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Mobile Object Recognition with Its Enhancement

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Abstract:
Different methods employed for object detection are widely exploited covering application areas such as traffic monitoring, video surveillance and capturing various human activities and motion. The traditional methods that have earlier been proposed for detection are found to be beneficial if the detected object is properly identified. Moreover, minimizing the effect of dynamic changes as well as development of the algorithm which is robust of intensity variation is a challenging task. So this paper emphasizes on enhancement followed by detection which provide an ease for identification of distant objects. The task of detection was performed on a video using simple detectors and developing an approach for proper segmentation of moving objects. Moving body was detected from a video having a frame rate of 25 frames per second, total bit rate of 234 kbps and having 160x112 as frame width and height. Further operation of enhancement and detection was processed on MATLAB R2013b tool.

I. INTRODUCTION:

The manual way for monitoring any system depends on subjective analysis and judging which provides low accuracy and sometimes gives wrong results. The traffic monitoring system as well as system employing feature extraction needs to first find the interested feature to be extracted that may get eroded due to noise. So enhancement of those features with an efficient algorithm development should be done for increasing the efficiency thereby increasing the accuracy of the detected object. For monitoring and tracking any object in a video a technique called background subtraction is generally used. The implanted technique should be robust of intensity and illumination variation and the dynamic changes should also be hindered. A corresponding vector field and an optical flow field can also define a motion. The displacement of pixels between two frames is described by a corresponding vector whereas the velocity is defined by the optical flow of the pixels. The algorithms developed for motion segmentation should be capable of removing the problems of occlusion and aperture. Development of such an algorithm that removes all such problems is a challenging task. In this paper the detection of moving object was done by the method of EX-OR between different frames [1].The preprocessing of video is shown in section III. The detection through efficient algorithm development is shown in section IV. The tracking of the object through background subtraction is described in section V and the results of detection with enhanced images are shown in section VI.

II. DETECTION:

A. Related work

From the past few years different methodologies have been proposed which has widely covered application areas such as artificial intelligence, computer vision, security surveillance, traffic security, feature extraction, identification of distant object, face

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recognition, expression detection and many more. All these applications led to untiring efforts for further research in this field. Many existing algorithm show results of detection in best way possible but the implemented algorithms may have drawback of speed, they may be sensitive to illumination variation and noise. For detection a large number of techniques exist. The detection of moving objects can be carried in three different categories which includes frame difference method, optical flow method and background subtraction method. Optical flow method is used for analyzing the motion in an image sequence and proves to be beneficial as it can work even if the camera is moving but this method is computationally very complex and also gets affected by noise. Without specific hardware this method cannot be applied to a video stream in real time.

Most of the drawbacks of this method were removed by X. G. Wu et al where the improved method solved the problem of velocity transmission near the boundary points [2]. Differencing method uses the difference of the pixels between two consecutive frames for detecting the motion of the object and uses a method of threshold to extract the information of moving regions. Different temporal differencing algorithms have been implemented. A. D. Sappaet al implemented the technique of detection by combining edge detection technique with normal temporal differencing. The algorithm was advantageous in terms of anti jamming and was also simple but accurate extraction of object was not possible.

Background subtraction is a method of detecting moving regions from an image. Reference background should be updated every time in a video sequence. Many algorithms have been developed to minimize the effect of dynamic scenes. G. Jing et al. proposed a mean based model in which the establishment of the background was done by considering time median of each pixel. Y. Sheikh et al. proposed an estimation based model. It was robust to dynamic changes butit lacked in real time detection of objects and was a bit complicated [2].The detected result should be such that it should be free from noise. The presence of noise causes illumination variation in the pixel value which is not desired. So enhancement of captured image should also be done. Processing of images to extract some specific features is called as image enhancement [3]. The main motive of image enhancement is to improve the original image for some specific applications. It sharpens and improves the quality of image features such as boundaries, contrast to make a better graphic display and for better analysis. Image enhancement has been categorized into spatial domain method and frequency domain method [4].Spatial domain method is based on direct manipulation of pixels in an image. Frequency domain method is based on modifying FT of an image. Enhancement of an image is done by sharpening, noise removal and for increasing brightness. Noise is a major factor that needs to be considered as noisy signal creates distortion that may result in false detection or may lack in accuracy. Our aim is to reduce the effect of noise so that better detection results are obtained.

III. EFFICIENT DETECTION:

A. Pre-processing of a video:

The captured video is in RGB format. For processing avideo, the video needs to be converted into frames first andthen processing each frame having RGB component is donethat affects the processing speed a lot. The conversion of RGBimages into gray images for enhancing the speed is done by using standard NTSC equation.

Intensity=0.2989(R)+0.5870(G)+0.1140(B) (1)

The result of conversion of RGB image into gray is shown in Fig. 1.

Fig. 1. Result of RGB to gray image.

