International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Special Issue Apr 2021 www.irjet.net p-ISSN: 2395-0072

FEATURE EXTRACTION BASED FORENSIC SCIENCE TO ANALYSE CRIME SCENE

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Abstract— Deep convolutional Neural Networks (CNNs) are a distinguished type of Neural Networks that is known for its state-of-the-art performance on different standards. The application of many feature extraction stages (hidden layers) that can spontaneously learn representations from the data is the major reason behind the effective learning capability of deep CNN. Crime Investigation especially in homicide cases requires concentrated and stage wise collection of data. In this project, we consider a procedure for relating earlier obtained data of the homicide cases with the present one. It is based upon CNN and is used by homicide detectives and other specific charge people for giving enhanced reports. Our Aim is thus to provide an automated crime analysis system (CAS) that is based upon CNN. The system also possesses a visualization feature that provides the user a picturing of crime details. This feature applies an incremental approach to represent the suspects and their concerns. So, a detailed visual description is attained.

Keywords—convolutional neural networks, crime investigation, homicide detectives, automated crime analysis system.

I. INTRODUCTION

Crime scene prediction from a camera is extremely important while performing 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 reply. 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, enforcement agencies analyse the video and take necessary evidence of a criminal offense scene. We believe this is a very slow process to act on a crime scene. For this reason, we wanted to form a system which will quickly act on a criminal offense scene. Moreover, there area 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 a human being. If a computing system can detect the threatening objects and provides awareness of the authority just after detection, the right authority can quickly take action to prevent the potential criminal before he commits any crime. For example, 1st July of 2016, an event occurred in Dhaka during a restaurant. Terrorist went to the restaurant with guns, hand grenades and a knife etc. But initially, law enforcement agencies did not understand how dangerous the terrorists are. 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 answer the scene very quickly and should save important lives. This incident helped us to think more deeply to form a system which will be learned to detect threatening objects. In our project, we worked on detecting different types of foot print and bike tire marks etc... using a convolutional neural network.

II. RELATED WORKS

Crime scene investigation (CSI) image is a crucial part of the knowledge collected at crime scenes. Classification and retrieval of CSI images provide important clues and play a crucial role in solving serial crimes. So, there is an immediate necessity for an automatic and operative image classification and recovery system to instantly find related images from a large number of CSI images to enhance the

competence of the investigation while saving manpower and material resources [1].

Presently, there are some studies on CSI image retrieval. Present CSI image retrieval technologies can be classified into two classes: CSI image retrieval based on low-level features and that based on high-level semantics. CSI image retrieval technology based upon low-level features applies a content-based image retrieval (CBIR) framework in order to extract low-level features of the image (such as color histogram, gray level co-occurrence matrix, Gabor features, wavelet texture features, etc.) or to CBIR technology in CSI image retrieval [2].

In this, the author proposes to combine low level features of image dominant colour descriptors as color features, gray-level co-occurrence matrix as texture features and the edge feature obtained by gradient vector flow to improve CSI image retrieval performance. The disadvantage is that the computations is complex and slow [3].

Evidence associated with a police case is often divided into text evidence, photo/videos and digital evidence like documents within the laptop or chats and messages within the smartphone. All of those got to be processed into a standard storable format in order that they will be used further for searching or matching crimes. The textual evidence consists of complaints written by the victim, the FIR (First Information Report), the narrative reports of the cops conducting the case. The witnesses' statement of the crime, the evidence from the crime scene like receipts, diary, letters, notebooks, post its then on. These documents also are data and that they may play a crucial part within the identification of the offender. These documents, however, aren't digital and need to be converted before they will be used for searching and other purposes. They're converted into digital format using Optical Character Recognition [4].

The Annals of Statistics prediction is foretelling the probable crime rate for the near future and the places which can become hotspots for a crime type. Crime rate predictions are often finished as a kind of crime or an area or both. Hotspot prediction is completed across a state or country and every hotspot is often displayed. This study can be completed by crime type. For both the analysis the historical data is vital. We apply time-based data such as year and month to estimate the crime rate using regression. Prediction may be a mathematical model that tells us the longer-term data by using past data. Mostly regression techniques are used for prediction. Regression is the technique of demonstrating the correlation between data to study the way they contribute to the outcome together. Linear regression is applied when the correlation between the variables is linear. If the connection is non-linear then we will use polynomial regression. Logistic regression also called the binomial regression can be used when the prediction has only two states [5].

