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Anomalous Behaviour Detection in Crowded Environments Using Classifiers Artificial Neural Network and Support Vector Machine

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***Abstract**: Our proposed method focuses to detect and localize anomalous behavior in videos of the crowded area means different scenario from the dominant pattern. Proposed method consist motion and appearance information, therefore, different kinds of anomalies can be robustly identified in a wide range of situations. Histogram of oriented gradients can easily capture the varying dynamic of the crowded environment. Histogram of oriented gradients can also effectively recognize and characterize each frame of each scene. Our method of detecting anomalies using artificial neural network and support vector machine consist both appearance and motion features which extract this features within the spatiotemporal domain of moving pixels that ensures robustness to local noise and thus increases accuracy in detection of a local anomaly with low computational cost. UCSD dataset which will be used and which consist various situations with varying human crowds as well as traffic data with occlusions when feed to our proposed method can achieve significantly higher accuracy probably more for pixel level events detection as compared to any other methods.*

Keywords: Anomaly, Artificial Neural Network (Ann), Classifier, Computational Cost, Histogram of Oriented Gradients (Hog), Occlusion, Support Vector Machine (SVM), UCSD Dataset.

I. INTRODUCTION

Anomaly detection related to the specific model of expected behavior is a major task in view of security and surveillance system. Detection of movements in a restricted area such as there should not be any movement in the object, detecting the wrong direction of motion when considered all objects should represent the direction of motion in one direction and if the object is moving in opposite direction to it must be detected. Example, a person is cycling in moving crowd opposite to their direction. A Huge amount of data has to be analyzed while considering surveillance on roads, airport, stations and many with the aim of safety. A number of methods are available to detect anomalous behavior in a crowded environment which are having more computation cost.

Anomalous behavior in one video can be a part of another situation as a normal pattern. Therefore anomaly can be defined as less probability of occurrence in a captured video which is to be observed. Detection of abnormal behavior in a crowded area is spatio temporal change in appearance and motion of the captured frame. The anomaly can be localized by means of appearance and motion information. Anomaly appearing in a part of the frame can be captured by using algorithm only on the Region of Interest (ROI). Spatio-temporal information is used to increase the accuracy of detection of result for validation of algorithm observed on datasets of crowded people. Proposed method can be generalized to varying traffic conditions.

II. RELATED WORK

By using dictionary learning method sparse reconstruction cost is evaluated to measure normality of the testing sample. Thus, abnormal events are detected using sparse reconstruction cost. The novel dictionary selection method is designed with scarcity dictionary selection method along with a scarcity reconstruction to reduce the size of the dictionary. Sparse reconstruction cost is more robust as compared to the other detection methods because of the application prior weights for each basis in sparse reconstruction. This method gives a solution to detect both local and global abnormal event by updating dictionary incrementally.

3D volumes in the local area KL divergence used and new prototypes are produced by using the 3D Gaussian distribution of spatiotemporal gradients. Densely crowded scenes are difficult to analyze with conventional approaches. Therefore statistical framework to model the local spatiotemporal motion pattern and their behavior for the densely crowded scene are presented. Thus in this method, the dense activity of the crowded area are exploited by modeling the high emotions in the local area. Therefore, a number of frames are required for accurate analysis to cover each region separately to train HMM for every region is high. This method is considered for the very high densely crowded scene. Therefore cannot handle scenes with middle and low density.

III.PROBLEM DEFINITION

Anomaly detection is finding a problem of pattern in data which is not confirmed to expected behavior. The main aim of anomaly detection is finding data patterns which are different from normal one. Techniques used in anomaly detection are domain specific.

Due to rapid growth in crowd areas in the real world, analysis of crowded scenes has increasing demand. This technique helps in visual surveillance, public space design, and crowded area management. We are detecting anomalies in a crowded area such as motion and behavior of events in crowded scenes. Considering security point of view even it is very difficult for trained security person to monitor situations in a highly crowded area. Therefore anomaly detection in the densely crowded area becomes more important. We can also detect human behavior abnormalities in crowded surveillance environment. We apply this technique in a crowded area such as malls, gardens, markets, railway stations, airport terminals etc.

