ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 4, April 2015

Moving Object Detection and Tracking Using Hybrid Approach in Real Time to Improve Accuracy

DharaTrambadia[1], ChintanVarnagar[2], PrajeshKathiriya[3]

Post Graduate Student, Department of Computer Engineering, Atmiya Institute of Technology and Science, Rajkot, India[1]

Associate Professor, Department of Computer Engineering, Atmiya Institute of Technology and Science, Rajkot, India[2]

HOD, Department of Electronics Engineering, Balaji Institute of Engineering and Technology, Junagadh, India[3]

ABSTRACT: Real time motion detection has very wide application in human motion recognition or vehicle motion recognition. Patient monitoring, human–computer interaction are the recent applications of the human motion recognition, and is recent application of vehicle motion recognition are vehicle counting and very helpful in traffic control by detecting vehicle as per size, color, speed. In video surveillance real time motion recognition is very difficult so I want to work on real time motion recognition. Based on above discussion in my research work I have decided to develop intelligent framework for Real time motion detection or recognition for appropriate thing or object. Still real time image based or video based motion detection are hidden area so I want to carry out my work on real time video based detect behaviour of human as per movement of object or vehicle detection in sense of hybrid. It will prove very helpful for public safety.

KEYWORDS: Object Detection, Object Tracking, Gaussian Mixture Model, Optical Flow

I. INTRODUCTION

Motion detection and object tracking algorithms are an important research area of computer vision and comprise building blocks of various high-level techniques in video analysis that include tracking and classification of trajectories. In the domain of computer vision, object tracking plays a very important role. With the advent of powerful computers, the proliferation of high definition and economical video cameras, and the applications that require automated analysis of a video, a great increase in the interest in object tracking algorithms has come in picture.

For object recognition, navigation systems and surveillance systems, object tracking is an indispensable first step. Object tracking has significance in real time environment because it enables several important applications such as Security and surveillance [1] to recognize people, to provide better sense of security using visual information, In Medical therapy to improve the quality of life for physical therapy patients and disabled people, In Retail space instrumentation to analyse shopping behaviour of customers to enhance building and environment design, Video abstraction to obtain automatic annotation of videos, to generate object based summaries, Traffic management to analyse flow, to detect accidents, Video editing to eliminate cumbersome human operator interaction, to design futuristic video effects. Detecting the moving objects relative to the whole image is the major task of it. Detecting moving objects is the foundation of other advanced applications, such as target tracking, targets classification and target behaviour understanding [2]. Different methods are available for the detection of moving object from video sequences. There are four main methods for object detection which are stated below:

1) Spatiotemporal Difference
2) Background Subtraction
3) Optical Flow

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4) Block Matching Method

Temporal difference computes the difference between two or three consecutive frames. It is good at adapting to the dynamic environments, but generally poor at extracting enough relevant feature pixels, resulting holes being generated in the moving object. This method is based on simple convolution so this method is fast and simple to implement. But beside of all these advantages, this method is susceptible to noise and to variations of the timings of movements. Background subtraction can extract the most precise foreground by modelling the background. Background subtraction method uses the current frame minus the reference background image. The pixels where the difference is above a threshold are classified as the moving object The Mixture of Gaussians method is widely used for the background modelling [3]. But it is sensitive to scene changes caused by light and weather etc.

Optical flow presents an apparent change of a moving object's location or deformation between frames. There are two different methods for optical flow i.e. 1) Lucas-Kanade and 2) Horn-Schunck. Optical flow estimation yields a two-dimensional vector field, i.e., motion field that represents velocities and directions of each point of an image sequence [9]. Optical flow gives all motion information. But optical flow computation methods usually are too complex to use in real-time applications if without special hardware [11]. Block matching techniques match blocks from the current frame with blocks from a reference frame.

The objective of tracking is to establish correspondence of objects and object parts between consecutive frames of video. It is a significant task in most of the surveillance applications since it provides cohesive temporal data about moving objects which are used both to enhance lower level processing such as motion segmentation and to enable higher level data extraction such as activity analysis and behaviour recognition. Object tracking can be classified into four major categories: region based tracking, active-contour-based tracking, feature-based tracking, and model-based tracking. Different methods have been applied in this regard to achieve effective motion tracking like Template Matching, Histogram Based Tracking, Contour Based Tracking, Particle Filters, Mean Shift Tracker, Kalman Tracker, SVM Tracker, Optical Flow etc [1].

