A DEEP LEARNING APPROACH FOR ANOMALY DETECTION IN SURVEILLANCE CAMERAS

[1] S Venkata ramana, Assistant Professor, Department of CSE, Malla Reddy Engineering College for Women, Hyderabad.
[2] S. Sai Naga Charishma Valli, B.Tech, Department of CSE, Malla Reddy Engineering College for Women, Hyderabad.
[3] R.Rushika Reddy, B.Tech, Department of CSE, Malla Reddy Engineering College for Women, Hyderabad.
[4] R.Abhignya, B.Tech, Department of CSE, Malla Reddy Engineering College for Women, Hyderabad.
[5] R.Sravanthi, B.Tech, Department of CSE, Malla Reddy Engineering College for Women, Hyderabad.

Abstract: With the increasing in the number of anti-social activates that have been taking place, security has been given utmost importance lately. Many Organizations have installed CCTVs for constant Monitoring of people and their interactions. For a developed Country with a population of 64 million, every person is captured by a camera 30 times a day. A lot of video data generated and stored for certain time duration. A 704x576 resolution image recorded at 25fps will generate roughly 20GB per day. Constant Monitoring of data by humans to judge if the events are abnormal is near impossible task as requires a workforce and their constant attention. This creates a need to automate the same. Also , there is need to show in which frame and which part of it contain the unusual activity which aid the faster judgment of the unusual activity being abnormal. This is done by converting video into frames and analyzing the persons and their activates from the processed frame .Machine learning and Deep Learning Algorithms and techniques support us in a wide accept to make Possible.

1. INTRODUCTION

Human face and human behavioural pattern play an important role in person identification. Visual information is a key source for such identifications. Surveillance videos provide such visual information which can be viewed as live videos, or it can be played back for future references. The recent trend of 'automation' has its impact even in the field of video analytics. Video analytics can be used for a wide variety of applications like motion detection, human activity prediction, person identification, abnormal activity recognition, vehicle counting, people counting at crowded places, etc. In this domain, the two factors which are used for person identification are technically termed as face recognition and gait recognition respectively. Among these two techniques, face recognition is more versatile for automated person identification through surveillance videos. Face recognition can be used to predict the orientation of a person's head, which in turn will help to predict a person's behaviour. Motion recognition with face recognition is very useful in many applications such as verification of a person, identification of a person and detecting presence or absence of a person at a specific place and time. In addition, human interactions such as subtle contact among two individuals, head motion detection, hand gesture recognition and estimation are used to devise a system that can identify and recognize suspicious behaviour among pupil in an examination hall successfully. This paper provides a methodology for suspicious human activity detection through face recognition. Video processing is used in two main domains such as security and research. Such a technology uses intelligent algorithms to monitor live videos. Computational complexities and time complexities are some of the key factors while designing a real-time system. The system which uses an algorithm with a relatively lower time complexity, using less hardware resources and which produces good results will be more useful for time-critical applications like bank robbery detection, patient monitoring system, detecting and reporting suspicious activities at the railway station, etc. Manual monitoring of exam hall through invigilators and manual monitoring of exam hall through surveillance videos is performed throughout the world. Monitoring an examination hall is a very challenging task in terms of man power. Manual monitoring of examination halls may be prone to error during human supervision. Such a system when implemented as an 'automatic suspicious activity detection system' will not only help in detecting suspicious activities but also helps in minimizing such activities. Moreover, the probability of error will be much lesser. This system will serve as a useful surveillance system for educational institutions. This paper describes a technology in which real time videos are analysed and are used for human activity analysis in an examination hall, thus helping to classify whether the particular person's activity is suspicious or not. The system developed identifies abnormal head motions, thereby prohibiting copying. It also identifies a student moving out of his place or swapping his position with another student. Finally the system detects contact between students and hence prevents passing incriminating material among students. In our research, we have contributed upon a system that will intellectually process live video of examination halls with

students and classify their activities as suspicious or not. This research proposes an intelligent algorithm that can monitor and analyse the activities of students in an examination hall and can alert the educational institute's administration on account of any malpractices/suspicious activities.The Suspicious Human Activity Detection system aims to identify the students who indulge in malpractices/suspicious activities during the course of an examination. The system automatically detects suspicious activities and alerts administration.

