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Face Detection and Recognition on Real-Time Streaming Cctv Data For Police Investigation

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ABSTRACT
There are grave security concerns as a result of the unusually high rate of crime and theincreased number of offenders on the free.Crime prevention and criminal identification arepolice officer's main priorities since lives and property are on the line. Protection is the mainfocus of the police, although there aren't enough of them to really fight crime. Multiple specialuser and private locations have cameras installed for security and surveillance purposes,particularly CCTV, as a result of the development of security generation .The CCTV footagecan be used to identify suspects present at the scene. Utilizing fully automated face recognition technology, this real-time criminal detection system is based on facial recognition. The OpenCVLBPH (Local Binary Pattern Histograms) algorithms and the Haar feature-based cascadeclassifier are used to identify and recognize faces. Face detection and recognition will beautomated and real-time with this innovation. It is still challenging to precisely locate the face.Researchers frequently employ the Viola-Jones framework to identify faces and other items in apicture. Classifiers for face detection are provided through open communities like OpenCV.

Keywords: *CCTV, OpenCV, Crime Prevention, LBPH.*

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I. INTRODUCTION

Many security strategies have been created over time to assist protect sensitive data and reduce the likelihood of a security breach. Face recognition software utilises a person's face to instantly recognise and confirm them from a frame from a videosource that is a digital picture or movie. Thisis one of the few fingerprint techniques that provides both high precision and little interference. By matching specific facial characteristics from the picture, a person canbe verified using a face database or other technology.. A well-known biometrics system for identification, authorization, and authentication is this method. The automatically tagging tool offers the conceptto share photos with others who are in thema new depth and also telling others about theindividual in the picture. Our goal was to create a system that police or investigation departments could use to identify criminals from their faces. The facial recognition approach employed is quick, reliable,comparatively easy to learn, and accurate. It also uses simple and straightforward algorithms. Although psychologists, neuroscientists, and engineers have studied face and facial expression recognition formore than 20 years, it has only recently gained significant attention.

Numerous studies have producedevidence, and commercial applications have sprung from their efforts. Any processingsystem's first step is identifying the area of the image where the face is visible. However, facial recognition from a singleimage is difficult because size, location, orientation, and mindset can all vary.. Lighting conditions, occlusion, and facial expressions all affect how people seem overall.

Face Detection includes

Pose: A face's appearance in a picture canbe affected by the camera's angle with respect to the subject's face (frontal, 45 degrees, profile, upside down), and certain facial characteristics, like the nose or eye, may be partly or entirely hidden.

whether there are skeletal components present or not: Beards, moustaches, and spectacles are among the facial traits that mayor may not be present. There is also a significant lot of variation in the size, colour,and form of these features.

Sacial expression: A person's facial expression directly influences how their facelooks.

Occlusion: Other objects may partially obscure faces. Some people's faces may partially obscure others in a group

picture.

Orientation of the image: Face imagesdirectly change depending on how thecamera rotates around the optical axis.
imaging circumstances: The qualities ofthe camera (sensor responsiveness, lenses,and lighting) affect how a face appears(spectra, source distribution, and intensity).

Real-time face detection is the initial feature of the suggested system. When a face is discovered, the system tries toidentify it. Whether it does, it instantly alertsthe appropriate authorities if the identified face belongs to a wanted person or is a missing person. The victim's facial data will first be kept on the server.

This information will be sent to each camera in the system. Another major priority is placed on finding the victim by consulting earlier data and repeatedlyflipping between the cameras to determine where they were last seen.Advantages of System

- Lessening of human effort.
- Faster tracking of offenders.
- System that is entirely autonomous.
- Video is always accessible.
- Offers reliable surveillance

Finding the offender and hunting him down manually takes a lot of time. Therefore, it would be wiser to create anautomated system that constantly hunts or searches for the culprit. If the criminal's photo is uploaded to the server, the criminal recognition system will search for the offender constantly, and the concerned official will be alerted if the offender is captured on any of the cameras. In India, 80,000 kids go missing each year. Numerousinfamous offenders are discovered to be missing. The goal of the proposed work is toinform the authorities of missing persons or criminals, improve surveillance and data access, and minimize human effort and time.

