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Difference of Gaussian on Frame Differenced Image

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Abstract: In this paper, we presented a method to find the edges of a moving objects in video. Moving objects can be detected by using various methods. In this we use frame difference method for moving object detection. After detection of moving object the Difference of Gaussian method is applied to get edges. So by using this method output will be better in less computation.

Keywords: Background subtraction, Difference of Gaussian, Frame difference, Gradient operator.

I. INTRODUCTION

Moving object detection is an essential task in case of video surveillance. Almost all video analysis contain three steps the first and important step is interesting moving object detection, second step is tracking of such object from frame to frame and the third step is analysis of object to recognize their characteristics. So moving object detection is significant task i.e. it is one of the video processing technique. It can be affected by many hurdle like light variation, illumination changes etc. Moving object detection is the process of separation of foreground objects from the background in a sequence of video frames. Dynamic changes will be eliminated by using pre and post processing. Dynamic changes includes camera oscillations, high frequency background object such as tree. Edge detection is the process of finding meaningful transitions in an image [7]. It is useful for object classification. Edge detection are depends on order of derivative of pixel values. The edge detection under first order derivative are Gradient edge detection. The first order derivative operators are very sensitive to noise and produce thicker edges. Second order derivative operators are more sophisticated methods towards automatized edge detection, but it is also very noise-sensitive. Since differentiation amplifies noise, smoothing is suggested prior to applying the Laplacians [7]. In that context, typical examples of second order derivative edge detection are the Difference of Gaussian (DoG) and the Laplacian of Gaussian (LoG).

II. RELATED WORK

The initial step is moving object detection. Various methods are developed for moving object detection. Some of them are background subtraction, frame differencing, temporal differencing, optical flow etc. All the method has some drawback or other. In case of background subtraction, logic is the difference between current frame and a reference frame [1]. The selection of background is called background modelling. The method is not suitable for dynamic background, illumination changes or in presence of shadow. Temporal differencing, the pixel wise difference between two successive frames are calculated to find moving object [4]. The disadvantage is that converging regions will be detect as moving object [1]. Optical flow is the best method for moving object detection, it is based on optical flow field calculation of images or video frames [1]. Moving object will have some velocity based on this we can detect the moving object. The drawback is the calculation time. In case of frame differencing, the difference between two consecutive frames are calculated for moving object detection. The first frame will be subtracted from second frame, so complete contour will not get .All these are about moving object detection. Next step is the edge detection of detected moving object.

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 [7]. Discontinuities in image brightness are of many types like discontinuities in depth, discontinuities in surface orientation and changes in material properties. Various technique have been proposed for edge detection of moving object. The mostly used edge detection methods are Gradient method and Laplacian method. In the ideal case, by applying an edge detection to an edge image will result in a set of connected curves that indicate the location between two areas of objects. In Gradient edge detection method by using maximum and minimum in the first derivative of the image detects the edges. Among, Gradient edge detectors Canny is the best edge detector. Algorithm for Canny edge detection includes five steps [7]. First step is smoothing, i.e.

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blurring of image by using Gaussian filter to remove noise. Second step is finding gradients for intensity values in image. Third step is non-maximum suppression, only local maxima should be marked as edges. To get rid of spurious response to edge detection. Forth step is double thresholding, Potential edges are determined by thresholding. And the fifth step is edge tracking by hysteresis, final edges are determined by suppressing all edges which are not connected to a very certain edge.

III. DIFFERENCE OF GAUSSIAN

Difference of Gaussian filter is obtained by taking difference of two Gaussian functions [7]. It is computed by applying two Gaussian operators with different values of σ to an image and by the difference of these resulting two smoothened images. The expression of difference of Gaussian is

$$h(m,n) = \mathrm{h}_1(m,n) - \mathrm{h}_2(m,n) \quad (1)$$

Where h_1 (m, n) and h_2 (m, n) are two Gaussian functions which are given by

$$\mathrm{h}_1(m,n) = e^{r^2/2{\sigma_1}^2} \quad (2)$$

$$\mathrm{h}_2(m,n) = e^{r^2/2{\sigma_2}^2} \quad (3)$$

Where $\sigma_1 > \sigma_2$

From Eqns. (1), (2) and (3)

$$\mathrm{h}(m,n) = e^{\frac{r^2}{2{\sigma_1}^2}} - e^{\frac{r^2}{2{\sigma_2}^2}} \quad (4)$$

