IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Title: VIDEO SURVEILLANCE SYSTEM EMPLOYING VIDEO PRIMITIVES

37 C.F.R. § 1.132 DECLARATION OF KENNETH A. ZEGER

I, Kenneth A. Zeger, declare as follows:

1. My name is Kenneth A. Zeger. I am a Full Professor of Electrical and Computer Engineering at the University of California, San Diego (UCSD). I understand that my declaration is being submitted in connection with the above-referenced reexamination proceeding pending in the United States Patent and Trademark Office.

I. Qualifications, Background, and Experience

2. I have studied, taught, and practiced electrical and computer engineering for over thirty years.

3. I attended the Massachusetts Institute of Technology ("MIT") and earned Bachelors (SB) and Masters (SM) of Science Degrees in Electrical Engineering and Computer Science in 1984. I earned a Masters of Arts (MA) Degree in Mathematics in 1989 from the University of California, Santa Barbara. I also earned my Ph.D. in Electrical and Computer Engineering from the University of California, Santa Barbara in 1990.

4. I have held the position of Full Professor of Electrical and Computer Engineering at UCSD since 1998, having been promoted from Associate Professor after two years at UCSD. I teach courses full-time at UCSD in the fields of Electrical and Computer Engineering, and specifically in subfields including information theory and image coding, at the undergraduate and graduate levels. Prior to my employment at UCSD, I taught and conducted research as a faculty member at the University of Illinois, Urbana-Champaign for four years, and at the University of Hawaii for two years.

5. I am president of Zunda LLC ("Zunda") a California company located in San Diego, California. Zunda provides expert witness and technical consulting services in the fields of electrical engineering and computer hardware/software.

6. My twenty-plus years of industry experience include consulting work for the United States Department of Defense as well as for private companies such as Xerox, Nokia, MITRE, ADP, and Hewlett-Packard. The topics upon which I provide consulting expertise include image, video, and speech coding; data compression; networks; digital communications; pattern recognition; computer software; and mathematical analyses.

7. I have authored almost 70 peer-reviewed journal articles, the majority of which are on the topic of compression or information theory. I have also authored over 100 papers at various conferences and symposia over the past twenty-plus years, such as the IEEE International Symposium on Information Theory, the International Conference on Image Processing, and the Data Compression Conference.

8. I was elected a Fellow of the IEEE in 2000, an honor bestowed upon only a small percentage of IEEE members. I was awarded the National Science Foundation Presidential Young Investigator Award in 1991, which included $500,000 in research funding. I received this award one year after receiving my Ph.D.

9. I have served as an Associate Editor for the IEEE Transactions on Information Theory publication and have been an elected member of the IEEE Information Theory Board of Governors for three, three-year terms. I organized and have been on the technical advisory committees of numerous workshops and symposia in the areas of image coding, information theory, and data compression. I regularly review submitted journal manuscripts, government funding requests, conference proposals, student theses, and textbook proposals. I also have given many lectures at conferences, universities, and companies on topics in image coding, data compression, and information theory.

10. I have extensive experience in electronics hardware and computer software, from academic studies, work experience, and supervising students. I personally program computers on an almost daily basis and have fluency in many different computer languages.

11. A more complete recitation of my professional experience including a list of my publications is set forth in my curriculum vitae, attached to my declaration as Exhibit Z1.

II. Compensation and Engagement

12. Zunda is being compensated for my work in this matter by Rothwell, Figg, Ernst & Manbeck, at my current rate of $690 per hour. Neither Zunda nor I have any personal or

financial stake or interest in the outcome of the above-referenced reexamination or any related litigation matter. Neither Zunda's nor my compensation is dependent upon my testimony or the outcome of this proceeding or any related litigation matter. Neither Zunda nor I have any relation with or financial interest in the assignee of U.S. Patent No. 7,868,912 ("the '912 patent"), ObjectVideo, Inc.

III. The Reexamination Proceeding

13. It is my understanding that, on May 24, 2013, an anonymous Requestor ("the Requester") filed a Request for *Ex Parte* Reexamination (the "Request") with the United States Patent and Trademark Office (the "Office") requesting reexamination of the '912 patent and that, on June 20, 2013, the Office issued an Order granting the Request (the "Order"). I understand that the Office determined that the Request established a substantial new question of patentability with respect to claims 1-22 of the '912 patent. Thus, it is my understanding that the Office is reexamining claims 1-22 of the '912 patent.

14. It is also my understanding that, on August 30, 2013, the Office issued an Office Action (the "Office Action" or "OA"). In the Office Action, claims 1-22 of the '912 patent are rejected under 35 U.S.C. § 102(b) as anticipated by certain of the references identified in the Office Action and/or under 35 U.S.C. § 103(a) as being obvious in view of certain of the references identified in the Office Action.

15. I have read and understand the '912 patent, its prosecution history, and the references cited in the '912 patent. I have read and understand the Request, the Order, the Office Action, and the references cited in the Office Action. I have also read and understand the comments filed by the Bosch, the third party requester, on July 11, 2012, in the previous *inter partes* reexamination (Control No. 95/001,912) of the '912 patent ("Bosch's comments").

16. I was asked to consider and address the following rejections of claims 1-4 and 6-22 of the '912 patent raised in the Office Action:

(i) Claims 1-3 and 6-22 under 35 U.S.C. § 102(b) as anticipated by German Patent Publication No. DE 101 53 484 A1 to Gilge ("Gilge");

(ii) Claims 1-4 and 6-22 under 35 U.S.C. § 102(b) as anticipated by "ObjectVideo Forensics: Activity-Based Video Indexing and Retrieval For Physical Security Applications," Lipton *et al.* ("Lipton");

(iii) Claims 1, 3, 4, 6, 8, 9, 11-13, 15-20, and 22 under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,969,755 to Courtney ("Courtney");

(iv) Claims 1, 3, 4, 6, 8, 9, 11-13, 15-20, and 22 under 35 U.S.C. § 102(b) as anticipated by "Moving Object Detection and Event Recognition Algorithms for Smart Cameras," Olson *et al.* ("Olson");

(v) Claims 1-3 and 6-22 under 35 U.S.C. § 103(a) as unpatentable over Gilge in view of U.S. Patent No. 6,628,835 to Brill *et al.* ("Brill");

(vi) Claims 1-4 and 6-22 under 35 U.S.C. § 103(a) as unpatentable over Lipton in view of Brill;

(vii) Claims 1, 3, 4, 6, 8, 9, 11-13, 15-20, and 22 under 35 U.S.C. § 103(a) as unpatentable over Courtney in view of Brill;

(viii) Claims 1, 3, 4, 6, 8, 9, 11-13, 15-20, and 22 under 35 U.S.C. § 103(a) as unpatentable over Olson in view of Brill;

(ix) Claims 1-3 and 6-22 under 35 U.S.C. § 103(a) as unpatentable over Gilge in view of "Object Oriented Conceptual Modeling of Video Data," Day *et al.* ("Day");

(x) Claims 1-4 and 6-22 under 35 U.S.C. § 103(a) as unpatentable over Lipton in view of Day;

(xi) Claims 1, 3, 4, 6, 8, 9, 11-13, 15-20, and 22 under 35 U.S.C. § 103(a) as unpatentable over Courtney in view of Day; and

(xii) Claims 1, 3, 4, 6, 8, 9, 11-13, 15-20, and 22 under 35 U.S.C. § 103(a) as unpatentable over Olson in view of Day.

My opinions regarding these rejections are set forth below.[1]

IV. Applicable Laws/Rule

A. Claim Interpretation

17. I understand that, during reexamination, the pending claims must be given their broadest reasonable interpretation consistent with the specification, and that the broadest reasonable interpretation of the claims must also be consistent with the interpretation that those skilled in the art would reach.

B. Priority

18. I understand that claims of an application that is a continuation or continuation-in-part of an earlier U.S. application or international application which are fully supported under 35 U.S.C. § 112 by the earlier parent application have the effective filing date of that earlier parent application. A claim is adequately disclosed/fully supported under 35 U.S.C. § 112 by an earlier parent application if the earlier parent application satisfies the written description requirement.

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[1] The Office Action also included several rejections of claim 5. *See* Office Action at pp. 7, 8, 15-18. However, I was not asked to consider and address these rejections because I understand that the Patent Owner plans to propose cancellation of claim 5.

To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention.

C. Anticipation (35 U.S.C. § 102)

19. To support a rejection based on 35 U.S.C. § 102, I understand that the Examiner bears the burden of showing that a single prior art reference discloses all of the elements of the claim, arranged in the same manner as required by the claim, either explicitly or inherently.

D. Obviousness (35 U.S.C. § 103)

20. I also understand that a claim is not patentable if the differences between the subject matter of the claim and the disclosure of the prior art are such that the subject matter of the claim, as a whole, would have been obvious at the time of invention to a person having ordinary skill in the art to which the subject matter pertains.

21. In determining obviousness, I understand that it is necessary to consider the scope and content of the prior art; the differences between the prior art and the claims at issue; the level of ordinary skill in the pertinent art; and any objective evidence of non-obviousness related to the alleged merits of the claimed invention (which I understand is referred to as "objective indicia of non-obviousness"), such as commercial success, long-felt but unsolved needs, industry recognition, failure of others, and copying.

22. In determining obviousness based on a combination of prior art references, I also understand that evidence of some reason to combine the teachings is required to make the combination, and thus such evidence must be considered, along with any evidence that one or more of the references would have taught away from the claimed invention at the time of the invention.

23. I have been informed that the hypothetical person of ordinary skill in the art is presumed to know all of the teachings known in the art at the time the alleged invention was made. That person is presumed to have the technical competence and experience of skilled artisans working in the area of the subject invention and of the manner in which problems were solved. Factors that may be considered in determining the level of ordinary skill in the art include the types of problems encountered in the art, prior art solutions to those problems, the

rapidity with which innovations are made, the sophistication of the technology, and the educational level of active workers in the field.

V. Claim Construction

A. Attributes and Events

24. Given its broadest reasonable interpretation, it is my opinion that the claim language "attributes," as used in claims 1-22 of the '912 patent, means: observable characteristics. My "observable characteristics" definition is informed by how this phrase is used in the specification, including the claims, of the '912 patent. *See* U.S. Patent Application No. 09/987,707 ("the '707 application") at ¶ 80.[2] Further, the plain and ordinary meaning of the term "attributes" is that they are observable characteristics of something. *See* Exhibit Z3, Webster's New World Dictionary of Computer Terms (5th Ed. 1994) (providing "[a] characteristic quality of a data type, data structure, element of a data model, or system" as a definition of "attribute"). The specification of the '912 patent supports this plain meaning, such as when it discloses that:

> A video primitive refers to an observable attribute of an object viewed in a video feed. Examples of video primitives include the following: a classification; a size; a shape; a color; a texture; a position; a velocity; a speed; an internal motion; a motion; a salient motion; a feature of a salient motion; a scene change; a feature of a scene change; and a pre-defined model.

'707 application at ¶ 80.

25. Given its broadest reasonable interpretation, it is my opinion that the claim language "event" means: one or more objects engaged in an activity. The specification expressly defines an "event" as "one or more objects engaged in an activity." *See* '707 application at ¶ 48 ("An 'event' refers to one or more objects engaged in an activity."). My "one or more objects engaged in an activity" definition is informed by this express definition in the specification.

26. The specification of the '912 patent refers to the claimed "attributes" as "primitives,", and gives numerous examples of attributes/primitives, such as: "a classification; a size; a shape; a color; a texture; a position; a velocity; a speed; an internal motion; a motion; a salient motion; a feature of a salient motion; a scene change; a feature of a scene change; and a pre-defined model." '707 application at ¶ 80. The '912 patent also gives numerous examples of

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[2] Citations to the specification of the '912 patent refer to the '707 application, which was filed on November 15, 2001, and is incorporated by reference in the '912 patent. '912 patent at col. 1, lines 7-12.

events, such as: an object appears; a person appears; a red object moves faster than 10 m/s, two objects come together; a person exits a vehicle; a red object moves next to a blue object, an object crosses a line; an object enters an area; a person crosses a line from the left, an object appears at 10:00 p.m.; a person travels faster then [*sic*] 2 m/s between 9:00 a.m. and 5:00 p.m.; a vehicle appears on the weekend, a person crosses a line between midnight and 6:00 a.m.; a vehicle stops in an area for longer than 10 minutes; a person enters an area between midnight and 6:00 a.m.; and a security service is notified. *Id.* at ¶¶ 98-103. Generally speaking, attributes are simpler concepts than events.

27. More precisely, the '912 patent teaches that multiple detected attributes are to be examined and then, based upon such attributes, a decision is made as to whether or not certain events occurred. '707 application at ¶ 118. The system described in the '912 patent is configured to detect attributes by analyzing a video, but the choice of which attributes the system is configured to detect is not based upon which events are later to be identified. *See id.* at ¶ 79. In fact, tasking of the system to identify one or more events from the detected attributes is not even necessary. *Id.* at ¶ 79 ("Tasking occurs after calibration in block 22 and is optional. Tasking the video surveillance system involves specifying one or more event discriminators. Without tasking, the video surveillance system operates by detecting and archiving video primitives and associated video imagery without taking any action, as in block 45 in FIG. 4.").[3] While the specification of the '912 patent does not explicitly use the term "independence" (outside of the claims themselves), a person of ordinary skill in the art of the '912 patent would understand the '912 patent to teach that the choice of which events are to be identified (*i.e.*, tasking) is made at a time after configuration of the system to detect attributes, and furthermore that the choice of which attributes the system is configured to detect is not dictated/determined by which events the system might later be tasked to identify. *See id.* at ¶ 79. This indeed means that the attributes collected are independent of the events identified. Moreover, this independence of the attributes from the events in the '912 patent means that that *the selection of which attributes to detect is not based upon a predefined list of events to be determined.*

[3] Tasking the system determines the event discriminators that may be used in identifying events. *See* '707 application at ¶ 118 ("event discriminators are determined from tasking the system in block 23" and "are used to filter the video primitives to determine if any event occurrences occurred").

28. The specification of the '912 patent does not prohibit a determined event from being the same as a determined attribute, but such a scenario is not within the scope of the claims of the '912 patent, which require that the determined event not be one of the determined attributes. Claim 1 ("determines a first event that is not one of the determined attributes"); claim 6 ("determine an event that is not one of the detected attributes"); claim 9 ("detect an event that is not one of the detected attributes"); claims 12 and 18 ("the event not being one of the determined attributes").

29. To help clarify the distinction between the claimed "events" and the claimed "attributes," I will illustrate the concepts with an example based upon events such as an object moving, entering, or growing. The specification of the '912 patent discloses that "an 'event' refers to one or more objects engaged in an activity" and provides, as examples of an activity, "entering; exiting; stopping; moving; raising; lowering; growing; and shrinking." '707 application at ¶¶ 46 & 48. Multitudes of attributes/characteristics of an object that is engaging in any one such activity may be associated with the event that refers to the activity. The attributes/characteristics may include, for example, one or more of the object's position, width, length, (linear) speed, velocity, acceleration, third order and higher derivatives of motion vs. time, direction of motion, momentum, rotation, angular velocity, moment of inertia, angular momentum, occlusions, shading, proximity to nearby objects, etc. None of these attributes/characteristics is itself an "activity." Instead, these attributes/characteristics are numerical descriptions of particular observable aspects of the object that may be engaging in an activity. One might be able to logically deduce, from one or more of these attributes/characteristics, a particular activity in which an object is engaging, but that involves inference. Each of these example characteristics is an attribute that does not refer to an activity in which the object is engaged. In contrast, a hypothetical Boolean variable such as Is_Entering, Is_Exiting, Is_Moving, etc., which is true if the object is engaging in the associated activity and false if the object is not engaging in such activity, would be an example of an attribute that refers to an activity in which the object is engaged, because, in this case, no deductive reasoning is required to determine that a particular event referring to the object engaged in the activity occurred.

30. Inferring events based on the attributes (or primitives) provides several advantages. First, "[a]n operator is provided with maximum flexibility in configuring the system by using event discriminators," '707 application at ¶ 66, as opposed to the limitations associated with using prerecorded events. Second, inference analysis based on previously extracted attributes "greatly improves the analysis speed of the computer system" as the system can process only the attributes instead of reprocessing the video. *See id.* at ¶ 67. Third, inventing a system for analyzing "small-sized video primitives abstracted from the video" has many corresponding size-based benefits. *Id.* at ¶ 148. For example, the storage space and bandwidth necessary to manage the small-sized attributes is far less than for managing the video itself, even if the video is highly compressed. *See id.*

B. Independence-Based Claim Elements

31. Claims 1-4 and 6-22 of the '912 patent all contain limitations that require that the attributes must be independent from the event to be identified. The following claim elements (the "independence-based elements") incorporate this requirement:

Claim Element	Claims
which determines a first event that is not one of the determined attributes by analyzing a combination of the received determined attributes	'912 patent, claims 1-4
wherein the first processor determines attributes independent of a selection of the first event by the second processor	'912 patent, claims 1-4
the processor configured to determine an event that is not one of the detected attributes by analyzing a combination of the received attributes	'912 patent, claims 6-8
wherein the attributes received over the communications channel are independent of the event to be determined by the processor	'912 patent, claims 6-8
performing an analysis of a combination of the detected attributes to detect an event that is not one of the detected attributes	'912 patent, claims 9-11
wherein the detected attributes received in the stream of attributes are independent of a selection of the event to be detected	'912 patent, claims 9-11
wherein the stream of attributes is sufficient to allow detection of the event that is not one of the determined attributes	'912 patent, claims 12-17
wherein the attributes of the stream of attributes are created independently of the subsequent analysis	'912 patent, claim 15
wherein the stream of attributes is sufficient to allow detection of an event that is not one of the determined attributes by analyzing a	'912 patent, claim 16

Claim Element	Claims
combination of the attributes	
wherein the stream of attributes is transmitted over a communications channel without detection of an event at the first location	'912 patent, claim 17
wherein the processor determines attributes independently of a subsequent analysis of a combination of attributes to determine an event that is not one of the determined attributes	'912 patent, claims 18-22

32. There are at least three components to the independence-based claim elements. The first is a requirement of determining/detecting an event that refers to one or more objects engaged in an activity by analyzing the determined/detected attributes. '707 application at Abstract ("The system … extracts event occurrences from the video primitives using event discriminators."); ¶ 48 ("An 'event' refers to one or more objects engaged in an activity."); ¶ 118 ("In block 44, event occurrences are extracted from the video primitives using event discriminators. … The event discriminators are used to filter the video primitives to determine if any event occurrences occurred."). Referencing an already determined/detected event with respect to location and/or time is not a determination/detection of a new event because the analysis of the determined/detected attributes that determines/detects the one or more objects engaged in the activity has already occurred. *Id.* at ¶ 48 ("The event may be *referenced* with respect to a location and/or a time." (emphasis added)). *See also id.* at ¶ 80 ("An event discriminator refers to one or more objects optionally interacting with one or more spatial attributes and/or one or more temporal attributes.") & ¶ 97 ("In block 35, one or more discriminators are identified by describing interactions between video primitives (or their abstractions), spatial areas of interest, and temporal attributes of interest."). That is, a determined event does not change merely because the event is referenced with respect to a location and/or a time. *See id.*

33. This interpretation is also consistent with the loitering event discriminator example described in the specification of the patent. Specifically, the '912 patent discloses that "an operator can define an event discriminator (called a 'loitering' event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 application at ¶ 66. The exemplary loitering event discriminator analyzes detected attributes to determine any object engaged in a loitering activity

(*i.e.*, any object remaining stationary for a period of time) and then references the already determined loitering event to the automatic teller machine space (*i.e.*, a location) and between 10:00 p.m. and 6:00 a.m. (*i.e.*, a time).

34. A second component of the independence-based claim elements is that the detected attributes are independent of the event to be detected.[4] As explained above, this means that the choice of which attributes the system is configured to detect is not dictated/determined by which events the system might later be tasked to identify. That is, the selection of which attributes to detect is not based upon a predefined list of events to be determined, and, to the contrary, tasking of the system to identify one or more events occurs after configuration of the system to detect attributes. *See* '707 application at ¶ 79 ("Tasking occurs after calibration in block 22 and is optional. Tasking the video surveillance system involves specifying one or more event discriminators. Without tasking, the video surveillance system operates by detecting and archiving video primitives and associated video imagery without taking any action...."). Moreover, attributes detected based upon a predefined list of events would not suddenly become independent of the events in the predefined list simply because one or more events of the predefined list that are detected are later referenced to location and/or time. As noted above, a determined event does not change merely because the event is referenced with respect to a location and/or a time. *See id.* at ¶ 48 ("The event may be referenced with respect to a location and/or a time.").

35. A third component of the independence-based claim elements is that the identified event is not one of the detected attributes. As noted above, the specification of the '912 patent discloses some determined events that are the same as a determined attribute. *See* '707 application at ¶ 98 ("an object appears"). However, the specification of the '912 patent also discloses events that are not detected attributes. *See, e.g., id.* at ¶ 98 ("a person appears; a red object moves faster than 10 m/s"); & ¶ 99 ("two objects come together; a person exits a vehicle; a red object moves next to a blue object"). The claims of the '912 patent require determination of an event that is not a determined attribute (or allowance of detection of an event that is not a

[4] This is not a requirement that the event be independent of the determined attributes. The event is dependent on attributes because the attributes are analyzed to determine the event. *See* '707 application at ¶ 118 ("In block 44, event occurrences are extracted from the video primitives using event discriminators. ... The event discriminators are used to filter the video primitives to determine if any event occurrences occurred."). In other words, mathematically speaking, "X is independent of Y" does not imply that "Y is independent of X".

determined attribute) and are silent regarding determination of an event that is a determined attribute.

C. First and Second, Separate Attribute Determination and Event Determination Processors

1. Claims 1-4 Require First and Second, Separate Attribute Determination and Event Determination Processors

36. Claims 1-4 of the '912 patent require (1) "a first processor which analyzes a video to determine attributes of objects detected in the video" and (2) "a second processor, separate from the first processor, … which determines a first event that is not one of the determined attributes by analyzing a combination of the received determined attributes." I refer to this requirement as the "the separate attribute determination and event determination processors requirement" below.

37. Claims 1-4 are silent regarding *exclusive* assignment of attribute determination and event determination processing responsibilities to the first and second separate processors, respectively. In other words, claims 1-4 require "a first processor which analyzes a video to determine attributes of objects detected in the video" but are silent regarding whether the first processor determines an event by analyzing determined attributes. Similarly, claims 1-4 require "a second processor, separate from the first processor, … which determines a first event that is not one of the determined attributes [without reprocessing the video] by analyzing a combination of the received determined attributes" but are silent regarding whether the second processor performs video analysis to determine attributes of objects. To be clear, claims 1-4 require that the second processor determines the first event without reprocessing the video analyzed by the first processor but neither preclude the second processor from processing of the video analyzed by the first processor for other purposes (*e.g.*, to determine different attributes than those received by the first processor or to verify the attribute determination analysis performed by the first processor) nor preclude the second processor from analyzing a different video than the video analyzed by the first processor to determine attributes of objects detected in the different video.

38. My interpretation of claim 1 as *not* requiring *exclusive* assignment of attribute determination and event determination processing responsibilities to the first and second separate processors, respectively, is consistent with specification of the '912 patent . For example, in one embodiment, the '912 patent discloses a video surveillance/computer system 11 having a

computer 12 that is operated to determine attributes (*i.e.*, video primitives), determine events, and take appropriate responses when events are determined. '707 application at Figs. 1-4 & ¶¶ 71, 77, 104. The '912 patent discloses, in response to the computer system 11 determining an event, forwarding the determined attributes/video primitives "to another computer system via a network" and "tasking … another computer system" to determine events. *Id.* at ¶ 96. Thus, one of ordinary skill in the art would understand the '912 patent to disclose one computer system 11 that performs both attribute determination and event determination and "another computer system" that receives attributes forwarded from the computer system 11 and that is tasked by the computer system 11 to perform event determination on the attributes. *See id.*

2. Claims 6-22 do not Require First and Second, Separate Attribute Determination and Event Determination Processors

39. Given their broadest reasonable interpretation, it is my opinion that, although a system or device having (or a method using) the separate attribute determination and event determination processors required by claims 1-4 may fall within the scope of claims 6-22, claims 6-22 do not require the separate attribute determination and event determination processors required by claims 1-4. In other words, systems, devices, and methods having or using (a) the separate attribute determination and event determination processors required by claims 1-4 or (b) a single processor that performs both the attribute determination and the event determination may fall within the scope of claims 6-22.

40. Independent claim 6 requires "a processor" that is "configured to receive … detected attributes received over the communications channel" and to "determine an event … by analyzing a combination of the received attributes" itself. There is no recitation in claim 6 of a second processor, and claim 6 is silent as to what detects the attributes in the stream of attributes. Moreover, although claim 6 requires that "the processor is configured to determine the event without reprocessing the video," claim 6 does not preclude the "processor" from performing the initial processing of the video to detect the attributes. Accordingly, claim 6 would encompass a video system in which the recited "processor" performs the initial processing of the video to detect the attributes, a stream of the detected attributes is transmitted over the communications channel to a computer-readable medium, the recited "input" receives the stream of detected attributes over the communication channel from the computer-readable medium, and the recited "processor" determines the event without reprocessing the video by analyzing a combination of

the received attributes that it previously detected. However, claim 6 would also encompass a video system in which a second processor performs the initial processing of the video to detect the attributes, and the recited "input" receives the stream of detected attributes over the communication channel from the second processor.

41. This interpretation of claim 6 is consistent with the specification of the '912 patent. For example, the specification discloses (i) archiving attributes/video primitives in a computer-readable medium other than the computer-readable medium 13 of the computer system 11 that determines the attributes and (ii) determining events using the archived attributes without reprocessing the video. *See, e.g.,* '707 application at Figs. 1, 4 & 9; ¶ 117 ("The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium."); ¶ 118; ¶ 148 ("[T]he system analyses archived video primitives with event discriminators to generate reports, for example, without needing to review the entire source video. ... The video content can be reanalyzed ... in a relatively short period of time because only video primitives are reviewed and because the video source is not reprocessed."). However, the specification of the '912 patent also discloses a computer system 11 that detects attributes/video primitives and, in response to determining an event, (i) forwards the attributes/video primitives to another computer system and (ii) tasks another computer system with event discriminators to determine events from attributes/video primitives. *See id.* at ¶ 96 ("forwarding ... video primitives ... to another computer system via a network, such as the Internet" and "tasking the computer system 11 and/or another computer system" in response to an event determination) & ¶ 118 ("In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23.").

42. Independent claim 9 is a method claim that does not require the use of more than one processor to perform the claimed method steps and does not include the step of detecting the attributes. Thus, claim 9 is silent as to what detects the recited "detected attributes [received] over the communications channel." Although claim 9 requires "performing an analysis of a combination of the detected attributes to detect an event ... without reprocessing the video," claim 9 encompasses a method using a single processor to (i) perform an initial processing of a video to detect attributes, (ii) transmit a stream of the detected attributes over a communications

channel to a computer readable medium, (iii) receive the stream of detected attributes over the communications channel, (iv) perform an analysis of a combination of the detected attributes to detect an event that is not one of the detected attributes without reprocessing the video (the attributes being independent of a selection of the event to be identified), and (v) provide an alert, report information, and/or instruction upon detecting the event. This interpretation of claim 9 is consistent with the specification of the '912 patent. *See, e.g.,* '707 application at Figs. 1, 4, 9 & ¶¶ 117, 118, 148. However, claim 9 would also encompass a method in which a first processor performs the initial processing of the video to detect the attributes, and a second processor performs the method steps including receiving a stream of detected attributes over the communication channel (from the first processor) and analyzing the detected attributes (received from the first processor) to detect an event without reprocessing the video. This interpretation of claim 9 is also consistent with the specification of the '912 patent. *See id.* at ¶ 96 ("forwarding … video primitives … to another computer system via a network, such as the Internet" and "tasking the computer system 11 and/or another computer system" in response to an event determination).

43. Independent claim 12 is a method claim that does not require using more than one processor to perform the recited steps of "analyzing a video to detect an object," "creating a stream of attributes at a first location," and "transmitting the stream of attributes to a second location removed from the first location for subsequent analysis." The method of claim 12 does not include the step of performing an analysis to detect an event (*i.e.*, the step performed by a second processor in claims 1-4). Moreover, claim 12 would encompass a method using a single processor to (i) analyze a video to detect an object, (ii) create a stream of attributes at a first location by determining attributes of the detected object by analyzing the video, (iii) transmit the stream of attributes over a communications channel to a computer-readable medium at a second location removed from the first location for subsequent analysis, (iv) receive the stream of attributes from the computer-readable medium at the second location, and (v) perform the subsequent analysis (with reprocessing the video) to detect an event (that is not one of the determined attributes) of the video to provide an alert to a user.

44. Independent claim 18 recites "a processor at a first location" that "determines attributes," which are transmitted "to a second location removed from the processor for a

subsequent analysis of a combination of the attributes at the second location." The claim recites that "the attributes [be] sufficient to allow detection of an event ... , the event not being one of the determined attributes and being determinable by analyzing the combination of the attributes" and that "the attributes [be] sufficient to allow detection of an event without reprocessing the video of the first location." There is no recitation of a second processor for performing the subsequent analysis of the attributes. The "combination of the attributes at the second location" could be subsequently analyzed by the "processor at [the] first location," if any subsequent analysis ever takes place.

VI. Priority

A. Patent Claims 1-4 and 6-22

45. I have examined, in detail, the '912 patent and the '707 application, filed on November 15, 2001. It is my opinion that the '707 application describes the invention of claims 1-4 and 6-22 of the '912 patent in sufficient detail that one skilled in the art would reasonably conclude that the inventor had possession of the claimed invention, including (1) the separate attribute determination and event determination processors of claims 1-4 and (2) the independence-based elements of claims 1-4 and 6-22 (identified in ¶ 31, above). My opinion is supported by the appended claim chart (Exhibit Z2), which identifies the portions of the '912 patent and '707 application that provide support for claims 1-4 and 6-22.

1. First and Second, Separate Attribute Determination and Event Determination Processors Requirement of Claims 1-4

46. The '707 application reasonably conveys to one of ordinary skill in the art that the inventors were in possession of an invention that used two separate processors, one to determine attributes and one to analyze attributes. It is my opinion that at least paragraph 96 of the '707 application provides clear support for the separate attribute determination and event determination processors requirement of claims 1-4.

47. In paragraph 96, the '707 application discloses:

> In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; *forwarding* data (e.g., image data, video data, *video primitives*; and/or analyzed data) *to another computer system via a network*, such as the Internet; saving such data to a designated computer-readable medium; activating

> some other sensor or surveillance system; *tasking* the computer system 11 and/or *another computer system*; and directing the computer system 11 and/or another computer system.

'707 application at ¶ 96 (emphasis added). Thus, the '707 application discloses, as examples of a response to determining an event, both (i) "forwarding ... video primitives ... to another computer system via a network, such as the Internet" and (ii) "tasking ... another computer system." *Id.*

48. The disclosure of "forwarding ... video primitives ... to another computer system via a network" is explicit support for a first computer system that determines attributes/video primitives and, in response to determining an event, transfers the determined attributes/video primitives to another computer system over a network/communications link. The disclosure of "forwarding ... video primitives ... to another computer system via a network" is also explicit support for a second/other computer system, separate from the first computer system, in communication with the network/communications link to receive the determined attributes/video primitives transferred from the first computer system over the network/communications link. *See* ¶¶ 37 & 38 above (explaining why claims 1-4 do *not* require *exclusive* assignment of attribute determination and event determination processing responsibilities to the first and second separate processors, respectively). Also, because the '707 application discloses that event discriminators, which are used to determine events from the attributes/video primitives are determined from tasking, the disclosure of "tasking ... another computer system" is explicit support for a second/other computer system that is tasked to determine events by analyzing attributes/video primitives. *See* '707 application at ¶ 118 ("In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23.").

49. One of ordinary skill in the art would understand that each of the first computer system (that forwards/transmits attributes/video primitive and tasks another computer system) and the second/other computer system (that receives the forwarded video primitives and/or is tasked) would have at least one computer having at least one processor. *See* '707 application at Fig. 1 & ¶ 49. One of ordinary skill in the art would also understand that the second/other computer system (*i.e.*, the attribute receiving computer system) would use the forwarded

attributes/video primitives to determine events for at least three reasons. First, the whole purpose of determining attributes/video primitives is to use them to determine events. *See* '707 application at ¶ 118 ("event occurrences are extracted from the video primitives" and "filter[ing] the video primitives to determine if any event occurrences occurred"). Second, the '707 application separately lists "saving [video primitives] to a designated computer-readable medium" as an example of a response to a determined event. *Id.* at ¶ 96. The '707 application does not state that the second/other computer system would simply save/store the attributes/video primitives forwarded from the first computer system and not use them to determine events; instead the '707 application separately lists saving video primitives to a designated computer-readable medium (*i.e.*, it would be redundant). Third, the disclosure of the specific "tasking ... another computer system" by the first computer system 11 in response to detection of an event strongly supports that one of ordinary skill in the art would understand that the inventors were in possession of an invention where event determination is performed by the other computer systems regardless of the specific manner in which the other computer systems were tasked. Fourth, the disclosure of both "tasking ... another computer system" to determine events using video primitives and "forwarding ... video primitives ... to another computer system via a network" supports that one of ordinary skill in the art would understand that the inventors were in possession of an invention where the other computer system tasked to determine events using video primitives would use any video primitives to determine the events, including forwarded video primitives.

