# Facial Recognition for Criminal Identification

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**Abstract: Criminal identification has undergone a revolution as a result of the development of digital technologies. In this research, we suggest a method for criminal identification using facial recognition. By comparing the retrieved data with photographs and videos of the suspects obtained from numerous sources, facial recognition technology plays a significant part in this research. Facial recognition algorithms can precisely compare facial features and patterns to find probable matches by using sophisticated machine learning techniques. This helps in criminal investigations by allowing law enforcement authorities to quickly identify. We developed a prototype system that integrates face recognition to create a more efficient and accurate criminal identification system. Our testing demonstrated that the system is capable of accurately identifying criminals with a high degree of reliability. We believe that this system can used by the law enforcement agencies to maintain public safety.**

***Keywords:* *Surveillance camera, face recognition, face detection, Haar cascade, OpenCV*.**

## 1. INTRODUCTION

Law enforcement agencies face significant challenges in identifying criminals who evade capture by using false identities or disguises. Manual identification methods can be time-consuming and error-prone, and often rely on subjective judgments. To address this issue, this project proposes the development of a system for criminal identification using face recognition.

Criminal identification using face recognition is a rapidly evolving field that leverages advanced technology to identify individuals involved in criminal activities. It utilizes algorithms and machine learning techniques to analyse and compare facial features from images or videos with known databases of criminals or suspects. By accurately matching and identifying individuals, law enforcement agencies can expedite investigations, solve crimes, and enhance public safety.

The system will leverage machine learning algorithms to identify faces captured in surveillance footage and compare them against a database of known criminals. Python-OpenCV may be used to detect objects as well as faces. They, however, are unable to recognize rotating pictures so, Haar Cascade Classifier is used to recognise faces in tilted and blurred pictures. Python Facepplib is utilized for face extraction and includes several functions for comparing the characteristics of two photos. It is an API for recognizing and comparing faces. It accepts two photos as input and processes them through several phases. Facepplib has the benefit of being able to recognize faces in hazy or long-shot photos.

Because the prior criminal's and missing children's photos only require little data cleaning, they do not require the usage of the Haar classifier.

## 2. LITERATURE SURVEY

### *A. Face Recognition for Criminal Identification: An Implementation Of Principal Component Analysis for Face Recognition*

In this paper [1], the author describes the use CCTV video to compare pictures from the camera with criminal databases if no fingerprints are found at the crime site. This system is divided into five stages, the first of which is planning, in which the system are examined. The second step of requirement analysis examined the system's design requirements. The system interface is built with Visual Studio Code, while the database and code is done with MATLAB R2013b. Using the suggested model, they attained an accuracy of 80%.

### *B. Automated Criminal Identification by Face Recognition Using Open Computer Vision Classifiers.*

In this paper the authors have clearly mentioned the steps and algorithms they have used. The first phase in this work is real-time picture training, and the second step is employing a Harr-classifier for face identification. The third phase is a comparison of surveillance camera captured photos with real-time photographs, followed by the outcome section based on the comparison. The authors [2] use the Haar-classifier on Open-CV for face detection; Haar-cascading is one of the face detection strategies. Face tracking is performed on the open-CV platform using Harr-like classifiers. This technology recognizes more than one individual and may be used to locate the suspects we are looking for. When compared to the existing model, the new system has a much higher accuracy. They also told us that if we use the Aadhar database, and can quickly determine that the person is a criminal or not.

### *C. Airport Security Using Face-Recognition.*

In this paper, the authors expose a LBPH model. They are determining if the passenger is an authorized passport holder or not by using the Passport database. [3]They are employing image processing tools as well as the LBPH mathematical model in their endeavour. This procedure consists of six phases for airport security purposes, which are as follows: a) Capture picture with webcam b) Send captured image to Django server c) Extract LBPH feature set from image d) picture is compared with database image using classifier. If the matching is successful, the user's information are retrieved from the database. f) The predicted user details are emailed to the administrator. They use webcam pictures for LBPH processing and then apply classifiers to compare them to database photos. This will also assist to identify criminals who travel from one nation to another, and if the traveller has a loan from a bank, the passenger's comprehensive information will be given to the police station for verification.

### *D. Automatic Face Recognition Attendance System Using Python and OpenCV.*

According to the authors of this [4] work describe an autonomous facial recognition system for monitoring attendance. They use a camera to record photographs of people's faces, which are then matched to images already in their database. For name recognition, they use machine learning technology with an SVM classifier and for face detection, they use a gradient-oriented Histogram. They use open-CV for picture detection and identification, Tkinter for GUI application building, and Numpy to interact with arrays, all of which are Python libraries.

