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Suspicious Group Event Detection for Outdoor Environment

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Abstract—The Objective of this paper is to detect suspicious group events in video streams, most popular and challenging task in the Computer vision. To address this problem we proposed a method based on the image descriptor and classification approach. The method starts by optical flow computation followed by HOFO descriptor generation. This method can be evaluated using image descriptor with publically available dataset. HOFO descriptor is used as features to detect the suspicious moving queues .Support vector machine (SVM) is used for the classification approach. We apply this method on several Benchmark Dataset to detect suspicious event. The proposed method gives the promising results with the good accuracy.
Keywords— Suspicious group event, Optical flow, HOFO, SVM.

I. INTRODUCTION

Today, with advances in the technology and enhancement in life quality, there have been more no of surveillance cameras is installed in our surrounding for security reasons. The detection of abnormal group behaviors is an important research issue in the surveillance system and computer vision. Computer vision is domain that includes methods used to acquire, process, analyze, and understand the image. One of the most popular tasks in computer vision is analyzing abnormal events in outdoor environment.

Video surveillance activities can be manual, semi-automatic or automatic. Manual analysis of video can be done by a human operator. Nowadays such systems are widely used. Semi-automatic analysis involves some kind of video processing and also some sort of human intervention. Examples for this method are the systems that perform motion detection. In automatic system there is no human intervention and the system does both high-level decisions making tasks like detection of abnormal event and gesture recognition and the low level tasks, like motion detection and tracking. Detecting these types of unusual activities is an important issue in video surveillance [14].

Human Group activity detection is one of the key applications in Outdoor environments. Real-time group behavior analysis provides an efficient way of detecting the occurrence of any abnormal events in our surroundings this is very important in public safety. In some public places surrounding camera monitors these places and mainly monitoring for detection of abnormal events. Video surveillance systems are becoming important both in public and private environments to monitor the occurring group event. The automatic detection of abnormal group event can be used to alert the related authority person about dangerous behaviors.

II. RELATED WORK

The Detection of abnormal behavior in an outdoor environment is one of the most crucial tasks. There are numerous methods developed to detect an abnormal event that occur in our surroundings and these methods are based on segmentation approaches, feature extraction approaches and classification approaches. Segmentation has to be done to extract the human from the video sequence [12]. The human characteristics such as shape, poses, and body motions are then extracted and represent it by features. Then classification approach is applied on the extracted features. This is used to recognize the various events. Shadow of the moving object can be removed to avoid the processing of unwanted moving things [16].

The motion segmentation is performed on each frame of the video sequences and it is used to extract the human in that video sequences. YingLi Tian *et al* [8] proposed the mixture of Gaussians BGS method, Detects both background and static foreground object. It Handles occlusions in complex environments but low-light conditions reduces the ability to differentiate one object from another. This causes higher error rates and static-object detection in extremely crowded scenes is more difficult.

Shengyong Chen *et al* [3] proposed the Hierarchical background model. This method is used to Detect and track foreground object. Mean-shift algorithm is used for the segmentation approach. Computation on the foreground image may reduce the time and cost. 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. There are several method used to extract the features and one of the most important method is to find spatial-temporal relation [13] .

Yang Cong *et al* [2] Proposed the method called Spatio temporal filter method. The motion is characterized using the 3D spatio temporal data and extracts the feature by capturing both space and time relationship. It requires low computational complexity. This can be used to extract global features but it is sensitive to occlusion and Susceptible to the variation of timing movement. Nicholas Bauer *et al* [5] proposed combined Lucas-Kanade and Horn Schunck method. Lucas-Kanade method is the most widely used variant of the optical flow estimation. This method is an intensity-based differential technique and Robust under noise. This method is based on the assumption that the optical flow field is constant within a neighborhood region of pixels. The calculation of optical flow is done through non-linear optimization and lack the ability to produce dense optical flow fields. Horn Schunck method uses global constraint of smoothness to estimate the optical flow over the whole image. Produces dense flow fields and assumes that no error there in the spatial derivatives during the capturing process but it is sensitive to noise.

Y. Cong *et al* [9] proposed Multi-scale Histogram of Optical Flow (MHOF), a new feature descriptor is proposed and is used to construct the basis for sparse representation. It uses the bins to construct histogram orientation of optical flow. Therefore, it also describes the motion direction information as present in the traditional HOF, but also preserves the motion energy information.rom each unit first estimate the motion field by optical flow and then partition the image into a few basic units. N. Dalal *et al* [11] proposed HOG descriptor and here image gradient vectors are used. This is used to produce the weighted votes for local gradient orientation and these histograms are local in nature. This is to produce an appearance descriptor. HOG descriptor is calculated over a dense grid of overlapping blocks and each block divided into number of cell and they combined to form a global vector. The quantization of feature can be done using the One dimensional histogram[15].

