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An Effective Object Detection and Tracking by Background and Foreground Detection

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Abstract: the advance of technology makes video acquisition devices better and less costly, thereby increasing the number of applications that can effectively utilize digital video. Compared to still images, video sequences provide more information about how objects and scenarios change over time. For object recognition, navigation systems and surveillance systems, object tracking is an indispensable first-step. The conventional approach to object tracking is based on the difference between the current image and the background image. The algorithms based on the difference image are useful in extracting the moving objects from the image and track them in consecutive frames. The proposed algorithm, consisting of three stages i.e. Color extraction, foreground detection using gaussian mixture model and object tracking using blob analysis. Initially color extraction is done to extract the required color from a particular picture frame, after color extraction the moving objects present in the foreground are detected using gaussian mixture model and blob analysis is applied on consecutive frames of video sequence, so as to observe the motion of the object, hence the moving object in the video sequences will be tracked. The detected and tracked objects information on which data analysis is performed which helps to organize any city smartly.

Keywords: object recognition, detection, background detection, foreground detection, blob analysis.

I. INTRODUCTION

In recent years the automated video surveillance has evolved as a major milestone in the field of image processing and computer vision. The tracking of moving objects in video pictures has set a impact in computer vision. The techniques in the existing systems are mainly based on background subtraction. The initial step in object recognition, navigation systems and surveillance systems is the object tracking. In real time scenario, object tracking has greater importance as it is useful in various applications such as to observe the behavior of customers in a shopping area, Surveillance and security to identify the people, provide a higher level of security by making use of visual information, in medical field to increase the quality of human life for physical therapy patients or physically challenged people, to improve the design of building and environment, in order to obtain automatic annotation by video abstraction of videos, video editing to remove the interaction of human operator, in order to obtain summaries which are object-based, in analysis the flow of traffic, to detect the chances of accidents. Tracking is considered to be the most difficult task in the field of computer vision. The main objective of tracking is to synchronize object and object parts in the frames of the video. In surveillance applications object tracking plays a important role as it provides the temporal data which helps in enhancing the low level processing like motion segmentation and to provide data extraction of high level such as analyzing the activity and behavior recognition. In case of segmentation of low accuracy, tracking becomes tedious task to be applied in the congested situation. Examples of such segmentation which leads to error are as follows, full or partial occlusion of objects, shadows which are too long and irrelevant stationary items in the scene. For obtaining better results of tracking it is important to overcome shadows at motion level detection and should be able to overcome occlusions at tracking and segmentation level. According to the need of application, tracking in the video can be categorized. Tracking can be used in accordance with its methods that can provide the solution.

In tracking objects as a whole there are classified into two approaches: first one is based on matching it correspondingly and other is to tracking it explicitly and making useful for prediction of the position or estimation of the objects in a motion. On the other hand, the tracking a part of the object implies from a method (commonly human being) employs to locate the object which is based on the model schemes and tracking of the parts of the body. Some example of such models are 2D contour, cardboard model, 3D volumetric models and stick figure which used for the combination of the estimation of the motion methods with matching the

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correspondence objects tracking. It is modeled in such a way that it can be able to track the people's parts such feet, torso, heads and hands by means of the Cardboard Model which represents positions to be in relative and sizes of parts of the body. The individual objects have to be handled to keep templates of appearance for matching the merge and in case of splitting. In this paper the Gaussian Mixture Model has been used for the algorithm and a background modeling method is used for the extraction of objects moving and for prediction of trajectory.

The workers location or the objects moving has been tracked and plays a important in the monitoring of labour, coordination of the machine and management of the resource. For the tracking of an object in the camera is often utilization and obtaining information of construction of the motion of vehicle which can be employed in controls and coordination. Particularly for the control of targeting it multiple times in formations, the real-time tracking of autonomous vehicles, still suffers from constraints which are imposed for the resources computation. The prototypical tracking system the CMOS camera is used in the detection of the vehicle in their color-tags. For surveillance and monitoring systems the digital camera is the popular sensor used in these applications. The modern digital cameras, semiconductor technology have been improved for the high number of pixel number which can be provided greater detail of the image in various applications. A complementary metal oxide semiconductor or the charged-couple device contains an array that utilizes image sensor. The real image is transformed into RGB which is like a mosaic and a light is passed through the color filter array and lens projected on the digital image sensor array. The reconstructed raw RGB image then has an image which provides meaning for perception of human by de-mosaicing and correction of color.

