A method for edge detection of moving object in video

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Abstract—In the current situation, video surveillance system and video processing has relevant and crucial value in research. Its application is so varied and some of them are, security and surveillance, public areas such as airports, underground stations, mass events, video communication, traffic control etc. The main disadvantage of the system is that storage space required for storing these data are so large and retrieval of the same on demand. For these human resources are needed but manually reviewing the large amount of data often impractical. The proposed work is focused on bringing effective and efficient system with intelligence to avoid human intervention in identifying security threats. In this paper, detecting the edges of object which is moving by using different edge detector. In this paper, identifying the moving object, by using frame difference method.

Keywords—Background subtraction, edge detection, frame differencing, moving object detection and optical flow.

I. INTRODUCTION

From video, moving object detection and finding edges of detected moving object is very important and applicable in many cases. Security and surveillance is one of the application. It has important role in the modern world where detection of crimes and hideous movements is mainly based on hidden cameras and closed circuit TVs. The images reflected on these devices have helped finding out the convicts of many a crime. Surveillance is also of prime importance in all organizations to protect the interests of the organization and their activities. The methods of detecting moving objects have thus become important and it is a prime concern in the modern management. There are several methods which are currently used for the purpose, all of which have some disadvantages. After detection of moving object, identifying the objects is also important. The objective of this paper is to analyze the method of detecting moving objects and then identify the object using edge detector. The new task of identifying the physical movement of an object in an area is significant because the system is used in the complex problems like video object classification and tracking.

The identification of the actual shape of a moving object is relevant because the detection of the actual shape is influenced by many obstacles like dynamic scene changes, light variation, presence of shadow and so forth [1]. The detection is done through moving or fixed camera [6]. The main purpose of detection is to distinguish the foreground of the object from the stationary background [4]. In short the objective is to detect the objects that are in motion with respect to their background scene. In stationary camera the background is static.

The application of digital image processing is so varied [7]. One of the simplest ways to develop a basic understanding of the extent of image processing application is to categorize images accordingly to their source. In image processing image acquisition is the initial process. Image enhancement is one of the simplest and most appealing areas of digital image processing. The idea behind enhancement techniques is to bring out detail which is hidden, or simply to highlight certain features of interest in an image [7]. It is very subjective area of image processing. in this paper used image processing technique is segmentation.

Video surveillance is one of the currently challenging research topics in computer vision. Videos are sequences of images, each of which called frame, displayed in fast enough frequency so that human eyes can percept the continuity of its content. All image processing techniques can be applied to individual frames.

Edge detection is the process of identification of points in a digital image at which the image brightness changes sharply or, more formally, with discontinuities. The points at which image brightness changes sharply are organized in a typical manner usually set of curved line segments termed edges. The use of detection of sharp changes in image brightness is to identifying the important events and changes in properties of the world. Discontinuities in image brightness are of many types like: discontinuities in depth, discontinuities in surface orientation, and changes in material properties. In the ideal case, by applying an edge detector to an image will results set of connected curves that indicate the location between two areas of objects. The edges of images extracted from a two-dimensional image of a three-dimensional scene that is from the frames of video can be classified as viewpoint dependent or viewpoint independent. A viewpoint independent edge will reflects inherent properties of the three-dimensional objects, such as surface shape. A viewpoint dependent edge may change as the viewpoint changes, and it is the reflection of geometry of the scene, such as objects occluding one.
another. There are several methods to perform edge detection.

The mostly used edge detecting methods are gradient method and Laplacian method. In the gradient method by using maximum and minimum in the first derivative of the image detects the edges. While in case of Laplacian method searches for zero crossings in the second derivative of the image to find edges. Some examples of gradient method are Roberts, Prewitt, and Sobel and it is widely used.

A. Current methods for detecting moving object

The current methods of detecting moving objects are background subtraction, optic flow and frame differencing [4].

Background subtraction

This method is most used method for moving object detection [1]. As the name suggests, it is the process of separation of foreground objects from the background in a sequence of video frames. Fundamental logic is that difference between current frame and a reference frame. Reference frame also called “background image”. The selection of background (background modeling) can be classified into two categories which are recursive and non-recursive techniques [2]. Recursive technique includes frame differencing, linear predictive filter, median filter, and nonparametric model. Non-recursive technique uses method of sliding window approach for background estimation. Non-recursive techniques are highly adaptive, they do not depend on history beyond those frames stored in buffer. This method is not suited for the background is dynamic, illumination changes or in the presence of shadow [1].

