

Unusual Activity Detection in Surveillance Video using Machine Learning and Discriminative Deep Belief Network Techniques

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Abstract— In recent years, video police work systems are typically adopted more or less the planet as security issues and their low hardware price. Anomaly detection is one in all the analysis areas within the field of video police work. During this study, totally different existing cluster primarily based, like techniques EM bunch and classification primarily based anomaly detection techniques in video police work square measure mentioned. The video closed-circuit television includes background modeling, object detection, object following, activity recognition and classification. Recently, the machine learning primarily based anomaly detection techniques plays a significant role within the classification of the events into traditional and abnormal events. The new approaches just like the grouping of Convolution Neural Network and repeated Neural Network and cascade deep learning square measure the strong algorithms for big datasets. The options so extracted square measure fed to a Discriminative Deep Belief Network. Labeled videos of some uncertain activities also are fed to the DDBN and their options also are extracted. Then the options extracted exploitation Convolution Neural Network square measure compared against these options extracted from the labeled sample video of classified suspicious actions employing a Discriminative Deep Belief Network (DDBN) and varied suspicious actions square measure detected from the given video.

Keywords- Convolution Neural Network, Discriminative Deep Belief Neural Network, Recurrent neural network, video surveillance.

I. INTRODUCTION

Intruders could also from outside the host or the network or legitimate users of the network. Intrusion detection is that the method of observance the events that area unit occurring within the systems or networks and analyzing them for signs of attainable incidents, that area unit violations or threats to laptop security policies, acceptable use policies, or normal security practices. That system that detects the intrusion within the system is thought as IDs (Intrusion detection System). This concept has been around for 2 decades however recently seen a dramatic rise within the quality and incorporation into the general data security infrastructure. so the intrusion are often found primarily victimization 2 classification techniques: Misuse or signature based mostly detection and therefore the different is Anomaly detection.

II. DETECTION TECHNIQUES

The technique of detection, Signature primarily {based} additionally brought up as pattern based, appearance for proof legendary to be indicative of misuse. Whether or not it's searching for specific log entries or a particular payload in a very information packet, the NIDS/HIDS is searching for one thing it is aware of concerning – a signature of misuse. Whereas Anomaly based mostly detection

appearance for signs that one thing is out of the normal that might indicate some kind of misuse. Anomaly based mostly systems analyze current activity against a “baseline” of “normal” activity and appearance for deviations outside that that is taken into account traditional. These two techniques applied for the foremost classification of IDS named Host based mostly IDS; Network based mostly IDS (NIDS) and therefore the Hybrid IDS.

III. MACHINE LEARNING BASED TECHNIQUES

Anomaly detection techniques may be sub classified into applied math Approaches, psychological feature and Machine learning. Today, Machine learning techniques are in style for therefore several real time issues. Machine learning techniques are supported specific or implicit model that permits the patterns analyzed to be classified. It may be classified into Genetic Algorithms, formal logic, Neural Networks, Bayesian networks and outlier detection.

Machine learning will build the desired model mechanically supported some given coaching knowledge. The required coaching knowledge can be used and this is a plus point in using the proposed approach. With the increase the quality and also the variety of various attacks, machine learning techniques that enable constructing and maintaining anomaly

detection system with less human intervention is the need of the hour.

To apply machine learning technique in favor of intrusion finding will mechanically then assemble the model that supports the training model set, that contains knowledge instance which will be represented by applying a set of attributes and associated labels.

The nature of attributes categorized or continuous may be the different types of attributes determine the relevance of abnormality techniques. The knowledge instance related labels are of two types normal and abnormal (ie. binary). There are also researchers who have detected various attacks like DoS, U2R, R2L and Probe instead of the abnormal label. This knowledge performance is accomplished to produce additional info concerning the anomalies varieties. Anomaly detection techniques embrace supervised techniques and unattended techniques

K -Nearest Neighbor

K-nearest neighbor is individual amongst the humble and traditional statistic technique for classify sample. It calculate the fairly accurate distance connecting varied points on the key vectors, then assigns the unlabelled purpose to the category of its K-nearest neighbors. Within the method of making k-NN classifier, (k) is a vital consideration and varied (k) values will cause varied performance. If k is extremely immense, the neighbors that used for prediction can consume giant categorization time and have an effect on the prediction accuracy.

Bayesian Network (BN)

Hecker man states a Bayesian network of need that encodes probabilistic relationships among variables concerned. Generally this is used for finding out intrusions which applies mathematical schemes. It has the capability of finding the interdependence's between variables and of predicting events. It also includes precious data and information. According to Johan send & Lee Bayesian network system given a correct arithmetic solution though it appears rough.

Supervised Neural Network

User and daemons activities in systems are predicted by NN learning. By properly designing NN several issues are encountered by rule base approaches can be dealt. Multilayer perceptron and radial basis operate (RBF) square measure the first note worthy.