The image processing additionally used for applications of sensing in extraction of object, this is required for every pixel of image. Moreover, the notice has been considered that processing of image consumes a lot of space in a memory and is most computed in the resources for the computer system.The initial step for the recognition of the object is the moving object detection. The main aim of object moving is for the detection at the extraction of the objects moving that are of interest in sequences of video with back-ground which can be dynamic or static. The spatial or temporal information are used by the algorithm in the sequence of image for the performance of the objects moving detection, and the pixel intensity is the most commonly used approach. The algorithms which have been proposed in the literature is the object moving detection, most of the algorithm can be categorized into one among three different most popular approaches. In the real time approach some of them can perform the object moving detection, in which the background subtraction is included. There are two basic problems which include one for speed processing and second one the reliability for the object moving detection, and also the quality measurement of related algorithm of two indexes which are mentioned majorly. The object moving is detected and can be divided into three categories, including background subtraction method, frame difference method and optical flow method.

II. PROPOSED METHOD

To Background modeling, background subtraction and foreground detection are the principal steps of background subtraction approaches Background model is the image which doesn't include any moving objects. A good background model generation assures an accurate detection of moving objects in a video sequence. This paper proposes a background modeling approach. To generate this model, we use both pixel-based and block-based processes to classify background pixels from those belong to the foreground. After that, to minimize the noise in the results of the background subtraction the structure-texture decomposition is applied on the absolute difference image. Just the structure component which contains the homogeneous parts of the image is used in the segmentation. The binary motion detection mask computation is made using a selected threshold. Fig. 1 represents the moving objects detection processes used by our approach.

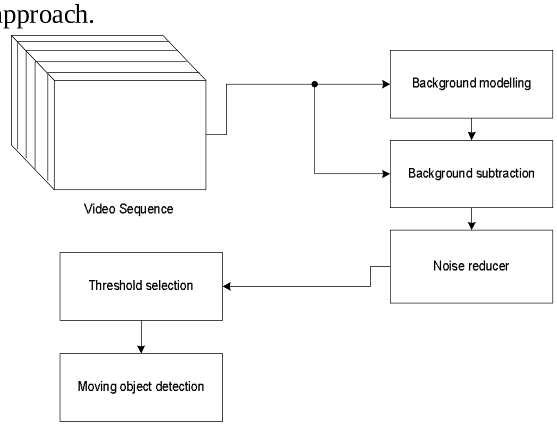

Figure 1. Motion detection process

A. Background Modeling

The proposed background model utilizes block-based and the statistical characteristics of a pixel in order to extract the static image (background image). The block-based background model generation including the matrix representation and the probabilities calculation is presented as follows:

Matrix representation: Our background model development consists in dividing the T initial images of the sequence into blocks of n pixels where n can be in the range of 2,4,8,16. In this paper, we use n 2 . Therefore, each formed block has 2 pixels. After that, each block (i,j) of the sequence are combined to form a matrix Mbi, j . Consequently, we have M, N / n2 matrix of blocks, such as each image of the sequence has M rows and N columns.

Probabilities calculation: After the matrixes of blocks are formed, the probability density function (pdf) of pixels intensity into each matrix is computed. The probability density function of each pixels luminance l of the matrix Mbi, j can be expressed as follows:

$$pdf(l) = nl / (T \times n)$$

The pixel that has the highest value of pdf is classified as background. The same idea is applied for the block candidate background. In order to select the block background, the probability of each block in the matrix which is the sum of pdfs for each pixel is computed .the probability of block at time t

B. Background Subtraction

The technique used in the image processing fields and in the computer vision is called as Background subtraction. This can be also known as detection of foreground. It is method wherein foreground of an image is extracted and processed further. The regions of an image which is interest are objects (humans, cars, etc.) and are foregrounded. It is a widely used technique for detecting objects moving in videos captured from static cameras.

The process of subtracting and separation of the foreground object from the background image in the sequence of frames of video is called as background subtraction.

