic Terminal Disclaimer filed on September 8, 2015

APPROVED

This patent is subject to a terminal disclaimer

DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

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|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 23420981 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Jeanne Andrea Di Grazio |
| Filer Authorized By: | |
| Attorney Docket Number: | 022096.0037C2 |
| Receipt Date: | 08-SEP-2015 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 11:23:03 |
| Application Type: | Utility under 35 USC 111(a) |

Payment information:

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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.



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Table with columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO., EXAMINER, ART UNIT, PAPER NUMBER, NOTIFICATION DATE, DELIVERY MODE. Includes application details for 13/975,251 and 89980 7590.

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@nsiplaw.com
pto.nsip@gmail.com

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.
2. This communication is in response to Applicant's amendment filed on 29 April 2015. Claims 1 and 2 have been amended. Claims 1 and 2 remain pending.

Drawings

3. The drawings received on 1 October 2013. These drawings are acceptable.

Response to Amendment

4. The Preliminary Amendments filed on 01 October 2013 and 01 August 2014 has been considered by the Examiner.

Response to Arguments

5. Applicant's arguments, see pages 1-10, filed 29 April 2015, with respect to the rejection of claims 1-2 under Park (Pub No. 2006/002466) in view of Boon et al. (US Patent No. 7,995,654) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn.
6. With regards to the Double Patenting rejection, the rejected claims of the instant application is merely an obvious modification of the issued application. The only difference between the claims is the omission of "between pixel values and predicted pixel values" or "based on an intra prediction mode". This omission does not change

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the scope of the claims because both the issued application and the instant application perform entropy decoding of encoded video to obtain transform coefficients and scanning based on intra prediction to obtain difference values. Therefore, a double patenting rejection is proper against the claims of the instant application because the scope is not patentably distinct from the issued application. The Applicant failed to address this issue by filing a terminal disclaimer, therefore, the rejection will be maintained in view of the reasons below.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

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A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1-2 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2 of U.S. Patent No. 8,548,060.

Although the conflicting claims are not identical, they are not patentably distinct from each other because the scope of the claims is the same for the instant application and the issued application. Each claim identical method and apparatus for performing entropy decoding of encoded video information to obtain transform coefficients and selecting of the scanning mode based on an intra prediction mode.

4. Claim(s) 1-2 of US Patent No. 8,548,060 contain(s) every element of claim(s) 1-2, of the instant application and as such anticipate(s) claim(s) 1-2 of the instant application.

5. "A later patent claim is not patentably distinct from an earlier patent claim if the later claim is obvious over, or anticipated by, the earlier claim. In re Longi, 759 F.2d at 896,225 USPQ at 651 (affirming a holding of obviousness-type double patenting because the claims at issue were obvious over claims in four prior art patents); In re

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Berg, 140 F.3d at 1437, 46 USPQ2d at 1233 (Fed. Cir. 1998) (affirming a holding of obviousness-type double patenting where a patent application claim to a genus is anticipated by a patent claim to a species within that genus). " ELI LILLY AND COMPANY v BARR LABORATORIES, INC., United States Court of Appeals for the Federal Circuit, ON PETITION FOR REHEARING EN BANC (DECIDED: May 30, 2001).

Conclusion

2. **THIS ACTION IS MADE FINAL.** 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 mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COURTNEY FIELDS whose telephone number is (571)272-3871. The examiner can normally be reached on Mon - Fri. 7:00 - 4:00 pm; IFP.


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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Nalven can be reached on 571-272-3839. 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). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COURTNEY FIELDS/
Examiner, Art Unit 2496
May 28, 2015

/ANDREW NALVEN/
Supervisory Patent Examiner, Art Unit 2496

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|--------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------|
| Search Notes  | Application/Control No. 13975251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. |
| | Examiner COURTNEY FIELDS | Art Unit 2496 |

| CPC- SEARCHED | | |
|----------------------|-------------|-----------------|
| Symbol | Date | Examiner |
| H04N 19/00218 | 05/28/2015 | CDF |
| H04N 19/159 | 05/28/2015 | CDF |
| H04N 19/136 | 05/28/2015 | CDF |
| H04N 19/61 | 05/28/2015 | CDF |
| H04N 19/129 | 05/28/2015 | CDF |
| H04N 19/103 | 05/28/2015 | CDF |
| H04N 19/11 | 05/28/2015 | CDF |
| H04N 19/176 | 05/28/2015 | CDF |


| CPC COMBINATION SETS - SEARCHED | | |
|----------------------------------------|-------------|-----------------|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|-----------------------------------|-----------------|-------------|-----------------|
| Class | Subclass | Date | Examiner |
| | | | |

| SEARCH NOTES | | |
|-----------------------------------------------------|-------------|-----------------|
| Search Notes | Date | Examiner |
| EAST Search (USPAT, PG-PUB, DERWENT, IBM, EPO, JPO) | 05/28/2015 | CDF |
| NPL Search (Google Scholar) | 05/28/2015 | CDF |

| INTERFERENCE SEARCH | | | |
|---------------------------------|--------------------------------|-------------|-----------------|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
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|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------|
| <i>Index of Claims</i>  | Application/Control No. 13975251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. |
| | Examiner COURTNEY FIELDS | Art Unit 2496 |

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| ✓ | Rejected |
| = | Allowed |

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| - | Cancelled |
| ÷ | Restricted |

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|---|---------------------|
| N | Non-Elected |
| I | Interference |

| | |
|---|-----------------|
| A | Appeal |
| O | Objected |

Claims renumbered in the same order as presented by applicant
 CPA
 T.D.
 R.1.47

| CLAIM | | DATE | | | | | | | |
|-------|----------|------------|------------|--|--|--|--|--|--|
| Final | Original | 01/24/2015 | 05/28/2015 | | | | | | |
| | 1 | ✓ | ✓ | | | | | | |
| | 2 | ✓ | ✓ | | | | | | |

EAST Search History

EAST Search History (Prior Art)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|-------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------|---------|---------------------|
| L7 | 12 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra prediction" and "vertical intra prediction" and "coefficients" and "encoded video" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/05/28 12:34 |
| L6 | 24 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra prediction" and "vertical intra prediction" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/05/28 12:34 |
| L5 | 26 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra prediction" and "vertical intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/05/28 12:34 |
| L4 | 29 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra" and "vertical intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/05/28 12:33 |
| L3 | 0 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra" and "vertical intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/05/28 12:33 |
| L2 | 30 | "entropy decoding" and "scanning" and "intra prediction" and "horizontal intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/05/28 12:33 |
| L1 | 1161 | "entropy decoding" and "scanning" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/05/28 12:33 |
| S187 | 2 | "7995654".pn. | US-PGPUB; | OR | OFF | 2015/01/24 |

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|------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| | | | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 23:28 |
| S186 | 26 | "2006002466" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/01/24 23:12 |
| S185 | 53 | "entropy decoding" and "encoded video" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" and "pixel values" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| S184 | 72 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" and "pixel values" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| S183 | 73 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| S182 | 78 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| S181 | 80 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:38 |
| S180 | 4305 | "entropy decoding" and "video" and "encoding" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:38 |
| S179 | 4 | (H04N19/00218 and H04N19/159 and H04N19/136 and H04N19/61 and H04N19/129 and H04N19/103 and H04N19/11 and H04N19/176).CPC. and "entropy decoding" and "video" and | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | ON | 2015/01/24 22:37 |

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|------|------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| | | "encoding" | IBM_TDB | | | |
| S178 | 24 | (H04N19/00218 and H04N19/159 and H04N19/136 and H04N19/61 and H04N19/129 and H04N19/103 and H04N19/11 and H04N19/176).CPC. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:33 |
| S170 | 105 | 375/240.2.ccls. and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:08 |
| S169 | 291 | 375/240.2.ccls. and "entropy" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:08 |
| S168 | 1000 | 375/240.2.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:07 |
| S167 | 0 | 375/240.20.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:07 |
| S166 | 0 | 375/240.200.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:06 |
| S165 | 0 | 375/240.2.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:06 |
| S164 | 0 | 375/240.200.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:06 |
| S163 | 4 | "20070274385" "20050074062" | US-PGPUB; USPAT; USOCR; FPRS; EPO; | OR | OFF | 2013/05/13 13:09 |

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|------|-----|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| | | | JPO; DERWENT; IBM_TDB | | | |
| S162 | 0 | 382/247.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:39 |
| S161 | 0 | 375/240.03.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:39 |
| S160 | 2 | 375/240.16.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S159 | 0 | 375/240.27.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S158 | 3 | 375/240.24.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S157 | 6 | 375/240.12.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S156 | 0 | 375/240.20.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S146 | 24 | encoder and decoder and "intra prediction" and "entropy" | EPO; JPO; DERWENT | OR | OFF | 2013/05/13 12:21 |
| S145 | 152 | encoder and decoder and "intra prediction" | EPO; JPO; DERWENT | OR | OFF | 2013/05/13 12:18 |
| S144 | 1 | S139 and S143 | US-PGPUB; USPAT; USOCR; FPRS; EPO; | OR | OFF | 2013/05/13 12:17 |

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|------|---------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| | | | JPO; DERWENT; IBM_TDB | | | |
| S143 | 1 | "video recovery" and "scanning mode" and "decoded" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:17 |
| S142 | 0 | "video recovery" near5 "scanning mode" near5 "decoded" near5 "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:16 |
| S141 | 1 | "video recovery" near5 "scanning mode" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:15 |
| S140 | 3134865 | "video recovery" near5 scanning mode | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:14 |
| S139 | 3 | "entropy encoding" same "optimal" same "intra prediction" same "coefficients" same scan\$4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:11 |
| S138 | 8 | "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:09 |
| S137 | 13 | "entropy encoding" same "optimal" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:07 |
| S136 | 4 | "entropy encoding" near5 "zigzag" same "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:41 |
| S135 | 29 | "entropy encoding" near5 "zigzag" and "horizontal" | US-PGPUB; USPAT; | OR | OFF | 2012/11/07 19:41 |

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|------|-----|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| | | | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S134 | 0 | "entropy encoding" near5 "zigzag" near5 "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:41 |
| S133 | 41 | "entropy encoding" near5 "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S132 | 75 | "entropy encoding" with "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S131 | 152 | "entropy encoding" same "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S130 | 5 | "mode selection" with "intra prediction" with "DCT" with "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:14 |
| S129 | 138 | "mode selection" and "intra prediction" and "DCT" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:14 |
| S128 | 1 | S97 and "plane" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:07 |
| S127 | 1 | S97 and "direct current" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:52 |

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|------|---|-----------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| S126 | 6 | S97 and "pixels" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S125 | 8 | S97 and "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S124 | 0 | S97 and "pixel prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S123 | 3 | "20050157797" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:41 |
| S122 | 1 | "video recovery" same "entropy decoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:37 |
| S121 | 1 | "video recovery" with "entropy decoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:37 |
| S120 | 4 | "video recovery" and "decoding" and "entropy" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:33 |
| S119 | 0 | S97 and "recover" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:33 |
| S118 | 0 | S97 and "recovering" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | OFF | 2012/11/07 18:33 |

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| | | | DERWENT; IBM_TDB | | | |
| S117 | 0 | S97 and "video recovery" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:32 |
| S116 | 4 | S97 and (multipl\$7) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:31 |
| S115 | 1 | S97 and "dispersion" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:30 |
| S114 | 3 | S97 and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:14 |
| S113 | 0 | S97 and "zig zag" and "intra prediction" and "video" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S112 | 0 | S97 and "zig zag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S111 | 1 | S97 and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S110 | 0 | S97 and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" and (multipl\$7) and "dispersion" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S109 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and | US-PGPUB; USPAT; USOCR; | OR | OFF | 2012/11/07 18:13 |

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| | | "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" and (multipl\$7) and "dispersion" | FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S108 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" and (multipl\$7) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:12 |
| S107 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S106 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S105 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S104 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S103 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S102 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | OFF | 2012/11/07 18:10 |

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| | | | IBM_TDB | | | |
| S101 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S100 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S99 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S98 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zig zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S97 | 16 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:59 |
| S96 | 4 | encod\$3 with "9 prediction modes" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:58 |
| S95 | 0 | encod\$3 with "intra prediction" with "DCT" with "quantization" with "9 prediction modes" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:58 |
| S94 | 0 | encod\$3 with "intra prediction" with "DCT" with "quantization" with "9 prediction modes" with (entropy encod\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:57 |
| S93 | 7 | encod\$3 with "intra prediction" with "DCT" with "quantization" with scan\$4 with (entropy encod\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; | OR | OFF | 2012/11/07 17:54 |

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| | | | JPO; DERWENT; IBM_TDB | | | |
| S92 | 7 | encod\$3 with "intra prediction" with "DCT" with "quantization" with scan\$4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S91 | 50 | encod\$3 with "intra prediction" with "DCT" with "quantization" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S90 | 112 | encod\$3 with "intra prediction" with "DCT" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S89 | 1984 | encod\$3 with "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S88 | 2 | "8199819".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:33 |
| S87 | 5 | "20030081850" "4821119".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/06 15:18 |
| S86 | 23 | "vertical scanning" and "entropy encoding" and "horizontal" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S85 | 23 | "vertical scanning" and "entropy encoding" and "horizontal" and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S84 | 44 | "vertical scanning" and "entropy encoding" and "horizontal" | US-PGPUB; USPAT; | OR | OFF | 2012/08/16 16:51 |

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| | | | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S83 | 46 | "vertical scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S82 | 0 | "vertical scanning" near "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S81 | 1 | "vertical scanning" near5 "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:50 |
| S80 | 9 | "vertical scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:50 |
| S79 | 22 | "coefficient scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:47 |
| S78 | 77 | "coefficient scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:47 |
| S77 | 159 | "horizontal" and "vertical" and "entropy encoding" and "zig-zag" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:46 |
| S76 | 10 | "horizontal scan" and "vertical scan" and "entropy encoding" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:46 |

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| S75 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:46 |
| S74 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:45 |
| S73 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" and "residual" and "high" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:44 |
| S72 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" and "residual" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:44 |
| S71 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S70 | 0 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "residual signal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S69 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S68 | 33 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S67 | 0 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intraframe prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | OFF | 2012/08/16 16:43 |

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| | | | DERWENT; IBM_TDB | | | |
| S66 | 39 | "horizontal scanning" and "vertical scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S65 | 8 | "horizontal scanning" same "vertical scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:41 |
| S64 | 8607 | "horizontal scanning" same "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:41 |
| S63 | 10754 | "horizontal scanning" and "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:40 |
| S62 | 14 | "horizontal directional" and "vertical" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:43 |
| S61 | 1 | "horizontal-directional" and "vertical" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:43 |
| S60 | 1 | "horizontal-directional" same "vertical" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:43 |
| S59 | 1 | "horizontal-directional" same "vertical intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:42 |
| S58 | 1 | "horizontal-directional scanning" | US-PGPUB; USPAT; USOCR; | OR | OFF | 2012/08/15 16:42 |

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| | | | FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S57 | 9 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "vertical" and "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:36 |
| S56 | 0 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "selected mode" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:34 |
| S55 | 2 | "difference values" same "DCT" same "quantization" same "intra" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:32 |
| S54 | 2 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:31 |
| S53 | 15 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S52 | 17 | "difference values" same "DCT" same "quantization" same "intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S51 | 1 | "difference values" same "DCT" same "quantization" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S50 | 0 | "difference values" same "DCT" same "quantization" same "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S49 | 51 | "difference values" same "DCT" same | US-PGPUB; | OR | OFF | 2012/08/15 |

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| | | "quantization" | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 16:29 |
| S48 | 5 | "scanning mode" and "difference values" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:24 |
| S47 | 0 | "scanning mode" same "difference values" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:24 |
| S46 | 1 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.27.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S45 | 5 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.12.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S44 | 1 | "DCT coefficient" near5 "scanning" near5 "pixel" and 375/240.24.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S43 | 5 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.12 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S42 | 5 | "DCT coefficient" near5 "scanning" near5 "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:40 |
| S41 | 52 | "DCT coefficient" same "scanning" same "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | OFF | 2012/03/18 13:40 |

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| | | | IBM_TDB | | | |
| S40 | 12 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S39 | 14 | "DCT" same "scan" same "intra prediction" same "video" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S38 | 19 | "DCT" same "scan" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S37 | 0 | "DCT scan" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S36 | 0 | "discrete cosine transform scanning" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S35 | 0 | "DCT scanning" same "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S34 | 0 | "DCT scanning" same "intra-prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S33 | 2 | "DCT scanning" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S32 | 0 | "DCT scanning" same "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; | OR | OFF | 2012/03/18 13:34 |

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| | | | JPO; DERWENT; IBM_TDB | | | |
| S31 | 4 | (discrete cosine transform or (DCT)) near (scan\$4) same "intra- prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S30 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intra-prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S29 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S28 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S27 | 1173383 | (discrete cosine transform) or (DCT) near (scan\$4) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S26 | 2299 | (discrete cosine transform or (DCT)) near (scan\$4) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:31 |
| S25 | 11577 | (discrete cosine transform or (DCT)) near5 (scan\$4) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:31 |
| S24 | 23869 | (discrete cosine transform or (DCT)) same "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:31 |
| S23 | 900 | 375/240.2.ccls. and (discrete cosine transform or (DCT)) | US-PGPUB; USPAT; | OR | OFF | 2012/03/18 13:30 |

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|-----|------|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| | | | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S22 | 0 | 375/240.200.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:30 |
| S21 | 921 | 375/240.2.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:30 |
| S20 | 0 | 375/240.20.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S19 | 0 | S17 and S18 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S18 | 7919 | electronics and telecommunications.asn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S17 | 2 | S1 and S2 and S3 and S4 and S5 and S6 and S7 and S8 and S9 and S10 and S11 and S12 and S13 and S14 and S15 and S16 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S16 | 79 | dong-kyun.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S15 | 55 | dae-yeon.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |

| | | | | | | |
|-----|-----|----------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| S14 | 18 | chang-beom.in. and ahn.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S13 | 19 | seoung-jun.in. and oh.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S12 | 32 | dong-gyu.in. and sim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S11 | 141 | yung-lyul.in. and lee.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S10 | 204 | jin-woong.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S9 | 580 | jin-woo.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S8 | 52 | dae-young.in. and jang.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S7 | 15 | kyung-ae.in. and moon.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S6 | 115 | jae-gon.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | OFF | 2012/03/18 13:26 |

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|----|----|------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| | | | DERWENT; IBM_TDB | | | |
| S5 | 21 | in-seon.in. and jang.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S4 | 23 | seung-kwon.in. and beack.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S3 | 64 | jeong-il.in. and seo.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S2 | 33 | hae-chul.in. and choi.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S1 | 27 | se-yoon.in. and jeong.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |

EAST Search History (Interference)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|-------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------|---------|---------------------|
| S177 | 0 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients AND entropy AND encoding AND scanning AND mode AND decoding AND video AND recovery AND encoded AND video AND quantization AND vertical AND scanning AND horizontal AND scanning.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:43 |
| S176 | 1 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients AND entropy AND encoding AND scanning AND mode AND decoding AND video AND recovery.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:40 |
| S175 | 66 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:39 |

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| | | transformation AND quantization AND coefficients AND entropy AND encoding AND scanning AND mode AND decoding.CLM. | | | | |
| S174 | 40 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients AND entropy AND encoding AND scanning AND mode.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:38 |
| S173 | 109 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation AND quantization AND coefficients.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:38 |
| S172 | 67 | encoding AND mode AND selection AND optimal AND intra AND prediction AND video AND difference AND values AND transformation.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:37 |
| S171 | 572 | encoding AND mode AND selection AND optimal AND intra AND prediction.CLM. | US-PGPUB; UPAD | OR | OFF | 2013/05/13 14:37 |

5/ 28/ 2015 12:36:12 PM

C:\Users\cfields\Documents\EAST\Workspaces\encoding and decoding image using adaptive DCT coefficient scanning continuation.wsp

H. 263+: Video coding at low bit rates

G Cote, B Erol, M Gallant... - Circuits and Systems for ..., 1998 - [ieeexplore.ieee.org](#)

... frames—the difference between original frames and motion-compensated **predicted** frames—need be **encoded**. ... to the reference picture, an **encoder** can also choose not to **encode** it, and the ... the advanced **intra** coding mode employs a new VLC table for **encoding** the quantized ...
Cited by 529 Related articles All 16 versions Cite Save

Overview of the H. 264/AVC video coding standard

T Wiegand, GJ Sullivan... - Circuits and Systems ..., 2003 - [ieeexplore.ieee.org](#)

... Therefore, the frame/field **encoding** decision can also be made independently for each **vertical** pair of ... **prediction** and transform coding processes and instead directly send the values of the **encoded** samples ... 1) It allows the **encoder** to precisely represent the values of the samples ...
Cited by 7130 Related articles All 67 versions Cite Save

The H. 264/AVC advanced video coding standard: Overview and introduction to the fidelity range extensions

GJ Sullivan, PN Topiwala... - ..., the SPIE 49th ..., 2004 - [proceedings.spiedigitallibrary.org](#)

... which, in the case of P, B, or SP slices can be one of four initial distributions as selected by the **encoder**). After the **encoding** of each bin, the probability estimate in the context is updated to adjust upward the probability estimate for the bin value that was **encoded**. ...
Cited by 594 Related articles All 19 versions Cite Save

Video coder providing implicit **coefficient prediction** and **scan** adaptation for image coding and **intra** coding of video

BG Haskell, A Puri, RL Schmidt - US Patent 6,341,144, 2002 - [Google Patents](#)

... The **encoding/decoding** operation of the **prediction** and reconstruction circuit may also be performed ... the processor determines whether less bandwidth is occupied by the **encoded coefficients** or the ... The **encoder scans** blocks of **coefficients** to generate run-level events that are ...
Cited by 23 Related articles All 2 versions Cite Save

Intra-macroblock DC and AC coefficient prediction for interlaced digital video

RO Eifrig, X Chen, A Luthra - US Patent 5,974,184, 1999 - [Google Patents](#)

... the AC **coefficients** of the DC predictor block are used to differentially **encode** the AC ... Although differential **encoding** of DCT **coefficients** in an **INTRA** block as discussed in connection with ... coded blocks and MBs, a motion **decoding** function 648 processes the **encoded** MV data to ...
Cited by 104 Related articles All 2 versions Cite Save

Video compression—from concepts to the H. 264/AVC standard

GJ Sullivan, T Wiegand - Proceedings of the IEEE, 2005 - [ieeexplore.ieee.org](#)

... is reduced in order to reduce the amount of data needed to **encode** the representation. ... guarantees of end-to-end reproduction quality, as it allows even crude **encoding** methods to ... parallel processing, as each slice can be **encoded** and **decoded** independently of the other slices ...
Cited by 616 Related articles All 22 versions Cite Save

A novel **coefficient scanning** scheme for directional spatial **prediction**-based image compression

X Fan, Y Lu, W Gao - Multimedia and Expo, 2003. ICME'03. ..., 2003 - [ieeexplore.ieee.org](#)

... Therefore, as a first step in the **encoding** process for a given block, one may **predict** the block ... used instead of zigzag **scanning** in AVC/H.264 Since the table used in the **encoder** and **decoder** can be indicated by the **prediction** mode, there is no extra bit **encoded** into the ...
Cited by 28 Related articles All 5 versions Cite Save

Video coder providing implicit or explicit **prediction** for image coding and **intra** coding of video

BG Haskell, A Puri, RL Schmidt - US Patent 6,005,622, 1999 - [Google Patents](#)

... a macroblock, the processor determines whether less bandwidth is occupied by the **encoded coefficients** or the ... an inverse operation of the explicit predictor 170 of the **encoder** 100 ... Selective **prediction encoding** and **decoding** methods and devices with ac/dc and advanced video ...
Cited by 30 Related articles All 2 versions Cite Save

Adaptive **scanning** for H. 264/AVC **intra** coding

YL Lee, KH Han, DG Sim, J Seo - ETRI journal, 2006 - etrij.etri.re.kr

... To **encode** an MB in **intra** 16×16 mode in the luma component, all of the MB pixels are **predicted** from the ... In DC **prediction**, the average value of the neighboring 32 pixels situated on the block boundary that is previously **decoded** is used ... Since both **encoder** and **decoder** perform ...

Cited by 22 Related articles All 6 versions Cite Save

Variable block-size transforms for H. 264/AVC

M Wien - Circuits and Systems for Video Technology, IEEE ..., 2003 - ieeexplore.ieee.org

... With ABT, the **encoder** can trade energy compaction by larger transforms against the size of ... E. CABAC Transform **Coefficient Encoding** The binarization and context generation for the transform coefficients ... transform coding can be aligned to the properties of the **encoded** signal ...

Cited by 183 Related articles All 10 versions Cite Save

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Art Unit: 2496

Application No. 13/975,251

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Courtney D. FIELDS

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE
DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

AMENDMENT

Mail Stop: Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Non-Final Office Action mailed January 30, 2015, and having a period for response set to expire, on April 30, 2015.

The following amendments and remarks are respectfully submitted.

Reconsideration of the claims is respectfully requested.

Amendments to the specification begin on page 2 of this paper.

Amendments to the claims are reflected in the listing of the claims that begins on page 3 of this Paper.

Remarks begin on page 4 of this Paper.

IN THE SPECIFICATION:

The specification as amended below with replacement paragraphs shows added text with underlining and deleted text with ~~striketrough~~.

Please REPLACE paragraph [0001] on page 1 of the Specification with the following amended paragraph:

[0001] This application is a continuation of Application No. 12/377,617 ~~filed on~~ having a 371(c) date of February 16, 2009, now U.S. Patent No. 8,548,060, which is a U.S. National Stage application of International Application No. PCT/KR2007/001433 filed on March 23, 2007, which claims the benefit of Korean Application Nos. 10-2006-0077851 filed on August 17, 2006, and 10-2007-0008247 filed on January 26, 2007. The entire disclosures of Application No. 12/377,617, International Application No. PCT/KR2007/001433, and Korean Application Nos. 10-2006-0077851 and 10-2007-0008247 are incorporated herein by reference for all purposes.

IN THE CLAIMS:

This listing of the claims replaces all prior versions and listings of the claims in this application.

The text of all pending claims (including any withdrawn claims) is set forth below. Canceled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strike through~~. The status of each claim is listed with one of (Original), (Currently amended), (Canceled), (Withdrawn), (Previously presented), (New), and (Not entered).

Please AMEND claims 1-2 in accordance with the following:

1. (Currently Amended) A decoding method comprising:
performing entropy decoding of encoded video information to obtain transform coefficients;

selecting a scanning mode for the transform coefficients; and
scanning the transform coefficients based on the selected scanning mode;
wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode ~~that was used~~ to obtain difference values between pixel values and predicted pixel values.

2. (Currently Amended) The decoding method of claim 1, wherein the selecting of the scanning mode based on an intra prediction mode comprises:

selecting a horizontal scanning mode ~~when in response to~~ the intra prediction mode ~~being~~ a vertical intra prediction mode; and

selecting a vertical scanning mode ~~when in response to~~ the intra prediction mode ~~being~~ a horizontal intra prediction mode.

REMARKS

In accordance with the foregoing, the specification and claims 1-2 have been amended. Claims 1-2 are pending, with claim 1 being independent. No new matter is added.

Papers Filed on August 23, 2013, October 1, 2013, and August 1, 2014

Item 1 on page 1 (the form PTOL-326) of the Office Action of January 30, 2015, states that the Office Action is "[r]esponsive to communication(s) filed on 23 August 2013."

However, Preliminary Remarks were filed on August 23, 2013.

Also, a Preliminary Amendment submitting six new sheets of drawings containing FIGS. 1-11 was filed on October 1, 2013. As explained on page 3 of the Preliminary Amendment, these six new sheets of drawings were originally filed on February 16, 2009, in Application No. 12/377,617, the parent application of this continuation application, which is incorporated by reference in paragraph [0001] of this continuation application, and were being filed in this continuation application based on the incorporation by reference as permitted by MPEP 201.06(c)(IV)(A).

Also, a Second Preliminary Amendment submitting six replacement sheets of drawings containing FIGS. 1-11 was filed on August 1, 2014. The six replacement sheets of drawings replace the six new sheets of drawings containing FIGS. 1-11 filed on October 1, 2013.

Item 11 on page 1 (the form PTOL-326) of the Office Action of January 30, 2015, states that the drawings filed on August 1, 2014, have been accepted. However, the Office Action does not indicate the Preliminary Remarks of August 23, 2013, have been considered; that the drawings filed on October 1, 2013, have been accepted; and that the Preliminary Amendment of October 1, 2013, and the Second Preliminary Amendment of August 1, 2014, have been entered. Accordingly, it is respectfully requested that the Office indicate this in the next Office Action.

In particular, pages 2 and 3 of the Preliminary Remarks of August 23, 2013, state as follows:

This application is a continuation of Application No. 12/377,617 filed on February 16, 2009. Claims 1 and 2 of the present continuation application respectively correspond to allowed claims 19 and 24 of parent Application No. 12/377,617 that were canceled in the Amendment After Allowance Under 37 CFR 1.312 filed on August 23, 2013, in parent Application No. 12/377,617 revised as follows:

~~19-1.~~ A decoding method comprising:
 performing entropy decoding of ~~an~~-encoded video ~~information~~ to obtain ~~decoded~~-transform coefficients;
 selecting a scanning mode for the ~~decoded~~-transform coefficients; and
~~recovering an input video from scanning the decoded~~ transform coefficients ~~using based on~~ the selected scanning mode;
 wherein the selecting of a scanning mode comprises selecting the scanning mode based on an ~~optimal~~-intra prediction mode that was used ~~to perform intra prediction of the input video to obtain difference values between pixel values and predicted pixel values that were encoded to obtain the encoded video.~~

~~24-2.~~ The decoding method of claim-~~19-1~~, wherein the selecting of ~~a the~~ scanning mode ~~further based on an intra prediction mode~~ comprises:
 selecting a horizontal scanning mode when the ~~optimal~~-intra prediction mode is a vertical intra prediction mode; and
 selecting a vertical scanning mode when the ~~optimal~~-intra prediction mode is a horizontal intra prediction mode.

It is submitted that claims 1 and 2 of the present continuation application are allowable for at least the same reasons that corresponding claims 19 and 24 of parent Application No. 12/377,617 are allowable as discussed on pages 19-33 of the Amendment of March 20, 2013, filed in parent Application No. 12/377,617 and in the Examiner's Statement of Reasons for Allowance on pages 2-11 of the Notice of Allowability included in the Notice of Allowance of May 23, 2013, issued in parent Application No. 12/377,617, and an indication to that effect is respectfully requested.

In light of these arguments, Applicants expected to receive Notice of Allowance allowing claims 1 and 2, rather than an Office Action rejecting claims 1 and 2. Nothing in the Office Action of January 30, 2015, indicates that the Office considered the above arguments in the Preliminary Remarks of August 23, 2013.

Notice of References Cited (Form PTO-892)

The Office Action of January 30, 2015, includes a Notice of References Cited (form PTO-892) in which the Office has cited two references. Applicants note that both of these references were already cited in the Information Disclosure Statement of November 12, 2013, which was considered in the Office Action of January 30, 2015.

Double Patenting Rejection

Claims 1 and 2 have been rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 2 of U.S. Patent No. 8,548,060, which issued from Application No. 12/377,617, the parent application of this continuation application. This rejection is respectfully traversed.

The Office states as follows:

Although the conflicting claims are not identical, they are not patentably distinct from each other because the scope of the claims is the same for the instant application and the issued application. Each claim identical method and apparatus for performing entropy decoding of encoded video to obtain transform coefficients and selecting of the scanning mode based on an intra prediction mode.

Claim(s) 1-2 of US Patent No. 8,548,060 contain(s) every element of claim(s) 1-2, [*sic*] of the instant application and as such anticipate(s) claim(s) 1-2 of the instant application.

In response, Applicants respectfully provide the following comparison between this instant Application and U.S. Patent No. 8,548, 060 below.

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| This Application | U.S. Patent No. 8,548,060 |
| <p>1. A decoding method comprising:</p> <ul style="list-style-type: none"> performing entropy decoding of encoded video information to obtain transform coefficients; selecting a scanning mode for the transform coefficients; and scanning the transform coefficients based on the selected scanning mode; <p>wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode that was used to obtain difference values between pixel values and predicted pixel values.</p> | <p>1. A decoding apparatus comprising:</p> <ul style="list-style-type: none"> an entropy decoding unit configured to perform entropy decoding of an encoded video to obtain decoded transform coefficients; a scanning decision unit configured to select a scanning mode for the decoded transform coefficients; and a video recovery unit configured to recover an input video on from the decoded transform coefficients using the selected scanning mode; <p>wherein the scanning decision unit is further configured to select the scanning mode based on an optimal intra prediction mode that was used to perform intra prediction of the input video to obtain difference values that were encoded to obtain the encoded video.</p> |
| <p>2. The decoding method of claim 1, wherein the selecting of the scanning mode based on an intra prediction mode comprises:</p> <ul style="list-style-type: none"> selecting a horizontal scanning mode when the intra prediction mode is a vertical intra prediction mode; and selecting a vertical scanning mode when the intra prediction mode is a horizontal intra prediction mode. | <p>2. The decoding apparatus of claim 1, wherein the scanning decision unit is further configured to:</p> <ul style="list-style-type: none"> select a horizontal scanning mode when the optimal intra prediction mode is a vertical intra prediction mode; and select a vertical scanning mode when the optimal intra prediction mode is a horizontal intra prediction mode. |

MPEP 804(II)(B)(1) stipulates as follows:

Any obviousness-type double patenting rejection should make clear:

(A) The differences between the inventions defined by the conflicting claims — a claim in the patent compared to a claim in the application; and

(B) The reasons why a person of ordinary skill in the art would conclude that the invention defined in the claim at issue is anticipated by, or would have been an obvious variation of, the invention defined in a claim in the patent.

However, Applicants respectfully submit that the explanation of the rejection provided by the Office does not make clear the differences between claims 1-2 of the instant Application and claims 1-2 of US Patent No. 8,548,060, and the reasons why a person of ordinary skill in the art would conclude that the invention defined in claims 1-2 of the present application is anticipated by the invention defined in claims 1-2 of US Patent No. 8,548,060, as required by MPEP 804(II)(B)(1). Accordingly, it is submitted that the Office has not established a *prima facie* case of provisional nonstatutory obviousness-type double patenting with respect to claims 1-2 of the present application. Specifically, the Office did not address the features “**between pixel values and predicted pixel values,**” or “**based on an intra prediction mode**” which were recited in instant claims 1 and 2, but not recited in US Patent No. 8,548,060. For at least the foregoing reasons, it is respectfully requested that the rejection on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2 of copending U.S. Patent No. 8,548,060 be withdrawn.

In the event that the Office maintains the nonstatutory obviousness-type double patenting over claims 1-2 of copending U.S. Patent No. 8,548,060, Applicants respectfully request the Office to provide a detailed rationale addressing the specific features of instant claims 1-2 **so that the Applicants have the opportunity to fully respond.**

Rejection of claims under 35 USC §102 and 35 USC §103

Claim 1 has been rejected under 35 USC §102(b) as being anticipated by US Patent Application No. 2006/0002466 to Park ("Park"). Claim 2 has been rejected under Park in view of US Patent No. 7,995,654 to Boon et al. ("Boon"). These rejections are respectfully traversed, at least because Park and Boon fail to disclose "selecting the scanning mode **based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values.**"

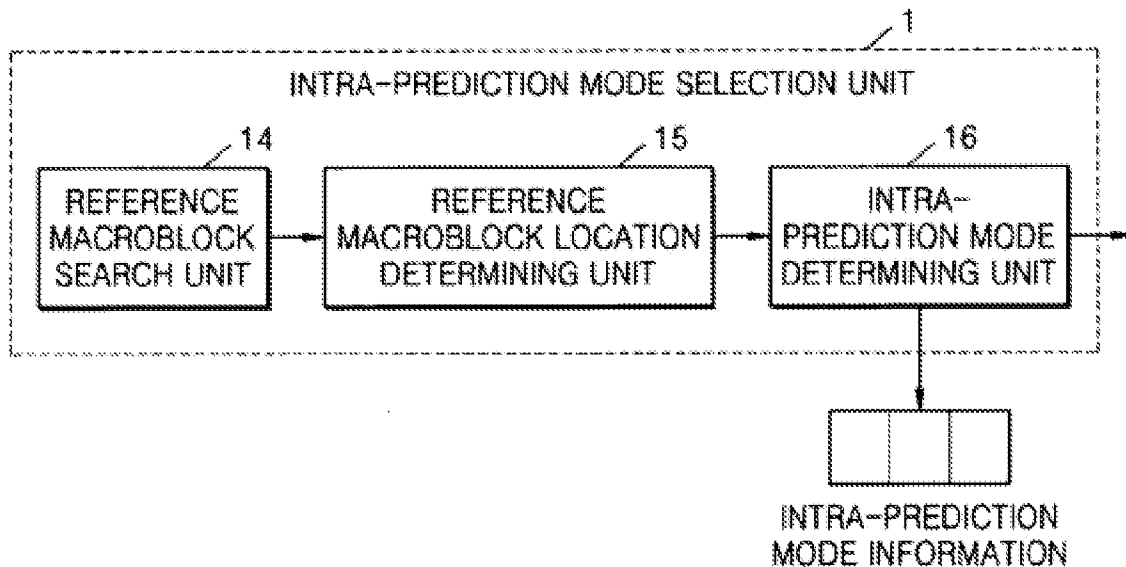
As described in the Specification, Park describes a prediction encoder including a prediction encoding unit which starts prediction from an origin macroblock of an area of interest of a video frame, continues prediction in a direction of ripple scanning with respect to a square ring that includes macroblocks and surrounds the origin macroblock, and encodes video by performing intra-prediction in 8×8 block units using information about a macroblock that has been just coded in a present square ring including a macroblock to be coded and at least one of macroblocks that are adjacent to the macroblock to be coded in a previous square ring which is inner square ring adjacent to the present square ring. Park further describes that the prediction encoding unit may predict a DCT coefficient of each block of the macroblock to be coded using a DCT coefficient of each block of the origin macroblock or a DCT coefficient of each block of the macroblock A, when the macroblock to be coded is a first macroblock after completion of encoding of the origin macroblock or there exist two reference macroblocks of the macroblock to be coded, wherein the two reference macroblocks includes a macroblock A that is included in the present square ring and has been just coded and a macroblock D that is included in the present square ring and is adjacent to the macroblock to be coded. See paragraphs [0026] – [0027]. Park further describes that the intra-prediction mode uses information of a predetermined scanning order. See paragraph [0179], [0187] – [0188].