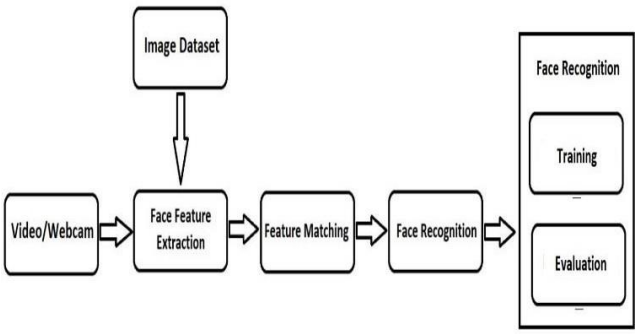

Fig.1 Architectural Diagram

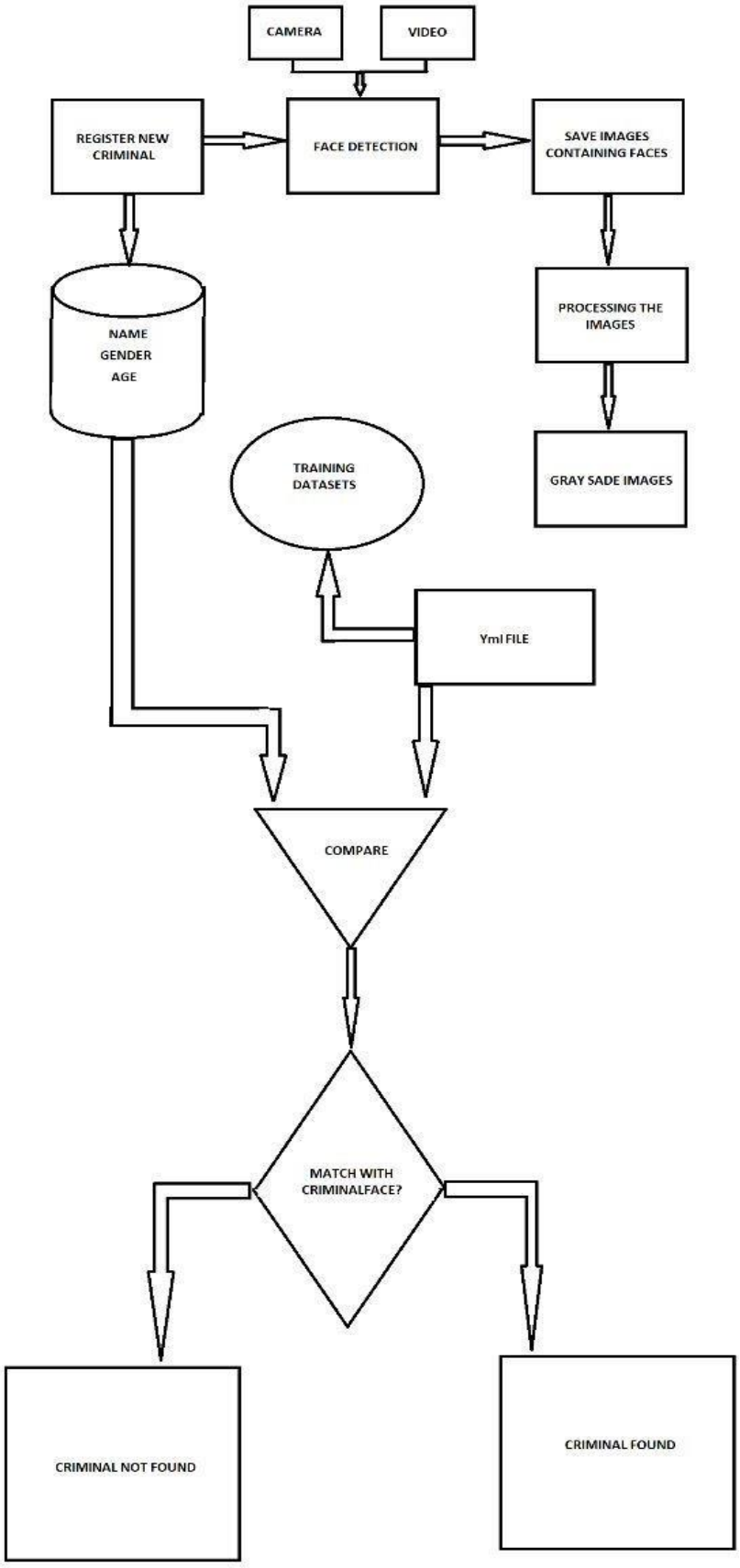

Fig. 2 Flow Chart

Image acquisition

The frame is obtained by this module from camera feeds. Using the OpenCV library, the Image Acquisition module is employed.

