ANOMALY DETECTION TECHNIQUES IN CROWDED AREAS

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ABSTRACT

Anomaly detection is the approach to determine unusual conditions or observations that are statistically different from the rest of the observations. It is used for detecting abnormal events in crowded areas like roads, rallies, hospitals, any public gatherings and traffic signals etc. Now-a-days, popularity of surveillance cameras is increasing. There are protection cameras in public places like railway station, airport and many others. Private organizations also have security cameras in their premises to deal with security challenges like robbery, fire accidents or any abnormal situations. If the situation is significantly different from the normal situation then it is detected as abnormal situation. From these security cameras, detecting abnormal events manually requires a security person completely hired which results in additional budget to the organization. But, there exist a lot of methods to detect abnormal activities in a given video stream without man power. Now-a-days, Deep learning has clearly proven its functionalities in a wide range of domains, including sounds, images, videos, and Natural Language Processing. Deep Learning techniques such as Convolutional Neural Networks (CNNs), Graph Neural Networks (GNNs) etc are abundantly used for handling abnormal event detection in fast and efficient manner. In this project, recent 3D CNN based models will be used for handling abnormal event detection. For the experimentation, Avenue dataset is considered with normal and abnormal crowd behavior videos of different scenes. The performance of the model is evaluated with an accuracy metric that gives the percentage of correctly classified frames in comparison to the ground truths.

Keywords: *Anomaly Detection, video surveillance, Deep learning, Convolutional Neural Network, Spatio-Temporal Autoencoder*.

1 INTRODUCTION

In recent times, the evolved countries are enhancing the security devices to safe guard and control the public and private crowd. Anomaly detection is a significant issue in a crowded region. Since, people have been made injuries and damages in public vicinity. So, often if any anomaly has come about in a crowded place, the anomaly detection is critical to protect humans and the surroundings without any extreme impairment. While the anomaly is perceived, alerting crowd human beings via an alerting device could be very imperative. Now- a- days, especially in non-public and public crowded place, the government desires a approach to offer protection with low cost.

Why Anomaly Detection Is Important?

It is critical for network admin to be able to identify and react to changing operational conditions. Any nuances in the operational conditions of data centers or cloud applications can signal unacceptable levels of business risk. On the other hand, some divergences may point to positive growth. Therefore, anomaly detection is central to extracting essential business insights and maintaining core operations. Consider these patterns all of which demand the ability to discern between normal and abnormal behavior precisely and correctly like- An online retail commercial enterprise ought to expect which discounts, events, or new merchandise can also additionally cause boosts in income so one can growth call for on their web servers, An IT safety group prevent to save you hacking and desires to detect abnormal login patterns and user behaviours and A cloud provider has to allot traffic and services and has to assess changes to infrastructure in light of existing patterns in traffic and past resource failures.

How Anomaly Events Are Detected ?

Deep learning-based anomaly detection algorithms have achieved high accuracy in automatically detecting anomalous activities such as falling of objects, anomalous access in restricted areas, traffic accidents, traffic laws violations, criminal activities, and many more. Anomaly detection algorithms usually use normal events as training data for training of models, and then apply model on online data to detect anomalies. The proposed algorithm divides video frames into variable sized cells. In the proposed particle filtering based technique, we first predict possible activities in a video frame.

Fig: Normal vs Abnormal Events

2 LITERATURE SURVEY

[1] Optical flow vectors are used to generate a Motion Information Image (MII) from the video, then to train a Convolutional Neural Network (CNN) for anomaly detection in crowded region. Abnormal event detection can be differentiated into two types i.e. Local abnormal events and global abnormal events.The methods used for global crowd behaviour analysis is object-based approach. Here group of individuals are considered as objects.

[2] Incremental Spatio Temporal Learner (ISTL) is unsupervised deep learning that utilizes active learning with fuzzy aggregation and distinguish the normal and abnormal events.It is unreasonable and impossible for human observers to examine and evaluate every video transmission.

[3] This paper mainly focused to reduce the computational cost approach in detection of crowd anomaly. It has 3 levels to detect the Abnormal situation in surveillance video. Crowd Unusual activity measured by different parameters like Movement pattern, Speed and Emerging point.

[4] The Network is secured by using authentication, firewall, and encryption are used but these security functions are not sufficient to secure the network. The main focus of the author to provide the extra security by using Convolution Neural networks, The dataset CIC-IDS2017(Canadian Cyber Security Institute Dataset) are used which contains different attacks like web attack ,port scan ,Dos .First it capture the network packets by using packet sniffing tool.

