ABNORMAL GROUP BEHAVIOUR DETECTION FOR OUTDOOR ENVIRONMENT

Pooja N S[1], Suketha[2]

[1] *Department of CSE, SCEM, Karnataka, India*
[2] *Department of CSE, SCEM, Karnataka, India*

ABSTRACT

The main objective of this paper is to detect an abnormal group event that occurs in the given input video streams. This is the most popular and one of the challenging tasks in Computer vision domain. The proposed method is based on image descriptor and the classification approach. The optical flow computation is the first step in proposed method and this step can be followed by HOFO descriptor generation. Publically available dataset is used to evaluate the proposed method. To detect the abnormal moving queues we are using features named as HOFO descriptor. The classification approach involves K-means clustering approach . We apply this method on various Benchmark Dataset to detect abnormal group event. The proposed method gives the effective and accurate results.

Keyword : - *Abnormal group event , HOFO.*

1. INTRODUCTION

Today advances in the technology is important enhance our quality of life. A surveillance camera plays an important role in improving security in our surroundings. The detection of abnormal/suspicious group behavior is one of the important research issues in the domain computer vision. Computer vision is the area that includes several method used to capture, process, analyze the image. One of the most challenging and popular tasks in computer vision is analyzing suspicious or abnormal group behavior in outdoor environment.

There are three types of Video surveillance activities and that are manual, semi-automatic or automatic video surveillance activities. Manual surveillance activities involves human operator to do the video analysis. Nowadays such manual systems are widely used. Semi-automatic activity involves video processing with some kind of human intervention. Systems that perform motion detection are example for this kind of surveillance analysis. There is no human intervention in automatic system and the system does both high-level and low-level decisions making tasks. Gesture recognition and abnormal event detection are high-level task whereas low level task are motion detection and tracking. Detecting these types of unusual or abnormal activities is an important issue in the video surveillance.

Suspicious or unusual events are something that is different from the normal event and relate to the panic events. Abnormal event detection in outdoor scenes is a main task in public safety. In general, normal group behavior corresponds to calm movements, where people moving slowly without making any excessive gestures through the scene. Suspicious behavior is occur when more rapid movements done by a human. The proposed method focus on detecting the events like walk, move and run.

2. RELATED WORK

The abnormal behavior detection in an outdoor environment is one of the most difficult tasks. Several methods are developed to detect these kinds of unusual behavior. These methods are based on segmentation, feature extraction and classification approaches. Segmentation is done to extract the human from the given input video sequence. The

human characteristics such as poses and body motions represented as features are then extracted. Then classification approach is applied on the features which are extracted in earlier approach.

The motion segmentation method is applied on each frame of the video sequences and it is used to extract the human in that video sequences. The segmentation technique can be categorized in to two types and it is based upon the mobility of camera and that are Static camera segmentation and Moving camera segmentation. In first case camera is fixed to a particular position and the angle to which it move is 0. The background is stable here and it never moves, so the background model can be designed in advance only. The moving camera is a active camera which has a dynamic location and angle. Static camera segmentations include Background subtraction method [6][11] , Gaussian Mixture Model[12] and Moving camera segmentation include temporal differencing[13]. Moving object segmentation in video sequence is important for many computer vision applications. Segmentation of moving object is extraction of foreground from background. Segmentation process includes steps as object detection and motion detection. Currently one of the most important and active research topics in computer vision is human segmentation.

The segmented image has extracted several characteristics such as shape, poses and motions which are represented in the form of features. Feature extraction reduces the amount of resources that is required to describe a large set of data. Analysis with a large number of variables generally requires a large amount computation but Feature extraction reduces the computation. The features can be categorized as spatiotemporal filter method and the local descriptors and appearance-based features. Spatiotemporal filter focuses on extraction of global features by considering the whole image. Duan-Yu Chen et.al proposed the method based on spatiotemporal properties of the target[9] where the proposed method can detect and classify the moving targets in video streams and here targets are detected by computation of the pixel wise difference between consecutive frames and then that are classified with a temporally boosted classifier and spatiotemporal oriented energy" analysis. Jyh-Yeong Chang et.al proposed the optical flow technique [16] and is used for image stabilization system and it facilitates the local motion vector field used to estimate the global disturbing translational and rotational motions, this is also capable of removing the rotational disturbance.