In above study, we face the problem to detect dynamically varying anomalies in time and space of videos which consists crowds varying with different densities and having more computational cost and accuracy of identification is comparatively less. To capture these anomalies effectively in a wide range both appearance and motion features are considered.

IV.EXISTING SYSTEM

1) HOS DESCRIPTOR

To construct the Histogram of Swarm (HOS) descriptor agent position is required which is obtained by prey motion patterns and forces acting on the agent. By computing average of swarm agent position weighted histogram of agent's position is obtained corresponding to optical flow orientation. Thus triplets over each time window are used to include information such as temporal to obtain final motion descriptor.

2) MOTION MODELLING USING HOS DESCRIPTOR

Initially, videos are divided into small frames. Histogram of the oriented gradient is used for dividing images into small frames. A novel motion descriptor is built on the basis of swarm intelligence to capture crowd dynamics. Real swarms which encounter in nature their behaviour and characteristics are more dominant. Therefore they are used to form histograms of the swarm which is used to detect anomaly event in Region of Interest analysis.

3) PREY GENERATION

Prey which is tracked by the swarm consists optical flow magnitude values of a pixel which are inside Region of Interest. Thus prey does not consist luminance value and their quantity varies in frame equal to the number of Region of Interest.

V. ALGORITHM OF PROPOSED SYSTEM

1) Input normal video and anomaly video for anomaly detection.

2) A number of sequential frames (approximately 150 to 200) are obtained.

3) The background is subtracted by comparing frames with consecutive frames and Region of Interest (ROI) is obtained.

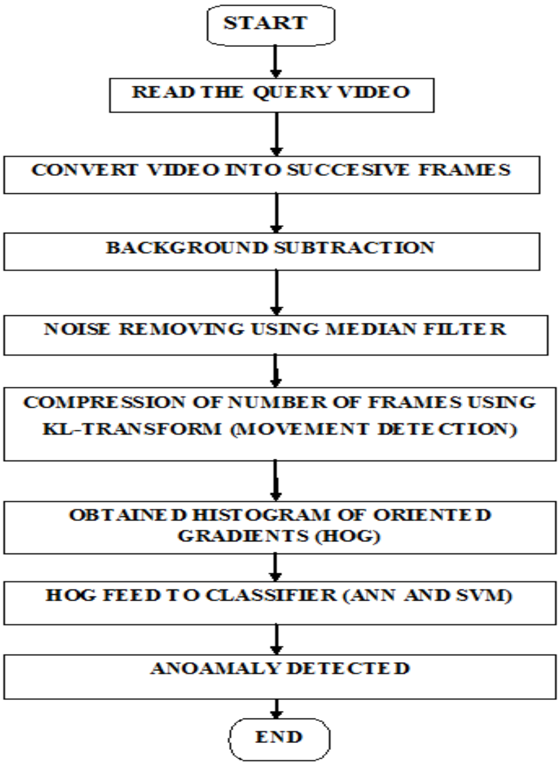
4) The noise is removed from Region of Interest (ROI).

5) A number of frames are compressed using KL transform (movement detection).

6) Histogram of Oriented Gradient (HOG) is obtained in the form of triplets with 4 blocks each.

7) Histogram of Oriented Gradient (HOG) is feed to classifier Artificial Neural Network (ANN) and classifier Support Vector Machine (SVM) to detect an anomaly.

VI. FLOWCHART OF PROPOSED SYSTEM



VII. PROPOSED SYSTEM

Using histogram of oriented gradient (HOG) appearance and motion features can be easily and effectively describe each scene. The UCSD database which is use having high detection rate which outperformers effectively in the most challenging pixel level criteria in Region of Interest. Along with histogram of gradients median filter and KL-Transform is used for obtaining better performance.