50. Thus, for the reasons set forth above and in the appended priority claim chart (Exhibit Z2), it is my opinion that the disclosure of the '707 application of "forwarding ... video primitives ... to another computer system via a network" and "tasking ... another computer system" reasonably conveys, with sufficient detail and clarity, to those skilled in the art that, as of November 15, 2001, the inventors were in possession of the separate attribute determination and event determination processors.

2. Single Processor and Separate Processor Embodiments Encompassed by Patent Claims 6-22

51. For the reasons set forth above in paragraphs 39-44, claims 6-22 do not require separate attribute determination and event determination processors and, instead, encompass video systems, video devices, and methods in which either (a) a single processor performs both

attribute detection and event determination or (b) a first processor performs attribute determination and a second, separate processor perform event determination. It is my opinion that the '707 application reasonably conveys, with sufficient detail and clarity, to those skilled in the art that, as of November 15, 2001, the inventors were in possession of both the single processor and separate processor embodiments.

52. The '707 application fully supports the single processor embodiment by disclosing a computer system 11 having a computer 12, which can have a single processor, and using the computer system 11 to (i) analyze a video to detect objects and attributes/video primitives, (ii) archive the detected attributes/video primitives in a computer-readable medium other than the computer-readable medium 13 of the computer system 11 that determines the attributes, and (iii) determine events using the archived attributes without reprocessing the video. *See, e.g.,* '707 application at Figs. 1, 4 & 9; ¶ 49 ("A computer can have a single processor or multiple processors … ."); ¶ 71 ("A computer system 11 comprises a computer 12 having a computer-readable medium 13 embodying software to operate the computer 12 according to the invention."); ¶¶ 106-116 (describing attribute/video primitive detection); ¶ 117 ("The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium."); ¶ 118 (describing event determination); ¶ 148 ("[T]he system analyses archived video primitives with event discriminators to generate reports, for example, without needing to review the entire source video. … The video content can be reanalyzed … in a relatively short period of time because only video primitives are reviewed and because the video source is not reprocessed.").

53. The '707 application also fully supports separate attribute determination and event determination processors for the reasons set forth above in paragraphs 46-50. For example, the '707 application discloses a computer system 11 that detects attributes/video primitives and, in response to determining an event, (i) forwards the attributes/video primitives to another computer system and (ii) tasks another computer system with event discriminators to determine events from attributes/video primitives. *See id.* at ¶ 96 ("forwarding … video primitives … to another computer system via a network, such as the Internet" and "tasking the computer system 11 and/or another computer system" in response to an event determination) & ¶ 118 ("In block 44, event occurrences are extracted from the video primitives using event discriminators. The

video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23."). One of ordinary skill in the art would understand that each of the computer system 11 that forwards/transmits attributes/video primitive and the other computer system that receives the attributes/video primitives would have at least one computer having at least one processor. *See* '707 application at Fig. 1 & ¶ 49.

3. Independence-Based Elements

54. It is my opinion that one of ordinary skill in the art would understand the '707 application to fully support the independence-based claim elements of claims 1-4 and 6-22 of the '912 patent (identified in ¶ 31, above).

55. Support for the independence-based claim elements (identified in ¶ 31, above) related to attribute determination being independent of event determination can be found throughout the '707 application, including Fig. 9 & ¶¶ 38, 48, 66, 67, 96, 148, 150, 151. Notably, the definition of "event" as "refer[ring] to one or more objects engaged in an activity," '707 application at ¶48, distinguishes "event" from a "video primitive," *i.e.*, "an observable attribute of an object viewed in a video feed." *Id.* at ¶ 80. Moreover, in defining an "event," the '912 patent states that "[t]he event may be referenced with respect to a location and/or a time." *Id.* at ¶ 48. The '912 patent also discloses numerous examples of events that are not attributes. *See, e.g., id.* at ¶¶ 98-103 (listing examples of event discriminators such as "a red object moves next to a blue object," "a person crosses a line from the left," and "a vehicle stops in an area for longer than 10 minutes").

56. As explained in paragraphs 32-35 above, the independence-based claim elements include at least three components. One component is a requirement of determining/detecting an event that refers to one or more objects engaged in an activity by analyzing the determined/detected attributes, and this requirement cannot be met by merely referencing an already determined/detected event with respect to location and/or time because referencing an already determined event with respect to location and/or time does not create a new event. *See* ¶ 32 above. Support for this component of the independence-based claim elements can be found throughout the '912 patent. *See, e.g.,* '707 application at ¶ 118 ("In block 44, event occurrences are extracted from the video primitives using event discriminators. ... The event discriminators are used to filter the video primitives to determine if any event occurrences occurred.") & ¶ 48

("The event may be *referenced* with respect to a location and/or a time."). *See also id.* at ¶ 80 ("An event discriminator refers to one or more objects optionally interacting with one or more spatial attributes and/or one or more temporal attributes.") & ¶ 97 ("In block 35, one or more discriminators are identified by describing interactions between video primitives (or their abstractions), spatial areas of interest, and temporal attributes of interest.").

57. Another component is that the detected attributes are independent of the event to be detected, which means that the choice of which attributes the system is configured to detect is not dictated/determined by which events the system might later be tasked to identify (*i.e.*, the selection of which attributes to determine are not based upon a predefined list of events to be determined, and, to the contrary, tasking of the system to identify one or more events occurs after configuration of the system to detect attributes). *See* ¶¶ 27 & 34 above. Support for this component of the independence-based claim elements can be found throughout the '912 patent. *See, e.g.,* '707 application at ¶ 79 ("Tasking occurs after calibration in block 22 and is optional. Tasking the video surveillance system involves specifying one or more event discriminators. Without tasking, the video surveillance system operates by detecting and archiving video primitives and associated video imagery without taking any action...."). *See also id.* at Fig. 9 & ¶¶ 38, 66, 67, 148, 150, 151.

58. Another component of the independence-based claim elements is that the identified event is not one of the detected attributes. *See* ¶¶ 28 & 35 above. Support for this component of the independence-based claim elements can be found throughout the '912 patent, which discloses numerous examples of events that are not any of the detected attributes analyzed to determine the events. *See, e.g., id.* at ¶¶ 98-103 (listing examples of event discriminators such as "a red object moves next to a blue object," "a person crosses a line from the left," and "a vehicle stops in an area for longer than 10 minutes") & ¶ 118 ("[A]n event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion.").

C. New Claims

59. I have examined, in detail, new claims 23-44 of Patent Owner's amendment and reply, the '912 patent, and the '707 application, filed on November 15, 2001. It is my opinion that both the '912 patent and the '707 application fully support new claims 23-44 of Patent Owner's amendment and reply.

60. New claims 23-25 are similar to patent claims 1, 6, and 9, respectively, but additionally require "filtering." The filtering requirement is fully supported by the specification of the '912 patent, which discloses that "[t]he event discriminators are used to *filter* the video primitives to determine if any event occurrences occurred." '707 application at ¶ 118 (emphasis added). *See also id.* at ¶ 30 ("A need exists to *filter* video surveillance data to identify desired portions of the video surveillance data." (emphasis added)) & ¶ 32 ("An object of the invention is to *filter* video surveillance data to identify desired portions of the video surveillance data." (emphasis added)).

61. New claims 26-30 are similar to patent claims 1, 6, 9, 12, and 18, respectively, but additionally require "first and second objects" and that the determined event be "the first and second objects coming together." The "first and second objects" and determined event that is "the first and second objects coming together" are fully supported by the specification of the '912 patent, which discloses "two objects come together" as an example of "an event discriminator for multiple objects." '707 application at ¶ 99.

62. New claims 31-33 are similar to patent claims 1, 6, and 9, respectively, but additionally require "first and second objects," that the determined event be "the first and second objects coming together," and "filtering." The "first and second objects" and determined event that is "the first and second objects coming together" are fully supported by the specification of the '912 patent, which discloses "two objects come together" as an example of "an event discriminator for multiple objects." '707 application at ¶ 99. The filtering requirement is fully supported by the specification of the '912 patent, which discloses that "[t]he event discriminators are used to *filter* the video primitives to determine if any event occurrences occurred." '707 application at ¶ 118 (emphasis added). *See also id.* at ¶ 30 ("A need exists to *filter* video surveillance data to identify desired portions of the video surveillance data." (emphasis added))

& ¶ 32 ("An object of the invention is to *filter* video surveillance data to identify desired portions of the video surveillance data." (emphasis added)).

63. New claims 34-38 are similar to patent claims 1, 6, 9, 12, and 18, respectively, but additionally require that "none of the determined [or detected] attributes refers to the object [or one or more objects] engaged in an activity." This additional feature is fully supported by the specification of the '912 patent, which discloses the determination of events solely from attributes that are non-event characteristics of an object (*i.e.*, non-event attributes). *See, e.g.*, '707 application at ¶¶ 100 & 118. For example, the '912 patent discloses, as an example, that "an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 application at ¶ 118. The attributes used to determine if the wrong way event occurred are times, object types, positions, and directions, and all of these attributes are non-event attributes. In other words, none of these attributes used to determine if the wrong way event occurred refers to an object engaged in activities. Another example in the specification of the '912 patent of an event identified from solely non-event attributes is the "object crosses a line" event, which is disclosed as an example of an event discriminator for an object and a spatial attribute." '707 application at ¶ 100. A skilled person would understand from reading the specification of the '912 patent that detecting an object crossing a line would be accomplished by detecting purely non-event attributes based on time and location, namely where the object is located as a function of time and where the line is located.

64. New claims 39-41 are similar to patent claims 1, 6, and 9, respectively, but additionally require "filtering" and that "none of the determined attributes refers to the object engaged in an activity." These additional features are fully supported by the specification of the '912 patent for the reasons set forth above in paragraphs 60 and 63.

65. New dependent claims 42-44 depend on new claims 23-25, respectively, and additionally require attribute filtering to determine if the event occurred. The attribute filtering requirement is fully supported by the specification of the '912 patent, which discloses that "[t]he

event discriminators are used to *filter* the video primitives to determine if any event occurrences occurred." '707 application at ¶ 118 (emphasis added). *See also id.* at ¶ 30 ("A need exists to *filter* video surveillance data to identify desired portions of the video surveillance data." (emphasis added)) & ¶ 32 ("An object of the invention is to *filter* video surveillance data to identify desired portions of the video surveillance data." (emphasis added)).

VII. Anticipation

66. I have examined, in detail, Courtney and Olson and the pages of the Request claim charts submitted with the Request incorporated by reference in the Office Action. It is my opinion that neither Courtney nor Olson anticipates any of claims 1-4 and 6-22 of the '912 patent.

67. More specifically, neither Courtney nor Olson discloses, expressly or inherently, the independence-based elements (identified and defined in ¶ 31, above) found in all of the rejected claims. Like other "event-indexing" systems (*i.e.*, systems that index/bookmark when particular events occur in a video) in the prior art, the Automatic Video Indexing ("AVI") system of Courtney or the Autonomous Video Surveillance ("AVS") system of Olson search an index for a *previously determined event*. Searching for already determined events produces the same events that have already been detected. This is true even if the search is for already determined events that involve a particular object, occur at a particular location, and/or occur at a particular time; searching for already determined events does not create new events (*i.e.*, events that are different from the already determined events). Similarly, mere referencing of an already determined event with respect to a particular location and/or time does not change the already determined event. Accordingly, like other event-indexing systems, Courtney and Olson fail to disclose the independence-based elements of the claims of the '912 patent.

A. Rejection based on Courtney

1. Independence-Based Elements

68. Courtney does not disclose and would not have suggested the independence-based claim elements of the '912 patent.

69. Courtney is an example of the event-indexing art and thus describes a method of indexing a video when particular events occur in the video. *See* Courtney at Abstract & Fig. 16. In essence, Courtney bookmarks each event as it processes the video. *Id.* at col. 4, line 62-col. 5,

line 3. A user can then construct a query to search for those bookmarked events in the video. *Id.* at col. 12, lines 41-52. In contrast, the system described and claimed in the '912 patent allows users to search for events that were not identified in the initial processing of the video (and thus were not bookmarked). *See* '707 Application at ¶¶ 67, 118, 148. Instead of bookmarking previously-identified events, the '912 patent describes detecting attributes of an object (or primitives) so that a combination of those attributes can be analyzed to deduce the existence of events. *See id.*

70. I have the Request and Bosch's comments, and I am aware that the Requester alleges that the indexed events of Courtney correspond to the claimed "attributes" and that the events selected by the querying and/or event scanning of Courtney correspond to the claimed "events." However, neither the Requester nor Bosch has provided an adequate explanation as to why the indexed event selected by the querying and/or event scanning of Courtney would not be one of the indexed events of Courtney or how the indexed events of Courtney could be independent from the indexed events selected by the querying and/or event scanning of Courtney. Bosch alleged that "Courtney discloses no limitation on the user's ability to formulate queries using the user interface 17." Bosch comments at p. 18. Bosch's allegation is incorrect because the user's ability to formulate queries using the user interface 17 is limited to a predefined list of "[e]ight events of interest." Courtney at col. 10, lines 44-64. In addition, even though the user of the user interface 17 of Courtney has some flexibility in formulating queries, the events selected by the querying of Courtney are limited to the indexed events of Courtney. *Id.* at col. 12, line 53-col 13, line 19. The independence based claim elements are directed to the recited "attributes" and "events" and not to attributes and a formulation of a query for particular attributes. As explained below, the events selected by the querying and/or event scanning of Courtney are the exact events indexed by the vision subsystem of Courtney, and the events indexed by the vision subsystem of Courtney depend on the events that can be selected by the querying and/or event scanning of Courtney.

71. Fig. 1 of Courtney "shows a high-level diagram of the Automated Video-Indexing (AVI) system 10 according to one embodiment." Courtney at col. 3, line 66-col. 4, lines 10.

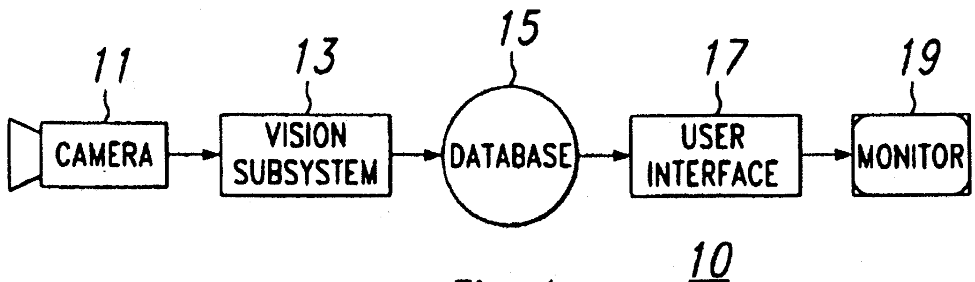

Fig. 1

72. Courtney discloses that "a camera 11 provides input to a vision subsystem 13 including a programmed computer which processes the incoming video which has been digitized to populate a database storage 15." Courtney at col. 4, lines 1-4. Courtney discloses that the vision subsystem 13 segments the incoming video and analyzes it "to create a symbolic representation of the foreground objects and their movement." *Id.* at col. 4, lines 29-45. According to Courtney, the "symbolic record of video content is referred to as the video 'meta-information.'" *Id.* at col. 4, lines 45-47. "[T]he vision subsystem 13 scans through the meta-information and places an index mark at each occurrence of eight events of interest: appearance/disappearance, deposit/removal, entrance/exit, and motion/rest of objects." *Id.* at col. 4, lines 62-65. "The system stores the output of the vision subsystem--the video data, motion segmentation, and meta-information--in the database 15 for retrieval through the user interface 17." *Id.* at col. 5, lines 4-6.

73. Fig. 16 of Courtney shows an example of the bookmarked events in the video.

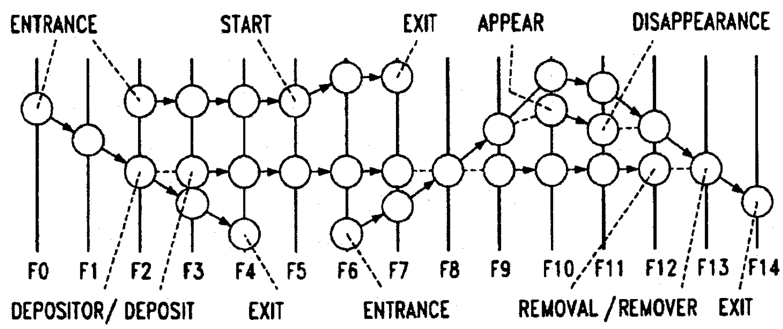

Fig. 16

74. As is shown in this figure, the system bookmarks frames with events. Queries can be constructed to search for these particular event bookmarks. *See* Courtney at col. 12, lines 41-43. Indeed, queries themselves take the following form:

$$Y=(C, T, V, R, E),$$

where

C is a video clip,
$T=(t_i, t_j)$ specifies a time interval within the clip,
V is a V-object within the clip meta-information,
R is a spatial region in the field of view, and
E is an object-motion event.

Id. at col. 12, lines 45-54.

75. Courtney discloses that "E" stands for "object-motion event." Courtney at col. 12, line 52. So, one of the things that the system uses as input for a query is the event "E" itself bookmarked in the motion graph. *See id.* at Fig. 16. The "E" is disclosed as one of eight *pre-defined* events, which include an object's Appearance, Disappearance, Entrance, Exit, Deposit, Removal, Motion, and Rest. *Id.* at col. 10, lines 50-61. The only way that a user can search for an event is by including the "E" in the query input. *See id.* at col. 12, lines 45-54. If, somehow, E is not used in the query, then the query engine of Courtney simply searches for the existence of particular objects, but it is then incapable of searching for an event. *See id.* In other words, if the user does not include an "object-motion event" (E) in the query, then the system of Courtney only queries for the existence of video clips, a time interval within the video clips, and/or a spatial region within the field of view and does not query for an event (*i.e.*, one or more objects engaged in an *activity*).

76. Courtney discloses that "[t]he clip C specifies the video sub-sequence to be processed by the query, and the (optional) values of T, V, R, and E define the scope of the query. ... Thus, the query engine processes Y by finding all the video sub-sequences in C that satisfy, T, V, R, and E." Courtney at col. 12, lines 53-60. Courtney discloses that the query engine retrieves a motion graph G corresponding to the clip C. *Id.* at col. 12, lines 61-63. If one or more of T, V, R, and E are specified in a query Y, they are used to truncate the motion graph G to result in a graph G containing only the objects satisfying all the constraints of the query. *Id.* at col. 12, line 61-col. 13, line 19. *See also id.* at Figs. 17-21 & col. 13, lines 20-24 (illustrating the

steps performed by the query engine to process a query for particular exit events that have already been identified). If all of the parameters C, T, V, R, and E are specified, then the query Y of Courtney narrows the motion graph G corresponding to the video clip C to all occurrences of the previously determined specified event E for the specified object V with reference to the specified time T and specified location R. Regardless of which C, T, V, R, and E are specified, the query Y of Courtney returns one or more of the already determined and indexed events. The query Y of Courtney does not create any new events. For example, *specifying R and/or T merely references an already determined and indexed event with respect to location and/or time. Such reference to time and location does not change the event itself according to the definition of an event in the '912 patent.*

77. Processing of the queries Y of Courtney does not determine any new events referring to one or more objects engaged in an activity because all of the events E referring to one or more objects engaged in the predefined appearance, disappearance, entrance, exit, deposit, removal, motion, and rest activities have already been determined and indexed. *Compare* Courtney at col. 11, lines 5-67 (explaining the rules applied by the motion analyzer 23 of Courtney to the semantic information to identify the eight events in a video sequence and annotate the identified events in a directed graph) with Courtney at col. 13, line 53-col. 13, line 19 (no disclosure of applying rules to identify events during the processing of the queries Y).

78. The manner in which the queries Y of Courtney merely reference previously determined and indexed events E with respect to a video clip C, time T, object V, and/or location R and do not determine any events referring to one or more objects engaged in an activity by analyzing attributes is illustrated by the example in Courtney, which discloses:

> For example, the user may select a region in the scene and specify the query "show me all objects that are removed from this region of the scene between 8 am and 9 am." In this case, the user interface searches through the video meta-information for objects with timestamps between 8 am and 9 am, then filters this set for objects within the specified region that are marked with "removal" event tags. This results in a set of objects satisfying the user query. From this set, it then assembles a set of video "clips" highlighting the query results. The user may select a clip of interest and proceed with further video analysis using playback or queries as before.

Courtney at col. 5, lines 12-23. In this example, the user query processed by the user interface of Courtney merely references previously determined and indexed removal events with respect to a "specified region" (*i.e.*, a location) and "between 8 am and 9 am" (*i.e.*, a time). All of the removal events have already been determined and "marked with 'removal' event tags in the index, the user interface of Courtney merely searches for already determined removal events that occurred at a specified location and specified time, and the query results do not produce any new removal events. *Id.* at col. 5, lines 12-23.

79. In Fig. 27, Courtney shows an embodiment of the video indexing system that is implemented as a real-time system. Courtney at col. 16, lines 16-18.

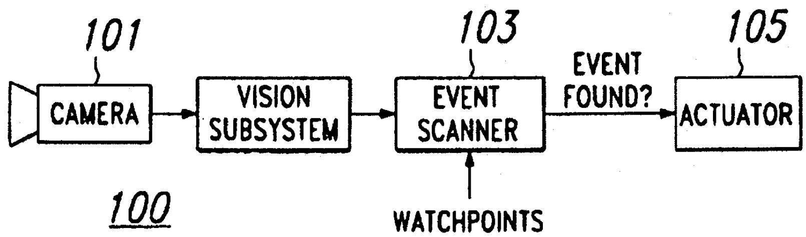

Fig. 27

80. Courtney also discloses that:

> An event scanner 103 continuously reads the motion graph updates and searches for motion events as specified by pre-set watchpoints. These watchpoints may take the same form as queries from the AVI user interface, i.e. Y=(C,T,V,R,E). When the criteria for one of the watchpoints is met, the event scanner signals an actuator 105 (such as an alarm).

Courtney at col. 16, lines 22-28. However, the event scanner 103 searches *pre-defined* events bookmarked in the motion graph output by the vision subsystem 13. *See* Courtney at col. 4, lines 62-65 and col. 16, lines 19-28 ("the vision subsystem 100 … continuously updates a motion graph annotated with event index marks," and the "event scanner 103 continuously reads the motion graph updates and searches for motion events"). Like the query engine of Courtney, the event scanner 103 of Courtney does not analyze any semantic information to determine any new events referring to one or more objects engaged in an activity because the events have already been determined and indexed by the motion analyzer 23 in the vision subsystem 13. *See id.* at col. 9, lines 13-15; col. 10, line 44-col. 11, line 67; col. 16, lines 19-28.

81. Because Courtney describes an event-indexing prior art system, Courtney can only search for an event based upon a previously indexed event. *See* Courtney at col. 4, lines 62-65 & col. 10, lines 50-61. The indexed events of Courtney refer to objects engaged in activities,

and there is no disclosure in Courtney suggesting any analysis of the indexed events other than searching the indexed events for those that occur at specified location R, at a specified time T, and/or with a specified object V. *See id.* at Fig. 16; col. 10, lines 50-64; col. 12, line 41-col. 13, line 19. Moreover, even if the indexed events of Courtney could be considered to be attributes of an object, an indexed event identified by a query and/or watchpoint of Courtney is one of the indexed events. Thus, the indexed events of Courtney are not *independent* from the searched for (*i.e.*, identified) event. The indexed event, in this case, is the searched for event, which may involve a specified event and/or be referenced with respect to a location and/or time.

82. The "independence" in the claims of the '912 patent enables events to be searched for by examining attributes which are not themselves events, just characteristics of objects such as size, location, velocity, etc. *See, e.g.,* claim 1 ("a first event that is not one of the determined attributes"); claim 6 ("an event that is not one of the detected attributes"); claim 12 ("the event not being one of the determined attributes"). The '912 patent explicitly defines events to be objects engaged in activities and draws a distinction between events and attributes (aka primitives), which represent a characteristic of an object. '707 application at ¶¶ 48 & 80. An important innovation in the '912 patent is that an event detection system can be set up *without the need* to track specific events – rather *only non-event attributes of objects need to be tracked* and then event occurrences can be deduced solely from the detected attributes. This invention simplifies engineering implementation and can thus improve efficiency over systems that are required to track events themselves. The '912 patent allows events to be detected based on other events, but the claimed subject matter of the '912 patent does not address the detection of events based on detected pre-arranged events and instead requires attributes that are not events and that are independent from the one or more events identified from the attributes. That is, the '912 claims require events to be detected from a plurality of attributes that are not objects engaged in activities.

2. Separate Attribute Determination and Event Determination Processors Requirement of Claims 1-4

83. Claims 1-4 of the '912 patent require "a first processor which analyzes a video to determine attributes of objects detected in the video." Claims 1-4 additionally require "a second processor, separate from the first processor, ... which determines a first event that is not one of

the determined attributes by analyzing a combination of the received determined attributes." Courtney does not disclose such first and second processors. *See* Courtney throughout.

84. Courtney discloses a single vision subsystem 13 (Fig. 1) that "create[s] a symbolic representation of the foreground objects and their movement," scans through this representation (called "meta-information"), stores the meta-information for "later indexing," and finally "scans through the meta-information and places an index mark at each occurrence of eight events of interest . . . ." Courtney at col. 4, lines 29-65. Courtney discloses that the vision subsystem 13 comprises a "motion segmentor 21, object tracker 22, motion analyzer 23, recorder 24, and compressor 25." *Id.* at col. 5, lines 44-47. *See also id.* at Fig. 5.

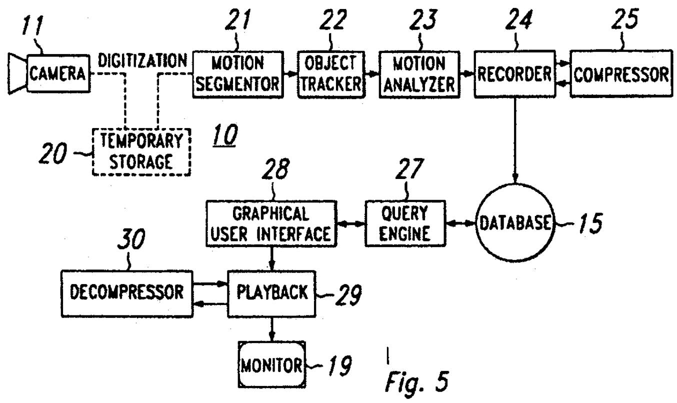

Fig. 5

85. The object tracker 22 detects and tracks objects, and the motion analyzer 23 "analyzes the results of the object tracker and annotates the motion graph with index marks describing several events of interest." Courtney at col. 8, line 52-col. 10, line 64.

86. Even though Courtney discloses a flow diagram in Fig. 5 with separate blocks for processes of the object tracker 22 and motion analyzer 23, both the object tracker 22 and motion analyzer 23 are part of the same vision subsystem 13. Courtney at col. 5, lines 44-47 ("Note that the motion segmentor 21, object tracker 22, motion analyzer 23, recorder 24, and compressor 25 comprise the vision subsystem 13 of FIG. 1."). Courtney nowhere discloses that the functions of the object tracker 22 and motion analyzer 23 in his flow diagram are performed by separate computers or processors. *See* Courtney throughout.

87. Plus, even if, for the sake of argument, the functionality of user interface 17 or event scanner 103 were performed by a second processer separate from a processor that

performed the functionality of vision subsystem 13, such second processor would not determine a first event by analyzing a combination of received determined attributes. *See* Courtney at col. 4, lines 6-9 and col. 16, lines 22-28. To the contrary, Courtney discloses that vision subsystem 13 "places an index mark at each occurrence of eight events of interest." Courtney at col. 4, lines 62-65. The user interface 17 and event scanner 103 merely search for events already determined by the vision subsystem 13. *See id.* at col. 5, lines 12-19 (the user interface searches a set of objects for objects "marked with 'removal' event tags"); col. 12, lines 41-52; and col. 16, lines 22-28 ("event scanner 103 ... searches for motion events"). At least because Courtney does not disclose that the user interface 17 or the event scanner 103 determines a first event by analyzing a combination of received determined attributes, neither the user interface 17 nor the event scanner 103 can be the "second processor" required by claim 1.

B. Rejection based on Olson

1. Independence-Based Elements

88. Olson does not disclose and would not have suggested the independence-based claim elements of the '912 patent, which are listed above in paragraph 31. *See* Olson throughout.

89. I have the Request and Bosch's comments, and I am aware that the Requester alleges that the location and event reports emitted by the AVS core engine of each smart camera of Olson correspond to the claimed "attributes" and that the events searched for by the VSS of Olson correspond to the claimed "events." However, neither the Requester nor Bosch has provided an adequate explanation as to why an event selected by the VSS of Olson would not be one of the events emitted by the AVS core of a smart camera of Olson or how the events emitted by the AVS core of a smart camera of Olson could be independent from the events emitted by the AVS core of a smart camera of Olson that are selected by the VSS of Olson. As explained below, the events selected by the VSS of Olson are the exact events emitted by the AVS core of a smart camera of Olson, and the events AVS core of a smart camera of Olson depend on the events that can be selected by the VSS of Olson.

90. Like Courtney, Olson is an example of event-indexing art. *See* Olson at pp. 159 & 166. Olson describes an autonomous video surveillance ("AVS") system with smart video cameras that recognize events involving objects in a video and output streams of events to a

video surveillance shell ("VSS"). *Id.* at Fig. 4, pp. 159 & 166. "Each camera has associated with it an independent AVS core engine that … finds and tracks moving objects." *Id.* at p. 166. The VSS "filters the incoming event streams for user-specified alarm conditions and takes the appropriate actions." *Id.* at p. 166.

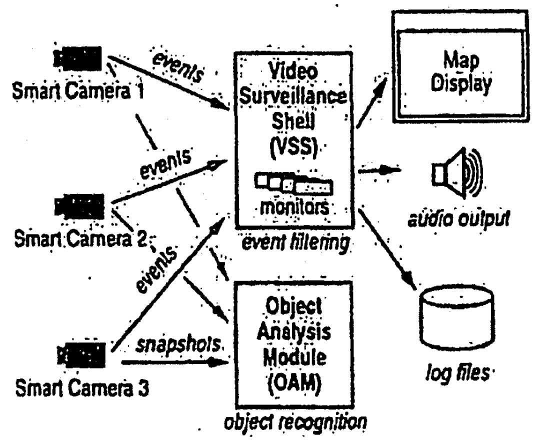

Figure 4: The situational awareness system

91. Again, like Courtney, Olson describes a motion graph that bookmarks events on particular frames. Olson at Fig. 2 (reproduced below) & p. 164. Compare to Courtney at Fig. 16.

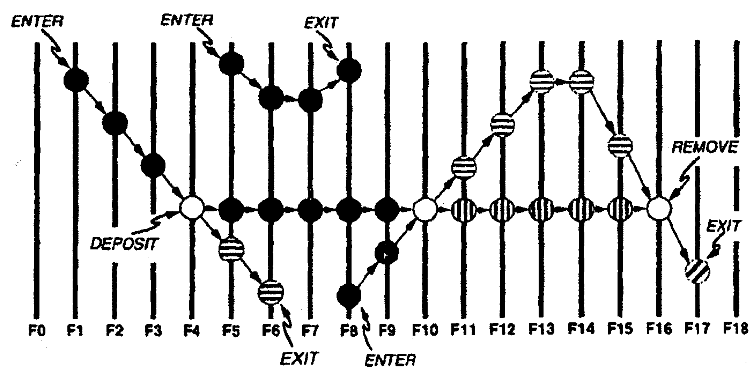

Figure 2: Event detection in the motion graph.

