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The Virtual Soldier: Detecting, Recognizing, Tracing, Informing Criminals as well as Crimes in Real World

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Abstract - *Finding criminals or hunting for people, in a CCTV video footage, after a crime scene or major attack takes place, is a time-consuming task. Pattern Analytical System and Data Mining techniques are powerful tools that helps in removing covered up information from a huge dataset to upgrade exactness and productivity of estimating.*

Traditional prediction frameworks are hard to manage the enormous information and exactness of crime detection. As informed to us by cyber cell members, they make multiple members of the department sit with laptops and computers literally to search through the CCTV footage to find and trace the guilty, as they don't have the automated system for doing this task with them. This process is both time and labor intensive.

In this research paper we have tried to survey the existing technologies as well as we propose a new system for criminal Detection & Recognition using OpenCV and Machine Learning, which if used by our Crime Agencies would definitely help them to find criminals from CCTV footage. The proposed system can not only help find criminals but if used properly on different sites such as railway stations etc., can also help find missing children and people from the CCTV footage available from the respective site. Existing solutions use traditional face recognition algorithms which can be troublesome in changing Indian environments especially factors like light, weather and especially orientation and the second part of this project is detecting the vehicle thefts in real time using OCR and sending SMS to its owner for emergency.

Key Words: Machine Learning, Prediction, Data Mining, Analytics, Estimation, Pattern, OCR, SMS, Django.

1. INTRODUCTION

Circuit Television Cameras (CCTV's) are widely used to control occurrence of crimes in the surroundings. Although CCTVs are deployed at various public and private areas to monitor the surroundings there is no improvement in the control of crimes. This is because CCTV requires human supervision which can cause human prone errors like missing of some important crime events by human while monitoring numerous screens recorded by CCTVs at same time and Retrieval of images with object-of-interest from a vast pool of social media images has been a research interest in cybercrime research community for detecting criminal behaviors in social media. Due to inherent diversity and therefore the low duplicate property of images on social media, it brings forth many challenges in image retrieval, especially in identifying distinct features for a given object-of-interest. The quick and accurate identification of criminal activity is paramount to securing any residence. With the rapid climb of smart cities, the mixing of crime detection systems seeks to enhance this security. In the past a robust reliance has been placed on standard video surveillance so as to realize this goal. This often creates a backlog of video data that has got to be monitored by a supervising official. For large urban areas, this creates an increasingly large workload for supervising officials which leads to an increase in error rate Automatic recognition of violence between individuals or crowds in videos in real time is very difficult but at the same time, if it is implemented in a right direction can provide a high accurate result.

Our Problem revolves around 4 different types of crimes i.e.

1) Crimes happening by the known criminal in real time.

2) Crimes happening by unknown criminal in real time.

3) Crimes like mob lynching which normally happens in crowd

4) Crimes like stealing of vehicles.

2. LITERATURE SURVEY

The first paper in this survey is also a survey of existing technologies as well as a new system for criminal Detection & Recognition using Cloud Computing and Machine Learning, which if used by our Crime Agencies would definitely help them to find criminals from CCTV footage. The proposed system can not only help find criminals but if used properly on different sites such as railway stations etc, can also help find missing children and people from the CCTV footage available from the respective site. Existing solutions use traditional face recognition algorithms which may be troublesome in changing Indian environments especially factors like light, weather and particularly orientation. Some CCTV are during a bad place and may get tilted leading to a wild increase in inaccuracy. This research paper proposes to use Microsoft Azure Cognitive services and Cloud system for implementation of the proposed system. The next phase this research is trying to compare

this proposed methodology with traditional techniques like HAAR cascade to judge performance of the proposed System, as it is important to have a high accuracy, for a project of this sensitivity [1].

The second paper proposed a real-time violence detector based on deep-learning methods. The proposed model consists of CNN as a spatial feature extractor and LSTM as relation learning method with attention on the three-factor (overall generality - accuracy - fast response time). The suggested model achieved 98% accuracy with speed of 131 frames/sec [2].

