Automated Video Surveillance System for Human Motion Detection

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Abstract— automated video surveillance systems are most useful and important in the security field of today's world. Video is a base for higher level intelligence applications. 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 moving objects 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. Here so many methods are discussed for background subtraction & motion detection. Al New Proposed method also described here.

Key words: Motion Detection, Background Subtraction, Foreground Extraction.

I. INTRODUCTION

There are so much work and research have been done in the area of video surveillance system with various applications. Shih-chia. 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). The HDS system uses histogram of oriented gradients based human detector, famous for detecting humans in still images. Foreground extraction is done by stasticalmodeling. Background model deals with stationary part only and ignores the moving foreground. This system incorporates with GMM. So, the ROI of motion are identified. HDS is useful for categorization of objects presenting in ROI. For an example human figure, vehicle, animal. For HDS, they followed histogram of oriented gradients which is created by Navneet Dalal and Bill Trigs. For checking that human is presenting ROI or not, SVM (support vector machine) is used. Linear SVM is used for baseline classifier for better performance. 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].

II. DISSCUSSION OF VARIOUS METHODS FOR MOTION DETECTION

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. Lipton et.al developed two frame temporal difference scheme suggests that a pixel is moving if it satisfies the following:

$$I_n(X)-I_{n-1}(X)>T \qquad (2.1)$$

$I_n(X)$ is gray level pixel intensity value at position X and at n times of instance of video image sequence I in the range[0,255].T is the predetermined threshold.[8] In online mixture model, assume the values of particular pixel over time as a "pixel process".

Consider a particular pixel, at time t, {x0, y0}, is its history

$$\{X1, Xt\} = \{I(x0, y0, i); 1\_ i \_ t\} \qquad (2.2)$$

Where I is the image sequence. The method uses an approximation to Gaussian mixture modeling to describe the recent history of color and depth scene observation at each pixel, is described by Michael Harville, Gaile Gordon and John Woodfill in paper[9].A method for motion detection in the given video sequence is Foreground extraction using background subtraction. As we know, image is a combination of stationary part and motion (moving) part. The part which is stable during the video sequence is called stationary part. For instance: background, while the moving part is not stationary. With the use of Static background subtraction algorithm, we get original image (which contain motion as well as stationary part) and estimated background image (which is having only stationary part) and after that subtracted original image from estimated background image operation gives motion part only. In other words, we can say that foreground regions of interest are extracted through various morphological operations like Thresholding, Erosion, and Dilation etc. Prithviraj Banerjee and Somnath Sengupta [3] proposed the overview of surveillance system as shown in figure 1.In that, the image is acquired from camera which is consisting stationary and motion part. With the use of Adaptive background modeling algorithm background subtracted and foreground extracted. Histograms of Oriented Gradients for human detection detect the human motion and then it can classify as a human or non-human entity through SVM (Support Vector Machine).

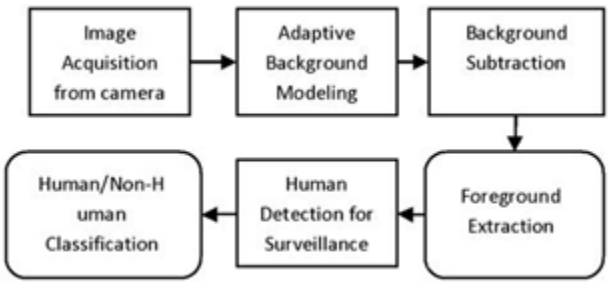

Fig. 1: Surveillance System Overview [1]

Steps involved in HDS System: Histogram for Oriented Gradients (HOG) for human detection algorithm described by Navneet Dalal and Bill Trigs. According to that, the image window is divided into small spatial regions which is called "cell".

1) With the use of Adaptive background modeling bounding box generate and then bounding box resized to a dimension 128x64 pixel size.
2) Gradients in the image computed using simple 1-D mask. There are three types of gradients taken: Horizontal Gradients, Vertical Gradients and L1 norm Gradients.
3) Image is divided into cell which is a multiple regions of fixed rectangular size as shown in figure 2. Histogram of Gradient directions is computed. [A to I Histogram bins with angular difference of 20°.] [10].
4) 9 component feature vectors are generated for the entire selected regions.
5) 128x64 pixel image consisting of 7 blocks width wise and 15 blocks height wise and its generating 3780 dimension feature vector.
6) SVM (Support Vector Machine) classifier decides that the regions of interest having a human figure or not.