Independent Claim 1

However, Park fails to describe each and every feature of independent claim 1, **because Park does not describe or suggest**, at least, selecting the scanning mode **based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values**, as instantly claimed by Applicants.

In rejecting claim 1, the Office asserts that Park discloses selecting the scanning mode **based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values in paragraph [0187]**. Applicants respectfully disagree that Park discloses selecting the scanning mode **based on an intra prediction mode**.

Instead, Park describes that an intra-prediction mode determining unit determines a mode having a minimum sum of absolute differences between a macroblock to be coded and each predicted macroblock in an intra-prediction mode according to a **predetermined scanning order**. See paragraphs [0179] and [0187]. In other words, Park describes that the scanning order is already chosen and fixed, and not selected. Therefore, Applicants submit that Park fails to disclose selecting a scanning mode based on an intra prediction mode. In fact, Park discloses that a scanning mode is **already predetermined** and thus not selected, contrary to Applicants' instant claim 1.



Park describes that the intra-prediction mode determining unit (16) determines a mode according to an already **predetermined** scanning order, rather than selecting a scanning order as recited in Applicants' claim 1.

Because Park fails to disclose or suggest selecting the scanning mode **based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values**, Applicants submit that Park fails to disclose all of the features of claim 1. For at least the foregoing reasons, it is respectfully requested that claim 1 is in condition for allowance.

Additionally, Boon fails to disclose or suggest selecting the scanning mode **based on an intra prediction mode used to obtain difference values between pixel values and predicted pixel values** as instantly claimed by Applicants, and is not relied upon by the Office to do so.

Accordingly, reconsideration of the rejection and allowance of claim 1 is respectfully requested.

Dependent Claim 2

Applicants respectfully submit that dependent claim 2 is allowable by virtue of their dependency on independent claim 1.

Additionally, Applicants respectfully submit that, contrary to the Office's assertions, that Boon fails to disclose selecting a horizontal scanning mode in response to the intra prediction mode being a vertical intra prediction mode; and selecting a vertical scanning mode in response to the intra prediction mode being a horizontal intra prediction mode. Rather, Boon describes a prediction method capable of generating prediction image data of a spatial region, and mentions sequences of a horizontal scan, a vertical scan, and a zigzag scan. See column 42 lines 41-45, FIGS. 27-29. However, Boon fails to mention any connection between a scanning mode and an intra prediction mode, much less selecting a horizontal scanning mode in response to the intra prediction mode being a vertical intra prediction mode; and selecting a vertical scanning mode in response to the intra prediction mode being a horizontal intra prediction mode, as instantly claimed in claim 2.

Fig.27

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 0 | 1 | 2 | 3 | 10 | 11 | 12 | 13 |
| 4 | 5 | 8 | 9 | 17 | 16 | 15 | 14 |
| 6 | 7 | 19 | 18 | 26 | 27 | 28 | 29 |
| 20 | 21 | 24 | 25 | 30 | 31 | 32 | 33 |
| 22 | 23 | 34 | 35 | 42 | 43 | 44 | 45 |
| 35 | 37 | 40 | 41 | 46 | 47 | 48 | 49 |
| 38 | 39 | 50 | 51 | 56 | 57 | 58 | 59 |
| 52 | 53 | 54 | 55 | 60 | 61 | 62 | 63 |

Horizontal Scanning

Fig.28

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 0 | 4 | 6 | 20 | 22 | 36 | 38 | 52 |
| 1 | 5 | 7 | 21 | 23 | 37 | 39 | 53 |
| 2 | 8 | 19 | 24 | 34 | 40 | 50 | 54 |
| 3 | 9 | 18 | 25 | 35 | 41 | 51 | 55 |
| 10 | 17 | 26 | 30 | 42 | 46 | 56 | 60 |
| 11 | 16 | 27 | 31 | 43 | 47 | 57 | 61 |
| 12 | 15 | 28 | 32 | 44 | 48 | 58 | 62 |
| 13 | 14 | 29 | 33 | 45 | 49 | 59 | 63 |

Vertical Scanning

Fig.29

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 0 | 1 | 5 | 6 | 14 | 15 | 27 | 28 |
| 2 | 4 | 7 | 13 | 16 | 26 | 29 | 42 |
| 3 | 8 | 12 | 17 | 25 | 30 | 41 | 43 |
| 9 | 11 | 18 | 24 | 31 | 40 | 44 | 53 |
| 10 | 19 | 23 | 32 | 39 | 45 | 52 | 54 |
| 20 | 22 | 33 | 38 | 46 | 51 | 55 | 60 |
| 21 | 34 | 37 | 47 | 50 | 56 | 59 | 61 |
| 35 | 36 | 48 | 49 | 57 | 58 | 62 | 63 |

Zigzag Scanning

Boon fails to mention any connection between a scanning mode and an intra prediction mode, contrary to Applicants' claimed invention.

Accordingly, reconsideration of the rejection and allowance of claim 2 is respectfully requested.

Conclusion

Applicant respectfully submits that a full and complete response has been made to the outstanding Office Action, and, as such, there being no other objections or rejections, this application is in condition for allowance and a notice of the same is earnestly solicited.

In the event this paper is not being timely filed, the Applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees only associated with the processing of this Response and any other documents filed concurrently with this Response may be charged to Counsel's Deposit Account 50-5113.

If the Office has any questions, or believes for any reason that personal communication will expedite prosecution of this application, the Office is hereby invited to telephone the undersigned at the number provided below.

Respectfully submitted,

Dated: April 29, 2015

By: /Xin Xie/
Xin Xie
Reg. No. 70,890

North Star Intellectual Property (NSIP) Law
1120 Connecticut Ave., NW
Suite # 304
Washington, DC 20036
(202) 429-0020 (ext. 950)

AMC/XXX

Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 22200066 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Alicia M. Choi/Sonja Straus |
| Filer Authorized By: | Alicia M. Choi |
| Attorney Docket Number: | 022096.0037C2 |
| Receipt Date: | 29-APR-2015 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 11:24:30 |
| 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 | | OA20150130_02200960037C2_ResponseAsFiled.pdf | 324251 4519ab4cb50cb00b3e13099514a26ed4e927dbed | yes | 13 |

| Multipart Description/PDF files in .zip description | | | |
|------------------------------------------------------------|--|--------------|------------|
| Document Description | | Start | End |
| Amendment/Req. Reconsideration-After Non-Final Reject | | 1 | 1 |
| Specification | | 2 | 2 |
| Claims | | 3 | 3 |
| Applicant Arguments/Remarks Made in an Amendment | | 4 | 13 |

Warnings:

Information:

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|-------------------------------------|--------|
| Total Files Size (in bytes): | 324251 |
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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.

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| | | | |
|-----------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|---------------------------------------|
| PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875 | Application or Docket Number 13/975,251 | Filing Date 08/23/2013 | <input type="checkbox"/> To be Mailed |
|-----------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|---------------------------------------|

ENTITY: LARGE SMALL MICRO

APPLICATION AS FILED – PART I

| FOR | NUMBER FILED | NUMBER EXTRA | RATE (\$) | FEE (\$) |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|----------|
| <input type="checkbox"/> BASIC FEE <small>(37 CFR 1.16(a), (b), or (c))</small> | N/A | N/A | N/A | |
| <input type="checkbox"/> SEARCH FEE <small>(37 CFR 1.16(k), (l), or (m))</small> | N/A | N/A | N/A | |
| <input type="checkbox"/> EXAMINATION FEE <small>(37 CFR 1.16(o), (p), or (q))</small> | N/A | N/A | N/A | |
| TOTAL CLAIMS <small>(37 CFR 1.16(i))</small> | minus 20 = | * | X \$ = | |
| INDEPENDENT CLAIMS <small>(37 CFR 1.16(h))</small> | minus 3 = | * | X \$ = | |
| <input type="checkbox"/> APPLICATION SIZE FEE <small>(37 CFR 1.16(s))</small> | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 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). | | | |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT <small>(37 CFR 1.16(j))</small> | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

APPLICATION AS AMENDED – PART II

| | (Column 1) | (Column 2) | (Column 3) | PRESENT EXTRA | RATE (\$) | ADDITIONAL FEE (\$) |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|------------------------------------|---------------|-----------------|---------------------|
| AMENDMENT | 04/29/2015 | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | | | |
| | Total <small>(37 CFR 1.16(i))</small> | * 2 | Minus | ** 20 | = 0 | X \$40 = 0 |
| | Independent <small>(37 CFR 1.16(h))</small> | * 1 | Minus | ***3 | = 0 | X \$210 = 0 |
| | <input type="checkbox"/> Application Size Fee <small>(37 CFR 1.16(s))</small> | | | | | |
| <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small> | | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

| | (Column 1) | (Column 2) | (Column 3) | PRESENT EXTRA | RATE (\$) | ADDITIONAL FEE (\$) |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|------------------------------------|---------------|-----------------|---------------------|
| AMENDMENT | | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | | | |
| | Total <small>(37 CFR 1.16(i))</small> | * | Minus | ** | = | X \$ = |
| | Independent <small>(37 CFR 1.16(h))</small> | * | Minus | *** | = | X \$ = |
| | <input type="checkbox"/> Application Size Fee <small>(37 CFR 1.16(s))</small> | | | | | |
| <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small> | | | | | | |
| | | | | | 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.

LIE
/DORIAN EVANS/

This collection of information is required by 37 CFR 1.16. 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, 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.**

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Table with columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO., EXAMINER, ART UNIT, PAPER NUMBER, NOTIFICATION DATE, DELIVERY MODE. Includes application details for 13/975,251 and 89980 7590.

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@nsiplaw.com
pto.nsip@gmail.com

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.
2. Claims 1-2 remain pending.

Information Disclosure Statement

3. The Information Disclosure Statement respectfully submitted on 12 November 2013 has been considered by the Examiner.

Continued Prosecution Application

4. This application is a continuation of Serial No. 12/377,617 filed on 16 February 2009 which is now, US Patent No. 8,548,060, issued on 01 October 2013.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140

Art Unit: 2496

F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1-2 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2 of U.S. Patent No. 8,548,060.

Although the conflicting claims are not identical, they are not patentably distinct from each other because the scope of the claims is the same for the instant application and the issued application. Each claim identical method and apparatus for performing entropy decoding of encoded video information to obtain transform coefficients and selecting of the scanning mode based on an intra prediction mode.

4. Claim(s) 1-2 of US Patent No. 8,548,060 contain(s) every element of claim(s) 1-2, of the instant application and as such anticipate(s) claim(s) 1-2 of the instant

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application.

5. "A later patent claim is not patentably distinct from an earlier patent claim if the later claim is obvious over, or anticipated by, the earlier claim. In re Longi, 759 F.2d at 896,225 USPQ at 651 (affirming a holding of obviousness-type double patenting because the claims at issue were obvious over claims in four prior art patents); In re Berg, 140 F.3d at 1437, 46 USPQ2d at 1233 (Fed. Cir. 1998) (affirming a holding of obviousness-type double patenting where a patent application claim to a genus is anticipated by a patent claim to a species within that genus). " ELI LILLY AND COMPANY v BARR LABORATORIES, INC., United States Court of Appeals for the Federal Circuit, ON PETITION FOR REHEARING EN BANC (DECIDED: May 30, 2001).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of pre-AIA 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 (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claim 1 is rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Park (Pub No. 2006/0002466).

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Referring to the rejection of claim 1, Park discloses a decoding method comprising: (See Park, Fig. 9, para. 0178)

performing entropy decoding of encoded video information to obtain transform coefficients; (See Park, paras. 0178-0179)

selecting a scanning mode for the transform coefficients; (See Park, para. 0179) and scanning the transform coefficients based on the selected scanning mode; (See Park, paras. 0180-0181)

wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode that was used to obtain difference values between pixel values and predicted pixel values. (See Park, para. 0187)

Claim Rejections - 35 USC § 103

4. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claim 2 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Park (Pub No. 2006/002466) in view of Boon et al. (US Patent No. 7,995,654). Park discloses the invention as claimed above, however, Park fails to explicitly disclose selecting a horizontal scanning mode when the intra prediction mode is a vertical intra

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prediction mode; and selecting a vertical scanning mode when the intra prediction mode is a horizontal intra prediction mode.

Boon et al. discloses image predictive coding method for storing digital image data of an image which is a static image or dynamic image into a recording medium for transmitting data through a communication line.

Referring to the rejection of claim 2, (Park modified by Boon et al.) wherein the selecting of the scanning mode based on an intra prediction mode comprises:

selecting a horizontal scanning mode when the intra prediction mode is a vertical intra prediction mode; and selecting a vertical scanning mode when the intra prediction mode is a horizontal intra prediction mode. (See Boon et al., Figs. 27-29, Col. 42, lines 41-45)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Park's prediction encoder/decoder from an origin macroblock of an area of interest of a video frame modified with Boon et al.'s image predictive coding method for storing digital image data of an image which is a static image or dynamic image into a recording medium for transmitting data through a communication line. Motivation for such an implementation would enable pixel values to be adjacent to one another in a vertical direction for predicting intra-frame prediction in a small region. (See Boon et al., Col. 23, lines 26-40)

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COURTNEY FIELDS whose telephone number is

Art Unit: 2496

(571)272-3871. The examiner can normally be reached on Mon - Fri. 7:00 - 4:00 pm;
IFP.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Nalven can be reached on 571-272-3839. 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). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COURTNEY FIELDS/
Examiner, Art Unit 2496
January 24, 2015

/ANDREW NALVEN/
Supervisory Patent Examiner, Art Unit 2496

| | | | |
|-----------------------------------|---------------------------------------|---------------------------------------------------------|-------------|
| Notice of References Cited | Application/Control No. 13/975,251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. | |
| | Examiner COURTNEY FIELDS | Art Unit 2496 | Page 1 of 1 |

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| * | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | Classification |
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| * | A US-2006/0002466 | 01-2006 | Park, Gwang-hoon | 375/240.03 |
| * | B US-7,995,654 | 08-2011 | Boon et al. | 375/240.12 |
| | C US- | | | |
| | D US- | | | |
| | E US- | | | |
| | F US- | | | |
| | G US- | | | |
| | H US- | | | |
| | I US- | | | |
| | J US- | | | |
| | K US- | | | |
| | L US- | | | |
| | M US- | | | |

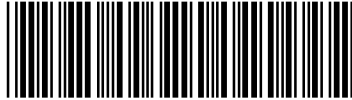
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| | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) | | | | |
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| | V | | | | |
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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| | | |
|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------|
| <i>Index of Claims</i>  | Application/Control No. 13975251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. |
| | Examiner COURTNEY FIELDS | Art Unit 2496 |

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|---|-----------------|
| ✓ | Rejected |
| = | Allowed |

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|---|-------------------|
| - | Cancelled |
| ÷ | Restricted |

| | |
|---|---------------------|
| N | Non-Elected |
| I | Interference |

| | |
|---|-----------------|
| A | Appeal |
| O | Objected |

Claims renumbered in the same order as presented by applicant
 CPA
 T.D.
 R.1.47

| CLAIM | | DATE | | | | | | | |
|-------|----------|------------|--|--|--|--|--|--|--|
| Final | Original | 01/24/2015 | | | | | | | |
| | 1 | ✓ | | | | | | | |
| | 2 | ✓ | | | | | | | |



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BIB DATA SHEET

Please amend the sheets drawings

CONFIRMATION NO. 9070

| SERIAL NUMBER | FILING or 371(c) DATE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---------------|--------------------------|-------|----------------|------------------------|
| 13/975,251 | 08/23/2013 | 375 | 2496 | 022090.0002C2 |
| | RULE | | | |

APPLICANTS

Industry-Academia Cooperation Group of Sejong University, Seoul, KOREA, REPUBLIC OF, Assignee (with 37 CFR 1.172 Interest);
 Kwangwoon University Research Institute for Industry Cooperation, Seoul, KOREA, REPUBLIC OF, Assignee (with 37 CFR 1.172 Interest);
 Electronics and Telecommunications Research Institute, Daejeon, KOREA, REPUBLIC OF, Assignee (with 37 CFR 1.172 Interest);

INVENTORS

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 Chang-Beom Ahn, Seoul, KOREA, REPUBLIC OF;
 Dae-Yeon Kim, Seoul, KOREA, REPUBLIC OF;
 Dong-Kyun Kim, Seoul, KOREA, REPUBLIC OF;

**** CONTINUING DATA *******

This application is a CON of 12/377,617 02/16/2009 PAT 8548060
 which is a 371 of PCT/KR07/01433 03/23/2007

**** FOREIGN APPLICATIONS *******

REPUBLIC OF KOREA 10-2006-0077851 08/17/2006
 REPUBLIC OF KOREA 10-2007-0008247 01/26/2007

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ****
 10/28/2013

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|----------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------|------------------------|---------------------|---------------------------|
| Foreign Priority claimed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Met after Allowance | STATE OR COUNTRY | SHEETS DRAWINGS | TOTAL CLAIMS | INDEPENDENT CLAIMS |
| 35 USC 119(a-d) conditions met <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | | | | | |
| Verified and /COURTNEY D FIELDS/ Acknowledged Examiner's Signature | Initials | KOREA, REPUBLIC OF | 6 | 2 | 1 |

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NSIP LAW
 P.O. Box 65745
 Washington, DC 20035

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|----------------------------------------------------------------------------------------------------------|---|----|--------------------------|--------------------------------|--|
| Substitute for form 1449/PTO | | | Complete if Known | | |
| | | | Application Number | 13/975,251 | |
| INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i> | | | Filing Date | August 23, 2013 | |
| | | | First Named Inventor | Se-Yoon Jeong et al. | |
| | | | Art Unit | 2499 2496 | |
| | | | Examiner Name | Unassigned C.Fields | |
| | | | Attorney Docket Number | 022090.0002C2 | |
| Sheet | 1 | of | 3 | | |

| U.S. PATENT DOCUMENTS | | | | | |
|-----------------------|-----------------------|--------------------------------------------|----------------------------|-------------------------------------------------|---------------------------------------------------------------------------|
| Examiner Initials* | Cite No. ¹ | Document Number | Patent or Publication Date | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
| | | Number - Kind Code ² (if known) | MM-DD-YYYY | | |
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| | | 2006/0002466 A1 | 01-05-2006 | Park | |
| | | 2007/0274385 A1 | 11-29-2007 | He | |

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| Examiner Initials* | Cite No. ¹ | Foreign Patent Document | | Publication Date | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T ⁶ |
| | | Country Code ³ - Number ⁴ - Kind Code ⁵ (if known) | MM-DD-YYYY | | | | |
| | | EP 0 230 632 A2 | | 08-05-1987 | Nishizawa | | |

| | | | |
|--------------------|-------------------|-----------------|------------|
| Examiner Signature | /Courtney Fields/ | Date Considered | 01/24/2015 |
|--------------------|-------------------|-----------------|------------|

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| Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i> | | | Complete if Known | | | |
| | | | Application Number | 13/975,251 | | |
| | | | Filing Date | August 23, 2013 | | |
| | | | First Named Inventor | Se-Yoon Jeong et al. | | |
| | | | Art Unit | 2409 2496 | | |
| | | | Examiner Name | Unassigned C.Fields | | |
| Sheet | 2 | of | 3 | Attorney Docket Number | 022090.0002C2 | |

| FOREIGN PATENT DOCUMENTS | | | | | | | |
|--------------------------|-----------------------|-------------------------------------------------------------------------------------|--|--------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------|----------------|
| Examiner Initials* | Cite No. ¹ | Foreign Patent Document | | 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 |
| | | Country Code ³ - Number ⁴ - Kind Code ⁵ (if known) | | | | | |
| | | EP 2 207 359 A2 | | 07-14-2010 | Ding | | |
| | | JP 2003-6643 A | | 01-10-2003 | Fukuda | | X |
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| NON-PATENT LITERATURE DOCUMENTS | | | | | | |
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| Examiner Initials* | Cite No. ¹ | Include name of the author, 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 ⁶ |
| | | | | D.-k. Kim et al., "Adaptive Scanning Using Pixel Similarity for H.264/AVC," <i>Proceedings of the 2006 Korean Signal Processing Conference</i> , Vol. 19, No. 1, pp. 1-4, September 23, 2006, Hanyang University Ansan Campus, Ansan, Republic of Korea (in Korean, including English abstract). | | |
| | | International Search Report and Written Opinion of the International Searching Authority issued on June 29, 2007, in counterpart International Application No. PCT/KR2007/001433. | | | | |
| | | H. Zrida et al., "High Level H.264/AVC Video Encoder Parallelization for Multiprocessor Implementation"; <i>Proceedings of the 2009 Design, Automation & Test in Europe Conference & Exhibition (DATE '09)</i> , pp. 940-945, conference held April 20-24, 2009, Nice, France, ISBN 978-3-9810801-5-5. | | | | |

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| Examiner Signature | /Courtney Fields/ | Date Considered | 01/24/2015 |
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| Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i> | | | | Complete if Known | | |
| | | | | Application Number | 13/975,251 | |
| | | | | Filing Date | August 23, 2013 | |
| | | | | First Named Inventor | Se-Yoon Jeong et al. | |
| | | | | Art Unit | 2490 2496 | |
| Examiner Name | Unassigned C.Fields | | | | | |
| Sheet | 3 | of | 3 | Attorney Docket Number | 022090.0002C2 | |

| U.S. PATENT APPLICATIONS | | | | | |
|--------------------------|----------|-----------------|------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Examiner Initials* | Cite No. | Application No. | Filing Date MM-DD-YYYY | Applicant | Assignee |
| | | 13/975,213 | 08-23-2013 | Se-Yoon Jeong et al. | Electronics and Telecommunications Research Institute Kwangwoon University Research Institute for Industry Cooperation Industry-Academia Cooperation Group of Sejong University |

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Rate-constrained coder control and comparison of video coding standards
 T Wiegand, H Schwarz, A Joch, F Kuesentel - Circuits and Systems for Video Coding, 2003
 ... at quarter-pixel locations are generated by averaging samples at the integer- and half-pixel positions ... Similar to MPEG-2, a frame of interlaced video can be coded as a single frame ... 2/4. Let the image sequence be partitioned into distinct blocks and the associated pixels be given ...

Overview of the H. 264/AVC video coding standard
 T Wiegand, GJ Sullivan, G Bjontegaard, A Luthra - Circuits and Systems for Video Coding, 2003
 ... is partitioned into macroblocks and is coded in a manner very similar to a ... motion compensation utilizes reference fields rather than reference frames, • the zig-zag scan of transform ... within an MBAFF frame, the methods that are used for zig-zag scanning, prediction of motion ...

The H. 264/AVC advanced video coding standard: Overview and introduction to the fidelity range extensions
 GJ Sullivan, FN Topiwala, A Luthra - Optical Science and Technology, the SPIE 48th Annual Meeting, 2004
 ... 8x8 block transformation matrix T4x4 or T8x8 is applied to every block of pixels, as given ... a secondary Hadamard transform using the H4x4 matrix shown below (note the basic similarity of T4x4 ... a serial engine that can be very compute intensive, especially for high pixel and data ...

Improved H. 264 intra coding based on bi-directional intra prediction, directional transform, and adaptive coefficient scanning
 Y Ye, M Karczewicz - Image Processing, 2008. ICIP 2008. 15th IEEE International Conference on, 2008
 ... Similar to TM, DIP uses motion search to find matching blocks in the already coded areas ... In general, higher weight is given to the prediction pixel that is closer to the current ... neighboring pixels that are farther apart, hence maximally improving prediction for more pixels within the ...

Video coding with H. 264/AVC: tools, performance, and complexity
 J Ostermann, J Bormans, P List, D Marpe - Circuits and Systems for Video Coding, 2004
 ... 3.3 Transform Coding Similar to former standards transform coding is applied in order to code the prediction error ... equal to 1, so-called trailing 1's (T1), is observed at the end of the scan ... and step, sign and level value of significant coefficients are encoded by scanning the list of ...

Overview of H. 264/MPEG-4 part 10
 S Kwon, A Tamhankar, KH Rao - Journal of Visual Communication and Image Processing, 2006
 ... Baseline Profile is limited to progressive scan. ... The 4 prediction modes for all of these cases are very similar to the 16 x 16 luma prediction modes, except that the order of mode numbers is ... 16 x 16, 16 x 8, 8 x 16 or 8 x 8, also four cases: 8 x 8, 8 x 4, 4 x 8 or 4 x 4 for 8 x 8 mode. ...

Apparatus for encoding and decoding image using adaptive dot ...
 www.google.com/patents/US20070234463
 App. - Filed Mar 23, 2007 - Published Nov 11, 2010 - Se-Yoon Jeong - Se-Yoon Jeong
 An encoding apparatus using a Discrete Cosine Transform (DCT) scanning, comprising: a mode selection means for selecting an optimal mode for intraprediction; ... a scanning mode decided based on pixel similarity of the residual coefficients. ... an entropy decoding means for performing entropy decoding onto encoded ...

Mode dependent scanning of coefficients of a block of video data
 www.google.com/patents/WO2012087715A1?cl=en
 App. - Filed Dec 14, 2011 - Published Jun 28, 2012 - Muhammed Zayed Osman - Qualcomm Incorporated
 selecting a scan order for the coefficients based on an intra coding mode used ... generating the syntax element to identify the selected scan order from the set of top ... scanning of the quantized transform coefficients, and entropy coding may ... or a decoder for subsequent use in the prediction of subsequent image data.

Differential Pixel Value Coding for HEVC Lossless ... in Tech
 http://www.intechopen.com/download/pdf/81763
 Jan 28, 2013 - coding, the residual data is not quantized transform coefficients but ... mode dependent differential pixel scanning and entropy coding using ... er and the decoder. ... Depending on the current sample location and the selected prediction an- ... In HEVC Intra coding, mode dependent coefficient scanning (MDSC) [14] is used.

Current Video Coding Standards - The University of Texas at Arlington
 http://www.uta.edu/faculty/krao/dip/Courses/standardsreviewN4b.docx

Application US20140037000

App enc dec usin dct c scar on p simi met

Inventors: Se-Yoon Jeong, Hae-Chul Cho, Beo, Seung-Hwon Beack, In-Seon Jang, Ji-Hyung Ae Moon, Goo-Young Jang, Joo-Woong Kim, Yung-Lyul Lee, Dong-Gyu Sim, Ch, Chang-Beom Ahn, Dae-Yeon Kim, Goo

Assignees: Electronics And Telecommunications Research Institute, Industry-Academia Coc Group Of Sejong University, Kwangwoon U, Research Institute For Industry Cooperatio

Publication number: US20140037000

Application number: 13/373,251

Filing date: Aug 23, 2013

Jul 5, 2010 - Residual image data is that which is obtained through taking the pixel by pixel ... One mode is selected from a total of 9 prediction modes for each 4 × 4 (similar to Fig. ... The coefficients after quantization are encoded by entropy coding for final bit ... intra prediction, directional transform, and adaptive coefficient scanning.' ...

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| L9 | 26 | "2006002466" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2015/01/24 23:12 |
| L8 | 53 | "entropy decoding" and "encoded video" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" and "pixel values" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| L7 | 72 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" and "pixel values" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| L6 | 73 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" and "horizontal scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| L5 | 78 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:39 |
| L4 | 80 | "entropy decoding" and "video" and "encoding" and "coefficients" and "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:38 |
| L3 | 4305 | "entropy decoding" and "video" and "encoding" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:38 |
| L2 | 4 | (H04N19/00218 and H04N19/159 | US-PGPUB; | OR | ON | 2015/01/24 |

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| | | and H04N19/136 and H04N19/61 and H04N19/129 and H04N19/103 and H04N19/11 and H04N19/176).CPC. and "entropy decoding" and "video" and "encoding" | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 22:37 |
| L1 | 24 | (H04N19/00218 and H04N19/159 and H04N19/136 and H04N19/61 and H04N19/129 and H04N19/103 and H04N19/11 and H04N19/176).CPC. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/01/24 22:33 |
| S170 | 105 | 375/240.2.ccls. and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:08 |
| S169 | 291 | 375/240.2.ccls. and "entropy" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:08 |
| S168 | 1000 | 375/240.2.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:07 |
| S167 | 0 | 375/240.20.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:07 |
| S166 | 0 | 375/240.200.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:06 |
| S165 | 0 | 375/240.2.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 14:06 |
| S164 | 0 | 375/240.200.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | OFF | 2013/05/13 14:06 |

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| | | | IBM_TDB | | | |
| S163 | 4 | "20070274385" "20050074062" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 13:09 |
| S162 | 0 | 382/247.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:39 |
| S161 | 0 | 375/240.03.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:39 |
| S160 | 2 | 375/240.16.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S159 | 0 | 375/240.27.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S158 | 3 | 375/240.24.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S157 | 6 | 375/240.12.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S156 | 0 | 375/240.20.ccls. and "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:38 |
| S146 | 24 | encoder and decoder and "intra prediction" and "entropy" | EPO; JPO; DERWENT | OR | OFF | 2013/05/13 12:21 |
| S145 | 152 | encoder and decoder and "intra | EPO; JPO; | OR | OFF | 2013/05/13 |

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| | | prediction" | DERWENT | | | 12:18 |
| S144 | 1 | S139 and S143 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:17 |
| S143 | 1 | "video recovery" and "scanning mode" and "decoded" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:17 |
| S142 | 0 | "video recovery" near5 "scanning mode" near5 "decoded" near5 "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:16 |
| S141 | 1 | "video recovery" near5 "scanning mode" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:15 |
| S140 | 3134865 | "video recovery" near5 scanning mode | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:14 |
| S139 | 3 | "entropy encoding" same "optimal" same "intra prediction" same "coefficients" same scan\$4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:11 |
| S138 | 8 | "entropy encoding" same "optimal" same "intra prediction" same "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:09 |
| S137 | 13 | "entropy encoding" same "optimal" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2013/05/13 12:07 |
| S136 | 4 | "entropy encoding" near5 "zigzag" same "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; | OR | OFF | 2012/11/07 19:41 |

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| | | | JPO; DERWENT; IBM_TDB | | | |
| S135 | 29 | "entropy encoding" near5 "zigzag" and "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:41 |
| S134 | 0 | "entropy encoding" near5 "zigzag" near5 "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:41 |
| S133 | 41 | "entropy encoding" near5 "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S132 | 75 | "entropy encoding" with "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S131 | 152 | "entropy encoding" same "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:40 |
| S130 | 5 | "mode selection" with "intra prediction" with "DCT" with "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:14 |
| S129 | 138 | "mode selection" and "intra prediction" and "DCT" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:14 |
| S128 | 1 | S97 and "plane" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 19:07 |
| S127 | 1 | S97 and "direct current" | US-PGPUB; USPAT; | OR | OFF | 2012/11/07 18:52 |

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| | | | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S126 | 6 | S97 and "pixels" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S125 | 8 | S97 and "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S124 | 0 | S97 and "pixel prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:44 |
| S123 | 3 | "20050157797" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:41 |
| S122 | 1 | "video recovery" same "entropy decoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:37 |
| S121 | 1 | "video recovery" with "entropy decoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:37 |
| S120 | 4 | "video recovery" and "decoding" and "entropy" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:33 |
| S119 | 0 | S97 and "recover" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:33 |

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| S118 | 0 | S97 and "recovering" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:33 |
| S117 | 0 | S97 and "video recovery" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:32 |
| S116 | 4 | S97 and (multipl\$7) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:31 |
| S115 | 1 | S97 and "dispersion" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:30 |
| S114 | 3 | S97 and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:14 |
| S113 | 0 | S97 and "zig zag" and "intra prediction" and "video" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S112 | 0 | S97 and "zig zag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S111 | 1 | S97 and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S110 | 0 | S97 and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | OFF | 2012/11/07 18:13 |

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| | | "scanning" and "residual signals" and (multipl\$7) and "dispersion" | DERWENT; IBM_TDB | | | |
| S109 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" and (multipl\$7) and "dispersion" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:13 |
| S108 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" and (multipl\$7) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:12 |
| S107 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual signals" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S106 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" and "residual" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S105 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" and "horizontal" and "vertical" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S104 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" and "coefficients" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |
| S103 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" and "DCT" and "quantization" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:11 |

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| S102 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S101 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" and "video" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S100 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S99 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S98 | 14 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. and "zig zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 18:10 |
| S97 | 16 | "8107532".pn. "7817718".pn. "7995654".pn. "7933334".pn. "7822119".pn. "8238426".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:59 |
| S96 | 4 | encod\$3 with "9 prediction modes" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:58 |
| S95 | 0 | encod\$3 with "intra prediction" with "DCT" with "quantization" with "9 prediction modes" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:58 |
| S94 | 0 | encod\$3 with "intra prediction" with "DCT" with "quantization" with "9 prediction modes" with (entropy encod\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | OFF | 2012/11/07 17:57 |

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| | | | DERWENT; IBM_TDB | | | |
| S93 | 7 | encod\$3 with "intra prediction" with "DCT" with "quantization" with scan\$4 with (entropy encod\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S92 | 7 | encod\$3 with "intra prediction" with "DCT" with "quantization" with scan\$4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S91 | 50 | encod\$3 with "intra prediction" with "DCT" with "quantization" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S90 | 112 | encod\$3 with "intra prediction" with "DCT" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S89 | 1984 | encod\$3 with "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:54 |
| S88 | 2 | "8199819".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/07 17:33 |
| S87 | 5 | "20030081850" "4821119".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/11/06 15:18 |
| S86 | 23 | "vertical scanning" and "entropy encoding" and "horizontal" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S85 | 23 | "vertical scanning" and "entropy encoding" and "horizontal" and "zigzag" | US-PGPUB; USPAT; USOCR; | OR | OFF | 2012/08/16 16:51 |

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| | | | FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S84 | 44 | "vertical scanning" and "entropy encoding" and "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S83 | 46 | "vertical scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S82 | 0 | "vertical scanning" near "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:51 |
| S81 | 1 | "vertical scanning" near5 "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:50 |
| S80 | 9 | "vertical scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:50 |
| S79 | 22 | "coefficient scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:47 |
| S78 | 77 | "coefficient scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:47 |
| S77 | 159 | "horizontal" and "vertical" and "entropy encoding" and "zig-zag" and "scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:46 |
| S76 | 10 | "horizontal scan" and "vertical scan" | US-PGPUB; | OR | OFF | 2012/08/16 |

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| | | and "entropy encoding" and "zig-zag" | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 16:46 |
| S75 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:46 |
| S74 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "zigzag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:45 |
| S73 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" and "residual" and "high" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:44 |
| S72 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" and "residual" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:44 |
| S71 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S70 | 0 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" and "residual signal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S69 | 21 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" and "zig-zag" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S68 | 33 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | OFF | 2012/08/16 16:43 |

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| | | | IBM_TDB | | | |
| S67 | 0 | "horizontal scanning" and "vertical scanning" and "entropy encoding" and "intraframe prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S66 | 39 | "horizontal scanning" and "vertical scanning" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:43 |
| S65 | 8 | "horizontal scanning" same "vertical scanning" same "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:41 |
| S64 | 8607 | "horizontal scanning" same "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:41 |
| S63 | 10754 | "horizontal scanning" and "vertical scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/16 16:40 |
| S62 | 14 | "horizontal directional" and "vertical" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:43 |
| S61 | 1 | "horizontal-directional" and "vertical" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:43 |
| S60 | 1 | "horizontal-directional" same "vertical" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:43 |
| S59 | 1 | "horizontal-directional" same "vertical" intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; | OR | OFF | 2012/08/15 16:42 |

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| | | | JPO; DERWENT; IBM_TDB | | | |
| S58 | 1 | "horizontal-directional scanning" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:42 |
| S57 | 9 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "vertical" and "horizontal" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:36 |
| S56 | 0 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "selected mode" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:34 |
| S55 | 2 | "difference values" same "DCT" same "quantization" same "intra" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:32 |
| S54 | 2 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" and "entropy encoding" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:31 |
| S53 | 15 | "difference values" same "DCT" same "quantization" same "intra" and "prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S52 | 17 | "difference values" same "DCT" same "quantization" same "intra" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S51 | 1 | "difference values" same "DCT" same "quantization" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:30 |
| S50 | 0 | "difference values" same "DCT" same "quantization" same "intraprediction" | US-PGPUB; USPAT; | OR | OFF | 2012/08/15 16:30 |

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| | | | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S49 | 51 | "difference values" same "DCT" same "quantization" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:29 |
| S48 | 5 | "scanning mode" and "difference values" and "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:24 |
| S47 | 0 | "scanning mode" same "difference values" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/08/15 16:24 |
| S46 | 1 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.27.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S45 | 5 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.12.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S44 | 1 | "DCT coefficient" near5 "scanning" near5 "pixel" and 375/240.24.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S43 | 5 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) and 375/240.12 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:45 |
| S42 | 5 | "DCT coefficient" near5 "scanning" near5 "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:40 |

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| S41 | 52 | "DCT coefficient" same "scanning" same "pixel" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:40 |
| S40 | 12 | "DCT" same "scan" same "intra prediction" same "video" same (encod\$3 or encipher\$3 or encrypt\$3) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S39 | 14 | "DCT" same "scan" same "intra prediction" same "video" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S38 | 19 | "DCT" same "scan" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S37 | 0 | "DCT scan" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S36 | 0 | "discrete cosine transform scanning" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:35 |
| S35 | 0 | "DCT scanning" same "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S34 | 0 | "DCT scanning" same "intra-prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S33 | 2 | "DCT scanning" same "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | OFF | 2012/03/18 13:34 |

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| | | | DERWENT; IBM_TDB | | | |
| S32 | 0 | "DCT scanning" same "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:34 |
| S31 | 4 | (discrete cosine transform or (DCT)) near (scan\$4) same "intra- prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S30 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intra-prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S29 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intraprediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S28 | 0 | (discrete cosine transform or (DCT)) near (scan\$4) near "intra prediction" | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S27 | 1173383 | (discrete cosine transform) or (DCT) near (scan\$4) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:32 |
| S26 | 2299 | (discrete cosine transform or (DCT)) near (scan\$4) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:31 |
| S25 | 11577 | (discrete cosine transform or (DCT)) near5 (scan\$4) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:31 |
| S24 | 23869 | (discrete cosine transform or (DCT)) same "scanning" | US-PGPUB; USPAT; USOCR; | OR | OFF | 2012/03/18 13:31 |


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| | | | FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |
| S23 | 900 | 375/240.2.ccls. and (discrete cosine transform or (DCT)) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:30 |
| S22 | 0 | 375/240.200.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:30 |
| S21 | 921 | 375/240.2.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:30 |
| S20 | 0 | 375/240.20.ccls. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S19 | 0 | S17 and S18 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S18 | 7919 | electronics and telecommunications.asn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S17 | 2 | S1 and S2 and S3 and S4 and S5 and S6 and S7 and S8 and S9 and S10 and S11 and S12 and S13 and S14 and S15 and S16 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:29 |
| S16 | 79 | dong-kyun.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S15 | 55 | dae-yeon.in. and kim.in. | US-PGPUB; | OR | OFF | 2012/03/18 |

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| S14 | 18 | chang-beom.in. and ahn.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S13 | 19 | seoung-jun.in. and oh.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:28 |
| S12 | 32 | dong-gyu.in. and sim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S11 | 141 | yung-lyul.in. and lee.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S10 | 204 | jin-woong.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:27 |
| S9 | 580 | jin-woo.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S8 | 52 | dae-young.in. and jang.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S7 | 15 | kyung-ae.in. and moon.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | OFF | 2012/03/18 13:26 |

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| S6 | 115 | jae-gon.in. and kim.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S5 | 21 | in-seon.in. and jang.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:26 |
| S4 | 23 | seung-kwon.in. and beack.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S3 | 64 | jeong-il.in. and seo.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S2 | 33 | hae-chul.in. and choi.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |
| S1 | 27 | se-yoon.in. and jeong.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2012/03/18 13:25 |

1/ 24/ 2015 11:17:10 PM

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adaptive DCT coefficient scanning continuation.wsp

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|--------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------|
| Search Notes  | Application/Control No. 13975251 | Applicant(s)/Patent Under Reexamination JEONG ET AL. |
| | Examiner COURTNEY FIELDS | Art Unit 2496 |

| CPC- SEARCHED | | |
|----------------------|-------------|-----------------|
| Symbol | Date | Examiner |
| H04N 19/00218 | 01/24/2015 | CDF |
| H04N 19/159 | 01/24/2015 | CDF |
| H04N 19/136 | 01/24/2015 | CDF |
| H04N 19/61 | 01/24/2015 | CDF |
| H04N 19/129 | 01/24/2015 | CDF |
| H04N 19/103 | 01/24/2015 | CDF |
| H04N 19/11 | 01/24/2015 | CDF |
| H04N 19/176 | 01/24/2015 | CDF |

| CPC COMBINATION SETS - SEARCHED | | |
|----------------------------------------|-------------|-----------------|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|-----------------------------------|-----------------|-------------|-----------------|
| Class | Subclass | Date | Examiner |
| | | | |

| SEARCH NOTES | | |
|-----------------------------------------------------|-------------|-----------------|
| Search Notes | Date | Examiner |
| EAST Search (USPAT, PG-PUB, DERWENT, IBM, EPO, JPO) | 01/24/2015 | CDF |
| Assignee Search | 01/24/2015 | CDF |
| Inventorship/Double Patenting Search | 01/24/2015 | CDF |
| NPL Search (Google Patent) | 01/24/2015 | CDF |

| INTERFERENCE SEARCH | | | |
|---------------------------------|--------------------------------|-------------|-----------------|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 13/975,251 | 08/23/2013 | Se-Yoon Jeong | 022090.0002C2 |

CONFIRMATION NO. 9070

POA ACCEPTANCE LETTER

89980
NSIP LAW
P.O. Box 65745
Washington, DC 20035



Date Mailed: 08/07/2014

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/01/2014.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/agizaw/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the accompanying transmittal letter (form PTO/AIA/15, PTO/AIA/16, PTO/AIA/18, PTO/AIA/19, PTO/SB/29, PTO/AIA/50, PTO/AIA/82A, or equivalent).