92. In fact, the Olson system is simply another version of the Courtney '755 indexing algorithm. *See* Olson at pp. 162 ("Our approach to event recognition is based on the video database indexing work of Courtney [1997]."), 163 ("We use the technique of Courtney [1997]."), and 164. In addition, Olson discloses that the AVS core algorithm sends a raw video

snapshot of the image to an Object Analysis Module ("OAM") "in order to determine the type of the object." *Id.* at p. 166. As Olson states, "[t]he OAM processing and the AVS core engine computations are asynchronous, so the core engine may have processed several more frames by time the OAM completes its analysis." *Id.* After the OAM has completed reprocessing the frame, it communicates the results to the AVS core engine. *Id.* The core engine then integrates the reprocessed information into its tracking system. *Id.* The AVS core engine then communicates the detected events to the Video Surveillance Shell (VSS) in the form of an "event stream." *Id.* The various "event streams" can then be filtered by the VSS engine in order to set up an alarm. *See id.*

93. The VSS of Olson does not perform an analysis of determined attributes to determine a new event that refers to one or more objects engaged in an activity because the events were previously detected by the smart cameras of Olson. Olson at Fig. 4 (showing events emitted from the smart cameras to the VSS) & p. 166 (each smart camera "core engine emits a stream of … event reports to the VSS"). Thus, the already determined events searched for by the VSS of Olson are the very same events determined by the smart cameras, and the VSS of Olson does not perform the event determination by analyzing determined attributes required by the claims of the '912 patent. To the contrary, the VSS merely searches for already determined events that involve a user specified object type, a user specified location, and/or a user specified time. Olson at Fig. 5 & p. 166 ("The user selects the type of event, the type of object involved in the event, the day of week and time of day of the event, where the event occurs, and what to do when the alarm condition occurs."). Unlike the smart cameras of Olson, the VSS does not determine any new events referring to one or more objects engaged in an activity because all of the events have already been determined. *Compare* Olson at p. 166 (each smart camera has an AVS core engine that "finds and tracks moving objects in the scent, maps their image locations to world coordinates, and recognizes events involving objects") *with* Olson at p. 166 (the VSS "filters the incoming event streams for user-specified alarm conditions" that reference the already determined events to a user specified "type of object involved in the event, the day of week and time of day of event, [and/or] where the event occurs"). *See* '707 application at ¶ 48 ("The event may be referenced with respect to a location and/or time."). That is, the VSS of Olson merely searches for already determined events that involved a specified object type,

occurred at a specified time, and/or occurred at a specified location, and the VSS does not determine any new events.

2. Separate Attribute Determination and Event Determination Processors Requirement of Claims 1-4

94. Claim 1 requires "a first processor which analyzes a video to determine attributes of objects detected in the video." Claim 1 additionally requires "a second processor, separate from the first processor, … which determines a first event that is not one of the determined attributes by analyzing a combination of the received determined attributes." Claims 2-4 depend on claim 1 and thus contain these same limitations.

95. Olson does not disclose the use of a second processor to determine an event that was not previously determined by a first processor, as required by claim 1 of the '912 patent. *See* Olson throughout. Further, Olson does not even disclose a video surveillance system having two or more computers connected via a network or one with multiple processors. *Id.*

96. Olson discloses neither that the VSS analyzes video nor that the VSS determines attributes. *See* Olson at p. 166. Accordingly, the VSS cannot be the first processor in claim 1. Moreover, Olson does not disclose that the VSS determines events by analyzing a combination of attributes. Rather, Olson discloses that the VSS receives events as its input. *See* Olson at p. 166. Thus, Olson does not disclose and would not have suggested that the VSS is determining events itself, and the VSS cannot be the second processor required by claim 1. Further, Olson discloses neither that the OAM determines attributes nor that the OAM determines events. *See Id.* at p. 166. The OAM merely "processes the snapshot in order to determine the type of object," and one or ordinary skill in the art of the '912 patent would not understand processing a snapshot to determine a type object to be a disclosure of detecting attributes nor of determining events. Thus, the OAM cannot correspond to either the first or second processor recited in claim 1. In addition, Olson does not disclose more than one processor in any one smart camera. *See* Olson at p. 166. Therefore, Olson does not disclose that a smart camera has separate first and second processors that correspond to the first and second processors recited in claim 1.

VIII. Obviousness

97. I have examined, in detail, each of the cited references, the Office Action, and the pages of the Request and claim charts submitted with the Request incorporated by reference in the Office Action. It is my opinion that none of claims 1-4 and 6-22 would have been obvious in

view of the cited references, alone or in the combinations relied upon by the Office. More specifically, neither Courtney nor Olson (*i.e.*, the primary references) alone disclose or would have suggested the independence-based elements required by claims 1-4 and 6-22, and the proposed modifications to the primary references do not remedy this deficiency of Courtney and Olson. In addition, neither Courtney nor Olson alone disclose or would have suggested the separate attribute determination and event determination processors required by claims 1-4, and the proposed modifications to the primary references do not remedy this deficiency of Courtney and Olson.

A. Level of Ordinary Skill in the Art

98. Based on my educational background and twenty-plus years of experience, it is my opinion that, as of the November 2001 time frame, the level of ordinary skill in the art of the '912 patent is that of a person typically having a Bachelor's degree in Electrical Engineering or Computer Science or the equivalent education or experience. This individual would have benefited from course work that includes image or signal processing, and computer science or programming, or the equivalent education or experience. In addition, this person would typically have about three years of industrial experience that would develop his/her knowledge of image processing and pattern recognition, or the equivalent.

B. Rejection based on Courtney and Brill

1. Independence-Based Elements

99. The independence-based elements of the claims of the '912 patent are listed above in paragraph 31. For the reasons set forth in paragraphs 68-82 above, Courtney neither discloses nor would have suggested the independence-based elements required by all of the rejected claims. Like Courtney, Brill also does not disclose and would not have suggested the independence-based claim elements of the '912 patent. *See* Brill throughout.

100. Brill is another example of event-indexing art, as it describes a method of indexing a video when particular "simple events" occur in the video. *See* Brill at Abstract; col. 3, line 41-col. 4, line 26; Fig. 2. According to Brill, a "simple event" is "an unstructured atomic event" of an object, such as enter, exit, rest, move, deposit, remove, lights-on, and lights-out events. *Id.* at col. 3, lines 41-49 & col. 4, lines 39-41 ("In the subsequent discussion, the term simple event means an unstructured atomic event."). Brill additionally discloses "complex

events" that are "structured, in that [each complex event] is made up of one or more sub-events. The sub-events of a complex event may be simple events, or they may be complex." *Id.* at col. 4, lines 41-45.

101. A user defines a simple event to be recognized by the system of Brill using the dialog box illustrated in Fig. 6, which allows a user to select from a vocabulary of potential simple events (*e.g.*, enter, exit, deposit, remove). *Id.* at col. 3, lines 41-49 ("the system recognizes [a] vocabulary of events"); col. 10, lines 39-58 (in defining one simple event, "[t]he user selects the event type"); Fig. 6 (showing definition of a "Loiter by the door" simple event by, among others, selecting the "loiter" event type from the potential simple event types). "This dialog box defines one simple event of [a] complex event sequence," and "[a]ny arbitrary number of different simple events can be defined via multiple uses of the dialog box." Brill at col. 10, lines 44-47. *See also id.* at Fig. 6.

102. Brill discloses that, "[a]fter one or more simple events have been defined, the user can define a complex event via the dialog box illustrated in Fig. 7." Brill at col. 10, lines 59-61. *See also id.* at col. 1, lines 43-48 ("a user interface ... enables someone to define a complex event by constructing a list of sub-events"). The dialog box illustrated in Fig. 7 presents two lists: (i) a list on the left including "all of the event types that have been defined thus far," which "generally include both user defined events and system primitive events," and (ii) a list on the right including "the sub-events of the complex event being defined." *Id.* at col. 10, line 64-col. 11, line 2. The dialog box illustrated in Fig. 7 also presents "an option menu via which the user indicates how the sub-events are to be combined" (*e.g.*, ordered, all, or any). *Id.* at col. 11, lines 11-21.

103. After each simple event is defined, the system of Brill begins to detect/recognize the defined simple events by analyzing a motion graph, as illustrated in Fig. 2, and after each complex event is defined, the system of Brill begins to detect/recognize the defined complex events by tabulating which of its sub-events have been detected as each such sub-event is detected. Brill at Figs. 2 & 3; col. 3, line 50-col. 4, line 26; col. 4, line 61-col. 5, line 28 ("Once the user has defined the complex events ... , the event detection system must recognize these events as they occur in the monitored area."); col. 11, lines 27-29 ("Once a simple or complex event has been defined, the system immediately begins recognition of the new events in real

time."). Accordingly, the simple events detected by the system of Brill depend on which simple and complex events a user defines for identification.

104. Before the GUI in Fig. 6 of Brill is activated for the very first time by pressing the OK button, Brill performs no detection at all. *See* Brill at Fig. 6. Brill does not detect any events by default. *See id.* However, Brill has a pre-defined list of 13 events from which the user can manually task the system to detect (possibly with reference to time and location). *See id.* If a user wants the Brill system to detect a simple or complex event E, then the user must, in advance, task the system using the GUI in Fig. 6 to detect all of the events B on which the event E logically depends. *See id.* Thus, the choice of which events B to detect is directly dependent on which event E the user desires to detect (*i.e.*, the user manually activates detection of the events B based on what is necessary to detect E). In fact, the choice of "attributes" (*i.e.*, simple or complex sub-events) in Brill is about as dependent on determined events (*i.e.*, simple or complex events) as you can get.

105. Fig. 3 of Brill illustrates a particular process 300 for identifying complex events. *Id.* at col. 4, lines 61-62. The process 300 begins by recognizing/detecting the previously defined simple events that make up the defined complex events. *See id.* at Fig. 3 ("input new image" step 301 and "detect simple event?" step 302) & col. 4, line 65-col. 5, line 1. In essence, a user of the system of Brill defines simple events (*e.g.*, by multiple uses of the dialog box shown in Fig. 6), *id.* at col. 10, lines 39-58, and the system of Brill bookmarks each defined simple event in a motion graph as it processes the video. *Id.* at col. 3, line 41-col. 4, line 26 ("to recognize events, the system analyzes the motion graph"); Fig. 2 (showing bookmarked "ENTRANCE," "EXIT," "DEPOSIT," and "REMOVAL" events in a motion graph). The example of the motion graph shown in Fig. 2 of Brill with bookmarked simple events is similar to the motion graph with bookmarked events shown in Fig. 16 of Courtney. *Compare* Brill at Fig. 2 *with* Courtney at Fig. 16 (reproduced in ¶ 31, above).

106. As user-defined simple events are detected, a newly detected simple event that matches a sub-event of a defined complex event is recorded as such. Brill at Fig. 3; col. 5, lines 2-19 (recognition of sub-events in ordered complex events); col. 5, line 57-col. 6, line 7 (recognition of sub-events in unordered complex events). When all (or any depending on the complex event definition) sub-events of a user-defined complex event are recognized, the

complex event is recognized/identified. *Id.* at Fig. 3; col. 5, lines 2-19 (recognition of ordered complex events); col. 5, line 57-col. 6, line 7 (recognition of unordered complex events). After recognizing/identifying a complex event, the process 300 determines whether the recognized/identified complex event matches any sub-events of other user-defined complex events. *Id.* at Fig. 3, col. 5, lines 22-26.

107. In Brill, the user-defined complex events dictate simple events that the user must also define (either before or after the complex event is defined). Brill at col. 1, lines 43-52; col. 4, lines 51-60; col. 10, lines 39-41 ("The user can select which events are to form the complex event via the dialog box interface illustrated in FIG. 6."). Brill discloses that simple events may need to be defined for the sole purpose of allowing complex events to be defined. *Id.* at col. 10, lines 52-54 ("If the event is only being defined in order to be used as a sub-event in a complex event, the user might not check any action box."). Further, a potential simple event (*i.e.*, those possible simple events within the recognized vocabulary of the system of Brill and displayed for selection in the simple event definition dialog box shown in Fig. 6) is detected, as illustrated in Fig. 2, if and only if the potential simple event is defined by a user, as illustrated in Fig. 6. *See id.* at Figs. 2 & 6; col. 3, lines 41-49 ("the system recognizes [a] vocabulary of events"); col. 4, lines 62-65 ("Once the user has defined the complex events … , the event detection system must recognize these events as they occur in the monitored area."); col. 11, lines 27-29 ("Once a simple or complex event has been defined, the system immediately begins recognition of the new events in real time."). In other words, no simple events are detected unless and until a user defines them using a dialog box, as illustrated in Fig. 6. *See id.* Also, each user-defined simple event identified by the system of Brill is one of the simple events detected by the system of Brill. Therefore, the detected simple events of Brill are not independent of the user-defined simple and complex events identified by the system of Brill.

108. Accordingly, neither the identification of "simple events" nor the identification of "complex events" taught by Brill corresponds to the recited independence-based elements of the claims of the '912 patent, and the independence-based claim elements are neither disclosed nor suggested by Brill.

109. Furthermore, the complex events of Brill are identified by applying the user definitions to detected events that refer to objects engaged in activities. *See* Brill at col. 3, line

41-col. 4, line 27. Brill does not teach the detection of events based solely on a plurality of non-event attributes, as taught in the '912 patent. Brill can only detect events by examining at least one detected event, not just simple attributes that aren't events themselves.

110. As both Courtney and Brill do not disclose and would not have suggested the independence-based elements of the claims of the '912 patent, combining Courtney and Brill, to the extent there is some reason to combine them, would not address the deficiencies of either reference.

2. Separate Attribute Determination and Event Determination Processors

111. For the reasons set forth in paragraphs 83-87 above, Courtney neither discloses nor would have suggested the separate attribute determination and event determination processors required claims 1-4. Like Courtney, Brill also does not disclose and would not have suggested the separate attribute determination and event determination processors of claims 1-4 of the '912 patent. *See* Brill throughout.

112. Brill discloses an image processing section 27 having a single processor 33 and a computer workstation 13 having a processor 17. *See* Brill at Fig. 1 (reproduced below) and col. 2, line 63-col. 3, line 24. However, Brill does not disclose that the processor 17 of the computer workstation 13 (as opposed to the processor 33 of the image processing section 27) performs event determination.

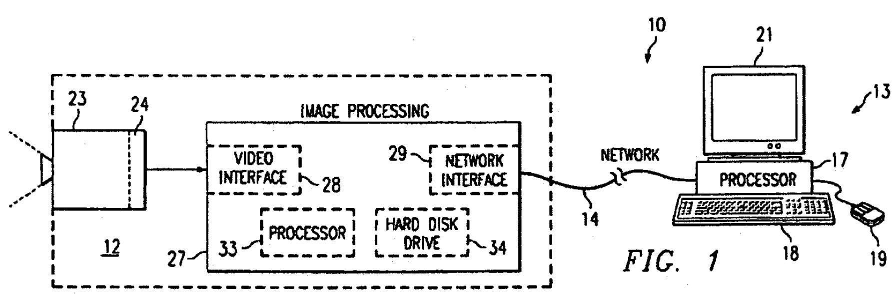

FIG. 1

113. Brill discloses that the "image processing section 27 analyzes the motion graph by tracking movement or non-movement of each identified change region through a succession of the frames of images from the video camera." *Id.* at col. 3, lines 50-53. Brill also discloses a computer workstation 13 having a processor 17. Brill discloses that a user may define complex events via one or more dialog boxes. Brill at Figs. 6-7 & col. 10, line 36-col. 11, line 30. Even

if the user uses the processor 17 to *define* the complex events, Brill does not disclose and would not have suggested using the processor 17 as opposed to the processor 33 of the image processing section 27 to *recognize* the defined complex events. Thus, Brill does not disclose and would not have suggested that the processor 33 of the image processing section 27 and the processor 17 of the computer workstation 13 are separate first and second processors that determine attributes and determine events, respectively.

114. As both Courtney and Brill do not disclose and would not have suggested the separate attribute determination and event determination processors of claims 1-4 of the '912 patent, combining Courtney and Brill, to the extent there is some reason to combine them, would not address the deficiencies of either reference.

C. Rejection based on Olson and Brill

1. Independence-Based Elements

115. The independence-based elements of the claims of the '912 patent are listed above in paragraph 31. For the reasons set forth in paragraphs 88-93 above, Olson neither discloses nor would have suggested the independence-based elements required by all of the rejected claims. For the reasons set forth above in paragraphs 100-110, Brill also does not disclose and would not have suggested the independence-based claim elements of the '912 patent. As both Olson and Brill do not disclose and would not have suggested the independence-based elements of the claims of the '912 patent, combining Olson and Brill, to the extent there is some reason to combine them, would not address the deficiencies of either reference.

2. Separate Attribute Determination and Event Determination Processors

116. For the reasons set forth in paragraphs 94-97 above, Olson neither discloses nor would have suggested the separate attribute determination and event determination processors required claims 1-4. For the reasons set forth above in paragraphs 112-113, Brill also does not disclose and would not have suggested the separate attribute determination and event determination processors of claims 1-4 of the '912 patent. As both Olson and Brill do not disclose and would not have suggested the separate attribute determination and event determination processors of claims 1-4 of the '912 patent, combining Olson and Brill, to the extent there is some reason to combine them, would not address the deficiencies of either reference.

C. Rejection based on Courtney and Day

1. Independence-Based Elements

117. The Office proposed a combination of Courtney and Day in which the video analysis and event detection system of Courtney is modified based on the conceptual modeling and heterogeneous query system of Day to allegedly "allow[] users maximum flexibility in processing heterogeneous queries as well as efficient online query processing against a graphical abstraction of data without performing computations on actual raw video data." Office Action at p. 13. Even with the proposed modification, Courtney would not have suggested the independence-based elements required by the claims of the '912 patent because Courtney, as modified, would still index pre-defined events, and the online query processing would query for indexed events. *See* ¶¶ 68-82.

118. Moreover, the entire premise behind Courtney's functionality is that of tracking and indexing events from a predefined list and then searching the indexed database for events that have already been indexed. *See* Courtney at Fig. 16 & col 12, line 41-col. 13, line 19. Day discloses a fundamentally different approach where Boolean functions of attributes are used to process queries in order to determine if events occurred. Day at p. 407. The systems disclosed in Courtney and Day would not fit together operationally, or, at the very least, not without extensive experimentation and probably a lot of luck, as I do not see a straightforward way to blend the features of each system in a functional way. I have not seen any suggestion to combine them and I don't believe a person of ordinary skill in the art would think it logical or advantageous to combine them since they work so differently. In fact, using the propositional logic approach of Day would not fit with the Courtney model of searching for already determined events, and using the Courtney approach of retrieving previously indexed events would not fit with the query method of Day. Each system would effectively "break" the other.

2. Separate Attribute Determination and Event Determination Processors

119. For the reasons set forth in paragraphs 83-87 above, Courtney neither discloses nor would have suggested the separate attribute determination and event determination processors required claims 1-4. Day's disclosure is from an abstract point of view, giving a mathematical description of possible queries, rather than a detailed engineering recipe for how to implement it. Accordingly, Day is silent regarding the structure used to implement the system of

Day. Thus, like Courtney, Day also does not disclose and would not have suggested the separate attribute determination and event determination processors required by claims 1-4. As both Courtney and Day do not disclose and would not have suggested the separate attribute determination and event determination processors of claims 1-4 of the '912 patent, combining Olson and Brill, to the extent there is some reason to combine them, would not address the deficiencies of either reference.

3. Event Determination by Analyzing Only the Received Attributes

120. Dependent claims 3, 8, and 11 each require determining the event by analyzing "only" the received attributes. Claim 3 ("the second processor determines the first event by analyzing only the attributes transferred by the communications link"); claim 8 ("the processor is operable to determine an event by analyzing only attributes of the received stream of attributes"); claim 11 ("the analysis performed to detect an event determines an event by analyzing only attributes received in the stream of detected attributes").

121. The proposed combination of Courtney and Day does not disclose and would not have suggested determining an event by analyzing "only" the received attributes. In particular, the Office proposed modifying the system of Courtney "with the described features of the conceptual modeling and heterogeneous query system of Day." Office Action at pp. 13-14. The conceptual modeling and heterogeneous query system of Day does not disclose and would not have suggested an analysis of "only" the received attributes. To the contrary, the queries of Day do not analyze the attributes stored in the VSDG alone but additionally analyze the object-oriented abstractions. *See* Day at p. 405, § 3.1 ("For video data, a user can use combination [*sic*] of various abstractions to construct his/her view of the video data. The important feature of this hierarchy, and in general for any object-oriented abstractions [*sic*], is that each terminal node is either a CTO [Conceptual Temporal Object, a CSO [Conceptual Spatial Object], or a PO [Physical Object]. Any complex video query is expressed as a function of these terminal nodes and processing of such query requires execution of some CTO and CSO over specified PO's.") & p. 407, § 3.2.3 ("all these queries generally require processing of various combination [*sic*] of object hierarchy (shown in Figure 5)"). In other words, Day is making decisions based on user inputted information that is the detected attributes in the VSDG. Day at p. 405, § 3.1 ("a user can use combination [*sic*] of various abstractions to construct his/her view of the video data"); p.

405, § 3.1 ("Figure 5 describes an object hierarchy of view/knowledge which a user would like to construct."). Thus, the proposed combination of Courtney with Day does not disclose and would not have suggested the analysis of "only" the received attributes required by dependent claims 3, 8, and 11.

4. Gaps in the Disclosure of Day

122. Day contains several gaps in its disclosure that leave a person skilled in the art unable to accomplish some of the assertions. For example, Day includes a discussion of (apparently automatic) detection of very complicated events such as Michael Jordan slam dunking and passing in professional basketball, and also the identification of what team position such a basketball player may be assigned (e.g. forward, guard, or center), and whether a player is in the professional NBA or college NCAA leagues. Day at p. 405, § 3.1. Day does not include any disclosure that would enable one of ordinary skill in the art to accomplish such feats, which, at the time of publication of Day in 1995, were technically impossible and, in fact, nothing more than wishful thinking. Even today it remains an unsolved task in general. Thus, Day is discussing a possible future technology that did not and still does not exist. The skilled reader of Day has no way to correctly understand Section 3.1 in light of this gap in reality. In reading Day, a skilled person would therefore have to make numerous guesses and assumptions as to how it could be implemented but could not be sure they are guessing correctly as to the true intent or actual disclosure in Day-I. Similarly, in Section 3.2.3 of Day, the slam dunk example of Section 3.1 is again used to supposedly illustrate the expression of queries in terms of predicate logic. The predicate logic equations given in Section 3.2.3 are sound from a Boolean logical point of view, but they are premised on false assumptions. Namely, they assume the basic Boolean input variables are algorithmically feasible to determine. For example, determining whether h_1 or h_2 is a hand, whether x is a basketball, whether y is a basket rim, whether z is a basket net, etc. are all monumentally difficult tasks that are not explained in Day – namely, because that technological capability did not exist in 1995. A skilled person would not know how to perform such queries. This would and, in my opinion, does render Section 3.2.3 confusing and not sound to a skilled person reading Day.

D. Rejection based on Olson and Day

1. Independence-Based Elements

123. The Office proposed a combination of Olson and Day in which the video analysis and event detection system of Olson is modified based on the conceptual modeling and heterogeneous query system of Day to allegedly allow users maximum flexibility in processing heterogeneous queries as well as efficient online query processing against a graphical abstraction of data without performing computations on actual raw video data.. Office Action at p. 13. Even with the proposed modification, Olson would not have suggested the independence-based elements required by the claims of the '912 patent because Olson, as modified, would still index pre-defined events, and the process online query processing would query for indexed events. *See* ¶¶ 88-93 above.

124. Moreover, the entire premise behind Olson's functionality is that of searching through events that have already been determined to see whether the already determined events satisfy user defined criteria with respect to object type, location, and/or time. *See* Olson at p. 166. Day discloses a fundamentally different approach where Boolean functions of attributes are used to process queries in order to determine if events occurred. Day at p. 407. The systems disclosed in Olson and Day would not fit together operationally, or, at the very least, not without extensive experimentation and probably a lot of luck, as I do not see a straightforward way to blend the features of each system in a functional way. I have not seen any suggestion to combine them and I don't believe a person of ordinary skill in the art would think it logical or advantageous to combine them since they work so differently. In fact, using the propositional logic approach of Day would not fit with the Olson model or searching for already determined events, and using the Olson approach of retrieving previously determined events would not fit with the query method of Day. Each system would effectively "break" the other.

2. Separate Attribute Determination and Event Determination Processors

125. For the reasons set forth in paragraphs 94-97 above, Olson neither discloses nor would have suggested the separate attribute determination and event determination processors required claims 1-4. Day's disclosure is from an abstract point of view, giving a mathematical description of possible queries, rather than a detailed engineering recipe for how to implement it. Accordingly, Day is silent regarding the structure used to implement the system of Day. Thus,

like Olson, Day also does not disclose and would not have suggested the separate attribute determination and event determination processors required by claims 1-4. As both Olson and Day do not disclose and would not have suggested the separate attribute determination and event determination processors of claims 1-4 of the '912 patent, combining Olson and Day, to the extent there is some reason to combine them, would not address the deficiencies of either reference.

3. Event Determination by Analyzing Only the Received Attributes

126. Dependent claims 3, 8, and 11 each require determining the event by analyzing "only" the received attributes. The proposed combination of Olson and Day does not disclose and would not have suggested determining an event by analyzing "only" the received attributes. In particular, the Office proposed modifying the system of Olson "with the described features of the conceptual modeling and heterogeneous query system of Day." Office Action at pp. 13-14. For the reasons explained above in paragraph 121, the conceptual modeling and heterogeneous query system of Day does not disclose and would not have suggested an analysis of "only" the received attributes. Thus, the proposed combination of Olson with Day does not disclose and would not have suggested the analysis of "only" the received attributes required by dependent claims 3, 8, and 11.

4. Gaps in the Disclosure of Day

127. As explained in paragraph 122 above, Day contains several gaps in its disclosure that leave a person skilled in the art unsure about how to accomplish some of the assertions.

IX. New Claims

A. New Claims 23-25

128. New claims 23-25 explicitly require "filtering." Filtering in the context of the '912 patent is a particular technique for examining streamed video attributes to determine if certain rules (*i.e.*, event discriminators) have been satisfied. *See* '707 application at ¶ 32. As a data processing technique, filtering has the capability of processing unlimited/unbounded/infinite data streams. *See* Exhibit Z4, Microsoft Computer Dictionary – 4th ed. at p. 185 (filtering can be applied to "*standard* or designated *input*" (emphasis added)); Exhibit Z5, IEEE 100: The Authoritative Dictionary of IEEE Standard Terms – 7th ed. at p. 435 (filtering can be applied to

"*standard input* or a list of input files" (emphasis added)).[5] However, in practice, filtering may optionally be used without algorithmic modification on finite data streams. Other, non-filtering search techniques for finite data sets, however, generally do not have the capability of working on infinite streams without algorithmic modification. One of the basic ideas taught in the '912 patent is that a video surveillance camera may be turned on, *and left on indefinitely as a monitor*, and the resulting stream of primitive data searched without end for information implying event occurrences. *See* '707 application at ¶ 65 ("The automatic video surveillance system of the invention is for monitoring a location for, for example, market research or security purposes.") & ¶ 76 ("examples of the video surveillance system of the invention applied to monitoring a grocery store").

129. The specification of the '912 patent discloses applicability to real time systems. '707 application at ¶ 33 ("An object of the invention is to produce a *real time* alarm based on an automatic detection of an event from video surveillance data." (emphasis added)); ¶65 ("The system is capable of analyzing video data from *live* sources or from recorded media." (emphasis added)); ¶ 104 ("The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output."). One of ordinary skill in the art would understand the recited "filtering" to be applicable to an infinite/unlimited data input, such as a real time data stream, so that the user rule could be used in a real time system.

130. Day fails to disclose and would not have suggested the filtering required by new claims 23-25. In contrast to the filtering required by the claims, Day does not filter video primitives and instead performs queries. *See, e.g.,* Day at p. 402, § 1 ("The proposed VSDG can be generated off-line and subsequently can be used to process user's *queries* on-line." (emphasis added)); p. 403, § 2.1 ("For example, occurrence of a slam-dunk in a sport video clip can be an episode in a user's specified *query*. The processing of this *query* requires evaluation of both spatial and temporal aspects of various objects." (emphasis added)); p. 404, § 3 ("Therefore, the

[5] "Standard input" is technical jargon dating back at least to 1973 in the Bell Laboratories Unix operating system and refers to an *unlimited* input data stream accessible to computer languages such as C for processing data. This would be common knowledge for a person skilled in the art of the '912 patent at the time of its invention. I personally began using infinite standard input data streams for filtering in the early 1980's when I programmed computers in the language C during my studies at MIT and during summer jobs at HP Laboratories.

system processes users' *queries* with the assistance of the object-oriented views." (emphasis added)); p. 408, § 4 ("Using propositional logic … , a user can specify queries and hence can retrieve corresponding video clips without ever reprocessing raw video data." (emphasis added)).

131. A person of ordinary skill in the art would understand that "filtering" and "querying" have different meanings and functions. Unlike filtering, querying is not normally capable of being applied to infinite/unlimited data input, such as a real-time data stream, and can only be applied to finite/limited amounts of data input. *See* Exhibit Z4, Microsoft Computer Dictionary – 4th ed. at p. 185 (filtering can be applied to "*standard* or designated *input*" (emphasis added)) & p. 368 (querying "extract[s] data from a database" (emphasis added)); Exhibit Z5, IEEE 100: The Authoritative Dictionary of IEEE Standard Terms – 7th ed. at p. 435 (filtering can be applied to "*standard input* or a list of input files" (emphasis added)). The system of Day is only capable of querying a directed graph, which is a finite/limited data set created from processing finite video clips. Day at p. 402, § 2 (disclosing a directed graph that is a finite/limited data set); p. 401, Abstract ("The proposed model segments a video clip into sub-segments consisting of objects."); p. 402, § 1 ("[f]or each input video clip"); p. 403, § 2.2 ("VSDG representation of a clip").

132. Day repeatedly and unambiguously discusses processing video "clips," which are finite length portions of a video sequence. For example, Day discloses that " both the spatial and temporal specifications of a clip can be represented as a directed graph, as shown in Figure 2, that consists of n video segments, labeled 111, V2, ..., Vn." Day at p. 403, § 2.2. The Day directed graph must first be constructed from a finite length video clip and then the graph can be queried to search for an event. *Id.* Thus, Day does not teach *filtering* of a *stream* but rather *querying* a *finite database*. This is an important distinction relative to the invention claimed in the '912 patent. As noted earlier, the filtering taught in the '912 patent and required by new claims 23-25 can be performed on finite length video segments as well as infinite length ones, without alteration of the basic technique. The query processing taught in Day cannot operate on infinite length video streams. However, the facts that the database queries in Day operate on finite length video clips and that filtering can also operate on finite length streams do *not* imply that Day is teaching filtering. That would be a false logical conclusion.

133. In the proposed combinations of Courtney in view of Day and Olson in view of Day, the primary reference is modified based on the conceptual modeling and heterogeneous query system of Day to allegedly allow users maximum flexibility in processing heterogeneous queries as well as efficient online query processing against a graphical abstraction of data without performing computations on actual raw video data. Courtney and Olson, if modified in the proposed manner, would include the querying of Day and, thus, would not include the "filtering" required by new claims 23-25.

134. Courtney makes reference to filtering, but Courtney does not use "filtering" in the sense of the filtering described and claimed in the '912 patent (*i.e.*, filtering a potentially unlimited length sequence of video data). Courtney discloses that "the user interface searches through the video meta-information for objects with timestamps between 8 am and 9 am, then filters this set for objects within the specified region that are marked with 'removal' event tags." Courtney at col. 5, lines 14-18. The notion of filtering here is simply a finite length version being used to perform a query of a fixed-length set. That is, Courtney discloses a finite filter that provides an implementation for a query, and Courtney does not disclose the filtering of a stream required by claims 23-25.

B. New Claims 26-30

135. New claims 26-30 require that the identified event be "the first and second objects coming together." Courtney, Olson, and Brill do not disclose and would not have suggested determining a coming together event. The closest of the events indexed in Courtney, Olson, and Brill is a removal event. Courtney at Fig. 16 ("Removal") & col. 10, lines 44-61 (listing "Deposit-An inanimate object is removed from the scene" as one of "[e]ight events of interest … defined to designate various motion events in a video sequence"); Olson at Fig. 2 ("REMOVE"), p. 164, § 3.3 (""If a moving track intersects a stationary track, and then continues to move, but the stationary track ends at the intersection, this corresponds to a REMOVE event. The remove event can be generated as soon as the remover disoccludes the location of the stationary object which was removed, and the system can determine that the stationary object is no longer at that location."); Brill at Fig. 2 ("Removal"), Fig. 6 ("remove"), Fig. 7 ("remove"), & ("If a moving object merges with a stationary object, and then continues to move while the stationary object disappears, as at 58, it is designated a REMOVE event. This would correspond to a situation

where a person walks to a notebook resting on a table, and then picks up the notebook and walks away."). However, one of ordinary skill in the art would understand that a removal event is not the same as a coming together event. Therefore, the cited references do not disclose and would not have suggested determining a coming together event. Furthermore, even if removal event could be interpreted as corresponding to the recited coming together event, the removal event of Courtney, Olson, and Brill, which is an indexed event, cannot be both one of the "detected attributes" as claimed and the identified "event" as claimed because the claims require that the identified event not be one of the detected attributes. *See, e.g.,* claim 26 ("a first event that is not one of the determined attributes"). Thus, Courtney, Olson, and Brill do not disclose and would not have suggested this feature.

C. New Claims 31-33

136. New claims 31-33 explicitly require "filtering" and require that the determined event be "the first and second objects coming together." For the reasons explained in paragraph 135 above, Courtney, Olson, and Brill index removal events in which two objects come together, and the removal event indexed in Courtney, Olson, and Brill cannot be both one of the "detected attributes" as claimed and the identified "event" as claimed. In addition, for the reasons set forth above in paragraphs 130-132, Day does not disclose and would not have suggested the filtering required by the claims.

D. New Claims 34-38

137. New claims 34-38 require that "none of the determined attributes refers to the object engaged in an activity." Thus, claims 34-38 require that none of the determined attributes analyzed to determine the event refers to the object engaged in an activity. Moreover, due to the explicit definition of an "event" as "refer[ring] to one or more objects engaged in an activity" ('707 application at ¶ 48), claims 34-36 require that the recited "event" and not the determined attributes themselves "refer[] to the object engaged in an activity."

