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A Hybrid Probability Based Technique for Efficient Object Tracking from Videos

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Abstract

Object tracking refers to track object from the sequence of images or from the video. The technique of mean shift has been applied to find exact location of an object from the video and this technique works to track single object from the video. In this paper, Improvement in mean shift technique to track multiple objects from the video is proposed. The proposed technique had been implemented in MATLAB. The outcomes demonstrate that the proposed technique works well in terms of time, correct detection rate, frame rate and accuracy percentage.

Keywords: CDR, FPS, Multiple objects, Object tracking

I. INTRODUCTION

The objective of object tracking is to locate the exact location of an object or multiple objects at a specific time from a video. The input to the object tracking strategy is the image frames taken after small intervals of time. Object tracking is performed by observing space and time variations in image frames [7]. Detection and classification of object are preceding steps for tracking of an object as shown in fig 1.

Fig 1: *A generic framework for object tracking*

A. Object Detection

Tracking strategies requires detection mechanism for identifying and clustering of pixels of an object of interest in video. Moving objects are considered as foremost origin of information [7].The point of convergence of many object detection strategies is moving object and the most utilized techniques for object detection are [3]:

Frame Differencing

This technique gives estimate of location of an object. The calculations utilized are uncomplicated and its implementation is effortless. Distinction between two consecutive images unveils to us the presence of moving object. This technique is robust and adaptable yet requires point by point blueprint of moving object [3].

Optical Flow

This technique obtains the pattern of clear movement of an object and its surfaces between a spectator and image scene. It gives complete information about movements of object and detection of moving object is done from background for more accuracy [3]. Optical flow strategy figures the image optical stream field and performs clustering process as indicated by optical stream conveyance attributes of image in fig 2.

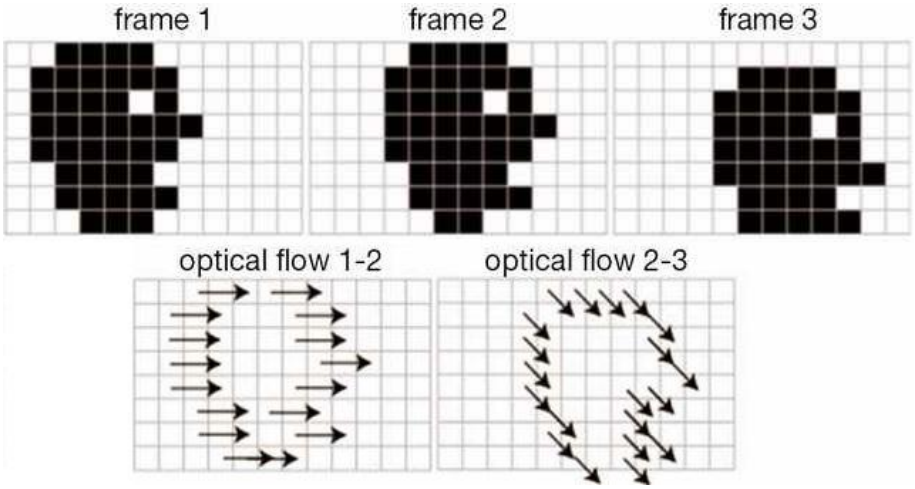

Fig 2: *Optical flow of frames [5]*

Background Subtraction

Background subtraction is the most comprehensively utilized technique for object detection. A pixel is considered as significant movement if the refinement is more conspicuous than threshold and named as frontal zone [3]. The goal is to leave quite recently the frontal region objects of energy by subtracting background pixels in the scene as shown in fig 3.

Fig 3: *Background Subtraction [4]*

B. Object Classification

Object classification is a technique which can classify the objects on the premise of their properties such as colour, motion, shape and texture. The commonly used classifiers are HMM and decision tree. Information of motion regions was given by various depictions of shape. Input features to shape based method is a mixture of image and scene features like image blob area and apparent aspect ratio of blob bounding box. Histograms are used for representing results [3].

C. Object Tracking

Object tracking means tracking the location of an object or multiple objects from sequence of image frames according to its movement around a scene and to predict future location of the detected object [8].The most broadly used object tracking method is clarified beneath:

Point Tracking [3]

Feature points are used for representation of moving objects. As the point tracking increases, lighting variation also get increased. Points can be lost due to high lighting variation. For tracking of objects for longer duration, it is important to reacquire points occasionally. Recognition of feature points is done and afterward by utilizing threshold, object is tracked as appeared in fig 4.