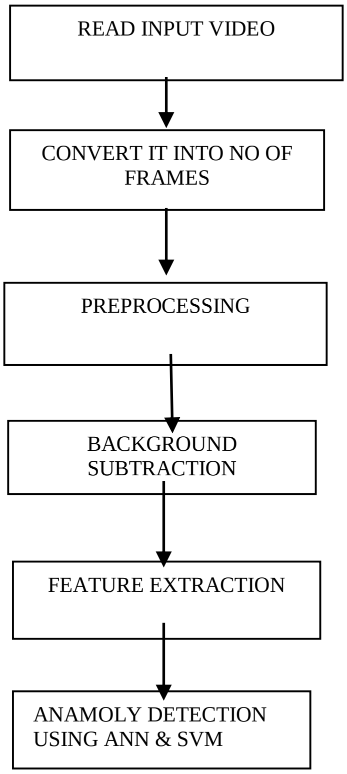


Fig.1.Block diagram of proposed system

We convert videos into number frames. After that background subtraction is done where current frame is subtracted from previous frame (for subtracting background comparison of successive frame is done) and region of interest (ROI) is obtained. For removing noise from obtained region of interest we are using median filter. Main function of KL-Transform in image processing is image compression. Here we are using this transform and are detecting movements. Histograms of oriented gradients are finally feed into classifier artificial neural network and classifier support vector machine for detecting videos are without anomaly or with anomaly. We have developed a program code for proposed algorithm in easiest MATLAB software.

VIII. PERFORMANCE EVALUATION

We have taken total four videos (two normal and two anomalous) from UCSD dataset for performing experiment in which we detect the videos are anomalous or not. Here, we are showing output of 1 normal and 1 anomalous video.