II. RELATED WORK

In this project, for object detection and object tracking, the hybrid method is used for better detection and with accurate tracking. Here for hybrid method, two methods is used, first is Adaptive Gaussian Mixture Modelling, which is background subtraction method and second is Optical Flow. Gaussian mixture modelling is widely used for background subtraction because it is simple and fast method. Also it can be used in the context of a complex environment. GMM is not a complete object tracking so that optical flow used with Gaussian to provide complete computation tracking [11]. Optical Flow can be used for quick calculation with simple background. Here foreground used for optical flow is foreground extracted using Gaussian Mixture Modelling techniques. Also this algorithm will implement in the real time environment so the complexity regarding the combination of two methods is increased. Also optical flow requires more care for implement in real time. So this problem have to take consideration while implementation.

Existing Algorithm:

1. GMM (Gaussian Mixture Model):

GMMs are often used in biometric systems, most notably in speaker recognition systems, due to their capability of representing a large class of sample distributions. One of the powerful attributes of the GMM is its ability to form smooth approximations to arbitrarily shaped densities. The classical uni-modal Gaussian model represents feature distributions by a position (mean vector) and a elliptic shape (covariance matrix) and a vector quantized (VQ) or nearest neighbour.

Model represents a distribution by a discrete set of characteristic templates. A GMM acts as a hybrid between these two models by using a discrete set of Gaussian functions, each with their own mean and covariance matrix, to allow a better modelling capability.

2. Optical Flow:

Optical flow is a technique used to describe image motion. It is usually applied to a series of images that have a small time step between them, for example, video frames. Optical flow calculates a velocity for points within the images, and

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

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Vol. 3, Issue 4, April 2015

provides an estimation of where points could be in the next image sequence. Optical flow estimation is used in computer vision to characterize and quantify the motion of objects in a video stream, often for motion-based object detection and tracking systems.

Motion detection is having great importance in the field of computer vision. An image contains lots of information, but it can't be inferred that what is going to happen in the immediate future. On the other hand, a sequence of images provides information about movement of objects.

Various techniques are available to detect the movement in a sequence, and they are classified broadly in two categories (i) Feature based detection, and (ii) Intensity based.
Assuming there is no camera motion, means having fixed camera position and no illumination change, it is possible to locate a point (x, y) of moving object in one frame to the same object in next frame

III. PROPOSED WORK

Here moving object is detected in real time. Also the detection technique is combination of two well-known object detection techniques i.e. Adaptive Gaussian mixture modelling and Optical flow.First taken real time input video sequence is given to the background subtraction model which updates background continuously. Then Gaussian Mixture Modelling is done for extraction of foreground. Then median filter is used for the shadow removal and morphological operation is done for filling the empty holes in image to increase the smoothness of the image. Then foreground is extracted from the video scene.