Support vector machine:

Vapnik is one of the important algorithms that are projected under SVM. First the SVM is mapped to input vector in the higher dimensional feature area. After that, the hyper plane separated from the high dimensional feature area is obtained.

The separated hyper plane is gained by the support vectors and not from the trained samples. So, it is very strong and easy for classification. Binary classification works on separating the training vectors. In call boundary, svm has totally different classed notes. SVM is a combination of two parameters which allows the user to distinguish the amount of unclassified samples.

Unsupervised Anomaly Detection Techniques:

These techniques don't would like coaching information. As different, they supported 2 fundamental assumption. earliest, they imagine that almost all of the system associates are traditional traffic and solely a awfully tiny traffic proportion is anomalous. succeeding, they anticipate that malicious traffic is statistically numerous beginning traditional traffic. per these 2 assumption, information teams of comparable instances that seem oft are assumed to be traditional traffic, whereas sometimes instances that significantly numerous commencing the bulk of the instance are regarded to be malicious.

One class support vector machine (OCSVM):

For anomaly detection, the OCSVM is the basic one that helps to easily identify the normality and abnormality. The difference between OCSVM and SVM is the quadratic optimization. In quadratic optimization, it included selected small proportion outliers that are previously defined. The outliers that lie in the starting point or in the origin are the best separated hyper plane. In the sequence of planes, the outstanding hyper planes are taken and grouped as a one class SVM. In OCSVM, the positive values represent conventional behavior and negative values represent abnormal behavior.

Semi-Supervised Learning (SSL)

This approach falls within the middle of the previous 2. Semi-supervised anomaly detection supposes that the coaching information has labeled instances for less than the conventional patterns. as a result of they are doing not would like labels for the anomaly patterns, they're additional loosely applicable than supervised algorithms.

Anomaly Detection Algorithms Comparison:

Diverse unattended abnormality recognition algorithms are functional to disturbance detection to reinforce IDSs performance levels like in cluster, options choice and classifications. The comparison of algorithms gives both advantages and disadvantages. Anomaly detection includes both supervised and unsupervised learning techniques. In the process of comparison, several algorithms may fail because those algorithms do not give good results. The proposed work mainly concentrates on machine learning techniques that help us to identify the abnormality in the video. The supervised learning techniques experiment to find out the unknown attacks in the video. Like SVM, the supervised

approach is used to achieve non-linear strategy. So, the K-means, SOM are neglected and SVM is used.

Feature Extraction Methods:

Feature extraction may be a task that embodies sex tracing each abstraction and motion data from a video that's distinctive in respect to specific activities among a scene. Feature extraction strategies in researches that use a visible-spectrum camera because the essential device will be divided into 2 major categories:

1. Strategies that extract low-level options at the pixel-level directly from the image. for example, a system that obtains the frequency and alter rate for every element in consecutive frames to construct a map of motion levels in an exceedingly scene.
2. Strategies that extract high-level options for a detected object once applying object pursuit or detection. For example, a system that detects and tracks individual's vehicles from a motion video. Additional recently, there's associate integrated pipeline, which mixes the low-level options and high-level options for abnormal behavior reasoning. This permits to spot abnormal behaviors for object trajectories relevant to hurry and direction, and in addition complicated behaviors relevant to the finer movement of every object. Generally, quite methodology use for feature extraction depends on the sort of police work target. All progressive papers that affect crowd anomaly detection use some sort of low-level pixel-based feature extraction, while object extraction and pursuit is that the most well liked methodology to be enforced to anomaly detection in people.

IV. METHODOLOGY USED

The projected system uses a Convolution Neural Network for extracting totally different options from the videos and a Discriminative Deep Belief Network for classifying the recognized actions into traditional activities and suspicious activities.

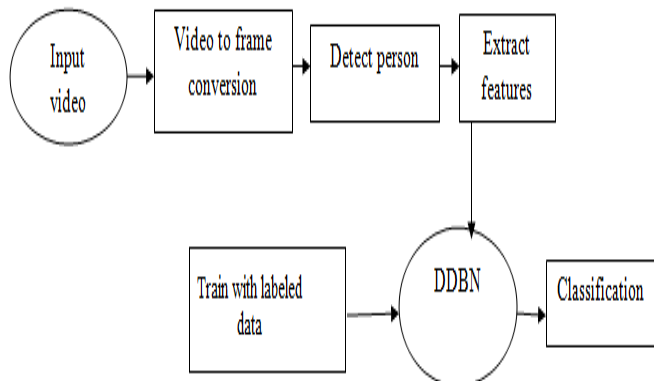


Fig 1: System Architecture

Background Subtraction:

It is a technique that processes the foreground area of the image. The common and most widely used for processing the image is object localization. For detecting moving objects in videos the background subtraction is used. Detection of moving objects from the frame and a organization is the basic one and it is called as "background image". An example for background duplication is police work pursuit. The objects that are not connected to the real world are subtracted from the background. In Indoor reflection of light in the screen can cause changes in the background of the image. Because of the change in climatic conditions in the outdoor is the reason for background strategies. The background image is a fact on the scene with no movement it occurs due to climatic conditions. Straightforward strategies like the running mathematician average or the median filter supply acceptable accuracy whereas achieving a high frame rate and having restricted memory necessities.

