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A Study of Different Motion Detection Algorithms in Computer Vision Applications

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ABSTRACT: In major applications of computer vision area are needs to be detect and identify objects which are in motion. Motion detection is the major area of computer vision. The main aim is to identify moving object from the consecutive image sequences. There are different methods available for moving object detection like temporal difference, optical flow and background subtraction.

KEYWORDS: Temporal difference, Optical flow, Background subtraction.

I.INTRODUCTION

In real time application motion detection is most challenging part in video surveillance system. A video is consist of static images and frames as well as audio data. For tracking, classification of the detected moving object the first step is to detect moving object from the captured video. The video captured by static camera. Object which is in motion is detected is called foreground detection or background detection.A field of computer vision is integration and automation of various representations and processes used in vision perception, which includes different techniques that are themselves important, such as statistical decision theory(statistical pattern classification applied to video, general patterns, or otherwise) and image processing (encoding, transmitting and transforming images)[6].Computer vision's main application is surveillance system. Surveillance system used in many electronic devices like CCTV cameras, are used in many places like airport, parking lots, railway stations and banks. In the past years we have to continuously monitor the system in emergency areas.one man can observe maximum four or five screens of the surveillance system.

Motion detection is the crucial part of computer vision area because of variety of applications like video surveillance, monitoring of security at airport, law enforcement, video compression, automatic target identification, marine surveillance and human activity recognition. There are several methods available for the object detection like temporal difference, optical flow and background subtraction method. The surveillance system uses Network Video Recorder (NVR) and IP camera. In the recent years the development of fully automated system is used for human monitoring. The main aim of such system used in public places is to detect the abnormal and suspicious activities. The main need of computer visionsystem for monitoring system are good speed and accuracy. The rapid increase of pedestrians may create problems in a street and the accidents due to the mob are increasing in our daily life. Human crowd should be avoided mainly in narrow streets to avoid traffic problem.A well-organized system should monitor the moving or non-moving human in the prohibited areas in a street [2]. Similarly passenger security is important factor of all railway agencies. Depend on the total time in which a person seems to present in an area of interest (AOI) can be considered as suspicious activity or the system treats the persons who wander, sit and stop for a long time in any area for a long time is to be monitored. In present, there is large changes in computer vision field gives benefit in control and monitoring of traffic

II.CLASSIFICATION OF DIFFERENT MOTION DETECTION METHODS

Motion detection is a technology of computer vision which identifying instances of objects such as vehicle, animals, human or bird and other moving objects. Motion detection is one of the primary stage of video surveillance system. There are different approaches of for motion detection can be categorized into Frame differencing, temporal differencing, optical flow, and Background subtraction

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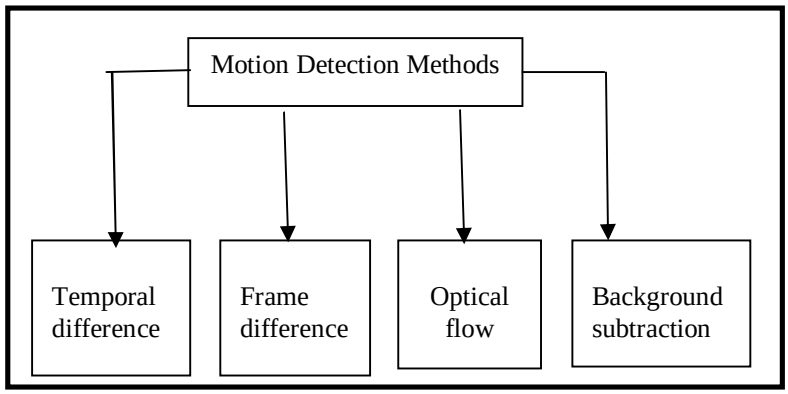

Fig 1. Different methods of Motion Detection

A. Temporal Difference

In past years, various motion detection methods have been proposed. The most commonly used method is temporal difference. Current frame is compared with previous frame. Then compared image output measure with threshold to get foreground part of object. But this technique may fails if object is uniformly distributed or objects have still for more than a frame period. In this method previous image Fk-1 (x, y) is subtracted from current frame F k (x, y). If pixel difference is greater than threshold value then it considered as part of foreground object otherwise considered as part of background object.

Moving object can be detected using threshold operation.

$$Dk(x, y) = \begin{cases} 1 & |Fk(x, y) - Fk\text{-}1(x, y| > Th \\ 0 & \text{others} \end{cases}$$

Where, Fk is current frame and Fk-1 is previous frame at time t. Temporal difference method is not detect still object but very sensitive to Threshold. Temporal difference is able to adapt greatly notably for a widespread group of dynamic environments. There is difficulty in accurate breakdown of an object in motion, and we can get fault within the detected movement.

