AI Based Crime Detection System & Alert

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Abstract—Nowadays Closed Circuit Television (CCTV) Cameras are installed everywhere in public places to monitor illegal activities like armed robberies. Most CCTV footage is used as post evidence after the occurrence of crime. In many cases a person might be monitoring the scene from CCTV but the attention can easily drift on prolonged observations.Efficiency of CCTV surveillance can be improved by incorporation of image processing and object detection algorithms into the monitoring process.

The object detection algorithms, previously implemented in CCTV video analysis detect pedestrians,animals and vehicles. These algorithms can be extended further to detect persons holding weapons like firearms or sharp objects like knives in public or restricted places.

Crime scene prediction without human intervention can have an outstanding impact on computer vision. In this paper, we present CNN in the use of detect knives, swords and guns in order to predict whether a crime has occurred in a particular image. We emphasized on the accuracy of detection so that it hardly gives us wrong alerts to ensure efficient use of the system. This paper uses Non linearity ReLu, Convolutional Neural Layer, Fully connected layer and dropout function of CNN to reach a result for the detection. We use Tensor flow open source platform to implement CNN to achieve our expected output. This system can achieve the test accuracy of 90.2 % for the datasets we have that are very much competitive with other systems for this particular task.

Keywords—Deep learning, Tensorflow, Convolution Neural Network CNN, Training Data, OpenCV

INTRODUCTION

Crime scene prediction from a camera is very important while working on a field of computer vision. In the modern era of science and technology, people set up surveillance cameras in different areas to get rid of crime. Still, it cannot help people as quickly as people want to respond. Usually after occurring at a crime scene, law enforcement agencies come to the area and take the footage from the video that was recorded at the time of the crime scene. Then, law enforcement agencies analyze the video and take necessary evidence of the crime scene. We believe this is a very slow process to act on a crime scene. For this reason, we wanted to make a system that can quickly act on a crime scene. Moreover, there are a lot of cameras being installed in different areas by law enforcement agencies or by any organization. They have to monitor all the cameras at a time with human beings. If a computer system can detect the threatening objects and give an alert to the authority just after detection, the proper authority can quickly take action to stop the potential criminal before he commits any crime. For example, 1st July of 2016, an incident occurred in Dhaka in a restaurant. The Terrorists went to the restaurant with guns, hand grenades and knives etc. But initially law enforcement agencies did not understand how dangerous the terrorists were. If the camera installed over there can give information to law enforcement agencies by any media (IP camera or control from police station etc.) just after exposing the weapons, law enforcement agencies can respond to the scene very quickly and may save important lives. This incident helped us to think more deeply to make a system that can be learned to detect threatening objects. In our paper, we worked on detecting revolvers, machine guns, shotguns, and knives using convolutional neural networks.

Literature survey

In the existing crime management system, most of the

Sr. no	Paper title	Author name	Year of publications	Implementation	Methodology	Pros	Cons
1	Proposed System for Criminal Detection and Recognition on CCTV Data Using Cloud and Machine Learning	Samit Shirsat Aakash Naik Darshan Tamse	2019	This system will be implemented in Microsoft azure with some machine learning algorithms like HAAR and CNNs.	This research paper is using the Cloud and machine learning methods.	The face recognition has high accuracy.	It is relatively slow.
2	Crime Analysis Through Machine Learning	Param Joshi Parminder Singh Kalsi Pooya Taheri	2018	This paper investigates machine-learning-based crime prediction.	This paper uses two models of ML called KNN and Decision tree classification.	N/A	The prediction accuracy rate is low.
3	Violent Crime Detection System	Yaroslav Dorogyy Vadym Kolisnichenko Kseniia Levchenko	2018	This system is implemented in artificial intelligence	This system uses behavioural analysis and violence detection.	Proposed system is able to make violence detection simple, instant and ubiquitous.	N/A
4	Crime Prediction and Analysis Using Machine Learning	Alkesh Bharati Dr Sarvanaguru RA	2018	This system is implemented using Machine Learning and it divides it implementation in 4 parts Data collection Data Preprocessing Feature selection Building and Training Model	This system uses KNN classifier, logistic regression, Bayesian methods.	This system predicts which type of crime is about to happen.	The accuracy rate is low.
5	AUTOMATED CRIMINAL IDENTIFICATION BY FACE RECOGNITION USING OPEN COMPUTER VISION CLASSIFIERS	Apoorva. Impana.H. Siri.S. Varshitha.M.	2019	This system is implemented using open CV classifiers.this system uses real time face detection using surveillance cameras.	This system uses the face recognition algorithm like the HAAR cascade .	This system has the capacity for automatically doing the process like recognize, detect and extract the features of the images and identifies the actions.	N/A

operations are done manually like sending complaints, taking actions against crimes, view status etc. This system needs more manpower to track the records of crimes. The existing system doesn't have system security. The existing system is time consuming and not very user friendly. So with the existing system if anybody wants to complain against crimes he must do it through the police. Retrieving old crime records is very time consuming. In

fig.1.1literature survey

the current system all work is done on papers so it is very difficult to secure crime reports data. Error detection in the previous entries made and data cross verification is another important function. These are done manually, and it would take time. The existing system has more workload for the authorized person, but in the case of the proposed System, the user can register on our site and send the crime report and complaint about a particular city or person.