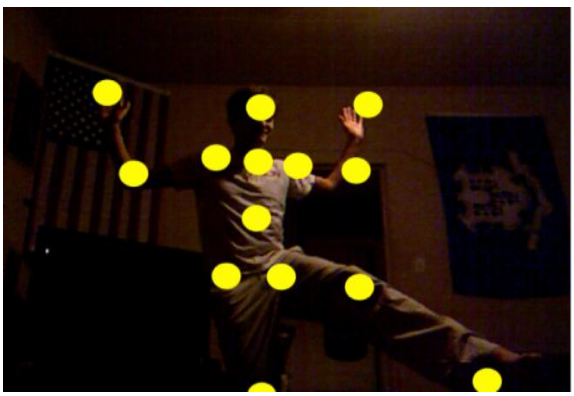

Fig 4: *Point Tracking [6]*

II. LITERATURE REVIEW

Ding and Huang (2016) [6] examined that the execution of a non specific object tracker may drop out when associated with recordings with severe movement obscure and the movement obscure is essential in honest recordings. In this paper, they proposed an approach to manage generic object tracker to an obscure invariant tracker without deblurring image progressions of unlabeled images. Wide trials demonstrate that the proposed algorithm robustly track objects in extremely obscured recordings and also in other testing scenes. **Parekh et al. (2014) [3]** introduced a concise survey of detection, classification and tracking algorithms including analysis and comparative investigation of strategies which are primarily utilized for tracking of an object. Available strategies for these stages have been clarified in detail and various weakness and restrictions were highlighted in every single technique. **Lipton and Patil (1998) [7]** proposed an algorithm including both temporal differencing and template matching. Motion detection detects the regions of motion under the template differencing which is difference between the current and previous frame and higher than a specified threshold. Each region of motion is cluttered into the object. Motion regions were recognized by motion detection using temporal differencing. After tracking of object, template was updated by merging of current template into the matched object. Matching is done at old position of an object. **Li et al. (2014) [9]** examined that background cues chiefly plays a supplementary part in many past methodologies for object tracking. In the event that object tracking deals with binary target classification issue, the similarity with the target and the distinction from the background can be considered similarly enlightening. **Singh et al. (2014) [14]** explained a method for detection of moving object in highly secured environment deployed in vehicles and permanent position. The issue addressed in this paper is improvement in efficiency of object detection in both disconnected and online video handling modes. Noise removal is also considered in this paper to improve image quality and segmentation.

III. METHODOLOGY

Proposed method

In probability based technique of object tracking, object states are not described by unique values but rather by probability distributions. Probabilistic method includes elements of randomness. Every time the method gives different results even with the same initial conditions. The events or states of the object are determined by probability of occurrence. Morphological segment is applied which scans the whole object and identify number of objects in each frame. Numerous strategies for single object tracking have been proposed in the past however tracking of multiple object is a difficult task. Improvement in mean shift technique to track multiple objects from the video is proposed. The flow of proposed work is shown in fig 5.

