AUTOMATED CRIMINAL RECOGNITION SYSTEM

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Abstract- *Taking into account the strange expansion in crime percentage and number of criminals, there is a need for a more powerful Criminal identification Method. Biometric techniques like thumb print identification are faded out today as criminals of these days obtaining cleverer to not leave their fingerprints on the scene. Human Face is the most important attribute to recognize any individual. It is a powerful item having a serious level of changeability in its appearance which makes it a superior distinguishing proof strategy among the other bio-metric methods. The individualistic characters of the human face can be extracted by face recognition. Face recognition is a simple and agile bio-metric technology. Face detection and recognition is the technology which is used to identify a person from a video or image. Our project aims to evaluate various faces using Convolution Neural Network (CNN) to provide a complete solution for Image based Face Detection with an accuracy of 65 to 75 percent for Criminal Identification. Convolutional Neural Networks are designed to figure with grid structured inputs, which have strong spatial dependencies in local regions of the grid. This project presents real time face recognition using an automated surveillance camera. In this system, we can detect and recognize the faces of the criminals in a video stream obtained from a camera in real-time. Criminal records generally consist of personal details and the photograph of the criminal. So, we can use these photographs along with his details. The video captured from the surveillance camera is converted into frames. When a face is detected in a frame, it is pre-processed and then it goes through feature extraction. The features of the processed real-time image are compared with the features of images which are stored in the criminal database. If a match is found, an alert message along with the location of the criminal would be sent to the authority.*

Keywords: Face recognition, CNN, Criminal identification, Notification system

I. INTRODUCTION

Crime department finds it difficult to analyze all public camera video data. Finding the past history and movements of the criminal becomes important but the manual process is time consuming. By using AI we aim to finish this task faster than any manual process can. Face is a window to human personality, emotions and thoughts. The face is significant for human identity and due to its distinguishable nature, every face is unique face recognition for criminal identification, one of a kind biometric technique that possesses the merit of high accuracy and low intrusiveness. It is a technique that uses a person's face to automatically detect and verify from video frames or images. Here we develop a system which can recognise human faces in a video, specifically CCTV data, that can be used to find criminals or missing people.

Face Identification has applications in various other fields too. Today, payment companies like MasterCard, Alipay have developed a system within which users will pay by taking selfies. Almost all smartphones, there's a Face lock. Face Detection is currently used at Picasa, PhotoBucket, and Facebook.

The face identification system presented in this paper is a unique combination of the best techniques available today for face detection, feature extraction and finally classification. Convolutional Neural Networks are designed to figure with grid-structured inputs, which have strong spatial dependencies in local regions of the grid. The foremost obvious example of grid-structured data may be a 2-dimensional image. The basic difference between fully connected and convolutional neural networks is the pattern of connection between consecutive layers. In a fully connected case, each unit is connected to any or all of the units within the previous layer. in an exceedingly convolutional layer of a neural network, on the opposite hand, each unit is connected to a (typically small) number of nearby units within the previous layer. Furthermore, all units are connected to the previous layer within the same way, with the precise same weights and structure. The overwhelming majority of applications of CNN specialize in Image data. Object Detection, Optical Character Recognition, Image Classification, Face Recognition, etc. are some real time samples of CNN. Our project aims to use Face Recognition Technique for Criminal Face Identification. Deep learning methods like MTCNN are used for automatic face recognition, where the system extracts meaningful facial features such as the length of the nose or jawline, the distance between the

eyes, the color of the eye etc. These features are useful for classification and performing matches with the database. Criminal records generally consist of personal details and the photograph of the criminal. So, we can use these photographs along with his details. The video captured from the surveillance camera is converted into frames. When a face is detected in a frame, it is pre-processed and then it goes through feature extraction. The features of the processed real-time image are compared with the features of images which are stored in the criminal database. If a match is found, an alert message along with the location of the criminal would be sent to the authority.

