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CRIMINAL IDENTIFICATION SYSTEM USING FACE DETECTION AND RECOGNITION

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Abstract -Criminal record contains personal information about a particular person along with photographs. To identify any criminal we need identification regarding that person, which are 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.

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.

Key Words:Criminal Identification (CI), Facial Recognition (FR), Haar Classifier (HR), Real-Time (RT), Viola-Jones (VJ)

1.INTRODUCTION

Criminal record contains personal information about a particular person along with a photo-graph. To identify any criminal, we need identification regarding that person, which are 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. Al-though 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 store the images of criminals in our database along with their 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.

2. Motivation

The world has seen exponential advancement over the last decade, there is an abnormal increase in the crime rate and also the number of criminals are increasing at an alarming rate, this leads toward a great concern about the security issues. various causes of theft, stealing crimes, burglary, kidnapping, human trafficking etc. are left unsolved because the availability of police personnel is limited, many times there is no identification of the person who was involved in criminal activities. To avoid this situation an automated facial recognition system for criminal identification is proposed using haar feature-based

cascade classifier. This system proves to be very beneficial for- keeping track of criminals and their activities.

3. FACE DETECTION USING VIOLA JONES ALGORITHM

The algorithm has four stages:

1. Haar Feature Selection:

Initially, the algorithm needs a lot of positive images of faces and negative images without faces to train the classifier. Then we need to extract features from it. First step is to collect the Haar Features. A Haar feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums.

2. Creating Integral Images:

So in Haar feature selection, we calculated the value of a feature. In reality, these calculations can be very intensive since the number of pixels would be much greater within a large feature. The integral image plays its part in allowing us to perform these intensive calculations quickly so we can understand whether a feature of a number of features fit the criteria.

3. Adaboost Training:

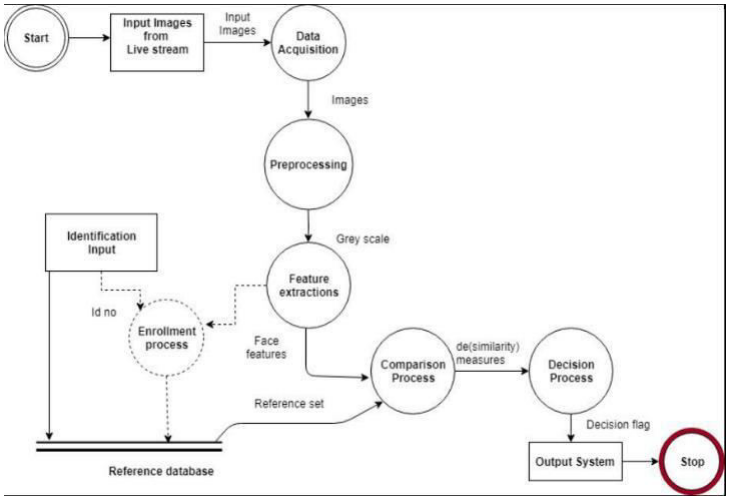
The algorithm learns from the images we supply it and is able to determine the false positives and true negatives in the data, allowing it to be more accurate. We would get a highly accurate model once we have looked at all possible positions and combinations of those features. Training can be super extensive because of all the different possibilities and combinations you would have to check for every single frame or image.

Let's say we have an equation for our features that deter- mines the success rate (as seen in the image), with f1, f2 and f3 as the features and a1, a2, a3 as the respective weights of the features. Each of the features is known as a weak classifier. The left side of the equation F(x) is called a strong classifier. Since one weak classifier may not be as good, we get a strong classifier when we have a combination of two or three weak classifiers. As you keep adding, it gets stronger and stronger. This is called an ensemble. You want to make sure that you have the most important features in front, but the question is how do you find the most important or the 'best' features? That's where Adaptive Boosting comes into play.

4. Cascading Classifiers:

Cascading is used to boost the speed and accuracy of our model. So we start by taking a subwindow and within this subwindow, we take our most important or best feature and see if it is present in the image within the subwindow. If it is not in the subwindow, then we don't even look at the subwindow, we just discard it. Then if it is present, we look at the second feature in the subwindow. If it isn't present, then we reject the subwindow. We go on for the number of features have, and reject the sub window without the feature. Evaluations may take split seconds but since you have to do it for each feature, it could take a lot of time.

Cascading speeds up this process a lot, and the machine is able to deliver results much faster.