I hereby appoint the practitioners of NSIP Law associated with the following Customer Number as my attorneys or agents to transact all business in the United States Patent and Trademark Office connected with the application identified in the accompanying transmittal letter:

89980

Please recognize the address of NSIP Law associated with the following Customer Number as the correspondence address for the application identified in the accompanying transmittal letter:

89980

I, the below-named Assignee, am the original Applicant (if there is only one Applicant) or an original Applicant (if there is more than one Applicant) of the application identified in the accompanying transmittal letter.

| | | | |
|---------------------|-------------------------------------------------------------------------------------|------|---------------|
| Name of Assignee | Industry-Academia Cooperation Group of Sejong University | | |
| Address of Assignee | 209, Neungdong-ro, Gwangjin-gu, Seoul 143-747, Republic of Korea | | |
| Signature |  | Date | July 28, 2014 |
| Name | Sun-Jae Kim | | |
| Title | President | | |

Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 19753924 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Randall Scott Svihla/Jessica LaBossiere |
| Filer Authorized By: | Randall Scott Svihla |
| Attorney Docket Number: | 022090.0002C2 |
| Receipt Date: | 01-AUG-2014 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 14:46:55 |
| 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 | Applicant Response to Pre-Exam Formalities Notice | IN20140106_0220900002C2_ResponseToInformationalNoticeAsFiled.pdf | 12487 <small>62de909c44718be6dbfe9d23b7cb60c1bff108a4</small> | no | 1 |

Warnings:

Information: United States Patent and Trademark Office Patents, LLC v. Elects. & Telecomm. Res. Inst., et. al.

Ex. 1005, p.225

| | | | | | |
|-------------------------------------|---------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------|----|---|
| 2 | Oath or Declaration filed | IN20140106_0220900002C2_D EExecuted.pdf | 114672 6e10e250af4b62de19b391b7732bbe69218 b445d | no | 4 |
| Warnings: | | | | | |
| Information: | | | | | |
| 3 | Power of Attorney | IN20140106_0220900002C2_P OA_byApplicant_ETRI.pdf | 65088 7774fc8938f91b37288ae1db203db3feca8c 6a40 | no | 1 |
| Warnings: | | | | | |
| Information: | | | | | |
| 4 | Power of Attorney | IN20140106_0220900002C2_P OA_byApplicant_Kwangwoon UnivResearchInstForIndCoop. pdf | 39959 0bf3477ad06ae79ff856fb8ab1717401e48f8 18e | no | 1 |
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| Information: | | | | | |
| 5 | Power of Attorney | IN20140106_0220900002C2_P OA_byApplicant_Ind- AcadCoopGroupSejongUniv. pdf | 30494 e5a99b88a9b8b499996042261397a1336f4 992d3 | no | 1 |
| Warnings: | | | | | |
| Information: | | | | | |
| Total Files Size (in bytes): | | | 262700 | | |

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 PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Application No. 13/975,251

Art Unit: 2496

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Courtney D. Fields

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

RESPONSE TO INFORMATIONAL NOTICE TO APPLICANT

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Informational Notice to Applicant mailed January 6, 2014, which does not set a period for response and requires a properly executed declaration for the inventors listed in the Notice. A properly executed declaration for those inventors is attached hereto.

Also attached hereto are Powers of Attorney by Applicant for the three applicants.

Respectfully submitted,

Date: August 1, 2014

/Randall S. Svihla/
Randall S. Svihla
Registration No. 56,273

NSIP Law
P.O. Box 65745
Washington, DC 20035
Telephone (202) 429-0020
Facsimile (202) 315-3758
CYP/RSS

Attachments

DECLARATION UNDER 37 CFR 1.63

As a below-named inventor, I hereby declare that this declaration is directed to United States Application Number 13/975,251 filed on August 23, 2013, entitled:

APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREOF

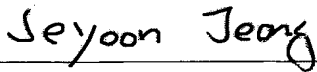
The above-identified application was made or authorized to be made by me.


I believe I am the original inventor or an original joint inventor of a claimed invention in the above-identified application.

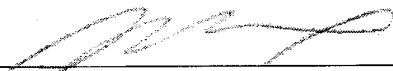
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 USC 1001 by fine or imprisonment of not more than five (5) years, or both.

I have reviewed and understand the contents of the above-identified application, including the claims.

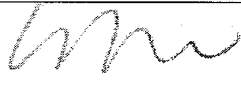
I am aware of the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information that became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.


| | | | |
|---------------------------|--------------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Se-Yoon Jeong | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Daejeon, Republic of Korea | | |
| Mailing Address | 101-1203 Geumseong Baekjo Apt., Birae-dong, Daedeok-gu, Daejeon 306-769, Republic of Korea | | |


| | | | |
|---------------------------|-------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Hae-Chul Choi | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Daejeon, Republic of Korea | | |
| Mailing Address | 105-904 Yangji Maeul, Banseok-dong, Yuseong-gu, Daejeon 305-150, Republic of Korea | | |


| | | | |
|---------------------------|-------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Jeong-Il Seo | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Daejeon, Republic of Korea | | |
| Mailing Address | 107-801 Sejong Apt., Jeonmin-dong, Yuseong-gu, Daejeon 305-728, Republic of Korea | | |

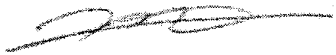
DECLARATION UNDER 37 CFR 1.63

| | | | |
|---------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Seung-Kwon Beack | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Seoul, Republic of Korea | | |
| Mailing Address | 957-13, Bangbae 2-dong, Seocho-gu, Seoul 137-062, Republic of Korea | | |


| | | | |
|---------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | In-Seon Jang | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Gunpo-si, Republic of Korea | | |
| Mailing Address | 202, 86-46, Sanbon-dong, Gunpo-si, Gyeonggi-do 435-040, Republic of Korea | | |

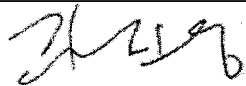
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|---------------------------|------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Jae-Gon Kim | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Daejeon, Republic of Korea | | |
| Mailing Address | 203-402 Saemmeori Apt., Dunsan-dong, Seo-gu, Daejeon 302-120, Republic of Korea | | |

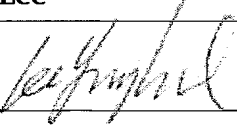
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|---------------------------|-------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Kyung-Ae Moon | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Daejeon, Republic of Korea | | |
| Mailing Address | 9-903 Hanmaru Apt., Dunsan-dong, Seo-gu, Daejeon 302-120, Republic of Korea | | |

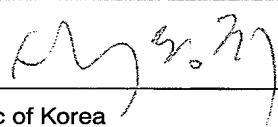
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|---------------------------|-------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Dae-Young Jang | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Daejeon, Republic of Korea | | |
| Mailing Address | 904-1701 Yeolmae Maeul, Noeun-dong, Yuseong-gu, Daejeon 305-768, Republic of Korea | | |

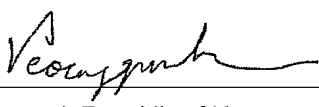
DECLARATION UNDER 37 CFR 1.63

| | | | |
|---------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Jin-Woo Hong | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Daejeon, Republic of Korea | | |
| Mailing Address | 130-702 Hanbit Apt., Eoeun-dong, Yuseong-gu, Daejeon 305-333, Republic of Korea | | |

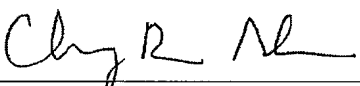
| | | | |
|---------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Jin-Woong Kim | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Daejeon, Republic of Korea | | |
| Mailing Address | 305-1603 Expo Apt., Jeonmin-dong, Yuseong-gu, Daejeon 305-761, Republic of Korea | | |


| | | | |
|---------------------------|------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Yung-Lyul Lee | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Seoul, Republic of Korea | | |
| Mailing Address | 1-704 Kukdong Apt., Garak-dong, Songpa-gu, Seoul 138-160, Republic of Korea | | |


| | | | |
|---------------------------|-------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Dong-Gyu Sim | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Seoul, Republic of Korea | | |
| Mailing Address | 31-607 Samho Apt., Wolgye-dong, Nowon-gu, Seoul 139-050, Republic of Korea | | |

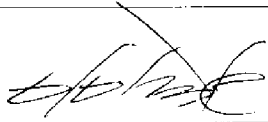
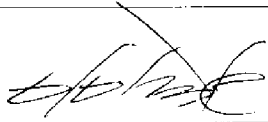
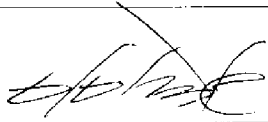
| | | | |
|---------------------------|--------------------------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Seoung-Jun Oh | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Seongnam-si, Republic of Korea | | |
| Mailing Address | 104-1902 I-Park, Jeongja 1-dong, Bundang-gu, Seongnam-si, Gyeonggi-do 463-010, Republic of Korea | | |

DECLARATION UNDER 37 CFR 1.63

| | | | |
|---------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Chang-Beom Ahn | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Seoul, Republic of Korea | | |
| Mailing Address | 109-501 Olympic Apt., 89, Bangi-dong, Songpa-gu, Seoul 138-050, Republic of Korea | | |

| | | | |
|---------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Dae-Yeon Kim | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Seoul, Republic of Korea | | |
| Mailing Address | 204-1203 Life Apt., Gongneung 3-dong, Nowon-gu, Seoul 139-243, Republic of Korea | | |

| | | | |
|---------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Inventor's Legal Name | Dong-Kyun Kim | | |
| Inventor's Signature |  | Date | July 28, 2014 |
| Residence (City, Country) | Seoul, Republic of Korea | | |
| Mailing Address | 106-412 Byeoksan Apt., Sanggye 5-dong, Nowon-gu, Seoul 139-748, Republic of Korea | | |

| POWER OF ATTORNEY BY APPLICANT | | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------|------------|
| I hereby revoke all previous powers of attorney given in the application identified in the accompanying transmittal letter (form PTO/AIA/15, PTO/AIA/16, PTO/AIA/18, PTO/AIA/19, PTO/SB/29, PTO/AIA/50, PTO/AIA/82A, or equivalent). | | | | |
| I hereby appoint the practitioners of NSIP Law associated with the following Customer Number as my attorneys or agents to transact all business in the United States Patent and Trademark Office connected with the application identified in the accompanying transmittal letter: 89980 | | | | |
| Please recognize the address of NSIP Law associated with the following Customer Number as the correspondence address for the application identified in the accompanying transmittal letter: 89980 | | | | |
| I, the below-named Assignee, am the original Applicant (if there is only one Applicant) or an original Applicant (if there is more than one Applicant) of the application identified in the accompanying transmittal letter. | | | | |
| Name of Assignee | Electronics and Telecommunications Research Institute | | | |
| Address of Assignee | 218, Gajeong-ro, Yuseong-gu, Daejeon 305-700 Republic of Korea | | | |
| Signature | <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">Date</td> <td style="text-align: center;">03-04-2014</td> </tr> </table> |  | Date | 03-04-2014 |
|  | Date | 03-04-2014 | | |
| Name | ICKCHAN LEE | | | |
| Title | Director Intellectual Property Management Team | | | |

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the accompanying transmittal letter (form PTO/AIA/15, PTO/AIA/16, PTO/AIA/18, PTO/AIA/19, PTO/SB/29, PTO/AIA/50, PTO/AIA/82A, or equivalent).

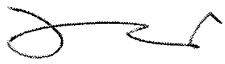
I hereby appoint the practitioners of NSIP Law associated with the following Customer Number as my attorneys or agents to transact all business in the United States Patent and Trademark Office connected with the application identified in the accompanying transmittal letter:

89980

Please recognize the address of NSIP Law associated with the following Customer Number as the correspondence address for the application identified in the accompanying transmittal letter:

89980

I, the below-named Assignee, am the original Applicant (if there is only one Applicant) or an original Applicant (if there is more than one Applicant) of the application identified in the accompanying transmittal letter.

| | | | |
|---------------------|-------------------------------------------------------------------------------------|------|----------------|
| Name of Assignee | Kwangwoon University Research Institute for Industry Cooperation | | |
| Address of Assignee | 447-1, Wolgye-dong, Nowon-gu, Seoul 139-701, Republic of Korea | | |
| Signature |  | Date | April 29, 2013 |
| Name | Jin Joo Choi | | |
| Title | President | | |

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Application No. 13/975,251

Art Unit: 2496

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Courtney D. Fields

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

SECOND PRELIMINARY AMENDMENT

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

Sir:

Prior to examination, and further to the Preliminary Remarks of August 23, 2013, and the Preliminary Amendment of October 1, 2013, please amend the above-identified application as follows.

The following amendments and remarks are respectfully submitted. Examination of the claims is respectfully requested.

Amendments to the drawings begin on page 2 of this paper.

Remarks begin on page 3 of this paper.

Six replacement sheets of drawings are attached following page 3 of this paper.

IN THE DRAWINGS:

Six replacement sheet of drawings containing FIGS. 1-11 are attached to this paper. No substantive changes have been made to FIGS. 1-11. The only changes are the deletion of the identifying material and the sheet numbers at the top of the new sheets of drawings containing FIGS. 1-11 filed on October 1, 2013, as discussed below in the remarks.

Please REPLACE the six new sheets of drawings containing FIGS. 1-11 filed on October 1, 2013, with the six replacement sheets of drawings containing FIGS. 1-11 attached hereto.

REMARKS

In accordance with the foregoing, FIGS. 1-11 have been amended. Claims 1 and 2 are pending, with claim 1 being independent.

New sheets of drawings containing FIGS. 1-11 were filed on October 1, 2013. As discussed on page 3 of the Preliminary Amendment of October 1, 2013, these new sheets of drawings are the drawings that were filed on February 16, 2009, in Application No. 12/377,617, the parent application of the present continuation application.

The new sheets of drawings filed on October 1, 2013, contain identifying material "WO 2008/020672" and "PCT/KR2007/001433" at the top of the sheets. This is the international publication number and the international application number of the international application of which the parent application is the U.S. national stage. The new sheets of drawings filed on October 1, 2013, also contain sheet numbers 1/6, 2/6, etc., at the top of the sheets. The identifying material and the sheet numbers have been deleted in the replacement drawings attached hereto. No substantive changes have been made to the drawings.

Conclusion

For at least the reasons discussed in on pages 2 and 3 of the Preliminary Remarks of August 23, 2013, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters that need to be addressed before the application can be allowed, it is respectfully requested that the Office telephone the undersigned attorney to discuss these matters before issuing an Office Action.

Respectfully submitted,

Date: August 1, 2014

/Randall S. Svihla/
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P.O. Box 65745
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Attachments

FIG. 1

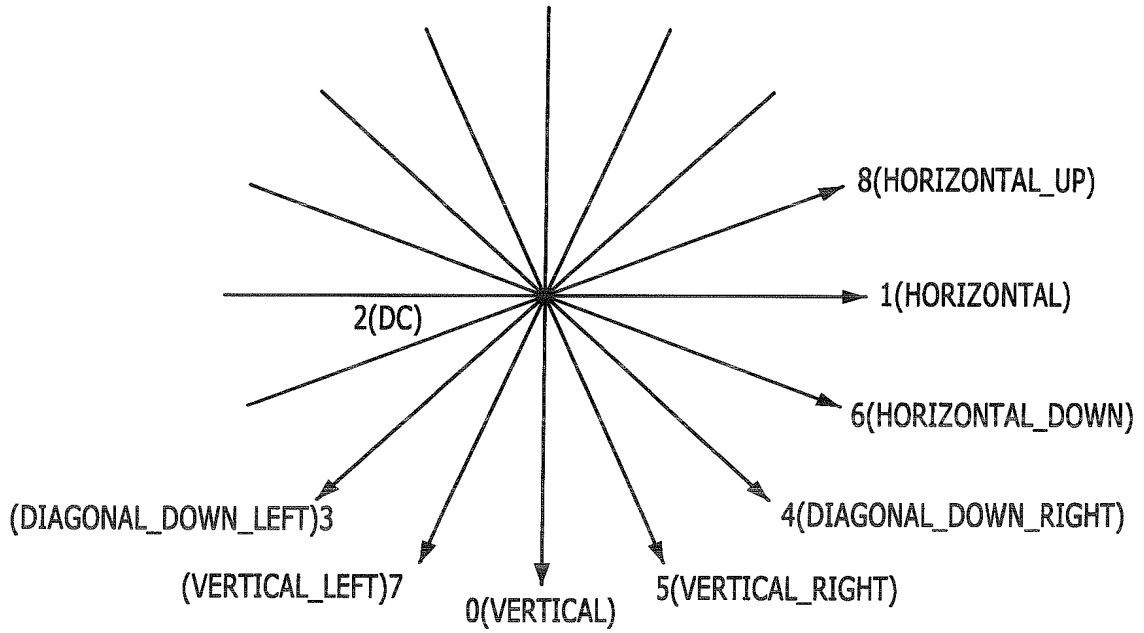


FIG. 2

| | | | | | | | | | |
|-----|---|---|---|---|---|-----|---|---|---|
| | X | A | B | C | D | E | F | G | H |
| 201 | I | a | b | c | d | 200 | | | |
| 202 | J | e | f | g | h | | | | |
| 203 | K | i | j | k | l | | | | |
| 204 | L | m | n | o | p | | | | |

Diagram illustrating a grid structure with rows and columns labeled with letters and numbers. The grid is divided into sections 201, 202, 203, and 204. A vertical arrow points downwards through the first column of the grid (A, e, i, m). A horizontal arrow points to the right from the first row of the grid (I, J, K, L).

FIG. 3

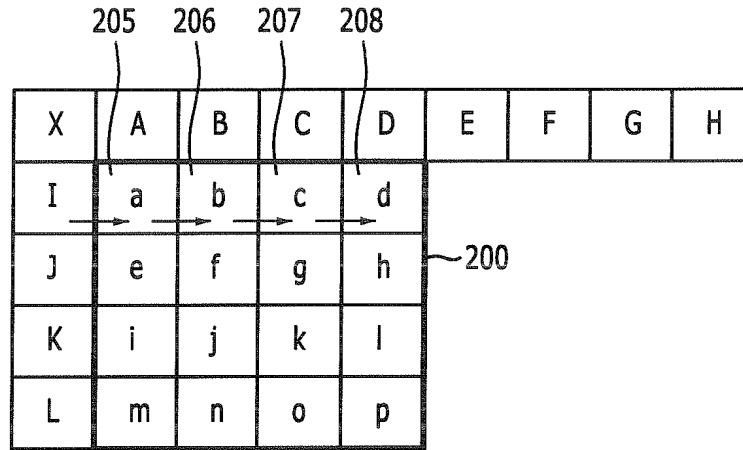


FIG. 4

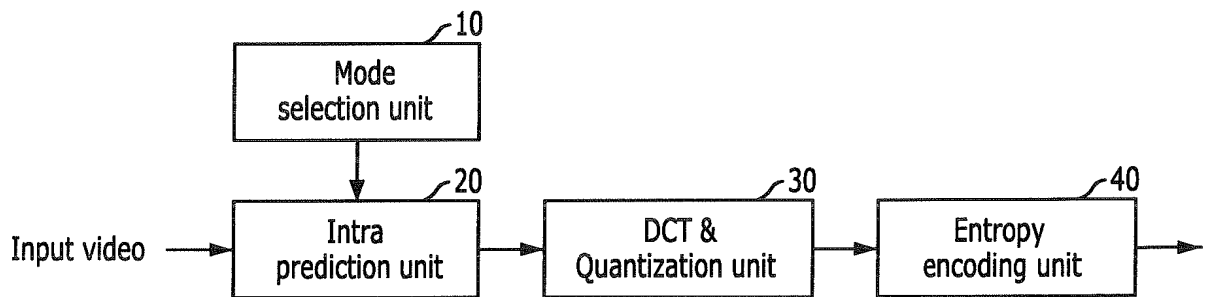


FIG. 5

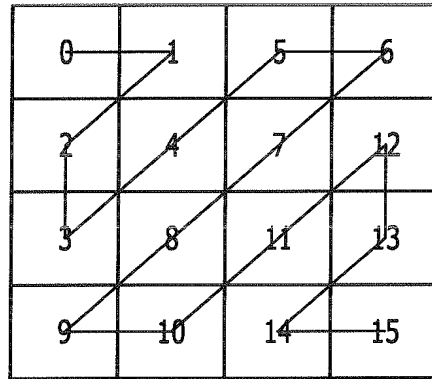


FIG. 6

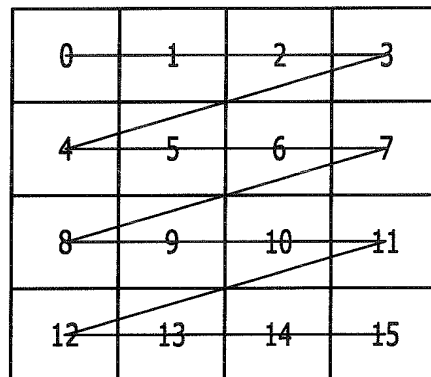


FIG. 7

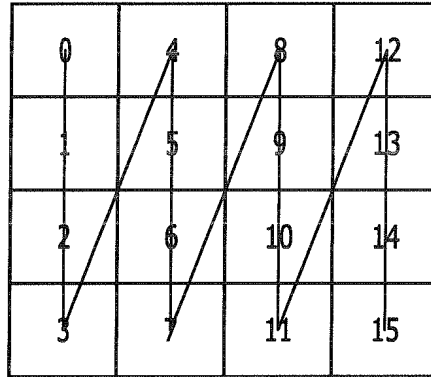


FIG. 8

| | | | | |
|---|---|---|---|---|
| | A | B | C | D |
| E | a | b | c | d |
| F | e | f | g | h |
| G | i | j | k | l |
| H | m | n | o | p |

FIG. 9

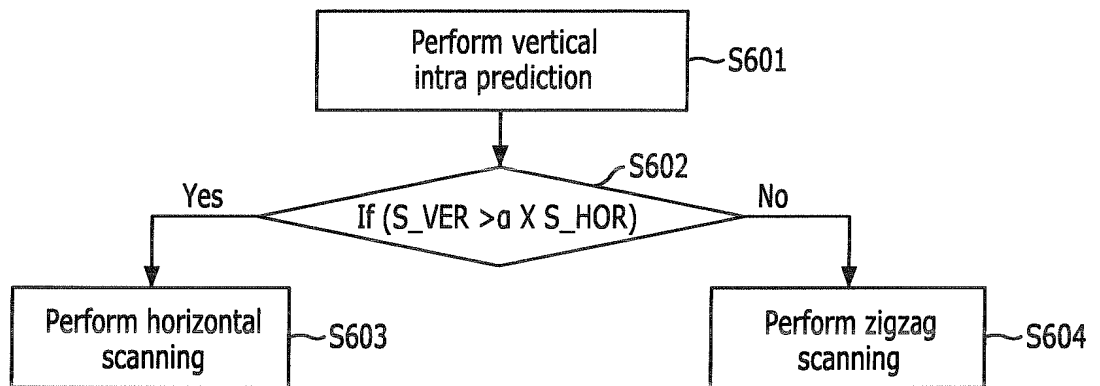


FIG. 10

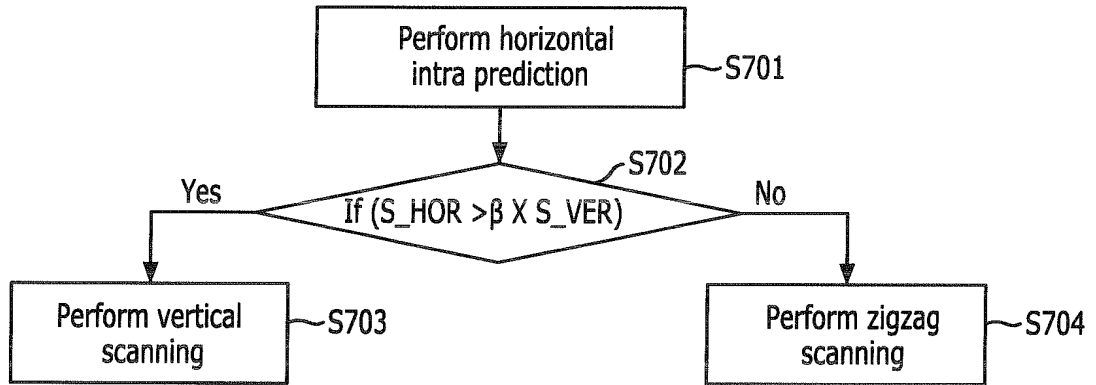
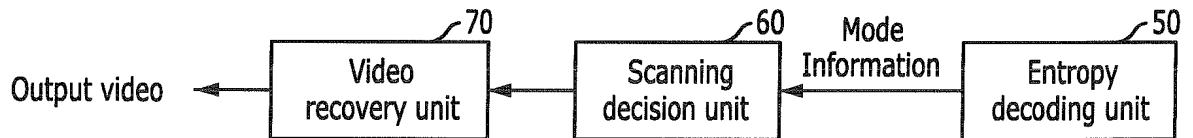


FIG. 11



Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 19758016 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Randall Scott Svihla |
| Filer Authorized By: | |
| Attorney Docket Number: | 022090.0002C2 |
| Receipt Date: | 01-AUG-2014 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 18:20:29 |
| Application Type: | Utility under 35 USC 111(a) |

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File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|-----------------------------------------------------|-------------------------------------------------------|------------------|------------------|
| 1 | | IN20140106_0220900002C2_S econdPreAmdAsFiled.pdf | 19017 0bdce34a543cf8a876b5efa05b3ff53c4f37e52e | yes | 4 |

| Multipart Description/PDF files in .zip description | | | |
|-----------------------------------------------------|--------------------------------------------------|-------|-----|
| | Document Description | Start | End |
| | Preliminary Amendment | 1 | 1 |
| | Applicant Arguments/Remarks Made in an Amendment | 2 | 4 |

Warnings:

Information:

| | | | | | |
|---|---------------------------------------------|--------------------------------------------------------|----------------------------------------------------|----|---|
| 2 | Drawings-only black and white line drawings | IN20140106_0220900002C2_ReplacementDrawingsAsFiled.pdf | 747339 2b3ddb4a2ff8e98031581a1a1f21dab181084bbf | no | 6 |
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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.

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| | | | |
|-----------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|---------------------------------------|
| PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875 | Application or Docket Number 13/975,251 | Filing Date 08/23/2013 | <input type="checkbox"/> To be Mailed |
|-----------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|---------------------------------------|

ENTITY: LARGE SMALL MICRO

APPLICATION AS FILED – PART I

| FOR | NUMBER FILED | NUMBER EXTRA | RATE (\$) | FEE (\$) |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|----------|
| <input type="checkbox"/> BASIC FEE <small>(37 CFR 1.16(a), (b), or (c))</small> | N/A | N/A | N/A | |
| <input type="checkbox"/> SEARCH FEE <small>(37 CFR 1.16(k), (l), or (m))</small> | N/A | N/A | N/A | |
| <input type="checkbox"/> EXAMINATION FEE <small>(37 CFR 1.16(o), (p), or (q))</small> | N/A | N/A | N/A | |
| TOTAL CLAIMS <small>(37 CFR 1.16(i))</small> | minus 20 = | * | X \$ = | |
| INDEPENDENT CLAIMS <small>(37 CFR 1.16(h))</small> | minus 3 = | * | X \$ = | |
| <input type="checkbox"/> APPLICATION SIZE FEE <small>(37 CFR 1.16(s))</small> | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 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). | | | |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT <small>(37 CFR 1.16(j))</small> | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

APPLICATION AS AMENDED – PART II

| | (Column 1) | (Column 2) | (Column 3) | PRESENT EXTRA | RATE (\$) | ADDITIONAL FEE (\$) |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|------------------------------------|---------------|-----------------|---------------------|
| AMENDMENT | 08/01/2014 | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | | | |
| | Total <small>(37 CFR 1.16(i))</small> | * 2 | Minus | ** 20 | = 0 | X \$40 = 0 |
| | Independent <small>(37 CFR 1.16(h))</small> | * 1 | Minus | ***3 | = 0 | X \$210 = 0 |
| | <input type="checkbox"/> Application Size Fee <small>(37 CFR 1.16(s))</small> | | | | | |
| <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small> | | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

| | (Column 1) | (Column 2) | (Column 3) | PRESENT EXTRA | RATE (\$) | ADDITIONAL FEE (\$) |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|------------------------------------|---------------|-----------------|---------------------|
| AMENDMENT | | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | | | |
| | Total <small>(37 CFR 1.16(i))</small> | * | Minus | ** | = | X \$ = |
| | Independent <small>(37 CFR 1.16(h))</small> | * | Minus | *** | = | X \$ = |
| | <input type="checkbox"/> Application Size Fee <small>(37 CFR 1.16(s))</small> | | | | | |
| <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small> | | | | | | |
| | | | | | 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.

LIE
/DEANNA RORIE/

This collection of information is required by 37 CFR 1.16. 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, 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.**

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www.uspto.gov

Table with 4 columns: APPLICATION NUMBER (13/975,251), FILING OR 371(C) DATE (08/23/2013), FIRST NAMED APPLICANT (Se-Yoon Jeong), ATTY. DOCKET NO./TITLE (022090.0002C2)

CONFIRMATION NO. 9070

PUBLICATION NOTICE

89980
NSIP LAW
P.O. Box 65745
Washington, DC 20035



Title: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR

Publication No. US-2014-0037000-A1

Publication Date: 02/06/2014

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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This is to certify that the following application annexed hereto
is a true copy from the records of the Korean Intellectual
Property Office

출원 번호 : 10-2006-0077851

Application Number

출원 년 월 일 : 2006년 08월 17일

Filing Date AUG. 17, 2006

출원인 : 한국전자통신연구원 외 2명

Applicant(s) Electronics and Telecommunications
Research Institute, et al.

2014년 01월 10일

특 허 청

COMMISSIONER



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| | |
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| 【수신처】 | 특허청장 |
| 【제출일자】 | 2006.08.17 |
| 【발명의 국문명칭】 | 화소 유사성에 따라 적응적인 D C T 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법 |
| 【발명의 영문명칭】 | Apparatus of encoding and decoding using adaptive scanning of DCT coefficients according to the pixel similarity, and it method |
| 【출원인】 | |
| 【명칭】 | 한국전자통신연구원 |
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| 【출원인코드】 | 2-2005-011470-2 |
| 【출원인】 | |
| 【명칭】 | 광운대학교 산학협력단 |
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| 【명칭】 | 특허법인 신성 |
| 【대리인코드】 | 9-2000-100004-8 |
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| 【포괄위임등록번호】 | 2000-051975-8 |
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【우편번호】 302-120
【주소】 대전 서구 둔산동 한마루아파트 9-903
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【발명자】
【성명】 홍진우
【성명의 영문표기】 HONG, Jin Woo
【주민등록번호】 590415-1XXXXXX
【우편번호】 305-333
【주소】 대전 유성구 어은동 한빛아파트 130-702
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【발명자】
【성명】 이영렬
【성명의 영문표기】 LEE, Yung Lyul
【주민등록번호】 611030-1XXXXXX
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【취지】 특허법 제42조의 규정에 의하여 위와 같이 출원합니다.

대리인

특허법인 신성 (인)

【수수료】

| | | |
|------------------|----------|----------|
| 【기본출원료】 | 0 면 | 38,000 원 |
| 【가산출원료】 | 23 면 | 0 원 |
| 【우선권주장료】 | 0 건 | 0 원 |
| 【심사청구료】 | 0 항 | 0 원 |
| 【합계】 | | 38,000 원 |
| 【감면사유】 | 정부출연연구기관 | |
| 【감면후 수수료】 | 19,000 원 | |

【첨부서류】 1. 전담조직임을 증명하는 서류_2통 2. 위임장[추후제출]_2통

【요약서】

【요약】

1. 청구범위에 기재된 발명이 속한 기술분야

본 발명은 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법에 관한 것임.

2. 발명이 해결하려고 하는 기술적 과제

본 발명은 소정 크기의 블록에 대한 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을 높이기 위한, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법을 제공하는데 그 목적이 있음.

3. 발명의 해결방법의 요지

본 발명은, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치에 있어서, 소정 크기의 블록에 대한 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을 높이는데 특징이 있음.

4. 발명의 중요한 용도

본 발명은 DCT 계수 스캐닝을 이용한 부호화/복호화 장치 등에 이용됨.

【대표도】

도 1

【색인어】

DCT 계수, 부호화, 복호화, 스캐닝, 화소 유사성

【명세서】

【발명의 명칭】

화소 유사성에 따라 적응적인 D C T 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법{Apparatus of encoding and decoding using adaptive scanning of DCT coefficients according to the pixel similarity, and it method}

【도면의 간단한 설명】

- <1> 도 1은 H.264/AVC에서의 4x4 블록에 대한 인트라 예측모드의 일실시에 설명도,
- <2> 도 2a는 인트라 vertical 모드에서의 화소 예측 방법에 대한 일실시에 설명도,
- <3> 도 2b는 인트라 horizontal 모드에서의 화소 예측 방법에 대한 일실시에 설명도,
- <4> 도 3은 본 발명에 따른 부호화 장치의 일실시에 구성도,
- <5> 도 4는 기존의 지그재그(Zig-zag) 스캐닝 방법에 대한 일실시에 설명도,
- <6> 도 5는 vertical과 horizontal 방향의 화소 유사성 예측 방법에 대한 일실시에 설명도,
- <7> 도 6a는 horizontal 스캐닝 방법에 대한 일실시에 설명도,
- <8> 도 6b는 vertical 스캐닝 방법에 대한 일실시에 설명도,
- <9> 도 7a는 인트라 vertical 예측 모드에서의 화소 유사성에 따른 적응적인 스

캐닝 장치의 일실시에 구성도,

<10> 도 7b는 인트라 horizontal 예측 모드에서의 화소 유사성에 따른 적응적인 스캐닝 장치의 일실시에 구성도,

<11> 도 8은 본 발명에 따른 복호화 장치의 일실시에 구성도이다.

【발명의 상세한 설명】

【발명의 목적】

【발명이 속하는 기술분야 및 그 분야의 종래기술】

<12> 본 발명은 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법에 관한 것으로, 더욱 상세하게는 소정 크기의 블록에 대한 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을 높일 수 있는, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법에 관한 것이다.