B.Frame Difference

Frame difference identify moving object by comparing variation between two consecutive frames. It perform subtraction between consecutive frames. Threshold is able toperform the segmentation. Previous approaches use image subtraction method to obtain output images by subtracting current frame from the previous frame. Frame differencing method not in obtainingthe entire form of the object as a result of which morphology operations are common used to obtain improved results. Motion detection system using background subtraction needs to handle a number of critical situations such as noisy image, due to a poor quality image source.

C. Optical Flow

Optical flow is detect motion of objects in a visual scene caused by the relative motion between the scene and an eye (a camera).Optical flow method is used in particular fields such as video compression, image segmentation for detecting a moving object and motion estimation to identify the motion vector of a moving object. Optical flow method of motion detection is basically depends on calculation of optical flow field of image (or video frame). Optical flow method uses flow vectors of moving objects to detect motion in an image. It is a precise method but time consuming. Using optical flow method we can also calculate steady image of background plane. This method can detect motion in video sequences even from a moving camera and moving background, however, most of the optical flow methods are complex and cannot be used in real-time without specialized hardware.

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D. Background Subtraction

Background subtraction is very important in security and surveillance applications, because this is the first and foremost step in identifying and detecting people or objects in the videos. It attempts to detect moving regions by subtracting the current image from a reference background image. The pixels difference is above a threshold are classified as foreground object. The identification of the background image is known as background modelling. Performance of background subtraction method gets affected when background is dynamic, illumination changes, in presence of shadow, Bootstrapping or Presence of noise in video. Many techniques are created to upgrade background subtraction method and overcome its drawbacks. It detects object in motion by deducting current image pixel-by-pixel from reference image. This is established by equating multiple images from the beginning. The main aim of background subtraction is the detection of objects in motion. This can be done by initially setting a background image, then subtract the present or current frame which contains the objects in motion that are to be detected. This process is easy and it acts in accordance to a simple protocol. It obtaining features of target data, nevertheless, it had sensitivity towards small changes within the external environment. Hence, its only usage is within situations in which the background can be predicted or is known. There are different steps involved in background subtraction method.

1. Background Image Initialization

There are various techniques to obtain the initial background image. For instance, the average brightness of pixels of first several frames as the background or using a background image frames without the hope of moving objects to approximate the background model parameters, median method and so on.

Median method expression is as follows:

Binit (x, y) = median f k(x, y) k =1, 2 ….n

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

2.Background Update

The background subtraction method has a great ability to cope up with changes of time. There needs to an update the background to extract the object in motion. When detecting, the pixels are considered to be a part of the object in motion. They manage the original background grey values and are not updated. As it relates to the pixels that are considered the background, the following equation is used to update the background module:

βk + 1(x, y) =ββk(x, y) + (1-β)f k(x, y)

Where beta is equal to (0, 1), a renewed parameter, and f k(x, y) is referred to as the pixel grey value within the existing framework. Beta k(x, y) is the background value of the existing frame, while beta k+1(x, y) is the background value of the other frame. By using static camera, the background model has the ability to remain fixed for a long time period.

3. Moving Object Extraction

Background subtraction is a regular method which separates the moving object within a frame. The method contains reducing an image containing the object found in the earlier background image and has no important foreground objects.

The region found within the image plane where a noticeable contrast can be seen in these images shows the location of the Pixel of the object in motion. Expressed by clusters of pixel, the objects are disjoined from the background image with the use of the threshold method. When the background image beta k(x, y) is retrieved, it is deducted from the existing frame f k(x, y). In the event that the pixel distinction is large compared to the set threshold Th, the pixels then appear in the objects in motion. If this does not occur, they appear as background pixels within the frame. If pixel value is greater than threshold value then considered as object is in motion otherwise object is in stationary position.

4.Removal of noise

The variation in the image obtained includes the noise amount in addition to the region of motion. These noises may or may not be contained in the illumination changes or environmental factors during transmitting the video from the camera for further processing. Hence, the removal of noise is needed. The noise may be filtered by adopting a median filter The region of motion includes flying birds, swaying tress, human beings, non-body parts, and also flying clouds. Further processing may be done using morphological methods. Corrosion operation is done to filtrate the majority of non-body regions of motion and in addition, without injury, maintain the structure of human motion. After this, the

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inaccessible areas of the image and the intervention of small pieces are disregarded in an effort to gain a precise human motion region.

III. CONCLUSION

In this paper, we performed the survey on different methods of motion detection. Background subtraction, frame difference and temporal difference are used for the motion detection. During survey it was identified that shadow, illumination variation, noise and dynamic background are the major issues which decrease the accuracy of the result. Many works can be solve these issues and provides better result related to conventional approaches, but need more computational time and need additional algorithm to deal with complex environment.

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