After extracting the feature classification methods are used to recognize the abnormal event. This is to classify behavior that whether it belongs to normal or abnormal behavior. To understand the behavior of the sequence from the training samples earlier several methods were used. Classification is performed at each frame. These include the following such as Bayesian network [10], Hidden Markov Model (HMM) [8], Support Vector Machine (SVM) [5]. Zhaowen Wang et.al [15] has developed time varying Dynamic Bayesian Network model and it describes the evolution of non stationary temporal sequences. Particle filtering method is used for the online inference of the hidden nodes. The current state of network can tracked adaptively with the latest data observation. Useful in camera tracking and multiple object interaction recognition. M. Syed Mohamed et al [5] proposed a method called Support Vector Machine. This method is used in classification stage.

The proposed method is used to detect abnormal group behavior in the video. It is based on histogram optical flow orientation (HOFO) with combination of K-means clustering approach . HOFO is used as feature to detect abnormal moving queues and it also models a partial image. K-means clustering method is used for classification purpose.

3. THE PROPOSED METHOD

The proposed method is used to detect the abnormal group activities that occurred in the video and this is done in unsupervised manner. The proposed system is summarized on Figure 1. The user will select the video and this method detects the suspicious or abnormal event in that video. Here user will select the video from the publically available dataset like PETS dataset or UMN dataset. These dataset contain the video which has the normal and unusual event in it. In order to detect group activities in an unsupervised manner for Outdoor Environment, video Processing is done. This processing includes optical flow creation, histogram generation and k means clustering approach that is used for classification purpose. Type of events focusing in this project is Walk, move and Run

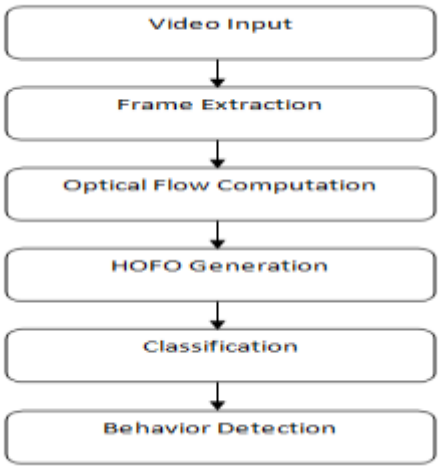

Fig -1 The Proposed Abnormal group behavior detection system

3.1. Optical flow computation:

Optical flow represents the motion of object. So the first step in this process includes computation of the optical flow features at grey scale. It is applied on consecutive frame obtained from the video. It is mainly used estimate the object velocity from one frame to another. Where the two frames has small step difference between them. Result of this process is a motion vector which represents the optical flow. This is to find speed and direction of the objects by considering two continuous frames. The method used to calculate the optical flow is Horn Schunck method (HS)[1]. This method is used to calculate the horizontal optical flow (u) and vertical optical flow (v). Optical flow computation between two frames required to solve the following optical flow constraint

In the outdoor environment the group of people walks slowly or calmly without any hurry. They may start to move very fast or run then this leads the occurrence of suspicious activity. The magnitude of the optical flow vector can be assumed to estimate the velocity. The magnitude value will be less if the walk slowly otherwise this value becomes more. This can be showed as shown in the figure 2.

