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(54) **SYSTEM AND METHOD FOR EARLY DETECTING DISASTERS BASED ON SVM**

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(57) **ABSTRACT**

A system for early detecting disasters based on an SVM (Support Vector Machine) may include: an input unit configured to decode a plurality of input images and convert the decoded images into shared data; a shared data management unit configured to manage the shared data provided from the input unit; a processing unit configured to analyze the shared data provided from the shared data management unit based on an SVM learning algorithm, and detect whether a disaster situation occurred; and an output unit configured to output the detection result of the processing unit.

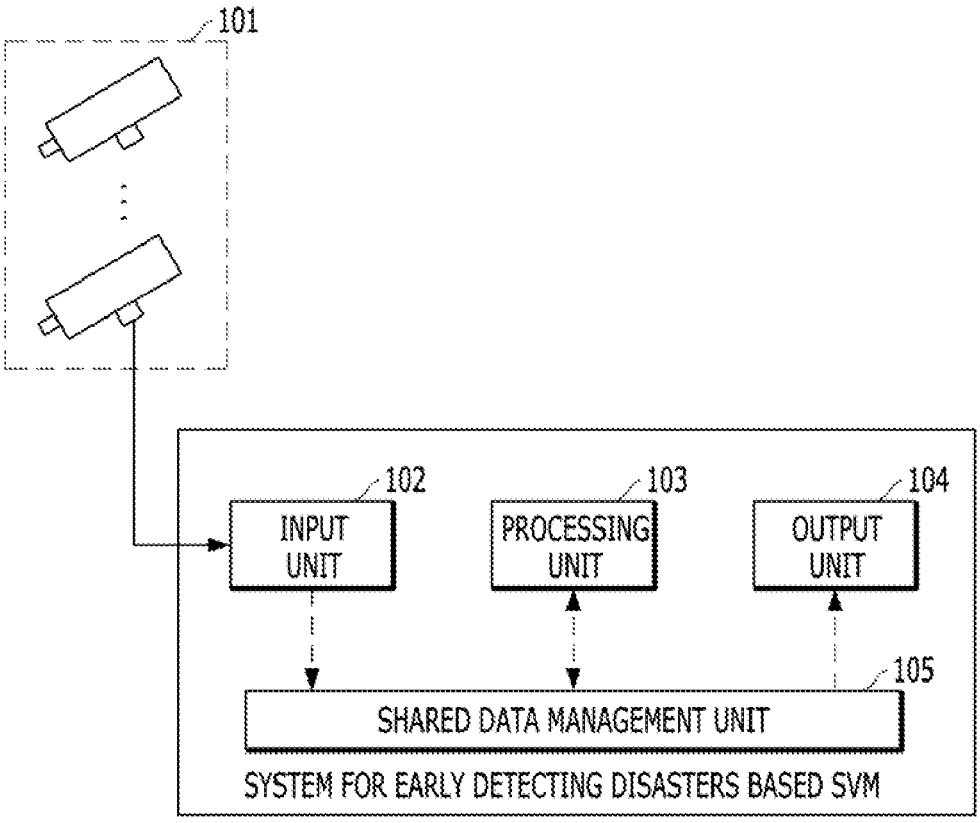


FIG. 1

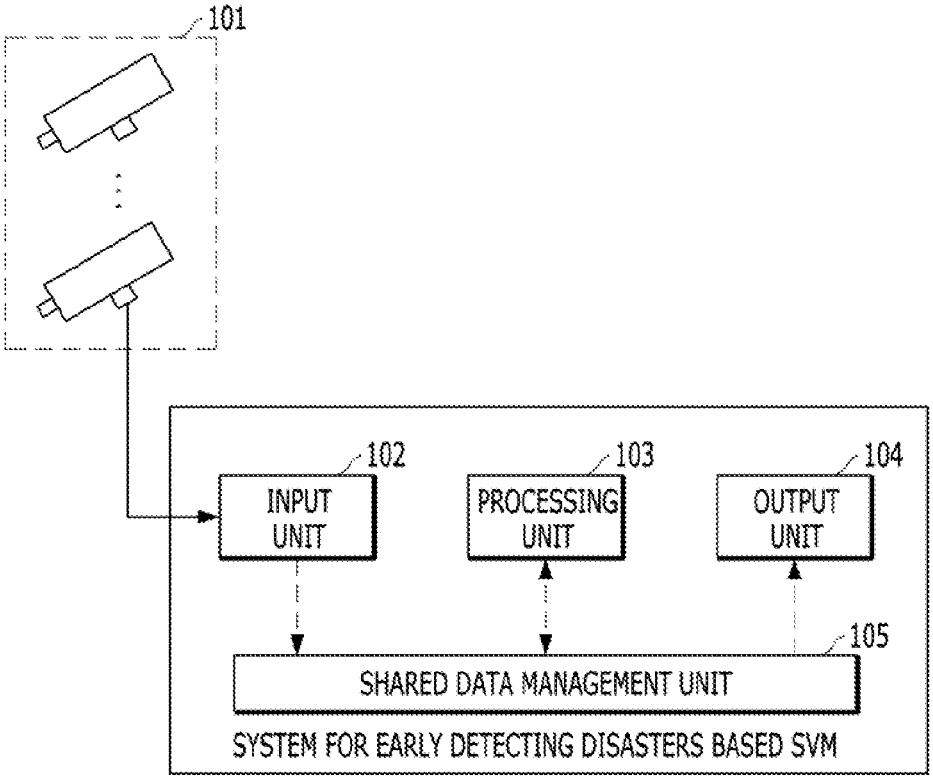

101
102
INPUT UNIT
103
PROCESSING UNIT
104
OUTPUT UNIT
105
SHARED DATA MANAGEMENT UNIT
SYSTEM FOR EARLY DETECTING DISASTERS BASED SVM

