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CRIMINAL DETECTION USING FACE RECOGNITION

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Abstract : We all know that human Face is a unique and crucial part of the human body structure that identifies a person. Face detection which is the task of localizing faces in an input image is a fundamental part of any face processing system. The aim of this paper is to present a review on methods and algorithms used for face detection. The algorithm Haar cascade was described. We represent a methodology for face detection robustly in real time environment. Here we use Haar cascade like classifier to track faces on OpenCV platform which is open source and developed by Intel. The main concept of this paper is to experiment with using deep learning neural networks to detect and quickly respond to crimes in progress with effective Criminal Recognition to reduce the crime rate. Manually doing and tracking is very difficult job for the police. We can use the proposed system to trace the identity of a criminal person. With the advancement in technology, we can place CCTV at many public places to capture the criminal's image. This system will be able to detect face and recognize face automatically as well. Using the previously captured faces and criminal's images that are available in the police station, the criminal face recognition system can be implemented. We have used deep learning libraries and some image processing tools to achieve this task.

Keywords: Face recognition; OpenCV; Haar Cascade; CCTV; Deep learning

I INTRODUCTION

Face detection is generally the first step towards many face-related applications like face recognition or face verification. But, face detection has very useful applications. One of the most successful applications of face detection is probably "Haar Cascade**".** Face Detection, a widely popular subject with a huge range of applications. Modern day Smartphones and Laptops come with in-built face detection software, which can authenticate the identity of the user. There are numerous apps that can capture, detect and process a face in real time, can identify the age and the gender of the user, and also can apply some really cool filters. The list is not limited to these mobile apps, as Face Detection also has a wide range of applications in Surveillance, Security and Biometrics as well. But the origin of its Success stories dates back to 2001, when Viola and Jones proposed the first ever Object Detection Framework for Real Time Face Detection in Video Footage.

II RELATED WORK

Face recognition is an important part of the capability of human perception system and is a routine task for humans, while building a similar computer system is still an on-going research area. The earliest work on face recognition can be traced back at least to the 1950s in psychology [Bruner and Tagiuri 1954] and to the 1960s in the engineering literature [Bledsoe 1964]. Some of the earliest studies include work on facial expression of emotions by Darwin [1972] (also Ekman [1998]) and on facial profile based biometrics by Galton [1888]). But re-search on automatic machine recognition of faces really started in the 1970s [Kelly 1970] and after the seminal work of Kanade [1973]. Over the past 30 years extensive research has been conducted by psychophysicists, neuroscientists, and engineers on various aspects of face recognition by humans and ma-chines. Psychophysicists and neuroscientists have been concerned with issues such as whether face perception is dedicated process (this issue is still being debated in the psychology community [Biederman and Kalocsai 1998; Ellis 1986;Gauthieretal. 1999; Gauthier and Logo-thetis 2000]) and whether it is done holistically or by local feature analysis.

Face detection techniques could only handle single or a few well-separated frontal faces in images with simple backgrounds, while state of the art algorithms can detect faces and their poses in cluttered backgrounds [Guetal. 2001; Heisele et al.2001; Schneiderman and Kanade 2000; Viola and Jones 2001]. Extensive research on the subtasks has been carried out and relevant surveys have appeared on, for example, the sub task of face detection [Hjelmasand Low 2001; Yang et al. 2002].

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During the past 5 to 8 years, much research has been concentrated on video based face recognition. The still image problem has several inherent advantages and disadvantages.

III MATERIALS AND METHODS

We can recognize faces using deep learning. Here we use face embeddings in which every face is converted into a vector. The technique of converting the face into a vector is called deep metric learning. Let me divide this process into three simple steps for better and easy understanding:

3.1. Face Detection : The first task that we perform is detecting faces in the image (photograph) or video stream. Now we know that the exact coordinates/location of the face, so we extract this face for further processing.