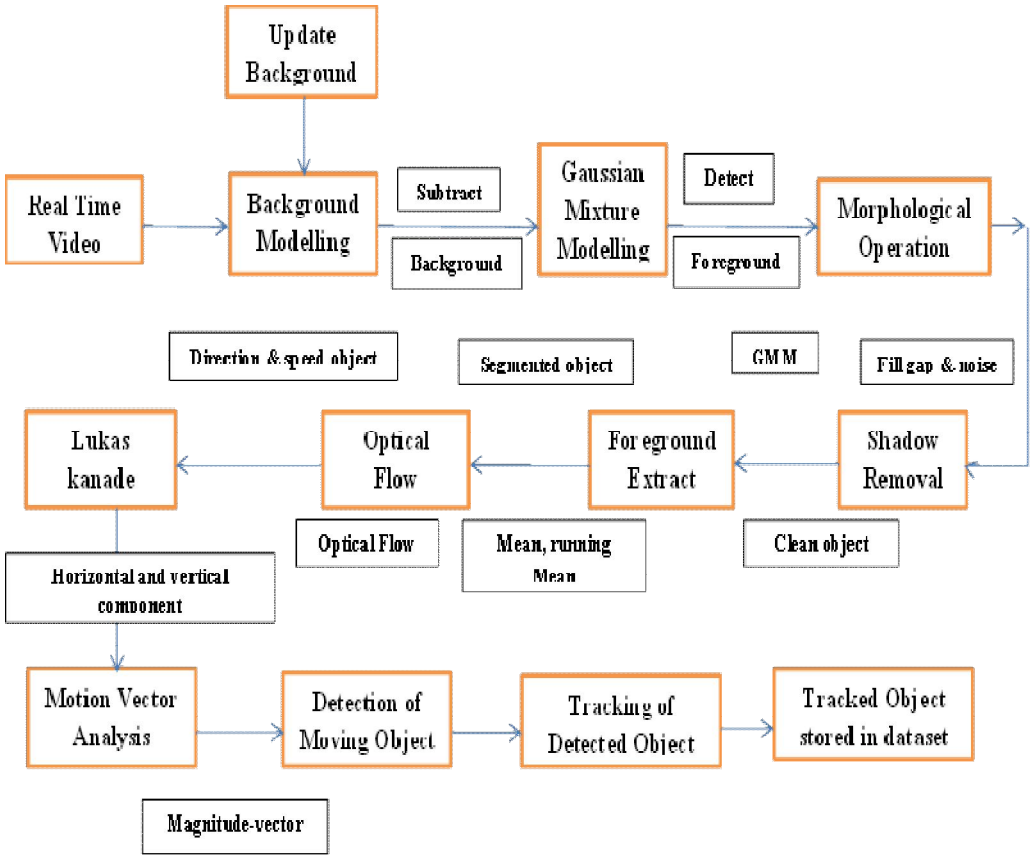

Fig.1 Flow chart of the Proposed Method

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ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

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This extracted foreground is used by the optical flow as a reference foreground. Optical flow gives all the information of the moving object in the form vectors. For Optical flow, very well-known Lukas-Kanade method is used here. Then by using optical information moving object is detected from the video. Using blob analysis the boundary box is bounded on the detected on the image. Then after detected object is tracked using optical flow method.

IV. EXPERIMENTAL SETUP AND RESULTS

We used Mat lab to implement our proposed approach. The experiment conducts on Intel Core 2 Duo CPU with 2GB RAM and 2.5 GHz speed. For analyzing result we measure fore ground detection with Gaussian mixture model and moving object tracking with optical flow.

Result of Existing Method (GMM)

Here result of GMM with taken input video .avi format. First screen in the result for original video. Foreground detect of moving object with using of GMM method. Second screen detect foreground of moving object. At last third screen showing the result of tracking of moving object.

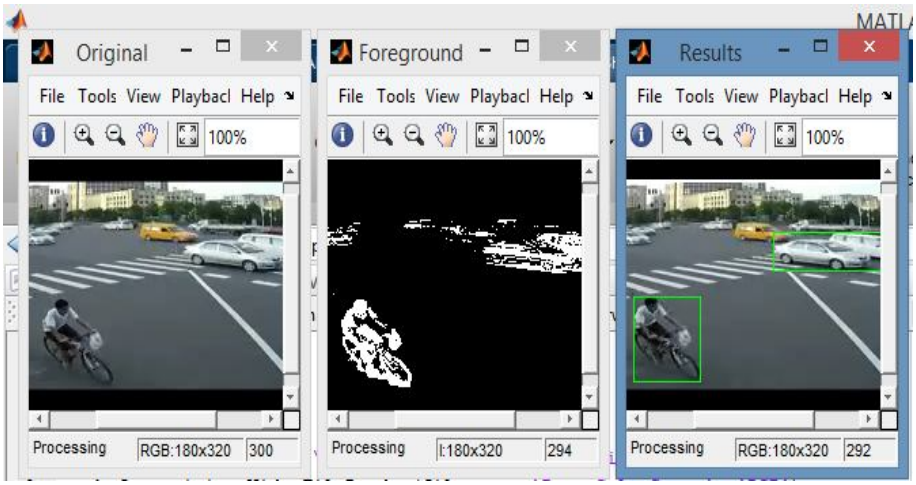

Fig.2 Snapshot of GMM first screen for original video, second for foreground detection, third for tracking.