<13> 동영상 데이터를 부호화하고 복호화하기 위해 마련된 영상 압축 표준에 따르면 하나의 프레임에 포함된 복수 개의 매크로 블록, 또는 매크로 블록을 더 작은 블록들로 나누어 얻어진 서브 블록 단위로 부호화 및 복호화를 수행한다. 부호화 및 복호화 방법은 시간적 예측과 공간적 예측을 기반으로 이루어진다. 시간적 예측

은 현재 프레임에서 매크로 블록 내의 블록(매크로 블록 또는 매크로 블록보다 작은 서브 블록들)들의 움직임 예측하는데 있어서 인접한 프레임의 블록을 참조하여 예측을 수행하는 것을 말하고, 공간적 예측은 부호화하고자 하는 현재 프레임의 매크로 블록 내의 블록을 현 프레임 내에서 이미 복원된 인접한 블록의 경계 화소를 이용하여 예측을 수행하는 것을 말한다.

<14> 공간적 예측을 인트라 예측(Intra prediction)이라고도 하는데, 인트라 예측은 어느 화소를 예측하는데 있어 그와 인접한 화소가 유사한 값을 가질 가능성이 많다는 특징을 이용한 것이다. H.264/AVC 표준은 9가지 방향성을 고려한 예측 모드를 이용하여 현재 블록의 화소값을 예측한다. 도 1은 H.264/AVC 표준에서 4x4 블록의 인트라 예측에 사용되는 9가지 예측모드이다. 예측방향에 따라 vertical 모드(모드 0), horizontal 모드(모드 1), DC 모드(모드 2), diagonal_down_left(모드 3), diagonal_down_right(모드 4), vertical_right(모드 5), horizontal_down(모드 6), vertical_left(모드 7), horizontal_up(모드 8)이 존재한다. 화살표는 예측방향을 나타낸다. 이하에서는 4x4 블록을 인트라 예측하는 경우, vertical 모드 및 horizontal 모드에서의 예측방법을 설명한다.

<15> 도 2a는 vertical 모드에서의 화소 예측을 설명하기 위한 도면이다.

<16> 화소 a(302), e(304), i(306), m(308) 는 수직방향으로 인접한 화소 A로부터 예측되고, 이와 같은 방법으로 화소 b, f, j, n 는 화소 B로부터 예측되고, 화소 c, g, k, o 는 화소 C로부터 예측되고, 화소 d, h, l, p 는 화소 D로부터 예측된다.

- <17> 도 2b는 horizontal 모드에서의 화소 예측을 설명하기 위한 도면이다.
- <18> 화소 a(312), b(314), c(316), d(318) 는 수평 방향으로 인접한 화소 I로부터 예측되고, 이와 같은 방법으로 화소 e, f, g, h 는 화소 J로부터 예측되고, 화소 i, j, k, l 는 화소 K로부터 예측되고, 화소 m, n, o, p 는 화소 L로부터 예측된다.
- <19> 한편, 부호화기에서는 상기의 예측된 화소와 현재 화소를 차분한 잔차 신호(화소 영역)를 DCT 및 양자화를 수행한다. 그 후, 변환 계수(transformed coefficient)를 지그재그(zig-zag) 스캐닝하여 엔트로피 부호화한다. 그러나 이러한 지그재그 스캐닝 방법은, 변환 계수의 에너지 컴팩션 특징은, 낮은 주파수에 에너지가 몰리고 높은 주파수에 에너지가 적게 나타나는 특징을 이용한 것이다. 하지만 인트라 예측 수행 후, 이와 같은 에너지 컴팩션이 항상 유효하지 않다는 문제점이 있다.

【발명이 이루고자 하는 기술적 과제】

- <20> 본 발명은 상기 문제점을 해결하기 위하여 제안된 것으로, 소정 크기의 블록에 대한 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을 높이

기 위한, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법을 제공하는데 그 목적이 있다.

<21> 본 발명의 다른 목적 및 장점들은 하기의 설명에 의해서 이해될 수 있으며, 본 발명의 실시예에 의해 보다 분명하게 알게 될 것이다. 또한, 본 발명의 목적 및 장점들은 특허청구범위에 나타낸 수단 및 그 조합에 의해 실현될 수 있음을 쉽게 알 수 있을 것이다.

【발명의 구성】

<22> 상기 목적을 달성하기 위한 본 발명은, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치에 있어서, 소정 크기의 블록에 대한 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을 높이기 위한, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치에 관한 것이다.

<23> 또한, 본 발명은, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 방법에 있어서, 소정 크기의 블록에 대한 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주

변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을 높이기 위한, 화소 유사성에 따라 적용적인 DCT 계수 스캐닝을 이용한 부호화/복호화 방법에 관한 것이다.

<24> 본 발명은 소정 크기의 블록에 대한 인트라 예측 수행 후, DCT와 양자화기를 통하여 생성된 변환 계수(DCT 및 양자화된 계수)에 대한 스캐닝 방법을 화소 유사성 예측을 통한 적응적인 선택을 통해 압축률을 높이는 동영상 부호화 및 복호화 방법 및 장치에 있어서, 본 발명에 따라 인트라 예측 수행 후, 인접 화소로부터 부호화 될 계수의 화소 유사성 정보를 이용, 잔차 신호(residual signal)의 수평 및 수직 유사성을 예측하여 그 정보에 따라 가장 효율적인 스캐닝 방법을 적용함으로써, 엔트로피 부호화의 효율을 높이고 종래의 부호화 방법보다 높은 압축률을 얻을 수 있는 특징을 지니는 압축 부호화 방식이다.

<25> 또한, 본 발명은, 현재 블록의 변환 계수 (quantized DCT 또는 quantized integer transform)에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록의 경계 화소(수평 및 수직 화소, 화소 영역)들 간의 유사성 정보를 이용하여 가장 효율적인 scanning 방식을 선택하여 압축률을 높이는 동영상 부호화 및 복호화 방법에 관한 것이다. 이때, 부호기와 복호기는 같은 유사성 정보를 이용함으로써 새로운 syntax의 추가가 필요없다.

<26> 또한, 본 발명은, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을

높이는 동영상 부호화 및 복호화 방법에 관한 것이다. 유사성 예측을 위하여 이미 복원된 수평, 수직 경계화소의 variance 정보를 고려하여 효율적 scanning mode를 선택한다. 유사성 예측을 위하여 variance 정보와 유사한 correlation 정도도 사용 가능하다.

<27> 또한, 본 발명은, 4x4 인트라 예측(Intra prediction) 모드 또는 MxN 인트라 예측(Intra prediction) 모드에 마찬가지로 적용가능하다.

<28> 상기 기술적 과제는 본 발명에 따라, 각 블록이 (a) 인트라 부호화시 vertical 예측 모드 및 horizontal 예측 모드로 결정된 경우, (b) 이미 복원된 주변 블록 경계 화소들 간의 유사성 이용하여, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 선택적으로 이용하는 단계; 및 (c) 선택된 스캐닝 방식에 따라 나열된 계수를 엔트로피 부호화하는 단계를 포함하는 것을 특징으로 하는 동영상 부호화 방법에 의해 달성된다.

<29> 상기 부호화 모드는, 휘도 블록인 경우에는 H.264/AVC의 인트라 4x4 휘도 부호화 모드인 vertical 모드, horizontal 모드, DC 모드, diagonal_down_left, diagonal_down_right, vertical_right, horizontal_down, vertical_left 및 horizontal_up 과 인트라 16x16 휘도 부호화 모드인 vertical 모드, horizontal 모드, plane 모드 및 DC 모드인 것이 바람직하다.

<30> 또한 상기 부호화 모드는, 색도 블록에 대해서는 H.264/AVC 인트라 MxN 색도 부호화 모드인, vertical 모드, horizontal 모드, plane 모드 및 DC 모드인 것이

바람직하다.

<31> 상술한 목적, 특징 및 장점은 첨부된 도면과 관련한 다음의 상세한 설명을 통하여 보다 분명해 질 것이며, 그에 따라 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 본 발명의 기술적 사상을 용이하게 실시할 수 있을 것이다. 또한, 본 발명을 설명함에 있어서 본 발명과 관련된 공지 기술에 대한 구체적인 설명이 본 발명의 요지를 불필요하게 흐릴 수 있다고 판단되는 경우에 그 상세한 설명을 생략하기로 한다. 이하, 첨부된 도면을 참조하여 본 발명에 따른 바람직한 일 실시예를 상세히 설명하기로 한다.

<32> 도 1은 H.264/AVC에서의 4x4 블록에 대한 인트라 예측모드를 도시한 도면이다

<33> 도 2a는 인트라 vertical 모드(모드 0)에서의 화소 예측을 설명하기 위한 도면이다.

<34> 도 2b는 인트라 horizontal 모드(모드 1)에서의 화소 예측을 설명하기 위한 도면이다.

<35> 도 3은 본 발명의 바람직한 실시 예에 따른 부호화 장치의 블록도이다.

<36> 영상이 입력되면 인트라 예측부(110)에서 예측을 수행한다. 본 실시 예에서는 휘도(luminance) 블록의 화소에 대해서는 4x4 인트라 예측을 수행하고, 색도(chrominance) 블록의 화소에 대해서는 8x8 인트라 예측을 수행한다. 모드 선택부(120)는 여러 가지 예측 모드 중에서 최적의 모드를 하나 선택한다. 즉, 4x4 인트라

라 예측, 16x16 인트라 예측 및 8x8 인트라 예측 시에 가능한 여러 가지 부호화 모드 중에서 하나를 선택한다. 일반적으로 율-왜곡(Rate-Distortion)을 가장 줄인 율-왜곡 최적화(RD Optimization) 방법에 따라 하나의 모드를 선택한다.

<37> DCT 및 양자화(130)는 인트라 예측부(110)에서 출력된 차이값, 즉, 부호화하고자 하는 현재 프레임의 매크로 블록내의 화소값과 예측 화소값의 차이를 나타내는 잔여 계수 블록 대하여 DCT와 양자화하여 엔트로피 부호화부(140)로 전달한다.

<38> 엔트로피 부호화부(140)는 스캐닝을 이용하여 계수를 나열한 후, 엔트로피 부호화하여 출력한다. 엔트로피 부호화는 발생빈도가 높은 데이터에 대해서는 적은 비트를 할당하고, 발생빈도가 낮은 데이터에 대해서는 많은 비트를 할당함으로써 데이터의 압축률을 높인 부호화방법을 말한다. 본 발명에서 사용되는 엔트로피 부호화방법에는 CAVLC(Context Adaptive Variable Length Coding) 또는 CABAC(Context-Based Adaptive Binary Arithmetic Coding) 등이 있다.

<39> 도 4는 기존의 지그재그 스캐닝 방법을 설명하기 위한 도면이다.

<40> 상기 도 4에 따른 기존의 지그재그 스캐닝 방법은, 화소 영역에 대해서 DCT를 수행하였을 경우, 변환 계수의 에너지 컴팩션 특징이 대부분의 경우 낮은 주파수에 에너지가 몰리고 높은 주파수에 에너지가 적게 나타나는 특징을 이용한 것이다. 하지만 방향성을 띤 인트라 예측을 할 경우, 잔차 신호의 수평과 수직 방향의 유사성이 서로 큰 차이를 보이게 되어 DCT의 에너지 컴팩션 특징이 항상 유효하지는 않다. 예를 들어, vertical 예측 모드는 대부분의 경우, 수직 방향의 화소 유사성이 높을 때 율-왜곡 과정에서 최적의 모드로 선택되어 첫 번째 행에 중요 계수가

몰리기 때문에 horizontal 스캐닝이 효율적이다. 하지만 다음과 같은 이유로 지그재그 스캐닝이 효율적인 경우가 발생한다.

<41> 도 5는 본 발명에 따른 vertical과 horizontal 방향의 화소 유사성 예측을 설명하기 위한 도면이다.

<42> 상기 도 5에 표기된 블록 내 1열의 화소(a,e,i,m)들의 수직 방향 유사성은, vertical 예측 후의 잔차 신호(a-A,e-A,i-A,m-A)들의 수직 방향 유사성과 서로 같다(2,3,4열의 경우도 동일). 다시 말해 vertical 예측을 할 경우 수직 방향 유사성은 변하지 않는다. 하지만 블록 내 1행의 잔차 신호(a-A,b-B,c-B,d-D)들의 수평 방향 유사성이 예측 전 보다 높아지게 되어 수직 방향의 유사성과 비슷해지거나 더 커지는 경우에는 지그재그 스캐닝이 효율적일 수 있다(2,3,4행의 경우도 동일).

<43> 따라서 본 발명에서는 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용하여 현재 블록 내의 수평 및 수직의 화소 유사성 예측을 통해 스캐닝 방법을 선택적으로 사용한다.

<44> 상기 도 5에 따르면 화소 A, B, C, D는 현재 부호화될 블록의 상단에 위치한 화소들이고, 화소 E, F, G, H는 현재 부호화될 블록의 좌측에 위치한 화소들이다. 상기 8개의 화소들은 복원된 화소들으로써, vertical 화소 유사성을 S_VER 이라 하고, horizontal 화소 유사성을 S_HOR 이라 하면, 각각의 화소 유사성은 수학적 식 1과 같이 계산된다.

【수학식 1】

$$S_VER = \frac{1}{\text{Variance}(E, F, G, H)}$$

<45>
$$S_HOR = \frac{1}{\text{Variance}(A, B, C, D)}$$

<46> vertical 예측 모드를 수행하였을 경우, S_HOR 에 factor α ($\alpha \geq 1$)를 곱한 값을 현재 블록의 잔차 신호의 수평 유사성 예측 값으로 사용한다. (α 값은 실시시 2로 고정하였다) S_VER 은 그 값 그대로 현재 블록의 잔차 신호의 수직 유사성 예측 값으로 사용된다.

<47> horizontal 예측 모드를 수행하였을 경우, S_VER 에 factor β ($\beta \geq 1$)를 곱한 값을 현재 블록의 잔차 신호의 수직 유사성 예측 값으로 사용한다. (β 값은 실시시 2로 고정하였다) S_HOR 은 그 값 그대로 현재 블록의 잔차 신호의 수평 유사성 예측 값으로 사용된다.

<48> 위와 같은 방법으로 구한 수직 및 수평 유사성 예측 값을 서로 비교하여 스캐닝 방법을 결정한다.

<49> 도 6a는 본 발명에 따른 horizontal 스캐닝 방법을 설명하기 위한 도면이다.

<50> 도 6b는 본 발명에 따른 vertical 스캐닝 방법을 설명하기 위한 도면이다.

<51> 도 7a는 인트라 vertical 예측 모드에서의 화소 유사성에 따른 적응적인 스

캐닝 장치의 블록도이다.

<52> 도 7a에 따르면, 인트라 vertical 예측 모드(210)일 경우 C_VER 값이 $\alpha \times C_HOR$ 값보다 크면(220), 본 발명에서 제안한 horizontal 스캐닝(230)을 사용하며, 그 외의 경우에는 기존의 지그재그 스캐닝(240)을 사용한다.

<53> 도 7b는 인트라 horizontal 예측 모드에서의 화소 유사성에 따른 적응적인 스캐닝 장치의 블록도이다.

<54> 도 7b에 따르면, 인트라 horizontal 예측 모드(250)일 경우 C_HOR 값이 $\beta \times C_VER$ 보다 크면, 본 발명에서 제안한 vertical 스캐닝(260)을 사용하며, 그 외의 경우에는 기존의 지그재그 스캐닝(240)을 사용한다.

<55> 도 8는 본 발명의 바람직한 실시 예에 따른 복호화 장치의 블록도이다.

<56> 엔트로피 복호화(410)는 본 발명에 따라 부호화된 비트 스트림을 입력받아 CAVLC(Context Adaptive Variable Length Coding) 또는 CABAC(Context-Based Adaptive Binary Arithmetic Coding) 등과 같은 엔트로피 복호화 방법에 따라 복호화를 수행한다. 복호화 된 인트라 예측 모드에 따라 앞서 기술한 방법을 이용, 현재 복호화 된 계수의 스캐닝 방식을 선택(420)하여 최종적인 계수를 복원(430)한다.

<57> 상술한 방법에 따라 H.264/AVC Reference Codec 인 JM86(Joint Model 86)을 이용하여 여러 가지 테스트 영상에 대하여 실험을 수행한 결과 다음과 같은 압축효율 증가를 가져올 수 있었다. H.264/AVC에서 실험영상으로 권고하는 영상을 이용하

여 실험을 수행하였다. 다음 표 1은 실험조건을 설명하기 위한 도면이다.

【표 1】

| | | | | | |
|--------|-------------------------------------------------|---------------------|-----------------|-----------------|----------------|
| 영상 | News (QCIF) | Container (QCIF) | Coast (QCIF) | Paris (QCIF) | Coast (CIF) |
| 전체 프레임 | 300 (30 Hz) | 300 (30 Hz) | 300 (30 Hz) | 300 (35 Hz) | 300 (30 Hz) |
| 조건 | CAVLC, Intra only, QP(18,22,26,40), 율-왜곡 최적화 사용 | | | | |

<58>

<59> 상기 표 1과 같이 크기가 다른 5개의 영상에 대해서 실험 하였다. 다음 표 2
 는 표 1과 같은 실험조건하에서 종래의 압축방법과 본 발명에 따른 압축방법에 따
 라 테스트 영상을 압축하였을 때의 압축률을 비교한 도표이다.

【표 2】

| Sequence | QP | H.264/AVC | | Proposed Method | | Bits saving (%) |
|------------------|----|-----------|-----------------|-----------------|-----------------|-----------------|
| | | PSNR (dB) | Bitrates (Kbps) | PSNR (dB) | Bitrates (Kbps) | |
| News (QCIF) | 18 | 45.64 | 2370.65 | 45.64 | 2344.75 | 1.51% |
| | 22 | 43.06 | 1714.99 | 43.05 | 1692.69 | 1.67% |
| | 26 | 40.32 | 1221.96 | 40.32 | 1206.02 | 1.51% |
| | 30 | 37.50 | 872.65 | 37.49 | 860.23 | 1.49% |
| Container (QCIF) | 18 | 44.84 | 874.63 | 44.84 | 857.75 | 1.93% |
| | 22 | 41.71 | 643.42 | 41.7 | 630.5 | 2.01% |
| | 26 | 38.61 | 451.07 | 38.61 | 441.54 | 2.11% |
| | 30 | 35.77 | 317.36 | 35.76 | 309.93 | 2.34% |
| Coast (QCIF) | 18 | 44.18 | 2200.99 | 44.13 | 2152.15 | 2.22% |
| | 22 | 40.61 | 1631.56 | 40.59 | 1592.37 | 2.40% |
| | 26 | 37.13 | 1139.76 | 37.12 | 1111.02 | 2.52% |
| | 30 | 34.00 | 765.52 | 33.99 | 746.77 | 2.45% |
| Paris (CIF) | 18 | 44.72 | 4360.41 | 44.71 | 4271.09 | 2.05% |
| | 22 | 41.57 | 3334.22 | 41.56 | 3259.84 | 2.23% |
| | 26 | 38.25 | 2450.69 | 38.24 | 2391.77 | 2.40% |
| | 30 | 35.04 | 1780.73 | 35.03 | 1736.21 | 2.50% |
| Coast (CIF) | 18 | 44.34 | 4068.4 | 44.33 | 4015.7 | 1.30% |
| | 22 | 40.8 | 2989.5 | 40.8 | 2950.65 | 1.30% |
| | 26 | 37.32 | 2074.47 | 37.32 | 2045.89 | 1.38% |
| | 30 | 34.21 | 1388.07 | 34.22 | 1369.23 | 1.36% |

<60>

<61> 상기 표 2에 따르면, H.264/AVC 의 지그재그 스캐닝 방식만을 사용하였을 때 와 제안된 인트라 예측 모드에 따른 적응적인 스캐닝 방식을 사용하였을 때의 실험 결과를 나타낸다. 제안된 방법의 압축률이 보다 우수함을 알 수 있다.

<62> 한편, 전술한 동영상 부호화 및 복호화 방법은 컴퓨터 프로그램으로 작성 가능하다. 상기 프로그램을 구성하는 코드들 및 코드 세그먼트들은 당해 분야의 컴퓨터 프로그래머에 의하여 용이하게 추론될 수 있다. 또한, 상기 프로그램은 컴퓨터

가 읽을 수 있는 정보저장매체(computer readable media)에 저장되고, 컴퓨터에 의하여 읽혀지고 실행됨으로써 동영상 부호화 및 복호화 방법을 구현한다. 상기 정보 저장매체는 자기 기록매체, 광 기록매체, 및 캐리어 웨이브 매체를 포함한다.

<63> 상술한 바와 같은 본 발명의 방법은 프로그램으로 구현되어 컴퓨터로 읽을 수 있는 형태로 기록매체(씨디롬, 램, 롬, 플로피 디스크, 하드 디스크, 광자기 디스크 등)에 저장될 수 있다. 이러한 과정은 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있으므로 더 이상 상세히 설명하지 않기로 한다.

<64> 이상에서 설명한 본 발명은, 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 있어 본 발명의 기술적 사상을 벗어나지 않는 범위 내에서 여러 가지 치환, 변형 및 변경이 가능하므로 전술한 실시예 및 첨부된 도면에 의해 한정되는 것이 아니다.

【발명의 효과】

<65> 상기와 같은 본 발명은, 부호화시의 인트라 부호화의 압축률을 향상시킬 수 있는 효과가 있다.

<66> 또한, 본 발명은 차후 개발될 인트라 예측을 사용하는 비디오 압축 기술에서도 마찬가지로 압축률을 향상시킬 수 있는 효과가 있다.

【특허청구범위】

【청구항 1】

화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치에 있어서,

소정 크기의 블록에 대한 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을 높이기 위한, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 장치.

【청구항 2】

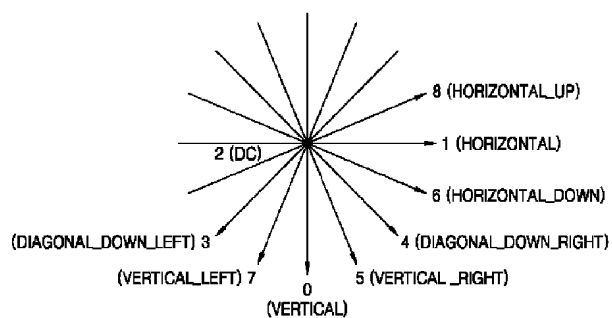
화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화/복호화 방법에 있어서,

소정 크기의 블록에 대한 인트라 예측 수행 후, 현재 블록의 변환 계수에 대한 적응적인 스캐닝을 적용하기 위하여, 이미 복원된 주변 블록 경계 화소(수평 및 수직 화소)들 간의 유사성 정보를 이용, 잔차 신호의 수평 및 수직 유사성을 예측하여 그 정보에 따라 지그재그 스캐닝, horizontal 스캐닝, vertical 스캐닝을 이용하여 압축률을 높이기 위한, 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이

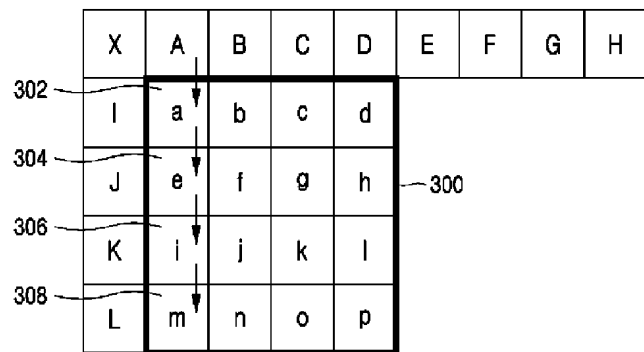
용한 부호화/복호화 방법.

【도면】

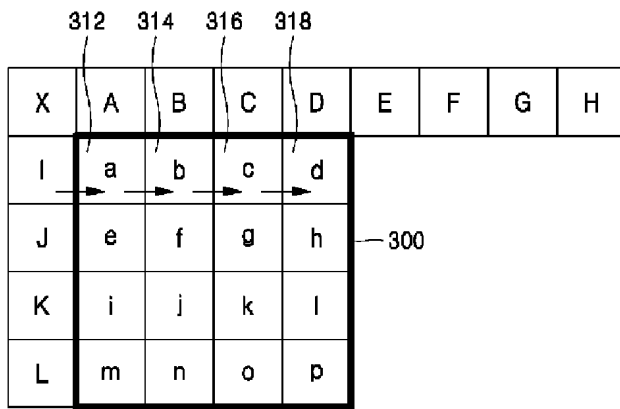
【도 1】



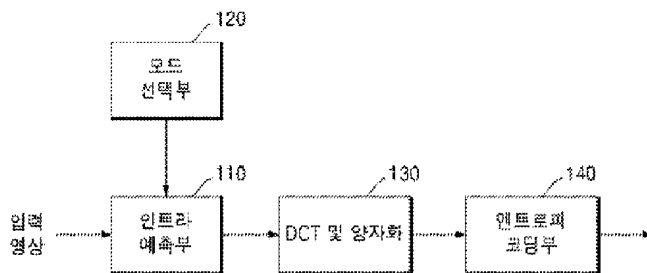
【도 2a】



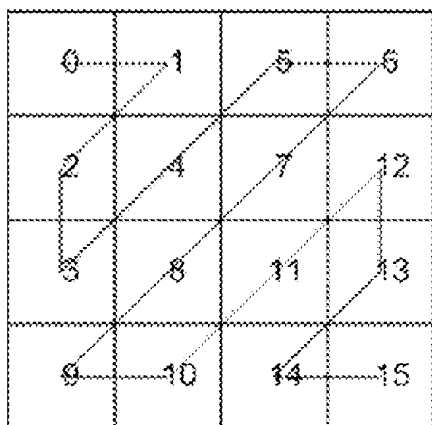
【도 2b】



【도 3】



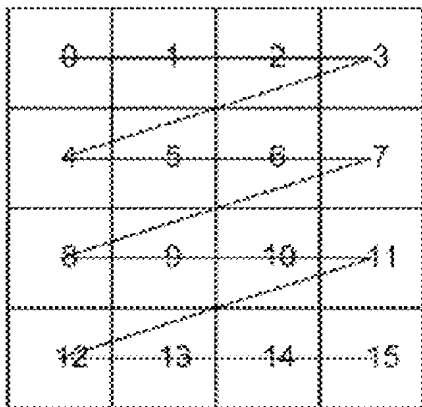
【도 4】



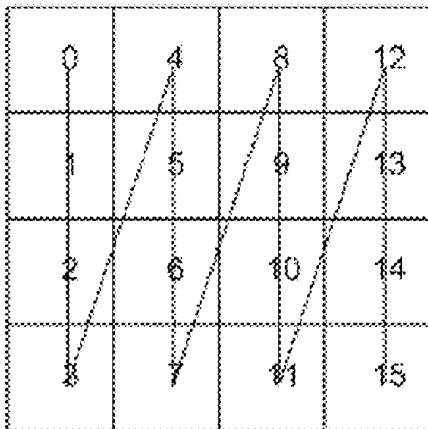
【도 5】

| | | | | |
|---|---|---|---|---|
| | A | B | C | D |
| E | a | b | c | d |
| F | e | f | g | h |
| G | i | j | k | l |
| H | m | n | o | p |

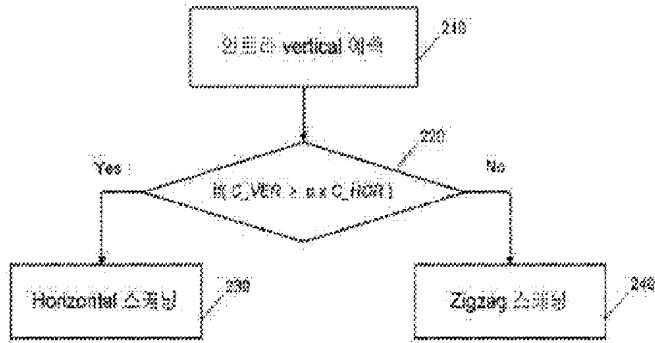
【도 6a】



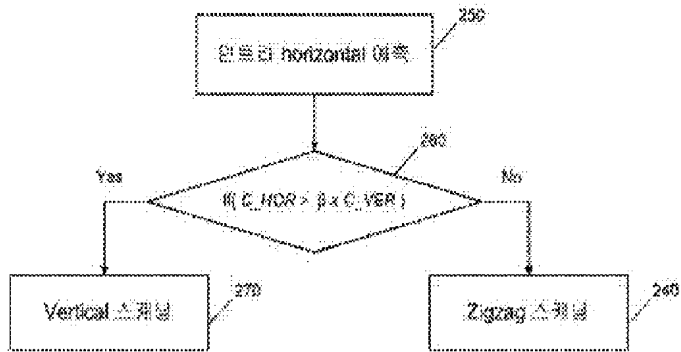
【도 6b】



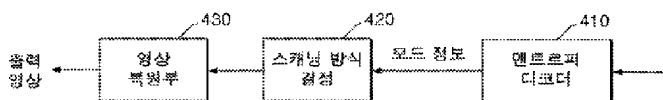
【도 7a】



【도 7b】



【도 8】





별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto
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출원 번호 : 10-2007-0008247

Application Number

출원 년 월 일 : 2007년 01월 26일

Filing Date JAN. 26, 2007

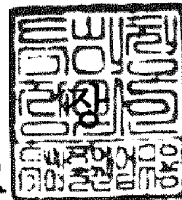
출원인 : 한국전자통신연구원 외 2명

Applicant(s) Electronics and Telecommunications
Research Institute, et al.

2014년 01월 10일

특 허 청

COMMISSIONER



【서지사항】

| | |
|------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 【서류명】 | 특허출원서 |
| 【권리구분】 | 특허 |
| 【수신처】 | 특허청장 |
| 【제출일자】 | 2007.01.26 |
| 【발명의 국문명칭】 | 화소 유사성에 따라 적응적인 이산 코사인 변환 계수 스케 닝을 이용한 부호화/복호화 장치 및 그 방법 |
| 【발명의 영문명칭】 | Apparatus and method of encoding and decoding using adaptive scanning of DCT coefficients according to the pixel similarity |
| 【출원인】 | |
| 【명칭】 | 한국전자통신연구원 |
| 【출원인코드】 | 3-1998-007763-8 |
| 【출원인】 | |
| 【명칭】 | 세종대학교산학협력단 |
| 【출원인코드】 | 2-2005-011470-2 |
| 【출원인】 | |
| 【명칭】 | 광운대학교 산학협력단 |
| 【출원인코드】 | 2-2004-010265-4 |
| 【대리인】 | |
| 【명칭】 | 특허법인 신성 |
| 【대리인코드】 | 9-2000-100004-8 |
| 【지정된변리사】 | 원석희, 박해천, 최종식, 박정후, 최장식, 심정희 |
| 【포괄위임등록번호】 | 2000-051975-8 |
| 【발명자】 | |
| 【성명】 | 정세윤 |

【성명의 영문표기】 JEONG, Se Yoon
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【주민등록번호】 741212-1XXXXXX
【우편번호】 137-062
【주소】 서울 서초구 방배2동 957-13
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【주민등록번호】 780930-2XXXXXX
【우편번호】 435-040
【주소】 경기 군포시 산본동 86-46 202호
【국적】 KR

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【성명의 영문표기】 KIM, Jae Gon
【주민등록번호】 670726-1XXXXXX
【우편번호】 302-120
【주소】 대전 서구 둔산동 샘머리아파트 203-402
【국적】 KR

【발명자】

【성명】 문경애
【성명의 영문표기】 MOON, Kyung Ae
【주민등록번호】 620524-2XXXXXX
【우편번호】 302-120
【주소】 대전 서구 둔산동 한마루아파트 9-903
【국적】 KR

【발명자】

【성명】 장대영
【성명의 영문표기】 JANG, Dae Young
【주민등록번호】 660224-1XXXXXX
【우편번호】 305-768

【주소】 대전 유성구 노은동 열매마을 904-1701
【국적】 KR
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【성명의 영문표기】 HONG, Jin Woo
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【우편번호】 305-333
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【발명자】
【성명】 김진웅
【성명의 영문표기】 KIM, Jin Woong
【주민등록번호】 591223-1XXXXXX
【우편번호】 305-761
【주소】 대전 유성구 전민동 엑스포아파트 305-1603
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【성명의 영문표기】 SIM, Dong Gyu

【주민등록번호】 700710-1XXXXXX
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【주민등록번호】 571107-1XXXXXX
【우편번호】 463-010
【주소】 경기 성남시 분당구 정자1동 아이파크 104-1902
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【성명의 영문표기】 AHN,Chang Beom
【주민등록번호】 580416-1XXXXXX
【우편번호】 138-050
【주소】 서울 송파구 방이동 89번지 올림픽선수기자촌 아파트
109-501
【국적】 KR
【발명자】
【성명】 김대연
【성명의 영문표기】 KIM,Dae Yeon
【주민등록번호】 820615-1XXXXXX
【우편번호】 139-243
【주소】 서울 노원구 공릉3동 라이프아파트 204-1203
【국적】 KR

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【성명의 영문표기】 KIM,Dong Kyun
【주민등록번호】 800417-1XXXXXX
【우편번호】 139-748
【주소】 서울 노원구 상계5동 벽산아파트 106-412
【국적】 KR

【우선권 주장】

【출원국명】 KR
【출원종류】 특허
【출원번호】 10-2006-0077851
【출원일자】 2006.08.17
【증명서류】 첨부

【공지예외적용대상증명서류의 내용】

【공개형태】 간행물 발표, 학술단체 서면발표
【공개일자】 2006.09.23

【심사청구】 청구

【취지】 특허법 제42조의 규정에 의한 출원, 특허법 제60조의 규정에 의한 심사청구를 합니다.

대리인

특허법인 신성 (인)

【수수료】

| | | | | |
|-----------------|----|---|---------|---|
| 【기본출원료】 | 0 | 면 | 38,000 | 원 |
| 【가산출원료】 | 35 | 면 | 0 | 원 |
| 【우선권주장료】 | 1 | 건 | 20,000 | 원 |
| 【심사청구료】 | 20 | 항 | 749,000 | 원 |

| | |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 【합계】 | 807,000 원 |
| 【감면사유】 | 정부출연연구기관 |
| 【감면후 수수료】 | 413,500 원 |
| 【기술이전】 | |
| 【기술양도】 | 희망 |
| 【실시권허여】 | 희망 |
| 【기술지도】 | 희망 |
| 【첨부서류】 | 1. 전담조직임을 증명하는 서류[세종대학교산학협력단]_1통 2. 전담조직임을 증명하는 서류[광운대학교 산학협력단]_1통 3. 위임장[세종대학교산학협력단, 광운대학교산학협력단]_1 통 4. 공지에외적용대상(신규성상실의예외, 출원시의특례)규 정을 적용받기 위한 증명서류_1통 |

【요약서】

【요약】

1. 청구범위에 기재된 발명이 속한 기술분야

본 발명은 화소 유사성에 따라 적응적인 이산 코사인 변환 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법에 관한 것임.

2. 발명이 해결하려고 하는 기술적 과제

본 발명은 입력된 영상에 인트라 예측을 수행하고, 인트라 예측된 영상에서 인접 화소로부터 부호화될 계수의 화소 유사성 정보를 기반으로 화소 유사성을 예측하며, 예측된 화소 유사성에 따라 가장 효율적인 스캐닝 방법을 적용하기 위한, DCT 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법을 제공하는데 그 목적이 있음.

3. 발명의 해결방법의 요지

본 발명은, 이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스캐닝을 이용한 부호화 장치에 있어서, 인트라 예측 시 최적 모드를 선택하기 위한 모드 선택수단; 상기 모드 선택수단에 의해 선택된 모드를 기반으로 입력된 영상에 대한 인트라 예측을 수행하는 인트라 예측수단; 상기 인트라 예측수단으로부터 출력된 잔차 계수 블록에 대해 이산 코사인 변환(DCT) 및 양자화를 수행하는 DCT 및 양자화수단; 및 상기 잔차 계수들의 화소 유사성에 따라 결정된 소정의 스캐닝 모드를 이용해 상기 양자화된 DCT 계수를 엔트로피 부호화하기 위한 엔트로피 부호화

수단을 포함함.

4. 발명의 중요한 용도

본 발명은 부호화/복호화 장치 등에 이용됨.

【대표도】

도 3

【색인어】

부호화, 복호화, DCT, 화소 유사성, 인트라 예측, 엔트로피 부호화, 엔트로피 복호화, 적응적인 스케닝

【명세서】

【발명의 명칭】

화소 유사성에 따라 적응적인 이산 코사인 변환 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법{Apparatus and method of encoding and decoding using adaptive scanning of DCT coefficients according to the pixel similarity}

【도면의 간단한 설명】

- <1> 도 1 은 H.264/AVC 표준에서 4×4 블록의 인트라 예측에 사용되는 9가지 예측 모드를 나타내는 일실시에 설명도,
- <2> 도 2a 는 수직 모드(vertical mode)에서의 화소 예측 방법을 나타내는 일실시에 설명도,
- <3> 도 2b 는 수평 모드(horizontal mode)에서의 화소 예측 방법을 나타내는 일실시에 설명도,
- <4> 도 3 은 본 발명에 따른 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화 장치의 일실시에 구성도,
- <5> 도 4a 는 본 발명에 이용되는 지그재그 스캐닝 방법을 나타내는 일실시에 설명도,
- <6> 도 4b 는 본 발명에 이용되는 수평(horizontal) 스캐닝 방법을 나타내는 일실시에 설명도,
- <7> 도 4c 는 본 발명에 이용되는 수직(vertical) 스캐닝 방법을 나타내는 일실

그 방법에 관한 것으로, 더욱 상세하게는 입력된 영상에 인트라 예측을 수행하고, 인트라 예측된 영상에서 인접 화소로부터 부호화될 계수의 화소 유사성 정보를 기반으로 화소 유사성을 예측하며, 예측된 화소 유사성에 따라 가장 효율적인 스캐닝 방법을 적용하는, DCT 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법에 관한 것이다.

