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A Novel approach of integration of high level features for detection of abnormal events in video surveillance

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ABSTRACT: More than 80 percent of video surveillance systems are used for monitoring people.Most of the research and uses of video surveillance is done on building or banks but we find rare in pedestrian field .video surveillance in pedestrian is challenging because when we try to classify normal and abnormal event most of the events are complementary together that's why it is one of challenging field in the video surveillance. Old human detection algorithms, based on background and foreground modelling, could not even deal with a group of people, to say nothing of a crowd. Recent robust and highly effective pedestrian detection algorithms are a new milestone of video surveillance systems.Based on modern approaches in deep learning we proposed deep one class model which consist of Convolutional neural network and one class svm. With this new approach the video surveillance getting new hike because of its performance and working. We performed this model on freely available UCSD dataset which results in accuracy of 90 percent which is goodcompare to the other algorithms this why it is considered into the state of art algorithm.

KEYWORDS: Deep Learning,SVM,CNN,DOC

I. INTRODUCTION

Abnormal event detection is one of the key research topics in the field of intelligent video surveillance. Its main task is to automatically screen abnormal events from the videos, so that security personnel can promptly deal with these anomalies. However, in practice itis not feasible to enumerate all cases of anomalies that may occur in a given monitoring video sequence, which makes the problem more challenging. In addition, abnormal events in complex videos provide quite a large quantity of valuable information for various kinds of prospective applications, such as intelligent monitoring and automatic alarm system, which makes this problem more meaningful.There are various definitions for an "abnormal event" in a video context. Usually, normal event and abnormal event are relative to each other, and anomaly often refers to an event that hardly ever occurs. Therefore, it is very hard or even impractical for us to look for models of basic unknown events.

Recently,deep neural networks have been widely used in the field of computer vision,and have played an important role in image retrieval, object detection and action recognition.However, abnormal event detection in surveillance videos has received relatively little attention. Recent empirical and theoretical studies have shown that a deeper architecture can achieve better generalization capabilities than a shallow one on challenging tasks propose a novel unsupervised deep learning framework for abnormal event detection. In through three stacked denouncing auto-encoders (SDAEs),appearance, motion, and their joint representations are learned. The abnormal score is then calculated by using three one-class SVM classifiers with these learning featuresengine, Among all the previous works, we find that these methods are almost based on two-stage learning. In the case of hierarchical learning, the global optimal solution is not necessarily the adduct of the optimal solution in each stage. Therefore, coupled with the inspiration from the extraordinary ability of the deep models which can capture complex distributions in real-world applications, we propose a straightforward end-to-end model named deep one class learning model which achieves a global optimal solution. Compared with the two-stage learning, our end-to-end model can not only reduce the artificial preprocessing and follow-up processing operations, but also make the model directly send the original input to the final output as far as possible. Besides, we can automatically adjust the model according to the data, as well as better integrate of the model.

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II. LITERATURE SURVEY

According to our literature survey, there are various methods and research is going in thefield of video surveillance and event detection. We came out with some interesting paperswhich strikes the concept of Event detection and video surveillance. We concluded it asfollows.