2. LITERATURE SURVEY

2.1 Deep Learning-Based Anomaly Detection in Video Surveillance: A Survey

Anomaly detection in video surveillance is a highly developed subject that is attracting increased attention from the research community. There is great demand for intelligent systems with the capacity to automatically detect anomalous events in streaming videos. Due to this, a wide variety of approaches have been proposed to build an effective model that would ensure public security. There has been a variety of surveys of anomaly detection, such as of network anomaly detection, financial fraud detection, human behavioral analysis, and many more. Deep learning has been successfully applied to many aspects of computer vision. In particular, the strong growth of generative models means that these are the main techniques used in the proposed methods. This paper aims to provide a comprehensive review of the deep learning-based techniques used in the field of video anomaly detection. Specifically, deep learning-based approaches have been categorized into different methods by their objectives and learning metrics. Additionally, preprocessing and feature engineering techniques are discussed thoroughly for the vision-based domain. This paper also describes the benchmark databases used in training and detecting abnormal human behavior. Finally, the common challenges in video surveillance are discussed, to offer some possible solutions and directions for future research.

2.2 Deep learning-based Anomaly Detection on Surveillance Videos: Recent Advances

Surveillance cameras number keeps increasing from year to year, in 2017 alone estimated 106 million new CCTV installed. Surveillance cameras are installed to widen surveillance coverage in order to detect anomalies. Conventionally, detecting anomalies through surveillance cameras are using human observers. The increasing number of surveillance cameras installed is increasing the need for an automatic system to replace unreliable human observer. Thus an intelligent computer vision-based system to detect anomalies need to be developed. The goal of this system is to provide a warning to the first responder accurately and as fast as possible while the system is running all the time. The faster the response of the first responder, the better chance of an anomaly to be resolved. Deep learning based method has been proposed to solve anomaly detection on videos. Anomaly detected is composed of a set of violent and non-violent crimes with high impact in society. To increase the accuracy of previous system to detect anomalies in condition that resembles real life situation, multiple processes need to be combined. This paper will review various method used to increase the performance of a deep learning based action recognition on videos. To capture temporal information effectively the model need to be able to use multimodalities to detect motion, incorporating long-range temporal structure, and numerous deep learning architectures with various characteristics.

2.3 Anomaly Detection in Traffic Surveillance Videos Using Deep Learning

In the recent past, a huge number of cameras have been placed in a variety of public and private areas for the purposes of surveillance, the monitoring of abnormal human actions, and traffic surveillance. The detection and recognition of abnormal activity in a real-world environment is a big challenge, as there can be many types of alarming and abnormal activities, such as theft, violence, and accidents. This research deals with accidents in traffic videos. In the modern world, video traffic surveillance cameras (VTSS) are used for traffic surveillance and monitoring. As the population is increasing drastically, the likelihood of accidents is also increasing. The VTSS is used to detect abnormal events or incidents regarding traffic on different roads and highways, such as traffic jams, traffic congestion, and vehicle accidents. Mostly in accidents, people are helpless and some die due to the unavailability of emergency treatment on long highways and those places that are far from cities. This research proposes a methodology for detecting accidents automatically through surveillance videos. A review of the literature suggests that convolutional neural networks (CNNs), which are a specialized deep learning approach

pioneered to work with grid-like data, are effective in image and video analysis. This research uses CNNs to find anomalies (accidents) from videos captured by the VTSS and implement a rolling prediction algorithm to achieve high accuracy. In the training of the CNN model, a vehicle accident image dataset (VAID), composed of images with anomalies, was constructed and used. For testing the proposed methodology, the trained CNN model was checked on multiple videos, and the results were collected and analyzed. The results of this research show the successful detection of traffic accident events with an accuracy of 82% in the traffic surveillance system videos.

3. EXISTING SYSTEM

We are dealing with huge amount of video data, this is easy to make people feel tired and the manual intervention will also produce omissions. It greatly affects the efficiency of the system. This has been solved by the automation of video surveillance. Today, manual monitoring of all the events on the CCTV (Closed Circuit Television) camera is impossible. Even if the event had already happened, searching manually the same event in the recorded video wastes a lot of time.