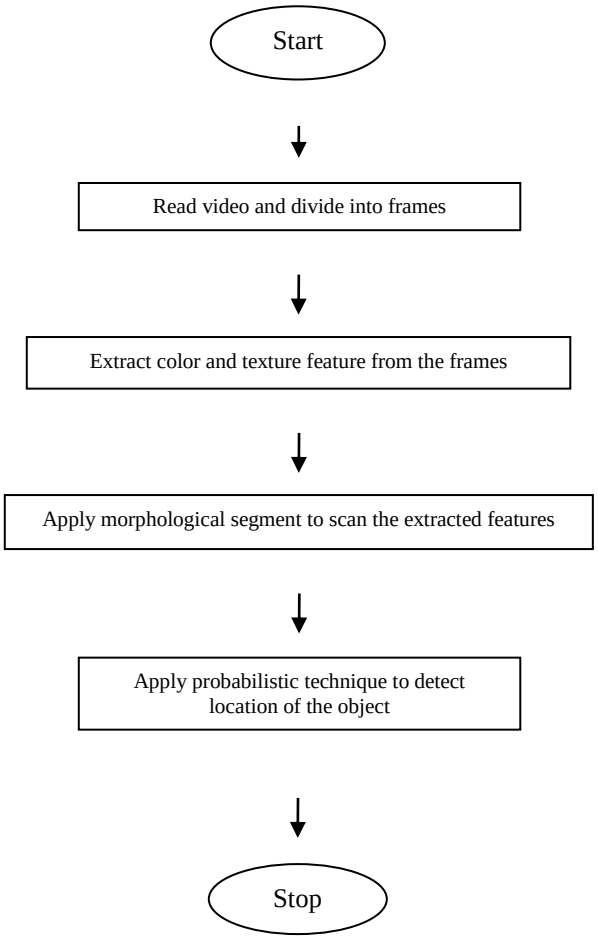

Fig 5: *Flow of proposed work*

A. Read video and divide video into frames

Video sequence consists of frames of images stitched together. Real time images assembled from output focus and reproduced images accumulated from uninhibitedly available database are used for image classification and division. These are crude pictures which are forbidden for analysis due to distinctive sorts of noise present in the pictures.

B. Extraction of color and texture feature

Color demonstrates magnificence and is utilized as effective apparatus as a part of substance based image retrieval. Color of the detected object helps in separating images from each other and calculates the intensity values of object pixels in present image frame. The goal is to recuperate each one of image whose color and texture courses of action resemble those of query image and then locate the correct area. Extract texture feature of image as texture is a repeated pattern of information of the structure with regular intervals. Texture gives the visual information about the object

in motion. The properties on which texture analysis is based are smoothness and uniformity. As there is no strict importance of image surface, it is successfully observed by individuals and is acknowledged to be a rich wellspring of visual data about the objects. This type of analysis is termed as texture analysis [2].

C. Morphological Scanning

Morphological administrators change the first image into another image through relationship with an image of some size which is structure part of an image. Morphology provides a proficient approach to manage the geometric characteristics of images and has been associated by an intemperate number of usages. The ultimate objective is to describe the key morphological operations. Morphology gives an efficient way to deal with geometric qualities of signals or images and has been connected generally an excessive number of utilizations. A technique based on fuzzy ramifications and incorporation grade operators is presented. The fuzzy operations of morphological segment scan expand the conventional operations by utilizing fuzzy sets. Union operation is supplanted by a greatest operation and convergence operation is supplanted by a base operation.

D. Apply Mean shift to gather similar information [3]

Mean shift technique is used to assess local density gradients of comparative pixels of image frames. Angle appraisals are performed in iterations and mean of pixel that exists in window is figured out. The result depends upon kernel size (bandwidth) and requires less manual mediation contrasted with different algorithms. Mean shift is a technique to bunch an image by accomplice each pixel with a peak of the image probability density. This peak is prepared by first describing a window in the area of the pixel and figuring the mean of that pixel. The consequence of mean shift is recently controlled by size of kernel and requires less manual intercession. Histograms of the previous image frame calculates confidence map of the present frame. Old position of the object helps in finding peak of the confidence map.

E. Apply Probabilistic Technique to detect location

The likelihood densities of the parameters are reachable in shut structure when a portion of the expressions are included. The proposed approach yields a distribution with a one of a kind maximum likelihood appraisal in which there exist an unbounded number of arrangements which are identical under the supposed geometric movement recuperation techniques. A transformation is doled out when it not just conveys the domain points near the relating range points but when it has an expansive support as it brings a huge measure of points which are near the domain points. On the off chance that the range points are in a degenerate arrangement, ML evaluation is additionally degenerated and it collapses the whole domain space to a linear relative assortment spread over by the range points. As the points approach decline, the ML gauge does not waver but easily approaches the decadence.

IV. RESULTS

In this paper, Technique of multiple object tracking has been proposed. In the existing technique, mean shift technique tracks only single object from the video. The enhanced probability based algorithm tracks multiple objects and performance of proposed algorithm is more than existing algorithm in terms of time, correct detection rate, frame rate and accuracy percentage.

A. Time

Time can be calculated as difference between the last clock and the start clock and is defined as time taken to detect all moving objects from the video.

B. Correct Detection Rate (CDR)

Correct detection rate is defined as the ratio of number of correctly detected objects and the total number of objects in a video sequence for a given threshold. The rate at which matching of ground truth and object getting tracked is done and there is no reference to the labels assigned. Considered values varies in between 0 and 1 where 0 refers to poor detection and 1 means good detection or ground truth objects are matched as shown in equation 1 where GT refers to ground truth (actual object motion). Correct detection rate (CDR) can be calculated as:

$$\text{Sum (GT == Predicted Labels) / numel (GT)} \qquad (1)$$

C. *Accuracy Percentage*

The accuracy percentage of object tracking in videos depends upon scene complexity factors, object configuration and interaction. Accuracy percentage is that proportion of the total detections that was correct as shown in equation 2 where CDR refers to correct detection rate. Accuracy percentage can be calculated as:

$$\text{Accuracy Percentage} = 100 * \text{CDR} \qquad (2)$$

D. Frame Rate

Frame rate is the recurrence rate at which device having ability to display images shows consecutive images called frames and is communicated in frames per second (FPS).