A. Literature survey on abnormal event detection usingMachine Learning

In 2000 the authors Yuri A. Ivanov [1], worked on event detection and they cameup with concept which named as Recognition of Visual Activities and Interactionsby Stochastic Parsing and method used was Hidden Markov Models (HMM), FiniteState Machines (FSM) which has its own advantage and limitation. In 2001, theauthors [8] Gerard Medioni addressed several problems related to the analysis of avideo stream. The main focus is on tracking and behaviouranalysis, he proposed theHierarchicalmodelling method but still it limited by the quality of detection. In 2008, the authors Amit Adam[2] worked on video-analysis algorithm to be asuitable for deployment in large-scale surveillance projects, certain requirementshave to be satisfied. It uses. In 2011, Vikas Reddy [7] proposed an anomaly detectionalgorithm targeted towards crowded scenes. He uses the MPPCA, Mixtures ofDynamic Textures method. By this method the actions which impossible to identify by traditional we can detect using this method but it may to detect the outlier. In 2012, the author Venkatesh Saligrama [3] proposes the anomaly detection onLocal Statistical Aggregates which can identify the events which comes for shorter time in frame this is the main role and for it uses the Gaussian model, HMM. In2014, the author Weixin Li [9] created the model named as Anomaly Detectionand Localization in Crowded Scenes which is used to implement 1) a center-surround discriminant saliency detector that produces spatial saliency scores, and 2) amodel of normal behaviour that is learned from training data and produces temporalsaliency scores. Uses the MDT model. In 2018, the author Xiaodan Li[4] worked on abnormal event detection and mademodel named as Object Oriented Anomaly Detection In Surveillance Videos which,uses Histogram variance of optical flow angle. The main idea behind this modelis to identify the abnormal event object by object i.e.Tracking the object usingspatio-temoporl feature and then classify it.

B. Literature survey on abnormal event detection usingDeep Learning

In 2017, Jiayu Sun, Jie Shao, Chengkun[5] He proposed an Abnormal event detection for video surveillance using deep one-class learning . By using deep one classlearning model the accuracy of detecting event is more accurate but as it worksonly when there is one class .Combination of CNN and One Class SVM called asDeep One Class model. In 2019 ,the author [6] Wenqing Chu said that ,in earliersolve the problem by extracting local features and then learning an outlier detection model on training videos. However, most previous approaches merely employhandcrafted visual features, which is a clear disadvantage due to their limited representation capacity.To overcome it the author uses 3D CNN and SCG-SF whichworks well in 4 real world dataset but its performance is not as good as supervisedmodel .In 2020,the author Hak Gu Kim,Yong Man Ro [10] proposes new method which is BMAN(bidirectional multi-scale aggregation networks) here author said that thismodel learn spatiotemporal patterns of normal events to detect deviations from thelearned normal patterns as abnormalities. The feature aggregation, robustness forobject scale variations and complex motions is achieved in normal pattern encoding. The resulting abnormal event detection is interpretable on the visual basis of wherethe detected events occur. Further, we validate the effectiveness of the proposednetwork designs by conducting ablation study and feature visualization.

III. SYSTEM DESIGN

A.System Architecture

The architecture of the system is the most relevant approach to show the overall structure. Input to the model can be given in the form of videos frames. Then, after training the model which is based on CNN with available handcrafted image dataset. First of all we will took dataset from UCSD video and converted it into frames for data preprocessing. Then we will initialize convolutional neural network and start feature extraction of normal events with the help of one class SVM algorithm we will detect the abnormal activities in pedestrian walkway based on the outlier detection concept.

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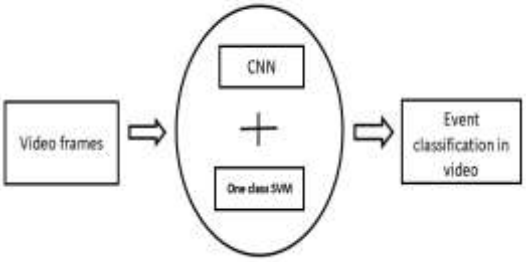

Fig1.System Architecture of Model

B. Specification of Algorithm

The given algorithms can be implemented using various libraries some of are keras, tensorflow and one class svm is implemented using sklearn library, where cnn is implemented by keras or tensorflow.

1. Deep One Class Model

The architecture of our Deep One-Class (DOC) model is shown in Fig 2 We propose the deep model with one-class SVM, a novel algorithm that integrates one-class SVM into Convolutional Neural Network (CNN), replacing the softmax layer of traditional deep architectures, which can learn a tight boundary of high-level features derived from CNN.

These features are given to one-class SVM layer to make the actual prediction. The whole system is trained with simple gradient ascent and descent learning algorithms on an enhanced objective of one-class SVM, and one-class SVM layer learns to minimize this objective.