The system architecture which is described below is understood by Farhan S. Khan and Salman A. Basset in their paper.

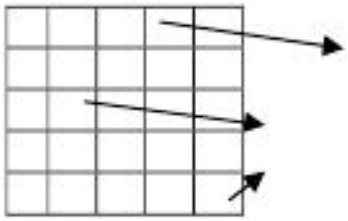

Fig. 2: System Architecture

1) The end-user performs the system initialization using System Initialization Agent (SIA) at the beginning. SIA stores as well as identify the current position, band colours and also status of hands-legs in the history. SIA divides initial frame into square blocks of size. With the use of Range based mode filter each blocks is consider as a moving object or background.
2) Object Detection Agent (ODA) is locate the object in the region given by Proximity Calculation Agent (PCA). With the use of Range mode filter each block in region and labels it as a part of object or background.
3) If object is detected successfully then their coordinates of unified blocks are stored in history and classification agent will classify new position. If the object is not identifying then Self-Occlusion Detection Agent (SODA) initiates the unidentified object's position.
4) When Motion Detection Agent fails to identify the object, self-occlusion agent is initialized.
5) Another agent is Classification Agent (CA), which is identifying the current position of a hand/leg. Moreover it also identifies whether the change in state compared to previous frame has occurred or not.

Brajesh Patel and Neelam Patel discuss various algorithm related to frame based motion detection in surveillance system. The action of sensing a physical movement in the video sequence/area is called motion detection. With the use of it we can also identifies the movement of an object within two or more successive frames. Motion detection can be achieved by Mechanical form or Electronics form. In mechanical form of motion detection, a tripwire, this is a simple form of motion detection. If a moving object steps into the tripwire's field of view (i.e. trips the wire), then a simple sound device (e.g.

bells) may alert the user [12]. While in electronic form of motion detection, motion detection have sensors which detect the movement of an object and according to that it send signals to sound device which produce an alarm or switch on to the image recording device. In that method, they approach three stages for video frame which are: Tracking Step, Detection Step and Validation Step. In tracking step, the objects which have been previously identified are tracked to find their position and shape within the current video frame [12]. Same time motion of these objects is estimated. In detection Step, the new moving objects are detected and their shape as well as motion is estimated. This step also consisting creation of new hypotheses regarding new moving objects. In final step i.e. validation step, if any of the hypotheses are deemed valid, then we have identified a new moving object at this frame and this will now be tracked through subsequent frames.

Face recognition in video surveillance is described by Christophe Pagano et al [13] in their paper. A generic system for video-based face recognition works like first it takes images from camera and then after segmentation Region of Interest (ROI) identifies.

The features vectors for extraction and tracking is completed and the biometric data base is decided the face recognition. This is an example of a system which is a combination of spatial and temporal computations. They also proposed a modular multi classifier system (MCS) for accurate recognition of individuals in video-to-video surveillance applications. It is composed of a long-term memory (LTM), an ensemble of binary 2-class classifiers or detectors (EoDs) per individual and a dynamic multi-objective optimization module.

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

A. GMM

The Mixture of Gaussians method is widely used for the background modeling since it was proposed by Friedman and Russell. Stauffer presented an adaptive background mixture model by a mixture of K Gaussian distributions.

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.

B. Optical flow

Optical flow or optic flow is the pattern of apparent motion of objects, surfaces, and edges in a visual scene caused by the relative motion between an observer and the scene. The optical flow method try to calculate the motion between two image frames which are taken at times t and t+ δt at every position. These methods are called differential since they are based on local Taylor Series approximation of the image signal; that is, they use partial derivatives with respect to the spatial and temporal coordinates. [14]