Table 1 shows the comparison of the parameters of mean shift technique and the probability based technique. The parameters time, correct detection rate, frame rate and accuracy percentage obtained from both the methods are tabulated and compared and the graphical representation of the table 1 results has been shown in fig 8, 9 and 10.

Table 1: *Results for CDR, Time, Accuracy percentage and Frame rate*

Parameter	**Mean Shift Technique**	**Probability based Technique**
Correct Detection Rate (CDR)	0.71	0.93
Time	0.08 sec per frame	0.05 sec per frame
Accuracy Percentage (%)	71.43%	92.86%
Frame Rate (FPS)	12 fps	20 fps

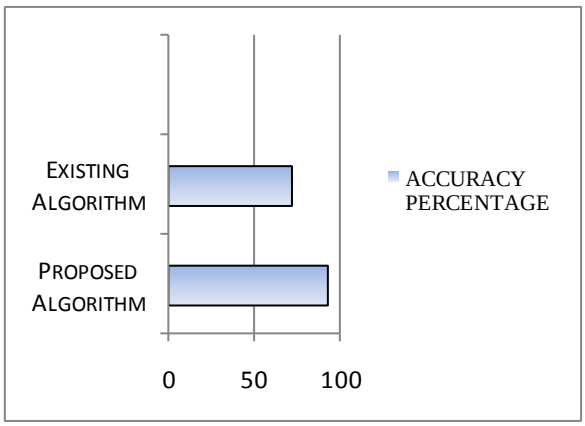

Fig 8: *Graphical analysis of accuracy percentage (%)*

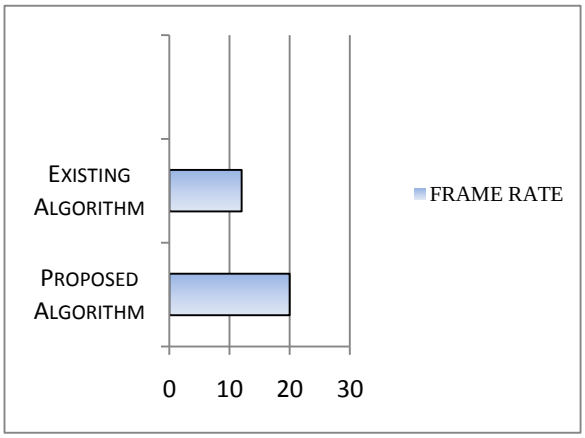

Fig 9: *Graphical analysis of frame rate (fps)*

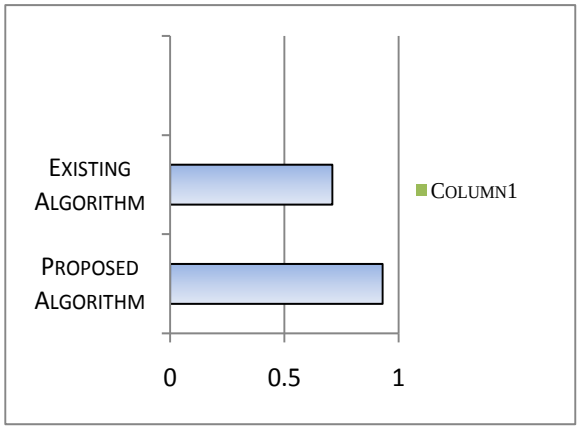

Fig 10: *Graphical analysis of Column 1*

From results detailed in table 1 and fig 8, 9 and 10, it can be concluded that the performance of probability based technique is more than mean shift technique in terms of time, correct detection rate, frame rate and accuracy percentage.

CONCLUSION

In this paper, it has been concluded that mean shift technique works well for the single object detection and tracking. For Tracking of multiple objects from the video, enhancement has been proposed in the mean shift technique. In the proposed technique, the morphological segmentation is applied which scans the whole object and identify number of objects in each frame. To remove noise from the frames, bilateral filter is applied. To predict location of multiple objects, probability based technique is applied which gather information of multiple pixels. The graphical results show that improved technique performs better than existing algorithm in terms of time, correct detection rate, frame rate and accuracy percentage.

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