FIG. 2

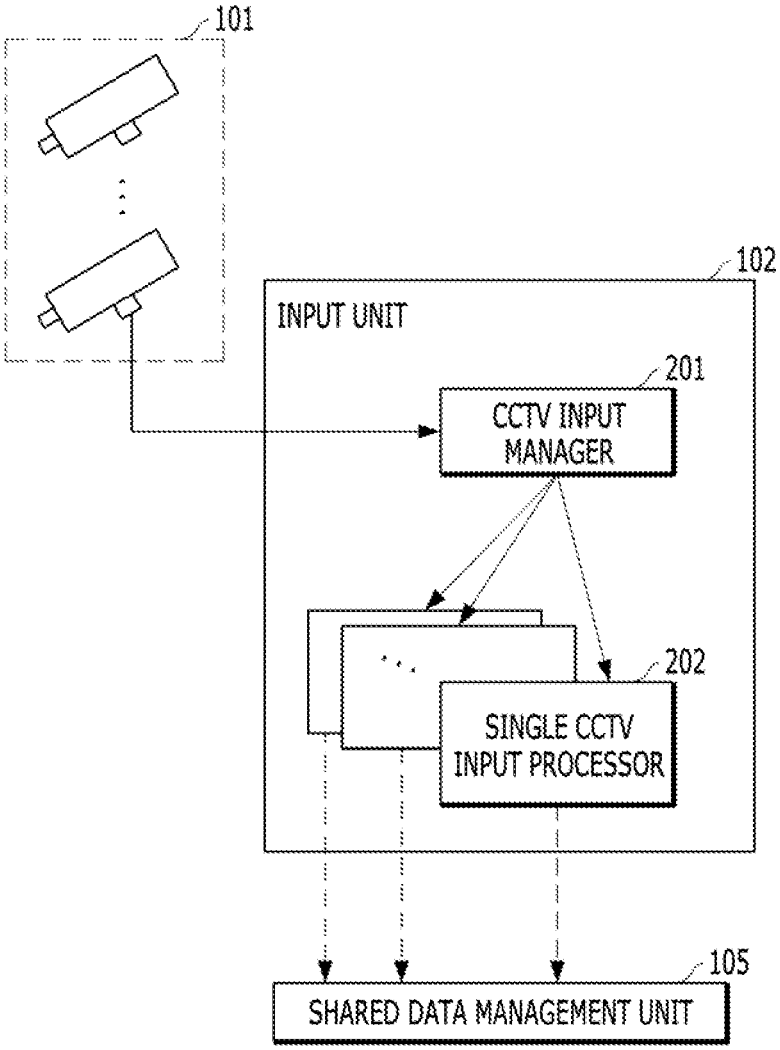

101
102
INPUT UNIT
201
CCTV INPUT MANAGER
202
SINGLE CCTV INPUT PROCESSOR
105
SHARED DATA MANAGEMENT UNIT

FIG. 3

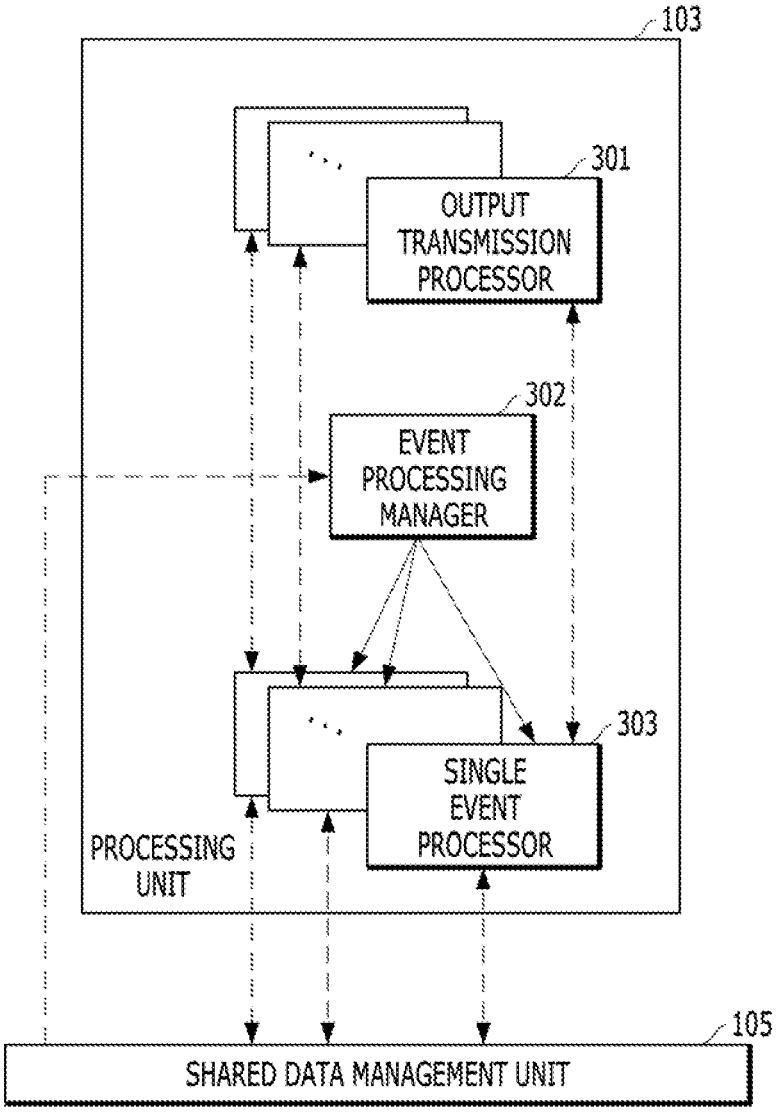

103
301
OUTPUT TRANSMISSION PROCESSOR
302
EVENT PROCESSING MANAGER
303
SINGLE EVENT PROCESSOR
PROCESSING UNIT
105
SHARED DATA MANAGEMENT UNIT

