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Intelligent Surveillance System Using Deep Learning

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***Abstract*—** It's of intensive importance to develop a way for automatic surveillance video analysis to acknowledge the presence of violence. During this work, to identify violent videos, we recommend a deep neural network. A convolutional neural network is used with a pre-trained inception model for extracting frame level features from a video. The characteristics of the frame level are then collectively employed during a long remembering variant that uses fully connected layers and leaky rectified linear units. Alongside the long remembering, the convolutional neural network is capable of capturing localized spatio-temporal features that alter the analysis of native motion within the video. The performance is more evaluated in terms of accuracy of recognition on standard benchmark datasets. The approach planned outperforms state-of -the-art strategies whereas process the videos in real time.

***Keywords*—** CNN; LSTM; RNN; Inception; GoogLeNet; VGG; AlexNet; Data-Set; Deep Learning; TensorFlow

I. INTRODUCTION

Over the past few decades, there has been significant growth in infrastructure throughout the world in security-related issues. Video based surveillance has thus become a crucial space for analysis with multiplied security demand. Using some equipment (usually digital camera), an intelligent video surveillance device mainly examines results, happenings, or ever-changing details generally from a distance in terms of people, cars, or other objects. Scopes such as avoidance, identification and intervention that led to the development of real and reliable video surveillance systems are capable of smart video processing skills. Earlier monitoring systems were more dependent on human operators. Due to better efficiencies and reliability, automated systems are now preferred in detecting violence incidents. Violence is an abnormal behavior and acts can be detected using a smart surveillance system that allows us to avoid dangerous accidents from happening. This system can be applied on a large scale, such as highways, parks, medical centers and alerting officials about the crime.

II. RELATED WORK

Ali Khaleghi and Mohammad Shahram Moin has discussed the CNN based method to detect the normal and abnormal videos from surveillance cameras. Feature extraction and anomaly detection are the two important steps which uses auto-encoders, convLSTM, Faster-RCNN and SVM classifier to predict the output [1].

Mr Antreas Antoniou considered two approaches to the monitoring system, the approach to identification and the approach to classification. The approach to detection consists of background subtraction and optical flow, while the approach to classification is based on neural networks. He has proposed two customized surveillance system architectures. Custom architecture is inspired by VGGNet and AlexNet. In that FC layers are reduced to 1024 * 1024 *7 from 4096 * 4096 * 1000. Custom Net 2 is also referred to as ParaNet. It is inspired from GoogLeNet and VGGNet. It has separate pipeline for every class [2].

Swathikiran Sudhakaran and Oswald Lanz gives trainable deep neural network model. The proposed model consists of a convolutional neural network for frame level function extraction and convolutional long short-time memory for characteristic aggregation within the temporal domain. The model uses three datasets which ends up in advanced performance[3].

Researchers took under consideration CNN and 3D CNN. They proposed a CNN model for identifying people in video and reducing interval by using CNN. After that, images are fed to the 3D CNN model, which was trained on spatiotemporal characteristics and final predictions are made[4].

The problem of anomaly detection is discussed by Prakhar Singh and Vinod Pankajakshan in their paper named “A Deep Learning Based Technique for Anomaly Detection in Surveillance Videos” using the Deep Neural Networks. This model illustrates the detection of anomalies and predicts whether an input video frame shows normal behaviour [5].

III. METHODOLOGY

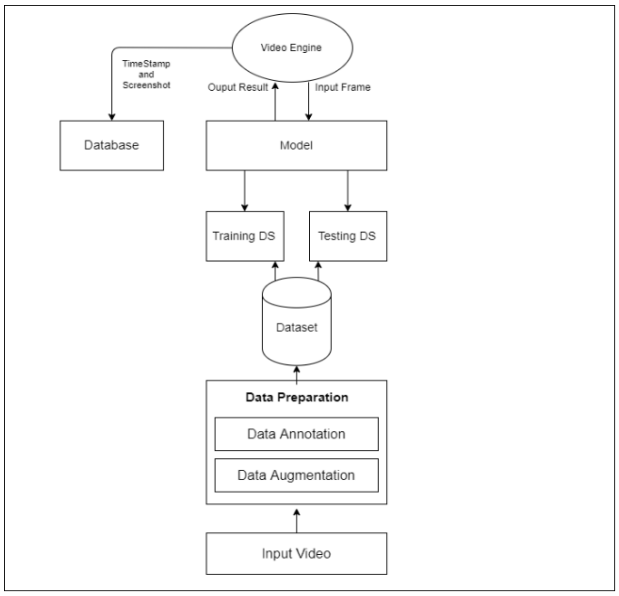

Fig. 1

System design

System design encompass five modules specifically data preparation module, dataset, Deep Leaning model, video engine and database. This technique is enforced in python and TensorFlow as a backend. User provides video file as associate input and system provides output as video is violent or non-violent. System supports .mp4 and .avi video formats.