3.2. Feature Extraction : Now see we have cropped out the face from the image, so we extract specific features from it. Here we are going to see how to use face embeddings to extract these features of the face. As we know a neural network takes an image of the face of the person as input and outputs a vector that represents the most important features of a face! In machine learning, this vector is nothing but called embedding and hence we call this vector face embedding**.** Now how this will help in recognizing the faces of different people?

When we train the neural network, the network learns to output similar vectors for faces that look similar. Let us consider an example, if you have multiple images of faces within different timelapse, it's obvious that some features may change but not too much. So in this problem, the vectors associated with the faces are similar or we can say they are very close in the vector space.

Up to this point, we came to know how this network works, let us see how to use this network on our own data. Here we pass all the images in our data to this pre-trained network to get the respective embeddings and save these embeddings in a file for the next step.

3.3. Comparing Faces : We have face embeddings for each face in our data saved in a file, the next step is to *recognize* a new image that is *not in our data*. Hence the first step is to compute the face embedding for the image using the same network we used earlier and then compare this embedding with the rest of the embeddings that we have. We recognize the face if the generated embedding is closer or similar to any other embedding.

Various packages are available to perform machine learning, deep learning, and computer vision problems. OpenCV is an open-source library. It is supported by different programming languages such as R, Python, etc. It runs probably on most platforms such as Windows, Linux, and macOS.

Convolution Neural Networks (CNNs) are a category of Neural Networks that have proven very effective in areas such as image recognition and classification. CNNs are a type of feed-forward neural networks made up of many layers. CNNs consist of filters or kernels or neurons that have learnable weights or parameters and biases. Each filter takes some inputs, perform convolution and optionally follows it with a non-linearity. A typical CNN architecture can be seen as shown in .The structure of CNN contains Convolutional ,max pooling, flattening, and Fully Connected layers The methodology depicted in the following is used for criminal detection

3.4 Steps in Convolution Neural Networks

1. Convolution
2. Max pooling
3. Flattening
4. Full Connection

3.4.1. Convolution : Convolution is done to an image using feature detector when input image is convolved with the feature detector then we get a feature map.

By applying convolution operation size of the image is reduced so we may lose some information. but features detector is one which stores the features and unwanted features are removed. Group of feature map is called convolution layer

3.4.2. Max pooling : Types of pooling-Max pooling, Mean Pooling, Sum pooling Max Pooling: By applying max pooling we are neglecting 75% of unwanted features and we are reducing spatial invariance this will avoid overfitting of the data

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3.4.3 Flattening : Flattening is converting n dimension to 1 dimension and applying ann to that 1 dimension array which

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just acts like inputs to the neurons. When output is not correct then in the backward propagation along with the weights feature detector (filter) is also optimized.

3.4.4. Full Connection : Full connection is dense layers. This flatten layer is taken as an input layer to the Artificial Neural Networks and we give one hidden layer and output layer. In compilation we use batch gradient descent and binary cross entropy as loss function.

IV RESULTS AND DISCUSSION

This entire description gives us the idea about how to project "Criminal detector which was built using the Face Recognition" system. When the program is executed the web camera pops up and it starts to detect faces .It can detect any number of faces that are present on a particular frame and forms a square around the image. Once the faces are detected it starts to recognize them by mapping it to the given data set. Then it shows the name for the framed person along with the number of faces that are detected .The framed part of the image gets cropped and is stored to the dataset of the storage of a particular pc.

Fig : An output of the software showing he is not a criminal

Fig : The output of a criminal

V CONCLUSION AND FUTURE SCOPE

The most innocuous danger of the criminality-from-face illusion is that good researchers will waste effort that could otherwise create solutions that truly would benefit humanity. Face recognition systems are part of facial image processing applications and their significance as a research area are increasing recently. The various applications of this system helps in crime prevention, video surveillance, person verification, and similar security activities. The joint efforts of the whole face recognition research community have made few applications of real-world face recognition achievable, but there are still several challenges to address and opportunities to explore for designing mature face recognition systems that can work in highly challenging environments and with images typically found within the social media environment. CCTV

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cameras with criminal detection should be put forth as they can be used for easily detecting the criminals from footage itself.

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