III. EXISTING SYSTEM

In this existing work, we refer to the matter of studying the information collected during a crime scene through the utilization of object detection. In this existing work, it addresses the problem of analysing the data gathered in a crime scene through the use of object detection. By detecting the objects present in the evidence found in a crime scene, it is not possible to extract some intelligence or relations.

IV. PROPOSED SYSTEM

A ConvNet/CNN is a Deep Learning procedure that gets an input image, allocates significance (learnable weights and biases) to several aspects/objects in the image and is able to distinguish one from the other.

- The proposed system also provides a crime visualization feature that gives the user a pictorial representation of crime details.
- CNN includes in figuring out the hidden feature of input images.
- The aim of using deep convolutional neural network techniques for the intelligent and timely analysis of crime.
- It encompasses a systematic approach for using deep convolutional neural networks to analyze crime data.
- By proposing this new framework, we aim to be able to leverage the deep neural network for prediction of crime rates and for proactive policing and prevention measures.

ADVANTAGES

The pre-processing required in a ConvNet is much lower as compared to other classification algorithms.

- Decreasing number of connections.
- Shared weights on the edges.
- Max pooling further reduces the complexity.
- Generating more discriminative features distinct from each other and this improves the retrieval accuracy.
- Image can be compared with DBMS (Database Management System) live using a Webcam.

V. ALGORITHMS

1*) Hierarchical Clustering Algorithm*

In this algorithm it implements a hierarchical based clustering solution. There are two major methods which are Agglomerative and Divisive. The Agglomerative is a 'top-down' method while the Divisive is a 'bottom-up' method.

2) Squared Error Based Algorithm

Statistical function which applies average of squares of deviations or errors. The K-Means Algorithm is a subset of this.

3) Convolutional Neural Network

When programming a CNN, the input is a tensor with shape (no. of images) x (width of image) x (height of image) x (depth of image). Then after entering into a convolution layer, the image becomes abstracted to a feature map, with shape (no. of images) x (width of feature map) x (height of feature map) x (feature map the following attributes:

- Convolution kernels defined by a width and height (hyper-parameters)
- The no. of input and output channels (hyper-parameter)
- The depth of the Convolution filter (the input channels) should be equal to the number channels (depth) of the input feature map

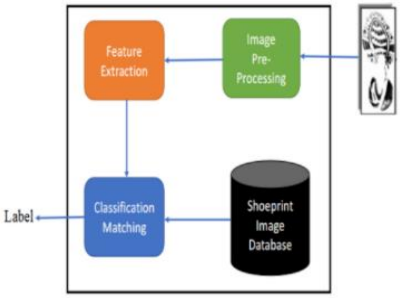

Fig 5.1: Algorithm

1. Removing the different distortions and enhancing the quality of images by pre-processing,
2. Producing distinguishing features of a shoe-print using feature extraction methods.
3. And finally comparing the query sample with the whole database containing the shoe-print models and assigning its class label using the extracted features.