138. The '912 patent specification requires (by its own definition) an event to be an object engaged in an activity ('707 application at ¶ 48), whereas an attribute (aka primitive) may be either an event or non-event characteristic of an object. '707 application at ¶¶ 80-91. The patent discloses the identification of events from solely attributes that are non-event characteristics of an object (*i.e.*, non-event attributes). For example, the '912 patent discloses, as

an example, that "an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 application at ¶ 118. The attributes used to determine if the wrong way event occurred are times, object types, positions, and directions, and all of these attributes are non-event attributes. In other words, none of these attributes used to determine if the wrong way event occurred refers to an object engaged in activities. Another example in the specification of the '912 patent of an event identified from solely non-event attributes is the "object crosses a line" even, which is disclosed as an example of an event discriminator for an object and a spatial attribute." '707 application at ¶ 100. A skilled person would understand from reading the specification of the '912 patent that detecting an object crossing a line would be accomplished by detecting purely non-event attributes based on time and location, namely where the object is located as a function of time and where the line is located.

139. None of the event-indexing references (*i.e.*, Courtney, Olson, and Brill) discloses or would have suggested this feature. To the contrary, in each of the event-indexing references, alleged attributes refer to an object engaged in an activity. Courtney at col. 10, lines 50-61 (indexed "Deposit" and "Removal" events); Olson at Fig. 2 & p. 163, § 3.2 (indexed "deposit" and "removal" events), Brill at col. 3, lines 41-45 (indexed "DEPOSIT" and "REMOVAL" events).

E. New Claims 39-41

140. New claims 39-41 require "filtering" and that "none of the determined attributes refers to the object engaged in an activity." For the reasons explained in paragraphs 138 and 139 above, none of the event-indexing references (*i.e.*, Courtney, Olson, and Brill) discloses or would have suggested this feature because, in Courtney, Olson, and Brill, the determined and indexed events (*i.e.*, the alleged attributes) all refer to an object engaged in an activity. In addition, for the reasons set forth above in paragraphs 130-132, Day does not disclose and would not have suggested the filtering required by the claims.

F. New Claims 42-44

141. New dependent claims 42-44 require attribute filtering to determine if the event occurred. For the reasons set forth above in paragraphs 130-132, Day does not disclose and would not have suggested the attribute filtering required by the claims.

XI. Conclusion

142. 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 are 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 '912 patent.

Date: 10-29-13

Dr. Kenneth A. Zeger

EXHIBIT

Z1

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Ph.D (ECE):	University of California, Santa Barbara (1990)
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S.M. (EECS):	Massachusetts Institute of Technology (1984)
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Faculty Positions

University of California, San Diego	-	Professor of Electrical Engineering (1998-present)
	- Associate	Professor of Electrical Engineering (1996-1998)
University of Illinois, Urbana-Champaign	- Associate	Professor of Electrical Engineering (1995-1996)
	- Assistant	Professor of Electrical Engineering (1992-1995)
University of Hawaii	- Assistant	Professor of Electrical Engineering (1990-1992)

Honors and Awards

- IEEE Fellow (2000)
- NSF Presidential Young Investigator Award (1991)
- United States Mathematical Olympiad (1980)

Consulting Experience

Clients:

- Answers, Inc.
- Automatic Data Processing Co.
- Hewlett-Packard Laboratories
- Institute for Defense Analyses
- Mathematics Consulting, Inc.
- MITRE Co.
- Nokia Telecommunications Inc.
- Prominent Communications Inc. (Chair of Technical Advisory Board)
- ViaSat Inc.
- Xerox Co. Palo Alto Research Center
- Zeger-Abrams Inc.
- Zunda LLC (President)
- Expert Witness in numerous patent infringement and trade secret litigations.

Topics:

- Image, fax, video, vision, television coding.
- Speech coding and recognition, audio coding, telephony.
- Electronic hardware devices: cell phones, printers, cameras, TV, computers, dongles, etc.
- Protocols, networks, Internet, security, GPS.
- Digital and wireless communications.
- Error correcting codes.
- Communication protocols.
- Software: C, C++, C#, BASIC, Lisp, Fortran, Cobol, Algol, Pascal, Assembler, TMS320, Java, DSP, Verilog, HTML, JavaScript, Perl, Visual Basic, VHDL.
- Department of Defense topics.

Professional Activities

- Board of Governors of IEEE Information Theory Society (1998-2000, 2005-2007, and 2008-2010)
- Associate Editor At-Large of *IEEE Transactions on Information Theory* (1995-1998).
- Steering Committee member of Fourth Workshop on Network Coding, Theory, and Applications (2007).
- Co-organizer of: Third Workshop on Network Coding, Theory, and Applications, San Diego (2007).
- Co-organizer of NSF Workshop on Joint Source-Channel Coding, San Diego, Calif. (1999)
- Co-organizer of IEEE Information Theory Workshop, San Diego, Calif. (1998)
- Co-organizer of Allerton Conference on Communication, Control, and Computing (1995)
- Co-organizer of IEEE Communication Theory Workshop, Ojai, Calif. (1990)
- International Advisory Committee of International Symposium on Spread Spectrum Techniques and Applications (ISSTA) (Taichung, Taiwan 2010)
- Program Committee member of Workshop on Network Coding (NetCod) (Beijing, China, 2011)
- Program Committee member of Workshop on Network Coding (NetCod) (Lausanne, Switzerland, 2009)
- Program Committee member of Workshop on Network Coding (NetCod) (Hong Kong, 2008)
- Program Committee member of Workshop on Network Coding (NetCod) (Boston, 2006)
- Program Committee member of Int. Symp. on Infor. Theory (ISIT) (Toronto, Canada 2008)
- Program Committee member of Int. Symp. on Infor. Theory (ISIT) (Adelaide, Australia 2005)
- Program Committee member of Int. Conf. on Image Processing (ICIP) (Atlanta, Georgia, September 2006).
- Program Committee member of Int. Conf. on Image Processing (ICIP) (Genova, Italy, 2005)
- Program Committee member of Int. Conf. on Image Processing (ICIP) (Singapore 2004)
- Program Committee member of Int. Conf. on Image Processing (ICIP) (Barcelona, Spain, 2003)
- Program Committee member of Int. Symp. on Infor. Theory and its Applic. (Melbourne, Australia 2014)
- Program Committee member of Int. Symp. on Infor. Theory and its Applic. (Honolulu, Hawaii 2012)
- Program Committee member of Int. Symp. on Infor. Theory and its Applic. (Taichung, Taiwan 2010)
- Program Committee member of Int. Symp. on Infor. Theory and its Applic. (Auckland, New Zealand 2008)
- Program Committee member of Int. Symp. on Infor. Theory and its Applic. (Soeul, Korea 2006)
- Program Committee member of Int. Symp. on Infor. Theory and its Applic. (Xian, China, 2002)
- Program Committee member of Int. Symp. on Infor. Theory and its Applic. (Hawaii, 2000)
- Program Committee member of Data Compression Conf. (Salt Lake City, Utah, 1996-2007)
- Plenary speaker at Nottingham Trent Univ. Workshop on Prob., Theory, & Appl. (England, 1998)
- Plenary speaker at IEEE Communication Theory Workshop (Destin, Florida, 1996)
- IEEE Communication Theory Technical Committee

- IEEE Signal Processing and Communications Electronics Technical Committee
- Started U.S.-Hungary Research Exchange Program
- MIT Educational Council (1985-present)

Research Interests

Source/Channel Coding, Image/Speech Compression, Networking, Statistical Learning and Pattern Matching, Information Theory, Graph and Complexity Theory, Combinatorial Monoid & Group Theory

Teaching Experience (g = grad, u = undergrad)

Calculus (u)
Probability (u)
Signals and Systems (u)
Circuits and Systems (u)
Information Theory (g)
Source Coding (g)
Random Processes (g)

Publications of Kenneth Zeger

Journal Papers:

1. **Kenneth Zeger and Allen Gersho**, "Zero-Redundancy Channel Coding in Vector Quantisation", *IEE Electronics Letters*, vol. 23, no. 12, pp. 654-656, June 1987.

2. **Kenneth Zeger and Allen Gersho**, "A Stochastic Relaxation Algorithm for Improved Vector Quantiser Design", *IEE Electronics Letters*, vol. 25, no. 14, pp. 896-898, July 1989.

3. **Kenneth Zeger and Allen Gersho**, "Pseudo-Gray Coding", *IEEE Transactions on Communications*, vol. 38, no. 12, pp. 2147-2158, December 1990.

4. **Hai-Ning Liu, Celia Wrathall, and Kenneth Zeger**, "Efficient Solution of some Problems in a Free Partially Commutative Monoid", *Information and Computation*, vol. 89, no. 2, pp. 180-198, December 1990.

5. **Kenneth Zeger**, "Corrections to 'Gradient Algorithms for Designing Predictive Vector Quantizers' ", *IEEE Transactions on Signal Processing*, vol. 39, no. 3, pp. 764-765, March 1991.

6. **Kenneth Zeger, Jacques Vaisey, and Allen Gersho**, "Globally Optimal Vector Quantizer Design by Stochastic Relaxation", *IEEE Transactions on Signal Processing*, vol. 40, no. 2, pp. 310-322, February 1992.

7. **Eyal Yair, Kenneth Zeger, and Allen Gersho**, "Competitive Learning and Soft Competition for Vector Quantizer Design", *IEEE Transactions on Signal Processing*, vol. 40, no. 2, pp. 294-309, February 1992.

8. **Kris Popat and Kenneth Zeger**, "Robust Quantization of Memoryless Sources using Dispersive FIR Filters", *IEEE Transactions on Communications*, vol. 40, no. 11, pp. 1670-1674, November 1992.

9. **Kenneth Zeger and Miriam R. Kantorovitz**, "Average Number of Facets per Cell in Tree-Structured Vector Quantizer Partitions", *IEEE Transactions on Information Theory*, vol. 39, no. 3, pp. 1053-1055, May 1993.

10. **Tamás Linder, Christian Schlegel, and Kenneth Zeger**, "Corrected Proof of de Buda's Theorem", *IEEE Transactions on Information Theory*, vol. 39, no. 5, pp. 1735-1737, September 1993.

11. **Kenneth Zeger, Anurag Bist, and Tamás Linder**, "Universal Source Coding with Codebook Transmission", *IEEE Transactions on Communications*, vol. 42, no. 2, pp. 336-346, February 1994.

12. **Tamás Linder and Kenneth Zeger**, "Asymptotic Entropy Constrained Performance of Tessellating and Universal Randomized Lattice Quantization", *IEEE Transactions on Information Theory*, vol. 40, no. 2, pp. 575-579, March 1994.

13. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Recent Trends in Lossy Source Coding", *Journal on Communications (Hungary)*, vol. XLV, pp. 16-22, March 1994.

14. **Kenneth Zeger and Allen Gersho**, "Number of Nearest Neighbors in a Euclidean Code", *IEEE Transactions on Information Theory*, vol. 40, no. 5, pp. 1647-1649, September 1994.

15. **Kenneth Zeger and Vic Manzella**, "Asymptotic Bounds on Optimal Noisy Channel Quantization Via Random Coding", *IEEE Transactions on Information Theory*, vol. 40, no. 6, pp. 1926-1938, November 1994.

16. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Rates of Convergence in the Source Coding Theorem, in Empirical Quantizer Design, and in Universal Lossy Source Coding", *IEEE Transactions on Information Theory*, vol. 40, no. 6, pp. 1728-1740, November 1994.

17. **Gábor Lugosi and Kenneth Zeger**, "Nonparametric Estimation via Empirical Risk Minimization", *IEEE Transactions on Information Theory*, vol. 41, no. 3, pp. 677-687, May 1995.

18. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Fixed Rate Universal Lossy Source Coding and Rates of Convergence for Memoryless Sources", *IEEE Transactions on Information Theory*, vol. 41, no. 3, pp. 665-676, May 1995.

19. **Gábor Lugosi and Kenneth Zeger**, "Concept Learning using Complexity Regularization", *IEEE Transactions on Information Theory*, vol. 42, no. 1, pp. 48-54, January 1996.

20. **Tamás Linder and Kenneth Zeger**, "On the Cost of Finite Block Length in Quantizing Unbounded Memoryless Sources", *IEEE Transactions on Information Theory*, vol. 42, no. 2, pp. 480-487, March 1996.

21. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Empirical Quantizer Design in the Presence of Source Noise or Channel Noise", *IEEE Transactions on Information Theory*, vol. 43, no. 2, pp. 612-637, March 1997.

22. **Jon Hamkins and Kenneth Zeger**, "Improved Bounds on Maximum Size Binary Radar Arrays", *IEEE Transactions on Information Theory*, vol. 43, no. 3, pp. 997-1000, May 1997.

23. **P. Greg Sherwood and Kenneth Zeger**, "Progressive Image Coding on Noisy Channels", *IEEE Signal Processing Letters*, vol. 4, no. 7, pp. 189-191, July 1997.

24. **Bertrand Hochwald and Kenneth Zeger**, "Tradeoff Between Source and Channel Coding", *IEEE Transactions on Information Theory*, vol. 43, no. 5, pp. 1412-1424, September 1997.

25. **Tamás Linder, Vahid Tarokh, and Kenneth Zeger**, "Existence of Optimal Codes for Infinite Source Alphabets", *IEEE Transactions on Information Theory*, vol. 43, no. 6, pp. 2026-2028, November 1997.

26. **Jon Hamkins and Kenneth Zeger**, "Asymptotically Dense Spherical Codes - Part I: Wrapped Spherical Codes", *IEEE Transactions on Information Theory*, vol. 43, no. 6, pp. 1774-1785, November 1997.

27. **Jon Hamkins and Kenneth Zeger**, "Asymptotically Dense Spherical Codes - Part II: Laminated Spherical Codes", *IEEE Transactions on Information Theory*, vol. 43, no. 6, pp, 1786-1798, November 1997.

28. **András Méhes and Kenneth Zeger**, "Binary Lattice Vector Quantization with Linear Block Codes and Affine Index Assignments", *IEEE Transactions on Information Theory*, vol. 44, no. 1, pp. 79-94, January 1998.

29. **Pamela Cosman and Kenneth Zeger**, "Memory Constrained Wavelet-Based Image Coding", *IEEE Signal Processing Letters*, vol. 5, no. 9, pp. 221-223, September 1998.

30. **P. Greg Sherwood and Kenneth Zeger**, "Error Protection for Progressive Image Transmission Over Memoryless and Fading Channels", *IEEE Transactions on Communications*, vol. 46, no. 12, pp. 1555-1559, December 1998.

31. **Tamás Linder, Ram Zamir, and Kenneth Zeger**, "High-Resolution Source Coding for Non-difference Distortion Measures: Multidimensional Companding", *IEEE Transactions on Information Theory*, vol. 45, no. 2, pp. 548-561, March 1999.

32. **András Méhes and Kenneth Zeger**, "Randomly Chosen Index Assignments Are Asymptotically Bad for Uniform Sources", *IEEE Transactions on Information Theory*, vol. 45, no. 2, pp. 788-794, March 1999.

33. **Vahid Tarokh, Alexander Vardy, and Kenneth Zeger**, "Universal Bound on the Performance of Lattice Codes", *IEEE Transactions on Information Theory*, vol. 45, no. 2, pp. 670-681, March 1999.

34. **Akiko Kato and Kenneth Zeger**, "On the Capacity of Two-Dimensional Run Length Constrained Channels", *IEEE Transactions on Information Theory*, vol. 45, no. 4, pp. 1527-1540, July 1999.

35. **András György, Tamás Linder, and Kenneth Zeger**, "On the Rate-Distortion Function of Random Vectors and Stationary Sources with Mixed Distributions", *IEEE Transactions on Information Theory*, vol. 45, no. 6, pp. 2110-2115, September 1999.

36. **Hisashi Ito, Akiko Kato, Zsigmond Nagy, and Kenneth Zeger**, "Zero Capacity Region of Multidimensional Run Length Constraints", *The Electronic Journal of Combinatorics*, vol. 6(1), no. R33, 1999.

37. **Balázs Kégl, Adam Krzyżak, Tamás Linder, and Kenneth Zeger**, "Learning and Design of Principal Curves", *IEEE Transactions on Pattern Matching and Machine Intelligence*, vol. 22, no. 3, pp. 281-297, March 2000.

38. **Zsigmond Nagy and Kenneth Zeger**, "Capacity Bounds for the Three-dimensional (0, 1) Run Length Limited Channel", *IEEE Transactions on Information Theory*, vol. 46, no. 3, pp. 1030-1033, May 2000.

39. **Pamela Cosman, John Rogers, P. Greg Sherwood, and Kenneth Zeger**, "Combined Forward Error Control and Packetized Zerotree Wavelet Encoding for Transmission of Images Over Varying Channels", *IEEE Transactions on Image Processing*, vol. 9, no. 6, pp. 982-993, June 2000.

40. **András Méhes and Kenneth Zeger**, "Source and Channel Rate Allocation for Channel Codes Satisfying the Gilbert-Varshamov or Tsfasman-Vlăduţ-Zink Bounds", *IEEE Transactions on Information Theory*, vol. 46, no. 6, pp. 2133-2151, September 2000.

41. **Erik Agrell, Alexander Vardy, and Kenneth Zeger**, "Upper Bounds for Constant-Weight Codes", *IEEE Transactions on Information Theory*, vol. 46, no. 7, pp. 2373-2395, November 2000.

42. **András Méhes and Kenneth Zeger**, "Performance of Quantizers on Noisy Channels using Structured Families of Codes", *IEEE Transactions on Information Theory*, vol. 46, no. 7, pp. 2468-2476, November 2000.

43. **Akiko Kato and Kenneth Zeger**, "Partial Characterization of the Positive Capacity Region of Two-Dimensional Asymmetric Run Length Constrained Channels", *IEEE Transactions on Information Theory*, vol. 46, no. 7, pp. 2666-2670, November 2000.

44. **Tamás Linder, Ram Zamir, and Kenneth Zeger**, "On Source Coding with Side Information Dependent Distortion Measures", *IEEE Transactions on Information Theory*, vol. 46, no. 7, pp. 2697-2704, November 2000.

45. **Marc Fossorier, Zixiang Xiong, and Kenneth Zeger**, "Progressive Source Coding for a Power Constrained Gaussian Channel", *IEEE Transactions on Communications*, vol. 49, no. 8, pp. 1301-1306, August 2001.

46. **Erik Agrell, Alexander Vardy, and Kenneth Zeger**, "A Table of Upper Bounds for Binary Codes", *IEEE Transactions on Information Theory*, vol. 47, no. 7, pp. 3004-3006, November 2001.

47. **Erik Agrell, Thomas Eriksson, Alexander Vardy, and Kenneth Zeger**, "Closest Point Search in Lattices", *IEEE Transactions on Information Theory*, vol. 48, no. 8, pp. 2201-2214, August 2002.

48. **Jon Hamkins and Kenneth Zeger**, "Gaussian Source Coding with Spherical Codes", *IEEE Transactions on Information Theory*, vol. 48, no. 11, pp. 2980-2989, November 2002.

49. **Tamás Frajka and Kenneth Zeger**, "Residual Image Coding for Stereo Image Compression", *Optical Engineering*, vol. 42, no. 1, pp. 182-189, January 2003.

50. **Christopher Freiling, Douglas Jungreis, François Théberge, and Kenneth Zeger**, "Almost all Complete Prefix Codes have a Self-Synchronizing String", *IEEE Transactions on Information Theory*, vol. 49, no. 9, pp. 2219-2225, September 2003.

51. **Zsigmond Nagy and Kenneth Zeger**, "Asymptotic Capacity of Two-Dimensional Channels with Checkerboard Constraints", *IEEE Transactions on Information Theory*, vol. 49, no. 9, pp. 2115-2125, September 2003.

52. **Tamás Frajka and Kenneth Zeger**, "Disparity Estimation Window Size", *Optical Engineering*, vol. 42, no. 11, pp. 3334-3341, November 2003.

53. **Benjamin Farber and Kenneth Zeger**, "Quantizers with Uniform Encoders and Channel Optimized Decoders", *IEEE Transactions on Information Theory*, vol. 50, no. 1, pp. 62-77, January 2004.

54. **Tamás Frajka and Kenneth Zeger**, "Downsampling Dependent Upsampling of Images", *Signal Processing: Image Communication*, vol. 19, no. 3, pp. 257-265, March 2004.

55. **Michelle Effros, Hanying Feng, and Kenneth Zeger**, "Suboptimality of the Karhunen-Loève Transform for Transform Coding", *IEEE Transactions on Information Theory*, vol. 50, no. 8, pp. 1605-1619, August 2004.

56. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Linearity and Solvability in Multicast Networks", *IEEE Transactions on Information Theory*, vol. 50, no. 10, pp. 2243-2256, October 2004.

57. **Zsigmond Nagy and Kenneth Zeger**, "Bit Stuffing Algorithms and Analysis for Run Length Constrained Channels in Two and Three Dimensions", *IEEE Transactions on Information Theory*, vol. 50, no. 12, pp. 3146- 3169, December 2004.

58. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Insufficiency of Linear Coding in Network Information Flow", *IEEE Transactions on Information Theory*, vol. 51, no. 8, pp. 2745-2759, August 2005.

59. **Zsolt Kukorelly and Kenneth Zeger**, "Sufficient Conditions for Existence of Binary Fix-Free Codes", *IEEE Transactions on Information Theory*, vol. 51, no. 10, pp. 3433- 3444, October 2005.

60. **Benjamin Farber and Kenneth Zeger**, "Quantizers with Uniform Decoders and Channel Optimized Encoders", *IEEE Transactions on Information Theory*, vol. 52, no. 2, pp. 640-661, February 2006.

61. **Jillian Cannons, Randall Dougherty, Chris Freiling, and Kenneth Zeger**, "Network Routing Capacity", *IEEE Transactions on Information Theory*, vol. 52, no. 3, pp. 777-788, March 2006.

62. **Randall Dougherty, Chris Freiling, and Kenneth Zeger**, "Unachievability of Network Coding Capacity", *IEEE Transactions on Information Theory & IEEE/ACM Transactions on Networking (joint issue)*, vol. 52, no. 6, pp. 2365-2372, June 2006.

63. **Benjamin Farber and Kenneth Zeger**, "Quantization of Multiple Sources Using Nonnegative Integer Bit Allocation", *IEEE Transactions on Information Theory*, vol. 52, no. 11, pp. 4945-4964, November 2006.

64. **Randall Dougherty and Kenneth Zeger**, "Nonreversibility and Equivalent Constructions of Multiple-Unicast Networks", *IEEE Transactions on Information Theory*, vol. 52, no. 11, pp. 5067-5077, November 2006.

65. **Randall Dougherty, Chris Freiling, and Kenneth Zeger**, "Networks, Matroids, and Non-Shannon Information Inequalities", *IEEE Transactions on Information Theory*, vol. 53, no. 6, pp. 1949-1969, June 2007.

66. **Jillian Cannons and Kenneth Zeger**, "Network Coding Capacity with a Constrained Number of Coding Nodes", *IEEE Transactions on Information Theory*, vol. 54, no. 3, pp. 1287-1291, March 2008.

67. **Randall Dougherty, Chris Freiling, and Kenneth Zeger**, "Linear Network Codes and Systems of Polynomial Equations", *IEEE Transactions on Information Theory*, vol. 54, no. 5, pp. 2303-2316, May 2008.

68. **Jillian Cannons, Laurence Milstein, and Kenneth Zeger**, "An Algorithm for Wireless Relay Placement", *IEEE Transactions on Wireless Communications*, vol. 8, no. 11, pp. 5564-5574, November 2009.

69. **Rathinakumar Appuswamy, Massimo Franceschetti, Nikhil Karamchandani, and Kenneth Zeger** "Network Coding for Computing: Cut-Set Bounds", *IEEE Transactions on Information Theory* (special issue on networks), vol. 57, no. 2, pp. 1015-1030, February 2011.

70. **Randall Dougherty, Chris Freiling, and Kenneth Zeger**, "Network Coding and Matroid Theory", *Proceedings of the IEEE (special issue on network coding)*, invited, vol. 99, no. 3, pp. 388-405, March 2011.

71. **Randall Dougherty, Chris Freiling, and Kenneth Zeger**, "Linear rank inequalities on five or more variables", *SIAM Journal on Discrete Mathematics*, (submitted August 14, 2010).

72. **Rathinakumar Appuswamy, Massimo Franceschetti, Nikhil Karamchandani, and Kenneth Zeger** "Linear Codes, Target Function Classes, and Network Computing Capacity", *IEEE Transactions on Information Theory*, (to appear).

Book Chapter:

1. **Allen Gersho, Shihua Wang, and Kenneth Zeger**, "Vector Quantization Techniques in Speech Coding", Chapter 2 (pp. 49-84) in: *Advances in Speech Signal Processing*, S. Furui and M. Sondhi eds., Marcel Dekker Inc., 1992.

Book Review:

1. **Kenneth Zeger and Eve A. Riskin**, review of: "Vector Quantization" by Huseyin Abut (IEEE Press 1990), *IEEE Information Theory Society Newsletter*, December 1992.

Conference Papers:

1. **Fredrick Kitson and Kenneth Zeger**, "A Real-Time ADPCM Encoder using Variable Order Linear Prediction", *Proceedings IEEE International Conference on Acoust., Speech, and Sig. Processing (ICASSP)*, Tokyo, Japan, pp. 825-828, May 1986.

2. **Juin-Hwey Chen, Grant Davidson, Allen Gersho, and Kenneth Zeger**, "Speech Coding for the Mobile Satellite Experiment", (invited paper), special session on Mobile Satellite Communications, *Proceedings IEEE International Conference on Communications (ICC)*, pp 756-763, June 1987, Seattle, Washington.

3. **Kenneth Zeger and Allen Gersho**, "Real-Time Vector Predictive Coding of Speech", (invited paper), *Proceedings IEEE International Conference on Communications (ICC)*, pp 1147-1152, June 1987, Seattle, Washington.

4. **Kenneth Zeger and Allen Gersho**, "Vector Quantizer Design for Memoryless Noisy Channels", *Processing IEEE International Conference on Communications (ICC)*, Philadelphia, Pennsylvania, pp. 1593-1597, June 1988.

5. **Kenneth Zeger, Erdal Paksoy, and Allen Gersho**, "Source/Channel Coding for Vector Quantizers by Index Assignment Permutations", *IEEE International Symposium on Information Theory (ISIT)*, pp. 78-79, San Diego, California, January 1990.

6. **Eyal Yair, Kenneth Zeger, and Allen Gersho**, "Conjugate Gradient Methods For Designing Vector Quantizers", *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Albuquerque, New Mexico, pp. 245-248, May 1990.

7. **Ashok Popat and Kenneth Zeger**, "Robust Quantization of Memoryless Sources", *International Symposium on Information Theory and its Applications (ISITA)*, Honolulu, Hawaii, pp. 507-510, November 1990.

8. **Eyal Yair and Kenneth Zeger**, "A Method to Obtain Better Codebooks for Vector Quantizers than those Achieved by the Generalized Lloyd Algorithm", *Proceedings of the 17th Israel IEEE Convention*, Tel Aviv, Israel, pp. 191-194, March 1991.

9. **Kenneth Zeger and Allen Gersho**, "A Parallel Processing Algorithm for Vector Quantizer Design Based on Subpartitioning", *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Toronto, Canada, pp. 1141-1143, May 1991.

10. **Kenneth Zeger and Gopal Krishna**, "Bi-level Facsimile Compression With Unconstrained Tilings", *Proceedings of the Third International Conference on Advances in Communicationss and Control Systems* (COMCON) Victoria, Canada, pp. 853-864, October 1991.

11. **Kenneth Zeger and Miriam R. Kantorovitz**, "Average Number of Facets per Cell in Tree-Structured Euclidean Partitions", *International Symposium on Information Theory and its Applications (ISITA)*, Ibusuki, Japan, pp. 573-576, December 1991.

12. **Kenneth Zeger and Victor Manzella**, "Asymptotic Noisy Channel Vector Quantization Via Random Coding", *International Symposium on Information Theory and its Applications (ISITA)*, Ibusuki, Japan, pp. 577-580, December 1991.

13. **Kenneth Zeger and Anurag Bist**, "Universal Adaptive Vector Quantization with Application to Image Compression", *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, San Francisco, California, pp. 381-384, March 1992.

14. **Kenneth Zeger**, "Asymptotic Analysis of Zero Delay Source-Channel Coding", *IEEE Communication Theory Workshop*, Port Ludlow, Washington, June 1992 (invited paper).

15. **Kenneth Zeger and Vic Manzella**, "Asymptotically Optimal Noisy Channel Quantization Via Random Coding", *Joint DIMACS/IEEE Workshop on Coding and Quantization*, Rutgers University, Piscataway, NJ, October 1992.

16. **Tamás Linder and Kenneth Zeger**, "Asymptotic Entropy Constrained Performance of Tessellating and Universal Randomized Lattice Quantization", *IEEE International Symposium on Information Theory (ISIT)*, San Antonio, Texas, pg. 390, January 1993.

17. **Kenneth Zeger and Miriam R. Kantorovitz**, "Average Number of Facets per Cell in Tree-Structured Vector Quantizer Partitions", *IEEE International Symposium on Information Theory (ISIT)*, San Antonio, Texas, pg. 393, January 1993.

18. **Tamás Linder, Christian Schlegel, and Kenneth Zeger**, "Correction and Interpretation of de Buda's Theorem", *IEEE International Symposium on Information Theory (ISIT)*, San Antonio, Texas, pg. 65, January 1993.

19. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Universality and Rates of Convergence in Lossy Source Coding", *Data Compression Conference (DCC)*, Salt Lake City, Utah, pp. 89-97, April 1993.

20. **András Méhes and Kenneth Zeger**, "Redundancy Free Codes for Arbitrary Memoryless Binary Channels" *28th Annual Conference on Information Sciences and Systems (CISS)*, Princeton University, New Jersey, pp. 1057-1062, March 1994.

21. **Gábor Lugosi and Kenneth Zeger**, "Nonparametric Estimation using Neural Networks", *IEEE International Symposium on Information Theory (ISIT)*, Trondheim, Norway, pg. 112, June 1994.

22. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Rates of Convergence in the Source Coding Theorem, in Empirical Quantizer Design, and in Universal Lossy Source Coding", *IEEE International Symposium on Information Theory (ISIT)*, Trondheim, Norway, pg. 454, June 1994.

23. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Fixed Rate Universal Lossy Source Coding for Memoryless Sources and Rates of Convergence", *IEEE International Symposium on Information Theory (ISIT)*, Trondheim, Norway, pg. 453, June 1994.

24. **Kenneth Zeger and Allen Gersho**, "How Many Points in Euclidean Space can have a Common Nearest Neighbor ?", *IEEE International Symposium on Information Theory (ISIT)*, Trondheim, Norway, pg. 109, June 1994.

25. **Gábor Lugosi and Kenneth Zeger**, "Concept Learning using Complexity Regularization", *IEEE Workshop on Information Theory*, Rydzyna, Poland, June 1995 (invited).

26. **András Méhes and Kenneth Zeger**, "On the Performance of Affine Index Assignments for Redundancy Free Source-Channel Coding", *Data Compression Conference (DCC)*, Salt Lake City, Utah, pg. 433, April 1995.

27. **Jon Hamkins and Kenneth Zeger**, "Asymptotically Optimal Spherical Codes", *29th Annual Conference on Information Sciences and Systems (CISS)*, Johns Hopkins University, Maryland, pp. 52-57, March 1995.

28. **Jon Hamkins and Kenneth Zeger**, "Asymptotically Optimal Spherical Code Construction", *IEEE International Symposium on Information Theory (ISIT)*, British Columbia, Canada, pg. 184, September 1995.

29. **Tamás Linder and Kenneth Zeger**, "On the Cost of Finite Block Length in Quantizing Unbounded Memoryless Sources", *IEEE International Symposium on Information Theory (ISIT)*, British Columbia, Canada, pg. 370, September 1995.

30. **Gábor Lugosi and Kenneth Zeger**, "Concept Learning using Complexity Regularization", *IEEE International Symposium on Information Theory (ISIT)*, British Columbia, Canada, 229, September 1995.

31. **András Méhes and Kenneth Zeger**, "Affine Index Assignments for Binary Lattice Quantization with Channel Noise", *IEEE International Symposium on Information Theory (ISIT)*, British Columbia, Canada, pg. 377, September 1995.

32. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Designing Vector Quantizers in the Presence of Source Noise or Channel Noise", *Data Compression Conference (DCC)*, Salt Lake City, Utah, pp. 33-42, April 1996.

33. **Jon Hamkins and Kenneth Zeger**, "Wrapped Spherical Codes", *30th Annual Conference on Information Sciences and Systems (CISS)*, Princeton University, New Jersey, pp. 290-295, March 1996.

34. **Vahid Tarokh, Alexander Vardy, and Kenneth Zeger**, "On The Performance of Lattice Codes", *30th Annual Conference on Information Sciences and Systems (CISS)*, Princeton University, New Jersey, pp. 300-305, March 1996.