DISADVANTAGES OF EXISTING SYSTEM

1. Time consuming.
2. Man power required
3. Results not effective

4. PROPOSED SYSTEM

Human behavior detection in video surveillance system is an automated way of intelligently detecting any suspicious activity. Number of efficient algorithms is available for the automatic detection of human behavior in public areas like airports, railway stations, banks, offices, examination halls etc. Video surveillance is the emerging area in the application of Artificial Intelligence, Machine Learning and Deep Learning. Artificial intelligence helps the computer to think like human. In machine learning, important components are learning from the training data and make prediction on future data.

ADVANTAGES

1. Effective monitoring,
2. Less manpower required,
3. cost effective auditing capability,
4. adopting new security trends

SYSTEM ARCHITECTURE

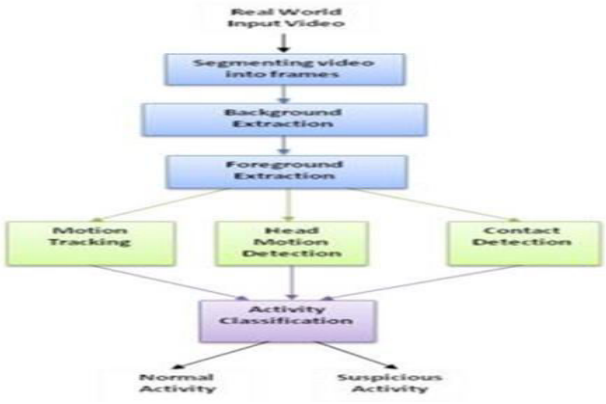

Fig 1: System Architecture

5. UML DIAGRAMS

1. CLASS DIAGRAM

The cornerstone of event-driven data exploration is the class outline. Both broad practical verification of the application's precision and fine-grained demonstration of the model translation into software code rely on its availability. Class graphs are another data visualisation option.

The core components, application involvement, and class changes are all represented by comparable classes in the class diagram. Classes with three-participant boxes are referred to be "incorporated into the framework," and each class has three different locations:

• The techniques or actions that the class may use or reject are depicted at the bottom.

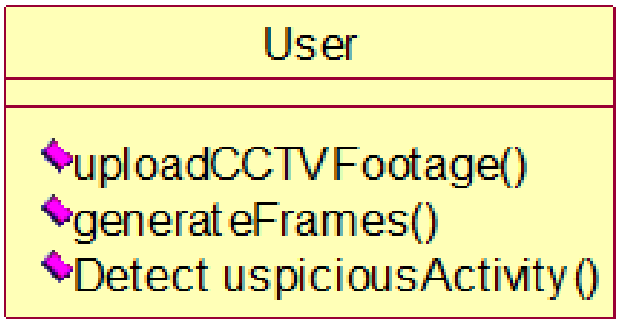

Fig 5.1 shows the class diagram of the project

2. USECASE DIAGRAM:

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors

in the system can be depicted.