Output of normal video

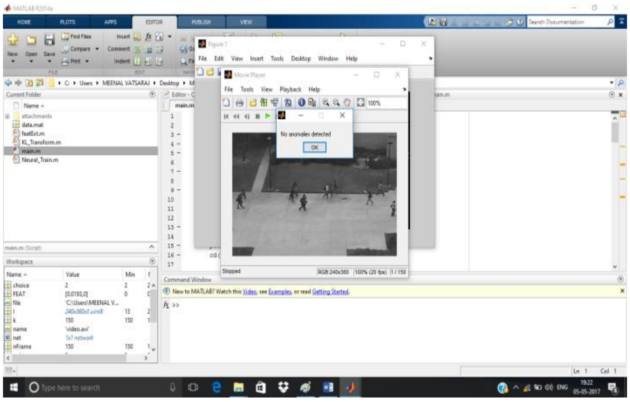


Fig.2.Output by using classifier ANN

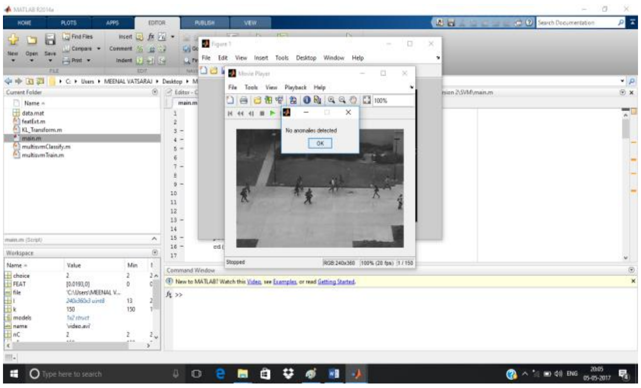


Fig.3.Output by using classifier SVM

Output of anomalous video

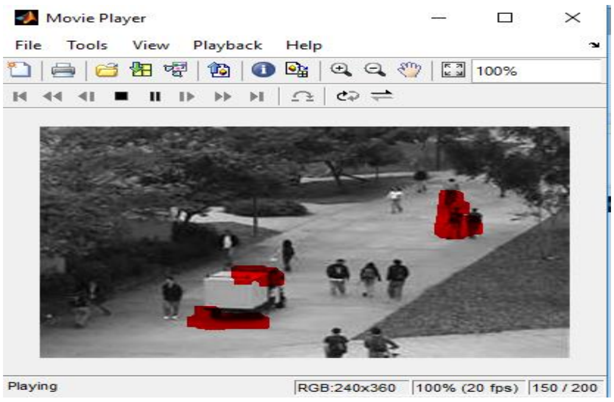


Fig.4.Movement detected by using KL-transform

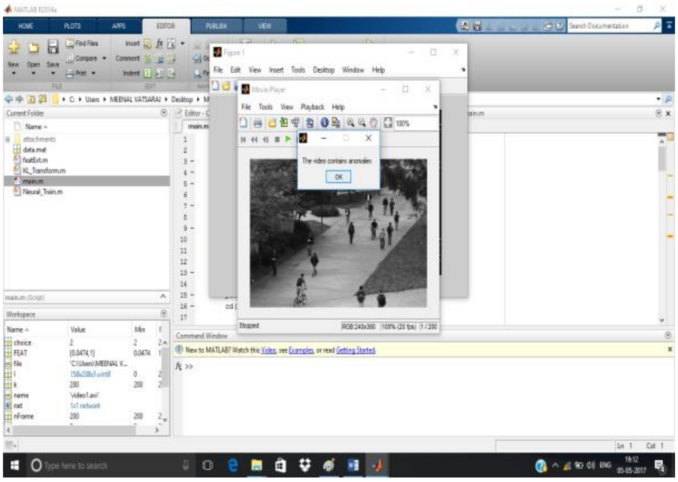


Fig.5.Output by using classifier ANN

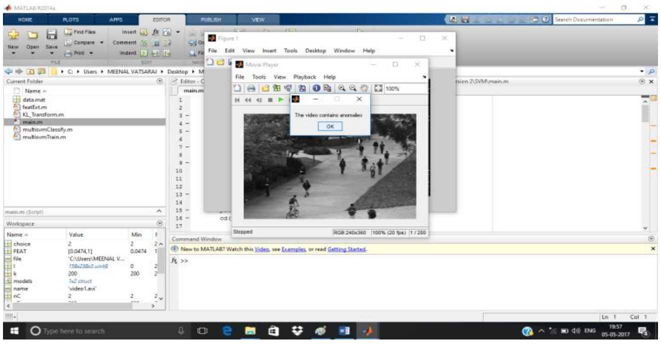


Fig.6.Output by using classifier SVM

Artificial Neural Network Graph

For our case, In Artificial Neural Network (ANN) maximum 1000 epoch are considered. Data collected randomly and training done by scale conjugate gradient method. Output obtained at 23rd iteration with $4.79e^{-0.7}$ gradients.

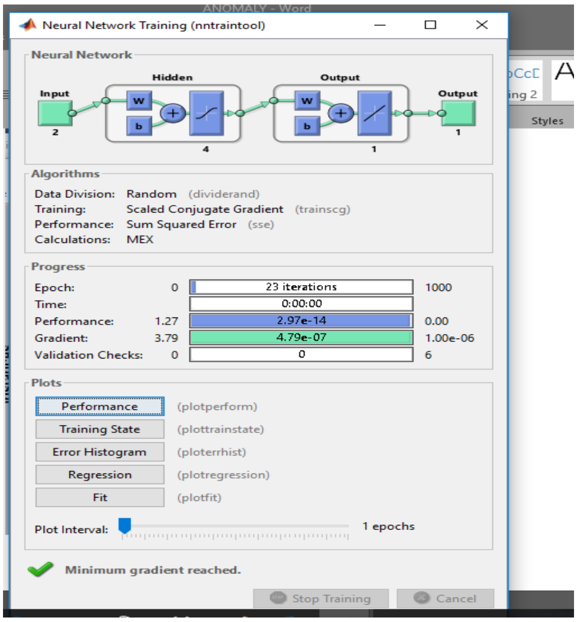


Fig.7.Neural network training

We have considered 1000 epoch but reference gradient is10^{-5}. This value obtained in 23 iterations so maximum training iterations are 23 as shown in figure.