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. Xiaogang Wang *et al* [10] proposed hierarchical Bayesian models and it is used model activities and the interactions in crowded scenes. Without tracking and human labeling, this system is able to summarize particular activities and interactions in the scene. Segment the Video sequences to detect suspicious activities. Positions and directions of moving pixels is used as low-level visual features. But complicated temporal logic is used to model the activities and interaction. So some abnormality will not be detected in this case.

Derek Hao Hu *et al* [7] proposed the Hidden Markov Model and this is capable to predict the changing motion accurately. It captures the temporal structure of the feature. This representation is used for both detection and tracking the event, requires an Optimized no of states. State transitions are specified and used for analysis of spatial temporal variable. This model is sequential in nature so this model cannot capture parallel events.

M. Syed Mohamed *et al* [6] proposed Support Vector Machine. This is a State of the art technique and is used for classification stage. In One class SVM, the SVM have been applied to detect abnormal event in one class setting. Used for identification and extraction of feature area. The SVM method shows high performance results is based on normal behavior frames. This method is used to detect event such as indoor and outdoor walk, run, bend, sit and lie down.

In this paper the proposed method is used to detect suspicious group activity in the video is histogram optical flow orientation (HOFO) that is combined with one class support vector machine (SVM). HOFO descriptor is used as feature to detect suspicious moving queues and also models a partial image.SVM is used for classification method.

III. THE PROPOSED APPROACH

The Proposed system is designed to detect the suspicious event that occurs in the video streams. The proposed system is summarized on Figure 1. The user will first select the video and this system detects the unusual event in that video. Here user will select the video from the 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 SVM classification [1].

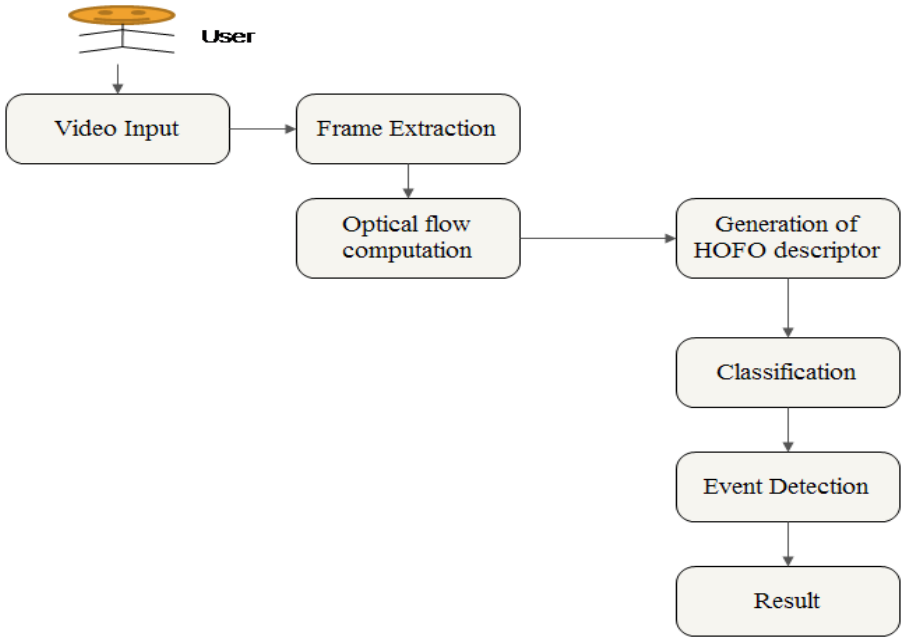

Figure 1. The Framework of the proposed suspicious event detection system

3.1. Optical Flow Computation

Videos contain many number of frames in it, therefore we need to extract those frames from the input video. After extracting each frame from the video that user has selected next step is compute the optical flow for each frame. These frames are series of images from the video that have a small time step between them. Optical flow represents the motion of object. So the first step in this process includes computation of the optical flow features at grey scale [4]. It is applied on consecutive frame obtained from the video. Result of this process is a motion vector which represents the optical flow. Optical flow can be created by points paring in one frame to the points in the next frame. This Type of point matching is done by comparing the intensities of these points within a given window. Pairing points can be done by comparing intensity of point with another point that has the smallest difference in the intensity. Once points have been matched, the velocity is calculated as the distance that the point has moved.