FIG. 4

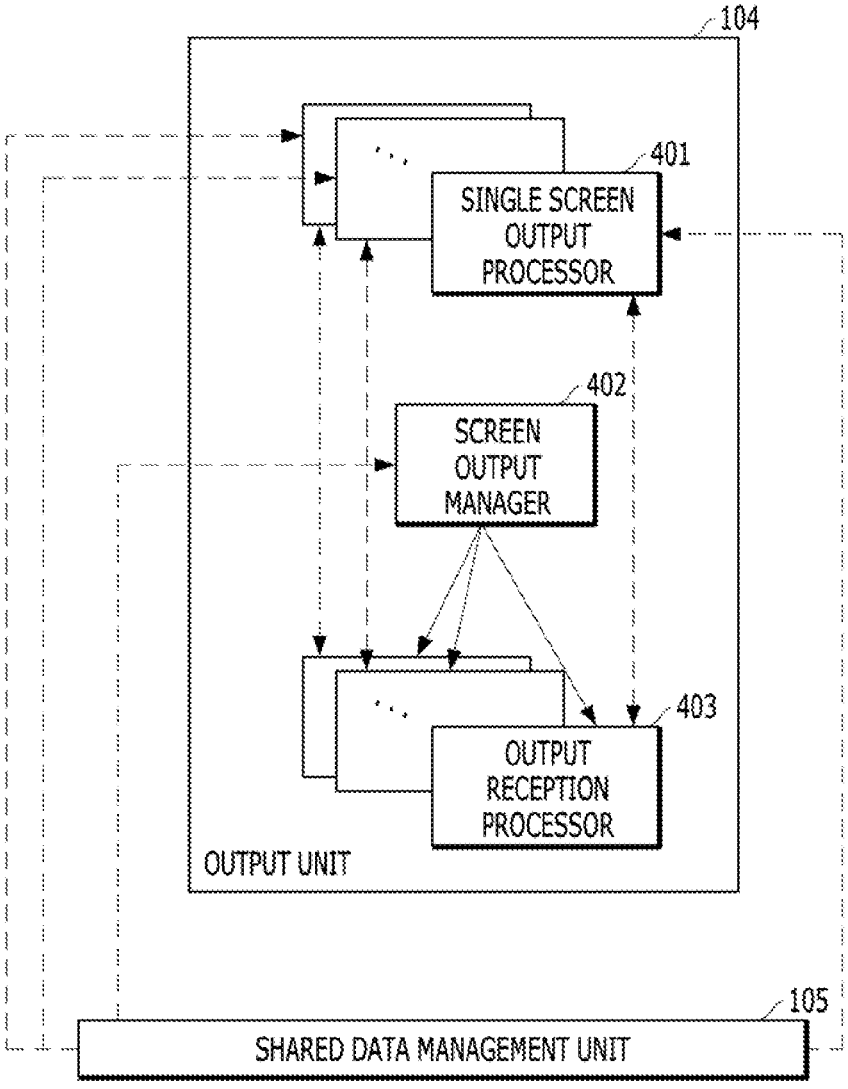

104
401
SINGLE SCREEN OUTPUT PROCESSOR
402
SCREEN OUTPUT MANAGER
403
OUTPUT RECEPTION PROCESSOR
OUTPUT UNIT
105
SHARED DATA MANAGEMENT UNIT

FIG. 5

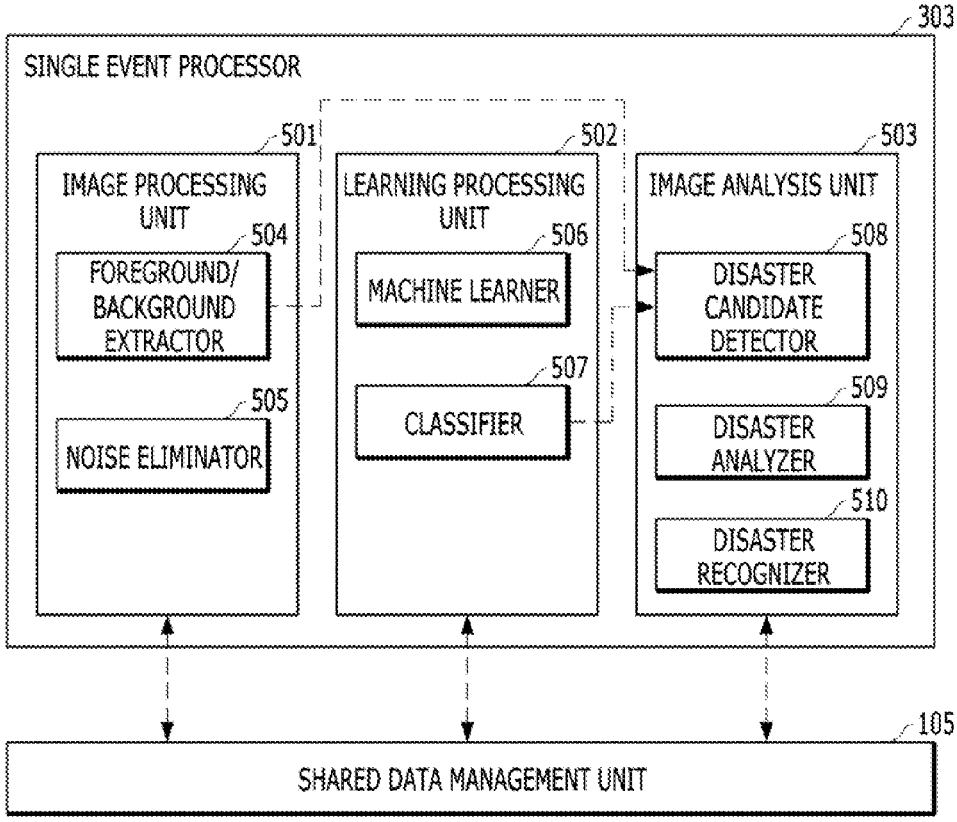

303
SINGLE EVENT PROCESSOR
501
IMAGE PROCESSING UNIT
504
FOREGROUND/ BACKGROUND EXTRACTOR
505
NOISE ELIMINATOR
502
LEARNING PROCESSING UNIT
506
MACHINE LEARNER
507
CLASSIFIER
503
IMAGE ANALYSIS UNIT
508
DISASTER CANDIDATE DETECTOR
509
DISASTER ANALYZER
510
DISASTER RECOGNIZER
105
SHARED DATA MANAGEMENT UNIT

FIG. 6A

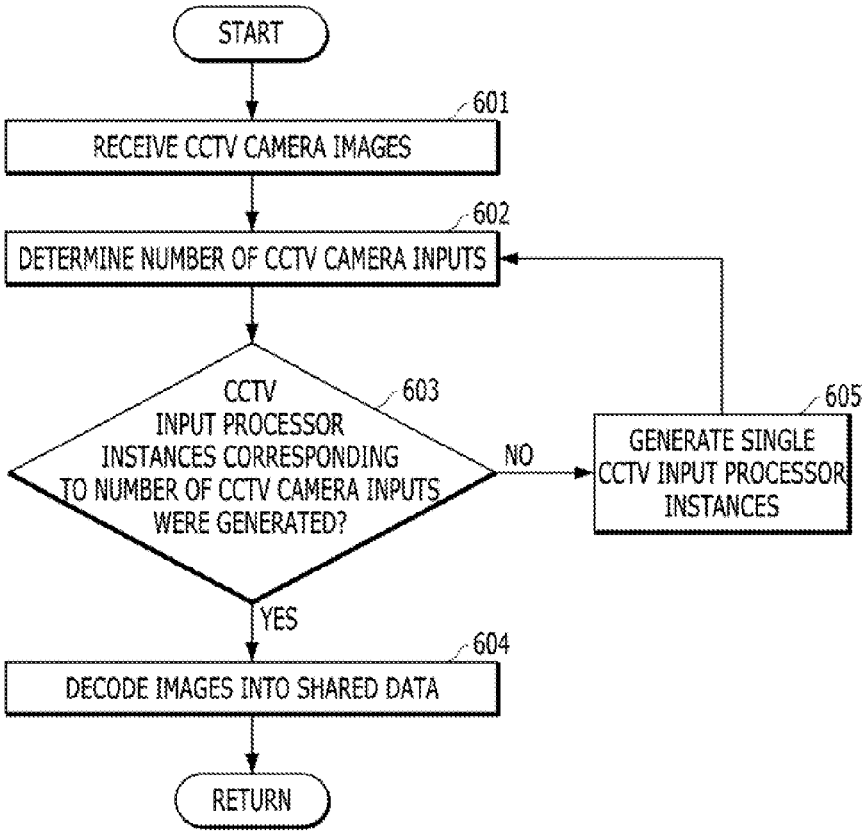

START
601
RECEIVE CCTV CAMERA IMAGES
602
DETERMINE NUMBER OF CCTV CAMERA INPUTS
603
CCTV INPUT PROCESSOR INSTANCES CORRESPONDING TO NUMBER OF CCTV CAMERA INPUTS WERE GENERATED?
NO
605
GENERATE SINGLE CCTV INPUT PROCESSOR INSTANCES
YES
604
DECODE IMAGES INTO SHARED DATA
RETURN