Convolution Neural Network

As the next step within the procedure, options of the frames within which the humans are detected and extracted employing a convolution Neural Network (CNN) is shown in Figure 2 below.

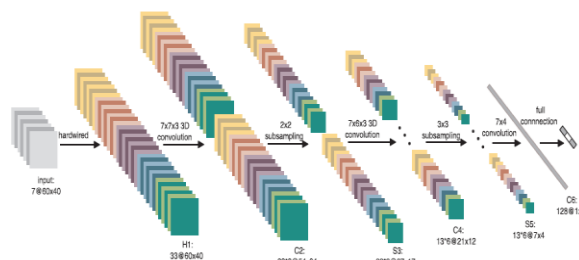


Fig 2: CNN Architecture

The CNN is designed in such a way that it takes seven frames from the total frames. First a group of automatically occurring kernels is applied to input frames. The second layer has five different channels, grey, gradient-x, gradient-y, optflow-x, optflow-y.

The channels and their frames are,

1. The grey channels have the grey image elements and their values.
2. The seven input frames are computed horizontally and vertically for obtaining the feature maps in gradient-x, gradient-y.
3. The optflow-x, optflow-y contains the optical flow field that is computed horizontally and vertically.

The layers are mainly used for gaining the previous information. At every part of the image, the two sets of various convolutions are applied. In c2 layers two sub-sampling is applied in the feature maps. C4 is obtained by

applying the convolution with a kernel size of seven on every 5 channels. Layer s5 is obtained by sampling three sub samples in the c4 layer, this leads to reduce spatial resolution. The size of the output elements is mapped and reduced to one. The layer C6 contains 28 feature maps of equal size 1.

Discriminative Deep Belief Network

The options extracted from labeled sample video are compared with the options extracted from the classified actions. To classify the found out actions into user nominal suspicious activities, the application is trained for both supervised and unsupervised algorithms. For the coaching purpose sample labeled video knowledge sets are used. Classification underneath labeled knowledge may be renowned. It is a doubtless one, it is the correct one but is tough and high priced. In content based retrieval, the similar images in the frames are collected and organized. It has one labeled picture as a input query image and several unlabeled pictures that are the output query image. Some of the semi-supervised ways are self-training, TSVM, graph based methods etc. Like kernalized linear model, the semi supervised techniques use various design. Deep design with non-linear operations helps to predict the semi-supervised learning that helps to deal AI tasks. This paper is a work of both semi-supervised learning and deep design conjoined as Discriminative Deep Belief Network (DDBN). These two stages of DBN produce a real semi-structured learning. The DBM-rNCA is a combination of DBN and its neighborhood element. NCA performs a easy classification progress through semi-supervised learning, Further, the DDBN is applied to different types of classification tasks. Thus varied suspicious activities are detected.

V. RESULT AND DISCUSSION

In brief surveyed completely different machine learning based mostly anomaly detection techniques in video police work like proximity bunch for detective work abnormal activities, k-means, SVM, adjacent flow location estimation, distributed semi-nonnegative matrix factorization and deep neural network strategies for detective work anomalies in objects scenes, citizen density technique for maritime video police work, optical flow based mostly frequent pattern for distinctive abnormal events, in an exceedingly novel approach, combination of CNN and RNN is additionally used for detective work anomalies in numerous applications. Then this output is fed to a DDBN that is employed to classify the recognized actions into traditional and anomaly proceedings by coaching the system mistreatment semi supervised learning technique. The options therefore extract square measure fed to a Discriminative Deep Belief Network (DDBN).

VI. CONCLUSION

The work planned a anomaly activity detection from the police work video oppression convolutional neural network for feature extraction and a discriminative deep belief network for action classification. Compared with the previous works, the planned approach achieves higher classification by deep-learning-based model. when humans area unit detected employing a background subtraction methodology, seven frames area unit hand-picked during which the area unit the world the realm of the bounding boxes calculated for the humans detected are larger among all. From these seven hand-picked frames, thirty three feature maps area unit extracted that area unit in 5 completely different channels outlined by, grey channel, gradient-x, gradient-y, optflow-x and optflow-y channels. These thirty three feature maps area unit given as input to the CNN that returns a 128D options in an exceedingly single vector. Then this output is fed to a DDBN that is employed to classify the recognized actions into traditional and suspicious actions by coaching the system victimization semi supervised learning methodology. The deep learning model ensures additional accuracy and lesser false positives.

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