3.2. HOFO Descriptor Generation

The HOFO descriptor is presented as the feature and that is used to detect abnormal moving queues. Here each frame is divided into number of blocks and then HOFO is computed on each block of it. The HOFO descriptor is computed over dense grids of overlapping block and later combines the Histogram of each block to get a vector which is global in nature. A weighted vote of the each pixel is calculated and it is based on the optical flow element orientation centered on it, then all the votes are gathered into orientation bins this is done over local spatial regions. Optical flow and Histogram of the particular video sequences is showed in Figure 2.

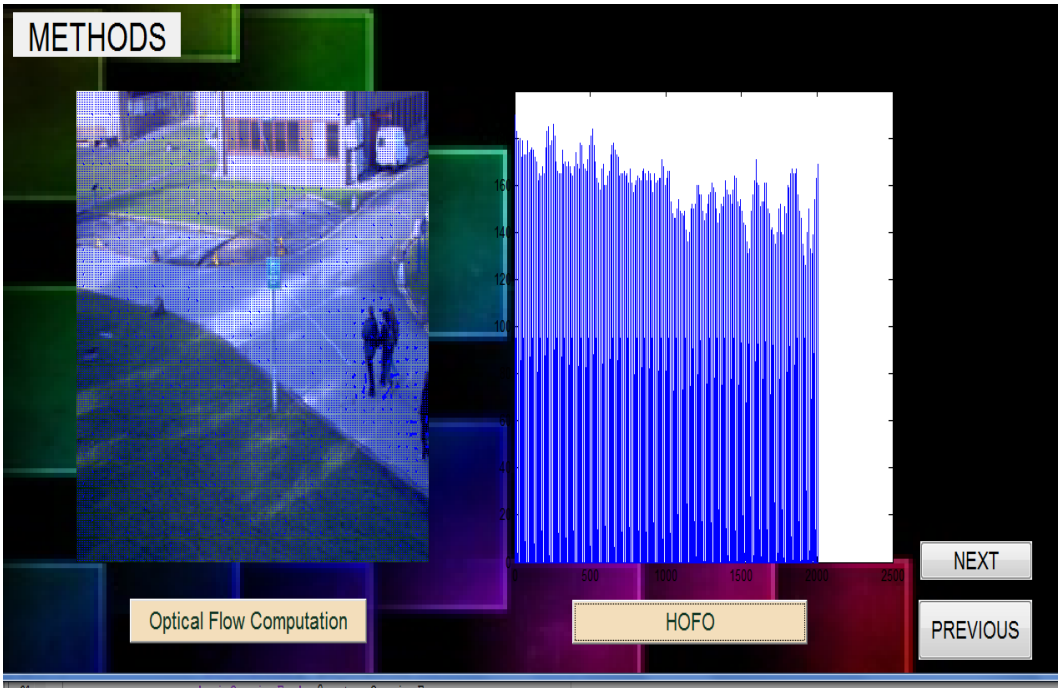

Figure 2. Optical Flow and Histogram of the video sequence.

3.3. Classification

There are two types of Techniques in machine learning that are supervised learning and unsupervised learning. In supervised approach set of training data is used and it takes these as input and analyzes it. It identifies the pattern that is used for classification. One class SVM method is used to detect particular event in it. It is a method used for classification. As result we obtain a support vector and based on support vector each frame is classified and event will be detected. Based on the result of classification group activity will be detected. If unusual activity present in it then alert will be generated.

IV. RESULTS

Two datasets are used to evaluate our proposed methods, which are PETS 2009 dataset and UMN dataset. These datasets are used for event detection purpose and events which focus in this paper is walk, move, run. PETS 2009 dataset contain various video sequences, which has usual and suspicious activity in it. First we train these video sequences to detect the suspicious event and later we test our system by considering different video clips as input. The detection result of the outdoor scene is shown in the Figure 3. The usual scene is defined as the group of people walking calmly without making any excessive gesture. Suspicious activity is the one where group of people who are running that is with rapid movements.