FIG. 6B

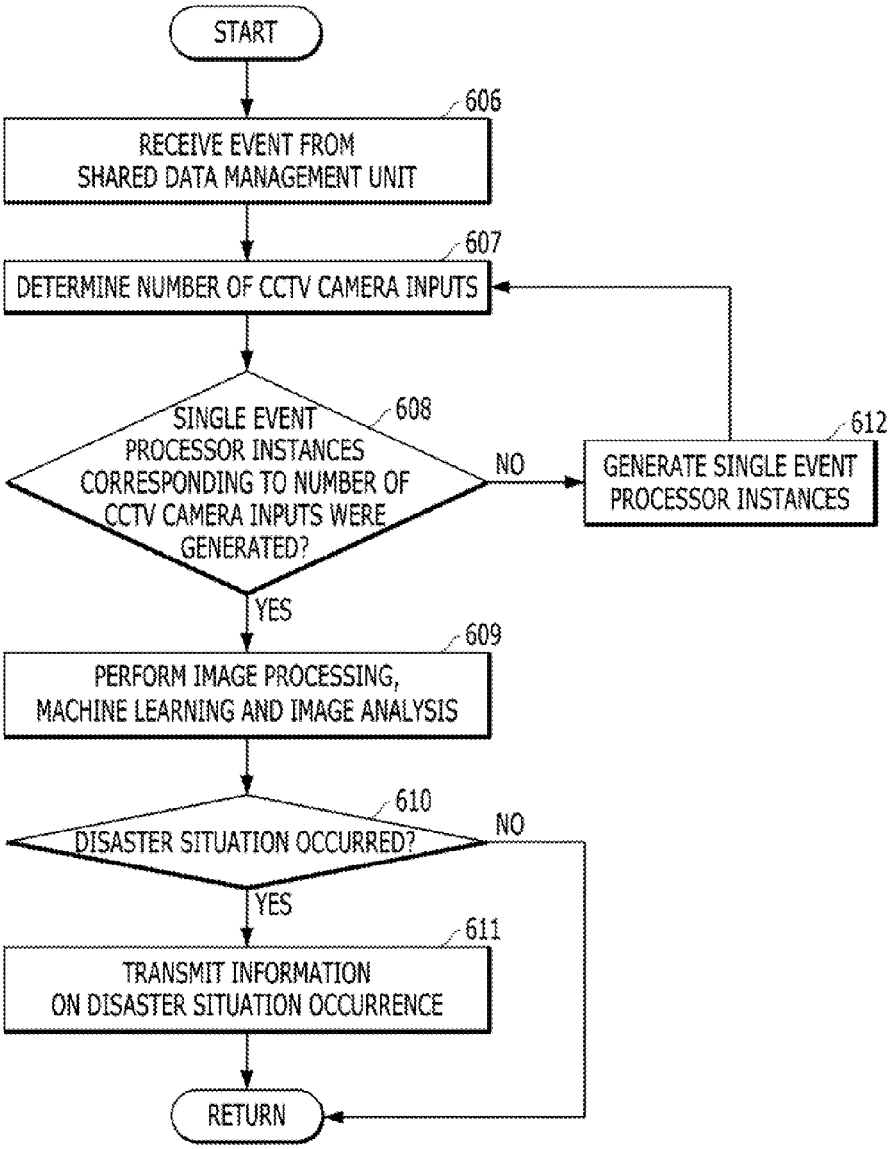
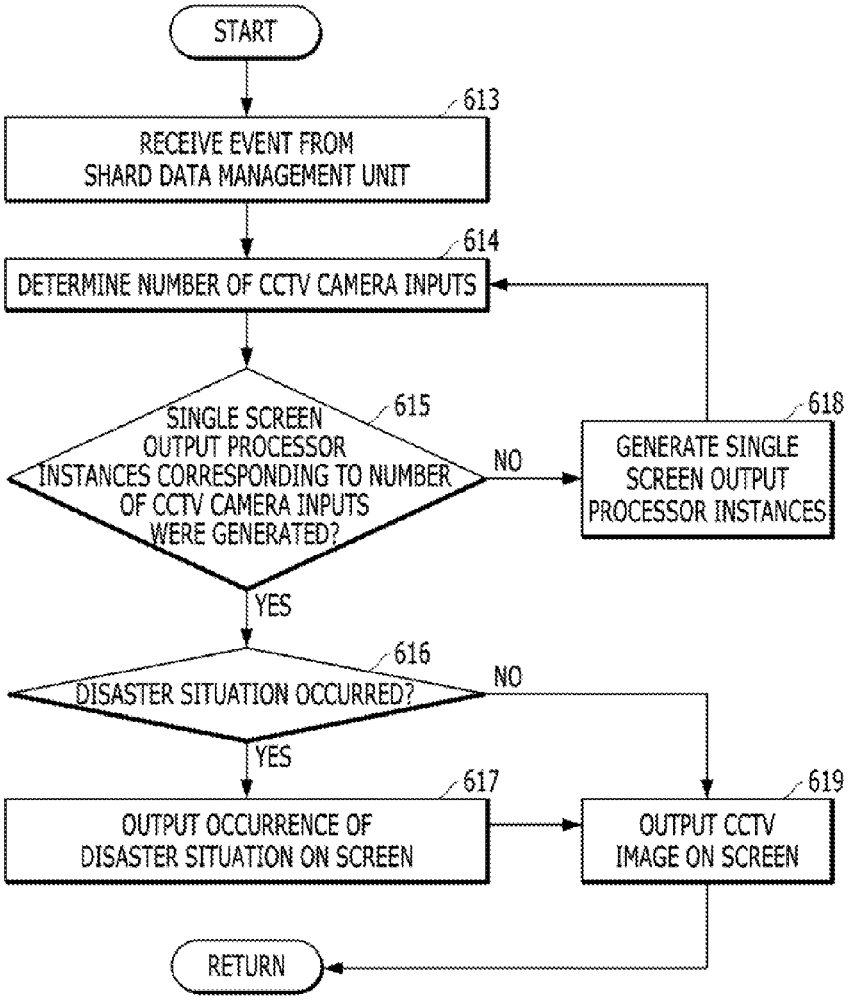

