A Moving Human-Object Detection for Video Access Monitoring

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Abstract—In this paper, a simple moving human detection method is proposed for video surveillance system or access monitoring system. The frame difference and noise threshold are used for initial detection of a moving human-object, and simple labeling method is applied for final human-object segmentation. The simulated results show that the applied algorithm is fast to detect the moving human-objects by performing 95% of correct detection rate. The proposed algorithm has confirmed that can be used as an intelligent video access monitoring system.

Keywords—Moving human-object detection, Video access monitoring, Image processing.

I. INTRODUCTION

THERE are various algorithms are used to detect moving object for video surveillance system. In order to detect moving objects in high speed, the complexity of algorithm must be simplified. Moving object detection algorithms based on frame difference has considerable processing speed than the algorithms of optical flow, statistical learning algorithm.

In [1], author proposed a moving object detection algorithm based on frames difference and edge detection. In [2], the background subtraction and three frame differencing method is proposed for target extraction. In [3], author proposed a very similar method to [2], and it uses HSV color model to remove shadow and illuminated pixels from the subtracted image. The algorithm in [4] proposed a multimodal adaptive background subtraction method for object detection, which takes care of the usual affection such as changing illumination, occlusion, clutter and irrelevant extraneous movements, but it has such a heavy load of parameters since the background model change adaptively over time.

After initial object detection, final object segmentation processing is needed to enhance object shaping. Some conventional segmentation algorithms such as connected component labeling and k-clustering have some considerable accuracy with high complexity. The proposal of [5] combine Krisch operator with optical flow method in order to reduce computational load and prevent being sensitive to noise. In [6], the connected component labeling based segmentation algorithm has some considerable accuracy while its processing

time is comparatively long. For fast detection of moving human, frame difference and simple object segmentation are applied in this paper.

II. HUMAN-OBJECT DETECTION ALGORITHM

The proposed human detection algorithm in this paper has three step operations. The block diagram of the algorithm is shown in Fig. 1.
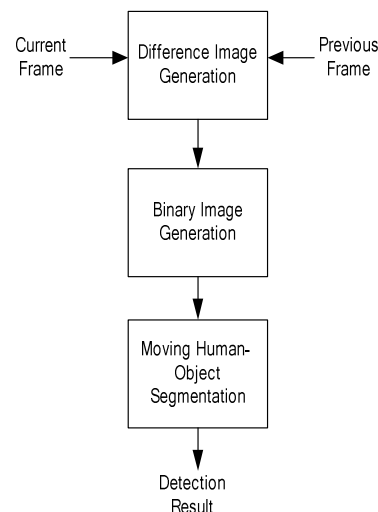

Fig. 1 Block diagram of human-object detection algorithm

A. Difference Image Generation

To detect the moving object in the surveillance, two consecutive frames from the video sequence must be subtracted. The frame difference processing eliminates the static area that common for both considered frame while the temporally changed area over time is remained. Differs from theory, the frame difference image doesn't contain only the areas that introduced by moving objects but also the areas that generated due to the noise and shadow in practical. Furthermore, the resulted image can be represented as the combination of shadow portion, noise portion and moving portion. The moving portion represents the fluctuated areas that introduced by moving objects while noise portion and shadow portion represent the fluctuated noise and shadow areas respectively. It needs a further process to eliminate the noise areas from the resulted image in above. An adaptive threshold is used for noise elimination and explained in the next part.

B. Binary Image Generation

The noise pixels and shadow pixels in the frame difference image always have numerically small gray values while object pixels contain high gray values. Based on this concept, the frame difference image is separated into two parts by noise threshold. Pixels those have smaller gray values than noise threshold are set down to zero and the other pixels those have greater gray values than noise threshold are set up to one and then the image that contains only the object pixels can be obtained. There are many ways to define the threshold (*TH*) depending on the surveillance application. The easiest way for defining *TH* is the fixed threshold method. If a fixed threshold is used, it can be caused to classify the noise pixels as object pixels depending on the threshold value. Therefore, it needs an adaptive threshold method. The adaptive threshold is calculated by combining the standard deviation (σ) and the mean value of the difference image (μ).

$$TH(k) = 2\mu(k) + \sigma(k) \qquad (1)$$

The used threshold has always greater values than the standard deviation, which is not too much higher. Therefore, the used threshold value can remove noise as well as shadow without considerable affection on object pixels since shadow pixels have smaller gray values than object pixels.

C. Moving Human-Object Segmentation

The moving objects that obtained from the previous processes are usually a number of closely spaced scattered small regions. Accordingly it needs a further procedure for segmenting those disorder pixels in order to obtain the final moving objects. In many systems, connected component labeling is used for object segmentation, but in this paper, a very simple method is applied. This method has comparatively greater processing speed than other labeling algorithms. The applied method is described in bellow. First, image is divided into observation-windows by considering the size of objects that are going to detect and their contemplation. Finally, assign observation-window number (OWN) as in the Fig. 2. It considered an image that is the size of 8 x 8 and observation-window size is decided as 4 x 4. The binary image is generated at the noise and shadow filtering processing above explained. Then this binary image subtracts with the assigned observation-window number that shown in Fig. 2.

After subtraction, the following processing is performed in order to eliminate the pixels that had value of zero at the binary image. If subtraction result is same with window number, then the pixel value is zero. Otherwise, subtraction result is marked. According to above processing, the neighborhood pixels in an object have the same label number when it is in a window and the separated objects will have difference label number. The same object can be fallen into neighbor windows. Therefore, it needs to check whether the pixels those at the window edges are zero or not. It scans vertically and horizontally on window edges to find whether object pixels fall in neighbor windows or not. If any pixel at the considered window edge has a label, then the window that contains the considered pixel is labeled same as previous window. Then each of these regions obtained as smallest rectangular boxes in order to indicate the position of the moving object, and the final result of the segmentation processing is shown in Fig. 2.

Fig. 2 Binary image, Observation-window number and Object segmentation result using simple labeling (Black-line box)

III. SIMULATION RESULT AND CONCLUSION

To verify proposed algorithm, 100 frames were simulated, and 95 of them were correct detection and 5 of them had false detection by performing 95% of correct detection rate. The some simulated results are shown in Fig. 3. Therefore, proposed algorithm can be used as an effective moving object detection algorithm since it has a high detection rate.

Fig. 3 Simulation result images

The applied algorithm is not sensitive for sudden illumination as well as for light blinking. Also, the applied segmentation method has considerable processing speed while it is not complex, but it still has a shortcoming to be solved. Individual human can be grouped with others when there are many humans

in the field, and the size of a window has to be decided to depend on the size of objects that expecting to detect. Eventually, the applied method is comparatively effective for real-time moving human-object detection.

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