B. Segmentation

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Different targets may correspond to result of motion detection. The cameras that are mounted capture the relevant information which may be human, vehicles, building and other objects. So, correct classification of an object is must. For detection of any object we first need to segment the relevant Information in a frame. Thresholding is the method employed for it. Mapping of the captured frames into black and white images carrying 1-bit information per pixel is done which converts the grey image into binary image [1].

$$p = \begin{cases} 0, \text{ intensity} < \text{threshold} \\ 1, \text{ intensity} > \text{threshold} \end{cases}$$

where p is the new value of pixel. The problem with thresholding is that it is a manual process. For a particular value of threshold the frame needs to be analyzed first [5].Also changing the intensity value for a particular frame needs the value to be updated again. So, the thresholding here is done by Otsu method which sets the threshold by itself. This method is used to threshold the image by taking into account the clustering pixels. The optimum threshold is calculated which separates the two classes for minimizing their combined spread which is its intra class variance. Fig. 2, shows the result after thresholding at different values.

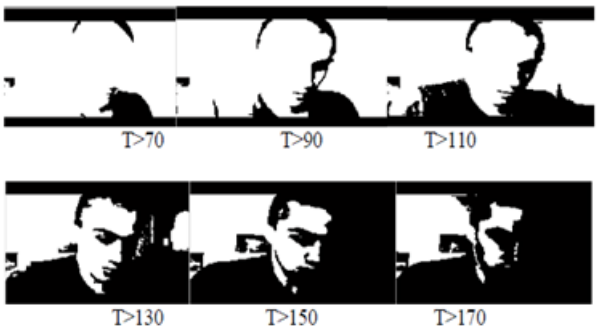

Fig. 2. Segmentation at various threshold values.

The information from binary image then needs to get extracted. For extracting the information of edges different operators are present. Proper selection of operators is must. We have used canny detector in this as it smoothens the image, finds the gradients, provides non maximal suppression and edges are tracked by hysteresis easily. Results after canny detector at different threshold are shown in Fig. 3, and results of detection by Otsu method of threshold and using a Canny edge detector are shown in Fig. 4.

Fig. 3. Detection using canny detector at different threshold.

IV. TRACKING OF MOVING OBJECT:

To precisely extract a moving object from any video having a complex background a simple technique of background subtraction is generally used. This technique differentiates between the pixels that are stationary and non-stationary per frame [6]. For modeling, the background information of the pixel is used. The proposed technique is implemented by applying EX-OR operation between the frames which states that the detected part will be shown when the pixel values of the frame are different, same values of Pixel in the frame shows no detection [1].

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Fig. 5. EX-OR operation for detection.

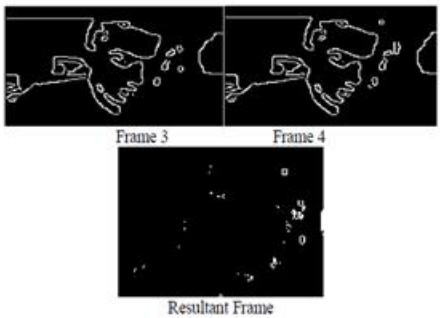

Fig. 6. EX-OR operation between frames for detecting moving object.

V. ENHANCEMENT:

In recent years, the demand for resolution enhancement of pictorial data in images has increased in order to improve the quality of an image. By performing image enhancement process we can easily improve the clarity of an image Methods and objectives of enhancement can vary according to requirements or applications. There are many algorithms that have been developed efficiently for image enhancement. The algorithms tend to be simple, qualitative and accurate. Some of the algorithms are Median filter, Contrast stretching, Histogram Equalization, Negative image transformation and power law transformation. In this paper histogram equalization algorithm is used. Histogram equalization is a distribution of a particular type of data [7]. By this method the contrast and appearance of an image are improved. Entire spectrum of pixels (0-255) is stretched by this process. A histogram that covers all possible values which is used by gray scale is determined as a good histogram. Some of the methods employed for it are Histogram expansion, Local area histogram equalization (LAHE), Cumulative histogram equalization, Par sectioning and odd sectioning. In this paper, cumulative histogram equalization is used. This method has better performance in comparison to other methods developed for histogram equalization. Enhancement process of an image includes the process of sharpening, noise removal and increasing the brightness of an image. A key advantage of this method is that it is a fairly straight forward technique and an invertible operator. The result after enhancement of an image is shown Fig. 7.Theresult of image after enhancement can be easily visualized by comparing it to the image shown in Fig. 1.After enhancement the pixel cover more information of the edges. Fig. 8 illustrates that good detection results are obtained by using the same detector and same method of threshold.

Fig. 7. Image after enhancement

Fig. 8. Detection results after enhancement.

TABLE I. PSNR OBTAINED AFTER ENHANCEMENT

Frame format	Enhancement results		
	Target	*PSNR*	*MSE*
.tif	Human motion	18.4136	936.9523

The results are more appropriate for videos covering medical applications such as in MRI machines where enhancement as well as detection is required. In air surveillance

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for finding the obstacles in front. In military applications as well. The algorithm fails in capturing video in night, in heavy rainfall and snowfall.

VI. CONCLUSION:

The tracking techniques described in this paper are very much useful for video surveillances, monitoring, pattern recognition and applications related to computer vision. Analysis of each implemented algorithm is done correctly. The implemented detection technique is very much beneficial for correct identification. The hardware implementation of the algorithm developed with proper development of verilog code is left as future work.

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