START
606
RECEIVE EVENT FROM SHARED DATA MANAGEMENT UNIT
607
DETERMINE NUMBER OF CCTV CAMERA INPUTS
608
SINGLE EVENT PROCESSOR INSTANCES CORRESPONDING TO NUMBER OF CCTV CAMERA INPUTS WERE GENERATED?
NO
612
GENERATE SINGLE EVENT PROCESSOR INSTANCES
YES
609
PERFORM IMAGE PROCESSING, MACHINE LEARNING AND IMAGE ANALYSIS
610
DISASTER SITUATION OCCURRED?
NO
YES
611
TRANSMIT INFORMATION ON DISASTER SITUATION OCCURRENCE
RETURN

FIG. 6C


START
613
RECEIVE EVENT FROM SHARD DATA MANAGEMENT UNIT
614
DETERMINE NUMBER OF CCTV CAMERA INPUTS
615
SINGLE SCREEN OUTPUT PROCESSOR INSTANCES CORRESPONDING TO NUMBER OF CCTV CAMERA INPUTS WERE GENERATED?
NO
618
GENERATE SINGLE SCREEN OUTPUT PROCESSOR INSTANCES
YES
616
DISASTER SITUATION OCCURRED?
NO
YES
617
OUTPUT OCCURRENCE OF DISASTER SITUATION ON SCREEN
619
OUTPUT CCTV IMAGE ON SCREEN
RETURN

SYSTEM AND METHOD FOR EARLY DETECTING DISASTERS BASED ON SVM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority of Korean Patent Application No. 10-2016-0036767, filed on Mar. 28, 2016, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] 1. Field

[0003] Exemplary embodiments of the present invention relate to a system and method for early detecting disasters based on an SVM (Support Vector Machine), and more particularly, to a system and method for early detecting disasters based on an SVM, which receives images from a plurality of CCTV (Closed Circuit Television) cameras, detects a disaster or unusual situation (that is, a disaster situation), such as fire, flood, building abnormality (for example, abnormal exterior of building), distribution monitoring and unattended guarding, and informs a user of the unusual situation, and a computer readable recording medium which stores a program for embodying the method.

[0004] 2. Description of the Related Art

[0005] Conventionally, they receive images from a plurality of CCTV cameras in order to monitor a security area. In most cases, however, they determine a disaster situation with manpower or cannot help but to analyze one or a few CCTV images due to a physical limit or cost limit, in order to determine whether a disaster situation occurred.

[0006] Thus there is a demand for a technology which can process images provided from a plurality of CCTV cameras at the same time, automatically analyze the CCTV images based on an SVM (Support Vector Machine) learning algorithm, and determine whether a disaster situation occurred.

SUMMARY

[0007] Various embodiments are directed to a system and method for early detecting disasters based on an SVM, which analyzes images received from a plurality of CCTV cameras using an SVM learning algorithm, detects a disaster situation such as fire, flood, building abnormality, distribution monitoring, and unattended guarding and informs a user of the disaster situation, and a computer readable recording medium which stores a program for embodying the method.

[0008] In an embodiment, a system for early detecting disasters based on an SVM may include: an input unit configured to decode a plurality of input images and convert the decoded images into shared data; a shared data management unit configured to manage the shared data provided from the input unit; a processing unit configured to analyze the shared data provided from the shared data management unit based on an SVM learning algorithm, and detect whether a disaster situation occurred; and an output unit configured to output the detection result of the processing unit.

[0009] In an embodiment, a method for early detecting disasters based on an SVM may include: receiving encoded images from a plurality of cameras; decoding the received encoded images, and converting the decoded images into shared data; analyzing the images provided as the shared data based on an SVM learning algorithm, and determining whether a disaster situation occurred; and outputting the detection result.

[0010] In an embodiment, there is provided a computer readable recording medium which stores a program for embodying: receiving encoded images from a plurality of cameras; decoding the received encoded images, and converting the decoded images into shared data; analyzing the images provided as the shared data based on an SVM learning algorithm, and determining whether a disaster situation occurred; and outputting the detection result.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a configuration diagram illustrating a system for early detecting disasters based on an SVM in accordance with an embodiment of the present invention.

[0012] FIG. **2** is a detailed configuration diagram of an input unit of FIG. **1**.

[0013] FIG. **3** is a detailed configuration diagram of a processing unit of FIG. **1**.

[0014] FIG. **4** is a detailed configuration diagram of an output unit of FIG. **1**.

[0015] FIG. **5** is a detailed configuration diagram of a single event processor of FIG. **3**.

[0016] FIGS. **6**A to **6**C are flowcharts illustrating a method for early detecting disasters based on an SVM in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

[0017] Various embodiments will be described below in more detail with reference to the accompanying drawings. The present invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. While the present invention is, described, detailed descriptions related to publicly known functions or configurations will be ruled out in order not to unnecessarily obscure subject matters of the present invention.

[0018] Throughout the specification, when an element is referred to as being connected or coupled to another element, it should be understood that the former can be directly connected or coupled to the latter, or electrically connected or coupled to the latter via an intervening element therebetween. Furthermore, when it is described that one element "comprises", "includes" or "has" some elements, it should be understood that it may comprise (or include or has) only those elements, or it may comprise (or include or have) other elements as well as those elements if there is no specific limitation. The terms of a singular form may include plural forms unless referred to the contrary.

[0019] Hereafter, the embodiments of the present invention will be described with reference to the accompanying drawings.

[0020] FIG. **1** is a configuration diagram illustrating a system for early detecting disasters based on an SVM (Support Vector Machine) in accordance with an embodiment of the present invention. The system may include a plurality of CCTV cameras **101**, an input unit **102**, a processing unit **103**, an output unit **104**, and a shared data management unit **105**. The input unit **102**, the processing unit **103** and the output unit **104** may correspond to main

components of the system, and the shared data management unit **105** may manage shared data of the three main components.

[0021] As illustrated in FIG. **1**, the system for early detecting disasters based on an SVM in accordance with the embodiment of the present invention may include the input unit **102**, the shared data management unit **105**, the processing unit **103** and the output unit **104**. The input unit **102** may decode a plurality of CCTV images and convert the decoded CCTV images into shared data. The shared data management unit **105** may manage the shared data from the input unit **102**. The processing unit **103** may analyze the shared data from the shared data management unit **105** based on an SVM learning algorithm, and detect whether a disaster situation occurred. The output unit **104** may output the CCTV images and the information on the disaster situation occurrence.