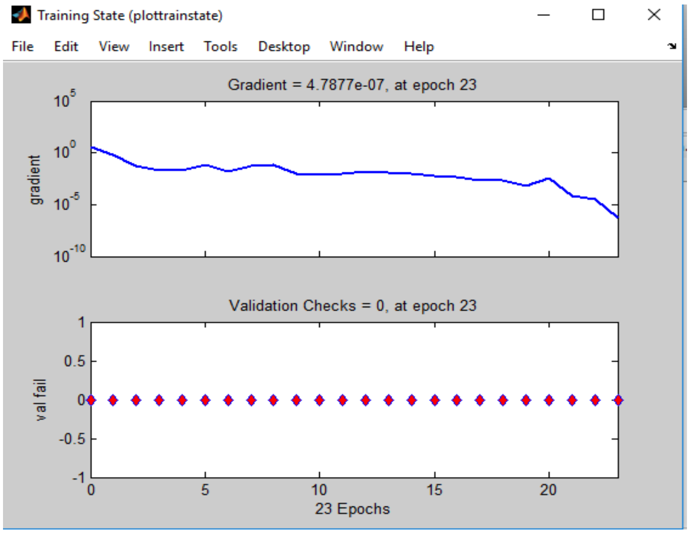


Fig.8.Training set

While calculating histogram in 20^{th} bin +ve error is found at $5.14e^{-0.8}$ (time). Maximum error obtained which is nothing but anomaly in the present frame.

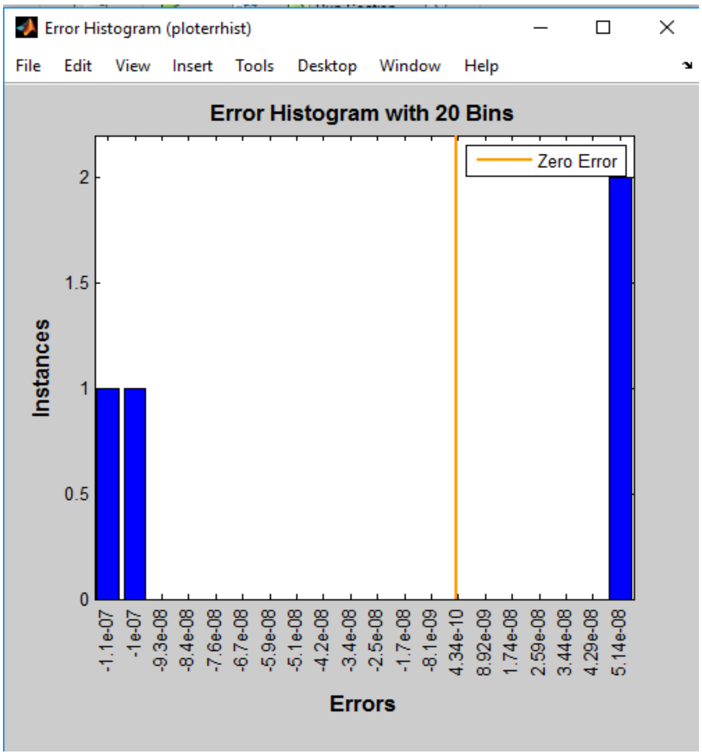


Fig.9.Error histogram

Performance of Artificial Neural Network (ANN) in 23 iterations with sum squared error.