By this condition, it is clear that the Difference of Gaussian filter function resembles a Mexican-hat wavelet.
Result by using difference of Gaussian filter method, is the complete contour of object with minimum calculation. It can be shown that the DOG operator approximates the LOG operator

IV. GRADIENT EDGE DETECTION ON FRAME DIFFERENCED METHOD

Gradient edge detection or for Laplacian of Gaussian are applicable only for grey scale images. The Fig.1. shows that different frames in a video at grey level for finding the presence of moving object detection. Fig.2. includes three figures in that first one shows the output of frame differenced image at grey level condition. Second figure shows that Gradient operation applied frame differenced image that is Canny edge detection on frame differenced image and the last figure is for Laplacian of Gaussian on frame differenced image.

Algorithm:
1. Video input
2. Convert into frames
3. Convert the frames which are in RGB format to Grey level
4. Apply frame difference method for moving object detection
5. Apply algorithm of Canny edge detection on detected moving object

Fig. 1. Different frames in the input video (a) Frame 71, (b) Frame 72 (Grey level)

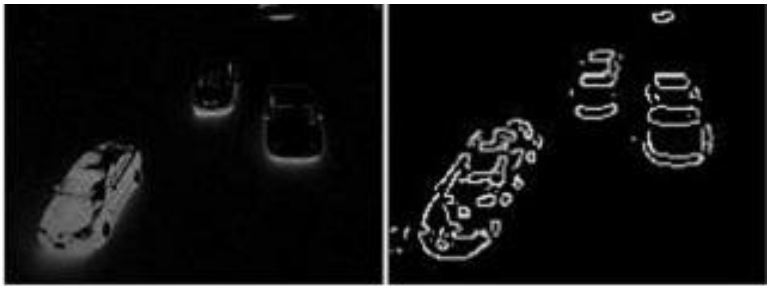

Fig. 2. (a) Frame differenced image (b) Canny edge detected image of frame differenced.

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(c) Laplacian of Gaussian of Frame differenced image.

V. DIFFERENCE OF GAUSSIAN ON FRAME DIFFERENCED METHOD

One of the main advantage of Difference of Gaussian for edge detection is that it can be used for colour images as well as in case grey level images. In Fig.3. is different frames of videos in RGB colour space. Fig.4. (a) is frame differenced images of two frames as shown in Fig.3. Fig.4. (b) shows the final output of the proposed method. It shows that Difference of Gaussian on Frame differenced image. From figure, we can see that by using the proposed method we will get the complete contour or the fine edges of object no other information or noise as compared to others.

Algorithm

1. Video input
2. Convert into frames
3. Apply frame difference method for moving object detection
4. Apply Gaussian filtering to smoothen the image with two different values of σ. with $\sigma_1 > \sigma_2$
5. Difference of these filtered images will result the output as Difference of Gaussian

Fig. 3. Different frames in the input video (a) Frame 71, (b) Frame 72

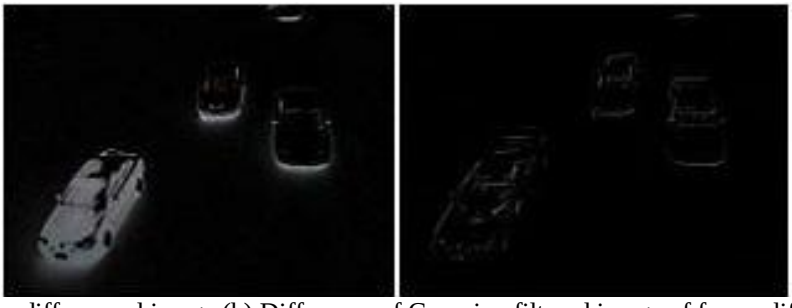

Fig. 4. (a) Frame differenced image (b) Difference of Gaussian filtered image of frame differenced image

Fig. 5. Different frames in the input video (a) Frame 784, (b) Frame 785

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Fig. 6. (a) Frame differenced image (b) Difference of Gaussian filtered image of frame differenced image

By using Difference of Gaussian method noise is less as compared to Gradient method because of smoothing by Gaussian filter.Fig.5. and Fig.6. shows the output of the proposed method by using other input data.

VI. CONCLUSION

In this paper we presented an edge detection method of moving object for processing video data. It summarizes as fine edge detection of detected moving object. Amongst the method reviewed, Difference of Gaussian on detected object is found to be more promising as it gives connected contour of object in less computation time. This present work can be extended further by using moving camera. Also we will try to test our method on real time videos.

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