International Journal of Advance Engineering and Research Development (IJAERD)
Volume 1,Issue 5,May 2014, e-ISSN: 2348 - 4470 , print-ISSN:2348-6406

Automated Video Surveillance System For Human Motion Detection With Face Detection

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Abstract: Automated video surveillance systems are of most importance in the field of security. The task of detecting moving objects in surveillance. Video is create a base for higher level intelligence applications, Now a days, video surveillance is an important security asset to control theft, trespassing or traffic monitoring, banks, department stores, highways, crowded public places and borders. In this thesis, our objective is to design a complete framework able to automatically detect and recognize humans in video sequences acquired with a static camera. The aimed practical application for this framework is its use as an automatic intelligent video surveillance system. In video surveillance, detection of moving objects from a video is necessary for object classification, target tracking, activity recognition, as well as behavior understanding. For better result, I have used this proposed technique: combination of Gaussian mixture model technique & optical flow technique. A face detection system is a computer application for automatically detecting a human face from digital image or video frame from a video source. As a conclusion, this is aimed to researchers interested to research on the basic idea of human motion detection algorithm using image.

Key Words:background subtraction,real time motion detection,comparison of various methods

I. INTRODUCTION

Automated video surveillance systems are of most importance in the field of security. In this system, detection of moving objects from a video is important for object classification, target tracking, activity recognition, and behavior understanding There are so much work and research have been done in the area of video surveillance system with various applications.

II. DISSCUSSION OF VARIOUS METHODS FOR MOTION DETECTION

Huang focused for an advanced video surveillance system. His system gives three classes for the methods of motion detection 1.background subtraction 2.temporal differencing 3.optical flow [1].Background subtraction is the most popular and consistance moving objects 'differentiation. Optical flow method is for the projection of motion on the image plane and often requires levels of computational complexity. The temporal difference effectively adapts environmental changes, but it has the limitation for a sensitive threshold for noisy and local consistency properties of the change mask [2]. Prithviraj Banerjee and Somnath Sengupta employs the system which is the combination of Gaussian Mixture Modeling based adaptive background modeling algorithm and human detection for surveillance system (HDS). HDS system decides at each frame for the tracking of particular object. Object has been tracked after certain number of frames and then declares it as a human or non- human entity [3]. Xinyi Cui, Qingshan Liu, Shaoting Zhang, Fei Yang, Dimitris N. metaxas propose a new and efficient method to find salient motion regions in video sequences. The main idea is to roughly remove the redundant part of a volume data and keep the salient motion regions. They observed some general cases: 1.the region of foreground is usually smaller than that of background 2.background motion is usually smaller than foreground object motion 3.background has more regular patterns, even when dynamic background exists. So, they analyzed the temporal slices of videos, the unexpected potion or distinct motion trajectories. For detecting distinct trajectories, they design an algorithm temporal spectral residual by using spectral residual in temporal domain [4].Kinjal A Joshi and Darshak G Thakore has presented so many methods for moving object detection in their paper [5].Eigen background subtraction method proposed by Oliver et al. In this method for moving object detection for moving object segmentation Eigen space model is used. Principle Component Analysis (PCA) is used for reduction of dimensionality of the space