35. **Kenneth Zeger**, "Recent Problems in Lossy Source Coding: Theory and Practice", *IEEE Communication Theory Workshop*, Destin, Florida, April 1996 (invited plenary speaker).

36. **Bertrand Hochwald and Kenneth Zeger**, "Bounds on the Tradeoff between Source and Channel Coding with a Delay Constraint", *International Symposium on Information Theory and its Applications (ISITA)*, Victoria, Canada, pp. 755-758, October 1996.

37. **Shawn Herman and Kenneth Zeger**, "Progressive Source Coding for Variable Rates on a Packet Network", *International Symposium on Information Theory and its Applications (ISITA)*, Victoria, Canada, pp. 417-420, October 1996.

38. **Vahid Tarokh, Alexander Vardy, and Kenneth Zeger**, "Sequential Decoding of Lattices", *International Symposium on Information Theory and its Applications (ISITA)*, Victoria, Canada, pp. 1-4, October 1996.

39. **Tamás Linder, Vahid Tarokh, and Kenneth Zeger**, "Existence of Optimal Codes for Infinite Source Alphabets", *Allerton Conference on Communication, Control, and Computing*, Allerton Park, Illinois, pp. 62-65, October 1996.

40. **P. Greg Sherwood and Kenneth Zeger**, "Progressive Image Coding on Noisy Channels", *Data Compression Conference (DCC)*, Salt Lake City, Utah, pp. 72-81, March 1997.

41. **Tamás Linder, Ram Zamir, and Kenneth Zeger**, "Multidimensional Companding for Non-difference Distortion Measures", *31st Annual Conference on Information Sciences and Systems (CISS)*, Johns Hopkins University, Maryland, pp. 132-137, March 1997.

42. **András Méhes and Kenneth Zeger**, "Tradeoff Between Source and Channel Coding for Codes Satisfying the Gilbert-Varshamov Bound", *31st Annual Conference on Information Sciences and Systems (CISS)*, Johns Hopkins University, Maryland, pp. 314-318, March 1997.

43. **Bertrand Hochwald and Kenneth Zeger**, "Tradeoff Between Source and Channel Coding", *IEEE International Symposium on Information Theory (ISIT)*, Ulm, Germany, pg. 335, July 1997.

44. **Jon Hamkins and Kenneth Zeger**, "Improved Bounds on Maximum Size Binary Radar Arrays", *IEEE International Symposium on Information Theory (ISIT)*, Ulm, Germany, pg. 518, July 1997.

45. **Jon Hamkins and Kenneth Zeger**, "Structured Spherical Codes for Gaussian Quantization", *IEEE International Symposium on Information Theory (ISIT)*, Ulm, Germany, pg. 62, July 1997.

46. **Vahid Tarokh, Alexander Vardy, and Kenneth Zeger**, "Sequential Decoding of Lattice Codes", *IEEE International Symposium on Information Theory (ISIT)*, Ulm, Germany, pg. 497, July 1997.

47. **Tamás Linder, Gábor Lugosi, and Kenneth Zeger**, "Empirical Quantizer Design in the Presence of Source Noise or Channel Noise", *IEEE International Symposium on Information Theory (ISIT)*, Ulm, Germany, pg. 514, July 1997.

48. **Tamás Frajka, P. Greg Sherwood, and Kenneth Zeger**, "Progressive Image Coding with Spatially Variable Resolution", *International Conference on Image Processing (ICIP)*, Santa Barbara, California, October 1997.

49. **P. Greg Sherwood and Kenneth Zeger**, "Error Protection of Wavelet Coded Images Using Residual Source Redundancy", *Asilomar Conference on Signals, Systems, and Computers*, Monterey, California, November 1997 (invited paper).

50. **Pamela Cosman and Kenneth Zeger**, "Memory Constrained Wavelet-Based Image Coding", *The First Annual UCSD Conference on Wireless Communications*, La Jolla, California, pp. 54-60, March 1998.

51. **Tamás Linder, Ram Zamir, and Kenneth Zeger**, "The Multiple Description Rate Region for High Resolution Source Coding", *Data Compression Conference (DCC)*, Salt Lake City, Utah, pp. 149-158, March 1998.

52. **Kenneth Zeger**, "Information Theory and Probability", *Workshop on Probability : Theory and Applications*, Nottingham Trent University, England, April 1998 (invited plenary speaker).

53. **András Méhes and Kenneth Zeger**, "Randomly Chosen Index Assignments Are Asymptotically Bad for Uniform Sources", *IEEE International Symposium on Information Theory (ISIT)*, Cambridge, Massachusetts, p. 250, August 1998.

54. **Tamás Linder, Ram Zamir, and Kenneth Zeger**, "On Source Coding with Side Information for General Distortion Measures", *IEEE International Symposium on Information Theory (ISIT)*, Cambridge, Massachusetts, p. 70, August 1998.

55. **Balázs Kégl, Adam Krzyżak, Tamás Linder, and Kenneth Zeger**, "Principal Curves: Learning and Convergence", *IEEE International Symposium on Information Theory (ISIT)*, Cambridge, Massachusetts, p. 387, August 1998.

56. **Akiko Kato and Kenneth Zeger**, "On the Capacity of Two-Dimensional Run-Length-Limited Codes", *IEEE International Symposium on Information Theory (ISIT)*, Cambridge, Massachusetts, p. 320, August 1998.

57. **P. Greg Sherwood and Kenneth Zeger**, "Error Protection for Progressive Image Transmission Over Memoryless and Fading Channels", *International Conference on Image Processing (ICIP)*, Chicago, Illinois, vol. 1, pp. 324-328, October 1998.

58. **Pamela Cosman, Tamás Frajka, and Kenneth Zeger**, "Image Compression for Memory Constrained Printers", *International Conference on Image Processing (ICIP)*, Chicago, Illinois, vol. 3, pp. 109-113, October 1998.

59. **Marc Fossorier, Zixiang Xiong, and Kenneth Zeger**, "Joint Source-Channel Image Coding for a Power Constrained Noisy Channel", *International Conference on Image Processing (ICIP)*, Chicago, Illinois, vol. 2, pp. 122-126, October 1998.

60. **Pamela Cosman, Jon Rogers, P. Greg Sherwood, and Kenneth Zeger**, "Image Transmission over Channels with Bit Errors and Packet Erasures", *Asilomar Conference on Signals, Systems, and Computers*, Monterey, California, November 1998.

61. **Balázs Kégl, Adam Krzyżak, Tamás Linder, and Kenneth Zeger**, "A Polygonal Line Algorithm for Constructing Principal Curves", *Neural Information Processing Systems (NIPS)*, Denver, Colorado, MIT Press, Vol. 9, pp. 501-507, December 1998.

62. **P. Greg Sherwood and Kenneth Zeger**, "Macroscopic Multistage Image Compression for Robust Transmission over Noisy Channels", *Visual Communication and Image Processing (VCIP)* , San Jose, California, SPIE Vol. 3653, pp. 73-83, January 23-29, 1999 (invited).

63. **András György, Tamás Linder, and Kenneth Zeger**, "On Lossy Coding of Sources with Mixed Distribution", *33st Annual Conference on Information Sciences and Systems (CISS)*, Johns Hopkins University, Maryland, pp. 619-623, March 1999.

64. **András Méhes and Kenneth Zeger**, "Performance of Quantizers on Noisy Channels using Structured Families of Codes", *Data Compression Conference (DCC)*, Salt Lake City, Utah, pp. 473-482, March 1999.

65. **András György, Tamás Linder, and Kenneth Zeger**, "On the Rate-Distortion Function of Random Vectors and Stationary Sources with Mixed Distributions", *Canadian Workshop on Information Theory*, Kingston, Ontario, June 1999 (invited).

66. **Hisashi Ito, Akiko Kato, Zsigmond Nagy, and Kenneth Zeger**, "Characterization of Zero Capacity Region for High Dimensional Run Length Constrained Codes" (in Japanese), *Proceedings of the Research Institute for Mathematical Sciences, (RIMS Kokyuroku)*, Kyoto University, Vol. 1100, , pp. 109-116, June 1999.

67. **Julià Minguillón, Juame Pujol, and Kenneth Zeger**, "Progressive Classification Scheme for Document Layout Recognition" *The International Symposium on Optical Science, Engineering, and Instrumentation*, Denver, Colorado, SPIE Vol. 3816, July 1999.

68. **P. Greg Sherwood, Xiaodong Tian, and Kenneth Zeger**, "Channel Code Blocklength and Rate Optimization for Progressive Image Transmission", *Wireless Communications and Networking Conference (WCNC)*, New Orleans, Louisiana, pp. 978-982, September 1999 (invited).

69. **Pamela Cosman, Tamás Frajka, Dirck Schilling, and Kenneth Zeger**, "Memory Efficient Quadtree Wavelet Coding for Compound Images", *33rd Asilomar Conference on Signals, Systems, and Computers*, Monterey, California, pp. 1173-1177, October 1999.

70. **Zsigmond Nagy and Kenneth Zeger**, "Capacity Bounds for the 3-dimensional (0, 1) Run Length Limited Channel", *13th Annual Symposium on Applied Algebra, Algebraic Algorithms, and Error-Correcting Codes (AAECC)*, Honolulu, Hawaii, Springer Lecture Notes in Computer Science, vol. 1719 , pp. 245-251, November 1999.

71. **Erik Agrell, Alexander Vardy, and Kenneth Zeger**, "Constant-Weight Code Bounds from Spherical Code Bounds", *IEEE International Symposium on Information Theory (ISIT)*, Sorrento, Italy, p. 391, June 2000.

72. **Hisashi Ito, Akiko Kato, Zsigmong Nagy and Kenneth Zeger**, "Zero Capacity Region of Multidimensional Run Length Constraints", *IEEE International Symposium on Information Theory (ISIT)*, Sorrento, Italy, p. 281, June 2000.

73. **Akiko Kato and Kenneth Zeger**, "Positive Capacity Region of Two-dimensional Asymmetric Run Length Constrained Channels", *IEEE International Symposium on Information Theory (ISIT)*, Sorrento, Italy, p. 279, June 2000.

74. **Zsigmond Nagy and Kenneth Zeger**, "Asymptotic Capacity of the Two-Dimensional Square Constraint", *IEEE International Symposium on Information Theory (ISIT)*, Sorrento, Italy, p. 180, June 2000.

75. **P. Greg Sherwood, Xiaodong Tian, and Kenneth Zeger**, "Efficient Image and Channel Coding for Wireless Packet Networks", *International Conference on Image Processing (ICIP)*, Vancouver, Canada, pp. 132-135, September 2000.

76. **Tamás Frajka and Kenneth Zeger**, "Robust Packet Image Transmission by Wavelet Coefficient Dispersement" *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Salt Lake City, Utah, vol. 3, pp. 1745-1748, May 2001.

77. **Jon Hamkins and Kenneth Zeger**, "Optimal Rate Allocation for Shape-Gain Gaussian Quantizers", *IEEE International Symposium on Information Theory (ISIT)*, Washington, D.C., p. 182, June 2001

78. **Zsolt Kukorelly and Kenneth Zeger**, "The Capacity of Some Hexagonal (d, k) Constraints", *IEEE International Symposium on Information Theory (ISIT)*, Washington, D.C., p. 64, June 2001

79. **Thomas Stockhammer and Kenneth Zeger**, "Distortion Bounds and Channel Code Rates for Progressive Quantization", *IEEE International Symposium on Information Theory (ISIT)*, Washington, D.C., p. 263, June 2001

80. **Benjamin Farber and Kenneth Zeger**, "Quantizers with Uniform Encoders and Channel Optimized Decoders" *Data Compression Conference (DCC)*, Salt Lake City, Utah, pp. 292-301, March 2002.

81. **Zsolt Kukorelly and Kenneth Zeger**, "New Binary Fix-Free Codes with Kraft Sum 3/4", *IEEE International Symposium on Information Theory (ISIT)*, Lausanne, Switzerland, p. 178, June 2002.

82. **Tamás Frajka and Kenneth Zeger**, "Residual Image Coding for Stereo Image Compression", *International Conference on Image Processing (ICIP)*, Rochester, New York, vol. 2, pp. 217-220, October 2002.

83. **Kenneth Zeger**, "Suboptimality of the Karhunen-Loève Transform for Fixed-Rate Transform Coding", *IEEE Global Telecommunications Conference (GLOBECOM)*, Taipei, Taiwan, vol. 2, pp. 1224-1228, November 2002.

84. **Michelle Effros, Hanying Feng, and Kenneth Zeger**, "Suboptimality of the Karhunen-Loève Transform for Transform Coding", *Data Compression Conference (DCC)*, Salt Lake City, Utah, pp. 293-302, March 2003.

85. **Benjamin Farber and Kenneth Zeger**, "Optimality of the Natural Binary Code for Quantizers with Channel Optimized Decoders", *IEEE International Symposium on Information Theory (ISIT)*, Yokohama, Japan, p. 483, June 2003.

86. **Zsigmond Nagy and Kenneth Zeger**, "Asymptotic Capacity of Two-Dimensional Channels with Checkerboard Constraints", *IEEE International Symposium on Information Theory (ISIT)*, Yokohama, Japan, p. 74, June 2003.

87. **Christopher Freiling, Douglas Jungreis, François Théberge, and Kenneth Zeger**, "Self-Synchronization of Huffman Codes", *IEEE International Symposium on Information Theory (ISIT)*, Yokohama, Japan, p. 49, June 2003.

88. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Linearity and Solvability in Multicast Networks", *38th Annual Conference on Information Sciences and Systems (CISS)*, Princeton University, New Jersey (invited), pp. 1-4, March 2004.

89. **Zsigmond Nagy and Kenneth Zeger**, "Capacity Bounds for the Hard-Triangle Model", *IEEE International Symposium on Information Theory (ISIT)*, Chicago, Illinois, p. 162, June 2004.

90. **Benjamin Farber and Kenneth Zeger**, "Cell Density Functions and Effective Channel Code Rates for Quantizers with Uniform Decoders and Channel Optimized Encoders", *IEEE International Symposium on Information Theory (ISIT)*, Chicago, Illinois, p. 429, June 2004.

91. **Jillian Cannons, Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Network Routing Capacity", *Center for Discrete Mathematics and Theoretical Computer Science (DIMACS) Working Group on Network Coding*, Rutgers University, Piscataway, New Jersey (invited), January 2005.

92. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Insufficiency of Linear Network Codes", *Center for Discrete Mathematics and Theoretical Computer Science (DIMACS) Working Group on Network Coding*, Rutgers University, Piscataway, New Jersey (invited), January 2005.

93. **Benjamin Farber and Kenneth Zeger**, "Quantization of Multiple Sources Using Integer Bit Allocation", *Data Compression Conference (DCC)*, Salt Lake City, Utah, pp. 368-377, March 2005.

94. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Unachievability of Network Coding Capacity", *First Workshop on Network Coding, Theory, and Applications (NETCOD)*, Riva del Garda, Italy (invited), April 2005.

95. **Jillian Cannons, Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Network Routing Capacity", *IEEE International Symposium on Information Theory (ISIT)*, Adelaide, Australia, pp. 11-13, September 2005.

96. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Insufficiency of Linear Network Codes", *IEEE International Symposium on Information Theory (ISIT)*, Adelaide, Australia, pp. 264-267, September 2005.

97. **Randall Dougherty and Kenneth Zeger**, "Nonreversibility of Multiple Unicast Networks", *Allerton Conference on Communication, Control, and Computing*, Allerton Park, Illinois (invited), September 2005.

98. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "The Vámos Network", *Second Workshop on Network Coding, Theory, and Applications (NETCOD)*, Boston, Massachusetts, April 2006.

99. **Rathinakumar Appuswamy, Massimo Franceschetti, and Kenneth Zeger** "Sufficiency of Linear Codes for Broadcast-Mode Multicast Networks", *IEEE International Symposium on Information Theory (ISIT)*, Seattle, Washington, July 2006.

100. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Six New Non-Shannon Information Inequalities", *IEEE International Symposium on Information Theory (ISIT)*, Seattle, Washington, July 2006.

101. **Zsolt Kukorelly and Kenneth Zeger** "Automated Theorem Proving for Hexagonal Run Length Constrained Capacity Computation", *IEEE International Symposium on Information Theory (ISIT)*, Seattle, Washington, July 2006.

102. **Jillian Cannons and Kenneth Zeger**, "Network Coding Capacity with a Limited Number of Coding Nodes", *Allerton Conference on Communication, Control, and Computing*, Allerton Park, Illinois (invited), September 2006.

103. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Matroidal Networks", *Allerton Conference on Communication, Control, and Computing*, Allerton Park, Illinois (invited), September 2007.

104. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Linear Network Codes and Systems of Polynomial Equations", *IEEE International Symposium on Information Theory (ISIT)*, Toronto, Canada, July 2008.

105. **Rathinakumar Appuswamy, Massimo Franceschetti, Nikhil Karamchandani, and Kenneth Zeger** "Network Coding for Computing", *Allerton Conference on Communication, Control, and Computing*, Allerton Park, Illinois (invited), September 2008.

106. **Jillian Cannons, Laurence Milstein, and Kenneth Zeger**, "Wireless Relay Placement", *IEEE Radio and Wireless Symposium (RWS)*, San Diego, California (invited), January 2009.

107. **Rathinakumar Appuswamy, Massimo Franceschetti, Nikhil Karamchandani, and Kenneth Zeger**, "Network Computing Capacity for the Reverse Butterfly Network", *IEEE International Symposium on Information Theory (ISIT)*, Seoul, Korea, June 2009.

108. **Kenneth Zeger**, "Network Coding and Computing", *The 5th Western Canadian Summer School on Communications and Information Theory*, Banff, Alberta, Canada, August 2010 (invited plenary talk).

109. **Rathinakumar Appuswamy, Massimo Franceschetti, Nikhil Karamchandani, and Kenneth Zeger**, "Network Computing and Linear Codes", *Information Theory and its Applications Workshop (ITA)*, San Diego, California, February 2011 (poster session).

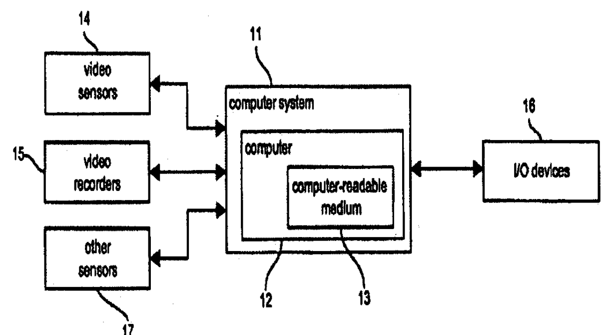
110. **Rathinakumar Appuswamy, Massimo Franceschetti, Nikhil Karamchandani, and Kenneth Zeger**, "Linear Coding for Network Computing", *IEEE International Symposium on Information Theory (ISIT)*, St. Petersburg, Russia, July-August 2011.

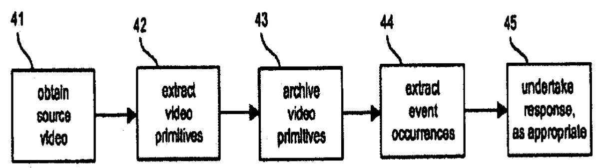
111. **Randall Dougherty, Christopher Freiling, and Kenneth Zeger**, "Achievable Rate Regions for Linear Network Coding", *Information Theory and its Applications Workshop (ITA)*, San Diego, California, February 2012.

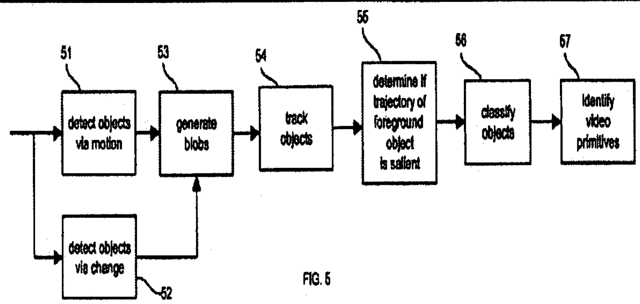
Exhibit Z2

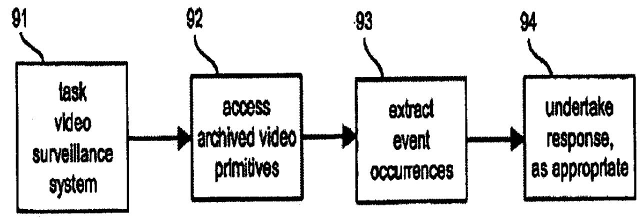
EXHIBIT Z2

Priority Claim Chart based for U.S. Patent No. 7,868,912 (the "'912 Patent") based on the U.S. Patent Application No. 09/987,707 (the "'707 Application")

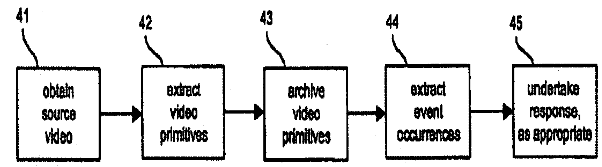
#	Claim Text of the '912 Patent	'707 Application
1	A video system comprising:	*See, e.g.*, '707 Application at Fig. 1 and ¶¶ 2, 71, and 104.  FIG. 1 '707 Application at Fig. 1. "The invention relates to a system for automatic video surveillance employing video primitives." '707 Application at ¶ 2. "FIG. 1 illustrates a plan view of the video surveillance system of the invention. A computer system 11 comprises a computer 12 having a computer-readable medium 13 embodying software to operate the computer 12 according to the invention. The computer system 11 is coupled to one or more video sensors 14, one or more video recorders 15, and one or more input/output (I/O) devices 16. The video sensors 14 can also be optionally coupled to the video recorders 15 for direct recording of video surveillance data. The computer system is optionally coupled to other sensors 17." '707 Application at ¶ 71. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of

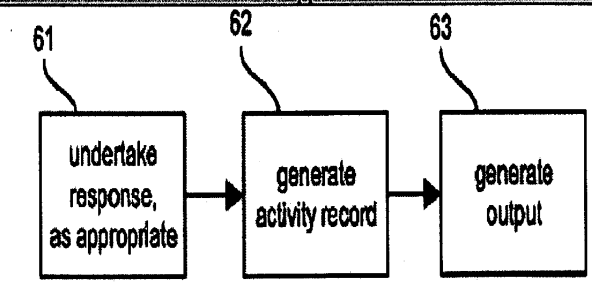
#	Claim Text of the '912 Patent	'707 Application
		objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.
1	a first processor which analyzes a video to determine attributes of objects detected in the video, the first processor being in communication with a first communications link to transfer the determined attributes over the communications link; and	*See, e.g.*, '707 Application at Figs. 1, 4, 5, 9; ¶¶ 49, 96, 106-117, 148.  FIG. 4 '707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option, non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117.

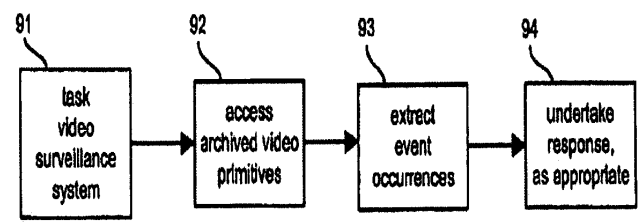
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 5 '707 Application at Fig. 5. "FIG. 5 illustrates a flow diagram for extracting video primitives for the video surveillance system. Blocks 51 and 52 operate in parallel and can be performed in any order or concurrently. In block 51, objects are detected via movement. Any motion detection algorithm for detecting movement between frames at the pixel level can be used for this block. As an example, the three frame differencing technique can be used, which is discussed in {1}. The detected objects are forwarded to block 53." '707 Application at ¶ 107. "In block 57, video primitives are identified using the information from blocks 51-56 and additional processing as necessary. Examples of video primitives identified are the same as those discussed for block 23. As an example, for size, the system can use information obtained from calibration in block 22 as a video primitive. From calibration, the system has sufficient information to determine the approximate size of an object. As another example, the system can use velocity as measured from block 54 as a video primitive." '707 Application at ¶ 116. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g.,

#	Claim Text of the '912 Patent	'707 Application
		image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.

#	Claim Text of the '912 Patent	'707 Application
		"A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49.
1	a second processor, separate from the first processor, in communication with the first communications link to receive the determined attributes transferred from the first processor over the first communications link, which determines a first event that is not one of the determined attributes by analyzing a combination of the received determined attributes and which provides, in response to a determination of the first event, at least one of an alert to a user, information for a report, and an instruction for taking an action,	*See, e.g.*, '707 Application at Figs. 3, 4, 6, and 9; ¶¶ 48, 49, 96, 97, 98-104, 117-124, and 148-151. "An 'event' refers to one or more objects engaged in an activity. The event may be referenced with respect to a location and/or a time." '707 Application at ¶ 48. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.

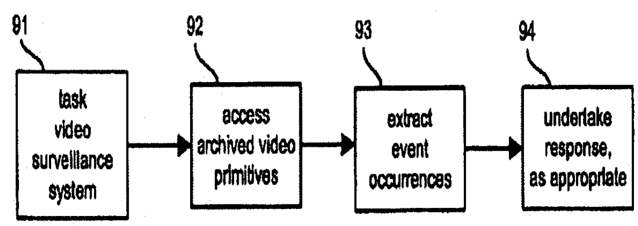
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118. "In block 45, action is taken for each event occurrence extracted in block 44, as appropriate. FIG. 6 illustrates a flow diagram for taking action with the video surveillance system." '707 Application at ¶ 119.

#	Claim Text of the '912 Patent	'707 Application
		 FIG. 6 '707 Application at Fig. 6. "In block 61, responses are undertaken as dictated by the event discriminators that detected the event occurrences. The response, if any, are identified for each event discriminator in block 34." '707 Application at ¶ 120. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96. "In block 35, one or more discriminators are identified by describing interactions between video primitives (or their abstractions), spatial areas of interest, and temporal attributes of interest. An interaction is determined for a combination of one or more objects identified in block 31, one or more spatial areas of interest identified in block 32, and one or more

#	Claim Text of the '912 Patent	'707 Application
		temporal attributes of interest identified in block 33. One or more responses identified in block 34 are optionally associated with each event discriminator." '707 Application at ¶ 97. "In block 62, an activity record is generated for each event occurrence that occurred. The activity record includes, for example: details of a trajectory of an object; a time of detection of an object; a position of detection of an object, and a description or definition of the event discriminator that was employed. The activity record can include information, such as video primitives, needed by the event discriminator. The activity record can also include representative video or still imagery of the object(s) and/or area(s) involved in the event occurrence. The activity record is stored on a computer-readable medium." '707 Application at ¶ 121. "In block 63, output is generated. The output is based on the event occurrences extracted in block 44 and a direct feed of the source video from block 41. The output is stored on a computer-readable medium, displayed on the computer system 11 or another computer system, or forwarded to another computer system. As the system operates, information regarding event occurrences is collected, and the information can be viewed by the operator at any time, including real time. Examples of formats for receiving the information include: a display on a monitor of a computer system; a hard copy; a computer-readable medium; and an interactive web page." '707 Application at ¶ 122.  FIG. 9 '707 Application at Fig. 9.

#	Claim Text of the '912 Patent	'707 Application
		"FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151. "Examples of an event discriminator for a single object include: an object appears; a person appears; and a red object moves faster than 10 m/s." '707 Application at ¶ 98. "Examples of an event discriminator for multiple objects include: two objects come together; a person exits a vehicle; and a red object moves next to a blue object." '707 Application at ¶ 99. "Examples of an event discriminator for an object and a spatial attribute include: an object crosses a line; an object enters an area; and a person crosses a line from the left." '707 Application at ¶ 100.

#	Claim Text of the '912 Patent	'707 Application
		"Examples of an event discriminator for an object and a temporal attribute include: an object appears at 10:00 p.m.; a person travels faster then 2 m/s between 9:00 a.m. and 5:00 p.m.; and a vehicle appears on the weekend." '707 Application at ¶ 101. "Examples of an event discriminator for an object, a spatial attribute, and a temporal attribute include: a person crosses a line between midnight and 6:00 a.m.; and a vehicle stops in an area for longer than 10 minutes." '707 Application at ¶ 102. "An example of an event discriminator for an object, a spatial attribute, and a temporal attribute associated with a response include: a person enters an area between midnight and 6:00 a.m., and a security service is notified." '707 Application at ¶ 103. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49.
1	wherein the first processor determines attributes independent of a selection of the first event by the second processor, and	*See, e.g.*, '707 Application at Fig. 9; ¶¶ 66, 67, 79, 98-103, 118, 148, 150, and 151. "An operator is provided with maximum flexibility in configuring the system by using event discriminators. Event discriminators are identified with one or more objects (whose descriptions are based on video primitives), along with one or more optional spatial

#	Claim Text of the '912 Patent	'707 Application
		attributes, and/or one or more optional temporal attributes. For example, an operator can define an event discriminator (called a "loitering" event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 Application at ¶ 66. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 23 of FIG. 2, the video surveillance system is tasked. Tasking occurs after calibration in block 22 and is optional. Tasking the video surveillance system involves specifying one or more event discriminators. Without tasking, the video surveillance system operates by detecting and archiving video primitives and associated video imagery without taking any action, as in block 45 in FIG. 4." '707 Application at ¶ 79.  FIG. 9

#	Claim Text of the '912 Patent	'707 Application
		'707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.
1	wherein the second processor determines the first event without reprocessing the video analyzed by the first processor.	*See, e.g.*, '707 Application at ¶¶ 67 & 148. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system

#	Claim Text of the '912 Patent	'707 Application
		of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
2	The video system of claim 1, wherein the first communications link comprises a network.	*See, e.g.*, '707 Application at ¶¶ 49, 53, 96. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a

#	Claim Text of the '912 Patent	'707 Application
		computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "A "network" refers to a number of computers and associated devices that are connected by communication facilities. A network involves permanent connections such as cables or temporary connections such as those made through telephone or other communication links. Examples of a network include: an internet, such as the Internet; an intranet; a local area network (LAN); a wide area network (WAN); and a combination of networks, such as an internet and an intranet." '707 Application at ¶ 53. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.
3	The video system of claim 1, wherein the second processor determines the first event by analyzing only the attributes transferred by the communications link.	*See, e.g.*, '707 Application at ¶¶ 67, 118, 148. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary

#	Claim Text of the '912 Patent	'707 Application
		commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months."

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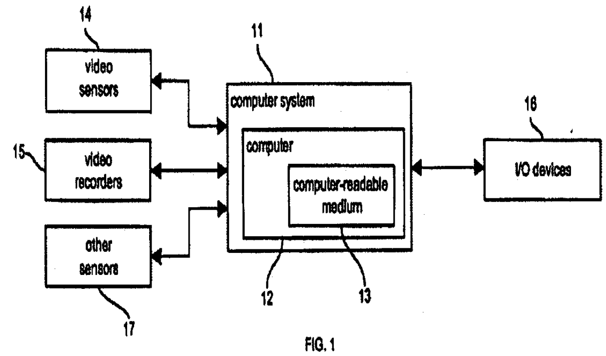
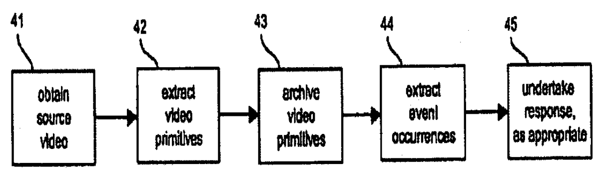
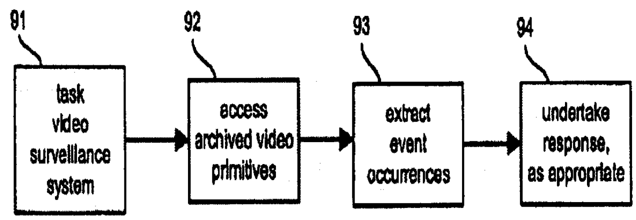
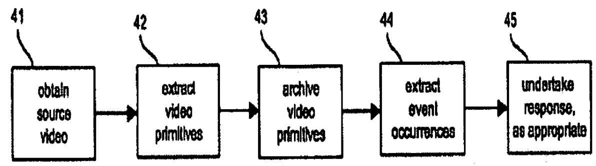
		With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
4	The video system of claim 1, wherein the second processor analyzes the attributes to detect the first event in real time.	*See, e.g.*, '707 Application at ¶¶ 33, 65, 104. "An object of the invention is to produce a real time alarm based on an automatic detection of an event from video surveillance data." '707 Application at ¶ 33. "The automatic video surveillance system of the invention is for monitoring a location for, for example, market research or security purposes. The system can be a dedicated video surveillance installation with purpose-built surveillance components, or the system can be a retrofit to existing video surveillance equipment that piggybacks off the surveillance video feeds. The system is capable of analyzing video data from live sources or from recorded media. The system can have a prescribed response to the analysis, such as record data, activate an alarm mechanism, or active another sensor system. The system is also capable of integrating with other surveillance system components. The system produces security or market research reports that can be tailored according to the needs of an operator and, as an option, can be presented through an interactive web-based interface, or other reporting mechanism." '707 Application at ¶ 65. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.
6	A video system, comprising:	*See, e.g.*, '707 Application at Fig. 1 and ¶¶ 2, 71, and 104.