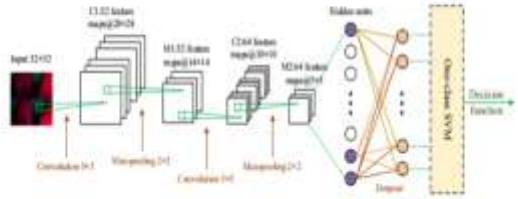

Fig2.DOC model

2. Convolutional Neural Network

CNNs are a class of Deep Neural Networks that can recognize and classify particular features from images and are widely used for analyzing visual images. Their applications range from image and video recognition, image classification, medical image analysis, computer vision and natural language processing. A convolution tool that separates and identifies the various features of the image for analysis in a process called as Feature Extraction.A fully connected layer that utilizes the output from the convolution process and predicts the class of the image based on the features extracted in previous stages. The architecture
Ofcnn is shown in Fig 3

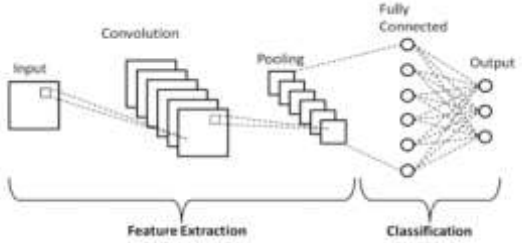

Fig3.CNN Architecture

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3. One Class Support Vector Machine

The One-class SVM (OC-SVM) was introduced by Sch¨olkopf as a support vector method for novelty detection.Notationally, let us consider a dataset xi R N , i = 1, . . . , n belonging to a given class of interest. The goal is to find a hyperplane of maximum margin separation from the origin. The hyperplane is defined in a high dimensional Hilbert feature space H where the samples have been mapped to through a non-linear transformation.

IV. RESULTS

A. Metric for performance evaluation

For classification problems, evaluation metrics compare the expected class label to the Predicted class label or interpret the predicted probabilities. For the model, the evaluation Model generated is shown in the fig 4. We have used the following metrics

	precision	recall	f1-score	support
-1	0.10	0.18	0.13	6804
1	0.96	0.93	0.95	163196
accuracy			0.90	170000
macro avg	0.53	0.56	0.54	170000
weighted avg	0.93	0.90	0.91	170000

Fig4. Classification Report

B. Precision

Precision can be described as the fraction of relevant instances among the retrieved in Stances. I.e. Number of true positives to the Predicted Positives. The precision is 0.96

C. Recall

Recall is the number of true positives to the number of actual total positives.It is 0.93

D. Accuracy

The accuracy that we are getting from this evaluation is 0.90

E.ROC Curve

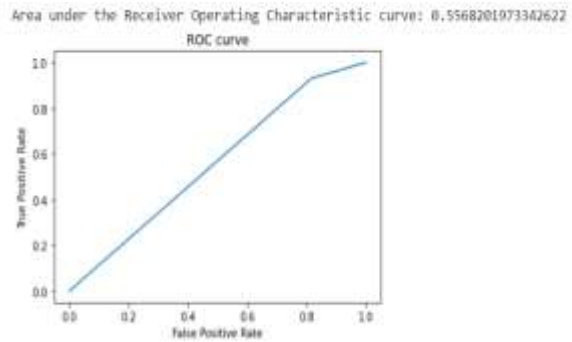

Fig5. ROC curve

F. Implementation Results

Below fig6. Shows abnormal event detection

Fig6. Truck and Car detection in pedestrian video

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V. CONCLUSION

In our project, weused deep learning to the challenging video anomaly detection problem. We used a deep one-class learning model for abnormal event detection from video sequences by combining CNN and one-class SVM.One-class SVM layer not only distinguishedd normal/abnormal cases as a discriminator, but also optimizes parameters of the whole model as an optimization objective. This model is trained on UCSD dataset with hyper parameter tuning which gives better accuracy. We achieved the accuracy of 90%.

Compare to the ideal results the actual results detect event more accurately..We will be looking forward in future to test this model on real world video surveillance so that we can use this model anywhere.

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