[0022] At this time, the input unit **102** may receive the encoded CCTV images from the plurality of CCTV cameras **101**, decode the received CCTV images, and convert the decoded CCTV images into shared data. That is, the input unit **102** may receive the encoded CCTV images from the plurality of CCTV cameras **101** existing in a local or remote area, decode the received CCTV images into the shared data, and transmit the shared data to the shared data management unit **105**. For this operation, the input unit **102** may determine the number of CCTV camera inputs, using the CCTV images inputted from the plurality of CCTV camera **101**, and generate single CCTV input processor instances of FIG. **2**. Such series of operations may be independently performed on the respective CCTV images by the plurality of single CCTV input processors **202**, thereby processing different CCTV images at the same time.

[0023] The shared data management unit **105** may serve to manage the shared data provided through the input unit **102** such that the processing unit **103** and the output unit **104** can use the shared data. That is, the shared data management unit **105** may retain and manage the shared data received from the input unit **102**, and transmit events such as the CCTV image inputs and the shared data to the processing unit **103** and the output unit **104**, such that the respective units process the corresponding events.

[0024] The processing unit **103** may analyze the CCTV images received as the shared data from the shared data management unit **105**, based on the SVM learning algorithm and detect whether a disaster situation occurred. That is, the processing unit **103** may perform image processing, machine learning and image analysis using the CCTV images stored as the shared data in the shared data management unit **105**, in order to detect whether a disaster situation occurred. For this operation, the processing unit **103** may determine the number of CCTV camera inputs, using the CCTV images stored as the shared data in the shared data management unit **105**, and generate single event processor instances for processing events and output transmission processor instances for managing output data in FIG. **3**.

[0025] Furthermore, the processing unit **103** may independently perform monitoring on CCTV images, such as fire, flood building abnormality, unattended guarding and distribution monitoring, according to a disaster detection mode preset by user input data. At this time, the disaster detection mode may be preset by the user input data and stored in an event processing manager **302**, and used when each of the single event processors **303** determines whether a disaster situation occurred.

[0026] The output unit **104** may receive the information on disaster situation occurrence and output the received information on a screen, or receive CCTV images and output the received CCTV images on the screen. That is, the output unit **104** may receive the information on disaster situation occurrence, detected by the processing unit **103**, and inform a user of the information. Furthermore, the output unit **104** may receive CCTV images as shared data in the shared data management unit **105**, output the received CCTV images on the screen, and create a log file for the corresponding data, if necessary. For this operation, the output unit **104** may determine the number of CCTV camera inputs, using the CCTV images stored as the shared data in the shared data management unit **105**, and generate single screen output processor instances and output reception processor instances of FIG. **4**.

[0027] At this time, the CCTV images stored in the form of shared data may be outputted to preset positions of the screen by the single screen output processors **401** of FIG. **4**, and the output reception processors **403** may receive, the information on disaster situation occurrence from the output transmission processors **301** of FIG. **3** and output an additional alarm (for example, sound) in addition to the screen output through the single screen output processors **401**.

[0028] As described above, the input unit **102**, the processing unit **103** and the output unit **104** of FIG. **1**, which are included in the system for early detecting disasters based on an SVM may be independently operated for each function, and also independently perform their operations according to the CCTV images. Thus, the system can detect different disaster situations at the same time, according to the disaster detection mode preset by the user input data.

[0029] FIG. **2** is a detailed configuration diagram of the input unit **102** of FIG. **1**.

[0030] As illustrated in FIG. **2**, the input unit **102** may include one CCTV input manager **201** and a plurality of single CCTV input processors **202**.

[0031] The CCTV input manager **201** may generate and manage single CCTV input processor instances each of which is capable of independently decoding a CCTV image and converting the decoded CCTV image into shared data, according to the number of CCTV camera inputs.

[0032] Each of the single CCTV input processors **202** may receive an encoded CCTV image from the CCTV camera **101** allocated thereto, decode the received image, convert the decoded image into shared data, and transmit the shared data to the shared data management unit **105**.

[0033] FIG. **3** is a detailed configuration diagram of the processing unit **103** of FIG. **1**, and FIG. **5** is a detailed configuration diagram of a single event processor **303** of FIG. **3**.

[0034] As illustrated in FIG. **3**, the processing unit **103** may include a plurality of output transmission processors **301** one event processing manager **302** and a plurality of single event processors **303**.

[0035] The event processing manager **302** may receive an event for a CCTV image input from the shared data management unit **105**, and generate a single event processor instance. Then, the event processing manager **302** may receive a shared data change completion event, and connect the corresponding single event processor **303** to process the

event. The shared data change completion event may indicate an event to notify that the shared data were changed.

[0036] The single event processors **303** may receive the shared data stored in the shared data management unit **105** and perform image processing, machine learning and image analysis to independently detect whether a disaster situation occurred. The single event processor **303** will be described later in detail with reference to FIG. **5**.

[0037] The output transmission processors **301** may maintain one-to-one connection to the single event processors **303**, and transmit the information on disaster situation occurrence, detected by the single event processor **303**, to the output reception processors **403** of FIG. **4** through the shared data management unit **105**.

[0038] As illustrated in FIG. **5**, the single event processor **303** may be divided into three parts or an image processing unit **501**, a learning processing unit **502** and an image analysis unit **503**.

[0039] The image processing unit **501** may include a foreground/background extractor **504** and a noise eliminator **505**. The image processing unit **501** may receive the shared data stored in the shared data management unit **105** and perform pre-processing on the received data.

[0040] At this time, the foreground/background extractor **504** may extract a foreground image and a background image from the CCTV image provided as the shared data, and set the extracted foreground image to a first candidate group of various disaster situations.

[0041] The noise eliminator **505** may eliminate noise which can be generated from the CCTV image, eliminate noise from the extracted foreground image or eliminate a part which cannot serve as a candidate group (for example, a candidate group with a narrow area from which additional characteristics cannot be extracted during the subsequent process), thereby reducing misdetection when an actual disaster situation is detected.

[0042] The learning processing unit **502** may include a machine learner **506** and a classifier **507**, and perform an operation related to machine learning based on the SVM.

[0043] At this time, the machine learner **506** may generate a support vector to be used in the classifier **507** through pre-learning, before the classifier **507** starts detection. The machine learner **506** may collect CCTV images on a basis of predetermined time, in order to utilize the CCTV images as learning data for machine learning, and update the support vector through a background operation.

[0044] The classifier **507** may extract a second candidate group of various disaster situations, using the support vector generated by the machine learner **506**.

[0045] The image analysis unit **503** may include a disaster candidate detector **508**, a disaster analyzer **509** and a disaster recognizer **510**. The image analysis unit **503** may receive the first and second candidate groups of various disaster situations, and detect a disaster situation.

[0046] The image analysis unit **503** may include a disaster candidate detector **508**, a disaster analyzer **509** and a disaster recognizer **510**. The image analysis unit **503** may receive the first and second candidate groups of various disaster situations, and detect a disaster situation.

