AUTOMATIC MOVING OBJECT DETECTION USING MOTION AND COLOR FEATURES

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ABSTRACT- This paper deals with the impleme-ntation of automatic detection of objects using hybrid parameters like motion and color features which are inevitable in various computer based vision applications like video surveillance system. We are using the hybrid parameters for detection on Background subtraction technique with the help of integration of new methods into real time object tracking system, followed by statistical optimization steps to increase high accuracy using high resolution image. MATLAB functions are used to create a basic image processor having different features like Red, Blue and Green components of color image and various other features (noise addition, removal, edge detection, cropping, resizing etc.) that is used in basic image edition and the result is displayed on the GUI platform.

KEYWORDS-

1) MATLAB: Matrix Laboratory
2) GUI: Graphic User Interface
3) Background subtraction
4) ROIs: Region of interest.

INTRODUCTION

For the past few years, automatic moving object detection has become increasingly important with application in video surveillance, user interface by gesture which are very active research topics due to the growing importance for security and public safety. Video surveillance of human activity usually requires people to be tracked. We present our system for single moving object detection and tracking using a static webcam inside four walls. Here object tracking is central to any task related to vision system. In this paper we present simplified objct method based on Background subtraction technique and using Matlab software which is the best software for image processing so we implemented algorithm on Matlab. Many algorithm for moving object detection have been proposed in the literature, most of them can be categorized in one of three most popular approaches. Some of them can perform moving object detection in real time, they include background subtraction and frame differencing. The third approach is optical flow is a more complex method and does not work in real time. They often target a specific problem such as face detection is one of the example and it proposes an object detection algorithm that is calibrated for detecting and tracking humans and objects by performing Background subtraction in both color and texture at the expense of updating the background. There are a lot of common difficulties and problems encountered when performing moving object detection like illumination change(at different times of the day in case of outdoor) and due to these problem the moving object detection fro the background becomes very challenging. We use moving object detection to generate a motion mask which provides information such as position and size of the target object that is requires to initialize the object tracking module.ain constraint ad are based on background learning and or pixel level motion analysis or they focus on detecting particular object. We introduce hybrid moving object detection scheme with motion-color features followed by a statistical optimization steps to increase high accuracy by using hi-resolution image. Many previous detection methods works for usually lower video sequences under certain

constraints. There are various stages which include different processes like morphological operation, noise removal filter which are require to obtain desired image. This detected objects can then be supplied to a tracking algorithm using Kalman filtering for robust object tracking. The output of moving object detection module is a noisy motion mask which indicates the result of the background-foreground pixel classification. It will then be further processed using morphological operation to obtain an accurate motion mask. This mask is used to initialize the object tracking system.
There are different steps in the process which are explained in different sections as shown below:-

METHODOLOGY

There are many difficulties which can arise in tracking of objects due to abrupt object motion changing appearance pattern of the object and the scene.In layman language ,tracking can be defined as the problem of estimating the path of object in the image plane as it moves around the scene. In other words a tracker assigns consistent labels to the tracked object in different frames for almost all tracking algorithm assume that the object motion is smooth with no abrupt changes.
In the present work the concept of static frame is used because the background technique is relatively static due to its low computational cost. In this implementation static camera has been used to capture the current image to track down the object. Using frame differencing on frame by frame basis a moving object, if any is detected with high accuracy and efficiency. Once the object captured it undergoes through different processes to get desired image for the matching purpose. Here, camera is used to capture the image and place a basic sensing element and it is the first step for a good visual surveillance system. Digital signal in image processing are initial level of digital image processing. In digital image processing the object detection process affects object tracking and classification process as well.
The various work steps which are included in the detection process:-

1. Capture current image
2. Processing of image.
3. Select thresholding.
4. Difference of image is greater than threshold object detected
5. Noise removal.
6. Background subtraction.
7. Display.

Overview of the system

Figure shows the overview of the system. Moving object detection is performed during the decoding stage. After decoding stage we get input frame which is compared with reference frame I_n. Then these two frames go through motion analysis stage in which moving edge map is proposed to form a motion mask.
The second stage involves color analysis in which we perform color segmentation only for areas where the initial estimate of the moving object are, and then both the color mask and the motion mask are fused in the third stage. At last moving object are updated in the refinement stage.