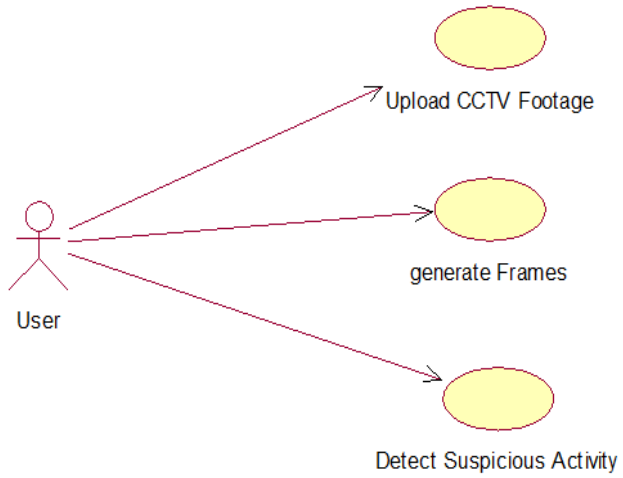

Fig 5.2 Shows the Use case Diagram

3. SEQUENCE DIAGRAM:

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

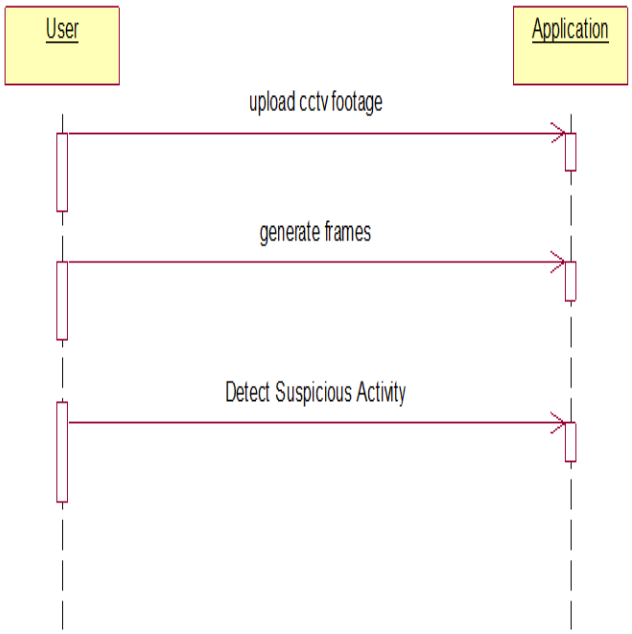

Fig 5.3 Shows the Sequence Diagram

6. RESULTS

6.1 Output Screens

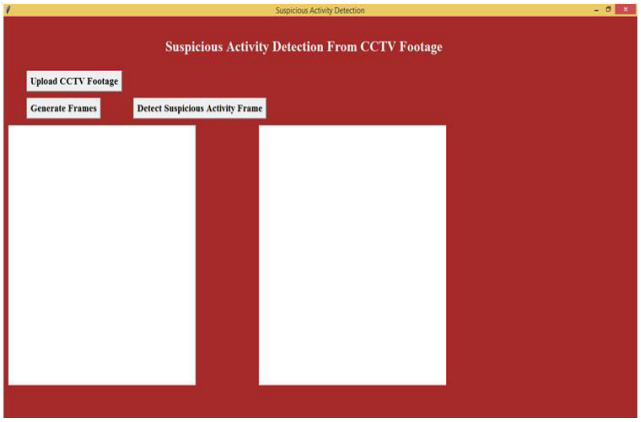

Fig 6.1 Upload the CCTV Footage

In above screen Click on 'Upload CCTV Footage' button to upload video

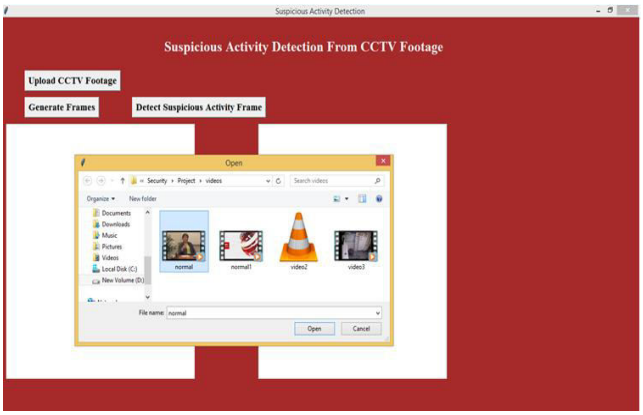

Fig 6.2 Uploading the CCTV Footage Video

In above screen i am uploading one normal video. After uploading video click on 'Generate Frames' button to generate frame

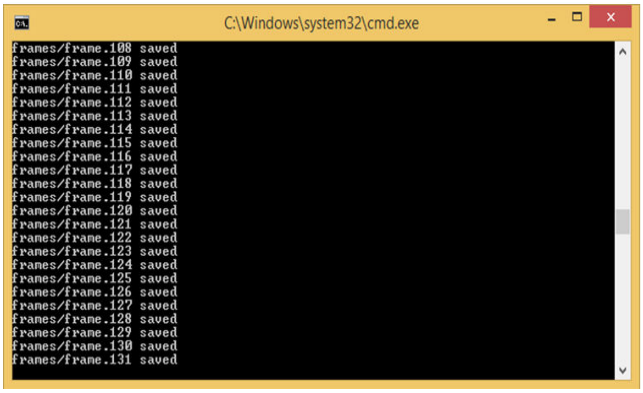

Fig 6.3 Generating Fames

In above black screen we can see extracted frames are saving inside 'frames' folder frame no. Now we see frames folder below which has images from video