The background is estimated by differencing the previous frame from the current frame. The background subtraction equation then becomes:

$$B(a,b,t) = I(a,b,t-1)$$

$$\Downarrow$$

$$| I(a,b,t) - I(a,b,t-1) / > th$$

Where th = threshold

Frame difference:

$$| frame_{s} - frame_{s-1} | > th$$

The background frame which is estimated is just a subtraction previous frame from the current frame and is evidently worked on only on its certain conditions of speed of an object and rate of frame. It is very sensitive to the threshold condition.

C. Foreground Detection

In the background subtraction approaches, when the background image is generated the difference between the current image in the sequence and the background image is calculated. Then, a threshold operation is applied to decide if a pixel belongs to the background or to the moving object.

The selection of the best threshold can be difficult. The most algorithms select it by testing a set of threshold values and then choose the one which is given the best results. In this paper we use the threshold proposed by the following equation:

$$th(x, y) = 1 - exp(t (x, y))$$

Where it *t I* is the current image and *t B* denotes the background image. The value of the threshold $th(x, y)$ has to be in range _0,1_. When the absolute difference is small, the threshold goes to *0*, and if the absolute difference value is significant, $th(x, y)$ converges to *1*.

the moving object can be represented by a binary image. The elaboration of this binary image will be realized by the computation of the binary motion detection mask $D(x, y)$. The pixel belong to the moving object when the result of the absolute difference is significant, therefore the threshold value is close to 1, otherwise is belong to the background. The binary image which represents the moving objects at time *t* of the sequence is computed.

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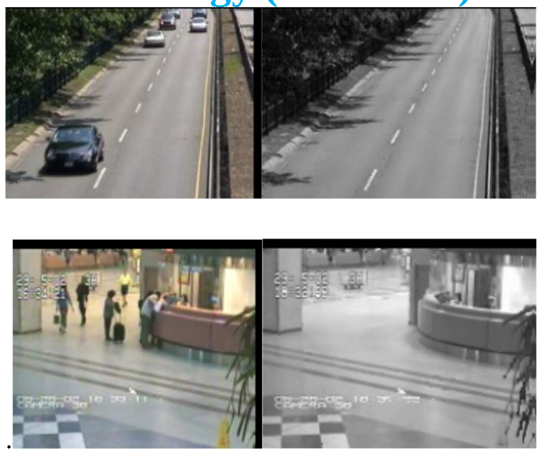

Figure 2. Background image of “Hiyway” and “Airport” sequences, first column: an image of the sequence, second column: background

D. Blob Analysis

A blob is an area for pixels which are connected in image processing. The study of various images in the regions which identifies these regions in an image. By the value of the pixels the algorithms is discerned and place them in one of 2 categories namely

The foreground (pixels with a non-zero value) or in

The background (pixels with a zero value).

The use of blob analysis is in the typical applications, the blob features determines the calculation of the perimeter and area, shape of blob, Feret diameter, and location which is used. The importance in analysis of blob is that the tools which make them suitable for different applications such as pharmaceutical, inspection of foreign matter in a food or pick-and-place.

Since a blob is a region in which the pixels are touched each other and the tools are analyzed by considering pixels which are touching the foreground pixels and is a part of the same blob. The human eye can easily identify the several distinct but the touching of blobs and may be interpreted by software as in a single blob. The blob in any portion of the background pixel has to detect in state because of reflection or lightning is considered as subtraction of background during analysis of blob.

Blob analysis is used for determination of blobs, which detects and satisfies the certain criteria and finds characteristics of spatial properties. In many applications the implementation of consuming of time plays important role, based on the characteristics of spatial domain the blob analysis of blob is used to remove blobs that are not been used for any purposed, and keeps only the useful blobs that is implemented in the execution and it analyzed for further process. It can also be used to determine the information in the statistical domain such as the number of blob used or size of the blob used, the presence of the region of blob and location in which the blob is located.