In Third Paper we saw a machine learning based predicting policing algorithm exploiting the modus operandi features of a recent crime and the existing prior criminal records. The proposed model predicts and probabilistically shortlist the potential suspects who could also be involved during a recent crime. Thereby, meaningful leads are produced to aid the investigation process. In this paper, we take the Punjab province of Pakistan as a case study and apply the proposed model on the real data collected from various police stations. The results show that the identification of potential suspects proved vital for the cases which involves criminals who had previous criminal record [3].

Fourth we saw a deep learning model based on 3D convolutional neural networks, without using hand-crafted features or RNN architectures exclusively for encoding temporal information. The improved internal designs adopt compact but effective bottleneck units for learning motion patterns and leverage the Dense Net architecture to promote feature reusing and channel interaction, which is proved to be more capable of capturing spatiotemporal features and requires relatively fewer parameters. The performance of the proposed model is validated on three standard datasets in terms of recognition accuracy compared to other advanced approaches. Meanwhile, supplementary experiments are carried out to evaluate its effectiveness and efficiency [4].

It presents different techniques for detection of such activities from the video proposed in the recent years. This research study reviews various state-of-the-art techniques of violence detection. In this paper, the methods of detection are divided into three categories that's supported classification techniques used: violence detection using traditional machine learning, using Support Vector Machine (SVM) and using Deep Learning [5]

In this work, they employ statistical analysis methods and machine learning models for predicting differing types of crimes in ny City, supported 2018 crime datasets. They have combined weather, and its temporal attributes like cloud cover, lighting and time of day to identify relevance to crime data. They note that weather-related attributes play a negligible role in crime forecasting. They have evaluated the various performance metrics of crime prediction, with and without the consideration of weather datasets, on different types of crime committed. Their proposed methodology will enable law enforcement to make effective decisions on appropriate resource allocation, including backup officers related to crime type and location [6].

In this work, an end-to-end deep neural network model for the purpose of recognizing violence in videos is proposed. The proposed model uses a pre-trained VGG-16 on ImageNet as spatial feature extractor followed by Long STM (LSTM) as temporal feature extractor and sequence of fully connected layers for classification purpose. The achieved accuracy is near state-of-the-art. Also, they contribute by introducing a new benchmark called Real- Life Violence Situations which contains 2000 short videos divided into 1000 violence videos and 1000 non-violence videos. The new benchmark is used for fine-tuning the proposed models achieving a best accuracy of 88.2% [7].

This paper proposed deep representation-based model using concept of transfer learning for violent scenes detection to identify aggressive human behaviors. The result reports that proposed approach is outperforming state-of-the art accuracies by learning most discriminating features achieving 99.28% and 99.97% accuracies on Hockey and Movies datasets respectively, by learning finest features for the task of violent action recognition in videos [8].

In this paper we came up with Crime Intension Detection System that detects crime in real time videos, images and alerts the human supervisor to require the required actions. To alert the supervisors or nearby police headquarters about the occurrence of crime. We added SMS sending module to our system which sends SMS to concern person whenever crimes are detected. The proposed system is implemented using Pre-trained deep learning model VGGNet19 which detects gun and knife in the hand of person pointing to some other person. We also compared the working of two different pre-trained models like Google Net InceptionV3 in training. The results obtained with VGG19 are more accurate in terms of training accuracy. This motivated us to use VGG19 with little fine tuning to detect crime intention in videos and pictures to beat the problems with existing approaches with more accuracy. And we made use of Fast RCNN and RCNN these algorithms are documented as Faster RCNN this helps us to draw the bounding box over objects in images like person, gun, knife and some untrained images are marked with N/A. Algorithms help for detection and classifications of objects over images [9].

