International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 04, April-2023

Criminal Investigation with the help of Face Recognition

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***Abstract*:- We all know that our Face is a unique and crucial part of the human body structure that identifies a person. Therefore, we can use it to trace the identity of a criminal person. With the advancement in technology, we are placed CCTV at many public places to capture the criminal's crime. Using the previously captured faces and criminal's images that are available in the police station, the criminal face recognition system of can be implemented. In this paper, we propose an automatic criminal identification system for Police Department to enhance and upgrade the criminal distinguishing into a more effective and efficient approach. Using technology, this idea will add plus point in the current system while bringing criminals spotting to a whole new level by automating tasks. Technology working behind it will be face recognition, from the footage captured by the CCTV cameras; our system will detect the face and recognize the criminal who is coming to that public place. The captured images of the person coming to that public place get compared with the criminal data we have in our database. If any person's face from public place matches, the system will display their image on the system screen and will give the message with their name that the criminal is found and present in this public place. This system is matching more than 80% of the captured images with database images.**

Keywords:- Unique, Structure, advancement, technology, CCTV, public places, Police Department, bringing criminals, CCTV cameras, detect the face, recognize the criminal, 80% of captured images,

I.) INTRODUCTION:

Over the years, a lot of security approaches have been developed that help in keeping confidential data secured and limiting the chances of a security breach. Face recognition which is one of the few biometric methods that possess the merits of both high accuracy and low intrusiveness is a computer program that uses a person's face to automatically identify and verify the person from a digital image or a video frame from a video source. It compares selected facial features from the image and a face database or it can also be a hardware which used to authenticate a person. This technology is a widely used biometrics system for authentication, authorization, verification and identification. A lot of company has been using face recognition in their security cameras, access controls and many more. Facebook has been using face recognition in their website for the purpose of creating a digital profile for the people using their website. In developed countries, the law enforcement create face database to be used with their face recognition system to compare any suspect with the database. However, because of unlimited knowledge through internet usage, most criminals are aware of thumbprint identification. Therefore, they become more cautious of leaving thumbprint by wearing gloves except for non-premeditated crimes. This paper to propose a facial recognition system for a criminal database where the identification of the suspect is done by face matched rather than thumbprint matched.

The objective of this study is two-fold:

1. Matching a face with available database accurately.
2. Applying principal component analysis for finding distinguishable features from many images to get the similarity for the target image.

The remaining of this paper is structured as follows. Next section discusses on related concepts of this study and relevant previous works, design and development describes the whole processes of system development, result and discussion highlights the outcomes and advantages, and final section outlines conclusion and future work.

The process of identifying and spotting a criminal is slow and difficult. Criminals, these days are getting smarter by not leaving any form of biological evidence or fingerprint impressions on the crime scene. A quick and easy solution is using state-of-the-art face identification systems. With the advancement in security technology, CCTV cameras are being installed at most of the buildings and traffic lights for surveillance purposes. The video footage from the camera can be used to identify suspects, criminals, runaways, missing persons etc. This paper explores a way to develop a criminal identification system.

Face recognition is a method of identifying or verifying the identity of an individual using their face. The step after the representation of faces is to identify them. In this comparison of the detected face image with the images, we have in our database based on face encodings. A facial recognition system maps facial expressions from an image or video using biometrics. To find known faces match from the database, it compares the details to a database. Facial recognition may aid in the identification of personal identity, but it also introduces privacy concerns. Commercial applications use facial recognition as well as it is used for a variety of purposes ranging from security to promotions.

II.) REQUIREMENT ANALYSIS:

Requirement analysis describes the analysis that is required in order to develop the proposed system through functional requirements and non-functional requirements. Functional requirements outline what the system should do and support the user activities in performing and completing tasks by using the proposed

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FRCI. The list below shows the functional requirements for FRCI.

1.) The system allows the user to register by using username and password given default as **"admin"**.
2.) The system allow user to input image to be matched.
3.) It allows image to be compared.
4.) The system provides matching event if the input has more than 70% similarity with the image in the face database.

The non-functional requirements describe the FRCI's security implementation that includes authentication by login, PCA and Eigenface algorithm.

