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Moving Object Detection using Foreground Detection for Video Surveillance System

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Abstract - *This paper gives a new method to detect moving object based on foreground detection or background subtraction. We set up a reliable background reference model based on statistical method and use a dynamic optimization threshold method to obtain a more complete moving object. After that, morphological filtering is done to remove the noise and solve the background disturbance trouble. The moving human bodies are accurately and reliably detected. The experiment results show that the proposed method runs quickly, accurately and fits for the real-time detection.*

Key Words: Background model, Foreground detection, Moving object detection, Morphology filtering.

1. INTRODUCTION

Motion tracking method plays an important role in any object tracking or video surveillance algorithm, to the extent that nearly all such algorithms start with motion detection. In the motion detection, moving human body detection is the most important part of the human body motion analysis, the purpose is to detect the moving human body from the reference image which contains static information in video sequences, and for the follow-up treatment such as the detected object classification, the human body tracking and behaviour understanding, its effective detection plays a very important role. Actually, the reliability with which potential foreground objects in movement can be identified, directly impacts on the efficiency and performance level achievable by subsequent processing stages of tracking and/or recognition. However, detecting regions of change in images of the same scene is not a straightforward task since it does not only depend on the features of the foreground elements, but also on the characteristics of the background such as, for instance, the presence of vacillating elements.

Presently different methods used in moving object detection are the background subtraction method, frame subtraction method, and the optical flow method. Difference between two consecutive images are used in frame subtraction method to determine the presence of moving objects. Its mathematical calculation is simple and easy implementation. In variety of dynamic environments, it has a strong adaptability, but it is generally difficult to obtain complete outline of moving object, has ability to appear the empty phenomenon, result of the detection of moving object is not accurate. Optical flow field is calculated in optical flow method. Clustering processing performed according to the optical flow distribution characteristics of image. This method gives complete moving object information and detect the moving object from the input video better, there are disadvantages like a multiple calculation, sensitive to noise, poor anti-noise performance, make it not suitable for real-time demanding occasions. The background subtraction method result can be obtain by comparing the current image and background image to detect moving objects, with simple algorithm, but this method is very sensitive to the dynamic changes in the external environment and has poor anti-interference ability. However, it can provide the most complete object information in the case of the background is known. In this paper, in a single static camera condition, we combine dynamic background modeling with dynamic threshold selection method based on the background subtraction, background has to update based on accurate detection of object, this method is enhance performance effect of moving object detection. Different critical situations requires to handle using background subtraction algorithm such as:

1. Gradual variations in the scene's lighting conditions;

2. Small movements of tree branches and bushes blowing in the wind

3. Noisy image, due to a poor quality image source

4. Variations of the object which are permanent in the scene such as cars that park

5. Movements of objects in the background that leave parts of it different from the background model (ghost regions in the image);

6. Multiple objects moving in the scene both for long and short periods;

7. Shadow regions that are projected by foreground objects and are detected as moving objects.

The main aim of this paper is to track the moving object using background algorithm. There are different steps involved such as motion detection, background modeling and subtraction, foreground detection, shadow detection and removing noise.

2. OVERVIEW

Nowadays computer vision systems doing research on how to detect moving object or human motion from more

complex scenes such as street monitoring. Accuracy of result may vary due to variation of lighting condition. People detection is difficult from crowdy environment. Due to occlusion and cloudy environment it is very difficult to detect object. The background subtraction algorithm is a widely used approach for detecting moving objects from videos using static cameras. The moving object can be detected by difference between the current frame and reference frame which has static information. Also called as the "background image", or "background model". Background image is initialize by its static information representation. It is updated regularly to adapt changes in environmental and physical conditions.

This method is commonly used for moving object detection. This uses the technique of comparison between current frame and reference frame to detect the moving object. Data is included in object information. Initialization of background image and update it is the main key of this algorithm. It affects on accuracy of test results. Therefore, this paper uses an efficient method to initialize the background, and update the background in real time.

3. PROPOSED METHOD

For video analysis there are steps to be performed like detection of moving object, tracking and analyzing the object in each frame. Solve the problems specified in related area for activity monitoring is main aim. This system is simple to detect moving object using background subtraction algorithm using MATLAB.

3.1 Background Image Initialization

There are many methods to get initial reference image contains static information. The average pixel brightness of starting many frames consider as a background or we can assume first frame as a background model. We can also consider an image contains static information as a background model.

From these methods time average method is mostly used for background model initialization. But this method not works when image has shadow problems.

Median value from consecutives frames can avoid this problem of shadowing. So in this paper we used median method to get background model.

Mathematically we can express as:

$$B_{init}(X, Y) = \text{median } f_k(x, y) \quad k = 1, 2 \ldots n$$

Where Binit is the initial background model, n is the total number of selected frames.