II. LITERATURE SURVEY

1) Web Front-End Real Time Face Recognition Based on TFJS

For more than half a century, face recognition has drawn a lot of interests among researchers and companies. And much effort currently has been devoted to creating better algorithms and shipping them on server, desktop or mobile devices. However, studies on web-based face recognition remain fresh and new. Also, with the boom of web-based one-click apps, face recognition running on browser-side is much needed, in order to reduce latency and server load.The applications of face recognition are various, including payment, security, advertising, entertainment, etc. Payment companies like Alipay, WeChat Pay and MasterCard have developed algorithms for users to pay by taking a selfie. While Apple, Huawei, XiaoMi and other mobile phone manufacturers are focusing on unlocking devices using face recognition. Also, Face++ and police are jointly using face recognition to identify criminals in public events. Douyin and kuaishou short video apps provide many face entertainment applications, such as face swap, make-up mode, and disfigure. In movie and TV shows, face recognition is used in video search such as only seeing him/her in iQiyi and Tencent video, and in film and television production industry, face recognition is used for face swapping or hunting for substitutes of a given actor/actress. Those applications show the mass usage of face recognition.Face recognition is a biometrical technology to identify a person by his/her facial information from a digital image or a video frame from a video source. Generally, face recognition includes several tasks like face detection, alignment, identification and verification. Face detection is an object detection task, which is to locate faces on a given image and give a bounding box for each face detected. Face alignment is to automatically locate landmarks on a face image, such as eye corners, mouth corners, etc. Face identification is to find if the given face is shown in the probe set. Face verification is to check if the two faces given are from the same person

2) Criminal Face Recognition System

Criminal record contains personal information about a particular person along with photographs. To identify any criminal we need identification regarding that person, which is given by the eyewitness. Identification can be done by fingerprint, eyes, DNA etc. One of the applications is face identification. The face is our primary focus of attention in social intercourse playing a major role in conveying identity and emotion. Although it is difficult to infer intelligence or character from facial appearance, the human ability to remember and recognize faces is remarkable.

A face recognition system uses a database of images and compares another image against those to find a match, if one exists. For each facial image, identification can be done using the RGB values for the eye color, the width and height of the face and also using various ratios which was done by Kovashka and Martonosi

This system is aimed to identify the criminals in any investigation department. In this system, we are storing the images of criminals in our database along with his details and then these images are segmented into four slices- forehead, eyes, nose and lips. These images are again stored in another database record so as to make the identification process easier. Eyewitnesses will select the slices that appear on the screen and by using it we retrieve the image of the face from the database. Thus this system provides a very friendly environment for both the operator and the eyewitness to easily identify the criminal, if the criminal's record exists in the database. This project is intended to identify a person using the images previously taken. The developed system is also a first milestone for video based face detection and recognition for surveillance.

3) Face Detection and Recognition System using Digital Image Processing

While recognizing any individual, the most important attribute is face. It serves as an individual identity of everyone and therefore face recognition helps in authenticating any person’s identity using his personal characteristics. The whole procedure for authenticating any face data is subdivided into two phases, in the first phase, the face detection is done quickly except for those cases in which the object is placed quite far, followed by this the second phase is initiated in which the face is recognized as an individual. Then the whole process is repeated thereby helping in developing a face recognition model which is considered to be one of the most

extremely deliberated biometric technologies. Basically, there are two types of techniques that are currently being followed in face recognition pattern, that is, the Eigenface method and the Fisherface method. The Eigenface method basically makes use of the PCA (Principal Component Analysis) to minimize the face dimensional space of the facial features. The area of concern of this paper is using digital image processing to develop a face recognition system. After the face is detected the main task of the face recognition system starts as to identify the known or unknown face and act accordingly. Often people are mistaken by the term face detection whereas face recognition means on the other hand is to authenticate a given face data based on the stored face data in the database. Once the face data matches with the database then the system is authenticated. There are different approaches that are being followed in the whole process of face recognition. Each process has its own pros and cons, and has also some limitations which makes it different from other approaches

Since the no. of Eigenfaces to be used is restricted in PCA transformation that's why the system did not have an accuracy of more than 90 percent for both manual and automatic face recognition. A further work that needs to be done is in the field of a fully automated frontal view face detection system which when displayed virtually shows a perfect accuracy. The real-world performance of this designed system will be far more precise. In view of attaining a high accuracy rate the designed and developed system was not adequately strong. One of the main reasons behind this flaw is that the sub-system of the face recognition system does not exhibit minute changes in degree of steadiness to scale or rotation of the segmented face image. The performance of this system can be compared with the manual face detection only if we integrate the eye detection system with the developed system.