Optic flow

It is based on calculation of optical flow field of image or video frame [1]. Clustering is performed on the basis of the obtained optical flow distribution information obtained from the image (video frame). This method allows obtaining complete knowledge about the movement of the object and is useful to determine moving target from the background [1]. When an observer moves in a straight line through a stationary scene, the optic flow field forms a radial pattern [9]. The center of this pattern, where the image motion is zero is known as focus of expansion. A moving object in the scene may introduce image velocities that are not match with this pattern, and this inconsistency can be used to detect the presence of a moving object. Discontinuities in optical flow can help in segmenting images into regions that corresponds to different object. The various applications of optic flow are object motion detection, action recognition, facial expression recognition etc. The disadvantage is large quantity of calculations are required to obtain optical flow information and it is sensitive to noise.

Frame differencing

This method identifies the presence of moving object by considering the difference between two consecutive frames [1]. By subtracting second image from the first image frame using image subtraction operator in consecutive frame get the desired output. It is very efficient method for detecting gray level changes between images by using frame differencing algorithm [3]. The algorithm may be subdivided into three parts. Initial step is the selection of perfect reference or background. Second step is the arithmetic subtraction operation and the last or third step is the selection of a suitable threshold. Reference image can be selected as a frame which is temporally adjacent image from a dynamic sequence. This method lacks in obtaining the complete contour of the object.

B. Edge detection methods

Mostly used edge detection method is Gradient edge detecting operator. First order derivatives of a digital image are based on various approximations of the 2D gradient [7]. Computation of the gradient of an image is based on obtaining partial derivative of $\frac{df}{dx}$ and $\frac{df}{dy}$ at every pixel location [7]. Here described this edge detecting techniques.

1) Sobel operator

The Sobel operator is generally used in image processing, in case of edge detection algorithms [10]. In this compute the gradient of image intensity function approximately, the gradient or differentiation is a discrete differentiation operator. For every point in image, applying Sobel operator results in either the corresponding gradient vector or the norm of this vector. Prime drawback of Sobel operators such as over-segmentation and sensitivity.

2) Prewitt operator

In Prewitt algorithm, find out the 8 gradient amplitude then take the maximum value of the point. Prewitt edge detection operator based on two templates with horizontal and vertical directions. While the edge is in multiples of directions [11]. Prewitt edge detection algorithm is sensitive to the noise.

3) LOG filter

LOG (Laplacian of a Gaussian) filter consists of Gaussian filter and Laplacian operator. The edge detection based on LOG filter consist of Gaussian filtering and the Laplacian operator is used for edge enhancement and edge detection [12].

4) Canny operator

The basic idea of canny operator is to use the first order derivative of 2-D Gaussian function in any direction as a noise filter. The Canny algorithm has difficulty in treating images which contain the salt and pepper noise, and it does not have the ability to adapt in the variance of the Gaussian filtering.
II. NOVEL APPROACH

In this paper, frame differencing method is used for moving object detection. Frame differencing case, the method is extremely easy to implement and use, too fast, corresponding background models are not constant, and they change over time. The problem in motion estimation occurs because of the detection of shadows, generated as result of bright point like illumination sources. These shadows may either be in contact with the detected object or disconnected from it. In the first case, the shadow distorts the object shape. In the second case, the shadow may be classified as a totally mistaken object in the scene. Also accuracy depends on object speed and frame rate. So it will not give good results in case of background is bimodal, slowly moving objects, if the objects are fast. Therefore in this case morphological operations are not well suited.

Gradient edge detection is applied only to grey scale image. After identification of moving object, the image will be converted into grey scale image, the edge detecting operators are applied to the result. In this paper Gradient edge detectors are applied. Canny is the best edge detector among them. From the experimental result we can see that the edge of the moving object can be clearly identified. Algorithm for Canny edge detection includes 5 steps: First step is, smoothing: Blurring of the image to remove noise. Second step is finding gradients: If the gradients of image has large magnitude it will be marked as edges. Third step, non-maximum suppression: In this only local maxima should be marked as edges. Forth step is double thresholding: Potential edges are determined by thresholding. And the final stage is edge tracking by hysteresis: Final edges are determined by suppressing all edges which are not connected to a very certain edge.

III. EXPERIMENTAL RESULT

At the experimental result, we can see the clear edges of the object which is moving in a video. So by using this method we can identify the object which will be present in the video frame as moving object.

Fig 1 shows the different frames in the input video. Fig 2 shows the moving object detection using frame differencing method. Fig 3 is edge detection (Sobel and Prewitt) for detected moving objects. Fig 4 is edge detection (LOG filter and Roberts) for detected moving objects. Fig 5 shows the output for canny edge detection.

From these figure we can see that Canny is the best edge detection technique among Gradient edge detection.

IV. CONCLUSION

In this paper moving object is detected by using frame difference method, which is adaptive to background and for the resultant image edge detection techniques are applied for the identification of the object. This paper is focused on the video which are captured by using static camera. In future this can be extended to moving camera and to identify multiple objects.

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