Objectives

● To detect crime scenes in minimum time.

● To cover most of the weapons, which could be used to do various crimes.

● To detect face and search the same in previous crime record

● Don't need Manpower for surveillance.

PROPOSED METHODOLOGY

Proposed system will have a camera to detect crime scenes. We are using python programming language to perform defined tasks along with Opencv, Machine learning, Image processing library/technology. We will complete this task in three step segmentation, Feature extraction, Classification. These three steps are explained with the example of knife detection.

Segmentation

The size of a knife in the hands of a person can be considered small relative to the size of the person. Hence, calculating global features (features computed for the whole CCTV image) may not be useful to detect the knife in an image as the global features carmost describe features of the knife separately from the rest of the image. Therefore, to calculate local features (features calculated after segmentation of Small images from whole image), images captured by camera should be divided into small segments. The process of segmentation of the complete image into small blocks is done with the help of a sliding window mechanism. Size of the image segment i.e sliding window is considered to be 100 x 100 pixels, as the size of the knife might not exceed 100 x 100 pixels in an image of 640 x 480 pixels captured by CCTV camera.

Feature Extraction

Various feature extraction algorithms were proposed in the field of computer vision. Different feature extraction algorithms compute unique features of an object of interest in an image. Features like colour, shape and texture can not always be considered in weapon detection. For example, the reflective property of knife blades makes knife detection based on colour features not feasible. First we considered Harris key point detection as our feature descriptor but as the knife contains very few corners, it was found to be less

effective. After literature study, it was assumed that a knife can be detected by finding a feature descriptor that is capable of estimating the approximate shape of a knife. HOG feature descriptor was chosen for our application as HOG features can describe the edges of knife blades.

Classification

Classification of an image segment as weapon or non weapon can be done with the help of artificial neural networks trained through supervised or unsupervised learning algorithms. In this project, a back-propagation algorithm which is a supervised learning algorithm is chosen in a feed-forward neural network for its simplicity. A neural network with two hidden layers is used. Neural networks are trained with different numbers of neurons in hidden layers and different sizes of training sets. These designed neural networks are evaluated using ROC (Receiver Operator Characteristics) graph. Neural network with 50 neurons in the first hidden layer and 30 neurons in the second hidden layer was found to detect knives with greater accuracy. For detection of a single type of weapon such as a knife, one output neuron is required. For detection of two types of weapons such as a knife and pistol, the output layer requires three output neurons.

In the background subtraction method humans are detected by subtracting the image from the reference background image and a knife is detected surrounding the detected human region. In the second method segmentation of humans was done using a sliding window of 400 x 200 pixels. As CCTV cameras can be mounted on the ceiling we assume that humans fit in the 400×200 pixels segment. After detection of humans in an image knife is detected in and surrounding the human segment.
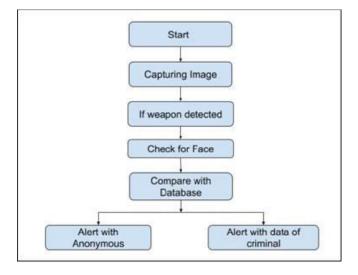

Fig.1.2 Flowchart of system

Expected Outcome

Expected outcome from the proposed system is to detect crime scenes in minimum time.

Proposed system will detect various weapons from all views (like Side view, Front view, Top view). It will be a fast and robust system.
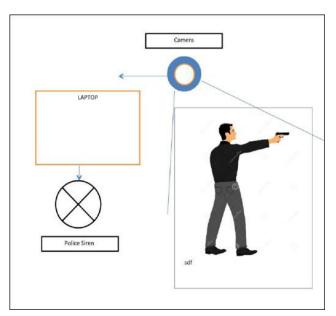

fig 1.3. Expected Output

Conclusion

The project titled AI based crime detection system and alert is developed to design a system that supports finding criminals in less time. The proposed system is to detect crime scenes in minimum time. Proposed system will detect various weapons from all views (like Side view, Front view, Top view). It will be a fast and robust system.

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