3.2 Background Modernizes

For better adapt to light changes by background model, it should be updated in real time to extract moving object. The update algorithm used in this paper is as follows:

We observed pixels of images if there are changes then it is part of moving object, if there is no change in pixels then it consider as a part of background model and it has to be updated. The following rules are used to update background model:

$$B_{k+1}(x, y) = \beta B_k(x, y) + (1-\beta) F_k(x, y)$$

Where β belongs to (0, 1) is updating coefficient.

Bk(x, y) and Bk+1(x, y) are background value of the current frame and the next frame respectively. Video is captured by static camera so background model has static information for long time. We can avoid sudden appearance of any object which is not included in the original background. Changes in external environment can be easily adapted.

3.3 Moving Object Mining

Background subtraction method is popular to extract moving object in a frame. In this method background model is subtracted from current frame to get foreground object which is interested. The object consist of pixels are separated from background image using threshold technique. Suppose background image B(x, y) and current frame Fk (x, y). Subtract background image from current frame .If difference is greater than initial threshold value T then resulted pixel is a part of moving object otherwise consider a part of background object. The object which is in motion can be detected using threshold method.

The moving object can be detected after threshold operation. Its expression is as follows:

$$D_k(x, y) = 1 \quad |F_k(x, y) - \beta_{k-1}(x, y)| > T$$

$$0 \text{ other}$$

Where Dk (x, y) is the differential results. Dynamic threshold method is used in this paper we proposed the. According to the lighting changes in the images threshold value changes. We have to add a dynamic threshold Delta to the above algorithm. Its mathematical expression is as follows:

$$D_k(x, y) = 1 \quad |F_k(x, y) - \beta_{k-1}(x, y)| > T + \Delta t$$

$$0 \text{ other}$$

The flow chart of moving human body extraction is shown in figure 1. Moving object from the captured video can be extracted but flying birds, floating clouds, swaying tree and other moving objects. Therefore we use the shape features of motion regions to further determine whether the moving object is a human being judging criteria are as follows:

(1) The detected object in motion value is larger than the set threshold.

(2) The aspect ratio of the detected object in motion region value should conform to the set ratio. If above mentioned two conditions are met, the moving object is the moving human body or is not a human body.

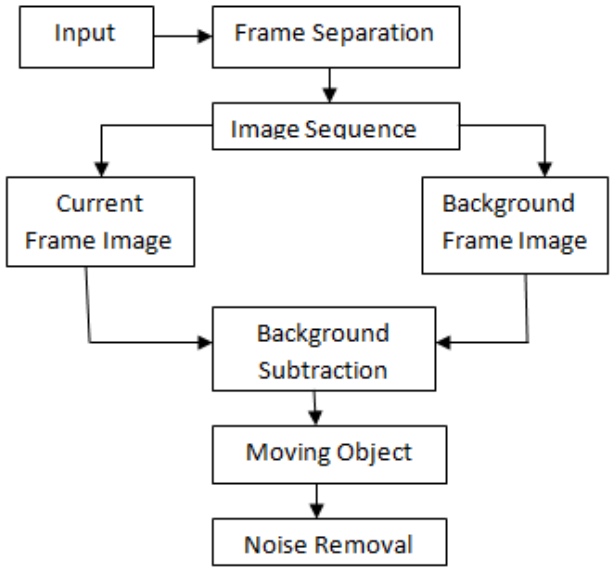

Fig.1. Flowchart of moving object mining

3.4 Reprocessing

There is discrepancy image obtained consist of motion region as well as noise. Hence noise has to remove from detected video. We used median filter with the 3 X 3 window for filtering the noise. After removing the noise not only moving region with human being but also include moving cars, flying. Birds, flowing clouds and swaying trees and other non-body parts. Further processing done by morphological processing Like to effectively filter out non-human activity areas using corrosion and filter out most of the non-body motion regions while preserving the shape of human motion without injury using expansion. Some isolated spots of the detected image and interference from video are eliminated, and we will get more accurate human motion region after completing expansion and corrosion operation.

3.5 Extraction of Moving Human Body

After completing median filtering and morphological operations, the region belongs to the moving human body could not be determined but some accurate edge regions will be got. After doing observation, we can find out that when will appear in some regions of the scene shadow and moving object appears. The presence of shadow will affect the accuracy in extraction of the moving object. Based on the results of the above methods, adopting the method of combining vertical with horizontal projection to detect the height of the motion region. This will avoid the impact of the shadow to a certain degree. Then we set the threshold value by analyzing the vertical projection value to remove the pseudo local maximum value and the pseudo-local minimum value of the vertical projection to determine the number and width of the body in the motion region, resulting obtained moving human body with precise edge.

3. CONCLUSIONS

In this paper, a proposed method is real-time and accurate new method for detecting moving human body using background subtraction. In this, single static camera captured video, we combine dynamic background modeling with dynamic threshold Selection method based on the background subtraction, and update background on the basis of accurate detection of object, this method is effective to enhance the effect of moving object detection in real time. Eventually, to remove the shadow effect we combine contour projection analysis with shape analysis. This paper shows that the background subtraction algorithm is fast and simple, better detection capability moving human body and it has a broad applicability.

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