In next research papers, study is based on the analysis of faces, emotions, Ages and genders to identify the suspects. Face recognition, emotion, age and gender identifications are implemented using deep learning-based CNN approaches. Suit's identification is based on LeNet architecture. In the implementation phase for the classification purpose, Keras deep learning library is used, which is implemented on top of TensorFlow. IMDb is the dataset used for the whole training

purpose. Training is performed using in AWS cloud which is more powerful and capable way of training instead of using local machines. Real-time Video and pictures are taken for the experiment. Results of the training and predictions are discussed below in brief [10].

In this paper the aim is to classify each facial image together of the seven facial expressions considered during this study. According to the characteristics of countenance recognition, a replacement convolution neural network structure is meant which uses convolution kernel to extract implicit features and max pooling to scale back the dimensions of the extracted implicit features. In comparison to AlexNet network, we will improve the popularity accuracy about 4% higher on the CK+ countenance database by the help of Batch Normalization (BN) layer to our network. A facial expression recognition system is constructed in this paper for the convenience of application, and the experimental results show that the system could reach the real-time needs [11].

In this paper, heterogeneous data-based danger detection (HDDD) mechanism is proposed for reducing crime rates. The HDDD mechanism may be a mechanism for detecting dangerous situations (e.g., homicide and violence) supported heterogeneous data that are data gathered from multiple devices like television (CCTV) cameras, smartphones, and wearable devices. The HDDD enables immediate detection of dangerous situations and then reduces crime rates by responding to the dangerous situations [12].

In this paper, they present CNN (Convolutional Neural Network) in the use of detect knife, blood and gun from an image. Detecting these threatening objects from image can give us a prediction whether a criminal offense occurred or not and from where the image is taken. They emphasized on the accuracy of detection so that it hardly gives us wrong alert to ensure efficient use of the system. This model uses Rectified Linear Unit (ReLU), Convolutional Layer, fully connected layer and dropout function of CNN to reach a result for the detection. We use TensorFlow, an open-source platform to implement CNN to achieve our expected output. The proposed model achieves 90.2% accuracy for the tested dataset [13].

3. GOAL AND SCOPE DEFINITION

The aim of this paper is to provide a comprehensive system for detecting crime and recognizing criminals and sending the appropriate information to the police body.

As a future scope extension of crime detection and analysis will be to generate the crime hot-spots that will help in deployment of police at most likely places of crime for any given window of time, to allow most effective utilization of police resources. The developed model will reduce crimes and will help the crime detection field in many ways that is from arresting the criminals to reducing the crimes by carrying out various necessary measures.

The above proposed approach will be implemented in the next phase of this project which will help us superior verify the performance and high accuracy of this approach with very low latency. Accuracy is of paramount importance for a project of this sensitivity. Also important is the ability to run on any machine regardless of the how powerful the hardware is. These both lead us to choose the Azure face API. The proposed methodology when implemented successfully could definitely be of great help to our Criminal agencies in detecting and finding of criminals, also search for missing people.

Proposed Model

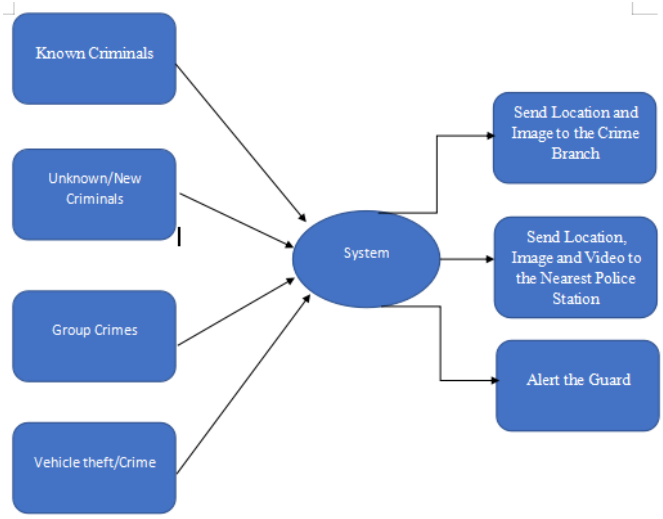

Fig. 1. Overview of System

We have divided our project in 4 modules and in the end, it will be a whole system in which all these features will be implanted and can be directly used by any of the CCTV Camera.