Result of Existing Method (Optical Flow)

This extracted foreground is used by the optical flow as a reference foreground. Optical flow gives all the information of the moving object in the form vectors. Proposed optical flow method straight forward and easier to implement and we assent has better performance. Mainly consist of three part velocity estimation, velocity threshold calculation and object boundary box determination. For Optical flow, very well-known Lukas-Kanade method is used here.First parameter is gain after the mean blocks in the velocity threshold. The gain need to be adjusted to filter out background in the image. Second parameter is the constant that is used for comparison with the boundary box. Using blob analysis the boundary box is bounded on the detected on the image. Then after detected object will be tracked.

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ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

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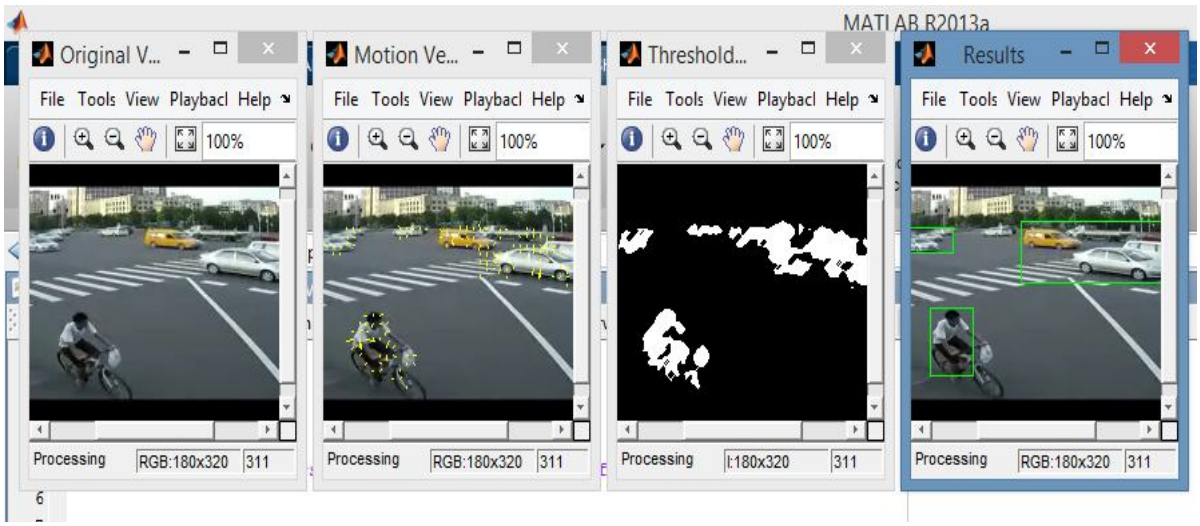

Fig.2 Snapshot of Optical Flow first screen for original video, second for Motion Vector, third for Threshold, fourth for tracking.

Result of Proposed Method

How to detect object in a video sequence using foreground detector based on Gaussian mixture models (GMMs) and extracted foreground use as reference for tracking object with using optical flow. Rather than immediately processing the entire video, the example starts by obtaining an initial video frame in which the moving objects are segmented from the background. This helps to gradually introduce the steps used to process the video (avi,mp4).The foreground detector requires a certain number of video frames in order to initialize the Gaussian mixture model. This example uses the first 50 frames to initialize three Gaussian modes in the mixture model.'Initial Variance', (30/255)^2)After the training, the detector begins to output more reliable segmentation results.