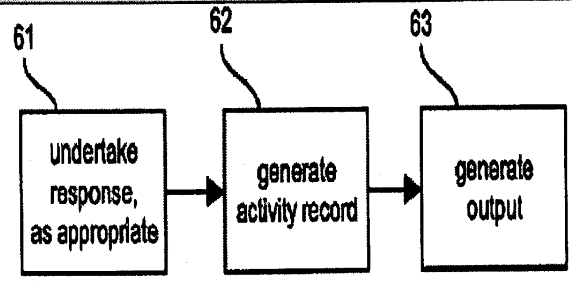
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 1 '707 Application at Fig. 1. "The invention relates to a system for automatic video surveillance employing video primitives." '707 Application at ¶ 2. "FIG. 1 illustrates a plan view of the video surveillance system of the invention. A computer system 11 comprises a computer 12 having a computer-readable medium 13 embodying software to operate the computer 12 according to the invention. The computer system 11 is coupled to one or more video sensors 14, one or more video recorders 15, and one or more input/output (I/O) devices 16. The video sensors 14 can also be optionally coupled to the video recorders 15 for direct recording of video surveillance data. The computer system is optionally coupled to other sensors 17." '707 Application at ¶ 71. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.

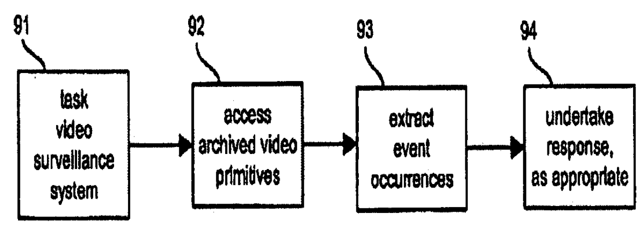
#	Claim Text of the '912 Patent	'707 Application
	an input in communication with a communications channel;	*See, e.g.*, '707 Application at Figs. 4 and 9 and ¶¶ 49, 118, 124, 148 and 150. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49.  FIG. 4 '707 Application at Fig. 4. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video

#	Claim Text of the '912 Patent	'707 Application
		primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in

#	Claim Text of the '912 Patent	'707 Application
		block 43 of FIG. 4." '707 Application at ¶ 150.
6	a processor configured to receive from the input a stream of detected attributes received over the communications channel, the attributes being attributes of one or more objects detected in a video, the processor configured to determine an event that is not one of the detected attributes by analyzing a combination of the received attributes and configured to provide, upon a determination of the event, at least one of an alert to a user, information for a report and an instruction for taking an action,	*See, e.g.*, '707 Application at Figs. 3, 4, 6, and 9; ¶¶ 48, 49, 96, 97-103, 104, 117-124, and 148-151. "An 'event' refers to one or more objects engaged in an activity. The event may be referenced with respect to a location and/or a time." '707 Application at ¶ 48. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.

#	Claim Text of the '912 Patent	'707 Application
		 FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118. "In block 45, action is taken for each event occurrence extracted in block 44, as appropriate. FIG. 6 illustrates a flow diagram for taking action with the video surveillance system." '707 Application at ¶ 119.

#	Claim Text of the '912 Patent	'707 Application
		 FIG. 6 '707 Application at Fig. 6. "In block 61, responses are undertaken as dictated by the event discriminators that detected the event occurrences. The response, if any, are identified for each event discriminator in block 34." '707 Application at ¶ 120. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96. "In block 35, one or more discriminators are identified by describing interactions between video primitives (or their abstractions), spatial areas of interest, and temporal attributes of interest. An interaction is determined for a combination of one or more objects identified in block 31, one or more spatial areas of interest identified in block 32, and one or more

#	Claim Text of the '912 Patent	'707 Application
		temporal attributes of interest identified in block 33. One or more responses identified in block 34 are optionally associated with each event discriminator." '707 Application at ¶ 97. "In block 62, an activity record is generated for each event occurrence that occurred. The activity record includes, for example: details of a trajectory of an object; a time of detection of an object; a position of detection of an object, and a description or definition of the event discriminator that was employed. The activity record can include information, such as video primitives, needed by the event discriminator. The activity record can also include representative video or still imagery of the object(s) and/or area(s) involved in the event occurrence. The activity record is stored on a computer-readable medium." '707 Application at ¶ 121. "In block 63, output is generated. The output is based on the event occurrences extracted in block 44 and a direct feed of the source video from block 41. The output is stored on a computer-readable medium, displayed on the computer system 11 or another computer system, or forwarded to another computer system. As the system operates, information regarding event occurrences is collected, and the information can be viewed by the operator at any time, including real time. Examples of formats for receiving the information include: a display on a monitor of a computer system; a hard copy; a computer-readable medium; and an interactive web page." '707 Application at ¶ 122.  FIG. 9 '707 Application at Fig. 9.

#	Claim Text of the '912 Patent	'707 Application
		"FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151. "Examples of an event discriminator for a single object include: an object appears; a person appears; and a red object moves faster than 10 m/s." '707 Application at ¶ 98. "Examples of an event discriminator for multiple objects include: two objects come together; a person exits a vehicle; and a red object moves next to a blue object." '707 Application at ¶ 99. "Examples of an event discriminator for an object and a spatial attribute include: an object crosses a line; an object enters an area; and a person crosses a line from the left." '707 Application at ¶ 100.

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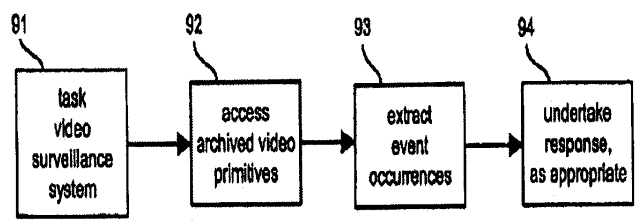
		"Examples of an event discriminator for an object and a temporal attribute include: an object appears at 10:00 p.m.; a person travels faster then 2 m/s between 9:00 a.m. and 5:00 p.m.; and a vehicle appears on the weekend." '707 Application at ¶ 101. "Examples of an event discriminator for an object, a spatial attribute, and a temporal attribute include: a person crosses a line between midnight and 6:00 a.m.; and a vehicle stops in an area for longer than 10 minutes." '707 Application at ¶ 102. "An example of an event discriminator for an object, a spatial attribute, and a temporal attribute associated with a response include: a person enters an area between midnight and 6:00 a.m., and a security service is notified." '707 Application at ¶ 103.
6	wherein the attributes received over the communications channel are independent of the event to be determined by the processor, and	*See, e.g.*, '707 Application at Fig. 9; ¶¶ 66, 67, 79, 148, and 150. "An operator is provided with maximum flexibility in configuring the system by using event discriminators. Event discriminators are identified with one or more objects (whose descriptions are based on video primitives), along with one or more optional spatial attributes, and/or one or more optional temporal attributes. For example, an operator can define an event discriminator (called a "loitering" event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 Application at ¶ 66. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can

#	Claim Text of the '912 Patent	'707 Application
		further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 23 of FIG. 2, the video surveillance system is tasked. Tasking occurs after calibration in block 22 and is optional. Tasking the video surveillance system involves specifying one or more event discriminators. Without tasking, the video surveillance system operates by detecting and archiving video primitives and associated video imagery without taking any action, as in block 45 in FIG. 4." '707 Application at ¶ 79.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely

#	Claim Text of the '912 Patent	'707 Application
		computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150.
6	wherein the processor is configured to determine the event without reprocessing the video.	*See, e.g.*, '707 Application at ¶¶ 67 and 148. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not

#	Claim Text of the '912 Patent	'707 Application
		reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
7	The video system of claim 6, wherein the communications channel comprises a network.	*See, e.g.*, '707 Application at ¶¶ 49, 53, and 96. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "A "network" refers to a number of computers and associated devices that are connected by communication facilities. A network involves permanent connections such as cables or temporary connections such as those made through telephone or other communication links. Examples of a network include: an internet, such as the Internet; an intranet; a local area network (LAN); a wide area network (WAN); and a combination of networks, such as an internet and an intranet." '707 Application at ¶ 53.

#	Claim Text of the '912 Patent	'707 Application
		"In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.
8	The video system of claim 6, wherein the processor is operable to determine an event by analyzing only attributes of the received stream of attributes.	*See, e.g.*, '707 Application at ¶¶ 67, 118, and 148. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator

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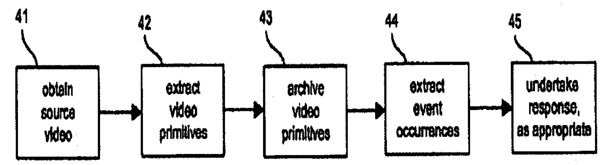
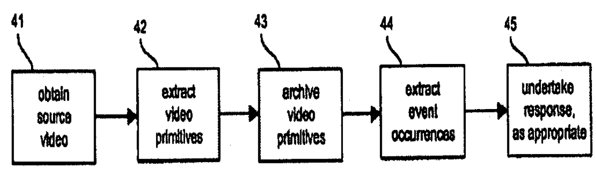
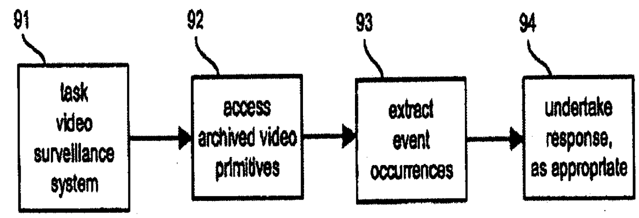
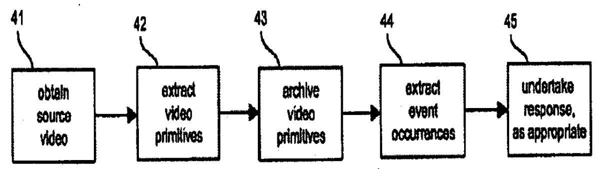
		checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
9	A method of detecting an event from a video, comprising:	*See, e.g.*, '707 Application at Figs. 2 and 4 and ¶¶ 76, 104, and 118. "FIG. 2 illustrates a flow diagram for the video surveillance system of the invention. Various aspects of the invention are exemplified with reference to FIGS. 10-15, which illustrate examples of the video surveillance system of the invention applied to monitoring a grocery store." '707 Application at ¶ 76. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In

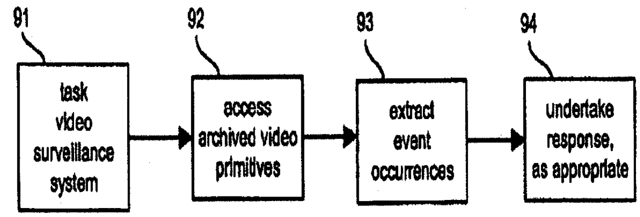
#	Claim Text of the '912 Patent	'707 Application
		addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.  FIG. 4 '707 Application at Fig. 4. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.
9	receiving a stream of detected attributes over a communications channel, the detected attributes representing attributes of an object previously detected in the video at a remote location;	*See, e.g.*, '707 Application at Figs. 4 and 9 and ¶¶ 49, 96, 118, 148 and 150. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a

#	Claim Text of the '912 Patent	'707 Application
		workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.  FIG. 4 '707 Application at Fig. 4. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to

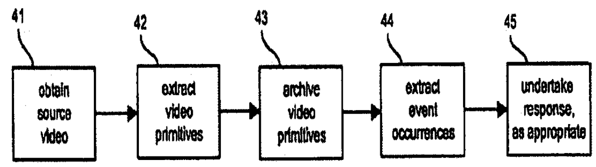
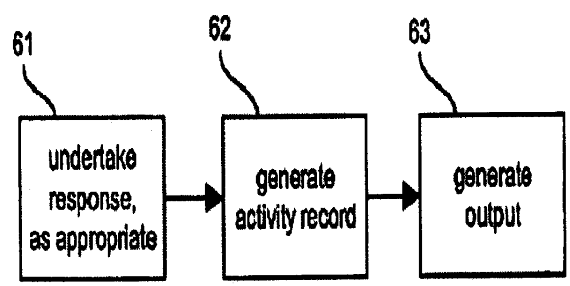
#	Claim Text of the '912 Patent	'707 Application
		filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be

#	Claim Text of the '912 Patent	'707 Application
		reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150.
9	performing an analysis of a combination of the detected attributes to detect an event that is not one of the detected attributes without reprocessing the video,	*See, e.g.*, '707 Application at Figs. 4 and 9 and ¶¶ 48, 67, 98-104, 117, 118, and 148-151. "An 'event' refers to one or more objects engaged in an activity. The event may be referenced with respect to a location and/or a time." '707 Application at ¶ 48. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.

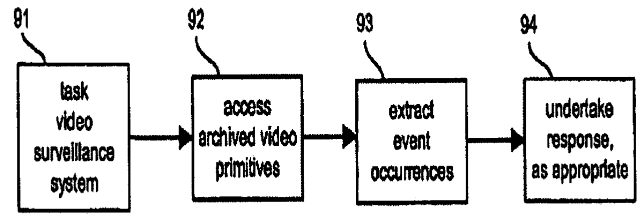
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.

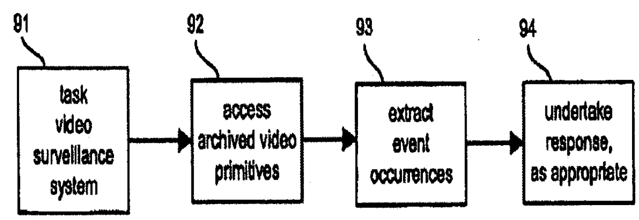
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.

#	Claim Text of the '912 Patent	'707 Application
		"Examples of an event discriminator for a single object include: an object appears; a person appears; and a red object moves faster than 10 m/s." '707 Application at ¶ 98. "Examples of an event discriminator for multiple objects include: two objects come together; a person exits a vehicle; and a red object moves next to a blue object." '707 Application at ¶ 99. "Examples of an event discriminator for an object and a spatial attribute include: an object crosses a line; an object enters an area; and a person crosses a line from the left." '707 Application at ¶ 100. "Examples of an event discriminator for an object and a temporal attribute include: an object appears at 10:00 p.m.; a person travels faster then 2 m/s between 9:00 a.m. and 5:00 p.m.; and a vehicle appears on the weekend." '707 Application at ¶ 101. "Examples of an event discriminator for an object, a spatial attribute, and a temporal attribute include: a person crosses a line between midnight and 6:00 a.m.; and a vehicle stops in an area for longer than 10 minutes." '707 Application at ¶ 102. "An example of an event discriminator for an object, a spatial attribute, and a temporal attribute associated with a response include: a person enters an area between midnight and 6:00 a.m., and a security service is notified." '707 Application at ¶ 103.
9	upon detecting the event, providing at least one of an alert to a user, information for a report and an instruction for taking an action,	*See, e.g.*, '707 Application at Figs. 3, 4, 6, and 9; ¶¶ 96, 97, 104, 119-124, and 148-151. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow

#	Claim Text of the '912 Patent	'707 Application
		diagram for operating the video surveillance system." '707 Application at ¶ 104.  FIG. 4 '707 Application at Fig. 4. "In block 45, action is taken for each event occurrence extracted in block 44, as appropriate. FIG. 6 illustrates a flow diagram for taking action with the video surveillance system." '707 Application at ¶ 119.  FIG. 6 '707 Application at Fig. 6. "In block 61, responses are undertaken as dictated by the event discriminators that detected the event occurrences. The response, if any, are identified for each event discriminator in block 34." '707 Application at ¶ 120.

#	Claim Text of the '912 Patent	'707 Application
		"In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96. "In block 35, one or more discriminators are identified by describing interactions between video primitives (or their abstractions), spatial areas of interest, and temporal attributes of interest. An interaction is determined for a combination of one or more objects identified in block 31, one or more spatial areas of interest identified in block 32, and one or more temporal attributes of interest identified in block 33. One or more responses identified in block 34 are optionally associated with each event discriminator." '707 Application at ¶ 97. "In block 62, an activity record is generated for each event occurrence that occurred. The activity record includes, for example: details of a trajectory of an object; a time of detection of an object; a position of detection of an object, and a description or definition of the event discriminator that was employed. The activity record can include information, such as video primitives, needed by the event discriminator. The activity record can also include representative video or still imagery of the object(s) and/or area(s) involved in the event occurrence. The activity record is stored on a computer-readable medium." '707 Application at ¶ 121. "In block 63, output is generated. The output is based on the event occurrences extracted in block 44 and a direct feed of the source video from block 41. The output is stored on a computer-readable medium, displayed on the computer system 11 or another computer system, or forwarded to another computer system. As the system operates, information

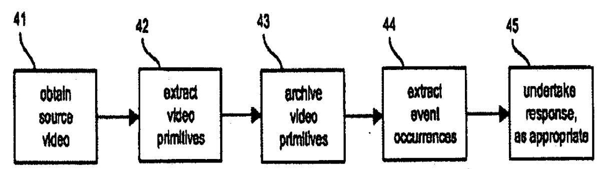
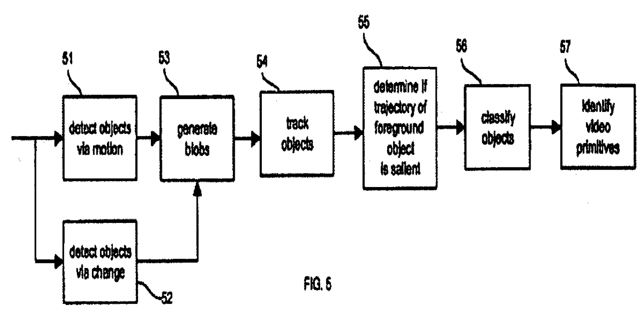
#	Claim Text of the '912 Patent	'707 Application
		regarding event occurrences is collected, and the information can be viewed by the operator at any time, including real time. Examples of formats for receiving the information include: a display on a monitor of a computer system; a hard copy; a computer-readable medium; and an interactive web page." '707 Application at ¶ 122.  FIG. 9 '707 Application at Fig. 9. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.
9	wherein the detected attributes received in the stream of attributes are independent of a selection of the event to be detected.	*See, e.g.*, '707 Application at Fig. 9; ¶¶ 66, 67, 79, 148, and 150. "An operator is provided with maximum flexibility in configuring the system by using event discriminators. Event discriminators are identified with one or more objects (whose descriptions are based on video primitives), along with one or more optional spatial attributes, and/or one or more optional temporal attributes. For example, an operator can define an event discriminator (called a "loitering" event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 Application at ¶ 66. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of

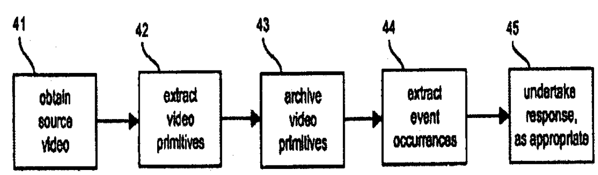
#	Claim Text of the '912 Patent	'707 Application
		information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 23 of FIG. 2, the video surveillance system is tasked. Tasking occurs after calibration in block 22 and is optional. Tasking the video surveillance system involves specifying one or more event discriminators. Without tasking, the video surveillance system operates by detecting and archiving video primitives and associated video imagery without taking any action, as in block 45 in FIG. 4." '707 Application at ¶ 79.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time

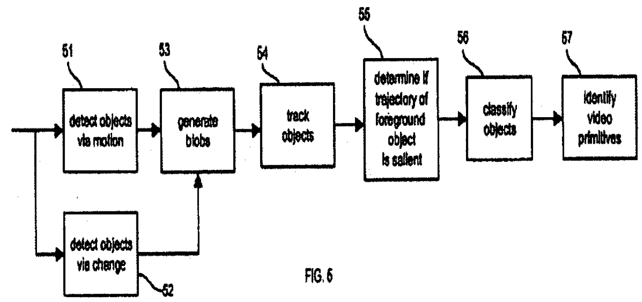
#	Claim Text of the '912 Patent	'707 Application
		because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150.
10	The method of claim 9, wherein the communications channel comprises a network.	*See, e.g.*, '707 Application at ¶¶ 49, 53, and 96. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "A "network" refers to a number of computers and associated devices that are connected by communication facilities. A network involves permanent connections such as cables or temporary connections such as those made through telephone or other communication links.

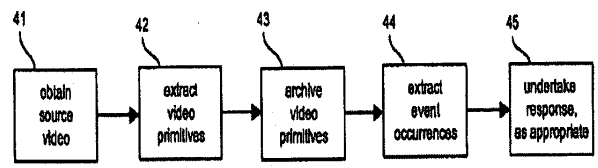
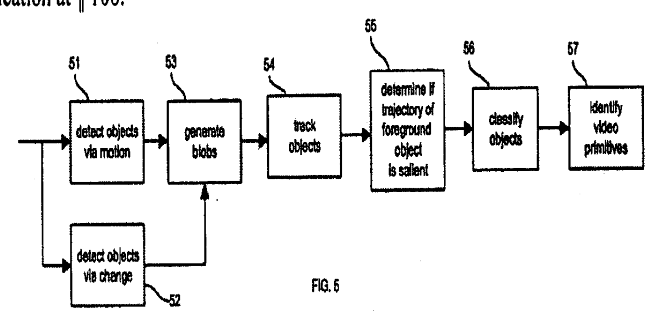
#	Claim Text of the '912 Patent	'707 Application
		Examples of a network include: an internet, such as the Internet; an intranet; a local area network (LAN); a wide area network (WAN); and a combination of networks, such as an internet and an intranet." '707 Application at ¶ 53. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.
11	The method of claim 9, wherein the analysis performed to detect an event determines an event by analyzing only attributes received in the stream of detected attributes.	*See, e.g.*, '707 Application at ¶¶ 67, 118, and 148. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators

#	Claim Text of the '912 Patent	'707 Application
		are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
12	A method comprising:	*See, e.g.*, '707 Application at Figs. 2, 4, and 5 and ¶¶ 76, 104, 106, and 107. "FIG. 2 illustrates a flow diagram for the video surveillance system of the invention. Various aspects of the invention are exemplified with reference to FIGS. 10-15, which illustrate examples of the video surveillance system of the invention applied to monitoring a grocery store." '707 Application at ¶ 76.

#	Claim Text of the '912 Patent	'707 Application
		"In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.  FIG. 4 '707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option, non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106.  FIG. 5

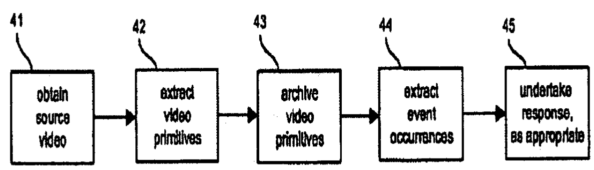
#	Claim Text of the '912 Patent	'707 Application
		'707 Application at Fig. 5. "FIG. 5 illustrates a flow diagram for extracting video primitives for the video surveillance system. Blocks 51 and 52 operate in parallel and can be performed in any order or concurrently. In block 51, objects are detected via movement. Any motion detection algorithm for detecting movement between frames at the pixel level can be used for this block. As an example, the three frame differencing technique can be used, which is discussed in {1}. The detected objects are forwarded to block 53." '707 Application at ¶ 107.
12	analyzing a video to detect an object;	*See, e.g.*, '707 Application at Figs. 2, 4, and 5 and ¶¶ 104-108. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.  FIG. 4 '707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option,

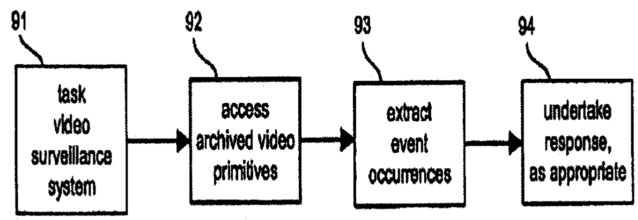
#	Claim Text of the '912 Patent	'707 Application
		non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106.  '707 Application at Fig. 5. "FIG. 5 illustrates a flow diagram for extracting video primitives for the video surveillance system. Blocks 51 and 52 operate in parallel and can be performed in any order or concurrently. In block 51, objects are detected via movement. Any motion detection algorithm for detecting movement between frames at the pixel level can be used for this block. As an example, the three frame differencing technique can be used, which is discussed in {1}. The detected objects are forwarded to block 53." '707 Application at ¶ 107. "In block 52, objects are detected via change. Any change detection algorithm for detecting changes from a background model can be used for this block. An object is detected in this block if one or more pixels in a frame are deemed to be in the foreground of the frame because the pixels do not conform to a background model of the frame. As an example, a stochastic background modeling technique, such as dynamically adaptive background subtraction, can be used, which is described in {1} and U.S. patent application Ser. No. 09/694,712 filed Oct. 24, 2000. The detected objects are forwarded to block 53." '707 Application at ¶ 108.

#	Claim Text of the '912 Patent	'707 Application
12	creating a stream of attributes at a first location by determining attributes of the detected object by analyzing the video;	*See, e.g.*, '707 Application at Figs. 2, 4, and 5 and ¶¶ 111-116. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.  FIG. 4 '707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option, non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106. 

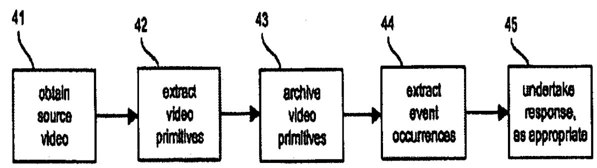
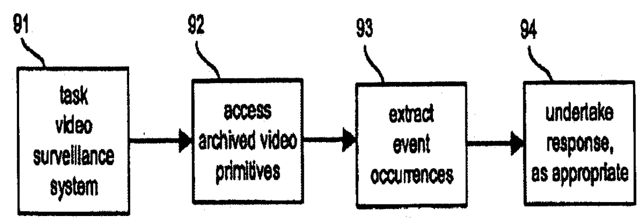
#	Claim Text of the '912 Patent	'707 Application
		'707 Application at Fig. 5. "FIG. 5 illustrates a flow diagram for extracting video primitives for the video surveillance system. Blocks 51 and 52 operate in parallel and can be performed in any order or concurrently. In block 51, objects are detected via movement. Any motion detection algorithm for detecting movement between frames at the pixel level can be used for this block. As an example, the three frame differencing technique can be used, which is discussed in {1}. The detected objects are forwarded to block 53." '707 Application at ¶ 107. "In block 53, blobs are generated. In general, a blob is any object in a frame. Examples of a blob include: a moving object, such as a person or a vehicle; and a consumer product, such as a piece of furniture, a clothing item, or a retail shelf item. Blobs are generated using the detected objects from blocks 32 and 33. Any technique for generating blobs can be used for this block. An exemplary technique for generating blobs from motion detection and change detection uses a connected components scheme. For example, the morphology and connected components algorithm can be used, which is described in {1}." '707 Application at ¶ 111. "In block 54, blobs are tracked. Any technique for tracking blobs can be used for this block. For example, Kalman filtering or the CONDENSATION algorithm can be used. As another example, a template matching technique, such as described in {1}, can be used. As a further example, a multi-hypothesis Kalman tracker can be used, which is described in {5}. As yet another example, the frame-to-frame tracking technique described in U.S. patent application Ser. No. 09/694,712 filed Oct. 24, 2000, can be used. For the example of a location being a grocery store, examples of objects that can be tracked include moving people, inventory items, and inventory moving appliances, such as shopping carts or trolleys." '707 Application at ¶ 112. "In block 55, each trajectory of the tracked objects is analyzed to determine if the trajectory

#	Claim Text of the '912 Patent	'707 Application
		is salient. If the trajectory is insalient, the trajectory represents an object exhibiting unstable motion or represents an object of unstable size or color, and the corresponding object is rejected and is no longer analyzed by the system. If the trajectory is salient, the trajectory represents an object that is potentially of interest. A trajectory is determined to be salient or insalient by applying a salience measure to the trajectory. Techniques for determining a trajectory to be salient or insalient are described in {13} and {18}." '707 Application at ¶ 114. "In block 56, each object is classified. The general type of each object is determined as the classification of the object. Classification can be performed by a number of techniques, and examples of such techniques include using a neural network classifier {14} and using a linear discriminatant classifier {14}. Examples of classification are the same as those discussed for block 23." '707 Application at ¶ 115. "In block 57, video primitives are identified using the information from blocks 51-56 and additional processing as necessary. Examples of video primitives identified are the same as those discussed for block 23. As an example, for size, the system can use information obtained from calibration in block 22 as a video primitive. From calibration, the system has sufficient information to determine the approximate size of an object. As another example, the system can use velocity as measured from block 54 as a video primitive." '707 Application at ¶ 116.
12	transmitting the stream of attributes to a second location removed from the first location for subsequent analysis,	*See, e.g.*, '707 Application at Figs. 4 and 9 and ¶¶ 49, 96, 117, 148, 150, and 151. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors,

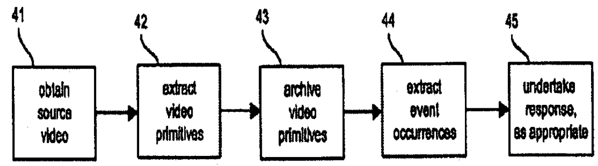
#	Claim Text of the '912 Patent	'707 Application
		which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.  FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event

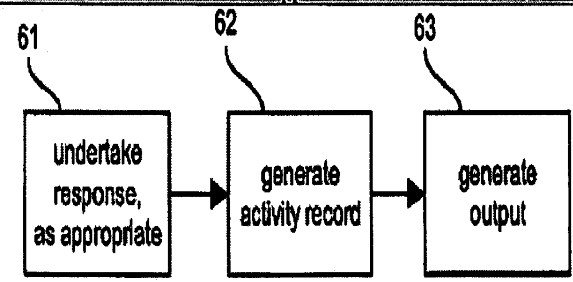
#	Claim Text of the '912 Patent	'707 Application
		discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated:

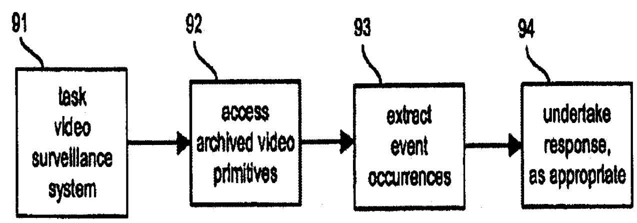
#	Claim Text of the '912 Patent	'707 Application
		"The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.
	wherein the stream of attributes are transmitted to the second location over a communications channel, and	*See, e.g.*, '707 Application at Figs. 4 and 9 and ¶¶ 49, 96, 117, and 148. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable

#	Claim Text of the '912 Patent	'707 Application
		medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.  FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review

#	Claim Text of the '912 Patent	'707 Application
		the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
12	wherein the stream of attributes is sufficient to allow the subsequent analysis to detect an event of the video to provide at least one of an alert to a user, information for a report and an instruction for taking an action, the event not being one of the determined attributes,	*See, e.g.*, '707 Application at Figs. 3, 4, 6, and 9; ¶¶ 48, 96, 97, 104, 117-124, and 148-151. "An 'event' refers to one or more objects engaged in an activity. The event may be referenced with respect to a location and/or a time." '707 Application at ¶ 48. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.

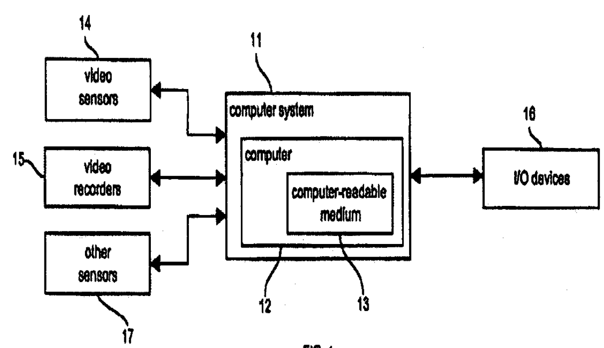
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118. "In block 45, action is taken for each event occurrence extracted in block 44, as appropriate. FIG. 6 illustrates a flow diagram for taking action with the video surveillance system." '707 Application at ¶ 119.

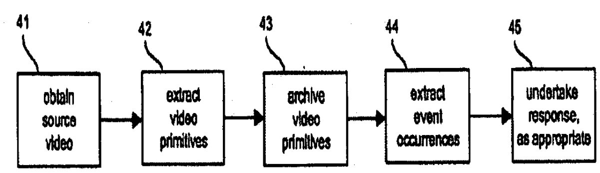
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 6 '707 Application at Fig. 6. "In block 61, responses are undertaken as dictated by the event discriminators that detected the event occurrences. The response, if any, are identified for each event discriminator in block 34." '707 Application at ¶ 120. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96. "In block 35, one or more discriminators are identified by describing interactions between video primitives (or their abstractions), spatial areas of interest, and temporal attributes of interest. An interaction is determined for a combination of one or more objects identified in block 31, one or more spatial areas of interest identified in block 32, and one or more

#	Claim Text of the '912 Patent	'707 Application
		temporal attributes of interest identified in block 33. One or more responses identified in block 34 are optionally associated with each event discriminator." '707 Application at ¶ 97. "In block 62, an activity record is generated for each event occurrence that occurred. The activity record includes, for example: details of a trajectory of an object; a time of detection of an object; a position of detection of an object, and a description or definition of the event discriminator that was employed. The activity record can include information, such as video primitives, needed by the event discriminator. The activity record can also include representative video or still imagery of the object(s) and/or area(s) involved in the event occurrence. The activity record is stored on a computer-readable medium." '707 Application at ¶ 121. "In block 63, output is generated. The output is based on the event occurrences extracted in block 44 and a direct feed of the source video from block 41. The output is stored on a computer-readable medium, displayed on the computer system 11 or another computer system, or forwarded to another computer system. As the system operates, information regarding event occurrences is collected, and the information can be viewed by the operator at any time, including real time. Examples of formats for receiving the information include: a display on a monitor of a computer system; a hard copy; a computer-readable medium; and an interactive web page." '707 Application at ¶ 122.  FIG. 9 '707 Application at Fig. 9.