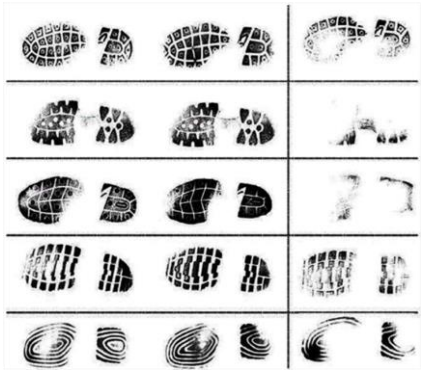

Fig 5.2: Different types of shoes print images

ARCHITECTURE DESIGN FLOW DIAGRAM

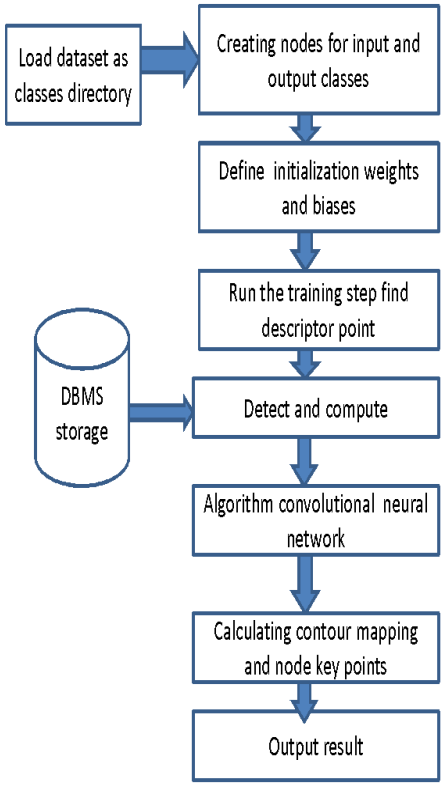

Fig 5.3 Block Diagram

VI. RESULTS

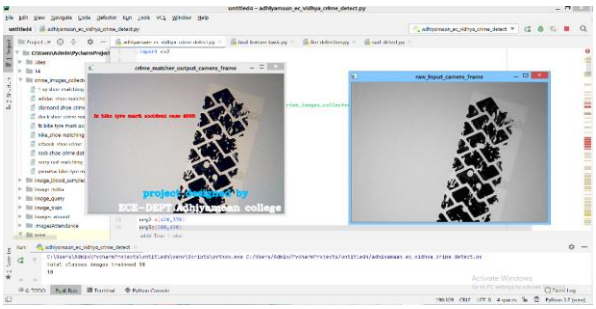

Fig 6.1: Fz bike tire mark accident case id 4566

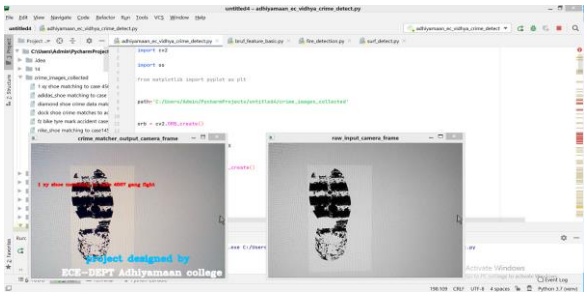

Fig 6.2: 1xy shoe matching to case 4567 gang fight

Fig 6.3: Adidas shoe matching to case 144 chain snatch

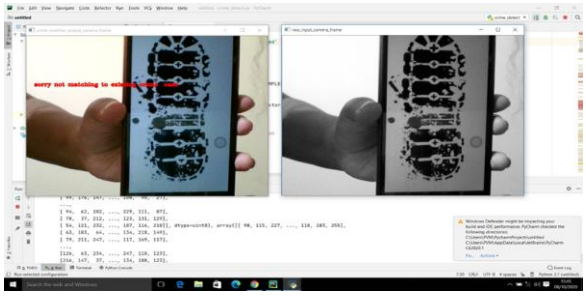

Fig 6.4: Unmatched Case

VII. CONCLUSION

We can successfully detect crime with case numbers on which we can predict the crime scene occurred or not. The wrong data is reduced that makes our model very efficient for this task compared to other models. To implement a convolution neural network. The results are given in percentage for each of the objects we want to detect. Forecasting a crime scene by identifying threatening objects can have a far-reaching impact on the computer vision field. For our datasets, the test accuracy is 99.2 % that is very competitive with the systems we have seen so far.

VIII. ACKNOWLEDGMENT

I would like to express my special thanks of gratitude to my Professor Mr.R.Somasundaram (AP/ECE), who gave me the golden opportunity to do this wonderful project of accountancy who also helped me in completing my project. I came to know about so many new things. I am really thankful to him. Secondly, I would also like to thank my friends who helped me a lot in finalizing this project within the limited time frame.

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