constructed from sample images. Chris Stauffer and W. E. L. Grimson described the adaptive background mixture modeling his paper. Their goal is to develop a robust, adaptive tracking system which is flexible when there is moving scene clutter, variations in lighting, multiple moving objects etc. changes during the scene observed [6]. To overcome the shortcoming of the basic background methods Statistical method is used. This method is inspired by background subtraction method, which is for extracting change regions from background.it uses characteristics of individual pixels of group to construct advance background model. At each frame it keeps and updates dynamic statistics of pixels, belonging to background image process. Example for this method is adaptive background mixture modeled by mixture of Gaussians. Heikkila and Silven presented the technique of background subtraction with Alpha. In this method first of all system reference background is initialized with first few frames of video and that is updated to adopt dynamic changes in the scene [7]. The pixels where the difference is above a threshold are classified as foreground. Some morphological functions are also used for better performance. Temporal difference method uses pixel wise differences between two or three consecutive frames in video imagery to extract moving regions. It is highly adoptive to dynamic changes, but it has limitation that sometimes it fails to extract pixels of a foreground object when the object has uniform texture or moves slowly. Segmentation and tracking of moving object are the important tasks in computer vision,in which the object detection and locating are the essential steps and take a great impact on the effect of segmentation and tracking.In a binary difference image the region with high density of motion pixels is approached by region shrinking to implement moving object detection and locating.under the situation of more than one object in an image power transformation is adopted to enhance objects at different position and then the region shrinking is used to detect and locate the objects.

III. PROPOSED METHOD FOR MOTION DETECTION

There are so many methods for motion detection from which this paper describes the combination of two methods:

1. Gaussian Mixture Modelling & 2. Optical flow

3.1 Gaussian Mixture Modelling

GMM has been widely used for robustly modeling complicated backgrounds, especially those with small repetitive movements (such as leaves, bushes, rotating fan, ocean waves, rain). In our work we be using the background model suggested by Stauffer et al. where each pixel is modeled as a mixture of gaussian and an approximation is used to update the model. In this work, the values of a particular pixel is modeled as a mixture of gaussians rather than modeling it as one particular type of distribution. Based on the persistence and the variance of each gaussian of the mixture, it is determined which gaussian may correspond to background colors. Pixel values that do not fit the background distributions are considered foreground.Mean and variance values are not changed with nonmatching distribution and with matching distribution they will be updated.The probability of observing the current pixel value is

$$P(X_t) = \sum_{i=1}^{K} w_{i,t} * \eta(X_t, \mu_{i,t}, \Sigma_{i,t}) \quad (1)$$

Wi,t is an estimate of the weight of the gaussian in the mixture at time t, $\mu_{i,t}$ is the mean value of the gaussian in the mixture at time t, $\Sigma_{i,t}$ is the covariance matrix of the gaussian in the mixture at time t, and where η is a gaussian probability density function.

The advantage of GMM is complete results of the operation the disadvantage is not a complete object tracking, GMM result of the operation complete but disadvantages include computing for a long time with more noise.

3.2 optical flow

Optical flow is a technique used to describe image motion. It is usually applied to a series of images example, video frames. Optical flow calculates a velocity for points within the images, and provides an estimation of where points could be in the next image sequence.The most basic assumption made in optical flow calculations is image brightness constancy. This is simply the assumption that from a short interval t1 to t2, while an object may change position, the reflectivity and illumination will remain constant. Mathematically, this is

$$f(x + \Delta x; y + \Delta y; t + \Delta t) = f(x; y; t) \quad (2)$$

where f(x; y; t) is the intensity of the image at position (x,y) and at time t, and Δx, Δy is the change in position and Δt is the change in time.There are two main types:1.Horn schunck's method2.Lucas-Kanade;s method

We used Lucas-Kanade method here:

The Lucas-Kanade method assumes that the displacement of the image contents between two nearby instants (frames) is small and approximately constant within a neighbourhood of the point p under consideration. Thus the optical flow

equation can be assumed to hold for all pixels within a window centered at p. Namely, the local image flow (velocity) vector (*vx* ,*vy*) must satisfy

$$Ix(q1)Vx + Iy(q1)Vy = -It(q1)$$
$$Ix(q2)Vx + Iy(q2)Vy = -It(q2) \quad (3)$$

where q1,q2 , ,qn are the pixels inside the window, andIx(qi), Iy(qi), It(qi) are the partial derivatives of the image I with respect to position x, y and time t, evaluated at the point qi and at the current time. These equations can be written in matrix from Av=b, where

$$A = \begin{bmatrix} I_x(q_1)\, I_y(q_1) \\ I_x(q_2)\, I_y(q_2) \\ \vdots \quad \vdots \\ I_x(q_n)\, I_y(q_n) \end{bmatrix}; v = \begin{bmatrix} V_x \\ V_y \end{bmatrix}; b = \begin{bmatrix} -I_t(q_1) \\ -I_t(q_2) \\ \vdots \\ -I_t(q_n) \end{bmatrix} \quad (4)$$

The advantages of Optical Flow are quick calculations and the disadvantage is a lack of complete object tracking.