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

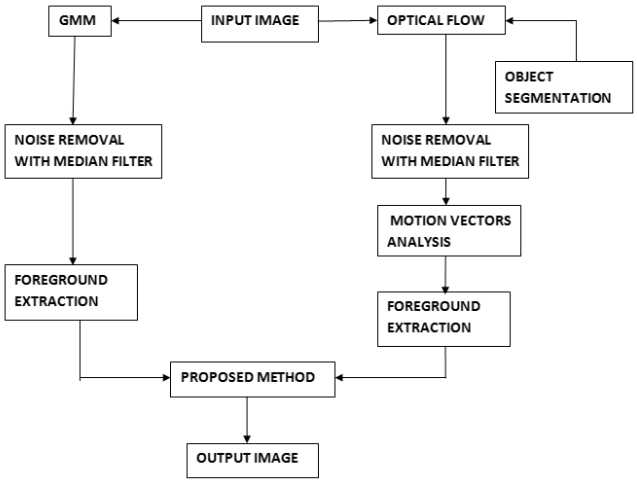

Fig. 3: Proposed Method

IV. CONCLUSIONS

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. With the use of motion detection we are tracking moving object and identify its activity. Extraction of information due to surveillance provides us object classification; define the difference between vehicles and humans, or between animals and humans, human identification. Some useful applications like to define human activities in video sequence which also includes animals or vehicles. Another application like track the vehicles as well as human simultaneously. The main feature of all of above is to ability to track the particular objects.

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REFERENCES

[1] W. Hu, T. Tan, L. Wang, and S. Maybank, "A survey on visual surveillance of object motion and behaviors," IEEE Trans. Syst., Man, Cybern. C, Appl. Rev., vol. 34, no. 3, pp. 334–352, Aug. 2004.

[2] Shih-Chia Huang, "An Advanced Motion Detection Algorithm with Video Quality Analysis for Video Surveillance Systems" Ieee Transactions On Circuits And Systems For Video Technology, Vol. 21, No. 1, January 2011

[3] Prithviraj Banerjee and Somnath Sengupta. Human motion detection and tracking for video surveillance. Available at

http://www.scf.usc.edu/~pbanerje/Homepage/HMD.Pdf.

[4] Xinyi Cui , Qingshan Liu , Shaoting Zhang , Fei Yang , Dimitris N. Metaxas, "Temporal Spectral Residual for fast salient motion detection", Neuro-computing 86 (2012) 24–32

[5] Kinjal A Joshi and Darshak G Thakore, "A survey on moving object detection and tracking in video surveillance system", IJSCE, ISSN: 2231-2307, volume-2, issue-3, July 2012.

[6] C. Stauffer and W. Grimson. Adaptive background mixture models for real time tracking. In Proc. of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, page 246- 252, 1999.

[7] Elgammal, A. Duraiswami, R., Hairwood, D., Anddavis, L. 2002. Background and foreground modelling using nonparametric kernel density estimation for visual surveillance. Proceedings of IEEE 90, 7, 1151–1163.

[8] Alan J.Lipton, Hironobu Fujiyoshi, Raju S. Patil "Moving Target Classification and tracking from real video", 2002.

[9] Michael Harville, Gaile Gordon and John Woodfill, "Foreground segmentation using adaptive mixture models in color and depth", IEEE workshop on Detection and Recognition of Events in Video, 3-11, 2001.

[10] N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection", Proceedings of the Conference on Computer Vision and Pattern Recognition, San Diego, California, USA, pp. 886 - 893, 2005.

[11] Kiryati, N.; Raviv, T.R.; Ivanchenko, Y.; Rochel, S., "Real-time Abnormal Motion Detection in Surveillance Video", International conference on Pattern Recognition, 1-4, 2008.

[12] Brajesh Patel and Neelam Patel, "Frame based motion detection for real-time surveillance", International Journal Computer Technology and Applications, ISSN 2229-6093 , Volume-3, Issue-2, page 650-655, 2012.

[13] Christophe Pagano, Eric Granger, Robert Sabourin and Dmitry O. Gorodnichy, "Detector Ensembles for Face Recognition in Video Surveillance", International Joint Conference on Neural Networks (IJCNN), Brisbane, QLD, 2012

[14] Bhavana C. Bendale, Prof. Anil R. Karwankar. Moving Object Tracking in Video Using MATLAB, International Journal of Electronics, Communication & Soft Computing Science and Engineering.

[15] Abhishek Kumar Chauhan, Prashant Krishan a Moving Object Tracking using Gaussian Mixture Model and Optical Flow, International Journal of Advanced Research in Computer Science and Software Engineering Volume 3, Issue 4, April 2013.