<18> 동영상 데이터를 부호화 및 복호화하기 위해 마련된 영상 압축 표준에 따르면, 하나의 프레임에 포함된 복수 개의 매크로 블록, 또는 매크로 블록을 더 작은 블록들로 나누어 얻어진 서브 블록 단위로 부호화 및 복호화를 수행한다. 여기서, 부호화 및 복호화 방법은 시간적 예측과 공간적 예측을 기반으로 이루어진다.

<19> 이때, 시간적 예측은 인접한 프레임의 블록을 참조하여 현재 프레임에서 매크로 블록 내의 블록들(즉, 매크로 블록 또는 매크로 블록보다 작은 서브 블록들)의 움직임을 예측하는 것을 의미한다.

<20> 그리고, 공간적 예측은 부호화하고자 하는 현재 프레임의 매크로 블록 내의 블록들(즉, 매크로 블록 또는 매크로 블록보다 작은 서브 블록들)을 현 프레임 내에서 이미 복원된 인접한 블록의 경계 화소를 이용하여 예측을 수행하는 것을 의미한다.

<21> 이때, 공간적 예측을 인트라 예측(Intra Prediction)이라고도 하는데, 인트라 예측은 어느 화소를 예측하는데 있어 그와 인접한 화소가 유사한 값을 가질 가능성이 많다는 특성을 이용한 것이다.

- <22> H.264/AVC(Advanced Video Coding) 표준은 인트라 예측 부호화, 1/4 단위의 가변 블록 움직임 추정 및 보상, CAVLC(Context-Based Adaptive Variable Length Coding) 및 CABAC(Context-Based Adaptive Binary Arithmetic Coding) 등의 기술들을 이용해 MPEG-2(Moving Picture Experts Group-2)의 약 2배의 압축율, MPEG-4(Moving Picture Experts Group-4)의 약 1.5배의 압축율을 보인다.
- <23> 이러한, H.264/AVC 표준은 9가지 방향성을 고려한 예측 모드를 이용하여 현재 블록의 화소 값을 예측한다.
- <24> 도 1 은 H.264/AVC 표준에서 4×4 블록의 인트라 예측에 사용되는 9가지 예측 모드를 나타내는 일실시에 설명도이다.
- <25> 도 1에 도시된 바와 같이, H.264/AVC 표준에서 4×4 블록의 인트라 예측에 사용되는 9가지의 예측 모드는, 예측 방향에 따라 수직 모드(vertical mode)(모드 0), 수평 모드(horizontal mode)(모드 1), DC 모드(모드 2), 대각선 하단 좌측(diagonal_down_left)(모드 3), 대각선 하단 우측(diagonal_down_right)(모드 4), 수직 우측(vertical_right)(모드 5), 수평 하단(horizontal_down)(모드 6), 수직 좌측(vertical_left)(모드 7) 및 수평 상단(horizontal_up)(모드 8)가 있다.
- <26> 여기서, DC 모드(모드 2)의 경우는 주변 화소들의 평균 값을 사용하여 인트라 예측을 수행하게 된다. 이때, 화살표는 예측 방향을 나타낸다.
- <27> 한편, 인트라 16×16 예측 부호화의 경우는 총 4개의 모드가 존재하며, 그 종류로는 수직 모드(vertical mode), 수평 모드(horizontal mode), DC 모드 및 평

면 모드(plane mode) 등이 있다.

<28> 또한, 인트라 8×8 예측 부호화의 경우는 인트라 4×4 예측 부호화와 동일하게 총 9가지의 모드가 존재한다. 색차 신호의 경우는 인트라 8×8 예측 부호화가 존재하며, 그 종류로는 DC 모드, 수직 모드(vertical mode), 수평 모드(horizontal mode) 및 평면 모드(plane mode) 등이 있다.

<29> 이하, 4×4 블록을 인트라 예측하는 경우, 수직 모드(vertical mode) 및 수평 모드(horizontal mode)에서의 예측 방법을 도 2a 및 도 2b를 참조하여 살펴보기로 한다.

<30> 도 2a 는 수직 모드(vertical mode)에서의 화소 예측 방법을 나타내는 일 실시예 설명도이다.

<31> 도 2a에 도시된 바와 같이, 화소 a(201), e(202), i(203) 및 m(204)는 수직 방향으로 인접한 화소 A로부터 예측이 된다.

<32> 상기와 같이, 화소 b, f, j 및 n는 수직 방향으로 인접한 화소 B로부터 예측이 된다. 또한, 화소 c, g, k 및 o는 수직 방향으로 인접한 화소 C로부터 예측이 된다. 또한, 화소 d, h, l 및 p는 수직 방향으로 인접한 화소 D로부터 예측이 된다.

<33> 도 2b 는 수평 모드(horizontal mode)에서의 화소 예측 방법을 나타내는 일 실시예 설명도이다.

<34> 도 2b에 도시된 바와 같이, 화소 a(205), b(206), c(207) 및 d(208)는 수평 방향으로 인접한 화소 I로부터 예측된다.

<35> 상기와 같이, 화소 e, f, g 및 h는 수평 방향으로 인접한 화소 J로부터 예측된다. 또한, 화소 i, j, k 및 l은 수평 방향으로 인접한 화소 k로부터 예측된다. 또한, 화소 m, n, o 및 p는 수평 방향으로 인접한 화소 l로부터 예측된다.

<36> 부호화기는 상기의 예측된 화소와 현재 화소를 차분한 잔차 신호(화소 영역)를 DCT 및 양자화를 수행한다. 그 후, 부호화기는 DCT 및 양자화된 변환 계수(Transformed coefficient)들을 지그재그(zig-zag) 스캐닝하여 엔트로피 부호화한다.

<37> 여기서, 지그재그 스캐닝 방식은 낮은 주파수에 에너지가 집중되고, 높은 주파수에 에너지가 적게 나타나는 변환 계수의 에너지 컴팩션의 특성을 이용한 것이지만, 인트라 예측 수행 후 이와 같은 에너지 컴팩션이 항상 유효한 것은 아니다.

<38> 즉, 지그재그 스캐닝 방식은 저주파 성분에서부터 고주파 성분으로 변환 계수를 스캐닝하는 방식으로, 변환 계수의 분포가 저주파 성분에 많이 나타나는 경우에 효율적이지만, 방향성을 띤 공간적 예측을 사용할 경우에는 변환 계수의 분포가 예측 방향에 영향을 많이 받기 때문에, 모든 방향 예측에 대해서 지그재그 스캐닝을 사용하는 것은 효율적이지 못하다는 문제점이 있다.

【발명이 이루고자 하는 기술적 과제】

<39> 본 발명은 상기 문제점을 해결하기 위하여 제안된 것으로, 입력된 영상에 인트라 예측을 수행하고, 인트라 예측된 영상에서 인접 화소로부터 부호화될 계수의

화소 유사성 정보를 기반으로 화소 유사성을 예측하며, 예측된 화소 유사성에 따라 가장 효율적인 스캐닝 방법을 적용하기 위한, DCT 계수 스캐닝을 이용한 부호화/복호화 장치 및 그 방법을 제공하는데 그 목적이 있다.

<40> 본 발명의 다른 목적 및 장점들은 하기의 설명에 의해서 이해될 수 있으며, 본 발명의 실시예에 의해 보다 분명하게 알게 될 것이다. 또한, 본 발명의 목적 및 장점들은 특허청구범위에 나타낸 수단 및 그 조합에 의해 실현될 수 있음을 쉽게 알 수 있을 것이다.

【발명의 구성】

<41> 상기 목적을 달성하기 위한 본 발명은, 이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스캐닝을 이용한 부호화 장치에 있어서, 인트라 예측 시 최적 모드를 선택하기 위한 모드 선택수단; 상기 모드 선택수단에 의해 선택된 모드를 기반으로 입력된 영상에 대한 인트라 예측을 수행하는 인트라 예측수단; 상기 인트라 예측수단으로부터 출력된 잔차 계수 블록에 대해 이산 코사인 변환(DCT) 및 양자화를 수행하는 DCT 및 양자화수단; 및 상기 잔차 계수들의 화소 유사성에 따라 결정된 소정의 스캐닝 모드를 이용해 상기 양자화된 DCT 계수를 엔트로피 부호화하기 위한 엔트로피 부호화수단을 포함한다.

<42> 또한, 본 발명은, 이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스캐닝을 이용한 복호화 장치에 있어서, 부호화된 영상을 엔트로피 복호화하기 위

한 엔트로피 복호화수단; 상기 엔트로피 복호화수단에 의해 복호화된 영상에 대한 스캐닝 모드를 결정하기 위한 스캐닝 모드 결정수단; 및 상기 스캐닝 결정수단에 의해 결정된 스캐닝 모드에 따라 영상을 복원하기 위한 영상 복원수단을 포함한다.

<43> 또한, 본 발명은, 이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스캐닝을 이용한 부호화 방법에 있어서, 인트라 예측 시 최적 모드를 선택하는 모드 선택 단계; 상기 모드 선택 단계에서 선택된 모드를 기반으로 입력된 영상에 대한 인트라 예측을 수행하는 인트라 예측 단계; 상기 인트라 예측 단계에서 출력된 잔차 계수 블록에 대해 이산 코사인 변환(DCT) 및 양자화를 수행하는 DCT 및 양자화 단계; 상기 잔차 계수들의 화소 유사성을 판단하는 판단 단계; 및 상기 판단 결과에 따라 결정된 소정의 스캐닝 모드를 이용해 상기 DCT 및 양자화 단계에서 양자화된 DCT 계수를 엔트로피 부호화하는 엔트로피 부호화 단계를 포함한다.

<44> 또한, 본 발명은, 이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스캐닝을 이용한 복호화 방법에 있어서, 부호화된 영상을 엔트로피 복호화하는 엔트로피 복호화 단계; 상기 엔트로피 복호화 단계에서 복호화된 영상에 대한 스캐닝 모드를 결정하는 스캐닝 모드 결정 단계; 및 상기 스캐닝 결정 단계에서 결정된 스캐닝 모드에 따라 영상을 복원하는 영상 복원 단계를 포함한다.

<45> 본 발명에서 부호화 모드는, 휘도(luminance) 블록인 경우에는 H.264/AVC의 인트라 4×4 휘도 부호화 모드인 수직 모드(vertical mode), 수평 모드(horizontal mode), 대각선 하단 좌측(diagonal_down_left), 대각선 하단 우측(diagonal_down_right), 수직 우측(vertical_right), 수평 하단(horizontal_down),

수직 좌측(vertical_left) 및 수평 상단(horizontal_up)과, H.264/AVC의 인트라 16 × 16 휘도 부호화 모드인 수직 모드(vertical mode), 수평 모드(horizontal mode), 평면 모드(plane mode) 및 DC 모드인 것이 바람직하다.

<46> 또한, 본 발명에서 상기 부호화 모드는, 색도(chrominance) 블록에 대해서는 H.264/AVC의 인트라 M × N 색도 부호화 모드인, 수직 모드(vertical mode), 수평 모드(horizontal mode), 평면 모드(plane mode) 및 DC 모드인 것이 바람직하다.

<47> 상술한 목적, 특징 및 장점은 첨부된 도면과 관련한 다음의 상세한 설명을 통하여 보다 분명해 질 것이며, 그에 따라 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 본 발명의 기술적 사상을 용이하게 실시할 수 있을 것이다. 또한, 본 발명을 설명함에 있어서 본 발명과 관련된 공지 기술에 대한 구체적인 설명이 본 발명의 요지를 불필요하게 흐릴 수 있다고 판단되는 경우에 그 상세한 설명을 생략하기로 한다. 이하, 첨부된 도면을 참조하여 본 발명에 따른 바람직한 일 실시예를 상세히 설명하기로 한다.

<48> 도 3 은 본 발명에 따른 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화 장치의 일실시예 구성도이다.

<49> 도 3에 도시된 바와 같이, 본 발명에 따른 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 부호화 장치는, 모드 선택부(10), 인트라 예측부(20), DCT 및 양자화부(30) 및 엔트로피 부호화부(40)를 포함한다.

<50> 여기서, 상기 모드 선택부(10)는 인트라 예측 시 가능한 여러 가지 예측 모

드 중에서 최적의 모드를 선택한다. 즉, 상기 모드 선택부(10)는 4×4 인트라 예측, 16×16 인트라 예측 및 8×8 인트라 예측 시에 가능한 여러 가지 부호화 모드 중에서 하나를 선택한다.

<51> 일반적으로, 상기 모드 선택부(10)는 율-왜곡(Rate-Distortion)을 가장 줄이기 위한 율-왜곡 최적화(Rate-Distortion Optimization) 방법에 따라 하나의 모드를 선택한다.

<52> 그리고, 상기 인트라 예측부(20)는 영상을 입력받아, 상기 모드 선택부(10)에 의해 선택된 모드를 기반으로 휘도 블록의 화소에 대해서는 4×4 인트라 예측을 수행하고, 색도 블록의 화소에 대해서는 8×8 인트라 예측을 수행한다.

<53> 그리고, 상기 DCT 및 양자화부(30)는 인트라 예측부(10)로부터 출력된 차이 값 즉, 부호화하고자 하는 현재 프레임의 매크로 블록 내의 화소 값과 예측 화소 값의 차이를 나타내는 잔차 계수 블록에 대하여 DCT 및 양자화를 수행하여 엔트로피 부호화부(40)로 전달한다.

<54> 그리고, 상기 엔트로피 부호화부(40)는 상기 DCT 및 양자화부(30)에 의해 DCT 및 양자화된 계수를 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용하여 DCT 계수를 나열하고, 나열된 DCT 계수를 엔트로피 부호화하여 출력한다.

<55> 이때, 엔트로피 부호화는 발생 빈도가 높은 데이터에 대해서는 적은 비트를 할당하고, 발생 빈도가 낮은 데이터에 대해서는 많은 비트를 할당함으로써, 데이터의 압축률을 높이는 부호화를 의미한다. 본 발명에서 사용되는 엔트로피 부호화 방

법으로는 CAVLC(Context Adaptive Variable Length Coding) 또는 CABAC(Context-Based Adaptive Binary Arithmetic Coding) 등이 있다.

<56> 여기서, 상기 엔트로피 부호화부(40)의 수직 및 수평 방향의 화소 유사성 예측 방법과, 인트라 수직(vertical) 및 수평(horizontal) 예측 모드에서의 스캐닝 방법에 대해 도 5 내지 도 7을 참조하여 보다 상세하게 살펴보기로 한다.

<57> 도 4a 는 본 발명에 이용되는 지그재그 스캐닝 방법을 나타내는 일실시에 설명도로서, 종래의 지그재그 스캐닝 방법을 나타낸다. 또한, 도 4b 는 본 발명에 이용되는 수평(horizontal) 스캐닝 방법을 나타내는 일실시에 설명도로서, 종래의 수평(horizontal) 스캐닝 방법을 나타낸다. 또한, 도 4c 는 본 발명에 이용되는 수직(vertical) 스캐닝 방법을 나타내는 일실시에 설명도로서, 종래의 수직(vertical) 스캐닝 방법을 나타낸다.

<58> 도 4a에 도시된 바와 같이, 본 발명에 이용되는 지그재그 스캐닝 방법은, DCT 및 양자화된 변환 계수의 저주파 성분이 2 차원 상에서 좌측 상단에 위치할 가능성이 높다는 것을 고려하여 고안된 방법으로, 낮은 주파수에는 DCT 후의 계수가 집중되어 나타나고, 높은 주파수에는 DCT 후의 계수가 적게 나타나는 변환 계수의 에너지 컴팩션의 특성을 이용한 것이다.

<59> 이러한 지그재그 스캐닝 방법은 수평 방향의 화소 유사성이 수직 방향의 화소 유사성과 비슷한 경우에 보다 효율적일 수 있다.

<60> 그러나, 인트라 예측 부호화를 수행할 경우, 특히 수직(vertical) 예측 모드

나 수평(horizontal) 예측 모드의 경우는 잔여 계수의 수직 방향의 유사성 및 수평 방향의 유사성이 서로 큰 차이를 보이게 되는 경우가 많기 때문에, 위와 같은 DCT 후의 계수 분포가 항상 유효하지 않다. 따라서, 모든 방향 예측에 대해 지그재그 스캐닝 방법을 사용하는 것은 효율적이지 못하다.

<61> 여기서, 수직(vertical) 예측 모드의 경우를 예를 들어 살펴보면, 수직 방향의 화소 유사성이 높을 때 율-왜곡(Rate-Distortion) 과정에서 최적의 모드로 선택되는 특징이 있는데, 이때의 변환 계수는 첫 번째 행에 중요 계수가 분포하는 현상이 생긴다. 이러한 경우에는 종래의 지그재그 스캐닝 방법보다는 도 4b의 수평(horizontal) 스캐닝 방법이 더욱 효율적이다.

<62> 한편, 수평(horizontal) 예측 모드의 경우를 예를 들어 살펴보면, 수평 방향의 화소 유사성이 높을 때 최적의 모드로 선택되며, 이때의 중요 계수는 첫 번째 열에 분포하는 현상이 생긴다. 이러한 경우에는 도 4c의 수직(vertical) 스캐닝 방법이 더욱 효율적이다.

<63> 그러나, 인트라 예측이 수행되기 전의 화소 유사성과 예측이 수행된 후의 잔여 계수의 화소 유사성이 상이하기 때문에, 단순히 인트라 예측 모드에 따라 상기도 4b 및 상기도 4c의 스캐닝 방법을 사용하는 것은 효율적이지 못하다.

<64> 따라서, 이미 복원된 주변 블록 경계 화소들(수평 방향의 화소 및 수직 방향의 화소) 간의 유사성 정보를 이용하여 현재 부호화될 블록의 수직 방향의 화소 유사성 및 수평 방향의 화소 유사성을 예측하고, 예측된 결과에 따라 적응적인 스캐닝 방법을 적용한다면 부호화 효율을 높일 수 있다.

<65> 도 5 는 본 발명에 따른 수직 및 수평 방향의 화소 유사성 예측 방법을 나타내는 일실시에 설명도이다.

<66> 도 5에 도시된 바와 같이, 화소 A, B, C 및 D는 현재 부호화될 블록의 상단에 위치한 화소들이고, 화소 E, F, G 및 H는 현재 부호화될 블록의 좌측에 위치한 화소들이다.

<67> 여기서, 수직(vertical) 예측 부호화의 경우, 현재 부호화될 블록 내 1 열의 화소들(a, e, i, m)의 수직 방향 화소 유사성은, 수직(vertical) 예측 후의 잔차 계수들(a-A, e-A, i-A, m-A)의 수직 방향 화소 유사성과 동일하다. 그 이유는 상기 잔차 계수들(a-A, e-A, i-A, m-A)은 화소들(a, e, i, m)과 동일한 예측 화소로 차분되어지므로, 그 상관성이 변하지 않기 때문이다.

<68> 이와 같이, 블록 내 2 열, 3 열 및 4 열의 화소들의 수직 방향 화소 유사성은, 수직(vertical) 예측 후의 각각의 잔차 계수들의 수직 방향 화소 유사성과 동일하다.

<69> 하지만, 현재 부호화될 블록 내 1 행의 화소들(a, b, c, d)의 수평 방향 유사성과 수직(vertical) 예측 후 잔차 계수들(a-A, b-B, c-C, d-D)의 수평 방향 화소 유사성은 서로 상이하다. 그리고, 수직(vertical) 예측 전 수평 방향의 화소 유사성은 수직(vertical) 예측 전보다 높아지게 되어 수직 방향의 화소 유사성과 비슷해지거나 더 커지는 경우가 발생한다.

<70> 이와 마찬가지로, 수평(horizontal) 예측 부호화의 경우, 블록 내 1 행의 화

소들(a, b, c, d)의 수평 방향 화소 유사성과 수평(horizontal) 예측 후 잔차 계수들(a-E, b-E, c-E, d-E)의 수평 방향 화소 유사성은 서로 동일하다. 그리고, 블록 내 2 행, 3 행 및 4 행의 화소들의 수평 방향 화소 유사성은, 수평(horizontal) 예측 후의 각각의 잔차 계수들의 수평 방향 화소 유사성과 동일하다.

<71> 하지만, 블록 내 1 열의 화소들(a, e, i, m)의 수직 방향 화소 유사성과 수평(horizontal) 예측 후 잔차 계수(a-E, e-F, i-G, m-H)의 수직 방향 화소 유사성은 서로 상이하다. 또한, 수평(horizontal) 예측 전 수직 방향의 화소 유사성은 수평(horizontal) 예측 전보다 높아지게 되어 수평 방향의 화소 유사성과 비슷해지거나 더 커지는 경우가 발생한다.

<72> 위와 같이 수직 및 수평 방향의 화소 유사성이 비슷해지게 될 경우, 수평(horizontal) 스캐닝 방법과 수직(vertical) 스캐닝 방법보다는 일반적인 지그재그 스캐닝 방법이 보다 효율적이다.

<73> 따라서, 인트라 수직(vertical) 예측 모드의 경우에는 잔차 계수들의 수직 방향 화소 유사성이 매우 높고, 수평 방향의 화소 유사성이 매우 낮은 경우에 수평 방향(horizontal) 스캐닝 방법을 사용하는 것이 보다 효율적이다.

<74> 한편, 인트라 수평(horizontal) 예측 모드의 경우에는 잔차 계수들의 수평 방향 화소 유사성이 매우 높고 수직 방향의 화소 유사성이 매우 낮은 경우에 수직(vertical) 스캐닝 방법을 사용하는 것이 보다 효율적이다.

<75> 인트라 4×4 예측 부호화의 효율을 높이기 위해, 상기 도 5의 복원된 8 개

의 화소들(A, B, C, D, E, F, G, H)의 수직 방향의 화소 유사성을 S_VER 이라 하고, 수평 방향의 화소 유사성을 S_HOR 이라 하면, 각각의 화소 유사성은 하기의 [수학식 1]과 같이 계산된다.

【수학식 1】

$$S_VER = \frac{1}{\text{Variance}(E, F, G, H)}$$

$$S_HOR = \frac{1}{\text{Variance}(A, B, C, D)}$$

<76>

<77> 여기서, *Variance()*는 분산을 나타내고, E, F, G, H 는 현재 부호화될 블록의 왼쪽에 인접한 화소들을 나타내며, A, B, C, D 는 현재 부호화될 블록의 위쪽에 인접한 화소들을 나타낸다.

<78> 수직(vertical) 예측 모드를 수행하였을 경우, S_HOR에 곱인자 (multiplication factor) α ($\alpha \geq 1$)를 곱한 값이 현재 블록의 잔차 계수의 수평 방향 화소 유사성 예측 값으로 사용된다(여기서, α 값은 실험시 2로 고정하였다). S_VER 은 그 값 그대로 현재 블록의 잔차 계수의 수직 방향 화소 유사성 예측 값으로 사용된다.

<79> 수평(horizontal) 예측 모드를 수행하였을 경우, S_VER에 곱인자

(multiplication factor) β ($\beta \geq 1$)를 곱한 값이 현재 블록의 잔차 계수의 수직 방향 화소 유사성 예측 값으로 사용된다(여기서, β 값은 실험시 2로 고정하였다). S_HOR은 그 값 그대로 현재 블록의 잔차 계수의 수평 방향 화소 유사성 예측 값으로 사용된다.

<80> 상기와 같은 방법으로 획득한 수직 및 수평 방향 화소 유사성 예측 값을 서로 비교하여 스캐닝 방법을 결정한다.

<81> 상기에서는 4×4 인트라 예측 모드를 예로 들어 설명하였지만, 이에 한정하지 않고 $M \times N$ 인트라 예측 모드 등에도 적용 가능하다.

<82> 이하, 인트라 수직(vertical) 및 수평(horizontal) 예측 모드에서의 스캐닝 방식을 선택하는 방법에 대해 도 6과 도 7을 참조하여 보다 상세하게 살펴보기로 한다.

<83> 도 6은 본 발명에 따른 인트라 수직(vertical) 예측 모드에서의 화소 유사성에 따른 적응적인 스캐닝 방법에 대한 일실시예 흐름도이다.

<84> 인트라 수직(vertical) 예측 모드일 경우(601), S_VER 값과 $\alpha \times S_HOR$ 값을 비교하여(602), S_VER 값이 $\alpha \times S_HOR$ 값보다 크면 수평(horizontal) 스캐닝을 사용하고(603), S_VER 값이 $\alpha \times S_HOR$ 값보다 작으면 지그재그 스캐닝을 사용한다(604).

<85> 여기서, 주변 화소의 유사성을 이용하여 현재 부호화할 블록의 수직 방향 화

소 유사성이 수평 방향의 화소 유사성보다 매우 높게 예측될 경우에는 DCT 및 양자화를 거친 변환 계수가 블록 내의 1 행에 수평 방향으로 분포하게 될 확률이 높기 때문에 수평(horizontal) 스캐닝 방법을 사용하면 높은 부호화 효율을 낼 수 있다.

<86> 도 7 은 본 발명에 따른 인트라 수평(horizontal) 예측 모드에서의 화소 유사성에 따른 적응적인 스캐닝 방법에 대한 일실시예 흐름도이다.

<87> 인트라 수평(horizontal) 예측 모드일 경우(701), S_HOR 값과 $\beta \times S_VER$ 값을 비교하여(702), S_HOR 값이 $\beta \times S_VER$ 값보다 크면 수직(vertical) 스캐닝을 사용하고(703), S_HOR 값이 $\beta \times S_VER$ 값보다 작으면 지그재그 스캐닝을 사용한다(704).

<88> 여기서, 주변 화소의 유사성을 이용하여 현재 부호화할 블록의 수평 방향 화소 유사성이 수직 방향 화소 유사성보다 매우 높게 예측될 경우에는 DCT 및 양자화를 거친 변환 계수가 블록 내 1 열에 수직 방향으로 분포하게 될 확률이 높기 때문에 수직(vertical) 스캐닝 방법을 사용하면 높은 부호화 효율을 낼 수 있다.

<89> 도 8 은 본 발명에 따른 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 복호화 장치의 일실시예 구성도이다.

<90> 도 8에 도시된 바와 같이, 본 발명에 따른 화소 유사성에 따라 적응적인 DCT 계수 스캐닝을 이용한 복호화 장치는, 엔트로피 복호화부(50), 스캐닝 결정부(60) 및 영상 복원부(70)를 포함한다.

<91> 여기서, 상기 엔트로피 복호화부(50)는 상기 화소 유사성에 따라 적응적인

DCT 계수 스캐닝을 이용한 부호화 장치에 의해 부호화된 영상(비트 스트림)을 입력 받아 CAVLC 또는 CABAC 등과 같은 엔트로피 복호화 방법에 따라 복호화를 수행한다. 또한, 상기 엔트로피 복호화부(50)는 엔트로피 복호화된 영상(비트 스트림)을 상기 스캐닝 결정부(60)로 전달한다.

<92> 그리고, 상기 스캐닝 결정부(60)는 상기 도 5 내지 도 8에서 설명한 바와 같이 인트라 예측 모드에 따라 상기 엔트로피 복호화부(50)에 의해 복호화된 계수의 스캐닝 방법을 결정한다.

<93> 그리고, 영상 복원부(70)는 상기 스캐닝 결정부(60)에 의해 결정된 스캐닝 방법을 이용하여 계수들을 최종적으로 복원(영상 복원)한다.

<94> 전술한 방법에 따라 'H.264/AVC Reference Codec' 인 JM86(Joint Model 86)을 이용하여 여러 가지 테스트 영상에 대하여 실험을 수행한 결과 다음과 같은 압축 효율 증가를 가져올 수 있었다. H.264/AVC에서 실험 영상으로 권고하는 영상을 이용하여 실험을 수행하였다.

<95> 하기 [표 1]은 상기 실험에 대한 조건을 나타낸다.

【표 1】

| 영상 | News (QCIF) | Container (QCIF) | Coast (QCIF) | Paris (QCIF) | Coast (CIF) |
|--------|-------------------------------------------------|---------------------|-----------------|-----------------|----------------|
| 전체 프레임 | 300 (30 Hz) | 300 (30 Hz) | 300 (30 Hz) | 300 (35 Hz) | 300 (30 Hz) |
| 조건 | CAVLC, Intra only, QP(18,22,26,40), 율-왜곡 최적화 사용 | | | | |

<96>

<97> 상기 [표 1]과 같이, 크기가 다른 5개의 영상에 대해서 실험하였다.

<98> 하기 [표 2]는 상기 [표 1]과 같은 실험 조건하에서 종래의 압축 방법 (H.264/AVC의 지그재그 스캐닝 방법)과 본 발명에 따른 압축 방법(인트라 예측 모드에 따른 적응적인 스캐닝 방법)을 이용하여 테스트 영상을 압축하였을 시의 영상의 압축률을 나타낸다.

【표 2】

| Sequence | QP | H.264/AVC | | Proposed Method | | Bits saving (%) |
|------------------|----|-----------|-----------------|-----------------|-----------------|-----------------|
| | | PSNR (dB) | Bitrates (Kbps) | PSNR (dB) | Bitrates (Kbps) | |
| News (QCIF) | 18 | 45.64 | 2370.65 | 45.64 | 2344.75 | 1.51% |
| | 22 | 43.06 | 1714.99 | 43.05 | 1692.69 | 1.67% |
| | 26 | 40.32 | 1221.96 | 40.32 | 1206.02 | 1.51% |
| | 30 | 37.50 | 872.65 | 37.49 | 860.23 | 1.49% |
| Container (QCIF) | 18 | 44.84 | 874.63 | 44.84 | 857.75 | 1.93% |
| | 22 | 41.71 | 643.42 | 41.7 | 630.5 | 2.01% |
| | 26 | 38.61 | 451.07 | 38.61 | 441.54 | 2.11% |
| | 30 | 35.77 | 317.36 | 35.76 | 309.93 | 2.34% |
| Coast (QCIF) | 18 | 44.18 | 2200.99 | 44.13 | 2152.15 | 2.22% |
| | 22 | 40.61 | 1631.56 | 40.59 | 1592.37 | 2.40% |
| | 26 | 37.13 | 1139.76 | 37.12 | 1111.02 | 2.52% |
| | 30 | 34.00 | 765.52 | 33.99 | 746.77 | 2.45% |
| Paris (CIF) | 18 | 44.72 | 4360.41 | 44.71 | 4271.09 | 2.05% |
| | 22 | 41.57 | 3334.22 | 41.56 | 3259.84 | 2.23% |
| | 26 | 38.25 | 2450.69 | 38.24 | 2391.77 | 2.40% |
| | 30 | 35.04 | 1780.73 | 35.03 | 1736.21 | 2.50% |
| Coast (CIF) | 18 | 44.34 | 4068.4 | 44.33 | 4015.7 | 1.30% |
| | 22 | 40.8 | 2989.5 | 40.8 | 2950.65 | 1.30% |
| | 26 | 37.32 | 2074.47 | 37.32 | 2045.89 | 1.38% |
| | 30 | 34.21 | 1388.07 | 34.22 | 1369.23 | 1.36% |

<99>

<100> 상기 [표 2]에 도시된 바와 같이, 본 발명에 따른 인트라 예측 모드에 따른 적응적인 스캐닝 방법을 사용하여 영상을 압축한 결과가 종래 H.264/AVC의 지그재그 스캐닝 방법만을 사용하여 영상을 압축한 결과보다 우수함을 알 수 있다.

<101> 상술한 바와 같은 본 발명의 방법은 프로그램으로 구현되어 컴퓨터로 읽을

수 있는 형태로 기록매체(씨디롬, 램, 롬, 플로피 디스크, 하드 디스크, 광자기 디스크 등)에 저장될 수 있다. 이러한 과정은 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있으므로 더 이상 상세히 설명하지 않기로 한다.

<102> 이상에서 설명한 본 발명은, 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에게 있어 본 발명의 기술적 사상을 벗어나지 않는 범위 내에서 여러 가지 치환, 변형 및 변경이 가능하므로 전술한 실시예 및 첨부된 도면에 의해 한정되는 것이 아니다.

【발명의 효과】

<103> 상기와 같은 본 발명은, 화소 유사성에 따라 가장 효율적인 스캐닝 방법을 적용하여 영상을 부호화 또는 복호화함으로써, 인트라 부호화의 압축률을 향상시킬 수 있는 효과가 있다.

<104> 또한, 본 발명은, 차후 개발될 인트라 예측을 사용하는 비디오 압축 기술에도 적용될 수 있으므로, 비디오 압축률을 향상시킬 수 있는 효과가 있다.

<105> 또한, 본 발명은, 부호화기와 복호화기에 동일한 유사성 정보를 적용함으로써, 새로운 모듈 추가에 대한 불필요함을 줄일 수 있는 효과가 있다.

【특허 청구범위】

【청구항 1】

이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스케닝을 이용한 부호화 장치에 있어서,

인트라 예측 시 최적 모드를 선택하기 위한 모드 선택수단;

상기 모드 선택수단에 의해 선택된 모드를 기반으로 입력된 영상에 대한 인트라 예측을 수행하는 인트라 예측수단;

상기 인트라 예측수단으로부터 출력된 잔차 계수 블록에 대해 이산 코사인 변환(DCT) 및 양자화를 수행하는 DCT 및 양자화수단; 및

상기 잔차 계수들의 화소 유사성에 따라 결정된 소정의 스케닝 모드를 이용해 상기 양자화된 DCT 계수를 엔트로피 부호화하기 위한 엔트로피 부호화수단

을 포함하는 부호화 장치.

【청구항 2】

제 1 항에 있어서,

상기 소정의 스케닝 모드는,

스평 방향 스케닝 또는 수직 방향 스케닝 또는 지그재그 스케닝 중 어느 하나인 것을 특징으로 하는 부호화 장치.

【청구항 3】

제 2 항에 있어서,

상기 엔트로피 부호화수단은,

상기 잔차 계수들의 수직 방향 화소 유사성이 높은 경우, 수평 방향 스캐닝을 이용해 부호화하고,

상기 잔차 계수들의 수평 방향 화소 유사성이 높은 경우, 수직 방향 스캐닝을 이용해 부호화하며,

상기 잔차 계수들의 수직 및 수평 방향의 화소 유사성이 비슷한 경우에는 지그재그 스캐닝을 이용해 부호화하는 것을 특징으로 하는 부호화 장치.

【청구항 4】

제 3 항에 있어서,

상기 엔트로피 부호화수단은,

수직 방향의 화소 유사성 값이 수평 방향의 화소 유사성 값에 제1 곱인자를 곱한 값보다 크면, 수직 방향의 화소 유사성이 높다고 판단하는 것을 특징으로 하는 부호화 장치.

【청구항 5】

제 3 항에 있어서,

상기 엔트로피 부호화수단은,

수평 방향의 화소 유사성 값이 수직 방향의 화소 유사성 값에 제2 곱인자를 곱한 값보다 크면, 수평 방향의 화소 유사성이 높다고 판단하는 것을 특징으로 하는 부호화 장치.

【청구항 6】

제 4 항에 있어서,

상기 수직 방향의 화소 유사성은,

현재 부호화된 블록의 왼쪽에 인접한 화소들에 대한 분산을 수행하여 계산하는 것을 특징으로 하는 부호화 장치.

【청구항 7】

제 5 항에 있어서,

상기 수평 방향의 화소 유사성은,

현재 부호화된 블록의 위쪽에 인접한 화소들에 대한 분산을 수행하여 계산하는 것을 특징으로 하는 부호화 장치.

【청구항 8】

제 6 항 또는 제 7 항에 있어서,

상기 제1 곱인자 및 상기 제2 곱인자는,
자연수 2인 것을 특징으로 하는 부호화 장치.

【청구항 9】

이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스캐닝을 이용한
복호화 장치에 있어서,

부호화된 영상을 엔트로피 복호화하기 위한 엔트로피 복호화수단;

상기 엔트로피 복호화수단에 의해 복호화된 영상에 대한 스캐닝 모드를 결정
하기 위한 스캐닝 결정수단; 및

상기 스캐닝 결정수단에 의해 결정된 스캐닝 모드에 따라 영상을 복원하기
위한 영상 복원수단

을 포함하는 복호화 장치.

【청구항 10】

제 9 항에 있어서,

상기 결정된 스캐닝 모드는 수평 방향 스캐닝 또는 수직 방향 스캐닝 또는
지그재그 스캐닝 중 어느 하나인 것을 특징으로 하는 복호화 장치.

【청구항 11】

이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스캐닝을 이용한 부호화 방법에 있어서,

인트라 예측 시 최적 모드를 선택하는 모드 선택 단계;

상기 모드 선택 단계에서 선택된 모드를 기반으로 입력된 영상에 대한 인트라 예측을 수행하는 인트라 예측 단계;

상기 인트라 예측 단계에서 출력된 잔차 계수 블록에 대해 이산 코사인 변환(DCT) 및 양자화를 수행하는 DCT 및 양자화 단계;

상기 잔차 계수들의 화소 유사성을 판단하는 판단 단계; 및

상기 판단 결과에 따라 결정된 소정의 스캐닝 모드를 이용해 상기 DCT 및 양자화 단계에서 양자화된 DCT 계수를 엔트로피 부호화하는 엔트로피 부호화 단계를 포함하는 부호화 방법.

【청구항 12】

제 11 항에 있어서,

상기 소정의 스캐닝 모드는 수평 방향 스캐닝 또는 수직 방향 스캐닝 또는 지그재그 스캐닝 중 어느 하나인 것을 특징으로 하는 부호화 방법.

【청구항 13】

제 12 항에 있어서,
상기 엔트로피 부호화 단계는,
상기 잔차 계수들의 수직 방향 화소 유사성이 높은 경우, 수평 방향 스캐닝
을 이용해 부호화하고,
상기 잔차 계수들의 수평 방향 화소 유사성이 높은 경우, 수직 방향 스캐닝
을 이용해 부호화하며,
상기 잔차 계수들의 수직 및 수평 방향의 화소 유사성이 비슷한 경우에는 지
그재그 스캐닝을 이용해 부호화하는 것을 특징으로 하는 부호화 방법.

【청구항 14】

제 13 항에 있어서,
상기 엔트로피 부호화 단계는,
수직 방향의 화소 유사성 값이 수평 방향의 화소 유사성 값에 제1 곱인자를
곱한 값보다 크면, 수직 방향의 화소 유사성이 높다고 판단하는 것을 특징으로 하
는 부호화 방법.