3.3 Proposed Architecture

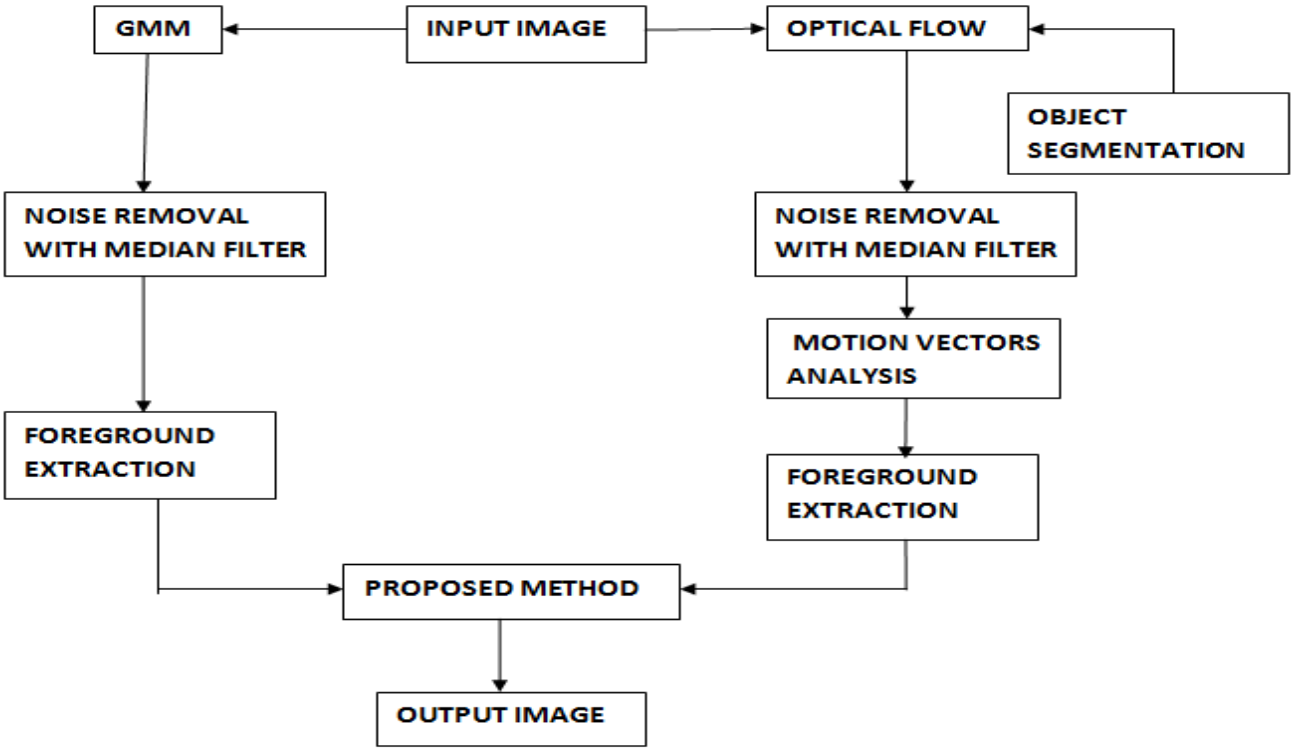


Fig.1 block diagram of Proposed method

By this proposed method we can take advantages of both the methods described above for improving result in terms of motion detection..I have also implemented this method in real time.