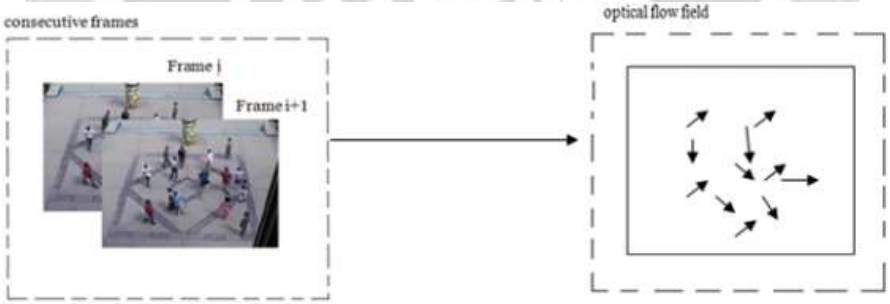

Fig -2 Optical flow obtained from the consecutive image

3.2. HOFO Generation:

The HOFO[1] is presented as the feature and that is used to detect suspicious moving queues. After obtaining the optical flow next step is to get the Histogram of optical flow orientation. HOFO feature extraction does not require the background subtraction technique. Optical flow vector can be obtained after applying HS method and the results vector u and v that represents horizontal vertical flow. The optical flow vector obtained per frame is a 2 dimension vectors and this optical flow vector is used to obtain the HOFO. Bin value should be used to obtain this histogram. Here HOFO is computed on each frame and is computed over dense grids of overlapping block as shown in the Figure 3.

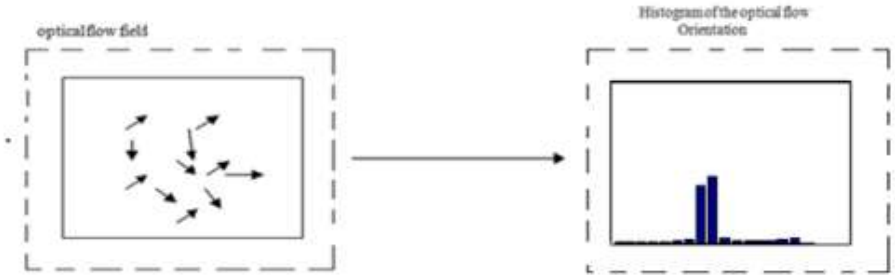

Fig -3 Histogram of optical flow orientation obtained from Optical flow

3.2. Classification:

The k means clustering method is used for classification purpose. This method is used to group the data in to specified number of clusters. The number of cluster is predetermined. Optical flow obtained from the frames is many in number and those are clustered into specified number of groups. Later k nearest neighbour technique is used to find which cluster has maximum number of data in it. After this process, that cluster will be consider for classification purpose. The threshold value are mentioned and it is based on optical flow and histogram values. Threshold value range is different for various events like walk, move and run. If the value obtained after the processing is fall under some threshold value means then the event corresponding to that range is occurred.

4. RESULTS

PETS 2009dataset and UMN datasets are the two dataset used to evaluate our proposed method. These datasets are used for abnormal event detection and events which focused in this paper are walk, move, run. PETS 2009 dataset contain numerous video sequences, which has usual and abnormal activity in it. First we train these video sequences to detect the abnormal event and later we evaluate the system by giving different video clips as input. The detection result of the outdoor scene is shown in the Figure 4. The normal scene is defined as the group of people walking calmly without making any excessive gesture. Abnormal activity is the one where group of people who are running that is with rapid movements.

a) Normal Activity: Walk b) Abnormal Activity: Run

Fig -4 Event detection result

5. CONCLUSION

The system automatically detects the abnormal activity in video and the system mainly focuses on detection event such as walk, move and run. This can be done by using the computation of histogram of optical flow orientation method. Depending upon the value obtained using the HOFO and by using the clustering approach this system detects the usual group event and the abnormal group event. The methods used in this system are optical flow computation, generation of HOFO and k means clustering approach. This system works well for the video that is captured within security critical outdoor environment. The proposed system evaluated on the publically available PETS and UMN dataset and this system provides the promising results. The limitation of the proposed system is that this will gives proper results only if the input video is captured from the static background.