4 IMPLEMENTATION

A. Import the required modules:

The Modules required to perform the facial recognition are cv2, as, image module and numpy. Cv2 is the OpenCV module and contains the functions for face detection and recognition. OS will be used to maneuver with image and directory names. First, we use this module to extract the image names in the database directory and then from these names an individual number is extracted, which is used as a label for the face in that image. Since, the dataset images are in gif formatand as of now, OpenCV does not support gif format, Image module from PIL is used to read the

image in grayscale format. Numpy arrays are used to store the images

2. Load the face detection Cascade:

To Load the face detection cascade the first step is to detect the face in each image. Once we get the region of interestcontaining the face in the image, we use it for training the recognizer. For the purpose of face detection, we will use the Haar Cascade provided by OpenCV. The haar cascades that come with OpenCV are located in the directory ofOpenCV installation. Haarcascade frontal face default.xml is used for detecting the face. Cascade is loaded using the cv2 CascadeClassifier function which takes the path to the cascade xml file. If the xml file is in the current workingdirectory, then relative path is used.

3. The Face Recognizer Object:

The next step involves creating the face recognizer object. The face recognizer object has functions like FaceRecognizer.train () to train the recognizer and FaceRecognizer.predict () to recognize a face. OpenCV currently provides Eigen face Recognizer, Fisher faceRe cognizer and Local Binary Patterns Histograms(LBPH) Face Recognizer. We have used LBPH recognizer because Real life isn't perfect. We simply can't guarantee perfect light settings in your images or 10 different images of a person. LBPH focuses on extracting local features from images. The idea is to not look at the whole image as a high-dimensional vector but describe only local features of an object. The basic idea of Local Binary Patterns is to summarize the local structure in an image by comparing each pixel with its neighbourhood. LBP operator is robust against monotonic gray scale transformations.

4. Image Preprocessing:

The preprocessing consists of a series of operations performed on the input image, which include Image smoothening, Background filtering, Resizing, De-noising, Grayscale conversion and Segmentation.

5. Image Classification:

Following steps will be executed:

1. Convolutional layer: Filter passes over the image, scanning a few pixels at a time. CNN develops multiple feature detectors and uses them to develop a feature map that predicts the class to which each feature belongs. Feature maps are also referred to as convolution layers.

ii. Pooling layer: This makes the network capable of detecting the object in the image without being confused by the differences in the image 's textures, the distances from where they are shot, their angles, or otherwise. Reduces the amount of information in each feature obtained in the convolutional layer while maintaining the most important information.

iii. Fully connected input layer: Takes the output of the previous layers, flattens them and turns them into a single vector that can be an input for the next stage.

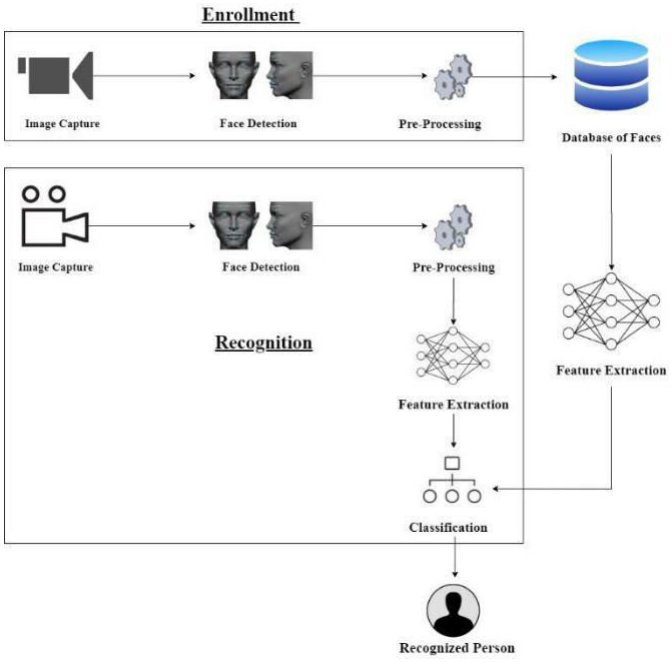
iv. The first fully connected layer: Input layer contains the vector of data that was created in the flattening step. It takes the inputs and applies weights to predict the correct label.

v. Fully connected output layer: Gives the final probabilities for each label.

6. Prediction System:

This system will predict and recognize faces of the criminals in an image and in a video stream obtainedfrom a camera in real time.

1. Items will be punctuated as sentences where it is appropriate.
2. Items will be numbered, followed by a period.



CONCLUSION

In this project, we can detect and recognize faces of the criminals in a video stream obtained from a camera in real time. We will use Haar feature-based cascade classifiers in OpenCV approach for face detection. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. This system uses our implementation of a face recognition system using features of a face including colors, features and distances. Using its two degree of freedom, our system allows two modes of operation, one that results in very few false positives and another which results in few false negatives. We have demonstrated various concerns related to the face recognition process, such as the lighting and background conditions in which the facial images are taken. Our system could be improved in the future through development of a face detection algorithm which is less prone to incorrectness, failure and performs well regardless of the skin colour. A more extensive feature set would also prevent the chance of tricking the system through the alteration of facial.

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