Module 1: Known Criminals like e.g., Dawood using HAAR Cascade and TensorFlow:

Since we have a lot of images of Dawood and lot of information to…we can train our data with its face, eyes etc. Once the dataset is ready with all the known criminal's data, we can pass it to our system which is a live CCTV Surveillance. So due to this if any particular moment camera recognizes a criminal and it gets matched with our dataset…It will give a message and alarm to the guard who will be at that moment monitoring the surveillance and also one message will go directly to the command center of police with the camera no. and location of the particular criminal.

Due to this…if police want to catch the criminal it can go directly catch or if police want to track the criminal or navigates its whole plan…then it can also put an eye on

it. and try to recognize its plan…or the reason of coming to that location.

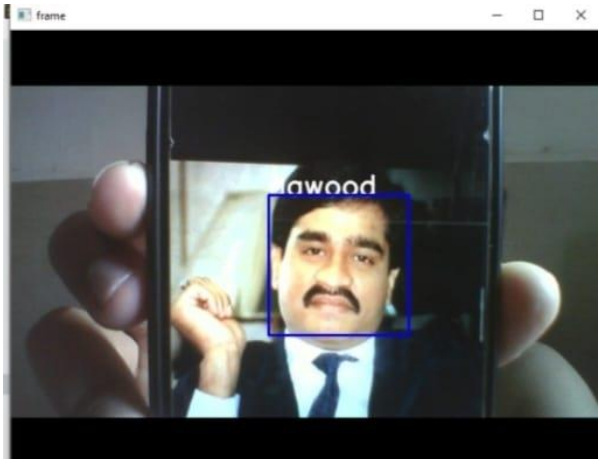

Fig 2: Image of criminal detected

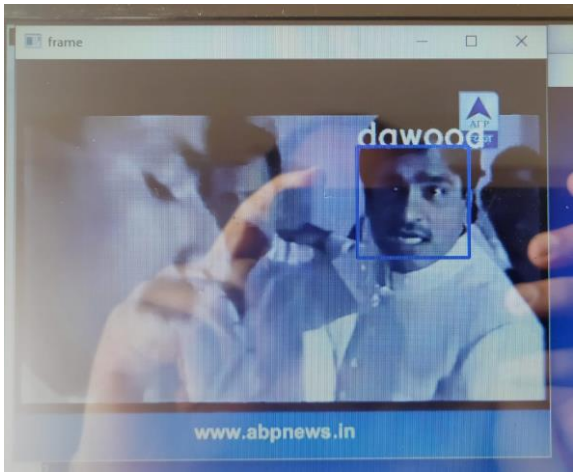

Fig 3: Video consisting frame of Criminal detected

Module 2: A new Criminal…which is not in our dataset:

If a crime is done by a normal person then without having any information about it. Police cannot catch him, in that with our system since it is capturing face of all the people passing through it…will try to scan that particular image to all the official websites, Facebook, Instagram etc.

Since nowadays everyone has a Facebook account or Instagram account…system can easily find out the name and place of the criminal.

Module 3: Live Crime detecting and passing it to the control room (Mob-Lynching):

Crimes like Mob-Lynching, fights between groups are often seen in India and all the people standing there they take videos of crime instead of calling the police. So, in this scenario our system with help of machine learning and artificial intelligence will try to recognize the crime scene as a normal scene or any anomaly or unwanted happening in the scene. If it detects something uneven the images, videos, and location of that crime will be directly sent to the nearest police station.

All this will be happening at a real time. In today's scenario…first the crime is happened and after then police investigates but with our system in between crime police can reach to the location at a fast rate.