【청구항 15】

제 13 항에 있어서,

상기 엔트로피 부호화 단계는,

수평 방향의 화소 유사성 값이 수직 방향의 화소 유사성 값에 제2 곱인자를 곱한 값보다 크면, 수평 방향의 화소 유사성이 높다고 판단하는 것을 특징으로 하는 부호화 방법.

【청구항 16】

제 14 항에 있어서,

상기 수직 방향의 화소 유사성은,

현재 부호화된 블록의 왼쪽에 인접한 화소들에 대한 분산을 수행하여 계산하는 것을 특징으로 하는 부호화 방법.

【청구항 17】

제 15 항에 있어서,

상기 수평 방향의 화소 유사성은,

현재 부호화된 블록의 위쪽에 인접한 화소들에 대한 분산을 수행하여 계산하는 것을 특징으로 하는 부호화 방법.

【청구항 18】

제 16 항 또는 제 17 항에 있어서,

상기 제1 곱인자 및 상기 제2 곱인자는,
자연수 2인 것을 특징으로 하는 부호화 방법.

【청구항 19】

이산 코사인 변환 계수(DCT : Discrete Cosine Transform) 스캐닝을 이용한
복호화 방법에 있어서,

부호화된 영상을 엔트로피 복호화하는 엔트로피 복호화 단계;

상기 엔트로피 복호화 단계에서 복호화된 영상에 대한 스캐닝 모드를 결정하
는 스캐닝 모드 결정 단계; 및

상기 스캐닝 결정 단계에서 결정된 스캐닝 모드에 따라 영상을 복원하는 영
상 복원 단계

를 포함하는 복호화 방법.

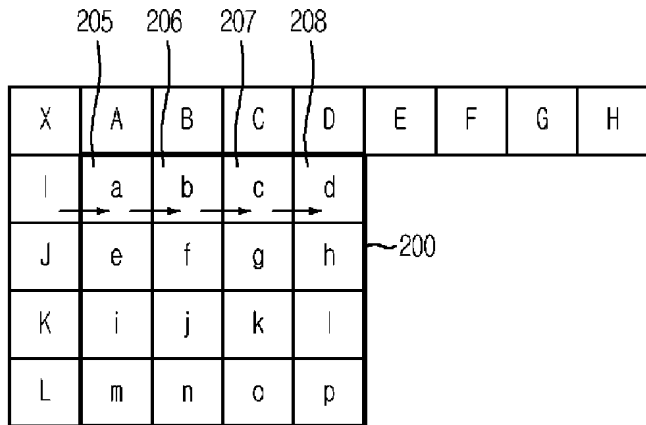
【청구항 20】

제 19 항에 있어서,

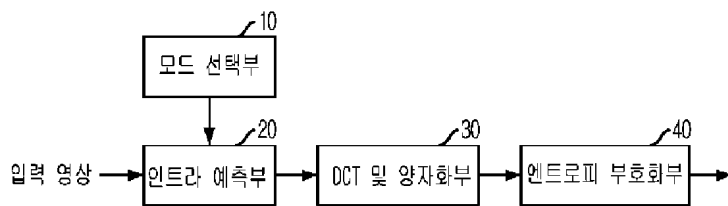
상기 결정된 스캐닝 모드는,

수평 방향 스캐닝 또는 수직 방향 스캐닝 또는 지그재그 스캐닝 중 어느 하
나인 것을 특징으로 하는 복호화 방법.

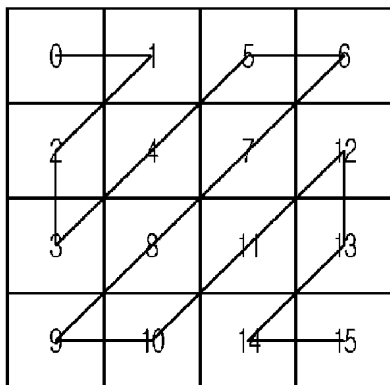
【도 2b】



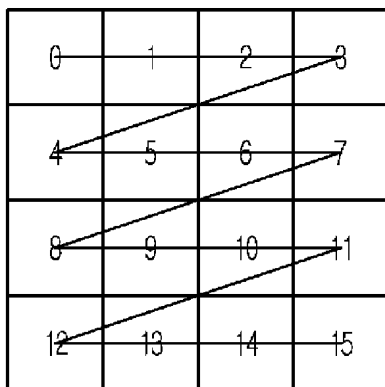
【도 3】



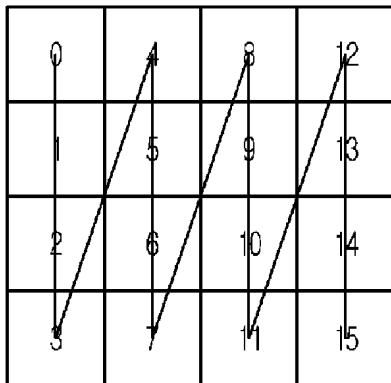
【도 4a】



【도 4b】



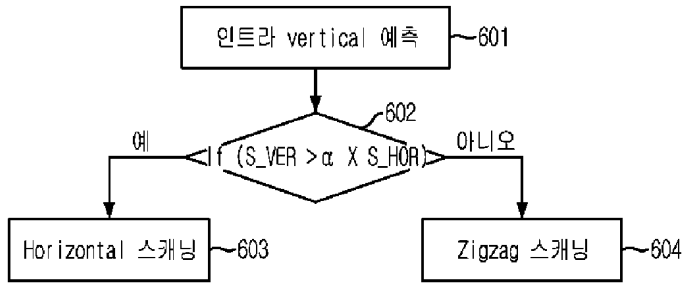
【도 4c】



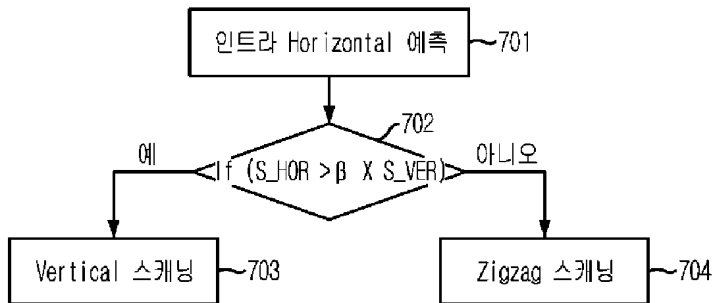
【도 5】

| | | | | |
|---|---|---|---|---|
| | A | B | C | D |
| E | a | b | c | d |
| F | e | f | g | h |
| G | i | j | k | l |
| H | m | n | o | p |

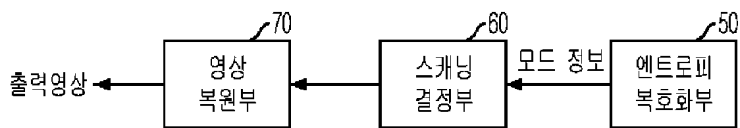
【도 6】



【도 7】



【도 8】





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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 | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 13/975,251 | 08/23/2013 | Se-Yoon Jeong | 022090.0002C2 |

CONFIRMATION NO. 9070

89980
NSIP LAW
P.O. Box 65745
Washington, DC 20035

NOTICE



Date Mailed: 01/06/2014

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
 - Se-Yoon Jeong
 - Hae-Chul Choi
 - Jeong-II Seo
 - Seung-Kwon Beack
 - In-Seon Jang
 - Jae-Gon Kim
 - Kyung-Ae Moon
 - Dae-Young Jang
 - Jin-Woo Hong
 - Jin-Woong Kim
 - Yung-Lyul Lee
 - Dong-Gyu Sim
 - Seoung-Jun Oh
 - Chang-Beom Ahn
 - Dae-Yeon Kim
 - Dong-Kyun Kim



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Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

Table with 7 columns: APPLICATION NUMBER, FILING or 371(c) DATE, GRP ART UNIT, FIL FEE REC'D, ATTY. DOCKET NO, TOT CLAIMS, IND CLAIMS. Row 1: 13/975,251, 08/23/2013, 2489, 800, 022090.0002C2, 2, 1

CONFIRMATION NO. 9070

89980
NSIP LAW
P.O. Box 65745
Washington, DC 20035

UPDATED FILING RECEIPT



Date Mailed: 01/06/2014

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 submit a written request for a Filing Receipt Correction. 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

Inventor(s)

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Assignment For Published Patent Application

Electronics and Telecommunications Research Institute, Daejeon, KOREA, REPUBLIC OF
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Industry-Academia Cooperation Group of Sejong University, Seoul, KOREA, REPUBLIC OF

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/377,617 02/16/2009 PAT 8548060
which is a 371 of PCT/KR07/01433 03/23/2007

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

REPUBLIC OF KOREA 10-2006-0077851 08/17/2006
REPUBLIC OF KOREA 10-2007-0008247 01/26/2007

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 10/28/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/975,251**

Projected Publication Date: 02/06/2014

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT
SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR

Preliminary Class

375

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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.

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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>.

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
13/975,251

APPLICATION AS FILED - PART I

(Column 1) (Column 2)

| FOR | NUMBER FILED | NUMBER EXTRA |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A |
| SEARCH FEE (37 CFR 1.16(k), (l), or (m)) | N/A | N/A |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A |
| TOTAL CLAIMS (37 CFR 1.16(j)) | 2 | minus 20 = * |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 1 | minus 3 = * |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 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)) | | |

* If the difference in column 1 is less than zero, enter "0" in column 2.

SMALL ENTITY

| RATE(\$) | FEE(\$) |
|--------------|------------|
| N/A | 70 |
| N/A | 300 |
| N/A | 360 |
| x 40 = | 0.00 |
| x 210 = | 0.00 |
| | 0.00 |
| | 0.00 |
| TOTAL | 730 |

OR OTHER THAN SMALL ENTITY

| RATE(\$) | FEE(\$) |
|--------------|---------|
| N/A | |
| N/A | |
| N/A | |
| | |
| | |
| | |
| | |
| TOTAL | |

APPLICATION AS AMENDED - PART II

(Column 1) (Column 2) (Column 3)

| AMENDMENT A | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|-----------------------------------------------------------------|---------------------------------------|----------------------------------|-------|------------------------------------|---------------|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = |
| | Application Size Fee (37 CFR 1.16(s)) | | | | |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | |

SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

OR OTHER THAN SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

(Column 1) (Column 2) (Column 3)

| AMENDMENT B | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|-----------------------------------------------------------------|---------------------------------------|----------------------------------|-------|------------------------------------|---------------|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = |
| | Application Size Fee (37 CFR 1.16(s)) | | | | |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | |

SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

OR OTHER THAN SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| 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 found in the appropriate box in column 1.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Application No. 13/975,251

Art Unit: 2489

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Unassigned

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

RESPONSE TO NOTICE TO FILE MISSING PARTS

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Notice to File Missing Parts mailed October 30, 2013, and having a period for response set to expire on December 30, 2013.

The small-entity surcharge of \$70.00 for late submission of an inventors' declaration is being paid concurrently herewith as required in the Notice. The inventors' declaration will be submitted within the time period set forth in the Notice.

In the event this paper is filed after the expiration of the period for response without an appropriate extension of time fee, the applicants respectfully petition for an appropriate extension of time. Please charge any fees under 37 CFR 1.16 and 1.17 that may be required only for this paper, any extension of time that may be required for this paper, and any paper

filed concurrently with this paper to Deposit Account No. 50-5113 in the name of North Star Intellectual Property Law, PC.

Respectfully submitted,

Date: December 27, 2013

/Randall S. Svihla/
Randall S. Svihla
Registration No. 56,273

NSIP Law
P.O. Box 65745
Washington, DC 20035
Telephone (202) 429-0020
Facsimile (202) 315-3758
CYP/RSS

Electronic Patent Application Fee Transmittal

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Application Number: | 13975251 |
| Filing Date: | 23-Aug-2013 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Filer: | Randall Scott Svihla/Sean Shoolbraid |
| Attorney Docket Number: | 022090.0002C2 |

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: | | | | |
| Late Filing Fee for Oath or Declaration | 2051 | 1 | 70 | 70 |

Petition:

Patent-Appeals-and-Interference:

Post-Allowance-and-Post-Issuance:

Extension of Time: Unified Patents, LLC v. Elects. & Telecomm. Res. Inst., et. al.

Ex. 1005, p.331

| Description | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------------|----------|----------|--------|----------------------|
| Miscellaneous: | | | | |
| Total in USD (\$) | | | | 70 |

Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 17770554 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Randall Scott Svihla/Sean Shoolbraid |
| Filer Authorized By: | Randall Scott Svihla |
| Attorney Docket Number: | 022090.0002C2 |
| Receipt Date: | 27-DEC-2013 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 17:05:25 |
| Application Type: | Utility under 35 USC 111(a) |

Payment information:

| | |
|------------------------------------------|-------------|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | \$70 |
| RAM confirmation Number | 2766 |
| Deposit Account | |
| Authorized User | |

File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /zip | Pages (if appl.) |
|---------------------------------------------|----------------------|-----------|----------------------------------|------------------|------------------|
| Unified Patents, LLC v. Res. Inst., et. al. | | | | Ex. 1005, p. 333 | |

| | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------|----|---|
| 1 | Applicant Response to Pre-Exam Formalities Notice | NTFMP20131030_0220900002 C2_ResponseToNTFMPAsFiled. pdf | 14441 ec4976da111f9baeb6fad746620e2eb1f7b37690 | no | 2 |
| Warnings: | | | | | |
| Information: | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30349 85f836bbe3d18b70c34df843ab6a1b1739b15774 | no | 2 |
| Warnings: | | | | | |
| Information: | | | | | |
| Total Files Size (in bytes): | | | 44790 | | |
| <p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p> | | | | | |

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|----------------------------------------------------------|---|----|--------------------------|----------------------|
| Substitute for form 1449/PTO | | | Complete if Known | |
| | | | Application Number | 13/975,251 |
| INFORMATION DISCLOSURE STATEMENT BY APPLICANT | | | Filing Date | August 23, 2013 |
| | | | First Named Inventor | Se-Yoon Jeong et al. |
| | | | Art Unit | 2489 |
| | | | Examiner Name | Unassigned |
| | | | Attorney Docket Number | 022090.0002C2 |
| Sheet | 1 | of | 3 | |
| <i>(Use as many sheets as necessary)</i> | | | | |

| U.S. PATENT DOCUMENTS | | | | | |
|-----------------------|-----------------------|--------------------------------------------|----------------------------|-------------------------------------------------|---------------------------------------------------------------------------|
| Examiner Initials* | Cite No. ¹ | Document Number | Patent or Publication Date | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
| | | Number - Kind Code ² (if known) | MM-DD-YYYY | | |
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|--------------------------|-----------------------|-------------------------------------------------------------------------------------|------------------|-------------------------------------------------|---------------------------------------------------------------------------|----------------|
| Examiner Initials* | Cite No. ¹ | Foreign Patent Document | Publication Date | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T ⁶ |
| | | Country Code ³ - Number ⁴ - Kind Code ⁵ (if known) | | | | |
| | | EP 0 230 632 A2 | 08-05-1987 | Nishizawa | | |

| | | | |
|--------------------|--|-----------------|--|
| 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. ¹Applicant's unique citation designation number (optional). ²See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04(a). ³Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶Applicant is to place a check mark here if English language Translation is attached (X indicates Abstract only provided).

| | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------|----|---|--------------------------|----------------------|
| Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i> | | | | Complete if Known | |
| | | | | Application Number | 13/975,251 |
| | | | | Filing Date | August 23, 2013 |
| | | | | First Named Inventor | Se-Yoon Jeong et al. |
| | | | | Art Unit | 2489 |
| Examiner Name | Unassigned | | | | |
| Sheet | 2 | of | 3 | Attorney Docket Number | 022090.0002C2 |

| FOREIGN PATENT DOCUMENTS | | | | | | | |
|--------------------------|-----------------------|-------------------------------------------------------------------------------------|--|--------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------|----------------|
| Examiner Initials* | Cite No. ¹ | Foreign Patent Document | | 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 |
| | | Country Code ³ - Number ⁴ - Kind Code ⁵ (if known) | | | | | |
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| NON-PATENT LITERATURE DOCUMENTS | | | | | | |
|---------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------|
| Examiner Initials* | Cite No. ¹ | Include name of the author, 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 ⁶ |
| | | | | D.-k. Kim et al., "Adaptive Scanning Using Pixel Similarity for H.264/AVC," <i>Proceedings of the 2006 Korean Signal Processing Conference</i> , Vol. 19, No. 1, pp. 1-4, September 23, 2006, Hanyang University Ansan Campus, Ansan, Republic of Korea (in Korean, including English abstract). | | |
| | | International Search Report and Written Opinion of the International Searching Authority issued on June 29, 2007, in counterpart International Application No. PCT/KR2007/001433. | | | | |
| | | H. Zrida et al., "High Level H.264/AVC Video Encoder Parallelization for Multiprocessor Implementation"; <i>Proceedings of the 2009 Design, Automation & Test in Europe Conference & Exhibition (DATE '09)</i> , pp. 940-945, conference held April 20-24, 2009, Nice, France, ISBN 978-3-9810801-5-5. | | | | |

| | | | |
|--------------------|--|-----------------|--|
| 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. ¹Applicant's unique citation designation number (optional). ²See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04(a). ³Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶Applicant is to place a check mark here if English language Translation is attached (X indicates Abstract only provided).

| | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|----------------------|
| Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i> | | | | Complete if Known | |
| | | | | Application Number | 13/975,251 |
| | | | | Filing Date | August 23, 2013 |
| | | | | First Named Inventor | Se-Yoon Jeong et al. |
| | | | | Art Unit | 2489 |
| | | | | Examiner Name | Unassigned |
| Sheet | 3 | of | 3 | Attorney Docket Number | 022090.0002C2 |

| U.S. PATENT APPLICATIONS | | | | | |
|--------------------------|----------|-----------------|------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Examiner Initials* | Cite No. | Application No. | Filing Date MM-DD-YYYY | Applicant | Assignee |
| | | 13/975,213 | 08-23-2013 | Se-Yoon Jeong et al. | Electronics and Telecommunications Research Institute Kwangwoon University Research Institute for Industry Cooperation Industry-Academia Cooperation Group of Sejong University |

| | | | |
|--------------------|--|-----------------|--|
| 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. ¹Applicant's unique citation designation number (optional).

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
SHINSUNG PATENT FIRM

2-3F, Line Bldg., 823-30, Yeoksam-dong, Kangnam-ku Seoul
135-080 Republic of Korea

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) **29 JUNE 2007 (29.06.2007)**

Applicant's or agent's file reference
P07E1129PCT

FOR FURTHER ACTION
See paragraph 2 below

| | | |
|-----------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------|
| International application No. PCT/KR2007/001433 | International filing date (day/month/year) 23 MARCH 2007 (23.03.2007) | Priority date(day/month/year) 17 AUGUST 2006 (17.08.2006) |
|-----------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------|

International Patent Classification (IPC) or both national classification and IPC

H04N 7/30(2006.01)i

Applicant

ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE et al



1. This opinion contains indications relating to the following items:
- Box No. I Basis of the opinion
 - Box No. II Priority
 - Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - Box No. IV Lack of unity of invention
 - Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - Box No. VI Certain documents cited
 - Box No. VII Certain defects in the international application
 - Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA ") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

| | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Name and mailing address of the ISA/KR</p>  <p>Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea</p> <p>Facsimile No. 82-42-472-7140</p> | <p>Date of completion of this opinion</p> <p>29 JUNE 2007 (29.06.2007)</p> | <p>Authorized officer</p> <p>LEE, Beaug Woo</p> <p>Telephone No.82-42-481-8227</p>  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2007/001433

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of:
 - the international application in the language in which it was filed
 - a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
2. This opinion has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established on the basis of:
 - a. type of material
 - a sequence listing
 - table(s) related to the sequence listing
 - b. format of material
 - on paper
 - in electronic form
 - c. time of filing/furnishing
 - contained in the international application as filed.
 - filed together with the international application in electronic form.
 - furnished subsequently to this Authority for the purposes of search.
4. In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

Form PCT/ISA/237 (Box No. I)(April 2007)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/KR2007/001433

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|--------|------|-----|
| Novelty (N) | Claims | 1-20 | YES |
| | Claims | NONE | NO |
| Inventive step (IS) | Claims | 1-20 | YES |
| | Claims | NONE | NO |
| Industrial applicability (IA) | Claims | 1-20 | YES |
| | Claims | NONE | NO |

2. Citations and explanations :

Reference is made to the following documents:

D1: JP2004-348741 A
D2: JP2003-006643 A

D1 discloses an image processing technique using DCT coefficients to determine the similarity between images for eliminating the need for an operation to decode the DCT-encoded images in such cases as performing a pixel comparison in the space domain. The image comparison method comprises comparison of DCT coefficients for a pair of image regions to determine the similarity between the image regions, wherein the comparison involves at least one AC coefficient and the influence of at least one AC coefficient is weighted in the determination of similarity.

D2 discloses a technique for a image processing. An initial similarity candidate calculating part calculates similarity between the first and second images on the basis of the first and second image feature expressed by quantized DCT coefficients. A coefficient converting processing part applies coefficient converting processing to at least one of first and second image feature amounts. A similarity calculating part calculates the similarity between the first and second images on the basis of the image feature amount obtained. Then, the similarity between the first and second images is determined out of a calculated similarity group.

I. Novelty and Inventive Step

Claim 1: The subject matter of claim 1 relates to an encoding apparatus using DCT scanning, comprising: a mode selecting unit for optimal mode of intra-prediction, an intra-prediction unit, a DCT and quantizing unit, an entropy encoding unit encoding the quantized DCT coefficients using scanning mode decided by pixel similarity of coefficient residues.

The difference of claim 1 from D1-D2 is that D1-D2 do not disclose nor teach an entropy encoding unit encoding the quantized DCT coefficients using scanning mode decided by pixel similarity of coefficient residues. Moreover, the difference is not obvious for a person skilled in the art even with any combinations of D1-D2. Therefore, claim 1 is considered to be novel(PCT Article 33(2)) and to involve an inventive step(PCT Article 33(3)).

Claims 2-8: Claims 2-8, which are dependent on claim 1, also comply with PCT Article 33(2) and PCT Article 33(3) as they are dependent claims.

(continued on the Supplemental sheet)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/KR2007/001433

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claims 1, 3, 11, 13 do not meet the requirements of PCT Article 6 in that the terms "optimal", "high similarity", "similar similarity" have technically-unclear meaning.

Claims 1, 8, 18 do not meet the requirements of PCT Article 6 in that the terms "the said quantized DCT coefficient", "the said second multiplying factor" are not found in claims 1, 8, 18, and are not found in any claims on which the claims 8, 18 depend.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of :

(Box No. V)

Claim 9: The subject matter of claim 9 relates to an decoding apparatus using DCT scanning, comprising: an entropy decoding unit for encoded image, a scanning decision unit deciding scanning mode for decoded image from the entropy decoding unit, an image restoring unit according the scanning mode decided.

The difference of claim 9 from D1-D2 is that D1-D2 do not disclose nor teach an entropy decoding unit for encoded image, a scanning decision unit deciding scanning mode for decoded image from the entropy decoding unit. Moreover, the difference is not obvious for a person skilled in the art even with any combinations of D1-D2. Therefore, claim 9 is considered to be novel(PCT Article 33(2)) and to involve an inventive step(PCT Article 33(3)).

Claim 10: Claim 10, which is dependent on claim 9, also complies with PCT Article 33(2) and PCT Article 33(3) as it is dependent claim.

Claim 11: The subject matter of claim 11 relates to an encoding method using DCT scanning, comprising: a mode selecting step for optimal mode of intra-prediction, an intra-predicting step, a DCT and quantizing step, a similarity deciding step for deciding pixel similarity of coefficient residues, an entropy encoding step for encoding the quantized DCT coefficients using scanning mode decided by the similarity deciding step.

The difference of claim 11 from D1-D2 is that D1-D2 do not disclose nor teach a similarity deciding step deciding pixel similarity of coefficient residues, an entropy encoding step encoding the quantized DCT coefficients using scanning mode decided by the similarity deciding step. Moreover, the difference is not obvious for a person skilled in the art even with any combinations of D1-D2. Therefore, claim 11 is considered to be novel(PCT Article 33(2)) and to involve an inventive step(PCT Article 33(3)).

Claims 12-18: Claims 12-18, which are dependent on claim 11, also comply with PCT Article 33(2) and PCT Article 33(3) as they are dependent claims.

Claim 19: The subject matter of claim 19 relates to an decoding method using DCT scanning, comprising: an entropy decoding step for decoding an encoded image, a scanning mode deciding step for deciding scanning mode of decoded image from the entropy decoding step, an image restoring step for restoring the image according the scanning mode decided at the scanning mode deciding step.

The difference of claim 19 from D1-D2 is that D1-D2 do not disclose nor teach an entropy decoding step for decoding an encoded image, a scanning mode deciding step for deciding scanning mode of decoded image from the entropy decoding step. Moreover, the difference is not obvious for a person skilled in the art even with any combinations of D1-D2. Therefore, claim 19 is considered to be novel(PCT Article 33(2)) and to involve an inventive step(PCT Article 33(3)).

Claim 20: Claim 20, which is dependent on claim 19, also complies with PCT Article 33(2) and PCT Article 33(3) as it is dependent claim.

II. Industrial Applicability

The industrial applicability of claims 1-20 is self-evident in the sense of PCT Article 33(4) because the subject matter claimed can be made or used in industry.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2007/001433

A. CLASSIFICATION OF SUBJECT MATTER

H04N 7/30(2006.01)i

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)

IPC8: H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO internal) "predict, similarity, DCT, coefficient"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|---------------------------------------------------------------------------------------------------------------------|-----------------------|
| A | JP2004-348741 A (MITSUBISHI ELECTRIC EUROPA BV.) 9 December 2004 see abstract, claims 1-5, 14-18, figures 1, 3-5 | 1-20 |
| A | JP2003-006643 A (CANON INC.) 10 January 2003 see abstract, claims 1, 5, 9, figures 1, 9-12 | 1-20 |

Further documents are listed in the continuation of Box C.

See patent family 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 application or patent 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 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

29 JUNE 2007 (29.06.2007)

Date of mailing of the international search report

29 JUNE 2007 (29.06.2007)

Name and mailing address of the ISA/KR



Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

LEE, Beaug Woo

Telephone No. 82-42-481-8227



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2007/001433

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|----------------------------------------|------------------|-------------------------|------------------|
| JP 16348741 | 09. 12. 2004 | EP01480170A1 | 24. 11. 2004 |
| | | EP1480170A1 | 24. 11. 2004 |
| | | JP16348741 | 09. 12. 2004 |
| | | JP2004348741A2 | 09. 12. 2004 |
| | | US20050002569A1 | 06. 01. 2005 |
| | | US2005002569AA | 06. 01. 2005 |
| JP15006643 | 10. 01. 2003 | JP15006643 | 10. 01. 2003 |
| | | JP2003006643A2 | 10. 01. 2003 |
| | | US20030081678A1 | 01. 05. 2003 |
| | | US2003081678A1 | 01. 05. 2003 |
| | | US2003081678AA | 01. 05. 2003 |
| | | US7079689BB | 18. 07. 2006 |

Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 17384131 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Randall Scott Svihla |
| Filer Authorized By: | |
| Attorney Docket Number: | 022090.0002C2 |
| Receipt Date: | 12-NOV-2013 |
| Filing Date: | 23-AUG-2013 |
| Time Stamp: | 19:20:55 |
| 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 | IDS20131112_0220900002C2_Statement.pdf | 16273 <small>aef8b70fb3ef6625a501d882c4d85a774478e84a</small> | no | 2 |

Warnings:

Information: United States Patents, LLC v. Elects. & Telecomm. Res. Inst., et. al.

Ex. 1005, p.345

| | | | | | |
|---|----------------------------------------------------|----------------------------------|------------------------------------------|----|---|
| 2 | Information Disclosure Statement (IDS) Form (SB08) | IDS20131112_0220900002C2_IDs.pdf | 89134 | no | 3 |
| | | | e2935332b4ecbd4f9ab9e55c95cccb7dae3f290c | | |

Warnings:

Information:

This is not an USPTO supplied IDS fillable form

| | | | | | |
|---|-----------------------|------------------------------|------------------------------------------|----|---|
| 3 | Non Patent Literature | WO-ISR_and_WO-06-29-2007.pdf | 300408 | no | 7 |
| | | | 4fa5e338c956ad5839bdcc9d5bbff4262ece6ae0 | | |

Warnings:

Information:

| | |
|-------------------------------------|--------|
| Total Files Size (in bytes): | 405815 |
|-------------------------------------|--------|

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 PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Application No. 13/975,251

Art Unit: 2489

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Unassigned

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

INFORMATION DISCLOSURE STATEMENT

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

Sir:

This Information Disclosure Statement is being filed pursuant to 37 CFR 1.97(b)(3) because it is being filed within three months of the filing date of the above-identified application pursuant to 37 CFR 1.97(b)(1), such that neither a statement under 37 CFR 1.97(e) nor the fee set forth in 37 CFR 1.17(p) is required.

This application is a continuation of Application No. 12/377,617 filed on February 16, 2009.

Attached hereto are 3 sheets entitled "Information Disclosure Statement by Applicant" citing 12 U.S. patent documents, 7 foreign patent documents, 3 non-patent literature documents, and 1 U.S. patent application, and a copy of the International Search Report and Written Opinion of the International Searching Authority issued on June 29, 2007, cited as one of the 3 non-patent literature documents.

Copies of the U.S. patent documents are not being provided pursuant to 37 CFR 1.98(a)(2)(ii).

A copy of the U.S. patent application is not being provided pursuant to MPEP 609.04(a)(II)(C) (see MPEP page 600-148).

Copies of the 7 foreign patent documents and the 2 non-patent literature documents other than the International Search Report and Written Opinion of the International Searching Authority issued on June 29, 2007, are not being provided pursuant to 37 CFR 1.98(d) because these documents were considered by the Office in parent Application 12/377,617, and were either cited by the Office in the parent application or cited in an Information Disclosure Statement filed in the parent application that complied with 37 CFR 1.98(a)-(c).

A concise explanation of the relevance of the 5 foreign patent documents that are not in the English language pursuant to 37 CFR 1.98(a)(3)(i) is not required pursuant to MPEP 609.04(a)(III) (see MPEP page 600-149) because these documents were considered by the Office in parent Application 12/377,617, and the relevance of these 5 foreign patent documents to the present application is the same as the relevance of these 5 foreign patent documents to the parent application as explained in the parent application.

US 8,548,060 issued from parent Application No. 12/377,617.

Application No. 13/975,213, like the present application, is a continuation of Application No. 12/377,617.

It is respectfully requested that this Information Disclosure Statement be considered.

Respectfully submitted,

Date: November 12, 2013

/Randall S. Svihla/
Randall S. Svihla
Registration. No. 56,273

NSIP Law
P.O. Box 65745
Washington, DC 20035
Telephone (202) 429-0020
Facsimile (202) 315-3758
CYP/RSS

Attachments



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

Table with 4 columns: APPLICATION NUMBER (13/975,251), FILING OR 371(C) DATE (08/23/2013), FIRST NAMED APPLICANT (Se-Yoon Jeong), ATTY. DOCKET NO./TITLE (022090.0002C2)

CONFIRMATION NO. 9070
FORMALITIES LETTER

89980
NSIP LAW
P.O. Box 65745
Washington, DC 20035



Date Mailed: 10/30/2013

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION
FILED UNDER 37 CFR 1.53(b)
Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing.

Applicant is given TWO MONTHS from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of \$ 70 for a small entity in compliance with 37 CFR 1.27, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within TWO MONTHS from the date of this Notice is \$ 70 for a small entity
• \$ 70 Surcharge.

Items Required To Avoid Processing Delays:

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
Se-Yoon Jeong
Hae-Chul Choi
Jeong-II Seo
Seung-Kwon Beack
In-Seon Jang
Jae-Gon Kim
Kyung-Ae Moon
Dae-Young Jang

Jin-Woo Hong
Jin-Woong Kim
Yung-Lyul Lee
Dong-Gyu Sim
Seoung-Jun Oh
Chang-Beom Ahn
Dae-Yeon Kim
Dong-Kyun Kim

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/byemane/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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

Table with 7 columns: APPLICATION NUMBER, FILING or 371(c) DATE, GRP ART UNIT, FIL FEE REC'D, ATTY. DOCKET NO, TOT CLAIMS, IND CLAIMS. Row 1: 13/975,251, 08/23/2013, 2482, 730, 022090.0002C2, 2, 1

CONFIRMATION NO. 9070

89980
NSIP LAW
P.O. Box 65745
Washington, DC 20035

FILING RECEIPT



Date Mailed: 10/30/2013

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 submit a written request for a Filing Receipt Correction. 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

Inventor(s)

- Se-Yoon Jeong, Daejeon, KOREA, REPUBLIC OF;
Hae-Chul Choi, Daejeon, KOREA, REPUBLIC OF;
Jeong-Il Seo, Daejeon, KOREA, REPUBLIC OF;
Seung-Kwon Beack, Seoul, KOREA, REPUBLIC OF;
In-Seon Jang, Gunpo-si, KOREA, REPUBLIC OF;
Jae-Gon Kim, Daejeon, KOREA, REPUBLIC OF;
Kyung-Ae Moon, Daejeon, KOREA, REPUBLIC OF;
Dae-Young Jang, Daejeon, KOREA, REPUBLIC OF;
Jin-Woo Hong, Daejeon, KOREA, REPUBLIC OF;
Jin-Woong Kim, Daejeon, KOREA, REPUBLIC OF;
Yung-Lyul Lee, Seoul, KOREA, REPUBLIC OF;
Dong-Gyu Sim, Seoul, KOREA, REPUBLIC OF;
Seoung-Jun Oh, Seongnam-si, KOREA, REPUBLIC OF;
Chang-Beom Ahn, Seoul, KOREA, REPUBLIC OF;
Dae-Yeon Kim, Seoul, KOREA, REPUBLIC OF;
Dong-Kyun Kim, Seoul, KOREA, REPUBLIC OF;

Applicant(s)

Industry-Academia Cooperation Group of Sejong University, Seoul, KOREA, REPUBLIC OF
Kwangwoon University Research Institute for Industry Cooperation, Seoul, KOREA, REPUBLIC OF
Electronics and Telecommunications Research Institute, Daejeon, KOREA, REPUBLIC OF

Assignment For Published Patent Application

Electronics and Telecommunications Research Institute, Daejeon, KOREA, REPUBLIC OF
Kwangwoon University Research Institute for Industry Cooperation, Seoul, KOREA, REPUBLIC OF

Industry-Academia Cooperation Group of Sejong University, Seoul, KOREA, REPUBLIC OF

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/377,617 02/16/2009 PAT 8548060
which is a 371 of PCT/KR07/01433 03/23/2007

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

REPUBLIC OF KOREA 10-2006-0077851 08/17/2006

REPUBLIC OF KOREA 10-2007-0008247 01/26/2007

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 10/28/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/975,251**

Projected Publication Date: 02/06/2014

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT
SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR

Preliminary Class

375

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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

page 2 of 4

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 (1-866-999-4258).

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.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
13/975,251

APPLICATION AS FILED - PART I

(Column 1) (Column 2)

| FOR | NUMBER FILED | NUMBER EXTRA |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A |
| SEARCH FEE (37 CFR 1.16(k), (l), or (m)) | N/A | N/A |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A |
| TOTAL CLAIMS (37 CFR 1.16(j)) | 2 minus 20 = * | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 1 minus 3 = * | |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 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)) | | |

* If the difference in column 1 is less than zero, enter "0" in column 2.

SMALL ENTITY

| RATE(\$) | FEE(\$) |
|--------------|------------|
| N/A | 70 |
| N/A | 300 |
| N/A | 360 |
| x 40 = | 0.00 |
| x 210 = | 0.00 |
| | 0.00 |
| | 0.00 |
| TOTAL | 730 |

OR OTHER THAN SMALL ENTITY

| RATE(\$) | FEE(\$) |
|--------------|---------|
| N/A | |
| N/A | |
| N/A | |
| | |
| | |
| | |
| | |
| TOTAL | |

APPLICATION AS AMENDED - PART II

(Column 1) (Column 2) (Column 3)

| AMENDMENT A | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|-----------------------------------------------------------------|---------------------------------------|----------------------------------|-------|------------------------------------|---------------|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = |
| | Application Size Fee (37 CFR 1.16(s)) | | | | |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | |

SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

OR OTHER THAN SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

(Column 1) (Column 2) (Column 3)

| AMENDMENT B | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|-----------------------------------------------------------------|---------------------------------------|----------------------------------|-------|------------------------------------|---------------|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = |
| | Application Size Fee (37 CFR 1.16(s)) | | | | |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | |

SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

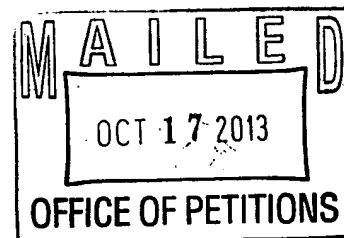
OR OTHER THAN SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| 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 found in the appropriate box in column 1.



NSIP LAW
P.O. Box 65745
Washington DC 20035



In re Application of :
Jeong et al. :
Application No. 13/975,251 : ON PETITION
Deposited: August 23, 2013 :
Attorney Docket No. 022090.0002C2 :

This is in response to the “PETITION UNDER 37 CFR 1.182 TO ACCORD A FILING DATE AS OF DATE OF APPLICATION” filed October 1, 2013, requesting that the above-referenced application be accorded a filing date of August 23, 2013. This petition is being treated pursuant to 37 CFR 1.53(e)(2)¹.

Application papers in the above-identified application were deposited on August 23, 2013. However, on September 16, 2013, the Office of Patent Application Processing mailed applicants a “Notice of Incomplete Nonprovisional Application,” notifying applicants that the application papers had not been accorded a filing date because the application was deposited without drawings. In response, applicants timely filed this petition. Applicants request that the application be amended to include the inadvertently omitted drawings on the basis that the application as filed contained a prior benefit claim under 37 CFR 1.55 or 1.78.

Petitioners’ arguments and evidence have been considered. However, a review of the application confirms that, as filed, the application contained at least one method claim. MPEP 601.01(f) provides that:

It has been USPTO practice to treat an application that contains at least one process or method claim as an application for which a drawing is not necessary for an understanding of the invention under 35 U.S.C. 113 (first sentence).