4) You Only Look Once: Unified, Real-Time Object Detection

YOLO, a new approach to object detection. Prior work on object detection repurposes classifiers to perform detection. Instead, we frame object detection as a regression problem to spatially separated bounding boxes and associated class probabilities. A single neural network predicts bounding boxes and class probabilities directly from full images in one evaluation. Since the whole detection pipeline is a single network, it can be optimized end-to-end directly on detection performance. Our unified architecture is extremely fast. Our base YOLO model processes images in real-time at 45 frames per second. A smaller version of the network, Fast YOLO, processes an astounding 155 frames per second while still achieving double the mAP of other real-time detectors. Compared to state-of-the-art detection systems, YOLO makes more localization errors but is less likely to predict false positives in the background. Finally, YOLO learns very general representations of objects. It outperforms other detection methods, including DPM and R-CNN, when generalizing from natural images to other domains like artwork.Humans glance at an image and instantly know what objects are in the image, where they are, and how they interact. The human visual system is fast and accurate, allowing us to perform complex tasks like driving with little conscious thought. Fast, accurate algorithms for object detection would allow computers to drive cars without specialized sensors, enable assistive devices to convey real-time scene information to human users, and unlock the potential for general purpose, responsive robotic systems.

Current detection systems repurpose classifiers to perform detection. To detect an object, these systems take a classifier for that object and evaluate it at various locations and scales in a test image. Systems like deformable parts models (DPM) use a sliding window approach where the classifier is run at evenly spaced locations over the entire image

III. FACE RECOGNITION OVERVIEW

At first, we trained a fully-convolutional CNN composed of seven convolutional layers with images of size 32 ×32,which is shown in Figure 2 and Table 2. Secondly, we trained a network consisting of four convolutional layers interspersed by three dropout layers for the task of facial parts detection. The network was trained with images of size 16 ×16. The output of the network consists of four detection scores, each one corresponding to the four classes of the facial parts (e.g, mouth,nose, eyes, irrelevant). The architecture of this CNN is also summarized in Figure 2 and Table 1. The first three layers of the facial parts CNN were connected in a parallel manner to the first three layers of the second CNN as shown in Figure 3.The output of the layers of the facial parts CNN, 11×11×24 is concatenated with the output of the layers of the face detection CNN, 11 ×11 ×32. The concatenation produces a volume of 11 ×11 ×56 which is entered as input to the layers conv4- conv7 as shown in Figure 3. The combined model is trained with RGB images of size 32×32. The 16 ×16 images of facial parts occupy 1/4 of the 32 ×32 training face images. We believe that the information provided by the detection of local face parts is crucial for detecting face regions and should be part of the initial stages of the detection process.

Our work follows the pipeline presented in [1], in a sense that our method does not require any extra module (e.g SVM) for classification as the CNN's output is describing enough for the task of face detection. As the model is fully-convolutional it accepts images of arbitrary size and produces a heat map of the face classifier. We trained the model presented in Figure 3 with images of size 32 ×32. In addition, no pooling layer was used since there was no need or room to further decrease the

size of data volume flowing through the network. As stated in [21], the use of the Parametric Rectified Linear Unit (PReLU) function had a positive impact regarding the detection accuracy of the CNN.

layer	kernel	# filters	input	output
convolution 1	3 x 3	24	32 x 32 x 3	30 x 30 x 24
convolution 2	4 x 4	24	30 x 30 x 24	14 x 14 x 24
convolution 3	4 x 4	32	14 x 14 x 24	11 x 11 x 32
convolution 4	4 x 4	48	11 x 11 x 32	8 x 8 x 48
convolution 5	4 x 4	32	8 x 8 x 48	5 x 5 x 32
convolution 6	3 x 3	16	5 x 5 x 32	3 x 3 x 16
convolution 7	3 x 3	2	3 x 3 x 16	1 x 1 x 2

TABLE 1 : Face detection CNN

layer	kernel	# filters	input	output
convolution 1	3 x 3	16	16 x 16 x 3	14 x 14 x 16
convolution 2	4 x 4	24	14 x 14 x 16	6 x 6 x 24
convolution 3	4 x 4	32	6 x 6 x 24	3 x 3 x 32
convolution 4	3 x 3	4	3 x 3 x 32	1 x 1 x 4

TABLE 2 : Part-based CNN

A. Proposed System

In this system, we can detect and recognize the faces of the criminals in a video stream obtained from a camera in real-time.