To create and test the application, use the Xampp server, which is a free and open source server. Their proposed model has an accuracy of 99.38%. The system's practicality can be boosted by using the cloud.

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*E. Attendance Monitoring System Using Face Detection & Face Recognition.*

The writers of this research [5] emphasized the importance of an attendance tracking system in the teaching and learning process. When a pupil enters the classroom, his or her image is taken. Pre-processing and face region extraction are performed on the acquired picture for subsequent processing. They are utilizing a facial recognition algorithm to label students as present if they arrived to school or absent if they did not come to school. They are employing a camera to capture the student's image, and after pre-processing, they are matching it to their student database and marking attendance.

*F. Photo sleuth: combining human expertise and face recognition to identify historical portraits*

In this research, the authors Portraits of Soldiers from the Civil War of America in 1861-65 are identified by creating a web-based platform i.e., Photo Sleuthing. They told that this identification system [6] is taken as finding a needle in the haystack. Where it contains 1) haystack building 2) the haystack narrowed down and 3) needle is finding in the haystack. Work is by combining automated face recognition and crowd-sourced human expertise. When this method was launched it helped to identify the unknown portraits and authors discussed implications for person identification pipelines. They show how Photo Sleuth's pipeline has helped to identify thousands of unknown images and also encouraging long-term volunteer contribution.

*G. Force Field Feature Extraction Using Fast Algorithm for Face Recognition Performance.*

In this paper, the authors have presented a face identification system that uses the fast algorithm. This model uses two datasets: 1) Olivetti Research Laboratory (ORL), 2) Unconstrained Facial Images (UFI). ORL contains 400 images of 92X92 pixels where 9 images are used for training purposes and 1 image for testing of each person. UFI contains 401 images of 128X128 pixels where 7 images are used for training purposes and 1 image for testing of each person. Captured image converted to HSV system and after that force field features is extracted from that image. Classification is done by using three distance methods that are: Manhattan, Euclidean, and Cosine. [7] By comparing these methods they got the best resolution and achieved an accuracy of 99.9% for the datasets ORL and UFI.

*H. An Advancement towards Efficient Face Recognition Using Live Video Feed.*

The authors [8] of this paper reviews a combination of the PCA model along with fisher face method and SVD projections has been used to gain results for better and higher efficiency and accuracy. The efficiency is indeed improved and recognition rates are increased.

*I. Face Recognition using Training Data with Artificial Occlusions.*

In this paper, we can see that with the increase of the number of images in each class, the recognition accuracy achieved by using the artificial occlusions approaches that using real occlusions [9].

*J. Face Detection and Recognition for Criminal Identification System.*

In this paper [10],the authors presents an innovative approach to ace recognition and how it is implemented for the purpose of criminal detection, using CNN the accuracy rate is over 95% has been observed for two datasets. In this paper, we have

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considered the following objectives to develop the proposed system

a) To create a face recognition system capable of properly identifying faces caught in surveillance footage.
b) To make the system easily upgradeable in order to stay up with technological breakthroughs and increasing criminal methods.
c) To identify the criminal's face, obtain the information contained in the database for the identified criminal, and send a notice to police officers with all of the facts and location.

## 3. PROPOSED METHOD

The proposed system of face recognition for criminal identification has a several steps, that are explained below

A. Image acquisition

The user provides the suspect image via a user interface, and the prior criminal photographs are added to the dataset. It can also employ camera footage or CCTV footage and webcam can also be used to provide the input.

B. Face detection

Face detection is done using OpenCV and the Haar cascade classifier is used for the detection of the face, it a cascade function.

C. Feature extraction

To extract the features from a picture, use OpenCV which detect multiscale and the parameters should be specified with the right values. On gathered facial pictures, it applies more than one classifier. Using changed XML of cascade classifiers, the image is transformed from RGB to Grayscale and HSV colors. The extracted characteristics are saved as an integer array, each with a unique value. The mapping is carried out using a deep learning method.

D. Template matching

The similarity level is determined by comparing the matching characteristics of two photos. Python Facepplib, API library of Python is used for template comparison. It extracts the faceprint from the suspect's input image as well as the criminal's original image. It then generates faceprints for criminal photos and compares them.

By comparing the generated faceprints by the extracted faceprints we will get the criminal details, if they match.