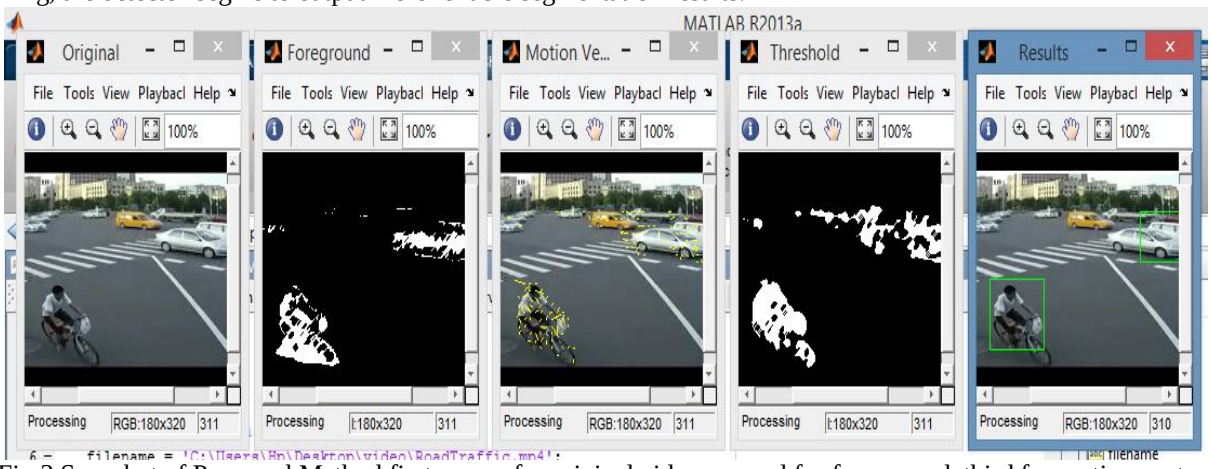

Fig.3 Snapshot of Proposed Method first screen for original video, second for foreground, third for motion vector, fourth for threshold, fifth for tracking.

V. COMPARISION OF PERFORMANCE PARAMETERS

Comparision of taken input video of different format like mp4,avi and same video testion in existing work and proposed work. Comparision parameter of video recall and precision.

Recall is the percentage of the desired items that are retrieved whereas Precision is the percentage of retrieved items that are desired items. Recall and Precision can be calculated by using the equation (1) and (2) respectively.

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$$\text{Recall} = \frac{\text{Correct}}{\text{Correct + Missed}} \quad (1)$$

$$\text{Precision} = \frac{\text{Correct}}{\text{Correct + False positive}} \quad (2)$$

Method Used	Video Type	Total moving object	Object Detected	Correct object	Missed object	False object	Recall	Precision
Gaussian	Viptraffic	10	9	9	1	0	90%	100%
	Atrium	9	11	9	0	2	100%	81%
	8.avi	6	4	4	2	0	66%	100%
Optical Flow	Viptraffic	10	10	10	0	0	100%	100%
	Atrium	9	13	8	1	5	88%	61%
	8.avi	6	12	5	7	1	41%	83%
Mix	Viptraffic	10	10	10	0	0	100%	100%
	Atrium	9	10	9	0	1	100%	90%
	8.avi	6	6	6	0	0	100%	100%

Comparision of performance parameters table

VI. CONCLUSION

Now a day, moving object detection and tracking becomes attractive and crucial research topic for researchers. There are many methods for the object detection and tracking. All the methods have their own advantages and disadvantages. For object tracking single method cannot give good accuracy for different kind of videos with different situation like poor resolution, change in weather condition. Here two methods are combined for the better and accurate detection and tracking of moving object. Gaussian Mixture Modelling is used for foreground extraction and that extracted foreground is used by the Optical flow method for object tracking. Advance study may open the door to find efficient algorithms to reduce computational cost and to decrease the time required for detecting the object for variety of videos containing diversified characteristics and increase accuracy rate with using GMM and Optical flow.

ACKNOWLEDGMENT

I am very grateful and would like to thank my guide Mr.ChintanVarnagar for their advice and continued support without them it would not have been possible for me to complete this paper. I would like to thank all my friends Colleague, husband and classmates for all the thoughtful and mind stimulating discussions we had, which prompted us to think beyond the obvious.

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ISSN(Online): 2320-9801
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BIOGRAPHY

Miss. DharaTrambadiya obtained her B. Tech. from C.U.Shah University, surendranagar in the year 2009 and M. Tech degrees from Atmiya , Rajkot in the year 2015. She is working as Assistant Professor in Balaji College of Engineering, Junagadh, and Gujarat. Her areas of interests are Image Processing and Video Processin8g.