- Criminal records generally consist of personal details and the photograph of the criminal. So, we can use these photographs along with his details.
- The video captured from the surveillance camera are converted into frames. i
- When a face is detected in a frame, it is pre-processed and then it goes through feature extraction. The features of the processed real-time image are compared
- If a match is found, an alert message along with the location of the criminal would be sent to the authority

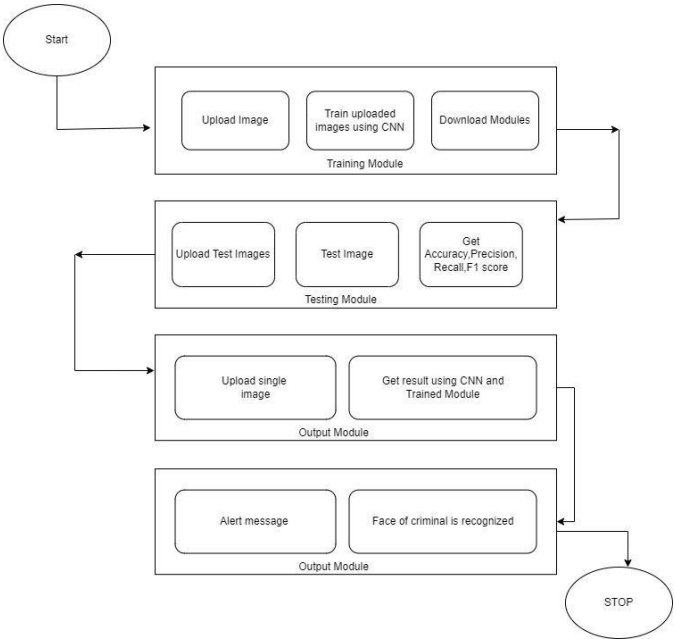

fig:workflow

Firstly, workflows require an image dataset to upload as an input. For that, we have made a dataset of images of criminals. And it will be loaded via HTML img tag. Once the dataset is ready,we start training the model using CNN. CNN uses a backpropagation algorithm . for each layer, there is a separate backpropagation algorithm. Internally, input data is organized into 2- dimensional grid structure and values of the individual grid referred to as pixels. Also, in order to encode the precise color of pixels, CNN uses RCB color scheme. After converting all images into 64*64 and applying RCB color channel, overall number of pixels of each image is 64*64*3.

Here CNN Face Detector is implemented using OpenCV. It initializes the Neural Network, normalized data and train model for Criminal Identification. Once a model is trained, it loads a pre-trained model, weights the metadata and tests on the testing dataset

IV. RESULT

The implementation was done in the python language in a jupyter notebook. In the face detection phase pixels for the face and bounding boxes were perfectly created. The trained images of people are recognized in real time and the notification or alert message was properly sent to the respective authority.

We have proposed a promising Criminal Recognition system for Face Videos. CCTV Cameras are used for continuous capturing of the video and images;When the images of criminals matches with CCTVcaptured image then on the

main screen the name of the criminal with the criminal found message will be displayed as shown below

V. CONCLUSION

This system uses the implementation of a face recognition system using features of a face including colors, features and distances.The main function of our system is to detect and extract faces from video cameras, CCTV footage and live video streaming. and recognize whether the person is Criminal or not. It can work with a variety of pictures and is sensibly strong to changes in face appearance or orientation, light conditions, and different variables. The advantage of this model is that it can recognize the side face and blurred image that other conventional models can't recognize.If a criminal is found, an alert message along with the location of the criminal would be sent to the authority

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