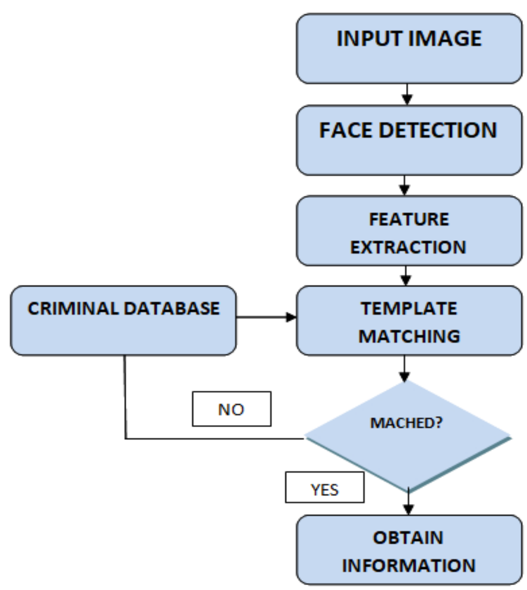


Figure 3.1 Flow diagram

**3.1 OpenCV**: OpenCV is a video and image processing library used for picture and video analysis such as facial identification, license plate reading, photo editing, sophisticated robotic vision, and a variety of other applications. OpenCV is can be used to identify and recognize the faces in real time from a live webcam feed. Over 2500 optimized algorithms are included in the collection, which includes a comprehensive mix of both classic and cutting-edge computer vision and machine learning approaches. These algorithms are capable of detecting and recognising faces, identifying objects, classifying human actions in videos, tracking camera movements, tracking moving objects, producing 3D point clouds from stereo cameras, extracting 3D models of objects, stitching images together to create a high-resolution image of an entire scene, and searching an image database for similar images.

**3.2 Haar Cascade**: The Haar Cascade technique detects objects in pictures using feature-based object detection. For detection, a cascade function is trained on a large number of positive and negative pictures. The approach does not require a large amount of processing and may be executed in real-time. We may create our own cascade function for bespoke items such as animals, automobiles, bikes, and so on. Because it only recognizes the matching form and size, Haar Cascade cannot be utilized for face recognition. The cascade function and cascading window are used in the Haar cascade. It attempts to calculate characteristics for each window and classify them as positive or negative. If the window may be considered a component of an item, it is positive; otherwise, it is negative.

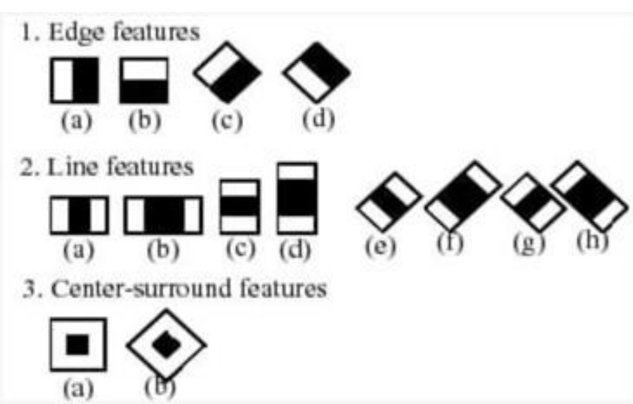


Figure3.2: Haar cascade features

**3.3 Face detection:** The major purpose of this stage is to record the faces of those who are available in front of the camera. This stage produces patches that contain each face in the input image. To create an ideal and preferable facial recognition system. To justify the scales and orientation of these patches, face alignment is conducted. Following the face detection process, human face patches are recovered.

**3.4 Face recognition:** Face recognition is a means of identifying or validating an individual's identification by utilizing their face. Using biometrics, a face recognition system maps facial emotions from an image or video. It compares the details to a database to identify known faces matches from the database. While facial recognition may help identify human identities, it also raises privacy problems

**3.5 Python Facepplib:** Python is a strong, well-documented language that can be applied to many different applications. Python is popularly utilised in computer vision technology because of its ease of usage. The Facepplib API makes it simple to carry out template matching. It is configured using the Api key and secret key parameters.

## 4. RESULTS AND DISCUSSION

The above implementation is done using python language in a pycharm. This application is tested with various image types. For experimental purposes. A sample dataset is used to test the system's accuracy level with a variety of photos, including blurry, distant, childhood, and Aadhar card images. It takes the input images and using face recognition and face detection methods, it compares the images with the criminal dataset images before displaying the information, allowing the user to determine whether or not the person in the image is a criminal. The below images shows the accuracy for different methods, in that Haar cascade has more accuracy when compared to others.