Modules: This system is split into 5 elements consistent with functions performed by system.

Data Preparation: This module deals with raw video data. It consists of 2 submodules data Augmentation and data Annotation.

Data Augmentation: It's a way of augmenting the available data. Main purpose of augmentation is to extend the scale of obtainable dataset.

Data Annotation: System is based of supervised learning thus annotation is vital module that labels the data.

Dataset: Dataset encompasses the data that is obtained from data preparation module. Further it is split into training and testing dataset. Deep Learning Model: this can be the deep learning model trained using input dataset. This model will be invoked by video engine and model can classify input as violent or non-violent.

Video Engine: This module is an associate interface between user and deep learning model. This will take input from user and it will pass that to deep learning model. It has feature of alerting government authorities if any suspicious activity is detected.

Database: This database contains timestamp and screenshot of suspicious activities identified by system.

PROPOSED SYSTEM:

The intention of our proposed system is to build an intelligent surveillance system which detects violence in given video frame. The intelligent surveillance system first learns features after which trains on those learned features. It detects violence in given video and if violence is detected in frames, it'll send alert to respective authorities and store detected frame in local database. The machine is created in such a manner that it facilitates the user with the aid of determining whether or not the crime happens or not in a short video sequence. This system can help Government Agencies to response faster. In our system, we are the use of TensorFlow GPU libraries to use GPU together with CPU to build the system that is able to exploiting parallelization for instant processing. Detecting the presence of violence using a high population, excessive dimensional dataset is challenging due to restrained dataset. CNN algorithm is used so that it will extract features in given video and then LSTM classification identifies the violence detection in given video frame and send alert if violence is detected.

IV. RESULTS AND DISCUSSION

System was tested on three standard datasets collected from various universities. Three datasets are namely Hockey Dataset, Movie Fight Scenes dataset, Real Life Violence Dataset. Hockey Dataset consist of violent and nonviolent scenes in hockey field. Similarly, movies dataset contains fight scenes collected from various movies. While, real life violence dataset has real time CCTV footages. Time required to process video is very less as compared to other models. This proposed algorithm gives best performance in spite of having hardware limitations. Time taken to process 5 seconds video clip is around 20 seconds, which is acceptable considering database manipulation operations and heavy deep learning model.

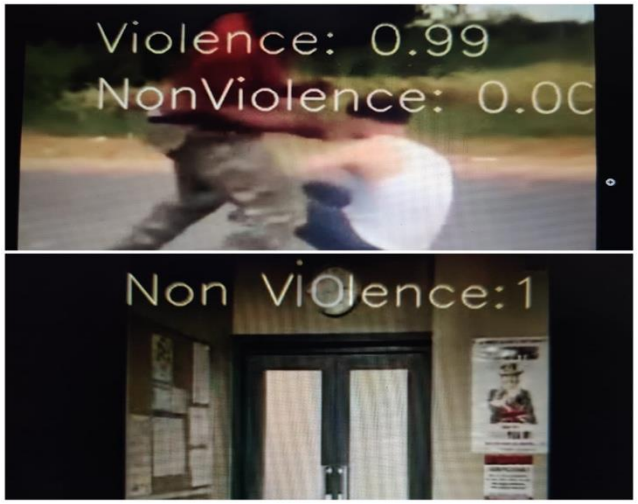

Fig.2. Result obtained from the detection system

In above image upper part is violent and below part is non-violent and system detects it successfully.

Below graph is of Accuracy vs Datasets.

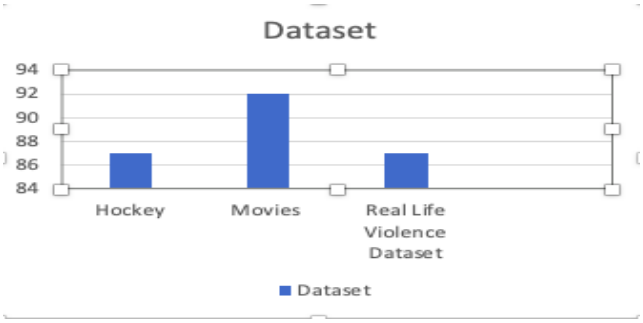

Fig.3. Dataset Vs Accuracy

V. CONCLUSION AND FUTURE SCOPE

This paper highlights that a convolutional neural network that leverages transfer learning with long short-term memory networks outperforms all the opposite variance of convolutional neural networks. By combining CNN with LSTM, the accuracy will increase to a definite margin as compared to pure transfer learning models.

The system provides a simple graphical user interface to interact with deep learning model. In addition to above points, performance of TensorFlow GPU is more than compared TensorFlow CPU. The system provides an easy graphical interface to interact with deep learning model. The proposed system only detects suspicious human behavior and presence of guns. Detection of fire and other weapons can be implemented in future. Cloud deployment can be done.

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