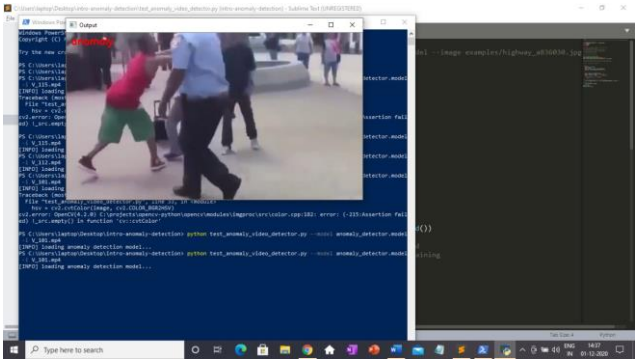

Fig 4: Live crime detection

Module 4: Vehicle Theft:

Suppose there is a situation wherein someone parks his/her Car or Bike in the parking lot of their society and in night, a thief robbed the bike and leaving the societies gate, so our system will work as an alarm system wherein in our database we will have all the entries of cars and bikes number plate in that society with their owner's name and phone number. so, our system using the cameras located on the gate will detect and recognize the number plate and will send a SMS by saying that your bike/car just leaved the gate.so by this instead of owner getting understand about the robbery of bike in morning he/she will get and instant message and can catch the criminal faster.

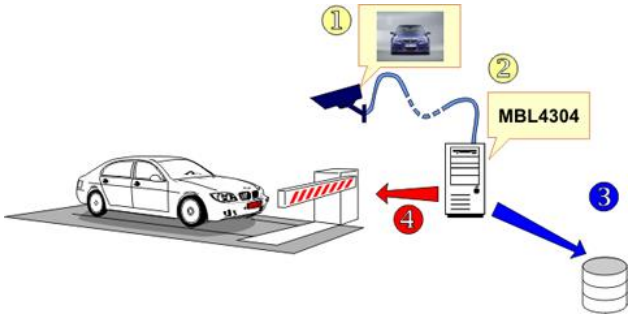

Fig 5: LPN detecting method

Fig 6: License Plate Number detection

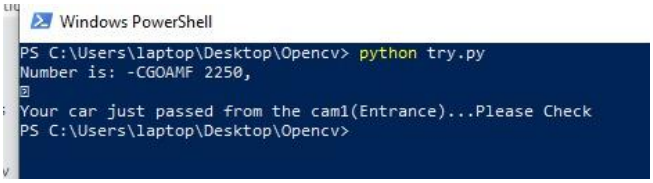

Fig 7: The correct number plate detected

4. CONCLUSIONS

In this research, we encountered several face recognition algorithms along the way. Some were really accurate while some were really slow. Our research found that Striking a balance between the Accuracy & Speed is really difficult. Some of the algorithms we came across through means of this research are HAAR, Eigen Faces, Cam shift, CNNs, Viola-Jones Algorithm, Gaussian, Eucledian distance, AdaBoost etc.

The most famous detection algorithm we came across through this research was HAAR. We also came across and learned about the Microsoft Azure, which bundle of the cloud computing services that are created by Microsoft which can be used for building, testing, as well as deploying, and managing the applications and services using a global network of the data centres managed by Microsoft , which has the various Face API services which is basically cloud based service which provides algorithms for analyzing the human faces found in images and videos. It is fast and accurate and thus our survey and the research helped us choose & use of Microsoft Azure to take care of our face recognition need.

The above proposed approach will be implemented in the next phase of this project which will help us superior verify the performance and high accuracy of this approach with very low latency. Accuracy is of paramount importance for a project of this sensitivity. Also important is the ability to run on any machine regardless of the how powerful the hardware is . These both lead us to choose the Azure face API. The proposed methodology when implemented successfully could definitely be of great help to our Criminal agencies in detecting and finding of criminals, also search for missing people.

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