III.) BACKGROUNDS AND RELATED WORKS:

System design defines the architecture, components, modules, interfaces and data for a system requirement. Figure 1 presents the overall system design of FRCI.

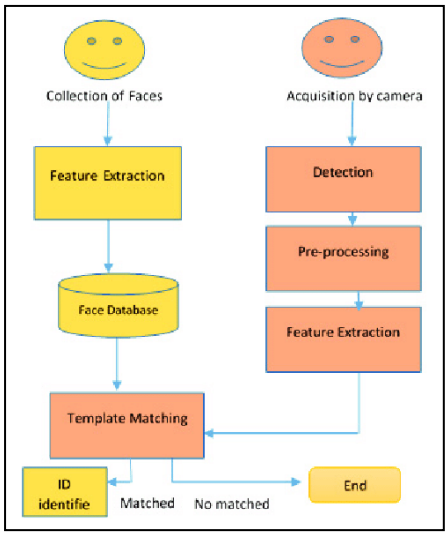

Figure 1: Architecture of FRCI

According to Figure 1, the first step is to create face databases as the match template for the system. A face database is created by acquiring collection of people photos. The photo should be half body photo where the face is facing front. In the process of verification of id for an image, the image which is captured using digital camera will be processed. The image will be detected and extracted and ready for the next stage. The next stage is pre-processing, where unnecessary features are eliminated. This is to reduce unnecessary processing effort. In the feature extraction, the images are collected from the database and represent it as a vector, then the algorithm will find the average face vector or the mean and it will subtract the mean face from each sample faces. All these photos then are processed using PCA procedures to get the Eigenface as the basis or standard features of human face. These features will be used in recognition phase where it try to match with the correct image in the database. If matched, the identification of the image will be verified, else it will stop.

IV.) CONCEPT:

AI Facial Recognition Technology is essential to identify criminals. Facial recognition powered by AI has been steadily gaining a good amount of attention. It has grown quickly all over the world as a worthy reliable solution to identify criminals and provide safety and security. It is not only significantly used by the government or the police forces but by many other organizations in various fields to prevent crime. This technology is said to have many benefits in comparison to other solutions of biometrics. The biometric system of fingerprint or palm print requires human interaction whereas facial recognition need not need any. It even doesn't require the individual's consent. Moreover, it is immensely useful to detect criminal activities in areas like the airport. The Law Enforcement Agencies have been benefited by AI Facial Recognition Technology in numerous methods. It can assist in producing unfailing evidence and facilitate well-organized investigations. This effective technology helps to collect the relevant data that is required by the LEAs to respond promptly and efficiently for crime prevention. Innefu Labs AI Vision Face Recognition System is state-of-the-art Facial Recognition solution is tailored for multiple use cases. Vision empowers the customers to successfully convert mundane and humongous data into crisp, actionable intelligence.

The primary function of this step is to capture the faces of the people who are available in front of the camera. The outputs from this step are patches that contain each face in the input image. To design a perfect and preferable face recognition system. Face alignment is performed to rationalize the scales and orientation of these patches. Further Next step after the face detection step is human face patches are extracted.

It is the most important task for the Police who are finding the criminals, but it is the difficult and most time-consuming task as they have to find it everywhere. It will be more difficult in cities or public places with high people density. In some cases, manual type of identification gives chance for getting more information related to criminals. Hence this paper proposes an automatic criminal identification system by detecting the face of criminals. This will help Police to identify and catch the criminals in public places. Criminal identification can be done in two ways, which is shown in figure 1. In Manual Identification System (MIS), identification is done by the Police officers searching them at public places. It takes a lot of time to give the proper attention and it also has the chances of skipping criminals as they will be alerted by seeing cops easily gets escape from there. Since the MIS is in the process of taking more time and we will not properly focus on everyone. But when it comes to an automated identification system (AIS) there is no need for observation going in a public place. Here all the process involved in this system is automated.