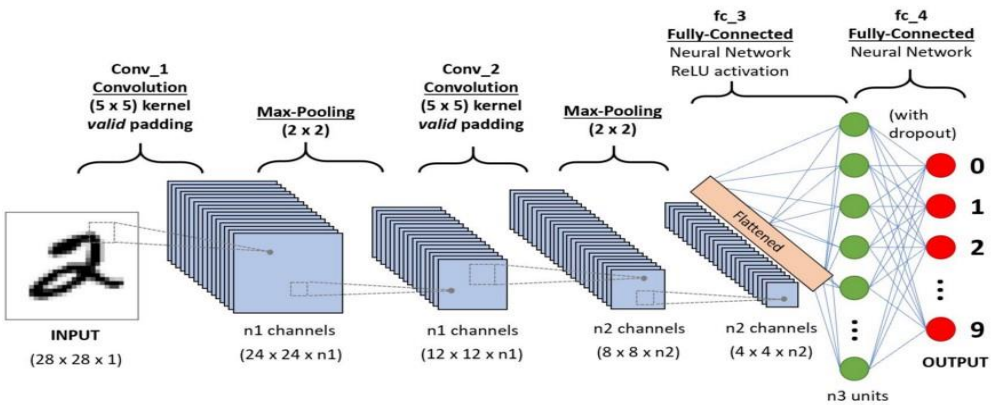
[5] The main aim of this paper is to reduce the man power and to save time and cost to detect abnormal events that occur in the crowded areas. The Algorithm that used in this paper is Convolution neural networks, SVM, Cosine similarity are used. The Datasets that used in this paper is USCD Ped1, UCSD Ped2, Avenue and Hockey datasets which contains abnormal events and behaviors.

3 METHODOLOGY

Convolutional Neural Network :

In deep learning, Convolution Neural network(CNN) is a class of artificial neural networks(ANN) is commonly used for analyze visual imagery purpose.it is particularly used for finding patterns in images to recognize objects, faces and scenes. CNN inspired by the human brain which contains nodes and each node is connected to all other nodes.it takes the input from the convolution layer and pass the information to all the layers and with the help of bias and weights the image is detected.by using the sigmoid the image is detected A convolution neural network has tens or hundreds of layers to detect the different features of an image.

A simple CNN consists of an input layer, followed by a stack of a convolutional layer with a certain activation function (CL) and a pooling layer (PL), the fully connected layer, and a final classification activation layer. The convolution layer and pooling layer are used for feature extraction and the layers fully connected layer and output layer is used for classification purpose. The convolution layer takes the input as input and produce feature maps. And the pooling layer is reduced the size of feature maps .so the usage of memory is reduced by reducing the size of images and it is also avoid the over fitting. And the regularization techniques are used to reduce over fitting and also improves the accuracy. fully connected layer is used for classification purpose by using the activation function like sigmoid, SoftMax are used for binary and multiclass classification.



3.1 Autoencoder :

Autoencoder is an unsupervised artificial neural network that tells how to compress and encode data efficiently before learning how to rebuild the data from the reduced encoded representation to a representation that is as close to the original input as possible. Autoencoder reduces the dimensions of data by learning how to ignore the noise in the data.

3.2 Spatio -Temporal Autoencoder (ST Autoencoder or STAE) :

Spatio-Temporal Autoencoder (ST Autoencoder or STAE) understands video representation automatically using deep neural networks and extracts features from both spatial and temporal dimensions using 3-dimensional convolutions. Space is referred to as spatial. The term temporal refers to time. When data is collected in both space and time, the term spatiotemporal, or spatial temporal, is often used in data analysis. It describes a situation in a specific place and time, such as movements across a geographic area over time.