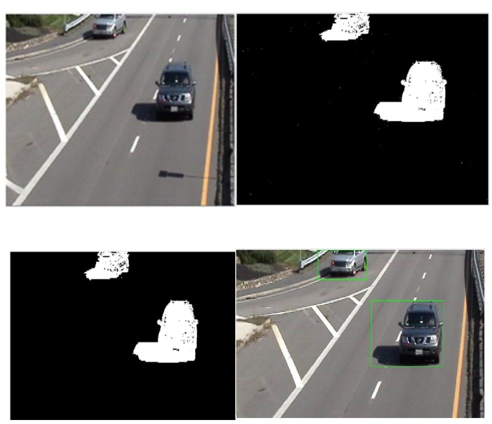

Figure 3: Representing original video, background image, foreground image, blob analysis with rectangle showing detection of object in video.

The detailed differences between original video, background image, foreground image and blob analysis are mentioned above. follows.

III. EXPERIMENTAL RESULTS

The detailed information is mentioned in this chapter gives us different video which are used in the observing it experimentally, number of the frames used in the detection of object based on block based background modeling. The detection of object is compared with the existing system using mathematical morphology and the proposed system using background modeling with morphology. The different operations are compared with the performance evaluation of recall and precision values results obtained with detection of object in video. The computational time is i.e the time taken to detect object is compared with mathematical morphology and block based background modeling detection of an object.

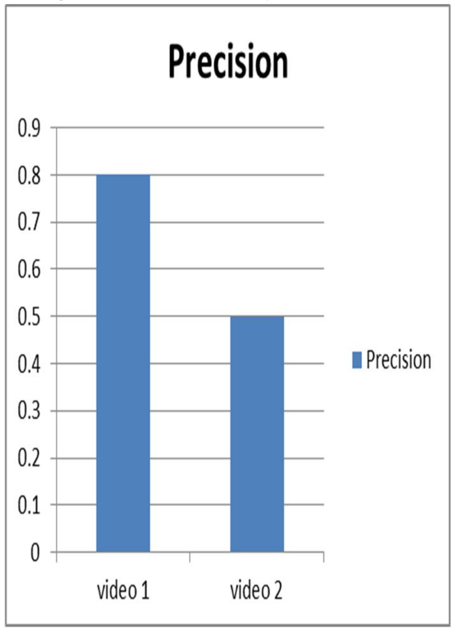

Figure 4: This shows that in video1 is objects are detected successfully whereas in video2 the objects are detected only limited.

The figure 4 explains that in two video inputs given the precision rate to detect and track an object in a video is video1 shows a precision rate of 0.8 and video2 shows a precision rate of 0.5. Therefore the average precision rate of detection and tracking of object using mathematical morphology is 65%.

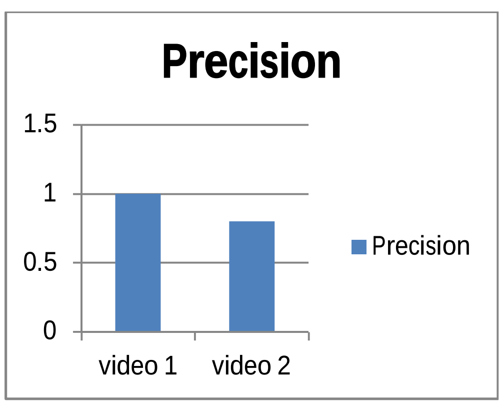

Figure 5: This shows that in video1 is objects are detected successfully whereas in video2 the objects are detected only to some extent fully.

The figure 5 explains that in two video inputs given the precision rate to detect and track an object in a video is video1 shows a precision rate of 1 and video2 shows a precision rate of 0.8. Therefore the average precision rate of detection and tracking of object

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using block based background modeling with morphology is 90%.

IV. CONCLUSION

In this research work, we have used block based background modeling with morphological operation for the identification and detection of the objects in a video. First the video is given an input which read in the form of frames one by one each. The frames are processed and preprocessed by converting it from RGB to gray scale. By applying a background subtraction algorithm we obtain a background and foreground image from a frame. Gaussian mixture model is used to remove the noise from a frame.

Thresholding segmentation is applied to discard unwanted pixels and to retain only pixels whose pixel value is greater than specified threshold. The morphological operation erosion is applied to obtain the structuring elements. Blob analysis is applied where it identifies an object in video and draws a rectangle around the identified object.