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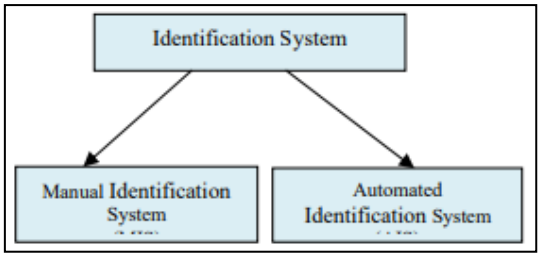

Figure 2: Types of Identification System

V.) GOAL:

This section highlights the main outcome of FRCI and its advantages. This study aims to design, develop and test the Face Recognition for Criminal Identification, all system functionalities are running well and therefore, this study successfully achieved the objectives. The main function of FRCI—image identification, was programmed with detection and extraction of image, projecting image and recognition of the image. The user need to input the image for identification for recognition process as shown in Figure 1. Once the image is recognized, detected and extracted, all the necessary features are extracted for identification There are many other similar software out there that provide the same functionality as FRCI, however, FRCI also has its own benefits that can contribute to society. Developing an automated facial recognition system can be challenging given its complexity and limited exposure, however with FRCI, students without knowledge to the biometrics system can use the source code to study the basic of facial detection and recognition system. Other than that, FRCI also features a user-friendly interface that requires minimum interaction between the users. With FRCI, users only need to input an image in the database and the system will do the rest.

Furthermore, since FRCI is developed as an open source system, other experienced developer or amateur programmer can add new function to the system with ease. Also, they will be able to give it new design and even improve its recognition algorithm. Its simple design also makes it easier to use.

Overall, there are several advantages that have been identified as follows:

1.) As a better alternative for criminal identification instead of using thumb print identification.

2.) Automate most of the identification activities. For instance, criminal photo captured through CCTV just need to feed into the system for identification. The system will then run automatically from recognizing, detecting and extracting the image, features extraction and identification activities.

The image below shows the Working of an Image Detection System.

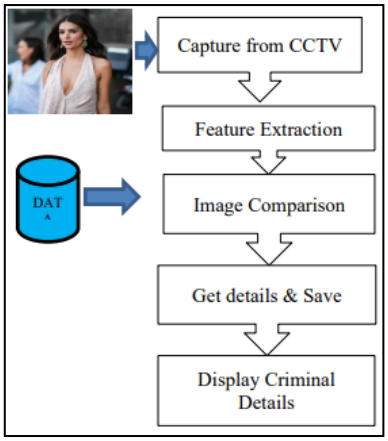

Figure 3: Execution System of Image Detection.

VI.) APPLICATIONS:

Any human being is characterized by her or his distinctive identity. The face of a human being is counted to be unique along with other physical features. It is a foremost quality that enables an individual to interact with others. With science and technology improving day by day the recognition of face has gained new dimensions. Nowadays, face recognition is carried out by facial recognition technology. It is an approach through which an individual is verified or identified from various digital sources, like the image or video. The face of an individual includes facial contours which are the main source for analyzing and comparing for identification.

i. Identifying Criminals through Surveillance

At the present time, the AI technology of facial recognition is comprehensively being applied for surveillance. It helps in detecting individuals or groups that need close surveillance, usually for lawful cause.AI Facial Recognition Technology can identify criminals at the scene of an event. It can further help in recognizing those criminals who roam free. In another way, it can be a great factor to make the cities safer. This technology makes possible monitoring of real-time data. It does so by capturing an image or video and then analyzes it and identifies it. Many of the Law Enforcement Agencies use AI facial recognition to recognize suspects from various documents or information available. It is also very important to install the cameras equipped with AI at strategic points to verify or identify criminals or individuals involved in unlawful activities.

ii. Tracking Criminals by the use of AI Technology

The police forces in order to track a criminal from a crowded area can use this technology to a greater effect. First, they need to do is feed an image of the crime doer into the AI-powered surveillance system. The cameras that scan all the area of the city is brought into play. The cameras would be analyzing and comparing all the faces that it detects. An alert goes off if the surveillance finds any match in the crowd. The police officers can reach the exact spot and apprehend the criminal. The police forces are