Thus, pursuant to § 601.01(f), a drawing is not considered essential for a filing date. The instant application is entitled to a filing date without drawings present in the application.

¹ Any request for review of a notification pursuant to paragraph (e)(1) of this section, or a notification that the original application papers lack a portion of the specification or drawing(s), must be by way of a petition pursuant to this paragraph accompanied by the fee set forth in § 1.17(f). In the absence of a timely (§ 1.181(f)) petition pursuant to this paragraph, the filing date of an application in which the applicant was notified of a filing error pursuant to paragraph (e)(1) of this section will be the date the filing error is corrected.

Accordingly, the Office should have granted the application a filing date and mailed a Notice of Omitted Items instead of a Notice of Incomplete Nonprovisional Application. As stated in MPEP 601.01(g) under the section entitled, "Application Entitled to a Filing Date," applicant may submit an amendment to include the inadvertently omitted portion of the drawing(s) pursuant to 37 CFR 1.57(a):

[i]f an application was filed on or after September 21, 2004, and contains a claim under 37 CFR 1.55 for priority of a prior-filed foreign application, or a claim under 37 CFR 1.78 for the benefit of a prior-filed provisional, nonprovisional, or international application that was present on the filing date of the application, and the omitted portion of the drawing(s) was inadvertently omitted from the application and is completely contained in the prior-filed application[.]

Please note that no petition is required and that the amendment must comply with 37 CFR 1.57(a) and 37 CFR 1.121. See MPEP § 201.17. Any amendment to include the inadvertently omitted drawing(s) will be considered by the examiner.

To the extent the instant petition requests a filing date of August 23, 2013 with no drawings present in the application, the petition is **GRANTED**.


Given the basis for granting this petition, the petition fee is being refunded.

Pursuant to this decision, the application will be referred to Office of Patent Application Processing for:

- X **correction of the filing date to August 23, 2013;**
- X **for indication in Office records, as appropriate, that "0" sheets of drawings were present on filing and**
- X **for issuance of a filing receipt.**

Entry of the amendment filed August 23, 2013 will be determined by the examiner.

Telephone inquiries concerning this matter may be directed to the undersigned at (571) 272-3230.


Shirene Willis Brantley
Attorney Advisor
Office of Petitions

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Application No. 13/975,251

Art Unit: 2482

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Unassigned

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR

PETITION UNDER 37 CFR 1.182 TO ACCORD A FILING DATE AS OF DATE OF DEPOSIT OF APPLICATION

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

Sir:

This is in response to the Notice of Incomplete Nonprovisional Application mailed September 16, 2013, and having a period for response set to expire on November 16, 2013.

The Notice states that this application was deposited on August 23, 2013, without drawings. This application is a continuation of Application No. 12/377,617, and a claim for the benefit of Application No. 12/377,617 is included in the Application Data Sheet included in the application papers filed on August 23, 2013. The following section appears on page 1 of the specification included in the application papers filed on August 23, 2013 (emphasis added):

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of Application No. 12/377,617 filed on February 16, 2009, which is a U.S. National Stage application of International Application No. PCT/KR2007/001433 filed on March 23, 2007, which claims the benefit of Korean Application Nos. 10-2006-0077851 filed on August 17, 2006, and 10-2007-0008247 filed on January 26, 2007. The entire disclosures of Application No. 12/377,617, International

Refund Ref: 08/16/2013 0030134855
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Adjustment date: 10/16/2013 CKHLOK
10/02/2013 INTEFSW 00006718 13975251
01 FC:2462 -200.00 OP

UNITED STATES PATENT & TRADEMARK OFFICE
Washington, D.C. 20231

| REQUEST FOR PATENT FEE REFUND | | | | | | | | | | |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------|--|--|----|--|--|--|
| 1 Date of Request: <u>10/08/13</u> | | 2 Serial/Patent # <u>13/975,251</u> | | | | | | | | |
| 3 Please refund the following fee(s): | | 4 PAPER NUMBER | 5 DATE FILED | 6 AMOUNT | | | | | | |
| <input type="checkbox"/> | Filing | | | \$ | | | | | | |
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| <input checked="" type="checkbox"/> | Petition | | 10/01/13 | \$ 200.00 | | | | | | |
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| <input type="checkbox"/> | Maintenance | | | \$ | | | | | | |
| <input type="checkbox"/> | Assignment | | | \$ | | | | | | |
| <input type="checkbox"/> | Other | | | \$ | | | | | | |
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| <input checked="" type="checkbox"/> | No Fee Due (Explanation): | 9 <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px; text-align: center;">--</td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table> | | | | | -- | | | |
| | | -- | | | | | | | | |
| Application entitled to filing date without drawings. Notice of Incomplete mailed in error. Refund petition fee. | | | | | | | | | | |
| 11 REFUND REQUESTED BY: | | | | | | | | | | |
| TYPED/PRINTED NAME: <u>Shirene Willis Brantley</u> | | TITLE: <u>Attorney Advisor</u> | | | | | | | | |
| SIGNATURE: <u><i>Shirene Willis Brantley</i></u> | | PHONE: <u>571 272-3230</u> | | | | | | | | |
| OFFICE: <u>Office of Petitions</u> | | | | | | | | | | |
| ***** THIS SPACE RESERVED FOR FINANCE USE ONLY: ***** | | | | | | | | | | |
| APPROVED: <u><i>Orllok</i></u> | | DATE: <u>10/16/13</u> | | | | | | | | |

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**Office of Finance
Refund Branch
Crystal Park One, Room 802B**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Application No. 13/975,251

Art Unit: 2482

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Unassigned

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

**PETITION UNDER 37 CFR 1.182 TO ACCORD A FILING DATE
AS OF DATE OF DEPOSIT OF APPLICATION**

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

Sir:

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The Notice states that this application was deposited on August 23, 2013, without drawings. This application is a continuation of Application No. 12/377,617, and a claim for the benefit of Application No. 12/377,617 is included in the Application Data Sheet included in the application papers filed on August 23, 2013. The following section appears on page 1 of the specification included in the application papers filed on August 23, 2013 (emphasis added):

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Application No. PCT/KR2007/001433, and Korean Application Nos. 10-2006-0077851 and 10-2007-0008247 are incorporated herein by reference for all purposes.

Thus, the entire disclosure of parent Application No. 12/377,617, which includes the drawings filed on February 16, 2009, in parent Application No. 12/377,617, was explicitly incorporated by reference in the present continuation application as of the date of deposit of August 23, 2013, of the present continuation application.

Accordingly, pursuant to MPEP 201.06(c)(IV)(A) (see MPEP pages 200-26 and 27), submitted herewith is a Preliminary Amendment adding the six sheets of drawings containing FIGS. 1-11 filed on February 16, 2009, in parent Application No. 12/377,617 to the present continuation application.

Pursuant to MPEP 201.06(c)(IV)(A) and 37 CFR 1.182, it is respectfully requested that the accompanying Preliminary Amendment adding the six sheets of drawings containing FIGS. 1-11 filed on February 16, 2009, in parent Application No. 12/377,617 to the present continuation application be entered, and that the present continuation application be accorded a filing date of August 23, 2013, which is the date of deposit of the present continuation application.

The small-entity petition fee of \$200.00 set forth in 37 CFR 1.17(f) required by 37 CFR 1.182 is being paid currently with the filing of this petition via EFS-Web.

Please charge any fees under 37 CFR 1.17(f) that may be required only for this paper to Deposit Account No. 50-5113 in the name of North Star Intellectual Property Law, PC.

Respectfully submitted,

Date: October 1, 2013

/Randall S. Svihla/
Randall S. Svihla
Registration No. 56,273

NSIP Law
P.O. Box 65745
Washington, DC 20035
Telephone (202) 429-0020
Facsimile (202) 315-3758
CYP/RSS

Attachments

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Application No. 13/975,251

Art Unit: 2482

Confirmation No. 9070

Filed: August 23, 2013

Examiner: Unassigned

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

PRELIMINARY AMENDMENT

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

Sir:

Prior to examination, and further to the Preliminary Remarks of August 23, 2013, please amend the above-identified application as follows.

The following amendments and remarks are respectfully submitted.

Amendments to the drawings begin on page 2 of this paper.

Remarks begin on page 3 of this paper.

Six new sheets of drawings are attached following page 4 of this paper.

IN THE DRAWINGS:

Six new sheets of drawings containing FIGS. 1-11 are attached to this paper. Please ADD these six new sheets of drawings to the present application for the reasons discussed below in the remarks.

REMARKS

In accordance with the foregoing, six new sheets of drawings containing FIGS. 1-11 have been added. Claims 1-20 are pending, with claims 1, 7, 11, and 16 being independent.

This application was deposited on August 23, 2013, without drawings. This application is a continuation of Application No. 12/377,617, and a claim for the benefit of Application No. 12/377,617 is included in the Application Data Sheet included in the application papers filed on August 23, 2013. The following section appears on page 1 of the specification included in the application papers filed on August 23, 2013 (emphasis added):

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Thus, the entire disclosure of parent Application No. 12/377,617, which includes the drawings filed on February 16, 2009, in parent Application No. 12/377,617, was explicitly incorporated by reference in the present continuation application as of the date of deposit of August 23, 2013, of the present continuation application.

Accordingly, pursuant to MPEP 201.06(c)(IV)(A) (see MPEP pages 200-26 and 27), the six sheets of drawings containing FIGS. 1-11 filed on February 16, 2009, in parent Application No. 12/377,617 have been added to the present continuation application in this Preliminary Amendment.

Pursuant to MPEP 201.06(c)(IV)(A), submitted herewith is a Petition Under 37 CFR 1.182 to Accord a Filing Date as of Date of Deposit of Application requesting that this Preliminary Amendment be entered, and that the present continuation application be accorded a

filing date of August 23, 2013, which is the date of deposit of the present continuation application.

Respectfully submitted,

Date: October 1, 2013

/Randall S. Svihla/
Randall S. Svihla
Registration No. 56,273

NSIP Law
P.O. Box 65745
Washington, DC 20035
Telephone (202) 429-0020
Facsimile (202) 315-3758
CYP/RSS

Attachments

1/6

FIG. 1

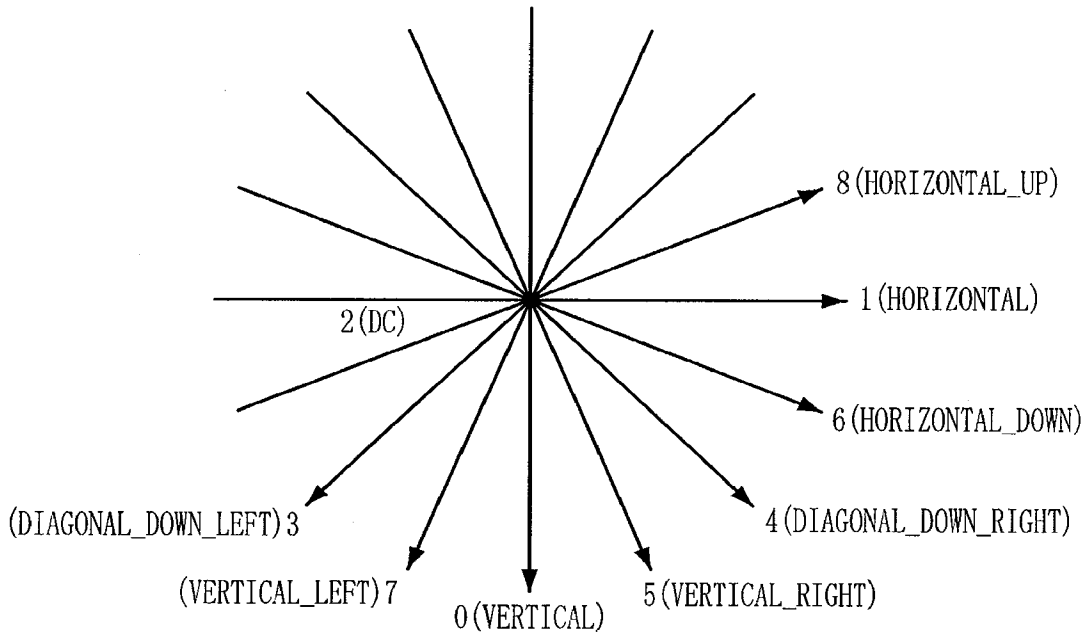


FIG. 2

| | | | | | | | | | |
|-----|---|---|---|---|---|---|---|---|---|
| | X | A | B | C | D | E | F | G | H |
| 201 | I | a | b | c | d | | | | |
| 202 | J | e | f | g | h | | | | |
| 203 | K | i | j | k | l | | | | |
| 204 | L | m | n | o | p | | | | |

200

FIG. 3

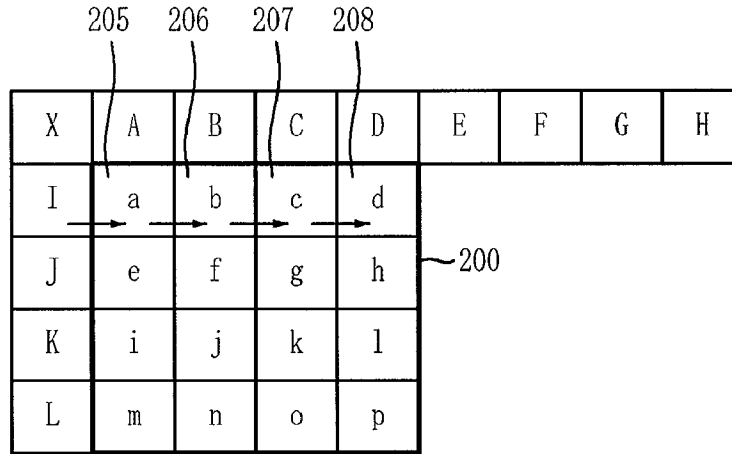
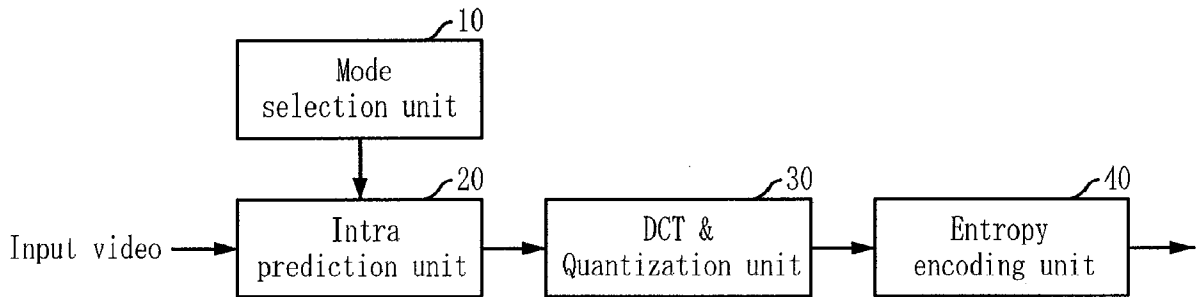


FIG. 4



3/6

FIG. 5

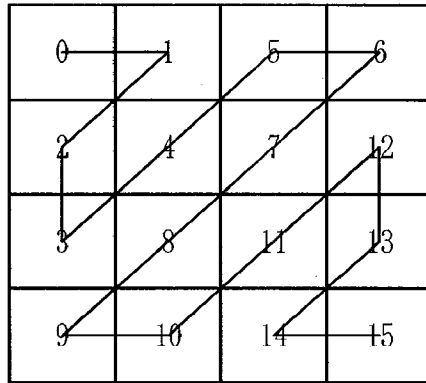
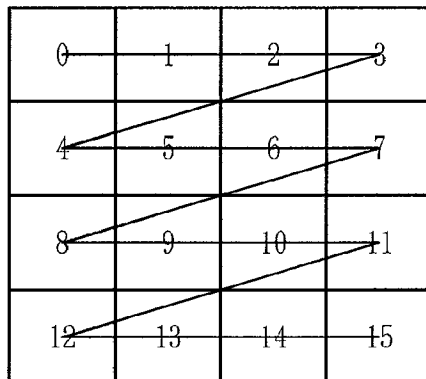


FIG. 6



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FIG. 7

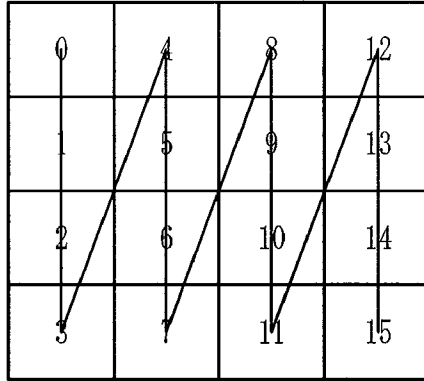
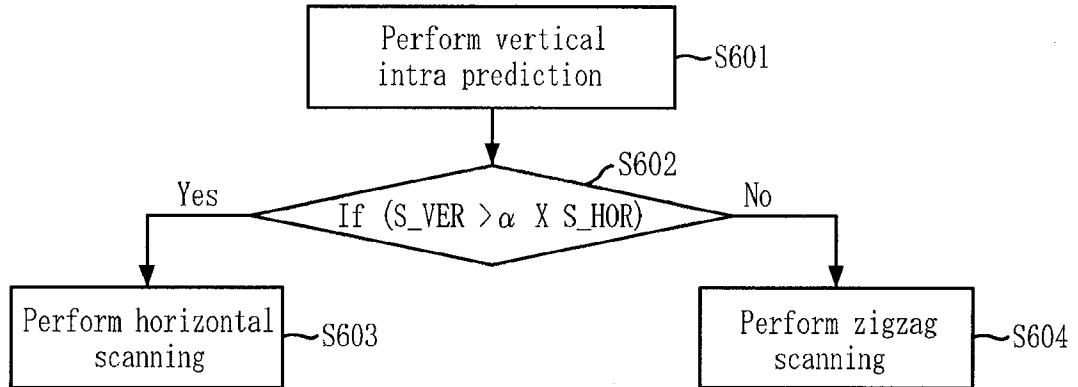


FIG. 8

| | | | | |
|---|---|---|---|---|
| | A | B | C | D |
| E | a | b | c | d |
| F | e | f | g | h |
| G | i | j | k | l |
| H | m | n | o | p |

5/6

FIG. 9



6/6
FIG. 10

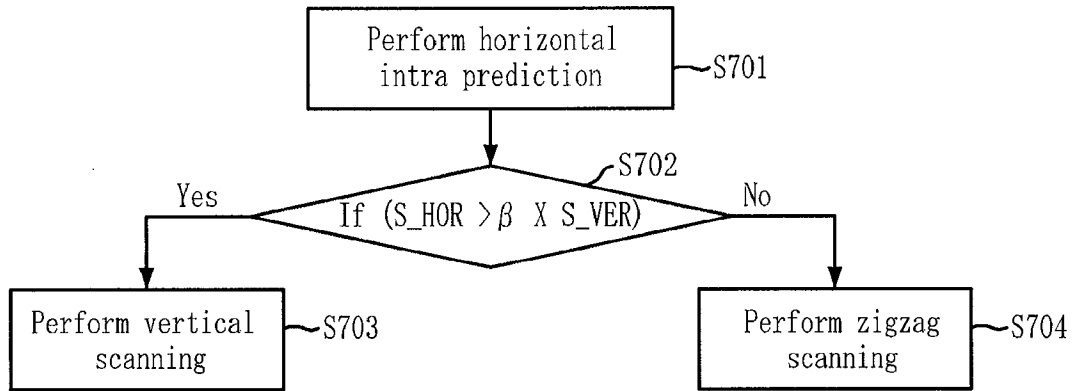
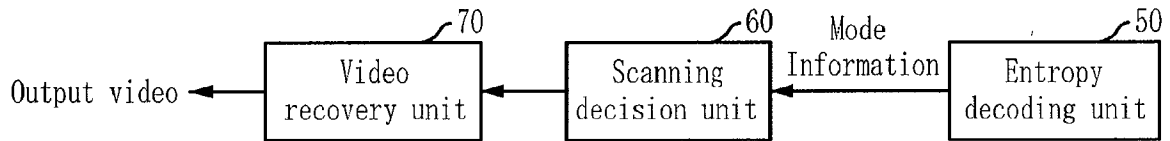


FIG. 11



Electronic Patent Application Fee Transmittal

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Application Number: | 13975251 |
| Filing Date: | |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Filer: | Randall Scott Svihla |
| Attorney Docket Number: | 022090.0002C2 |

Filed as Small Entity

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| Basic Filing: | | | | |
| Pages: | | | | |
| Claims: | | | | |
| Miscellaneous-Filing: | | | | |
| Petition: | | | | |
| Petition Fee - 37 CFR 1.17(F)(Group I) | 2462 | 1 | 200 | 200 |

Patent-Appeals-and-Interference:

Post-Allowance-and-Post-Issuance:

Extension of Time: Unified Patents; LLC v. Elects. & Telecomm. Res. Inst., et. al.

Ex. 1005, p.372

| Description | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------------|----------|----------|--------|----------------------|
| Miscellaneous: | | | | |
| Total in USD (\$) | | | | 200 |

Electronic Acknowledgement Receipt

| | |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| EFS ID: | 17013758 |
| Application Number: | 13975251 |
| International Application Number: | |
| Confirmation Number: | 9070 |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Customer Number: | 89980 |
| Filer: | Randall Scott Svihla |
| Filer Authorized By: | |
| Attorney Docket Number: | 022090.0002C2 |
| Receipt Date: | 01-OCT-2013 |
| Filing Date: | |
| Time Stamp: | 20:54:06 |
| Application Type: | Utility under 35 USC 111(a) |

Payment information:

| | |
|------------------------------------------|-------------|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | \$200 |
| RAM confirmation Number | 6718 |
| Deposit Account | |
| Authorized User | |

File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /zip | Pages (if appl.) |
|---------------------------------------------|----------------------|-----------|----------------------------------|------------------|------------------|
| Unified Patents, LLC v. Res. Inst., et. al. | | | | Ex. 1005, p. 374 | |

| | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------|-----|---|
| 1 | Petition for review by the Office of Petitions. | NOIA20130916_0220900002C2_PetitionUnder37CFR1_182AsFiled.pdf | 17983 12462a11d5b054c92933fd6b14e4f0d81c16243 | no | 2 |
| Warnings: | | | | | |
| Information: | | | | | |
| 2 | | NOIA20130916_0220900002C2_PreAmdAsFiled.pdf | 19174 fab6e354dacaac9eabbd7eb24868b4e8883a3f | yes | 4 |
| Multipart Description/PDF files in .zip description | | | | | |
| Document Description | | Start | End | | |
| Preliminary Amendment | | 1 | 1 | | |
| Applicant Arguments/Remarks Made in an Amendment | | 2 | 4 | | |
| Warnings: | | | | | |
| Information: | | | | | |
| 3 | Drawings-only black and white line drawings | NOIA20130916_0220900002C2_NewDrawingsAsFiled.pdf | 1012338 067b9b7cdd885b7ddc995c8800cec53c1b22f6d | no | 6 |
| Warnings: | | | | | |
| Information: | | | | | |
| 4 | Fee Worksheet (SB06) | fee-info.pdf | 30455 c89036139eb0ee1e23a8f3fde3a9b965d12ac52c | no | 2 |
| Warnings: | | | | | |
| Information: | | | | | |
| Total Files Size (in bytes): | | | 1079950 | | |
| <p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p> | | | | | |

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|-----------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|---------------------------------------|
| PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875 | Application or Docket Number 13/975,251 | Filing Date 08/23/2013 | <input type="checkbox"/> To be Mailed |
|-----------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|---------------------------------------|

ENTITY: LARGE SMALL MICRO

APPLICATION AS FILED – PART I

| FOR | NUMBER FILED | NUMBER EXTRA | RATE (\$) | FEE (\$) |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|----------|
| <input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| <input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (l), or (m)) | N/A | N/A | N/A | |
| <input type="checkbox"/> EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X \$ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X \$ = | |
| <input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 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). | | | |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

APPLICATION AS AMENDED – PART II

| | (Column 1) | (Column 2) | (Column 3) | PRESENT EXTRA | RATE (\$) | ADDITIONAL FEE (\$) |
|------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------|------------|------------------------------------|-----------------|---------------------|
| AMENDMENT | 08/23/2013 | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | | |
| | | * 2 | Minus | ** 20 | = 0 | X \$40 = 0 |
| | | * 1 | Minus | ***3 | = 0 | X \$210 = 0 |
| | | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s)) | | | | |
| | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

| | (Column 1) | (Column 2) | (Column 3) | PRESENT EXTRA | RATE (\$) | ADDITIONAL FEE (\$) |
|------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------|------------|------------------------------------|-----------------|---------------------|
| AMENDMENT | 10/01/2013 | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | | |
| | | * 2 | Minus | ** 20 | = 0 | X \$40 = 0 |
| | | * 1 | Minus | *** 3 | = 0 | X \$210 = 0 |
| | | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s)) | | | | |
| | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

* 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.

LIE
/CORALIA BETANCOURT/

This collection of information is required by 37 CFR 1.16. 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, 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.**

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
13/975,251

APPLICATION AS FILED - PART I

(Column 1) (Column 2)

| FOR | NUMBER FILED | NUMBER EXTRA |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A |
| SEARCH FEE (37 CFR 1.16(k), (l), or (m)) | N/A | N/A |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A |
| TOTAL CLAIMS (37 CFR 1.16(j)) | 2 minus 20 = * | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 1 minus 3 = * | |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 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)) | | |

* If the difference in column 1 is less than zero, enter "0" in column 2.

SMALL ENTITY

| RATE(\$) | FEE(\$) |
|--------------|------------|
| N/A | 70 |
| N/A | 300 |
| N/A | 360 |
| x 40 = | 0.00 |
| x 210 = | 0.00 |
| | 0.00 |
| | 0.00 |
| TOTAL | 730 |

OR OTHER THAN SMALL ENTITY

| RATE(\$) | FEE(\$) |
|--------------|---------|
| N/A | |
| N/A | |
| N/A | |
| | |
| | |
| | |
| | |
| TOTAL | |

APPLICATION AS AMENDED - PART II

(Column 1) (Column 2) (Column 3)

| AMENDMENT A | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|-------------|-----------------------------------------------------------------|----------------------------------|-------|------------------------------------|---------------|
| | Total (37 CFR 1.16(j)) | * | Minus | ** | = |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = |
| | Application Size Fee (37 CFR 1.16(s)) | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | |

SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

OR OTHER THAN SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

(Column 1) (Column 2) (Column 3)

| AMENDMENT B | | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|-------------|-----------------------------------------------------------------|----------------------------------|-------|------------------------------------|---------------|
| | Total (37 CFR 1.16(j)) | * | Minus | ** | = |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = |
| | Application Size Fee (37 CFR 1.16(s)) | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | |

SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| TOTAL ADD'L FEE | |

OR OTHER THAN SMALL ENTITY

| RATE(\$) | ADDITIONAL FEE(\$) |
|------------------------|--------------------|
| x = | |
| x = | |
| | |
| | |
| 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 found in the appropriate box in column 1.



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www.uspto.gov

Table with 4 columns: APPLICATION NUMBER (13/975,251), FILING OR 371(C) DATE (08/23/2013), FIRST NAMED APPLICANT (Se-Yoon Jeong), ATTY. DOCKET NO./TITLE (022090.0002C2)

CONFIRMATION NO. 9070
FORMALITIES LETTER

89980
NSIP LAW
P.O. Box 65745
Washington, DC 20035



Date Mailed: 09/16/2013

NOTICE OF INCOMPLETE NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

A filing date has NOT been accorded to the above-identified application papers for the reason(s) indicated below.

All of the items noted below and a newly executed oath or declaration covering the items must be submitted within TWO MONTHS of the date of this Notice, unless otherwise indicated, or proceedings on the application will be terminated (37 CFR 1.53(e)). Replies should be mailed to: Mail Stop Missing Parts, Commissioner for Patents, P.O. Box 1450, Alexandria VA 22313-1450. Extensions of time under 37 CFR 1.136 are NOT available.

The filing date will be the date of receipt of all items required below, unless otherwise indicated. Any assertions that the item(s) required below were submitted, or are not necessary for a filing date, must be by way of petition directed to the attention of the Office of Petitions accompanied by the \$400.00 petition fee (37 CFR 1.17(f)). If the petition states that the application is entitled to a filing date, a request for a refund of the petition fee may be included in the petition.

If the above-identified application contains a priority claim under 37 CFR 1.55 or benefit claim under 37 CFR 1.78 of a prior-filed application that was present on the filing date of the application and applicant wants to rely on 37 CFR 1.57(a) to add inadvertently omitted material to the above-identified application, applicant must file a petition under 37 CFR 1.57(a) accompanied by the \$400.00 petition fee (37 CFR 1.17(f)) within TWO MONTHS of the date of this Notice. Petitions should be mailed to: Mail Stop Petitions, Commissioner for Patents, P.O. Box 1450, Alexandria VA 22313-1450.

- The application was deposited without drawings. 35 U.S.C. 113 (first sentence) requires a drawing "where necessary for the understanding of the subject matter sought to be patented."

Applicant should reconsider whether the drawings are necessary under 35 U.S.C. 113 (first sentence).

Applicant is cautioned that submission of the above items by a means other than the USPTO's electronic filing system, EFS-Web, may cause the application to be subject to the non-electronic filing fee of \$400 (\$200 for a small entity). Section 10(h) of the Leahy-Smith America Invents Act (Public Law 112-29) requires an additional non-electronic filing fee of \$400 (\$200 for a small entity) for any nonprovisional application filed on or after November 15, 2011, other than by the USPTO's electronic filing system (EFS-Web), except for a reissue, design, or plant application. See also 37 CFR 1.16(t).

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Items Required To Avoid Processing Delays:

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):

Se-Yoon Jeong
Hae-Chul Choi
Jeong-II Seo
Seung-Kwon Beack
In-Seon Jang
Jae-Gon Kim
Kyung-Ae Moon
Dae-Young Jang
Jin-Woo Hong
Jin-Woong Kim
Yung-Lyul Lee
Dong-Gyu Sim
Seoung-Jun Oh
Chang-Beom Ahn
Dae-Yeon Kim
Dong-Kyun Kim

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/hteffer/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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| | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------|
| UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i> | | Attorney Docket No. | 022090.0002C2 | |
| | | First Named Inventor | Se-Yoon Jeong et al. | |
| | | Title | APPARATUS FOR ENCODING AND DECODING ... | |
| | | Express Mail Label No. | | |
| APPLICATION ELEMENTS <i>See MPEP chapter 600 concerning utility patent application contents.</i> | | Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450 | | |
| 1. <input checked="" type="checkbox"/> Fee Transmittal Form (PTO/SB/17 or equivalent) 2. <input checked="" type="checkbox"/> Applicant asserts small entity status. See 37 CFR 1.27 3. <input type="checkbox"/> Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent. 4. <input checked="" type="checkbox"/> Specification [Total Pages <u>18</u>] Both the claims and abstract must start on a new page. (See MPEP § 608.01(a) for information on the preferred arrangement) 5. <input checked="" type="checkbox"/> Drawing(s) (35 U.S.C. 113) [Total Sheets <u>6</u>] 6. Inventor's Oath or Declaration [Total Pages _____] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e)) a. <input type="checkbox"/> Newly executed (original or copy) b. <input type="checkbox"/> A copy from a prior application (37 CFR 1.63(d)) 7. <input checked="" type="checkbox"/> Application Data Sheet * See note below. See 37 CFR 1.76 (PTO/AIA/14 or equivalent) 8. CD-ROM or CD-R in duplicate, large table, or Computer Program (Appendix) <input type="checkbox"/> Landscape Table on CD 9. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required) a. <input type="checkbox"/> Computer Readable Form (CRF) b. <input type="checkbox"/> Specification Sequence Listing on: i. <input type="checkbox"/> CD-ROM or CD-R (2 copies); or ii. <input type="checkbox"/> Paper c. <input type="checkbox"/> Statements verifying identity of above copies | | ACCOMPANYING APPLICATION PAPERS | | |
| 10. <input type="checkbox"/> Assignment Papers (cover sheet & document(s)) Name of Assignee _____ 11. <input type="checkbox"/> 37 CFR 3.73(c) Statement <input type="checkbox"/> Power of Attorney (when there is an assignee) 12. <input type="checkbox"/> English Translation Document (if applicable) 13. <input type="checkbox"/> Information Disclosure Statement (PTO/SB/08 or PTO-1449) <input type="checkbox"/> Copies of citations attached 14. <input type="checkbox"/> Preliminary Amendment 15. <input type="checkbox"/> Return Receipt Postcard (MPEP § 503) (Should be specifically itemized) 16. <input type="checkbox"/> Certified Copy of Priority Document(s) (if foreign priority is claimed) 17. <input type="checkbox"/> Nonpublication Request Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 18. <input checked="" type="checkbox"/> Other: Preliminary Remarks _____ _____ _____ _____ | | * Note: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 must be included in an Application Data Sheet (ADS). (2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b). | | |
| 19. CORRESPONDENCE ADDRESS | | | | |
| <input checked="" type="checkbox"/> The address associated with Customer Number: <u>89980</u> OR <input type="checkbox"/> Correspondence address below | | | | |
| Name | | | | |
| Address | | | | |
| City | State | Zip Code | | |
| Country | Telephone | Email | | |
| Signature | /Randall S. Svihla/ | | Date | August 23, 2013 |
| Name (Print/Type) | Randall S. Svihla | | Registration No. (Attorney/Agent) | 56,273 |

This collection of information is required by 37 CFR 1.53(b). 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 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, 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.