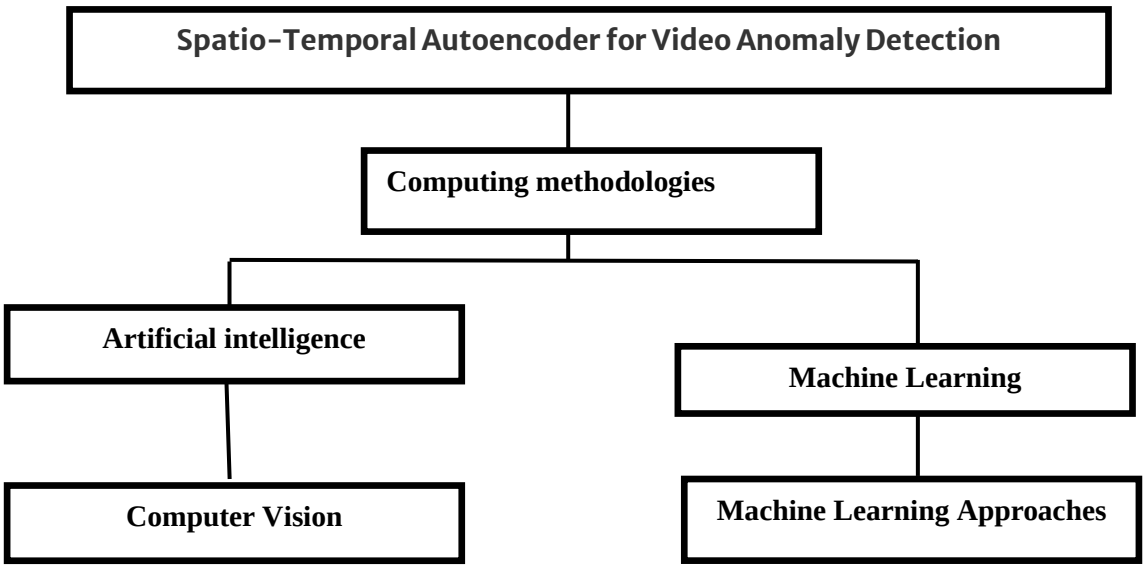


Fig3.2.1Flowchart of Video Anomaly Detection

4 RESULTS AND CONCLUSION:

The result should be detection of Abnormal Event in the given video input. Whenever a abnormal event detected in the video, the “Abnormal Event” Appears on the screen. By computing, the reconstruction loss using Euclidean distance between original image and reconstructed image the output is displayed as normal or abnormal event. If the loss is greater than the threshold value then the output is detected as abnormal events otherwise it is detected as normal video.

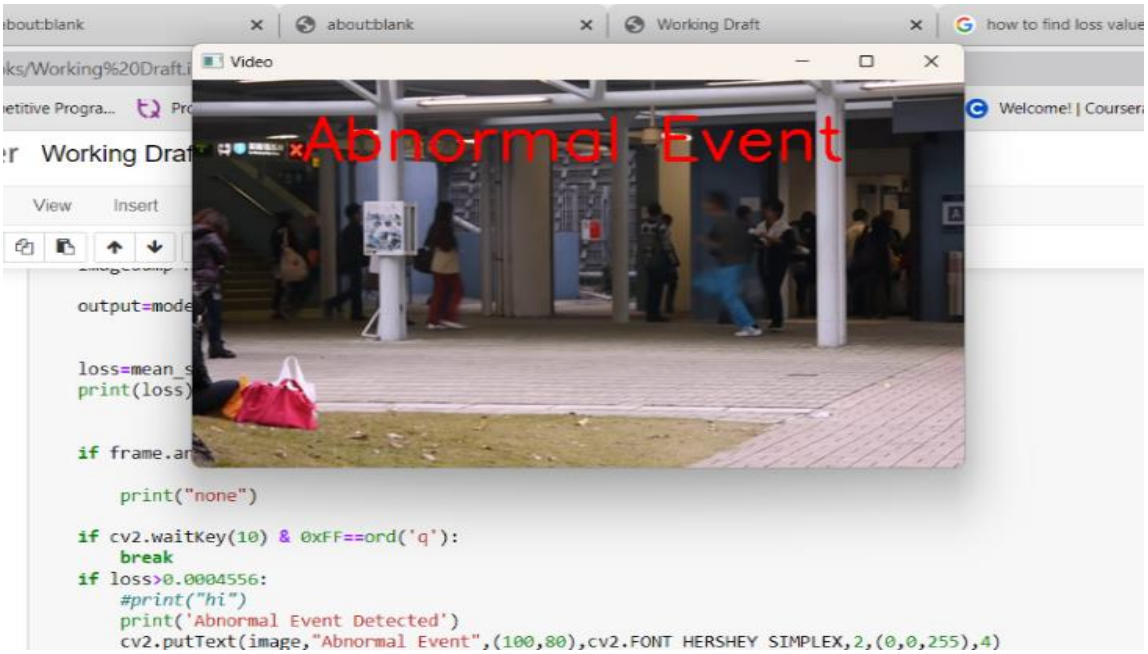


Fig 4.1 Detected Abnormal

In the above output diagram, the person is running, so the Euclidean distanace between is very high and the loss is greater than threshold value.so it is detected as abnormal event.the output blinks as abnormal event in the top of the video.

This project presents an approach for anomalous detection techniques in the crowded areas. The proposed approach is Spatio-Temporal Auto Encoder, which is based on 3-Dimensional Convolution Neural Network which are convolution 3D, convolution LSTM2D, convolution 3D Transpose. The spatial and temporal information is extracted by the encoded part and the frames are reconstructed by the decoder part. A CNN is used to learn about the normal and abnormal events. The abnormal events are detected by computing the reconstruction loss using Euclidean distance between original image and reconstructed image. Evaluations are conducted on publicly available datasets like Avenue dataset. This application is very help in present public scenario as everyone wants safety atmost. Most of the incidents is happening due to the information gap. Whenever there is property information, immediately actions can be reduced and controlled in short gap of time period. This also even gives the confidence to the public about their safety. The results indicate the proposed work is more effective.

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