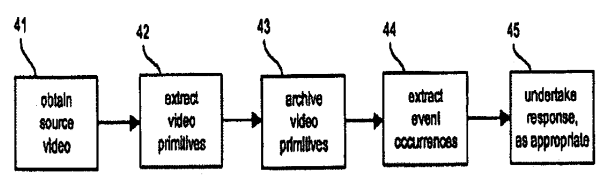
#	Claim Text of the '912 Patent	'707 Application
		"FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.
12	wherein the stream of attributes is sufficient to allow detection of the event that is not one of the determined attributes without reprocessing the video of the first location.	*See, e.g.*, '707 Application at ¶¶ 48, 67, 98-103, and 148. "An 'event' refers to one or more objects engaged in an activity. The event may be referenced with respect to a location and/or a time." '707 Application at ¶ 48. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary

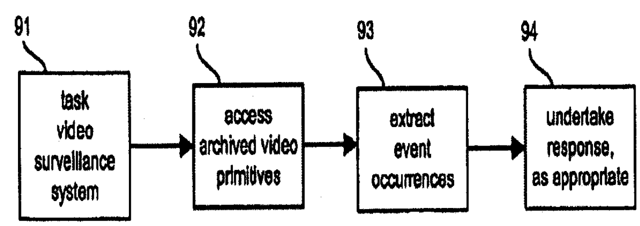
#	Claim Text of the '912 Patent	'707 Application
		commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "Examples of an event discriminator for a single object include: an object appears; a person appears; and a red object moves faster than 10 m/s." '707 Application at ¶ 98. "Examples of an event discriminator for multiple objects include: two objects come together; a person exits a vehicle; and a red object moves next to a blue object." '707 Application at ¶ 99. "Examples of an event discriminator for an object and a spatial attribute include: an object

#	Claim Text of the '912 Patent	'707 Application
		crosses a line; an object enters an area; and a person crosses a line from the left." '707 Application at ¶ 100. "Examples of an event discriminator for an object and a temporal attribute include: an object appears at 10:00 p.m.; a person travels faster then 2 m/s between 9:00 a.m. and 5:00 p.m.; and a vehicle appears on the weekend." '707 Application at ¶ 101. "Examples of an event discriminator for an object, a spatial attribute, and a temporal attribute include: a person crosses a line between midnight and 6:00 a.m.; and a vehicle stops in an area for longer than 10 minutes." '707 Application at ¶ 102. "An example of an event discriminator for an object, a spatial attribute, and a temporal attribute associated with a response include: a person enters an area between midnight and 6:00 a.m., and a security service is notified." '707 Application at ¶ 103.
13	The method of claim 12, further comprising: obtaining the video with a video capture apparatus.	*See, e.g.*, '707 Application at Figs. 1 and 4 and ¶¶ 71, 72, and 105.  '707 Application at Fig. 1. "FIG. 1 illustrates a plan view of the video surveillance system of the invention. A computer system 11 comprises a computer 12 having a computer-readable medium 13 embodying

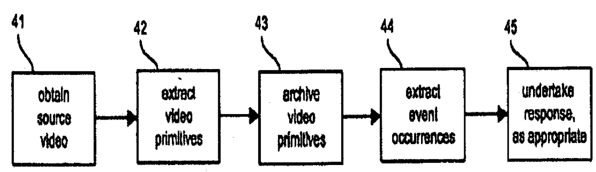
#	Claim Text of the '912 Patent	'707 Application
		software to operate the computer 12 according to the invention. The computer system 11 is coupled to one or more video sensors 14, one or more video recorders 15, and one or more input/output (I/O) devices 16. The video sensors 14 can also be optionally coupled to the video recorders 15 for direct recording of video surveillance data. The computer system is optionally coupled to other sensors 17." '707 Application at ¶ 71. "The video sensors 14 provide source video to the computer system 11. Each video sensor 14 can be coupled to the computer system 11 using, for example, a direct connection (e.g., a firewire digital camera interface) or a network. The video sensors 14 can exist prior to installation of the invention or can be installed as part of the invention. Examples of a video sensor 14 include: a video camera; a digital video camera; a color camera; a monochrome camera; a camera; a camcorder, a PC camera; a webcam; an infra-red video camera; and a CCTV camera." '707 Application at ¶ 72.  FIG. 4 '707 Application at Fig. 4. "In block 41, the computer system 11 obtains source video from the video sensors 14 and/or the video recorders 15." '707 Application at ¶ 105.
14	The method of claim 12, wherein the communications channel comprises a network.	*See, e.g.*, '707 Application at ¶¶ 49, 53, and 96. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose

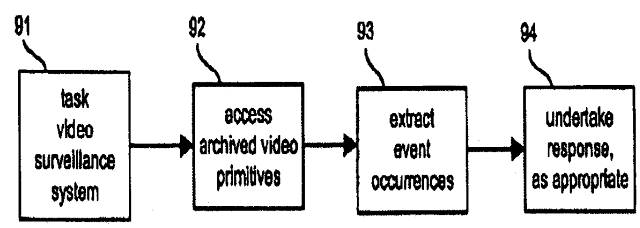
#	Claim Text of the '912 Patent	'707 Application
		computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "A "network" refers to a number of computers and associated devices that are connected by communication facilities. A network involves permanent connections such as cables or temporary connections such as those made through telephone or other communication links. Examples of a network include: an internet, such as the Internet; an intranet; a local area network (LAN); a wide area network (WAN); and a combination of networks, such as an internet and an intranet." '707 Application at ¶ 53. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.
15	The method of claim 12, wherein the attributes of the stream of attributes are created independently of the subsequent	*See, e.g.*, '707 Application at Figs. 4 and 9; ¶¶ 66, 67, 79, 106, 117, 118, 148, 150, and 151. "An operator is provided with maximum flexibility in configuring the system by using event discriminators. Event discriminators are identified with one or more objects (whose

#	Claim Text of the '912 Patent	'707 Application
	analysis.	descriptions are based on video primitives), along with one or more optional spatial attributes, and/or one or more optional temporal attributes. For example, an operator can define an event discriminator (called a "loitering" event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 Application at ¶ 66. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 23 of FIG. 2, the video surveillance system is tasked. Tasking occurs after calibration in block 22 and is optional. Tasking the video surveillance system involves specifying one or more event discriminators. Without tasking, the video surveillance system operates by detecting and archiving video primitives and associated video imagery without taking any action, as in block 45 in FIG. 4." '707 Application at ¶ 79.  FIG. 4

#	Claim Text of the '912 Patent	'707 Application
		'707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option, non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.  FIG. 9

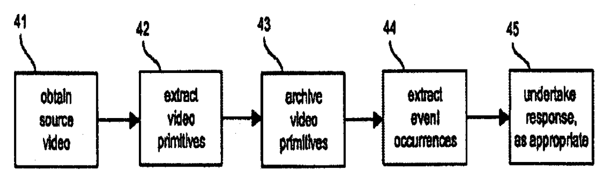
#	Claim Text of the '912 Patent	'707 Application
		'707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.
16	The method of claim 12, wherein the stream of attributes is sufficient to allow detection of an event that is not one of the determined attributes by analyzing a combination of the attributes.	*See, e.g.*, '707 Application at Figs. 4 and 9; ¶¶ 48, 66, 67, 98-103, 106, 117, 118, 148, 150, and 151. "An 'event' refers to one or more objects engaged in an activity. The event may be referenced with respect to a location and/or a time." '707 Application at ¶ 48. "An operator is provided with maximum flexibility in configuring the system by using event

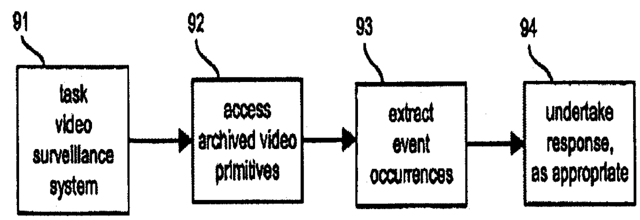
#	Claim Text of the '912 Patent	'707 Application
		discriminators. Event discriminators are identified with one or more objects (whose descriptions are based on video primitives), along with one or more optional spatial attributes, and/or one or more optional temporal attributes. For example, an operator can define an event discriminator (called a "loitering" event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 Application at ¶ 66. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67.  FIG. 4 '707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option,

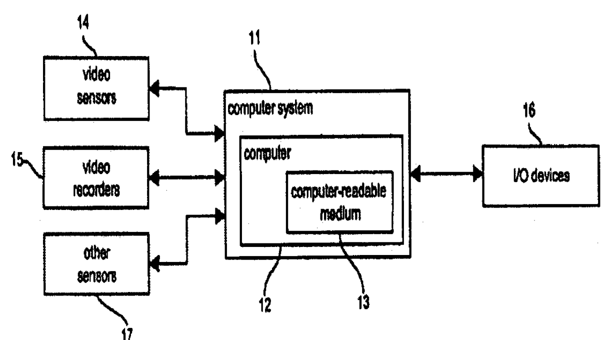
#	Claim Text of the '912 Patent	'707 Application
		non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the

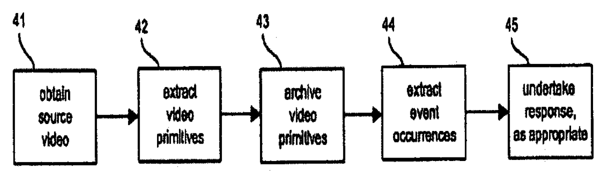
#	Claim Text of the '912 Patent	'707 Application
		invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151. "Examples of an event discriminator for a single object include: an object appears; a person appears; and a red object moves faster than 10 m/s." '707 Application at ¶ 98. "Examples of an event discriminator for multiple objects include: two objects come together; a person exits a vehicle; and a red object moves next to a blue object." '707 Application at ¶ 99. "Examples of an event discriminator for an object and a spatial attribute include: an object crosses a line; an object enters an area; and a person crosses a line from the left." '707 Application at ¶ 100.

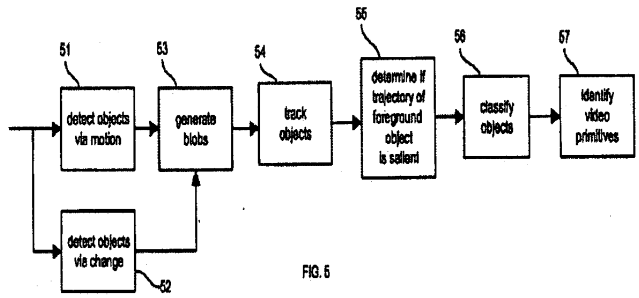
#	Claim Text of the '912 Patent	'707 Application
		"Examples of an event discriminator for an object and a temporal attribute include: an object appears at 10:00 p.m.; a person travels faster then 2 m/s between 9:00 a.m. and 5:00 p.m.; and a vehicle appears on the weekend." '707 Application at ¶ 101. "Examples of an event discriminator for an object, a spatial attribute, and a temporal attribute include: a person crosses a line between midnight and 6:00 a.m.; and a vehicle stops in an area for longer than 10 minutes." '707 Application at ¶ 102. "An example of an event discriminator for an object, a spatial attribute, and a temporal attribute associated with a response include: a person enters an area between midnight and 6:00 a.m., and a security service is notified." '707 Application at ¶ 103.
17	The method of claim 12, wherein the stream of attributes is transmitted over a communications channel without detection of an event at the first location.	*See, e.g.*, '707 Application at Figs. 4 and 9; ¶¶ 48, 66, 67, 106, 117, 118, 148, 150, and 151. "An 'event' refers to one or more objects engaged in an activity. The event may be referenced with respect to a location and/or a time." '707 Application at ¶ 48. "An operator is provided with maximum flexibility in configuring the system by using event discriminators. Event discriminators are identified with one or more objects (whose descriptions are based on video primitives), along with one or more optional spatial attributes, and/or one or more optional temporal attributes. For example, an operator can define an event discriminator (called a "loitering" event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 Application at ¶ 66. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system

#	Claim Text of the '912 Patent	'707 Application
		of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67.  FIG. 4 '707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option, non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an

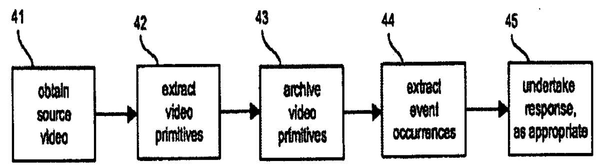
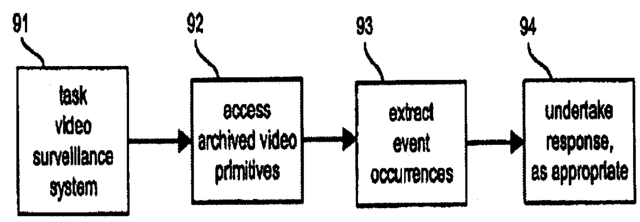
#	Claim Text of the '912 Patent	'707 Application
		event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed,

#	Claim Text of the '912 Patent	'707 Application
		which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.
18	A video device, comprising:	*See, e.g.*, '707 Application at Fig. 1 and ¶¶ 2, 71, and 104.  FIG. 1 '707 Application at Fig. 1. "The invention relates to a system for automatic video surveillance employing video primitives." '707 Application at ¶ 2. "FIG. 1 illustrates a plan view of the video surveillance system of the invention. A computer system 11 comprises a computer 12 having a computer-readable medium 13 embodying software to operate the computer 12 according to the invention. The computer system 11 is coupled to one or more video sensors 14, one or more video recorders 15, and one or more input/output (I/O) devices 16. The video sensors 14 can also be optionally coupled to the video recorders 15 for direct recording of video surveillance data. The computer system is optionally coupled to other sensors 17." '707 Application at ¶ 71.

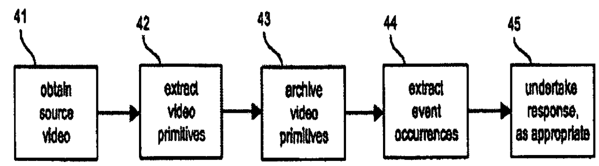
#	Claim Text of the '912 Patent	'707 Application
		"In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.
18	a processor at a first location which analyzes a video to detect an object and to determine attributes of the object detected in the video;	*See, e.g.*, '707 Application at Figs. 4 and 5 and ¶¶ 49, 106-117. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49.  FIG. 4

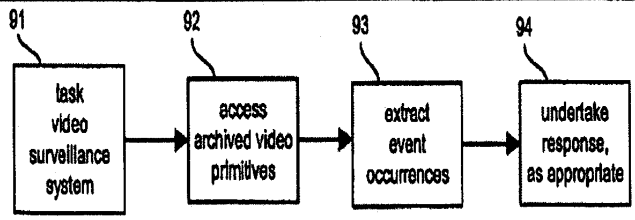
#	Claim Text of the '912 Patent	'707 Application
		'707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option, non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117.  FIG. 5 '707 Application at Fig. 5. "FIG. 5 illustrates a flow diagram for extracting video primitives for the video surveillance system. Blocks 51 and 52 operate in parallel and can be performed in any order or concurrently. In block 51, objects are detected via movement. Any motion detection algorithm for detecting movement between frames at the pixel level can be used for this block. As an example, the three frame differencing technique can be used, which is discussed in {1}. The detected objects are forwarded to block 53." '707 Application at ¶ 107.

#	Claim Text of the '912 Patent	'707 Application
		"In block 57, video primitives are identified using the information from blocks 51-56 and additional processing as necessary. Examples of video primitives identified are the same as those discussed for block 23. As an example, for size, the system can use information obtained from calibration in block 22 as a video primitive. From calibration, the system has sufficient information to determine the approximate size of an object. As another example, the system can use velocity as measured from block 54 as a video primitive." '707 Application at ¶ 116.
18	an output configured to transmit the attributes determined by the processor over a communications link,	*See, e.g.*, '707 Application at Figs. 4 and 9 and ¶¶ 49, 96, 117, and 148. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another

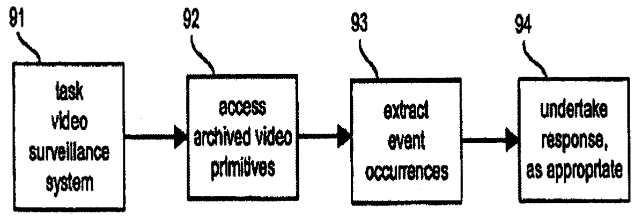
#	Claim Text of the '912 Patent	'707 Application
		computer system." '707 Application at ¶ 96.  FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The

#	Claim Text of the '912 Patent	'707 Application
		video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
18	wherein the output is configured to transmit the attributes to a second location removed from the processor for a subsequent analysis of a combination of the attributes at the second location,	*See, e.g.*, '707 Application at Figs. 4 and 9 and ¶¶ 49, 96, 117, 148, 150, and 151. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system

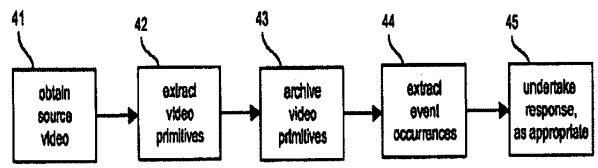
#	Claim Text of the '912 Patent	'707 Application
		via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.  FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118.

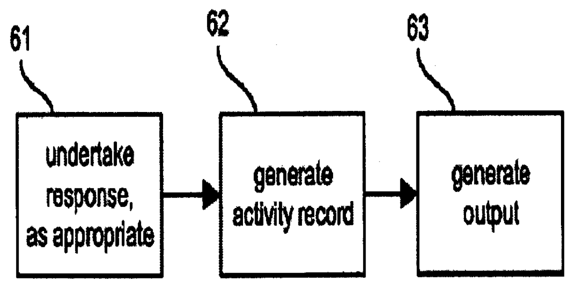
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.

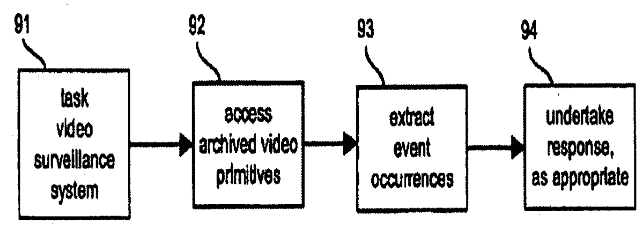
#	Claim Text of the '912 Patent	'707 Application
18	wherein the processor determines attributes independently of a subsequent analysis of a combination of attributes to determine an event that is not one of the determined attributes, and	*See, e.g.*, '707 Application at Fig. 9; ¶¶ 48, 66, 67, 79, 98-103, 148, 150, and 151. "An 'event' refers to one or more objects engaged in an activity. The event may be referenced with respect to a location and/or a time." '707 Application at ¶ 48. "An operator is provided with maximum flexibility in configuring the system by using event discriminators. Event discriminators are identified with one or more objects (whose descriptions are based on video primitives), along with one or more optional spatial attributes, and/or one or more optional temporal attributes. For example, an operator can define an event discriminator (called a "loitering" event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 Application at ¶ 66. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "In block 23 of FIG. 2, the video surveillance system is tasked. Tasking occurs after calibration in block 22 and is optional. Tasking the video surveillance system involves specifying one or more event discriminators. Without tasking, the video surveillance system operates by detecting and archiving video primitives and associated video imagery without taking any action, as in block 45 in FIG. 4." '707 Application at ¶ 79.

#	Claim Text of the '912 Patent	'707 Application
		 FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.

#	Claim Text of the '912 Patent	'707 Application
		"Examples of an event discriminator for a single object include: an object appears; a person appears; and a red object moves faster than 10 m/s." '707 Application at ¶ 98. "Examples of an event discriminator for multiple objects include: two objects come together; a person exits a vehicle; and a red object moves next to a blue object." '707 Application at ¶ 99. "Examples of an event discriminator for an object and a spatial attribute include: an object crosses a line; an object enters an area; and a person crosses a line from the left." '707 Application at ¶ 100. "Examples of an event discriminator for an object and a temporal attribute include: an object appears at 10:00 p.m.; a person travels faster then 2 m/s between 9:00 a.m. and 5:00 p.m.; and a vehicle appears on the weekend." '707 Application at ¶ 101. "Examples of an event discriminator for an object, a spatial attribute, and a temporal attribute include: a person crosses a line between midnight and 6:00 a.m.; and a vehicle stops in an area for longer than 10 minutes." '707 Application at ¶ 102. "An example of an event discriminator for an object, a spatial attribute, and a temporal attribute associated with a response include: a person enters an area between midnight and 6:00 a.m., and a security service is notified." '707 Application at ¶ 103.
18	wherein the attributes are sufficient to allow detection of an event to provide at least one of an alert to a user, information for a report and an instruction for taking an action, the event not being one of the determined	*See, e.g.*, '707 Application at Figs. 3, 4, 6, and 9; ¶¶ 96, 97, 104, 117-124, and 148-151. "In block 24 of FIG. 2, the video surveillance system is operated. The video surveillance system of the invention operates automatically, detects and archives video primitives of objects in the scene, and detects event occurrences in real time using event discriminators. In addition, action is taken in real time, as appropriate, such as activating alarms, generating reports, and generating output. The reports and output can be displayed and/or stored locally

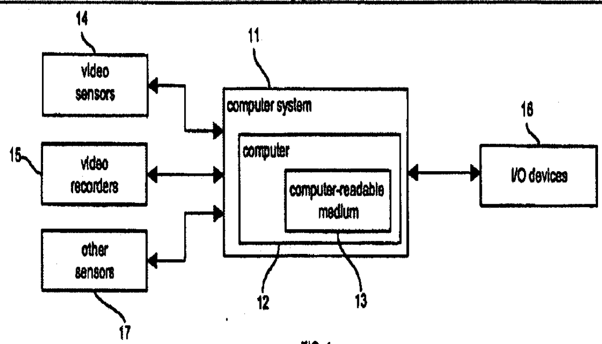
#	Claim Text of the '912 Patent	'707 Application
	attributes and being determinable by analyzing the combination of the attributes,	to the system or elsewhere via a network, such as the Internet. FIG. 4 illustrates a flow diagram for operating the video surveillance system." '707 Application at ¶ 104.  FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a 'wrong' direction of motion." '707 Application at ¶ 118. "In block 45, action is taken for each event occurrence extracted in block 44, as appropriate. FIG. 6 illustrates a flow diagram for taking action with the video surveillance system." '707 Application at ¶ 119.

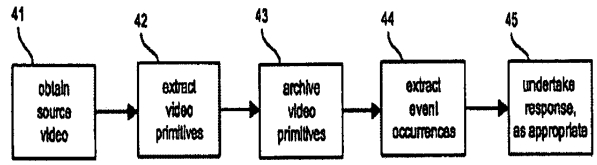
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 6 '707 Application at Fig. 6. "In block 61, responses are undertaken as dictated by the event discriminators that detected the event occurrences. The response, if any, are identified for each event discriminator in block 34." '707 Application at ¶ 120. "In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96. "In block 35, one or more discriminators are identified by describing interactions between video primitives (or their abstractions), spatial areas of interest, and temporal attributes of interest. An interaction is determined for a combination of one or more objects identified in

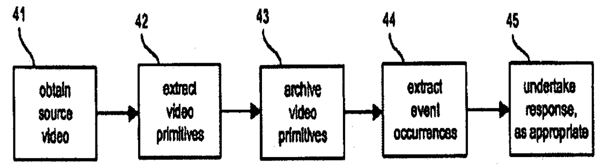
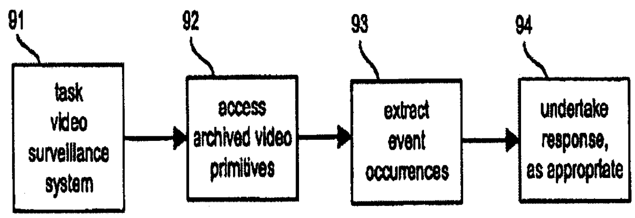
#	Claim Text of the '912 Patent	'707 Application
		block 31, one or more spatial areas of interest identified in block 32, and one or more temporal attributes of interest identified in block 33. One or more responses identified in block 34 are optionally associated with each event discriminator." '707 Application at ¶ 97. "In block 62, an activity record is generated for each event occurrence that occurred. The activity record includes, for example: details of a trajectory of an object; a time of detection of an object; a position of detection of an object, and a description or definition of the event discriminator that was employed. The activity record can include information, such as video primitives, needed by the event discriminator. The activity record can also include representative video or still imagery of the object(s) and/or area(s) involved in the event occurrence. The activity record is stored on a computer-readable medium." '707 Application at ¶ 121. "In block 63, output is generated. The output is based on the event occurrences extracted in block 44 and a direct feed of the source video from block 41. The output is stored on a computer-readable medium, displayed on the computer system 11 or another computer system, or forwarded to another computer system. As the system operates, information regarding event occurrences is collected, and the information can be viewed by the operator at any time, including real time. Examples of formats for receiving the information include: a display on a monitor of a computer system; a hard copy; a computer-readable medium; and an interactive web page." '707 Application at ¶ 122.  FIG. 9 '707 Application at Fig. 9.

#	Claim Text of the '912 Patent	'707 Application
		"FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150. "Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.
18	wherein the attributes are sufficient to allow detection of an event without reprocessing the video of the first location.	*See, e.g.*, '707 Application at ¶¶ 67 and 148. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and

#	Claim Text of the '912 Patent	'707 Application
		thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of the computer system." '707 Application at ¶ 67. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
19	The video device of claim 18, further comprising: a video capture apparatus to provide the video to the processor.	*See, e.g.*, '707 Application at Figs. 1 and 4 and ¶¶ 71, 72, and 105.

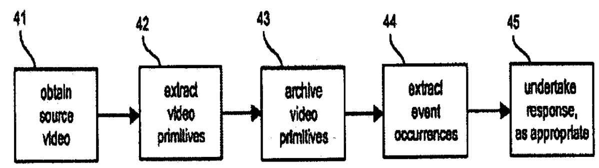
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 1 '707 Application at Fig. 1. "FIG. 1 illustrates a plan view of the video surveillance system of the invention. A computer system 11 comprises a computer 12 having a computer-readable medium 13 embodying software to operate the computer 12 according to the invention. The computer system 11 is coupled to one or more video sensors 14, one or more video recorders 15, and one or more input/output (I/O) devices 16. The video sensors 14 can also be optionally coupled to the video recorders 15 for direct recording of video surveillance data. The computer system is optionally coupled to other sensors 17." '707 Application at ¶ 71. "The video sensors 14 provide source video to the computer system 11. Each video sensor 14 can be coupled to the computer system 11 using, for example, a direct connection (e.g., a firewire digital camera interface) or a network. The video sensors 14 can exist prior to installation of the invention or can be installed as part of the invention. Examples of a video sensor 14 include: a video camera; a digital video camera; a color camera; a monochrome camera; a camera; a camcorder, a PC camera; a webcam; an infra-red video camera; and a CCTV camera." '707 Application at ¶ 72.

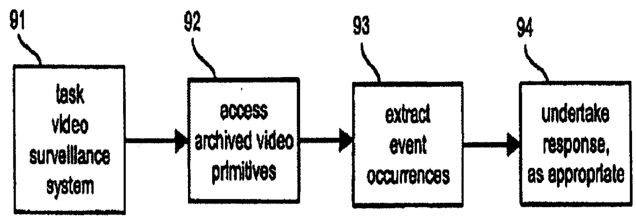
#	Claim Text of the '912 Patent	'707 Application
		 FIG. 4 '707 Application at Fig. 4. "In block 41, the computer system 11 obtains source video from the video sensors 14 and/or the video recorders 15." '707 Application at ¶ 105.
20	The video device of claim 18, wherein the output transmits a stream of the detected attributes over the communications link.	*See, e.g.*, '707 Application at Figs. 4 and 9 and ¶¶ 49, 117, and 148. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49.

#	Claim Text of the '912 Patent	'707 Application
		 FIG. 4 '707 Application at Fig. 4. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not

#	Claim Text of the '912 Patent	'707 Application
		reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148.
21	The video device of claim 20, wherein the communications link comprises a network.	*See, e.g.*, '707 Application at ¶¶ 49, 53, and 96. "A 'computer' refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network." '707 Application at ¶ 49. "A "network" refers to a number of computers and associated devices that are connected by communication facilities. A network involves permanent connections such as cables or temporary connections such as those made through telephone or other communication links. Examples of a network include: an internet, such as the Internet; an intranet; a local area network (LAN); a wide area network (WAN); and a combination of networks, such as an internet and an intranet." '707 Application at ¶ 53.

#	Claim Text of the '912 Patent	'707 Application
		"In block 34, a response is optionally identified. Examples of a response includes the following: activating a visual and/or audio alert on a system display; activating a visual and/or audio alarm system at the location; activating a silent alarm; activating a rapid response mechanism; locking a door; contacting a security service; forwarding data (e.g., image data, video data, video primitives; and/or analyzed data) to another computer system via a network, such as the Internet; saving such data to a designated computer-readable medium; activating some other sensor or surveillance system; tasking the computer system 11 and/or another computer system; and directing the computer system 11 and/or another computer system." '707 Application at ¶ 96.
22	The video device of claim 18, wherein the attributes are transmitted over the communications channel without detection of an event by the processor.	*See, e.g.*, '707 Application at Figs. 4 and 9; ¶¶ 66, 67, 106, 117, 118, 148, 150, and 151. "An operator is provided with maximum flexibility in configuring the system by using event discriminators. Event discriminators are identified with one or more objects (whose descriptions are based on video primitives), along with one or more optional spatial attributes, and/or one or more optional temporal attributes. For example, an operator can define an event discriminator (called a "loitering" event in this example) as a 'person' object in the 'automatic teller machine' space for 'longer than 15 minutes' and 'between 10:00 p.m. and 6:00 a.m.'" '707 Application at ¶ 66. "Although the video surveillance system of the invention draws on well-known computer vision techniques from the public domain, the inventive video surveillance system has several unique and novel features that are not currently available. For example, current video surveillance systems use large volumes of video imagery as the primary commodity of information interchange. The system of the invention uses video primitives as the primary commodity with representative video imagery being used as collateral evidence. The system of the invention can also be calibrated (manually, semi-automatically, or automatically) and thereafter automatically can infer video primitives from video imagery. The system can further analyze previously processed video without needing to reprocess completely the video. By analyzing previously processed video, the system can perform inference analysis based on previously recorded video primitives, which greatly improves the analysis speed of

#	Claim Text of the '912 Patent	'707 Application
		the computer system." '707 Application at ¶ 67.  FIG. 4 '707 Application at Fig. 4. "In block 42, video primitives are extracted in real time from the source video. As an option, non-video primitives can be obtained and/or extracted from one or more other sensors 17 and used with the invention. The extraction of video primitives is illustrated with FIG. 5." '707 Application at ¶ 106. "In block 43, the video primitives from block 42 are archived. The video primitives can be archived in the computer-readable medium 13 or another computer-readable medium. Along with the video primitives, associated frames or video imagery from the source video can be archived." '707 Application at ¶ 117. "In block 44, event occurrences are extracted from the video primitives using event discriminators. The video primitives are determined in block 42, and the event discriminators are determined from tasking the system in block 23. The event discriminators are used to filter the video primitives to determine if any event occurrences occurred. For example, an event discriminator can be looking for a 'wrong way' event as defined by a person traveling the 'wrong way' into an area between 9:00 a.m. and 5:00 p.m. The event discriminator checks all video primitives being generated according to FIG. 5 and determines if any video primitives exist which have the following properties: a timestamp between 9:00 a.m. and 5:00 p.m., a classification of 'person' or 'group of people', a position inside the area, and a

#	Claim Text of the '912 Patent	'707 Application
		'wrong' direction of motion." '707 Application at ¶ 118.  FIG. 9 '707 Application at Fig. 9. "FIG. 9 illustrates an additional flow diagram for the video surveillance system of the invention. In this additional embodiment, the system analyses archived video primitives with event discriminators to generate additional reports, for example, without needing to review the entire source video. Anytime after a video source has been processed according to the invention, video primitives for the source video are archived in block 43 of FIG. 4. The video content can be reanalyzed with the additional embodiment in a relatively short time because only the video primitives are reviewed and because the video source is not reprocessed. This provides a great efficiency improvement over current state-of-the-art systems because processing video imagery data is extremely computationally expensive, whereas analyzing the small-sized video primitives abstracted from the video is extremely computationally cheap. As an example, the following event discriminator can be generated: "The number of people stopping for more than 10 minutes in area A in the last two months." With the additional embodiment, the last two months of source video does not need to be reviewed. Instead, only the video primitives from the last two months need to be reviewed, which is a significantly more efficient process." '707 Application at ¶ 148. "In block 92, archived video primitives are accessed. The video primitives are archived in block 43 of FIG. 4." '707 Application at ¶ 150.