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adopting AI facial recognition which would enable tracking criminals in a less laborious way. Real-time facial recognition boasts incredible potential to prevent crime. As there are considerable advancements involving this technology, it is gradually beginning to extend. To perform accurately this new tracking solution must have access to wide range of databases. And these data should comprise varied faces and settings. The data must have faces of all diverse skin textures, being captured from different angles and in various lighting environments. All these can make the algorithm very precise.

iii. Revealing Masked Identities

When the facial recognition technology is powered by Artificial Intelligence it can provide great results in identifying criminals. During the recent times, most individuals, while committing an unlawful activity, conceal their identity. They hide their faces or cover their faces with scarves, masks etc. In such cases, AI uses deep-learning methods to identify the individual. The method involves mapping of a face with some facial points. The distance between various facial points and the angles are analyzed. This enables one to estimate the facial structure hidden beneath a mask. It is now that the projected facial configuration is compared existing images in the database. Thus, finally the real identity of the individual is unveiled. This recognition procedure would help recognize an individual merely by running a scan on the masked face. This would be a huge benefit for the police forces in identifying as well as nabbing the criminals. This technology would help law enforcers to identify individual quickly with the use of cameras installed at strategic points and also from unmanned aircraft. The AI Facial Recognition Technology is capable of identifying criminals or suspects in most circumstances. Whereas using other existing technologies it is almost not possible to do so.

iv. Cracking Down Identity Theft

The technology of facial recognition powered by AI also helps in arresting suspects involved in frauds and identity thefts. To identify individuals having more than one identity the image affixed in a driving license is analyzed and compared to other images that are already there in the database. This has lead to the identification of fraudsters and identity thieves who manipulate the administration with stolen identities or more than one license. This is also helpful in keeping the unruly drivers out of the roads and enhances the safety of other drivers and vehicles. Whenever a license of the driver is revoked or cancelled, the driver is not supposed to drive.

v. A Standalone Device

The facial recognition technologies have taken a huge leap with the influence of Artificial Intelligence. One of the latest innovations that have come up in this field is a 'box camera.' It is said to be capable of performing intricate facial recognition process. What it does is analysis of a face in real-time and provides a precise solution. It is stored with various facial features with different kinds of expressions. This device can make a practical approach to identify individuals of concern prior to the occurrence of any incident. If this device is stored with profiles of criminals, fraudsters and other offenders, it might detect a suspect then and there only.

VII.) CONCLUSION:

AI Facial Recognition Technology is essential to identify criminals. Facial recognition powered by AI has been steadily gaining a good amount of attention. It has grown quickly all over the world as a worthy reliable solution to identify criminals and provide safety and security. It is not only significantly used by the government or the police forces but by many other organizations in various fields to prevent crime. This technology is said to have many benefits in comparison to other solutions of biometrics. The biometric system of fingerprint or palm print requires human interaction whereas facial recognition need not need any. It even doesn't require the individual's consent. Moreover, it is immensely useful to detect criminal activities in areas like the airport. The Law Enforcement Agencies have been benefited by AI Facial Recognition Technology in numerous methods. It can assist in producing unfailing evidence and facilitate well-organized investigations. This effective technology helps to collect the relevant data that is required by the LEAs to respond promptly and efficiently for crime prevention

As for the future work, a lot more testing and debugging is needed as this system was developed in a very limited time and resources. However, since it is an open source software, developer can easily add new function and improve the default function. Additionally, the system can feature an image processing where the input image can be made less blurry so the system can detect face on lower quality images. Other than that, the system can use a database which contain the personal info of the person in the database, so whenever FRCI recognize a face, it will display the details about the person.

After considering all the facts present in introduction section, we did research in different applications and came up with a solution. Real-time criminal identification system will help police to control crime rate. This application helps them in many different ways. With the advancement in security technology and installation of cameras throughout the public areas, it will become easier for police personnel to monitor, track and find criminals from police control room using this application. In future advanced face recognition techniques can be used to improve the results and login page must be created so that any police personnel can access this application remotely. Moreover if a criminal is found in a particular zone then alert messages should be send to nearby police

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Vol. 12 Issue 04, April-2023

stations. The application that is developed is a simple and user friendly.

VIII.) REFERENCES:

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