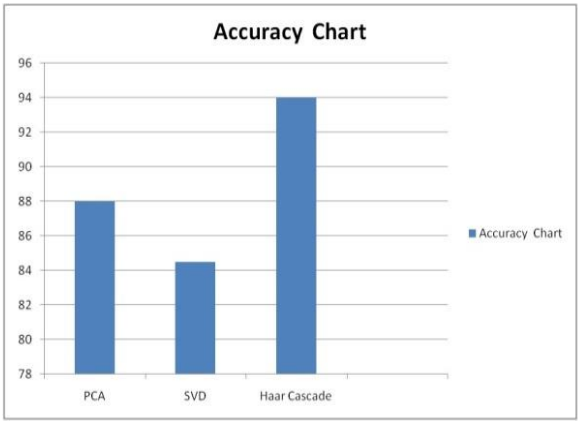


Figure 4.1 : Accuracy chart

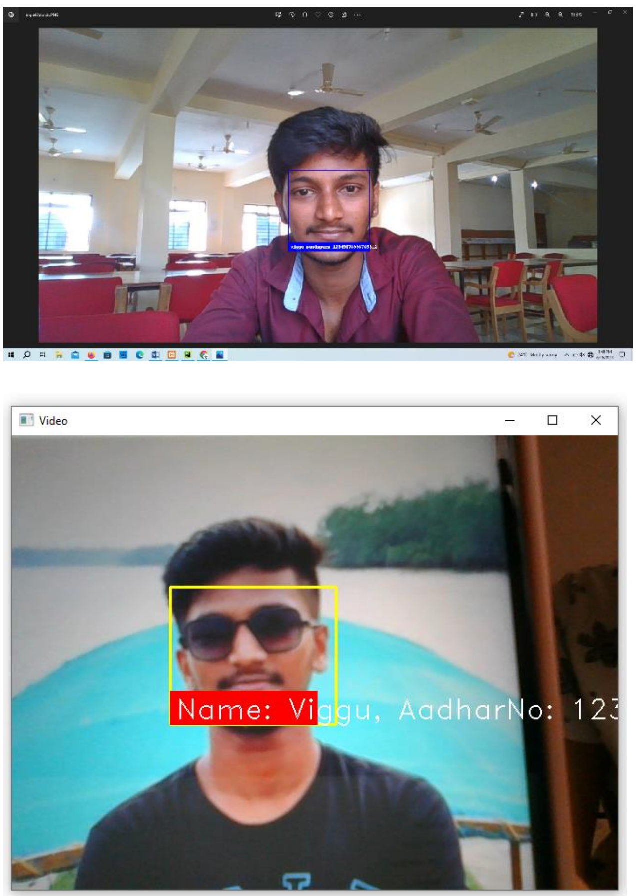


Figure 4.2 : Final Output

The presence of face recognition systems can act as a deterrent for potential criminals. The knowledge that their actions may be captured and linked to their identities through facial recognition technology can discourage individuals from engaging in criminal activities, thereby contributing to public safety.

Face recognition technology can also aid in locating missing persons. By comparing unidentified individuals captured in images or videos with databases containing images of missing persons, authorities can potentially identify and reunite them with their families.

The use of face recognition technology raises significant privacy concerns. The collection, storage and analysis of facial images require careful consideration of consent, data protection, and potential misuse. Safeguards must be in place to ensure the responsible and secure handling of personal information. The use of face recognition technology must comply with legal and regulatory requirements. Laws regarding data privacy, consent and the use of surveillance differ across jurisdictions, and the implementation of face recognition system must align with these regulations to protect civil liberties and individual rights.

Widespread adoption of face recognition technology for criminal identification requires public acceptance and trust. Engaging in public dialogue, addressing concerns, and ensuring transparent practices can help build trust and promote responsible use of the technology.

## 5. CONCLUSION AND FUTURE WORK

Criminal identification using face recognition technology has the potential to enhance law enforcement capabilities, expedite investigations, and improve public safety. However, careful consideration must be given to privacy, accuracy, bias, legal compliance, transparency, and public trust. It is essential to strike a balance between the benefits and risks associated with this technology, implementing appropriate safeguards and ethical guidelines to ensure its responsible use in a manner that respects individual rights and societal well-being.

We compare many sorts of photos in this study, and the accuracy level of the findings is pretty satisfactory. It works nicely with photos as well as web cam. The displayed findings are 87% correct. When compared to alternative techniques, this uses less memory space and takes less time to implement. This allows offenders to be readily identified. The research is conducted out using genuine criminal photographs found on the internet, and the findings are promising. The additional features can be added to this system like to make the system to use social media information and to implement a web scrapping technique. We feel that this application will help to easily identify criminal in our community.

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