#	Claim Text of the '912 Patent	'707 Application
		"Blocks 93 and 94 are the same as blocks 44 and 45 in FIG. 4." '707 Application at ¶ 151.

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Exhibit Z3

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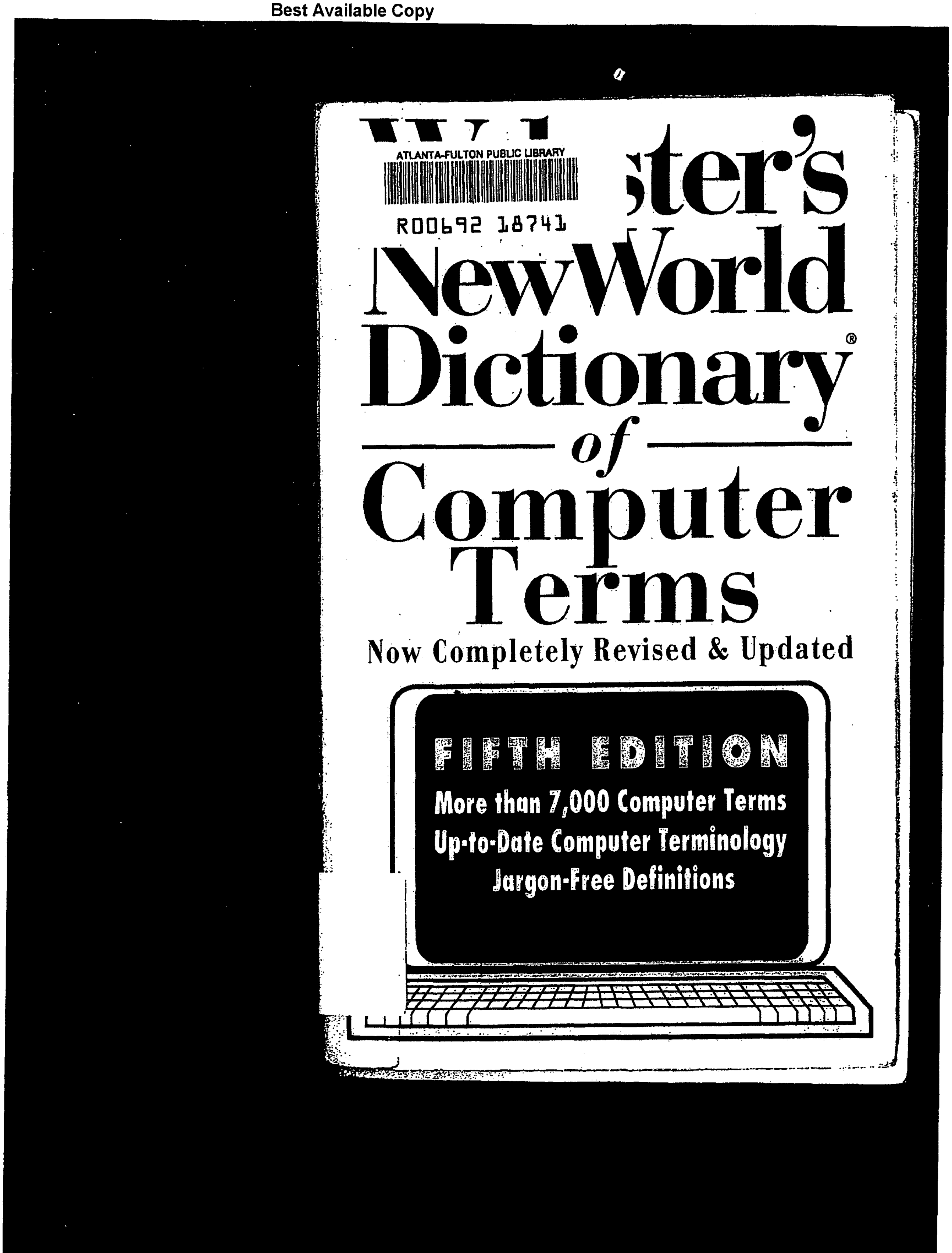

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Fifth Edition

atomic operation An operation that cannot be divided into smaller operations.

attach To connect a peripheral to a computer to increase its capacity.

attachment A device or feature attached to a processing unit.

attack In COMPUTER SECURITY, an attempt to violate data security.

attention key A terminal function key that, when pressed, causes an input-output interruption in the processing unit.

attenuation A decrease in the strength of a signal as it passes through a control system.

atto A prefix meaning one quintillionth, or a billionth of a billionth, as in 10^{-18}. Abbreviated as *a*.

attribute **(1)** The manner in which a variable is handled by the computer. **(2)** A characteristic quality of a data type, data structure, element of a data model, or system. **(3)** A feature of a device. **(4)** A column of a relation in a relational database.

audio Sound that can be heard by a human (15 to 20,000 Hz).

audio device Any computer device that accepts and/or produces sound.

audio output Computer output generated through voice synthesizers that create audible signals resembling a human voice.

audio-response device A device that converts data in internal storage to vocalized sounds understandable to humans. Also called a voice output unit or voice synthesizer.

audiovisual Pertaining to nonprint materials—such as films, tapes, and cassettes—that record information by sound and/or sight.

audiovisual program A COMPUTER PROGRAM that makes use of both images and sound.

audit **(1)** An inspection used to determine whether a system or procedure is working as it should or if a claimed amount is correct. **(2)** To review the activities of a DATA PROCESSING SYSTEM.

EXHIBIT

Z4

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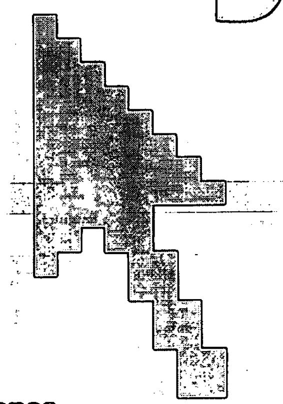

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maintains order as network users request files and make changes to them. To deal with the tasks of handling multiple—sometimes simultaneous—requests for files, a file server contains a processor and controlling software as well as a disk drive for storage. On local area networks, a file server is often a computer with a large hard disk that is dedicated only to the task of managing shared files. *Compare* disk server.

file sharing *n.* The use of computer files on networks, wherein files are stored on a central computer or a server and are requested, reviewed, and modified by more than one individual. When a file is used with different programs or different computers, file sharing can require conversion to a mutually acceptable format. When a single file is shared by many people, access can be regulated through such means as password protection, security clearances, or file locking to prohibit changes to a file by more than one person at a time.

file size *n.* The length of a file, typically given in bytes. A computer file stored on disk actually has two file sizes, logical size and physical size. The logical file size corresponds to the file's actual size—the number of bytes it contains. The physical size refers to the amount of storage space allotted to the file on disk. Because space is set aside for a file in blocks of bytes, the last characters in the file might not completely fill the block (allocation unit) reserved for them. When this happens, the physical size is larger than the logical size of the file.

filespec *n. See* file specification (definition 1).

file specification *n.* **1.** Abbreviated filespec. The path to a file, from a disk drive through a chain of directory files to the filename that serves to locate a particular file. **2.** A filename containing wildcard characters that indicate which files among a group of similarly named files are requested. **3.** A document that describes the organization of data within a file.

file structure *n.* A description of a file or group of files that are to be treated together for some purpose. Such a description includes file layout and location for each file under consideration.

file system *n.* In an operating system, the overall structure in which files are named, stored, and organized. A file system consists of files, directories, or folders, and the information needed to locate and access these items. The term can also refer to the portion of an operating system that translates requests for file operations from an application program into low-level, sector-oriented tasks that can be understood by the drivers controlling the disk drives. *See also* driver.

file transfer *n.* The process of moving or transmitting a file from one location to another, as between two programs or over a network.

File Transfer Protocol *n. See* FTP[1] (definition 1).

file type *n.* A designation of the operational or structural characteristics of a file. A file's type is often identified in the filename, usually in the filename extension. *See also* file format.

F

fill[1] *n.* In computer graphics, the colored or patterned "paint" inside an enclosed figure, such as a circle. The portion of the shape that can be colored or patterned is the fill area. Drawing programs commonly offer tools for creating filled or nonfilled shapes; the user can specify color or pattern.

fill[2] *vb.* To add color or a pattern to the enclosed portion of a circle or other shape.

film at 11 A phrase sometimes seen in newsgroups. An allusion to a brief newsbreak on TV that refers to a top news story that will be covered in full on the 11 o'clock news, it is used sarcastically to ridicule a previous article's lack of timeliness or newsworthiness. *See also* newsgroup.

film recorder *n.* A device for capturing on 35-mm film the images displayed on a computer screen.

film ribbon *n. See* carbon ribbon.

filter *n.* **1.** A program or set of features within a program that reads its standard or designated input, transforms the input in some desired way, and then writes the output to its standard or designated output destination. A database filter, for example, might flag information of a certain age. **2.** In communications and electronics, hardware or software that selectively passes certain elements of a signal and eliminates or minimizes others. A filter on a communications network, for example, must be designed to transmit a certain frequency but attenuate (dampen) frequencies above it (a lowpass filter), those below it (a highpass filter), or those above and below it (a bandpass filter). **3.** A pattern or mask through which data is passed to weed out specified items. For instance, a filter used in e-mail or in retrieving newsgroup messages can allow users to filter out messages from other users. *See also* e-mail filter, mask. **4.** In computer graphics, a special effect or production effect that is applied to bitmapped images; for example, shifting pixels within an image, making elements of the image transparent, or distorting the image. Some filters are built into a graphics program, such as a paint program or an image editor. Others are separate software packages that plug into the graphics program. *See also* bitmapped graphics, image editor, paint program.

filtering program *n.* A program that filters information and presents only results that match the qualifications defined in the program.

F

FilterKeys *n.* A Windows 9x accessibility control panel feature that enables users with physical disabilities to use the keyboard. With FilterKeys, the system ignores brief and repeated keystrokes that result from slow or inaccurate finger movements. *See also* accessibility. *Compare* MouseKeys, ShowSounds, SoundSentry, StickyKeys, ToggleKeys.

Final-Form-Text DCA *n.* A standard in Document Content Architecture (DCA) for storing documents in ready-to-print form for interchange between dissimilar programs. A related standard is Revisable-Form-Text DCA (RFTDCA). *Acronym:* FFTDCA. *See also* DCA (definition 1). *Compare* Revisable-Form-Text DCA.

find *vb. See* search[2].

Finder *n.* The standard interface to the Macintosh operating system. The Finder allows the user to view the contents of directories (folders); to move, copy, and delete files; and to launch applications. Items in the system are often represented as icons, and a mouse or similar pointing device is used to manipulate these items. The Finder was the first commercially successful graphical user interface, and it helped launch a wave of interest in icon-based systems. *See also* MultiFinder.

finger[1] *n.* An Internet utility, originally limited to UNIX but now available on many other platforms, that enables a user to obtain information on other users who may be at other sites (if those sites permit access by finger). Given an e-mail address, finger returns the user's full name, an indication of whether or not the user is currently logged on, and any other information the user has chosen to supply as a profile. Given a first or last name, finger returns the logon names of users whose first or last names match.

finger[2] *vb.* To obtain information on a user by means of the finger program.

fingerprint reader *n.* A scanner that reads human fingerprints for comparison to a database of stored fingerprint images.

fingerprint recognition *n.* A technology used to control access to a computer, network, or other device or to a secure area through a user's fingerprints. The patterns of an individual's fingers are scanned by a fingerprint reader or similar device and matched with stored images of fingerprints before access is granted. *See also* biometric.

FIPS \fips\ *n. See* Federal Information Processing Standards.

FIPS 140-1 *n.* Acronym for Federal Information Processing Standard 140-1. A U.S. government standard, issued by the National Institute of Standards and Technology (NIST), entitled Security Requirements for Cryptographic Modules. FIPS 140-1 defines four levels of security requirements related to cryptographic hardware and software modules within computer and telecommunications systems used for sensitive but unclassified data. The four security levels range from basic module design through increasingly stringent levels of physical security. The standard covers such security-related features as hardware and software security, cryptographic algorithms, and management of encryption keys. FIPS 140-1 products can be validated for federal use in both the United States and Canada after independent testing under the Cryptographic Module Validation (CMV) Program, developed and jointly adopted by NIST and the Canadian Communication Security Establishment. *See also* cryptography.

firewall *n.* A security system intended to protect an organization's network against external threats, such as hackers, coming from another network, such as the Internet. Usually a combination of hardware and software, a firewall prevents computers in the organization's network from communicating directly with computers external to the network and vice versa. Instead, all communication is routed through a proxy server outside of the organization's network, and the proxy server decides whether it is safe to let a particular message or file pass through to the organization's network. *See also* proxy server.

FireWire *n.* A high-speed serial bus from Apple that implements the IEEE 1394 standard. *See also* IEEE 1394.

firmware *n.* S
memory (RO
(RAM), read-
absence of el
low-level inp
ware. It falls
of ease of mo

FIR port \F I-
A wireless I/
computer tha
vice using in
output port.

FIRST \fərst\
sponse and S
the Internet S
CERT in ord
a unified resp
Internet Soci

first-generatio

first in, first o
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which they w
Such an orde
ing to be prin
Compare last

first normal fo

fitting *n.* The
most closely
measurement

FIX \fiks\ *n.* A
A connection
various intern
eral Internet E
View, Califor
Maryland. To
MILNET, ES
ment of Energ
Internet) with
1), MILNET.

fixed disk *n.* S

fixed-length fie
field whose si
stant. A fixed-
amount of spa
data stored in
length field.

quartz crystal *n.* A precisely shaped and precisely sized piece of the mineral quartz, used for its piezoelectric properties. When a voltage is applied to a quartz crystal, it vibrates at a frequency determined by its size and shape. Quartz crystals are commonly used to control the frequency of oscillator circuits such as the clocks in microcomputers. *See also* piezoelectric.

quasi-language *n.* A derogatory term for any programming language that, because of deficiencies, is not suitable for any serious work.

query[1] *n.* A specific set of instructions for extracting particular data.

query[2] *vb.* To extract data from a database and present it for use.

query by example *n.* A simple-to-use query language implemented on several relational database management systems. Using query by example, the user specifies fields to be displayed, intertable linkages, and retrieval criteria directly onto forms displayed on the screen. These forms are a direct pictorial representation of the table and row structures that make up the database. Thus, the construction of a query becomes a simple "checkoff" procedure from the viewpoint of the user. *Acronym:* QBE.

query language *n.* A subset of the data manipulation language; specifically, that portion relating to the retrieval and display of data from a database. It is sometimes used loosely to refer to the entire data manipulation language. *See also* data manipulation language.

Q

question mark *n. See* ?.

queue \kyōō\ *n.* A multi-element data structure from which (by strict definition) elements can be removed only in the same order in which they were inserted; that is, it follows a first in, first out (FIFO) constraint. There are also several types of queues in which removal is based on factors other than order of insertion—for example, some priority value assigned to each element. *See also* deque, element (definition 1). *Compare* stack.

queued access method *n.* A programming technique that minimizes input/output delays by synchronizing the transfer of information between the program and the computer's input and output devices. *Acronym:* QAM.

QuickDraw *n.* On the Macintosh, the built-in group of routines within the operating system that control the display of graphics and text. Application programs call QuickDraw for on-screen displays. *See also* Toolbox.

QuickDraw 3-D *n.* A version of the Macintosh QuickDraw library that includes routines for doing 3-D graphics calculations. *See also* QuickDraw.

quicksort *n.* An efficient sort algorithm, described by C.A.R. Hoare in 1962, in which the essential strategy is to "divide and conquer." A quicksort begins by scanning the list to be sorted for a median value. This value, called the *pivot*, is then moved to its final position in the list. Next, all items in the list whose values are less than the pivot value are moved to one side of the list, and the items with values greater than the pivot value are moved to the other side. Each resulting side is sorted the same way, until a fully sorted list results. *See also* sort algorithm. *Compare* bubble sort, insertion sort, merge sort.

QuickTime *n.* Software components developed by Apple for creating, editing, publishing, and viewing multimedia content. QuickTime, which supports video, animation, graphics, 3D, VR (virtual reality), MIDI, music, sound, and text, has been part of the Mac OS since version 7 of the operating system and is used in many Macintosh applications. Windows applications can also run QuickTime files, but require the installation of special player software. QuickTime is often used on the Web to provide Web pages with video and animation. Most Web browsers support plug-ins for running these types of files. QuickTime is also part of the new MPEG-4 specification. *See also* MPEG-4.

Quick View *n.* A feature, optionally installed as part of Windows 9x, that provides a set of file viewers for previewing the contents of files without having to start the application(s) that created them. The feature is accessed through the Quick View command, available either from the File menu or by right-clicking a filename. If the feature has been installed but the file type is not supported by a viewer, the Quick View command does not appear.

quit[1] *n.* 1. An FTP command that instructs the server to drop the current connection with the client from which it received the command. 2. A command in many applications for exiting the program.

quit[2] *vb.* 1. To st
ecute the norma
control to the o
bomb[2], crash[2] (c

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Contents

filling fraction *See:* filling factor.

fill light (illuminating engineering) Supplementary illumination used to reduce shadow or contrast. (EEC/IE) [126]

film (1) (rotating machinery) Sheeting having a nominal thickness not greater than 0.030 centimeters and being substantially homogeneous in nature. *See also:* electrochemical valve; direct-current commutating machine; asynchronous machine. (PE) [9]
(2) (electrochemical valve) The layer adjacent to the valve metal and in which is located the high-potential drop when current flows in the direction of high impedance. *See also:* electrochemical valve. (PE/EEC) [119]

film frame In micrographics, a line on microfilm, perpendicular to the document reference edge, on which binary characters may be written or read. (C) 610.2-1987

film integrated circuit An integrated circuit whose elements are films formed in situ upon an insulating substrate. *Note:* To further define the nature of a film integrated circuit, additional modifiers may be prefixed. Examples are: thin-film integrated circuit, and thick-film integrated circuit. *See also:* magnetic thin film; integrated circuit; electrochemical valve; thin film. (ED) 274-1966w, [46]

film storage *See:* magnetic thin film storage.

FILO *See:* first-in, last-out.

filter (1) (wave filter) A transducer for separating waves on the basis of their frequency. *Note:* A filter introduced relatively small insertion loss to waves in one or more frequency bands and relatively large insertion loss to waves of other frequencies. (SP) 151-1965w
(2) (A) A device or program that separates data, signals, or material in accordance with specified criteria. (B) A mask. (C) [20], [85]
(3) (illuminating engineering) A device for changing, by transmission or reflection, the magnitude or the spectral composition, or both, of the flux incident upon it. Filters are called selective (or colored) or neutral, according to whether or not they alter the spectral distribution of the incident flux. (EEC/IE) [126]
(4) (broadband local area networks) A circuit that selects or rejects one or more components of a signal related to frequency. (LM/C) 802.7-1989r
(5) A generic term used to describe those types of equipment whose purpose is to reduce the harmonic current or voltage flowing in or being impressed upon specific parts of an electrical power system, or both. (IA/SPC) 519-1992
(6) A command whose operation consists of reading data from standard input or a list of input files and writing data to standard output. Typically, the function of a filter is to perform some transformation on the data stream. (C/PA) 9945-2-1993
(7) (A) A circuit that eliminates certain portions of a signal, by frequency, voltage, or some other parameter. (B) A mathematical model which performs the same function on a summed version of the signal. *Synonym:* mask. (C) 610.10-1994
(8) An assertion about the presence or value of certain attributes of an entry in order to limit the scope of a search. (C/PA) 1328.2-1993w, 1224.2-1993w, 1326.2-1993w, 1327.2-1993w
(9) *See also:* low-pass filter; band-pass filter; high-pass filter. (PE) 599-1985w

filter, active *See:* active filter.

filter, all-pass *See:* all-pass filter.

filter attenuation band (filter stop band) A continuous range of frequencies over which the filter introduces an insertion loss whose minimum value is greater than a specific value. (CAS) [13]

filter, band-elimination *See:* band-elimination filter.

filter bank A contiguous set of filters covering the Doppler frequency range of interest, used to separate moving targets, commonly used in continuous wave (CW) and pulsed-Doppler radars and in the moving target detector (MTD) for detecting moving targets in clutter. (AES) 686-1997

filter, Butterworth *See:* Butterworth filter.

filter capacitor A capacitor used as an element of an electric wave filter. *See also:* electronic controller. (IA/IAC) [60]

filter capacitors Capacitors utilized with inductors and/or resistors for controlling harmonic problems in the power system, such as reducing voltage distortion due to large rectifier loads or arc furnaces power systems, relaying. (T&D/PE) 1036-1992, C37.99-2000

filter, Chebyshev *See:* Chebyshev filter.

filter, comb *See:* comb filter.

filter, damped *See:* damped filter.

filter effectiveness (shunt) Defined by the following two terms:

ρ_f = the impedance ratio that determines the per unit current that will flow into the shunt filter

ρ_s = the impedance ratio that determines the per unit current that will flow into the power source

ρ_f should approach unity and ρ_s should be very small at the tuned frequency. (IA/SPC) 519-1992

filter factor (illuminating engineering) The transmittance of "black light" by a filter. *Note:* The relationship among these terms is illustrated by the following formula for determining the luminance of fluorescent materials exposed to "black light":

candelas per square meter

$$= \frac{1}{\pi^*} \frac{\text{fluorens}}{\text{square meter}} \times \text{glow factor} \times \text{filter factor}$$

*π is omitted when luminance is in footlamberts and the area is in square feet. When integral-filter "black light" lamps are used, the filter factor is dropped from the formula because it already has been applied in assigning fluoren ratings to these lamps. (EEC/IE) [126]

filter, high-pass *See:* high-pass filter.

filter impedance compensator An impedance compensator that is connected across the common terminals of electric wave filters when the latter are used in parallel in order to compensate for the effects of the filters on each other. *See also:* network analysis; filter. (Std100) 270-1966w

filter inductor An inductor used as an element of an electric wave filter. *See also:* electronic controller. (IA/IAC) [60]

filter, low-pass *See:* low-pass filter.

filter matching loss The loss in output signal-to-noise ratio relative to a matched filter, caused by using a filter whose response is not matched to the transmitted signal. (AES/RS) 686-1990

filter mismatch loss The loss in output signal-to-noise ratio of a filter relative to the signal-to-noise ratio from a matched filter. *Note:* Filter mismatch loss is caused by using a filter whose response is not matched to the transmitted signal. (AES) 686-1997

filter pass band A frequency band of low attenuation (low relative to other regions termed stop bands). *See also:* filter transmission band. (CAS) [13]

filter, passive *See:* passive filter.

filter reactor (power and distribution transformers) A reactor used to reduce harmonic voltage in alternating-current or direct-current circuits. *See also:* reactor. (PE/TR) C57.12.80-1978r, [57]

filter, rejection *See:* rejection filter; filter.

filters (power supplies) Resistance-capacitance or inductance-capacitance networks arranged as low-pass devices to attenuate the varying component that remains when alternating-current voltage is rectified. *Note:* In power supplies without subsequent active series regulators, the filters determine the amount of ripple that will remain in the direct-current output. In supplies with active feedback series regulators, the regulator mainly controls the ripple, with output filtering serving

standard illuminant B (illuminating engineering) A representation of noon sunlight with a correlated color temperature of approximately 4900 K. It is defined by its relative spectral power distribution over the range from 320 nm to 770 nm. *Note:* It is anticipated that at some future date, that is yet to be decided, illuminant B will be dropped from the list of recommended standard illuminants. (EEC/IE) [126]

standard illuminant C (illuminating engineering) A representation of daylight having a correlated color temperature of approximately 6800 K. It is defined by its relative spectral power distribution over the range from 320 nm to 770 nm. *Note:* It is anticipated that at some future date, that is yet to be decided, illuminant C will be dropped from the list of recommended standard illuminants. (EEC/IE) [126]

standard illuminant D65 (illuminating engineering) A representation of daylight at a correlated color temperature of approximately 6500 K. It is defined by its relative spectral power distribution over the range from 300 nm to 830 nm. *Note:* At present, no artificial source for matching this illuminant has been recommended. (EEC/IE) [126]

standard input An input stream usually intended to be used for primary data input. (C/PA) 9945-2-1993

standard insulation class (instrument transformers) Denotes the maximum voltage in kilovolts that the insulation of the primary winding is designed to withstand continuously. *See also:* instrument transformer. (ELM) C12.1-1982s

standardization *See:* laboratory reference standards; echelon; laboratory working standards.

standardization coefficient A factor used for the direct conversion of a net area counting rate of a gamma-ray peak of a given energy, *E*, and from a specific radionuclide, *i*, to the activity of that radionuclide. (NI) N42.14-1991

standardize *See:* check; normalize.

standardized profile A balloted, formal, harmonized document that specifies a profile. (C/PA) 14252-1996

standard language Any language that conforms to an existing language standard. For example, ALGOL 60 and ALGOL 68 are considered standard languages. (C) 610.13-1993w, 610.10-1994w

standard lightning impulse (1) **(power and distribution transformers)** An impulse that rises to crest value of voltage in 1.2 μs (virtual time) and drops to 0.5 crest value of voltage in 50 μs (virtual time), both times being measured from the same origin and in accordance with established standards of impulse testing techniques. It is described as a 1.2/50 μs impulse. *Note:* The virtual value for the duration of the wavefront is 1.67 times the time taken by the voltage to increase from 30% to 90% of its crest value. The origin from which time is measured is the intersection with the zero axis of a straight line drawn through points on the front of the voltage wave at 30% and 90% crest value. (PE/TR) C57.12.80-1978r

(2) A full lightning impulse having a virtual front time of 1.2 μs and a virtual time to half-value of 50 μs. (PE/PSIM) 4-1995

(3) The wave shape of the standard impulse used is 1.2/50 μs (when not in conflict with products standards). (SPD/PE) C62.22-1997

(4) A unidirectional surge having a 30–90% equivalent rise time of 1.2 μs and a time to half value of 50 μs. (PE/T&D) 1243-1997

standard lightning impulse voltage shape An impulse that rises to crest value of voltage in 1.2 μs (virtual time) and drops to 0.5 crest value of voltage in 50 μs (virtual time), both times being measured from the same origin and in accordance with established standards of impulse testing techniques. It is described as a 1.2/50 impulse. (PE/C) 1313.1-1996

standard logic type The type STD_ULOGIC defined by IEEE Std 1164-1993, or any type derived from it, including, in particular, one-dimensional arrays of STD_U[...] one of its subtypes. (C/DA) [...]

standard loop input signals (A) (amplitude-[...] broadcast receivers) A "distant-signal" loop [...] as 86 dB below 1 V/m, or 5 000 μV/m (B) [...] modulation broadcast receivers) A "mean-[...] put is taken as 46 dB below 1 V/m or 5[...] (C) (amplitude-modulation broadcast receivers) [...] signal" loop input is taken a 26 dB below 1 V[...] μV/m. (D) (amplitude-modulation broadcast [...] "strong-signal" loop input is taken as 14 dB [...] 200 000 μV/m. *Note:* The above loop field [...] equivalent to the standard antenna input voltage [...] responding class of service. For example, the [...] voltage for antenna operation is 5 000 μV [...] to a field intensity if 1 250 μV/m assuming [...] meter antenna, whereas the mean-signal voltage [...] ceivers is arbitrarily taken as 5 000 μV/m. (C[...]

standard maximum usable frequency *See:* maximum [...] frequency.

standard M gradient *See:* refractive index gradient.

standard microphone A microphone the response [...] accurately known for the condition under which [...] used. *See also:* instrument. (EEC[...]

standard N gradient *See:* standard refractive index [...]

standard noise temperature (interference terminology) [...] temperature used in evaluating signal transmission [...] for noise factor 290 K (27°C). *See also:* interference [...]

standard observer (television) (color) (CIE 1931) [...] radiation whose colorimetric characteristics correspond [...] distribution coefficients $\bar{x}_\lambda$, $\bar{y}_\lambda$, $\bar{z}_\lambda$ adopted by the International Commission on Illumination (CIE) in 1931. (BT/AV) 2[...]

standard operating duty *See:* operating duty.

standard output An output stream usually intended [...] for primary data output. (C/PA) 99[...]

standard pitch *See:* standard tuning frequency.

standard potential (standard electrode potential) [...] ible potential for an electrode process when all [...] reactants are at unit activity on a scale in which the [...] for the standard hydrogen half-cell is zero. (GSD) [...]

standard power-frequency short-duration voltage [...] sinusoidal voltage with frequency between 48 Hz [...] and duration of 60 s. *Note:* Some apparatus standards [...] transformers) use a modified wave shape when [...] considerations or particular dielectric strength [...] make such modification necessary. (PE/C) [...]

standard propagation The propagation of radio waves [...] smooth spherical Earth of uniform dielectric constant [...] conductivity, under conditions of standard refraction [...] atmosphere. *See also:* refractive index gradient. (AP/PROP) 2[...]

standard radio atmosphere An atmosphere whose [...] fractivity gradient is equal to the standard refractive [...] gradient. *See also:* refractive index gradient. (AP/PROP) 21[...]

standard radio horizon The radio horizon corresponding [...] propagation through the standard radio atmosphere [...] refractive index gradient. (AP/PROP) 2[...]

standard reference material Material characterized by [...] National Institute of Standards and Technology (NIST) [...] the activity of radionuclides and issued with a certificate [...] gives the results of the characterization. (NI) N42[...]

standard reference position (of a contact) The nonoperated [...] de-energized position of the associated main device [...] the contact position is referred. *Note:* Standard reference [...] sitions of typical devices are shown in the following [...]

[...]	Standard Reference Position
[...] breaker	Main contacts open
[...] ecting switch	Main contacts open
[...]	De-energized position
[...]	De-energized position
[...]	Closed position

(SWG/PE) C37.100-1[...]

[...] refraction *See:* refractive index gradient.

[...] refractive index gradient A standard value of [...] [...] of refractivity, namely 39.2 N-Units/km, [...] [...] the refraction of radio waves in the troposph[...] [...] value corresponds, approximately, to the me[...] [...] gradient in the first kilometer of altitude in [...] [...] regions. *Synonym:* standard N gradient. *See also:* [...] index gradient. (AP/PROP) 211-[...]

[...] refractive index modulus gradient *See:* refra[...] gradient.

[...] register (motor meter) (dial register) A fou[...] [...] register, each dial of which is divided into ten [...] [...] division marks being numbered from zero to [...] [...] gearing between the dial pointers being such th[...] [...] movements of the adjacent dial pointers are in opp[...] [...] and in a 10-to-1 ratio. *See also:* watthour me[...] (PE/EEC)

[...] resistor (resistance standard) A resistor that [...] [...] high accuracy to a specified value, is but sl[...] [...] by variations in temperature, and is substantiall[...] [...] over long periods of time. *See also:* auxiliary dev[...] [...] instrument. (PE/EEC)

[...] response spectrum (SRS) A required respons[...] [...] (RRS) that is artificially created to cover the st[...] [...] of relays and whose shape is defined. The SR[...] [...] minated at any convenient frequency above 35 [...] (SWG/PE) C37.10[...]

[...] rod gap A gap between the ends of the two o[...] [...] square rods cut off squarely and mounted on sup[...] [...] length of rod equal to or greater than one-half [...] [...] overhangs the inner edge of each support. [...] [...] to be used for the approximate measurement [...] [...] *See also:* instrument. (EEC/PE[...]

[...] Mandatory requirements employed to prescri[...] [...] uniform approach to software developmen[...] [...] and operation. (C/SE) 73[...]

[...] basic reference Those standards with w[...] [...] of the electrical units are maintained in the la[...] [...] that serve as the starting point of the chain of s[...] [...] surements carried out in the laboratory. (ELM) C1[...]

[...] dc-ac transfer Instruments used to esta[...] [...] of an rms current or voltage (or the avera[...] [...] alternating power) with the corresponding stead[...] [...] (ELM) C[...]

[...] laboratory reference (metering) Stan[...] [...] used to assign and check the values of laborato[...] [...] standards. (ELM) C12.1-1988, C[...]

[...] laboratory secondary (metering) Stan[...] [...] used in the routine calibration tasks of the lab[...] (ELM) C12.1-1988, C[...]

[...] national Those standards of electrica[...] [...] that are maintained by the National Institu[...] [...] and Technology. (ELM) [...]

[...] transport Standards of the same nomi[...] [...] basic reference standards of a laboratory (and [...] [...] equal quality) that are regularly intercompar[...] [...] group but are reserved for periodic interlabo[...] [...] tests to check the stability of the basi[...] [...] (ELM)

[...] source (illuminating engineering) [...] [...] having the same spectral distribution as [...] [...] illuminant. (EE[...]

[...] source A (illuminating engineering) A [...] [...] lamp operated at a color temperature of [...] [...] national Practical Temperature Scale, 1968)