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| | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|
| Application Data Sheet 37 CFR 1.76 | | Attorney Docket Number | 022090.0002C2 |
| | | Application Number | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | | |
| 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

| | |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | 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.) |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Inventor Information:

| | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------|--------------------|---------------|---------------------------------------|
| Inventor 1 | | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | | |
| Prefix | Given Name | Middle Name | Family Name | Suffix | |
| | Se-Yoon | | Jeong | | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | | |
| City | Daejeon | Country of Residence | | | KR |
| Mailing Address of Inventor: | | | | | |
| Address 1 | #101-1203 Geumseong Baekjo Apt., Birae-dong | | | | |
| Address 2 | Daedeok-gu | | | | |
| City | Daejeon | State/Province | | | |
| Postal Code | 306-769 | Country | | | KR |
| Inventor 2 | | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | | |
| Prefix | Given Name | Middle Name | Family Name | Suffix | |
| | Hae-Chul | | Choi | | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | | |
| City | Daejeon | Country of Residence | | | KR |
| Mailing Address of Inventor: | | | | | |
| Address 1 | #105-904 Yangji Maeul, Banseok-dong, Yuseong-gu | | | | |
| Address 2 | | | | | |
| City | Daejeon | State/Province | | | |
| Postal Code | 305-150 | Country | | | KR |
| Inventor 3 | | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | | |

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|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|
| Application Data Sheet 37 CFR 1.76 | | Attorney Docket Number | 022090.0002C2 |
| | | Application Number | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | | |

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|-------------|--------|
| | Jeong-Il | | Seo | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | |
| City | Daejeon | Country of Residence | i KR | |

| | | | | |
|-------------------------------------|------------------------------------------------|---------------------------------------|------|--|
| Mailing Address of Inventor: | | | | |
| Address 1 | #107-801 Sejong Apt., Jeonmin-dong, Yuseong-gu | | | |
| Address 2 | | | | |
| City | Daejeon | State/Province | | |
| Postal Code | 305-728 | Country | i KR | |
| Inventor | 4 | <input type="button" value="Remove"/> | | |

| Legal Name | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|-------------|--------|
| Prefix | Given Name | Middle Name | Family Name | Suffix |
| | Seung-Kwon | | Beack | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | |
| City | Seoul | Country of Residence | i KR | |

| | | | | |
|-------------------------------------|-----------------------------------|---------------------------------------|------|--|
| Mailing Address of Inventor: | | | | |
| Address 1 | 957-13, Bangbae 2-dong, Seocho-gu | | | |
| Address 2 | | | | |
| City | Seoul | State/Province | | |
| Postal Code | 137-062 | Country | i KR | |
| Inventor | 5 | <input type="button" value="Remove"/> | | |

| Legal Name | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|-------------|--------|
| Prefix | Given Name | Middle Name | Family Name | Suffix |
| | In-Seon | | Jang | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | |
| City | Gunpo-si | Country of Residence | i KR | |

| | | | | |
|-------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------|------|--|
| Mailing Address of Inventor: | | | | |
| Address 1 | #202, 86-46, Sanbon-dong, Gyeonggi-do | | | |
| Address 2 | | | | |
| City | Gunpo-si | State/Province | | |
| Postal Code | 435-040 | Country | i KR | |
| United Patents, LLC v. Elects. & Telecomm. Res. Inst., et. al. Ex. 1005, p.382 | | | | |

| | | |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------|
| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 022090.0002C2 |
| | Application Number | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | |

| | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------|--------------------|---------------|---------------------------------------|
| Inventor 6 | | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | | |
| Prefix | Given Name | Middle Name | Family Name | Suffix | |
| | Jae-Gon | | Kim | | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | | |
| City | Daejeon | Country of Residence | i | KR | |
| Mailing Address of Inventor: | | | | | |
| Address 1 | #203-402 Saemmeori Apt., Dunsan-dong, Seo-gu | | | | |
| Address 2 | | | | | |
| City | Daejeon | State/Province | | | |
| Postal Code | 302-120 | Country | i | KR | |

| | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------------------|--------------------|---------------|---------------------------------------|
| Inventor 7 | | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | | |
| Prefix | Given Name | Middle Name | Family Name | Suffix | |
| | Kyung-Ae | | Moon | | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | | |
| City | Daejeon | Country of Residence | i | KR | |
| Mailing Address of Inventor: | | | | | |
| Address 1 | #9-903 Hanmaru Apt., Dunsan-dong, Seo-gu | | | | |
| Address 2 | | | | | |
| City | Daejeon | State/Province | | | |
| Postal Code | 302-120 | Country | i | KR | |

| | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------|--------------------|---------------|---------------------------------------|
| Inventor 8 | | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | | |
| Prefix | Given Name | Middle Name | Family Name | Suffix | |
| | Dae-Young | | Jang | | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | | |
| City | Daejeon | Country of Residence | i | KR | |
| Mailing Address of Inventor: | | | | | |
| Address 1 | #904-1701 Yeolmae Maeul, Noeun-dong, Yuseong-gu | | | | |
| Address 2 | Unified Patents, LLC v. Elects. & Telecomm. Res. Inst., et. al. | | | | |
| | | | | | Ex. 1005, p.383 |

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|---------------------------------------|
| Application Data Sheet 37 CFR 1.76 | | Attorney Docket Number | 022090.0002C2 | |
| | | Application Number | | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | | | |
| City | Daejeon | State/Province | | |
| Postal Code | 305-768 | Country | KR | |
| Inventor 9 | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | |
| Prefix | Given Name | Middle Name | Family Name | Suffix |
| | Jin-Woo | | Hong | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | |
| City | Daejeon | Country of Residence | KR | |
| Mailing Address of Inventor: | | | | |
| Address 1 | #130-702 Hanbit Apt., Eoeun-dong, Yuseong-gu | | | |
| Address 2 | | | | |
| City | Daejeon | State/Province | | |
| Postal Code | 305-333 | Country | KR | |
| Inventor 10 | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | |
| Prefix | Given Name | Middle Name | Family Name | Suffix |
| | Jin-Woong | | Kim | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | |
| City | Daejeon | Country of Residence | KR | |
| Mailing Address of Inventor: | | | | |
| Address 1 | #305-1603 Expo Apt., Jeonmin-dong, Yuseong-gu | | | |
| Address 2 | | | | |
| City | Daejeon | State/Province | | |
| Postal Code | 305-761 | Country | KR | |
| Inventor 11 | | | | <input type="button" value="Remove"/> |
| Legal Name | | | | |
| Prefix | Given Name | Middle Name | Family Name | Suffix |
| | Yung-Lyul | | Lee | |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service | | | | |
| City | Seoul | Country of Residence | KR | |

| | | | |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|
| Application Data Sheet 37 CFR 1.76 | | Attorney Docket Number | 022090.0002C2 |
| | | Application Number | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | | |

Mailing Address of Inventor:

| | | | |
|-------------|--------------------------------------------|----------------|----|
| Address 1 | #1-704 Kukdong Apt., Garak-dong, Songpa-gu | | |
| Address 2 | | | |
| City | Seoul | State/Province | |
| Postal Code | 138-160 | Country | KR |

Inventor 12

Remove

Legal Name

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|--------|------------|-------------|-------------|--------|
| | Dong-Gyu | | Sim | |

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

| | | | |
|------|-------|----------------------|----|
| City | Seoul | Country of Residence | KR |
|------|-------|----------------------|----|

Mailing Address of Inventor:

| | | | |
|-------------|-------------------------------------------|----------------|----|
| Address 1 | #31-607 Samho Apt., Wolgye-dong, Nowon-gu | | |
| Address 2 | | | |
| City | Seoul | State/Province | |
| Postal Code | 139-050 | Country | KR |

Inventor 13

Remove

Legal Name

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|--------|------------|-------------|-------------|--------|
| | Seung-Jun | | Oh | |

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

| | | | |
|------|-------------|----------------------|----|
| City | Seongnam-si | Country of Residence | KR |
|------|-------------|----------------------|----|

Mailing Address of Inventor:

| | | | |
|-------------|----------------------------------------------|----------------|----|
| Address 1 | #104-1902 I-Park, Jeongja 1-dong, Bundang-gu | | |
| Address 2 | Gyeonggi-do | | |
| City | Seongnam-si | State/Province | |
| Postal Code | 463-010 | Country | KR |

Inventor 14

Remove

Legal Name

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|--------|------------|-------------|-------------|--------|
| | Chang-Beom | | Ahn | |

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

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| Application Data Sheet 37 CFR 1.76 | | Attorney Docket Number | 022090.0002C2 |
| | | Application Number | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | | |

| | | | |
|------|-------|----------------------|----|
| City | Seoul | Country of Residence | KR |
|------|-------|----------------------|----|

Mailing Address of Inventor:

| | | | |
|-------------|--------------------------------------------------|----------------|----|
| Address 1 | #109-501 Olympic Apt., 89, Bangi-dong, Songpa-gu | | |
| Address 2 | | | |
| City | Seoul | State/Province | |
| Postal Code | 138-050 | Country | KR |

Inventor 15

Remove

Legal Name

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|--------|------------|-------------|-------------|--------|
| | Dae-Yeon | | Kim | |

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

| | | | |
|------|-------|----------------------|----|
| City | Seoul | Country of Residence | KR |
|------|-------|----------------------|----|

Mailing Address of Inventor:

| | | | |
|-------------|-------------------------------------------------|----------------|----|
| Address 1 | #204-1203 Life Apt., Gongneung 3-dong, Nowon-gu | | |
| Address 2 | | | |
| City | Seoul | State/Province | |
| Postal Code | 139-243 | Country | KR |

Inventor 16

Remove

Legal Name

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|--------|------------|-------------|-------------|--------|
| | Dong-Kyun | | Kim | |

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

| | | | |
|------|-------|----------------------|----|
| City | Seoul | Country of Residence | KR |
|------|-------|----------------------|----|

Mailing Address of Inventor:

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 022090.0002C2 |
| | Application Number | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | |

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Application Information:

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| Title of the Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | | |
| Attorney Docket Number | 022090.0002C2 | Small Entity Status Claimed <input checked="" type="checkbox"/> | |
| 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) | 6 | Suggested Figure for Publication (if any) | |

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| Unified Patents, LLC v. Elects. & Telecomm. Res. Inst., et al. | Ex. 1005, p.387 |

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|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------------------|
| Application Data Sheet 37 CFR 1.76 | | Attorney Docket Number | 022090.0002C2 |
| | | Application Number | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | | |
| Prior Application Status | Pending | <input type="button" value="Remove"/> | |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| | Continuation of | 12377617 | 2009-02-16 |
| Prior Application Status | Abandoned | <input type="button" value="Remove"/> | |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| 12377617 | a 371 of international | PCT/KR07/01433 | 2007-03-23 |
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| Application Number | Country ⁱ | Filing Date (YYYY-MM-DD) | Priority Claimed |
| 10-2006-0077851 | KR | 2006-08-17 | <input checked="" type="radio"/> Yes <input type="radio"/> No |
| | | | <input type="button" value="Remove"/> |
| Application Number | Country ⁱ | Filing Date (YYYY-MM-DD) | Priority Claimed |
| 10-2007-0008247 | KR | 2007-01-26 | <input checked="" type="radio"/> Yes <input type="radio"/> No |
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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 022090.0002C2 |
| | Application Number | |
| Title of Invention | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR | |

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| Organization Name | Electronics and Telecommunications Research Institute | | |
| Mailing Address Information: | | | |
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| Address 2 | | | |
| City | Daejeon | State/Province | |
| Country | KR | Postal Code | 305-700 |
| Phone Number | | Fax Number | |
| Email Address | | | |
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| Organization Name | | Kwangwoon University Research Institute for Industry Cooperation | | |
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| Address 1 | | 447-1, Wolgye-dong, Nowon-gu | | |
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| Organization Name | Industry-Academia Cooperation Group of Sejong University | | |
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| Address 2 | | | |
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| First Name | Randall | Last Name | Svihla | Registration Number | 56273 |

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DESCRIPTION

APPARATUS FOR ENCODING AND DECODING IMAGE USING
ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL
SIMILARITY AND METHOD THEREFOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of Application No. 12/377,617 filed on February 16, 2009, which is a U.S. National Stage application of International Application No. PCT/KR2007/001433 filed on March 23, 2007, which claims the benefit of Korean Application Nos. 10-2006-0077851 filed on August 17, 2006, and 10-2007-0008247 filed on January 26, 2007. The entire disclosures of Application No. 12/377,617, International Application No. PCT/KR2007/001433, and Korean Application Nos. 10-2006-0077851 and 10-2007-0008247 are incorporated herein by reference for all purposes.

TECHNICAL FIELD

[0002] The present invention relates to an encoding/decoding apparatus and method using an adaptive Discrete Cosine Transform (DCT) coefficient scanning based on pixel similarity. More particularly, the present invention relates to an encoding/decoding apparatus and method which performs intra prediction onto input video, predicts pixel similarity based on pixel similarity information of coefficients to be encoded that is acquired from adjacent pixels in the intra-predicted video, and performs a most effective scanning, e.g., Discrete Cosine Transform (DCT) coefficient scanning, according to the predicted pixel similarity.

BACKGROUND ART

[0003] According to video compression standards for encoding/decoding video data, a frame is divided into a plurality of macro blocks and a macro block may be divided into a plurality of sub-blocks. The encoding/decoding is performed on the basis of a macro block unit or a sub-block unit based on temporal prediction and spatial prediction.

[0004] Herein, the temporal prediction is to predict motion of macro blocks or sub-blocks of a current frame by referring to blocks of adjacent frames.

[0005] The spatial prediction is to predict motion of macro blocks or sub-blocks of a current frame to be encoded by using boundary pixels of already recovered adjacent blocks.

[0006] The spatial prediction is also called intra prediction. The intra prediction takes advantage of a characteristic that when a pixel is predicted, pixels adjacent to it are highly likely to have similar values.

[0007] H.264/Advanced Video Coding (AVC) standard technology can compress video about twice as high as Moving Picture Experts Group 2 (MPEG-2) and about one and a half times as high as MPEG-4 by using such technique as intra prediction encoding, 1/4-pixel based variable block motion prediction and compensation, Context-based Adaptive Variable Length Coding (CAVLC), and Context-based Adaptive Binary Arithmetic Coding (CABAC).

[0008] The H.264/AVC standard predicts pixel values of a current block by using prediction modes of 9 directivities.

[0009] Fig. 1 illustrates 9 prediction modes used for intra prediction of 4 x 4 blocks.

[0010] As illustrated in Fig. 1, the 9 prediction modes used for intra prediction of 4 x 4 blocks include a vertical mode (mode 0), a horizontal mode (mode 1), a direct current (DC) mode (mode 2), a diagonal_down_left mode (mode 3), a diagonal_down_right mode (mode 4), a vertical_right mode (mode 5), a horizontal_down mode (mode 6), a vertical_left mode (mode 7), and a horizontal_up mode (mode 8).

[0011] Herein, in the DC mode (mode 2), intra prediction is performed using a mean value of adjacent pixels. The arrows indicate prediction directions.

[0012] Meanwhile, intra 16 x 16 prediction encoding includes a total of four modes, which are a vertical mode, a horizontal mode, a DC mode, and a plane mode.

[0013] Also, intra 8 x 8 prediction encoding includes a total of 9 modes, just like the intra 4 x 4 prediction encoding. As for color difference signals, intra 8 x 8 prediction encoding is performed, and the intra 8 x 8 prediction encoding includes a DC mode, a vertical mode, a horizontal mode, and a plane mode and so on.

[0014] Hereinafter, prediction methods in the vertical and horizontal modes for intra prediction of 4 x 4 blocks will be described with reference to Figs. 2 and 3.

[0015] Fig. 2 exemplarily illustrates a pixel prediction method in a vertical direction in a 4 x 4 block 200.

[0016] As shown in Fig. 2, pixel a 201, pixel e 202, pixel i 203, and pixel m 204 are predicted based on an adjacent pixel A in the vertical direction.

[0017] Also, pixels b, f, j and n are predicted based on an adjacent pixel B in the vertical direction, and pixels c, g, k and o are predicted based on an adjacent pixel C in the vertical direction. Pixels d, h, l and p are predicted based on an adjacent pixel D in the vertical direction.

[0018] Fig. 3 exemplarily illustrates a pixel prediction method in a horizontal direction in a 4 x 4 block 200.

[0019] As illustrated in Fig. 3, pixel a 205, pixel b 206, pixel c 207, and pixel d 208 are predicted based on an adjacent pixel I in a horizontal direction.

[0020] Also, pixels e, f, g and h are predicted based on an adjacent pixel J in the horizontal direction, and pixels i, j, k and l are predicted based on an adjacent pixel K in the horizontal direction. Pixels m, n, o and p are predicted based on an adjacent pixel L in the horizontal direction.

[0021] An encoder performs Discrete Cosine Transform (DCT) and quantization onto residual signals (which are of a pixel area) acquired by calculating differences between the predicted pixels and the current pixels. Subsequently, the encoder performs zigzag scanning and entropy encoding onto the transformed coefficients obtained from DCT and quantization.

[0022] Herein, although the zigzag scanning takes advantage of an energy compaction characteristic of a transformed coefficient that energy converges into low frequency components and energy appears little in high frequency components, the energy compaction after intra prediction is not always effective.

[0023] In short, the zigzag scanning is a method of scanning a transformed coefficient from low frequency components to high frequency components. When distribution of transformed coefficients appears more in the low frequency components, the zigzag scanning is effective. However, when spatial prediction having directivity is used, the distribution of transformed

coefficients is influenced by the direction of prediction. Therefore, it is ineffective to apply the zigzag scanning to the prediction of all directions.

DISCLOSURE

TECHNICAL PROBLEM

[0024] An embodiment of the present invention, which is devised to overcome the above problems, is directed to providing an encoding/decoding apparatus and method which performs intra prediction onto input video, predicts pixel similarity based on pixel similarity information of coefficients to be encoded acquired from adjacent pixels in the intra-predicted video, and performs a most effective scanning, e.g., DCT coefficient scanning, according to the predicted pixel similarity.

[0025] Other objects and advantages of the present invention can be understood by the following description, and become apparent with reference to the embodiments of the present invention. Also, it is obvious to those skilled in the art of the present invention that the objects and advantages of the present invention can be realized by the means as claimed and combinations thereof.

TECHNICAL SOLUTION

[0026] In accordance with an aspect of the present invention, there is provided an encoding apparatus using a Discrete Cosine Transform (DCT) scanning, which includes a mode selection means for selecting an optimal mode for intra prediction; an intra prediction means for performing intra prediction onto video inputted based on the mode selected in the mode selection means; a DCT and quantization means for performing DCT and quantization onto residual coefficients of a block outputted from the intra prediction means; and an entropy encoding means for performing entropy encoding onto DCT coefficients acquired from the DCT and quantization by using a scanning mode decided based on pixel similarity of the residual coefficients.

[0027] In accordance with another aspect of the present invention, there is provided a decoding apparatus using a DCT scanning, which includes an entropy decoding means for

performing entropy decoding onto encoded video; a scanning decision means for deciding a scanning mode for the video decoded in the entropy decoding means; and a video recovery means for recovering the video based on the scanning mode decided in the scanning decision means.

[0028] In accordance with another aspect of the present invention, there is provided an encoding method using a DCT scanning, which includes the steps of selecting an optimal mode for intra prediction; performing intra prediction onto video inputted based on the mode selected in the mode selection step; performing DCT and quantization onto residual coefficients of a block outputted from the intra prediction step; deciding pixel similarity of the residual coefficients; and performing entropy encoding onto DCT coefficients acquired from the DCT and quantization by using a scanning mode decided in the pixel similarity decision step.

[0029] In accordance with an aspect of the present invention, there is provided a decoding method using a DCT scanning, which includes the steps of performing entropy decoding onto encoded video; deciding a scanning mode for the video decoded in the entropy decoding step; and recovering the video based on the scanning mode decided in the scanning decision step.

[0030] According to an embodiment of the present invention, a luminance block may go through an intra 4 x 4 luminance encoding mode of H.264/Advanced Video Coding (AVC), which includes a vertical mode, a horizontal mode, a diagonal_down_left mode, a diagonal_down_right mode, a vertical_right mode, a horizontal_down mode, a vertical_left mode, and a horizontal_up mode, and an intra 16 x 16 luminance encoding mode of H.264/AVC, which includes a vertical mode, a horizontal mode, a plane mode, and a DC mode.

[0031] Also, according to an embodiment of the present invention, a chrominance block may go through an intra M x N chrominance encoding mode of H.264/AVC, which includes a vertical mode, a horizontal mode, a plane mode and a DC mode.

ADVANTAGEOUS EFFECTS

[0032] As described above, the present invention can improve a compression rate of intra encoding by applying a most effective scanning method according to pixel similarity in order to encode/decode video.

[0033] Also, the present invention can improve a video compression rate by being applied to a video compression technology using intra prediction, which will be developed in the future.

[0034] Also, the present invention can reduce a need for an additional module by applying the same similarity information to both encoder and decoder.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] Fig. 1 illustrates 9 prediction modes used for intra prediction of 4 x 4 blocks according to H.264/AVC.

[0036] Fig. 2 exemplarily illustrates a pixel prediction method in a vertical direction.

[0037] Fig. 3 exemplarily illustrates a pixel prediction method in a horizontal direction.

[0038] Fig. 4 is a block view showing an encoding apparatus using an adaptive DCT coefficient scanning based on pixel similarity in accordance with an embodiment of the present invention.

[0039] Fig. 5 exemplarily illustrates a zigzag scanning method used in the present invention.

[0040] Fig. 6 exemplarily illustrates a horizontal scanning method used in the present invention.

[0041] Fig. 7 exemplarily illustrates a vertical scanning method used in the present invention.

[0042] Fig. 8 illustrates a method for predicting pixel similarity in vertical and horizontal directions in accordance with an embodiment of the present invention.

[0043] Fig. 9 is a flowchart describing an adaptive scanning method based on pixel similarity in a vertical intra prediction mode in accordance with an embodiment of the present invention.

[0044] Fig. 10 is a flowchart describing an adaptive scanning method based on pixel similarity in a horizontal intra prediction mode in accordance with an embodiment of the present invention.

[0045] Fig. 11 is a block view showing a decoding apparatus using an adaptive DCT coefficient scanning based on pixel similarity in accordance with an embodiment of the present invention.

BEST MODE FOR THE INVENTION

[0046] The advantages, features and aspects of the invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter. When it is considered that detailed description on a related art may obscure a point of the present invention, the description will not be provided herein. Hereinafter, specific embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0047] Fig. 4 is a block view showing an encoding apparatus using an adaptive DCT coefficient scanning based on pixel similarity in accordance with an embodiment of the present invention.

[0048] As illustrated in Fig. 4, the encoding apparatus based on DCT coefficient scanning adaptive to pixel similarity includes a mode selection unit 10, an intra prediction unit 20, a DCT and quantization unit 30, and an entropy encoding unit 40.

[0049] The mode selection unit 10 selects an optimal mode among several available prediction modes for intra prediction. In other words, it selects one among a plurality of possible encoding modes when 4 x 4, 16 x 16, or 8 x 8 intra prediction is performed. Generally, the mode selection unit 10 selects one mode according to a rate-distortion optimization method for reducing an amount of distortion at a given bit rate.

[0050] The intra prediction unit 20 receives a video, and performs 4 x 4 intra prediction for pixels of luminance blocks and 8 x 8 intra prediction for pixels of chrominance blocks based on a mode selected in the mode selection unit 10.

[0051] The DCT and quantization unit 30 performs DCT and quantization onto difference values outputted from the mode selection unit 10, that is, onto residual coefficient blocks indicating differences between pixel values of macro blocks of a current frame to be encoded and predicted pixel values, and transmits resulting coefficients to the entropy encoding unit 40.

[0052] The entropy encoding unit 40 arrays DCT coefficients obtained in the DCT and quantization unit 30 by using an adaptive DCT coefficient scanning based on pixel similarity,

performs entropy encoding onto the arrayed DCT coefficients, and outputs an encoded video bitstream in accordance with the result.

[0053] Herein, the entropy encoding is an encoding technique for enhancing a compression rate by allocating a few bits to data highly likely to occur and many bits to data that are not likely to occur. Examples of the entropy encoding used in the present invention include Context-based Adaptive Variable Length Coding (CAVLC) or Context-based Adaptive Binary Arithmetic Coding (CABAC).

[0054] With reference to Figs. 8 to 10, described hereafter are a method of predicting pixel similarity in vertical and horizontal directions in the entropy encoding unit 40, and a scanning method in vertical and horizontal intra prediction modes.

[0055] Fig. 5 exemplarily illustrates a typical zigzag scanning method used in the present invention. Fig. 6 exemplarily illustrates a typical horizontal scanning method used in the present invention. Fig. 7 exemplarily illustrates a typical vertical scanning method used in the present invention.

[0056] As shown in Fig. 5, the zigzag scanning method used in the present invention is devised in consideration that low frequency components of transformed coefficients acquired from the DCT and quantization are highly likely to be positioned in the upper left part of a two-dimensional plane. It takes advantage of a transformed coefficient energy compaction characteristic that coefficients after DCT collectively appear in low frequencies, whereas coefficients after DCT less appear in high frequencies.

[0057] The zigzag scanning method may be more efficient when pixel similarity in the horizontal direction is similar to the pixel similarity in the vertical direction.

[0058] However, when intra prediction encoding, particularly, vertical or horizontal intra prediction, is performed, the similarity of the residual coefficients in the vertical direction shows much difference from the similarity in the horizontal direction. Thus, the above-described coefficient distribution is not always effective. Therefore, it is inefficient to apply the zigzag scanning to prediction of all directions.

[0059] To describe an example of the vertical prediction mode, the vertical prediction mode is selected as an optimal mode in a rate-distortion optimization process, when the pixel similarity

in the vertical direction is high. Herein, significant coefficients are distributed in the first row. Therefore, the horizontal scanning shown in Fig. 6 is more efficient than the typical zigzag scanning.

[0060] Meanwhile, to describe an example of the horizontal prediction mode, the horizontal prediction mode is selected as an optimal mode, when the pixel similarity in the horizontal direction is high. Herein, significant coefficients are distributed in the first column. Therefore, the vertical scanning shown in Fig. 7 is more efficient.

[0061] However, since the pixel similarity before intra prediction is different from pixel similarity of residual coefficients after the intra prediction, it is inefficient to simply use the scanning method of Fig. 6 or Fig. 7 according to the intra prediction mode.

[0062] Therefore, if pixel similarities in the vertical and horizontal directions of a block to be encoded are predicted based on similarity information among adjacent block boundary pixels which are already recovered and an adaptive scanning method according to the prediction result is used, the encoding efficiency can be increased.

[0063] Fig. 8 illustrates a method for predicting pixel similarity in vertical and horizontal directions in accordance with an embodiment of the present invention.

[0064] As illustrated in Fig. 8, pixels A, B, C and D are positioned adjacent to the upper part of a current block to be encoded, whereas pixels E, F, G and H are positioned adjacent to the left part of the current block to be encoded.

[0065] Herein, when vertical prediction encoding is performed, the vertical-directional pixel similarity of the pixels a, e, i and m in the first column of the current block to be encoded is the same as the vertical-directional pixel similarity of residual coefficients a-A, e-A, i-A, and m-A after vertical prediction. This is because the residual coefficients a-A, e-A, i-A, and m-A are differentiated by the same prediction pixel A from the pixels a, e, i and m, and thus the correlation does not change.

[0066] Also, the vertical-directional pixel similarity of the pixels in columns 2, 3 and 4 of the current block to be encoded is the same as the vertical-directional pixel similarity of residual coefficients after vertical prediction.

[0067] However, the horizontal-directional pixel similarity of the pixels a, b, c and d in the first row of the current block to be encoded is different from the horizontal-directional pixel similarity of residual coefficients a-A, b-B, c-C, and d-D after vertical prediction. Also, the horizontal-directional pixel similarity before vertical prediction is higher than the horizontal-directional pixel similarity after the vertical prediction. Thus, it becomes similar to or higher than the vertical-directional pixel similarity.

[0068] Likewise, in the case of the horizontal prediction encoding, the horizontal-directional pixel similarity of the pixels a, b, c and d in the first row of the current block to be encoded is the same as the horizontal-directional pixel similarity of residual coefficients a-E, b-E, c-E, and d-E after horizontal prediction. Also, the horizontal-directional pixel similarity of the pixels in rows 2, 3 and 4 of the current block to be encoded is the same as the horizontal-directional pixel similarity of the residual coefficients after horizontal prediction.

[0069] However, the vertical-directional pixel similarity of the pixels a, e, i and m in the first column of the current block to be encoded is different from the vertical-directional pixel similarity of residual coefficients a-E, e-F, i-G, and m-H after horizontal prediction. Also, the vertical-directional pixel similarity before horizontal prediction is higher than the vertical-directional pixel similarity after the horizontal prediction. Thus, it becomes similar to or higher than the horizontal-directional pixel similarity.

[0070] As described above, when the pixel similarities in the vertical and horizontal directions are similar, a general zigzag scanning method is more efficient than the horizontal and vertical scanning methods.

[0071] Therefore, when the vertical intra prediction mode is performed and the vertical-directional pixel similarity of residual coefficients is high and their horizontal-directional pixel similarity is low, it is more efficient to use the horizontal scanning.

[0072] Meanwhile, when the horizontal intra prediction mode is performed and the horizontal-directional pixel similarity of residual coefficients is high and their vertical-directional pixel similarity is low, it is more efficient to use the vertical scanning.

[0073] When the vertical-directional pixel similarity of recovered 8 pixels A, B, C, D, E, F, G and H of Fig. 8 is referred to as S_VER and their horizontal-directional pixel similarity is referred

to as S_HOR, the pixel similarities for increasing the efficiency of 4 x 4 prediction encoding can be calculated using the following Equation 1.

Equation 1

$$S_VER = \frac{1}{\text{Variance}(E, F, G, H)}$$

$$S_HOR = \frac{1}{\text{Variance}(A, B, C, D)}$$

[0074] In Equation 1, Variance() denotes a dispersion; E, F, G and H denote pixels adjacent to the left part of the current block to be encoded; and A, B, C and D denote pixels adjacent to the upper part of the current block to be encoded.

[0075] When the vertical prediction mode is carried out, a value obtained by multiplying S_HOR by a multiplication factor α ($\alpha \geq 1$) is used as a horizontal-directional pixel similarity prediction value of residual coefficients of the current block. Herein, the α value is fixed at 2 in an experiment. The S_VER as it is is used as a vertical-directional pixel similarity prediction value of the residual coefficients of the current block.

[0076] When the horizontal prediction mode is carried out, a value obtained by multiplying S_VER by a multiplication factor β ($\beta \geq 1$) is used as a vertical-directional pixel similarity prediction value of the residual coefficients of the current block. Herein, the β value is fixed at 2 in an experiment. The S_HOR as it is is used as a horizontal-directional pixel similarity prediction value of the residual coefficients of the current block.

[0077] The vertical-directional and horizontal-directional pixel similarity prediction values acquired in the above methods are compared to each other to decide a scanning method.

[0078] Although a 4 x 4 intra prediction mode is described in the above example, the present invention is not limited to the 4 x 4 intra prediction mode, and the present invention can be applied to an M x N intra prediction mode, too.

[0079] Hereinafter, a method of selecting a scanning method in the vertical and horizontal intra prediction modes will be described in detail with reference to Figs. 9 and 10.

[0080] Fig. 9 is a flowchart describing an adaptive scanning method based on pixel similarity in a vertical intra prediction mode in accordance with an embodiment of the present invention.

[0081] In case of a vertical intra prediction mode in step S601, an S_VER value and a value of $\alpha \times S_HOR$ are compared in step S602. When the S_VER value is greater than the value of $\alpha \times S_HOR$, a horizontal scanning method is used in step S603. When the S_VER value is smaller than the value of $\alpha \times S_HOR$, a zigzag scanning method is used in step S604.

[0082] Herein, when a vertical-directional pixel similarity of the current block to be encoded based on similarity of adjacent pixels is predicted higher than the horizontal-directional pixel similarity thereof, transformed coefficients obtained after DCT and quantization are highly likely to be distributed in a direction horizontal to a first row of the block. Therefore, the horizontal scanning method can bring about a high encoding efficiency.

[0083] Fig. 10 is a flowchart describing an adaptive scanning method based on pixel similarity in a horizontal intra prediction mode in accordance with an embodiment of the present invention.

[0084] In case of a horizontal intra prediction mode in step S701, an S_HOR value and a value of $\beta \times S_VER$ are compared in step S702. When the S_HOR value is greater than the value of $\beta \times S_VER$, a vertical scanning method is used in step S703. When the S_HOR value is smaller than the value of $\beta \times S_VER$, a zigzag scanning method is used in step S704.

[0085] Herein, when a horizontal-directional pixel similarity of the current block to be encoded based on similarity of adjacent pixels is predicted higher than the vertical-directional pixel similarity thereof, transformed coefficients obtained after DCT and quantization are highly likely to be disposed in a direction vertical to a first row of the block. Therefore, the vertical scanning method can bring about a high encoding efficiency.

[0086] Fig. 11 is a block view showing a decoding apparatus using an adaptive DCT coefficient scanning based on pixel similarity in accordance with an embodiment of the present invention.

[0087] As shown in Fig. 11, the decoding apparatus using an adaptive DCT coefficient scanning based on pixel similarity includes an entropy decoding unit 50, a scanning decision unit 60, and a video recovery unit 70.

[0088] The entropy decoding unit 50 receives an encoded video bitstream encoded in the encoding apparatus of Fig. 4 using an adaptive DCT coefficient scanning based on pixel similarity and decodes it through an entropy decoding method such as CAVLC or CABAC. Then, the entropy decoding unit 50 transmits the entropy-decoded video bitstream to the scanning decision unit 60.

[0089] The scanning decision unit 60 decides a scanning method for the coefficients decoded in the entropy decoding unit 50 according to an intra prediction mode, as described in the above with reference to Figs. 8 to 11.

[0090] The video recovery unit 70 finally recovers the coefficients by using the scanning method decided in the scanning decision unit 60 to recover the video.

[0091] An experiment was carried out for diverse test videos using Joint Model 86 (JM86), which is an H.264/AVC Reference Codec, according to the above-described methods. The result of an increase in compression efficiency was as follows. In the experiment, videos recommended by H.264/AVC as test videos were used. The following Table 1 shows conditions of the experiment.

Table 1

| Video | News (QCIF) | Container (QCIF) | Coast (QCIF) | Paris (QCIF) | Coast (CIF) |
|--------------|------------------------------------------------------------------|------------------|--------------|--------------|-------------|
| Entire Frame | 300 (30 Hz) | 300 (30 Hz) | 300 (30 Hz) | 300 (35 Hz) | 300 (30 Hz) |
| Conditions | CAVLC, Intra only, QP(18,22,26,30), rate-distortion optimization | | | | |

[0092] As shown in Table 1, five test videos with different sizes were used for the experiment.

[0093] The following Table 2 presents video compression rates when the test videos were compressed using a conventional compression method, which is a zigzag scanning method of

H.264/AVC, and the compression method of the present invention, which is the adaptive scanning method according to intra prediction mode under the same conditions as the Table 1.

Table 2

| Sequence | QP | H.264/AVC | | Method of the Present Invention | | Bit Saving rate (%) |
|------------------|----|-----------|-----------------|---------------------------------|-----------------|---------------------|
| | | PSNR (dB) | Bit rate (Kbps) | PSNR (dB) | Bit rate (Kbps) | |
| News (QCIF) | 18 | 45.64 | 2370.65 | 45.64 | 2344.75 | 1.51% |
| | 22 | 43.06 | 1714.99 | 43.05 | 1692.69 | 1.67% |
| | 26 | 40.32 | 1221.96 | 40.32 | 1206.02 | 1.51% |
| | 30 | 37.50 | 872.65 | 37.49 | 860.23 | 1.49% |
| Container (QCIF) | 18 | 44.84 | 874.63 | 44.84 | 857.75 | 1.93% |
| | 22 | 41.71 | 643.42 | 41.7 | 630.5 | 2.01% |
| | 26 | 38.61 | 451.07 | 38.61 | 441.54 | 2.11% |
| | 30 | 35.77 | 317.36 | 35.76 | 309.93 | 2.34% |
| Coast (QCIF) | 18 | 44.18 | 2200.99 | 44.13 | 2152.15 | 2.22% |
| | 22 | 40.61 | 1631.56 | 40.59 | 1592.37 | 2.40% |
| | 26 | 37.13 | 1139.76 | 37.12 | 111.02 | 2.52% |
| | 30 | 34.00 | 765.52 | 33.99 | 746.77 | 2.45% |
| Paris (CIF) | 18 | 44.72 | 4360.41 | 44.71 | 4271.09 | 2.05% |
| | 22 | 41.57 | 3334.22 | 41.56 | 3259.84 | 2.23% |
| | 26 | 38.25 | 2450.69 | 38.24 | 2391.77 | 2.40% |
| | 30 | 35.04 | 1780.73 | 35.03 | 1736.21 | 2.50% |
| (Coast) (CIF) | 18 | 44.34 | 4068.4 | 44.33 | 4015.7 | 1.30% |
| | 22 | 40.8 | 2989.5 | 40.8 | 2950.65 | 1.30% |
| | 26 | 37.32 | 2074.47 | 37.32 | 2045.89 | 1.38% |
| | 30 | 34.21 | 1388.07 | 34.22 | 1369.23 | 1.36% |

[0094] The Table 2 shows that the result of video compression using the adaptive scanning method according to the intra prediction mode, which is suggested in the present invention, is superior to that of video compression using only the conventional zigzag scanning method of H.264/AVC.

[0095] The method of the present invention described above may be realized as a program and stored in a computer-readable recording medium such as a CD-ROM, RAM, ROM, floppy disks, hard disks, magneto-optical disks and so forth. Since the program can be easily implemented by those skilled in the art to which the present invention pertains, further description of the program will not be provided herein.

[0096] While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

WHAT IS CLAIMED IS:

1. A decoding method comprising:
performing entropy decoding of encoded video information to obtain transform coefficients;
selecting a scanning mode for the transform coefficients; and
scanning the transform coefficients based on the selected scanning mode;
wherein the selecting of a scanning mode comprises selecting the scanning mode based on an intra prediction mode that was used to obtain difference values between pixel values and predicted pixel values.

2. The decoding method of claim 1, wherein the selecting of the scanning mode based on an intra prediction mode comprises:
selecting a horizontal scanning mode when the intra prediction mode is a vertical intra prediction mode; and
selecting a vertical scanning mode when the intra prediction mode is a horizontal intra prediction mode.

ABSTRACT OF THE DISCLOSURE

The present invention discloses an encoding apparatus using a Discrete Cosine Transform (DCT) scanning, which includes a mode selection means for selecting an optimal mode for intra prediction; an intra prediction means for performing intra prediction onto video inputted based on the mode selected in the mode selection means; a DCT and quantization means for performing DCT and quantization onto residual coefficients of a block outputted from the intra prediction means; and an entropy encoding means for performing entropy encoding onto DCT coefficients acquired from the DCT and quantization by using a scanning mode decided based on pixel similarity of the residual coefficients.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Se-Yoon Jeong et al.

Application No.: Unassigned

Art Unit: 2496 (anticipated)

Confirmation No.: Unassigned

Filed: August 23, 2013

Examiner: Courtney D. Fields (anticipated)

For: APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT
COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD
THEREFOR

PRELIMINARY REMARKS

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

Sir:

These Preliminary Remarks are being filed concurrently with the accompanying application identified above.

The following remarks are respectfully submitted.

Remarks begin on page 2 of this paper.

REMARKS

Claims 1 and 2 are pending, with claim 1 being independent.

Allowability of Claims 1 and 2

This application is a continuation of Application No. 12/377,617 filed on February 16, 2009. Claims 1 and 2 of the present continuation application respectively correspond to allowed claims 19 and 24 of parent Application No. 12/377,617 that were canceled in the Amendment After Allowance Under 37 CFR 1.312 filed on August 23, 2013, in parent Application No. 12/377,617 revised as follows:

~~19.1.~~ A decoding method comprising:
performing entropy decoding of an encoded video
information to obtain ~~decoded~~ transform coefficients;
selecting a scanning mode for the ~~decoded~~ transform coefficients; and
~~recovering an input video from scanning the decoded~~
transform coefficients using based on the selected scanning
mode;

wherein the selecting of a scanning mode comprises
selecting the scanning mode based on an optimal intra prediction
mode that was used to perform intra prediction of the input video
to obtain difference values between pixel values and predicted
pixel values, ~~that were encoded to obtain the encoded video.~~

~~24.2.~~ The decoding method of claim ~~19.1~~, wherein the
selecting of ~~a the~~ scanning mode further based on an intra
prediction mode comprises:

selecting a horizontal scanning mode when the optimal
intra prediction mode is a vertical intra prediction mode; and
selecting a vertical scanning mode when the optimal intra
prediction mode is a horizontal intra prediction mode.

It is submitted that claims 1 and 2 of the present continuation application are allowable for at least the same reasons that corresponding claims 19 and 24 of parent Application No. 12/377,617 are allowable as discussed on pages 19-33 of the Amendment of March 20, 2013, filed in parent Application No. 12/377,617 and in the Examiner's Statement of Reasons for Allowance on pages 2-11 of the Notice of Allowability included in the Notice of Allowance of May

23, 2013, issued in parent Application No. 12/377,617, and an indication to that effect is respectfully requested.

Conclusion

For at least the reasons discussed above, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters that need to be addressed before the application can be allowed, it is respectfully requested that the Office telephone the undersigned attorney to discuss these matters before issuing an Office Action.

Respectfully submitted,

Date: August 23, 2013

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Electronic Patent Application Fee Transmittal

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|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Application Number: | |
| Filing Date: | |
| Title of Invention: | APPARATUS FOR ENCODING AND DECODING IMAGE USING ADAPTIVE DCT COEFFICIENT SCANNING BASED ON PIXEL SIMILARITY AND METHOD THEREFOR |
| First Named Inventor/Applicant Name: | Se-Yoon Jeong |
| Filer: | Randall Scott Svihla |
| Attorney Docket Number: | 022090.0002C2 |

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
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| Basic Filing: | | | | |
| Utility filing Fee (Electronic filing) | 4011 | 1 | 70 | 70 |
| Utility Search Fee | 2111 | 1 | 300 | 300 |
| Utility Examination Fee | 2311 | 1 | 360 | 360 |

Pages:

Claims:

Miscellaneous-Filing:

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Patent-Appeals-and-Interference:

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| Post-Allowance-and-Post-Issuance: | | | | |
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| Miscellaneous: | | | | |
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| Unified Patents, LLC v. Res. Inst., et. al. | | | | Ex. 1005, p. 417 | |

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|--------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------|------------|----|
| 1 | Transmittal of New Application | ContApp_0220900002C2_App Transmittal.pdf | 129028 55fe1df91d39711c5abd5a12d165d175675 bfe4 | no | 1 |
| Warnings: | | | | | |
| Information: | | | | | |
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