6. REFERENCES

[1]. Tian Wang, Hichem snoussi ," Detection of abnormal Visual Event via Global Optical Flow Orientation Histogram" IEEE Trans. ,vol.9,No.6,pp.998-997,June 2014.
[2]. Yang Cong, Junsong Yuan, "Video Anomaly Search in Crowded Scenes via Spatio Temporal Motion Context", Multimedia, IEEE Trans.vol. 14, no. 1, pp. 66–75, 2012.
[3]. Shengyong Chen, Jianhua Zhang, Youfu Li and Jianwei Zhang , "A Hierarchical Model Incorporating Segmented Regions and Pixel Descriptors for Video Background Subtraction", IEEE Transactions On Industrial Informatics, Vol. 8, No. 1, February 2012.
[4]. Joshua candamo, Matthew Shreve, Dmitry B. Goldgof, Deborah B.sapper and Rangachar Kasthuri, "Understanding Transit scenes : A Survey on Human Behavior- Recognition Algorithms",IEEE Transaction on Intelligent Transportation System, Vol.11,No.1,march 2010.
[5]. M. Syed Mohamed, T. Kavitha, "Outlier Detection Using Support Vector Machine in Wireless Sensor Network Real Time Data", IJSCE ISSN: 2231-2307, Volume-1, Issue-2, May 2011.
[6] Nicholas Bauer, Pubudu Pathirana, and Peter Hodgson, "Robust Optical Flow with Combined Lucas-Kanade/Horn-Schunck and Automatic Neighborhood Selection", IEEE Computer Society, New York, NY, pp. 378-383.
[7] N. Dalal, B. Triggs, and C. Schmid, "Human detection using oriented histograms of flow and appearance," in Proc. ECCV, 2006, pp. 428–441.
[8] Derek Hao Hu, Xian-Xing Zhang, "Abnormal Activity Recognition Based on HDP-HMM Models", Twenty-First International Joint Conference on Artificial Intelligence (IJCAI), 2009.
[9] Duan-Yu Chen, Kevin Cannons, Hsiao-Rong Tyan, Sheng-Wen Shih, and Hong-Yuan Mark Liao, "Spatiotemporal Motion Analysis for the Detection and Classification of Moving Targets", IEEE Transactions On Multimedia, Vol. 10, No. 8, December 2008.
[10] N. N. A. Sjarif, "Detection Of Abnormal Behaviors In Crowd Scene: A Review", Int. J. Advance. Soft Comput. Appl., Vol. 4, No. 1, March 2012.
[11] Elhabian, Shireen Y," Moving object detection in spatial domain using background removal techniques-state-of-art",Recent patents on computer science,vol.1,pp.32-54,2008.
[12] Yusuke Kamishima, "Event detection in consumer videos using GMM supervectors and SVMs", Journal on Image and Video Processing, 2013.
[13] Kinjal A Joshi, Darshak G. Thakore, "A Survey on Moving Object Detection and Tracking in Video Surveillance System", International Journal of Soft Computing and Engineering (IJSCE), Vol.2, Issue-3, pp.120-127 July 2012.
[14] Xiaogang Wang, Xiaoxu Ma And W. Eric L. Grimson, "Unsupervised Activity Perception In Crowded And Complicated Scenes Using Hierarchical Bayesian Models" IEEE Transactions On Pattern Analysis And Machine Intelligence, Vol. 31, No. 3, March 2009.
[15] Zhaowen Wang, Ercan E. Kuruo glu, Xiaokang Yang, Yi Xu, and Thomas S. Huang, "Time Varying Dynamic Bayesian Network for Nonstationary Events Modeling and Online Inference", IEEE Transactions On Signal Processing, Vol. 59, No. 4, Pp.1553-1568, April 2011.
[16] Jyh-Yeong Chang, Wen-Feng Hu, Mu-Huo Cheng And Bo-Sen Chang, "Digital Image Translational And Rotational Motion Stabilization Using Optical Flow Technique", IEEE Transactions On Consumer Electronics, Vol. 48, No. I,pp.108-115 February 2002.