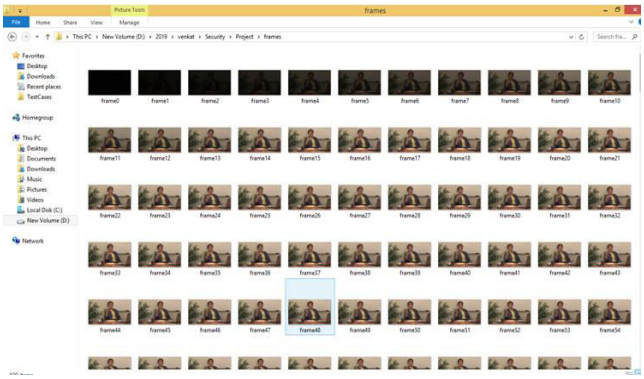

Fig 6.4 Extracting the images from video

In above folder screen we can see all images from video extracted. After frame extraction will get below screen

Fig 6.5 Run Suspicious Activity Frame

Now click on 'Detect Suspicious Activity Frame' button to start monitoring frames for suspicious activity

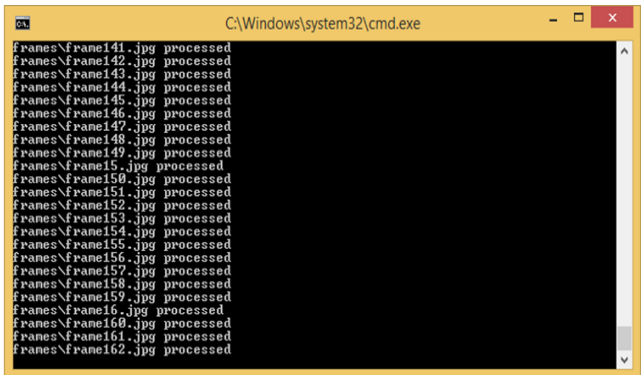

Fig 6.6 Processing of Each Frame

In above black console window we can see processing of each frame to detect suspicious activity.

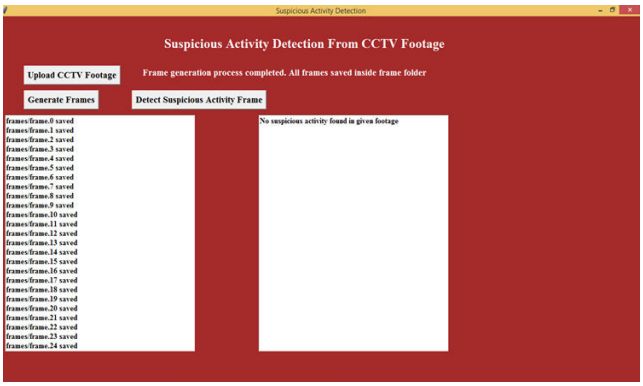

Fig 6.7 Detection of Suspicious Activity From Frame

In above screen we can see frames scanned and no suspicious activity found. Now we will upload another video and check status

7. CONCLUSION

In present world, almost all the people are aware of the importance of CCTV footages, but most of the cases these footages are being used for the investigation purposes after a crime/incident have been happened. The proposed model has the benefit of stopping the crime before it happens. The real time CCTV footages are being tracked and analyzed. The result of the analysis is a command to the respective authority to take an action if in case the result indicates an untoward incident is going to happen. Hence this can be stopped. Even though the proposed system is limited to academic area, this can also be used to predict more suspicious behaviors at public or private places. The model can be used in any scenario where the training should be given with the suspicious activity suiting for that scenario. The model can be improved by identifying the suspicious individual from the suspicious activity.

8. REFERENCES

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