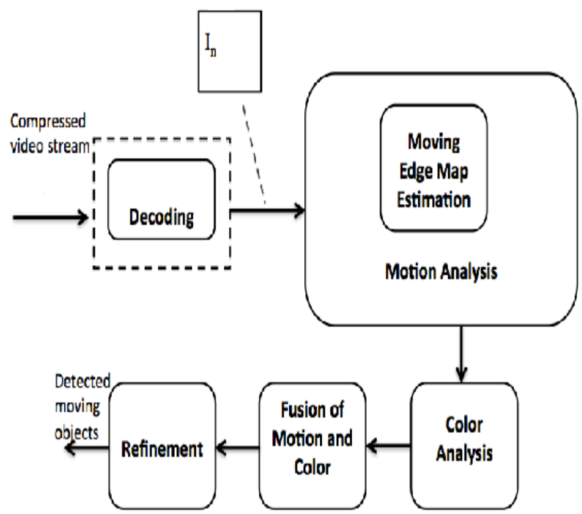


Fig: Overview of the proposed object detection algorithm

Motion analysis

After decoding the resultant frame is compared with reference frame and then we performed motion analysis which consists of :-

a) Background subtraction.
b) Edge detection technique.

Background subtraction

This method is one of the widely used methods to detect moving objects. It subtracts the generated background image from the input image frame to detect the moving objects. This difference image is then thresholded to extract the object. The problem with the stored background frame is that they are not adaptive to the environment changes which may create non-existent objects and also works for stationary background.

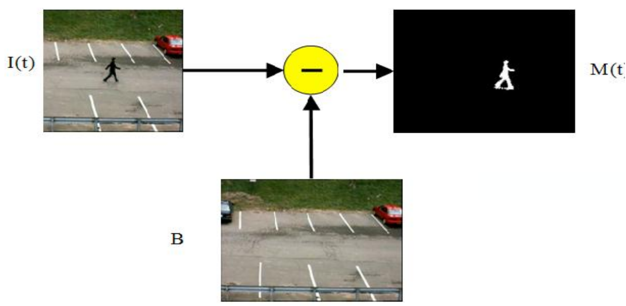


Fig : Background subtraction technique

Here,

I(t) = Input frame
B = Background frame
M(t) = Difference frame

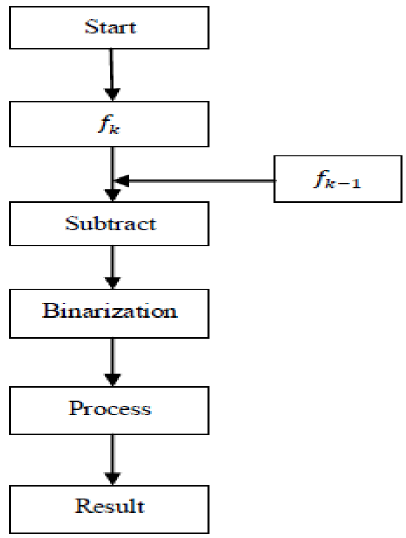
Frame Differencing

Frame differencing calculates the difference between two frames at every pixel postion and store the absolute difference. It is used to visualize the moving objects in a sequence of frames. It takes very less memory for performing the calculations. This extracted position is then used to extract a rectangular image template (size is dynamic depending upon the dimention of the object) from that region of the image(frame). The sequence of templates is generated as object changes its position.

The main objective of this study is to provide a better and enhance method to find the moving objects in the continuous video frame as well as to track them dynamically using template matching of the desired object. The proposed method is effective in reducing the number of false alarm that may be triggered by a number of reasons such as bad weather or other natural calamity.

Algorithm: The following section contains the analysis and explanation of algorithm used for detection and tracking an interested moving object.

The basic technique employs the image subtraction operator, which takes two images as input and produces the output. This output is simply a third image produced after subtracting the second image pixel values from the first image pixel values.



The general operation performed for this purpose is given by:

$$DIFF[I, j] = I_1[I, j] – I_3[I, j]$$

DIFF[I, j] represent the difference image of two frames.

Edge detection

The second stage of motion analysis employs the moving edged map. Edge information can be very useful in extraction shape information of a moving object. However, a simple difference of edges is not efficient because it suffers from noise. This is caused since noise varies from frame to frame, resulting in changes of the edge location. They define the difference of edges as:

$$DE_n = \Phi\left(I_{n-1} - I_n\right) = \theta\left(\nabla G * I_{n-1} - I_n\right)$$

Where the edge maps Φ (i) are calculated using the canny edge detector which suppresses the noise in the luminance difference. Here we first calculate the edge map differences of images DE_n using a canny edge detector. The moving edge map ME_n of the current frame I_n is calculated using the DE_n and the current frame's edge map $E_n=\phi(I_n)$. The edge map E_n = ($e1,e2,e3 \ldots\ldots\ldots e_l$) is defined as the set of all l edge

points detected by the canny edge detector in urrent frame I_n.
The moving edge map is then obtained by selecting all edge pixels within a small threshold distance T_1 of DE_n:

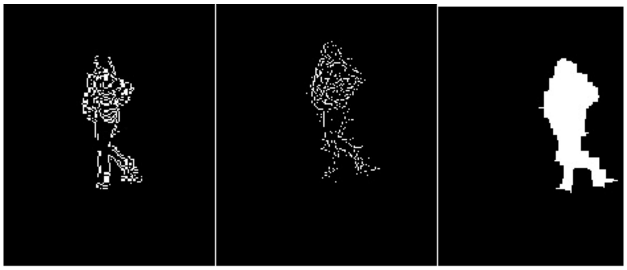


Fig: (a) edge map difference of images DE_n, (b) moving edge map ME_n, (c) area filling of Me_n

Here the picture emphasize that our algorithm performs moving edge map calculations only in the ROIs (Regions of Interest) of the motion vectors. We first consider each connected component in the motion vector mask, create ROIs, and then increase that ROI to allow a more generous area. Our algorithm provides a generous area here since it is an estimates and the boundaries will be further refined in the subsequent stages. The area filling shown in the above figure is the intersection of these two regions through a logical and operation, and we call this mask M_2.

We perform this union in order to include pixels of the true moving objects that may not be present in both masks. It is important to note that this union mask only provides an initial estimates of the moving objects. The object blobs will be fine-tuned through the color analysis stage and the refinement stage. The below fig shows the boundary of the moving edge map and the union motion mask

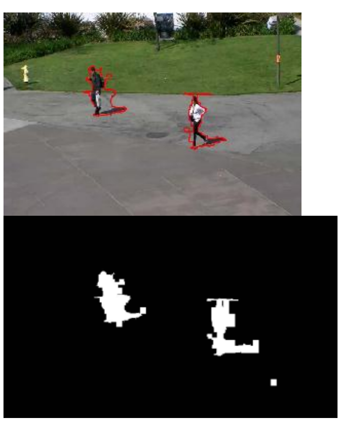


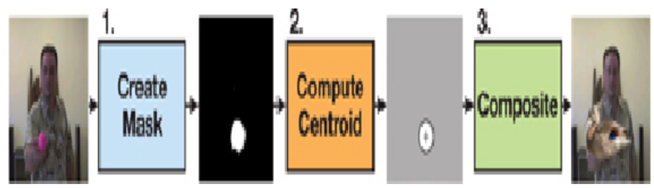
Fig. (a) Boundary of moving edge map, (b) union motion mask.

Color Analysis

The color analysis stage consist of collecting all color segmented regions overlapping with the motion mask. Similar to the calculation of the moving edge map the analysis first starts by pyramid segmentation on the ROIs of the motion vector mask, based on RGB values, and then performs collected components analysis to collect all color segmented regions R_C, k=1……p, where p is the no of regions. We then collect the moving color–segmented regions.

The general tasks needed to detect an object using color and then track it:

1. Create a masking image by comparing each pixel with a target color value. Convert pixels that fall within the range to white, and convert those that fall outside the range to black.
2. Find the centroid of the target color . the centroid of the tracked color defines the center position of the overlay image.
3. Composite an image over the detected object. Assuming the shape of the object doesnot change with respect to frame, then the change in area of the tracked color is proportional to the square of the distance of the object from the viewer.



Fusion of motion and color

Through empirical analysis we have found that using either a motion or color metric alone is not enough to extract a better boundary. As the first fusion step, we form a base mask of the current frame I_n as

$$Base_n = M_n \cap C_n$$

For some of the moving object blobs, we found that color analysis plays a key role in obtaining a more accurate boundary. Figure shows another frame and the boundary obtained by the moving edge map, and Figure shows the boundary obtained by the base mask

Fig (a) boundary obtained by the moving edge map, (b) boundary obtained by the base mask using color analysis.

It is also important to note that for some blobs, the base mask provides an underestimate of the moving objects since it does not include the entire moving object, as shown in Figure 10. This, combined with a union mask of candidate pixels, will be useful in the region-growing stage used in the boundary refinement.

Fig (a) binary mask obtained by the base mask, (b) boundary of the base mask showing the missing pixels of the true object boundary (person's foot).

CONCLUSION

We have introduced an algorithm for moving object detection for object tracking initialization. A technique for background subtraction with adaptive background model update with learning rate depending on pixel differences between the background model and previous frame is described, and an automatic setting of threshold for foreground-background pixel classification is presented.

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