(a)Usual activity: walk (b) Suspicious activity: Run

Figure 3. *Event detection Results. (a) People are walking slowly in same direction without making any rapid movements. (b) People are running with excessive gesture.*

UMN dataset contains various video sequences of the scenes such as lawn, plaza, indoor. In this paper the focus is on outdoor environment so the proposed approach is applied for lawn and the plaza scene. The detection result is shown in the Figure 4 and Figure 5. The usual activity is the individuals walking several directions so these samples are used for training and test purpose. The unusual scene or suspicious scene is where individuals are running. The event detection result is based on the HOFO descriptor and it gives a promising performance results.

(a) Usual lawn scene *(b) Suspicious lawn scene*

Figure 4. Event detection results that occurred in the lawn scene. (a)Usual lawn scene where people walking normally in several direction. (b) Suspicious lawn scene where people suddenly starts running.

(a)Usual plaza Scene *(b)Suspicious plaza Scene*

Figure 5. Event detection result that occurred in the plaza scene. (a)Usual plaza scene where individuals walking in different direction. (b) Suspicious plaza scene where individuals starts running.

In this paper results are based on the orientation of histogram of optical flow features (HOFO) and SVM classification algorithm. SVM method considers the global behavior of the frame so it is robust in nature. The result of this classification approach will be plot in confusion matrix as shown in Figure 3.

The confusion matrix consists of series of rows and columns which represents actual and predicted class. Diagonal of the matrix represents the number of sample which is correctly identified and the number of sample which is not showed in diagonal is errors. Here we specified the class corresponding to three events such as walk, move and Run. We train the video that has all of these events in it.

```
accuracy = 98.99%
Confusion Matrix:
    20     0     0
     1    32     0
     0     0    46
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Figure 3: Confusion Matrix

V.CONCLUSION

A method for suspicious group event detection is proposed. The methods used here are optical flow computation, HOFO descriptor generation and SVM classification. The accuracy obtained for the proposed method is showed by the confusion matrix and it also summarizes the relationship between the actual and predicted class. The events which are focused in this paper like walk, move and run are successfully detected. The proposed method has been evaluated on publically available dataset and it gives successful result with a good accuracy.

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] Weiming Hu, Tieniu Tan,Liang Wang, and Steve Maybank, "A Survey on Visual Surveillance of Object Motion and Behaviors", IEEE Transactions On Systems, Man, And Cybernetics—Part C: Applications And Reviews, Vol. 34, No. 3, August 2004.

[5] 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. 378-383,2006.

[6] 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.

[7] Derek Hao Hu, Xian-Xing Zhang, "Abnormal Activity Recognition Based on HDP-HMM Models", Twenty-First International Joint Conference on Artificial Intelligence (IJCAI), 2009.

[8] YingLi Tian, Rogerio Schmidt Feris, Haowei Liu,Arun Hampapur and Ming-Ting Sun, "Robust Detection of Abandoned and Removed Objects in Complex Surveillance Videos" , IEEE Transactions On Systems, Man, And Cybernetics—Part C: Applications And Reviews, Vol. 41, No. 5, September 2011.

[9] Y. Cong, J. Yuan, and J. Liu, "Sparse reconstruction cost for abnormal event detection," in *Proc. IEEE CVPR*, Colorado Springs, CO, USA, Jun. 2011, pp. 3449–3456.

[10] 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.

[11] N. Dalal, B. Triggs, and C. Schmid, "Human detection using oriented histograms of flow and appearance," in *Proc. ECCV*, 2006, pp. 428–441.
[12] Sarvesh Vishwakarma, and Anupam Agrawal "A survey on activity recognition and behavior understanding in video surveillance." The Visual Computer 29.10 (2013): 983-1009.
[13] Sarvesh Vishwakarma, and Anupam Agrawal "Representing feature quantization approach using spatial-temporal relation for action recognition."Perception and Machine Intelligence. Springer Berlin Heidelberg, 2012. 98-105.
[14] Sarvesh Vishwakarma, Rajat Singh, Anupam Agrawal, "Unusual activity detection for video surveillance."Proceedings of the First International Conference on Intelligent Interactive Technologies and Multimedia. ACM, 2010.
[15] Sarvesh Vishwakarma and Anupam Agrawal. "A novel approach for feature quantization using one-dimensional histogram." India Conference (INDICON), 2011 Annual IEEE. IEEE, 2011.
[16] Sarvesh Vishwakarma, and Anupam Agrawal. "A Robust Algorithm for Shadow Removal of Moving Object Detection in Video Surveillance System." Int. J. of Recent Trends in Engineering and Technology 4.1 (2010).