The performance evaluation is calculated with precision value and is compared with precision rate of existing system. The precision rate of block based background modeling with morphology is 90%.

The precision rate of mathematical morphology is just 65%. We can conclude that performance rate of block based background modeling with morphology is gives better result when compared to mathematical morphology.

V. ACKNOWLEDGMENTS

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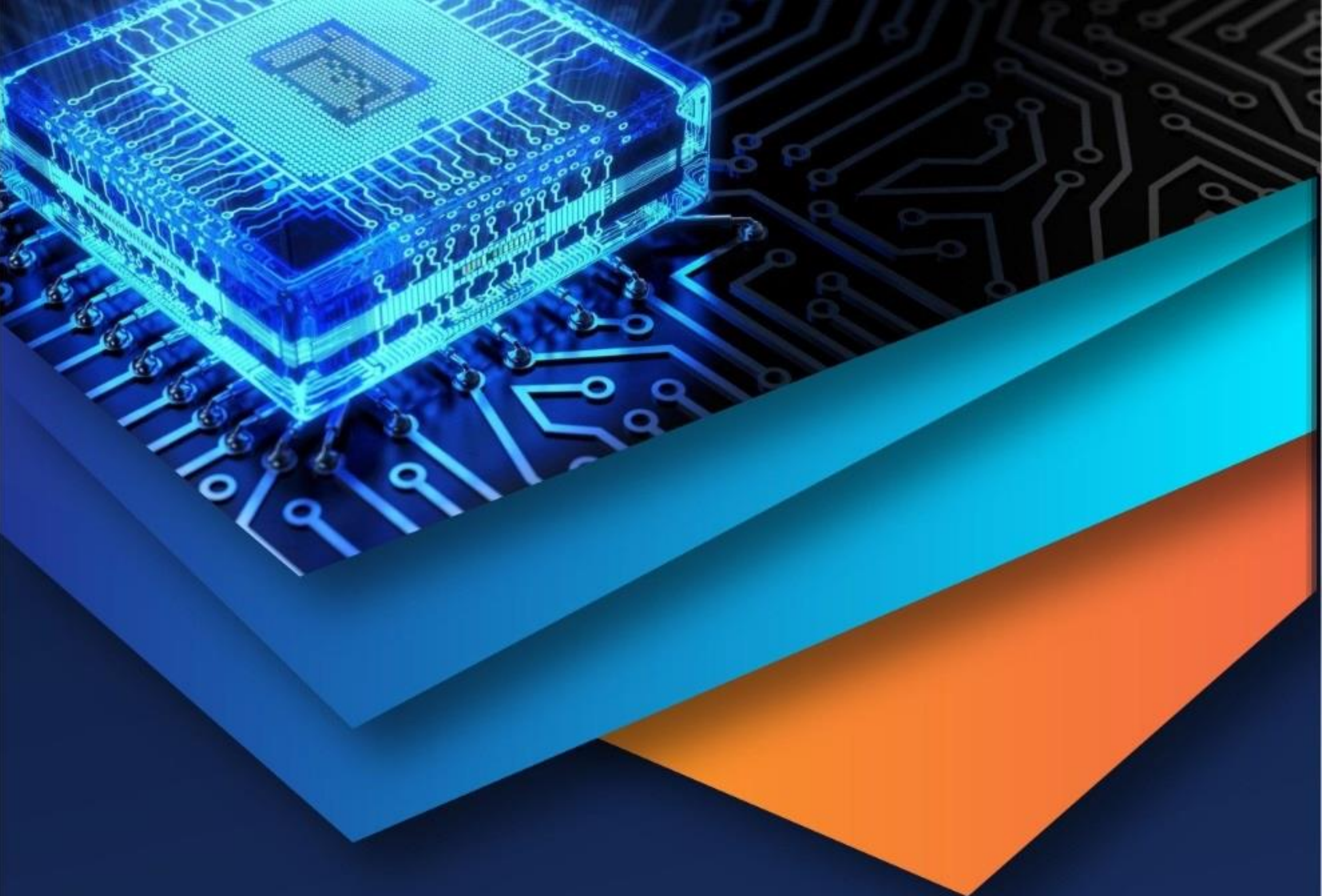

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