RESULTS

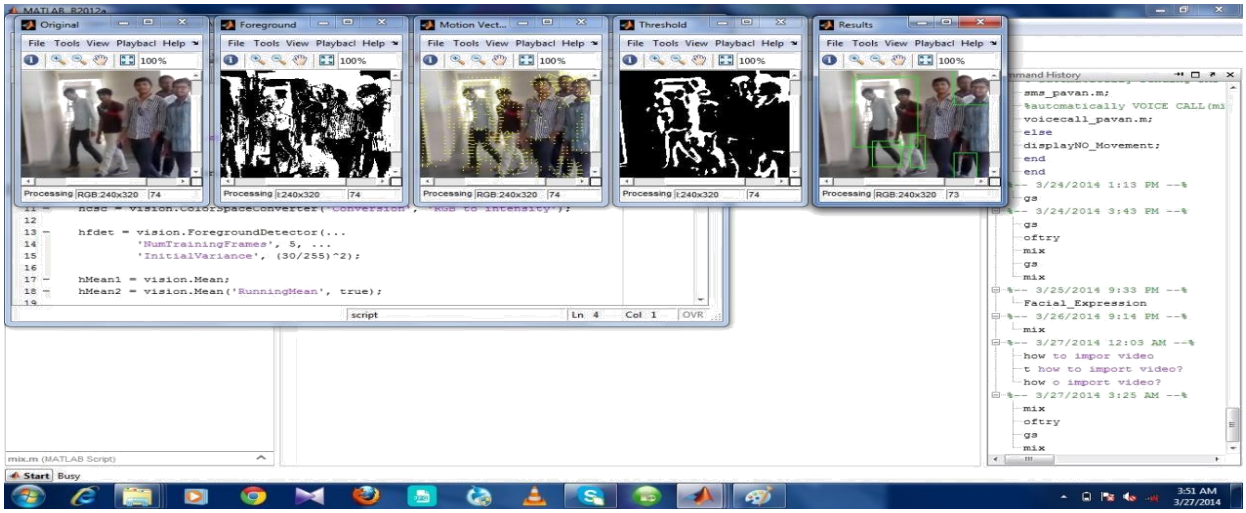


Fig.2- snapshot of existing video for proposed method

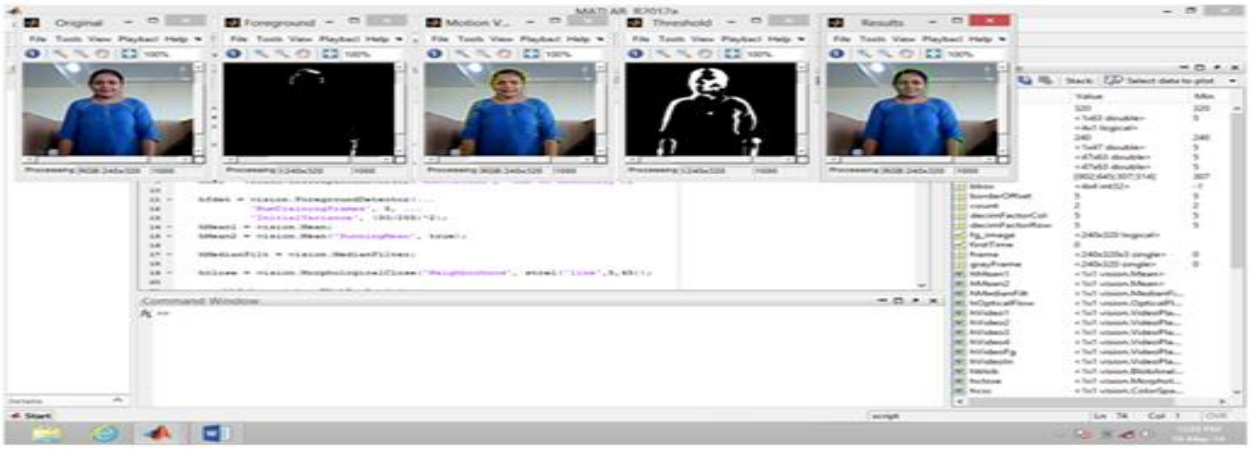
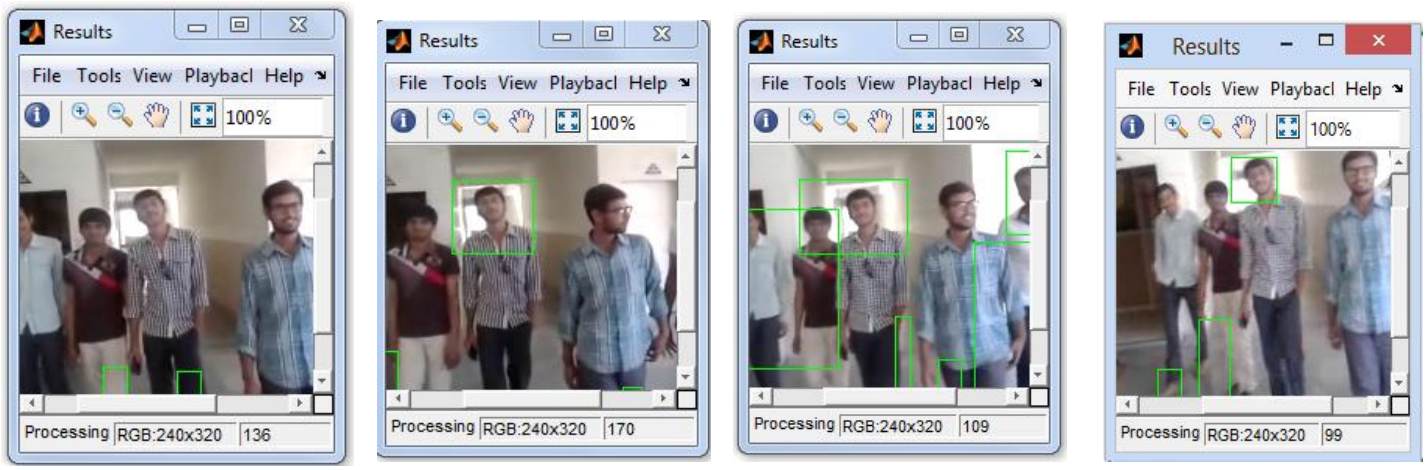


Fig.3- snapshot of real time video for proposed method

I have also compared proposed method with various existing methods and prove that result has been improved in terms of motion detection by this proposed method.there are the results of comparison with the methods:1.GMM 2.Optical Flow 3.Proposed Method 4.Shrinking Method.



GMM **Optical Flow** **Proposed Method** **Shrinking Method**

Fig.4-Comparison of proposed method with various existing methods

4.CONCLUSION

This paper gives the basic idea about various techniques used for motion detection in the field of video surveillance system. Video surveillance system is very useful in the field of security.There are many methods available for motion detection.Here I have used the combination of Gaussian mixture modelling and optical flow method for improving the result as compared to both of these techniques.I have used this method for human motion detection with face detection I have also implemented the proposed method in real time videos with existing videos. I have compared proposed method with existing methods and prove that through proposed method I have got better result compared to existing methods.

ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people who made it possible, whose consistent guidance and encouragement crowned my efforts with success. Monika Domadia highly thankful to my guide Megha Mehta without whose guidance the work would not have been materialized and she helps me to solve my difficulties arising during this paper writing. Also M.A.Domadia would like to acknowledge all other faculty member of E.C. Department and my classmates who have come forward to help me in every way at any time. With all this assistance little for remains for which I can take credit.

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BIOGRAPHIES

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