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A Study on Detecting a Deformed Shape in Static Structures

Hoejung Jung[1], Byungjin Jeong[2], Woosik Lee[1], Namgi Kim[1]*

[1] Computer Science, Kyonggi University, South Korea
{junghj, wslee, ngkim}@kyonggi.ac.kr
[2] Computer Science, KAIST, South Korea
bjjeong@nslab.kaist.ac.kr

Abstract. Detecting static structure deformed shape is very important to reduce properties and loss of human life. We can use a video camera to early catch emergence situations. Closed-circuit television (CCTV), also known as video surveillance, is the use of video cameras to transmit a signal to a specific place. We can get a sequence of images using CCTV and analyze the relationship between images in time series. Previous researches only focus on object tracking, environment monitoring, and taking video. They do not consider structure deformed shape which is one among big disasters. In this paper, we concentrate on detecting mechanism of static structure deformed shape in subtraction images. Then, we use CCTV to get images in the real world. Moreover, we introduce the detection mechanism to rapidly detect static structure deformed shape in time series. Lastly, we show the result of detected structure deformed shape based on proposed mechanism.

Keywords: CCTV, time series, detection, disaster.

1 Introduction

Although the quality of our life is increased due to advanced technologies, it makes diverse problems such as irregular environment changes, earthquakes, floods, and landslides [1]. In order to solve these problems, Closed-circuit television (CCTV), also known as video surveillance, can be used to detect emergencies [2].

There are many CCTV researches such as motion detection and video analysis techniques. Motion detection technique is used to track the human motions using difference values between previous and current video images. Video analysis techniques focus on information processing from original video images. However, previous researches only concentrate on object motions without static objects. Then, they are not useful to detect Static Structure Deformed Shape which is one of big disasters [3-5].

In this paper, we introduce our CCTV environment and time series analysis. Then, we show detected result using our detection scheme in the real world.

* Corresponding author: Namgi Kim, E-mail: ngkim@kyonggi.ac.kr

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2 Intelligence CCTV Environment

Fig. 1 shows our CCTV environment. Our CCTV consists of system main frame and an infrared projector. System main frame has three parts of a video camera, a preprocessor, and a network switch. Then, the video camera gets a sequence of video images and transmits images to a preprocessor. The preprocessor consists of micro controller, digital controller interfaces, status led, and serial and video interfaces. When the preprocessor get real-time images, it use interfaces to forward acquisition images to the network switch. After that, the network switch transmits video images through serial network cables. Furthermore, the infrared projector is used to get clear images in outside area with 110m distance between a camera and objects.

In this paper, we utilize IMC-8283 IP camera with an infrared mode which is able to transmit and receive on the network line. Moreover, it can get Full HD images which are HD Full image with a size of 1960x1960 pixels.

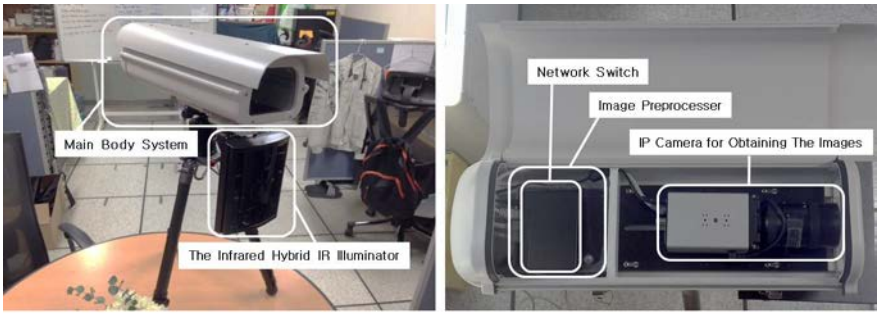

Fig. 1. Intelligent CCTV device

3 Time Series Analysis

A time series is a sequence of data points, typically consisting of successive measurements made over a time interval. In this paper, we get a sequence of images from CCTV around Gwanggyo Reservoir near by Kyonggi University. Then, we use Equation 1 called RGB color-difference formula [6] to detect the difference between previous and current images, where R is a red, G is green, and B is blue, E_{RGB} is a difference value.

$$\Delta E_{RGB} = \sqrt{\Delta R^2 + \Delta G^2 + \Delta B^2} \quad (1)$$

If we get E_{RGB} by calculating images inquired from CCTV, we can easily check the change level over the time. For example, if E_{RGB} is 0, it means the normal situation. If E_{RGB} is 10, it means little changes from original image. However, if E_{RGB} is 90, it means a dangerous situation to need Preventive measures. Fig. 2 shows three images we get from IMC-8283 IP camera. At *t1*, an image is original one. At *t2* and *t3*, two images are deformed images. Through Equation 1, we know that *t2* and *t3* images are changed.

Fig. 2. Three Static Structure Images in Time Series

4 Conclusion

In this paper, we introduced intelligence CCTV technique and time series analysis for static structure deformed detection. Moreover, we use RGB color-difference formula to get the difference between images. Then, we configure the threshold which is 0.1 to rapidly detect emergency situations. Through experimental results, we know that our scheme can exactly catch the static structure deformed shape.

In this future, we will adapt our scheme to various CCTV systems. Furthermore, we will propose new adaptive algorithm depending on current channel environments.

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