[0047] When the potential candidate group is detected, the disaster candidate detector **508** may use different characteristics according to the disaster detection modes such as fire monitoring, flood monitoring, building exterior monitoring, unattended guarding and distribution monitoring. According to each of the disaster detection modes, a different potential candidate group may be detected.

[0048] For example, in the case of fire, the disaster candidate detector **508** may use color values in various color formats (for example, Gray, RGB, YCbCr and HSV) and a color mean and standard deviation which are created by the color values, in order to detect flame and smoke. In the case of flood the disaster candidate detector **508** may use template matching information for recognizing a flooding table. In the case of building exterior monitoring and distribution monitoring, the disaster candidate detector **508** may use a color information difference and label difference information based on the color information difference. In the case of unattended guarding, the disaster candidate detector **508** may use information on whether a foreground image has been extracted.

[0049] The disaster analyzer **509** may receive the potential candidate group detected by the disaster candidate detector **508**, and determine a final candidate group by additionally using temporal and spatial elements. The temporal and spatial elements may include the duration of the potential candidate group and the area of the extracted candidate group in the CCTV image.

[0050] The disaster recognizer **510** may combine the final candidate group determined by the disaster analyzer **509** and external input information, and recognize the disaster situation. The external input information may include an area of interest which a user is intended to monitor and sensitivity which is the area ratio of the area of interest to the extracted candidate group. At this time the external input information such as the area of interest and the sensitivity may be set by the user through a user interface, and the set external input information may be stored in the event processing manager **302** and used by the single event processors **303**.

[0051] As such, when the disaster recognizer **510** recognizes a disaster situation, each of the single event processors **303** may set the disaster situation to the output transmission processor **301** connected thereto, and transmit information to the output reception processor **403**of the output unit **104**, the information indicating that the situation received from the corresponding CCTV camera is a disaster situation.

[0052] FIG. **4** is a detailed configuration diagram of the output unit **104** of FIG. **1**.

[0053] As illustrated in FIG. **4**, the output unit **104** may include a plurality of single screen output processors **401**, a screen output manager **402** and a plurality of output reception processors **403**. The plurality of single screen output processors **401** may output CCTV images on the screen in one-to-one response to the CCTV images. The screen output manager **402** may generate and manage single screen output processor instances. The plurality of output reception processors **403** may receive information on a disaster situation.

[0054] The screen output manager **402** may receive an event for the number of CCTV camera inputs (that is the number of CCTV image inputs) from the shared data management unit **105**, and generate the same number of single screen output processor instances as the number of CCTV camera inputs.

[0055] The screen output manager **402** may receive an event to output an analyzed CCTV image on the screen, and transmit the event to the corresponding single screen output processor **401** to output the CCTV image.

[0056] The single screen output processor **401** receiving the screen output event may output the decoded CCTV

image to a position which is determined during initialization, such that the user can check the CCTV image through the screen with the naked eye.

[0057] The output reception processors **403** may correspond one-to-one to the output transmission processors **301** of the processing unit **103**, and correspond one-to-one to the single screen output processors **401**. At this time, when the output reception processor **403** receives a disaster situation from the output transmission processor **301**, the output reception processor **403** may transmit an event to the single screen output processor **401** to inform the user of the disaster situation. Furthermore, the output reception processor **403** may inform the user of the disaster situation using another device, in addition to the screen output.

[0058] FIGS. **6**A to **6**C are flowcharts illustrating a method for early detecting disasters based on an SVM in accordance with an embodiment of the present invention. The method may include receiving encoded images from a plurality of CCTV cameras existing in a local or remote area through the input unit **102**; decoding the received encoded images and converting the decoded images into shared data; analyzing the CCTV images provided as the shared data based on the SVM learning algorithm and determining whether a disaster situation occurred; and outputting the determination result and the CCTV images such that a user can check whether the disaster situation occurred.

[0059] Referring to FIG. **6**A, the operation flow of the input unit **102** will be described as follows.

[0060] First, the CCTV input manager **201** of the input unit **102** may receive encoded CCTV images from the plurality of CCTV cameras **101** at step **601**.

[0061] The CCTV input manager **201** of the input unit **102** may determine the number of CCTV camera inputs (that is, the number of CCTV image inputs), using the CCTV images inputted from the plurality of CCTV cameras **101**, at step **602**.

[0062] The CCTV input manager **201** of the input unit **102** may check whether single CCTV input processor Instances corresponding to the number of CCTV camera inputs were generated, at step **603**. When the single CCTV input processor instances corresponding to the number of CCTV camera inputs were not generated, the CCTV input manager **201** may generate the single CCTV input processor instances at step **605**, and proceed to step **602**.

[0063] When it is checked at step **603** that the single CCTV input processor instances corresponding to the number of CCTV camera inputs were generated, the single CCTV input processors **202** may decode the encoded CCTV images, convert the decoded CCTV images into shared data, and transmit the shared data to the shared data management unit **105**, at step **604**.

[0064] Referring to FIG. **6**B, the operation flow of the processing unit **103** will be described as follows.

[0065] First, the event processing manager **302** of the processing unit **103** may receive an event of CCTV image inputs from the shared data management unit **105** at step **606** and check the number of CCTV camera inputs at step **607**.

[0066] The event processing manager **302** of the processing unit **103** may check whether single event processor instances corresponding to the number of CCTV camera inputs were generated, at step **608**. When the single event processor instances corresponding to the number of CCTV camera inputs were not generated, the single event processing manager **302** may generate the single event processor instances at step **612**, and proceed to step **607**.

[0067] When it is checked at step **608** that the single event processor instances were generated, the single event processors **303** may receive the shared data according to a shared data change completion event, and perform image processing, machine learning and image analysis, at step **609**. Then, the single event processors **303** may determine whether a disaster situation occurred, at step **610**.

[0068] When it is determined at step **610** that a disaster situation occurred, the output transmission processor **301** may transmit the information on disaster situation occurrence to the output reception processor **403** at step **611**.

[0069] The output transmission processor **301** may transmit the information on disaster situation occurrence to the output reception processor **403** through the shared data management unit **105**. The shared data management unit **105** may store and manage the information on disaster situation occurrence.

[0070] Referring to FIG. **6**C, the operation flow of the output unit **164** will be described as follows.

[0071] First, the screen output manager **402** of the output unit **104** may receive an event of CCTV image inputs from the shared data management unit **105** at step **613**, and determine the number of CCTV camera inputs at step **614**.

[0072] The screen output manager **402** of the output unit **104** may check whether single screen output processor instances corresponding to the number of CCTV camera inputs were generated, at step **615**. When the single screen output processor instances corresponding to the number of CCTV camera inputs were not generated, the screen output manager **402** may generate the single screen output processor instances at step **618**, and then proceed to step **614**. On the other hand, when the single screen output processor instances corresponding to the number of CCTV camera inputs were generated, the screen output manager **402** may check whether a disaster situation occurred, at step **616**.