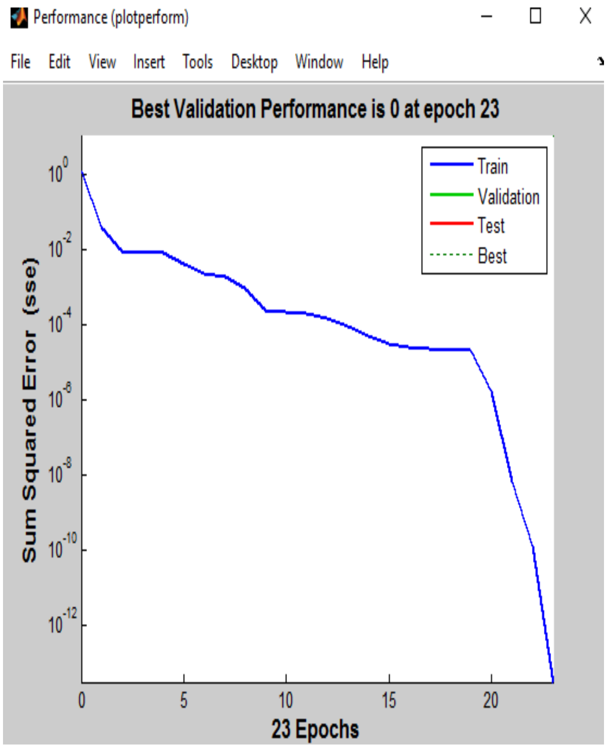


Fig.10.Performance of ANN

Neural Network Training Regression for 23 iterations is shown in figure.

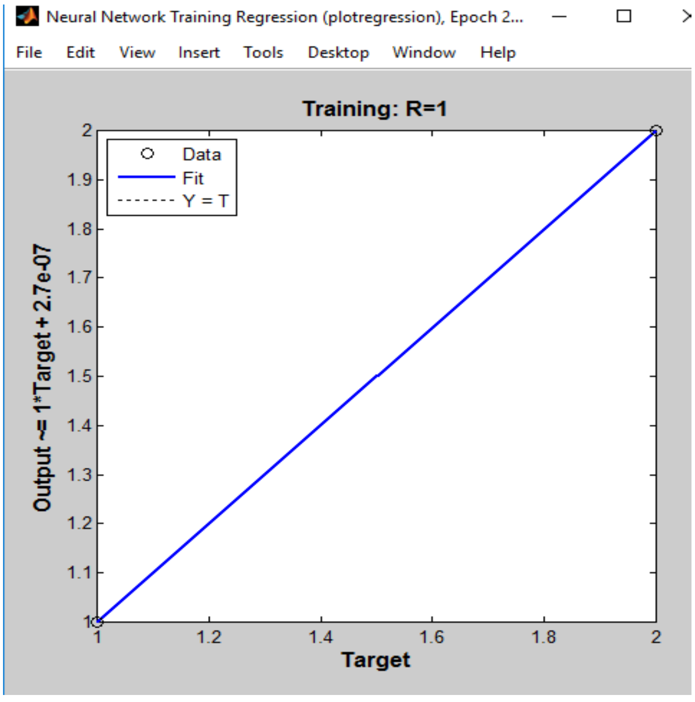


Fig.11.Neural network training regression

CONCLUSION

In above work we propose a novel method for anomaly detection in different scenarios which can be obtained from static surveillance camera. Using histogram of oriented gradient appearance and motion features can be obtained. Propose algorithm can demonstrate more effectively if used with UCSD dataset for detecting anomalous behavior in crowded local scale variation areas with various occlusions and noise in the videos. With the use of KL-Transform and median filter we get more accurate results due to image compression and noise removal and finally considering the movements. Thus using propose algorithm and artificial neural network classifier and support vector machine classifier computational cost can be reduced and its effectiveness in terms of accuracy can be increase for detecting anomalous behavior in different crowded environments. Therefore propose algorithm will be most appropriate for variety of surveillance and safety applications.

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