[0073] When it is checked at step **616** that no disaster situation occurred, the single screen output processors **401** may output the decoded CCTV images to positions determined during initialization, such that a user can check the CCTV images through the screen with the naked eye, at step **619**. On the other hand, when it is checked at step **616** that a disaster situation occurred, the single screen output processors **401** may output the occurrence of the disaster situation on the screen at step **617**, and output the CCTV images on the screen at step **619**.

[0074] The method for early detecting disasters based on an SVM in accordance with the embodiment of the present invention may be embodied in the form of a program command which can be executed through various computing units, and written to a computer readable recording medium. The computer readable recording medium may include a program command, a data file, a data structure or combinations thereof. The program command written to the medium may include program commands which are specifically designed for the present invention or publicly known to those skilled in the computer software industry. Examples of the computer readable recording medium may include magnetic media such as hard disk, floppy disk and magnetic tape, optical media such as CD-ROM and DVD, magneto-optical media such as floptical disk, and hardware devices such as ROM RAM and flash memory, which are configured to store and execute a program command. The media may include

transmission media, such as optical or metal line and waveguide, which include a carrier wave to designate a program command and a data structure. Examples of the program command may include not only machine codes created by a compiler, but also high-level language codes which can be executed in a computer by an interpreter or the like. The hardware device may be configured to operate as one or more software modules for performing the operation of the present invention, and vice versa.

[0075] In accordance with the embodiments of the present invention, the system and method for early detecting disasters based on the SVM can analyze images received from the plurality of CCTV cameras using the SVM learning algorithm, early detect a disaster situation such as fire, flood, building abnormality, distribution monitoring or unattended guarding, and inform a user of the disaster situation. Thus, the system and method can minimize personnel and material loss, and efficiently use resources required for system operation, thereby providing many advantages in terms of maintenance.

[0076] Furthermore, the input unit, the processing unit and the output unit may be independently configured, and common data may be processed separately from the independent units. Thus, the system and method may have a low-level computational complexity.

[0077] Furthermore, the system and method can process a plurality of high-resolution images at the same time, and independently perform image processing and analysis on the respective images.

[0078] Furthermore the system and method may analyze a disaster situation using the SVM learning algorithm thereby improving the reliability,

[0079] While the present invention has been described with respect to the specific embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A system for early detecting disasters based on an SVM (Support Vector Machine) comprising:

an input unit configured to decode a plurality of input images and convert the decoded images into shared data;

a shared data management unit configured to manage the shared data provided from the input unit;

a processing unit configured to analyze the shared data provided from the shared data management unit based on an SVM learning algorithm, and detect whether a disaster situation occurred; and

an output unit configured to output the detection result of the processing unit.

2. The system of claim **1**, wherein the input unit receives encoded CCTV images from a plurality of CCTV cameras, decodes the received CCTV images, converts the decoded CCTV images into shared data, and transmits the shared data to the shared data management unit.

3. The system of claim **1**, wherein the input unit comprises:

a CCTV input manager configured to generate single CCTV input processor instances; and

a plurality of single CCTV input processors configured to independently decode CCTV images according to the number of CCTV image inputs, and convert the decoded CCTV images into shared data.

4. The system of claim **1**, wherein the processing unit receives the CCTV images stored as the shared data in the shared data management unit, analyzes the received CCTV images based on the SVM learning algorithm, and detects whether a disaster situation occurred.

5. The system of claim wherein the processing unit independently performs monitoring on each of the CCTV images according to a preset disaster detection mode.

6. The system of claim **1**, wherein the processing unit comprises:

an event processing manager configured to receive an event of CCTV image inputs from the shared data management unit, generate single event processor instances, receive a shared data change completion event, and connect corresponding single event processors to process the event;

a plurality of single event processors configured to receive the shared data from the shared data management unit according to the shared data change completion event, perform image processing, machine learning and image analysis, and independently detect whether a disaster situation occurred; and

a plurality of output transmission processors configured to transmit the detection results of the single event processors.

7. The system of claim **6**, wherein the single event processor comprises:

an image processing unit configured to receive the shared data stored in the shared data management unit, extract foreground and background images, and eliminate noise;

a learning processing unit configured to perform machine learning based on the SVM; and

an image analysis unit configured to receive candidate groups of various disaster situations from the image processing unit and the learning processing unit, and detect a disaster situation.

8. The system of claim **7**, wherein the image processing unit comprises:

a foreground/background extractor configured to extract foreground and background images from a CCTV image provided in the form of shared data, and set the extracted foreground image to a first candidate group of various disaster situations; and

a noise eliminator configured to eliminate noise generated in the CCTV image, noise generated in the extracted foreground image or an unimportant part which does not serve as a candidate group.

9. The system of claim **8**, wherein the learning processing unit comprises:

a machine learner configured to generate a support vector to be used by a classifier though pre-learning before the classifier starts extraction; and

the classifier configured to extract a second candidate group of various disaster situations using the support vector generated by the machine learner.

10. The system of claim **9**, wherein the image analysis unit comprises:

a disaster candidate detector configured to detect a potential candidate group using the first candidate group extracted by the foreground/background extractor, the second candidate group extracted by the classifier, characteristics, based on the disaster detection mode;

a disaster analyzer configured to receive the potential candidate group detected by the disaster candidate detector, and determine a final candidate group using temporal and spatial elements; and

a disaster recognizer configured to combine external input information and the final candidate group determined by the disaster analyzer and recognize a disaster situation.

11. The system of claim **1**, wherein the output unit outputs the disaster situation detected by the processing unit and the CCTV images provided from the shared data management unit.

12. The system of claim **1**, wherein the output unit comprises:

a plurality of output reception processors configured to receive information on the disaster situation detected by the processing unit;

a screen output manager configured to generate single screen output processor instances; and

a plurality of single screen output processors configured to output the disaster situation received through the plurality of output reception processors and the CCTV images provided from the shared data management unit.

13. A method for early detecting disasters based on an SVM, comprising:

receiving encoded images from a plurality of cameras;

decoding the received encoded images, and converting the decoded images into shared data;

analyzing the images provided as the shared data based on an SVM learning algorithm, and determining whether a disaster situation occurred; and

outputting the detection result.

14. The method of claim **13**, wherein the analyzing of the images provided as the shared data comprises independently performing monitoring on each of the images according to a preset disaster detection mode.

15. A computer readable recording medium which stores a program for embodying:

receiving encoded images from a plurality of cameras;

decoding the received encoded images, and converting the decoded images into shared data;

analyzing the images provided as the shared data based on an SVM learning algorithm, and determining whether a disaster situation occurred; and

outputting the detection result.

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