The fundamental goal of an open source library of programming functions known as OpenCV is real-time computer vision (Open Source Computer Vision Library). To creategrayscale, the captured frames are transformed. Digital imaging, often known as digital image capture, isthe act of turning a real scene or an object's internal structure into a digitally recorded representation.The phrase is usually interpreted to indicate or to encompass the process,compression, storing, printing, anddisplay of such photos. The capacity to digitally produce copies of copies of copies forever without any qualitydegradation is one of the main advantages of a digital picture over an analogue image like a film snapshot.

Face Detection

This module recognizes,resizes, and records the face in the obtained picture. Face detection in a frame is accomplished by Face Detection Module using HaarCascade. A classifier, the Haar Cascade simply detects the object (face) for which it has been trained from the source. Frontal Face andProfile Face are the two subclassifiers adopted by this module in the Haar Cascade. When a face isfully turned toward the camera, frontal classifiers may distinguish frontal faces in the frame captured from the stream. When a face is onlypartially facing the camera, the profile classifier may distinguish partial faces in the frame capturedfrom the stream. Labels are appliedto the identified face region in the frame once the face has been detected. The frame is scaled to fit the observed area. JPEG-formattedframes are stored on the hard drive. Due to the faces' position and perspective in the movie, accurately detecting faces is a challenging process. High accuracy systems, like DLIB, on the other hand, offer high accuracy by using HOGcharacteristics from pictures. But, we used Haar Cascade, a machine learning methodology where a cascade function is taught using a huge number of both positive and negative photos, because our methodis based on reality and since video processing is continuous. Using it to locate objects in other photographs isthe next stage

Face Recognition

The system compares a few facial attributes from the image tofaces it is already familiar with. The Open Face program makes use of deep neural networks in order to embed the face on a 128- dimensional unit hypersphere and represent it. In contrast to other face representations, this embedding has the useful property of indicating that two faces are probably not the same person when there is a larger gapbetween them. This property simplifies the tasks of grouping,similarity detection,andclassification when compared to other face recognition algorithmswhere the Euclidean distance between features is meaningless. During the Open Face pipeline'straining phase, 500,000 images arefed into the neural network. Usingthese pictures as training data, Open Face creates 128 facial embeddings that reflect a typical face.

Person Identification

Once the individual has been identified by the particular camera, the system captures a picture of that person. The system notifies the registered email address through email. The notification email contains the camera number, the picture, and the name of theindividual who was recognized.

II. LITERATURE REVIEW

In his description of an automatic facial recognition system for the criminal database, Abdullah N.[1] used the well- known Principal Component Analysis approach. Face recognition and detection are both automated using that technique. This method will help law enforcement identify a suspect when his or her fingerprint is missing from the scene.

A method for recognizing faces using a haar classifier was proposed by Apoorva and Impana[2]. This method makes use of a single classifier to recognize a variety ofphoto types with varying rotations andattributes. It uses a number of weak classifiers rather than a sophisticated one.

Rasanayagam K.[3] described Convolution Neural Network (CNN)technique-based deep learning for face identification and recognition. Data is classified using the IMDb dataset and the AWS cloud. In order to reduce the numberof crimes that occur and improve the overallperformance of the police, recent technological advancements are proving to be of assistance.

Mantoro T.[4] discusses the use ofcascade classifiers and principal component analysis (PCA) to generate a face vector or face print. For security purposes, face recognition system provides fingerprint and biometric identification that makes useful to identify uniqueness of faces. The paper suggests ways to speed up the face recognition process and get accurate results. It employs a hybrid of Haar Cascades and Eigenface techniques, allowing for the simultaneous detection of 55 faces.

Chang L. [5] proposes feature extraction using a stacked convolutional auto encoder (SCAE) and deep

learning for pattern recognition for categorization. Additionally, it incorporates aspects of Local Binary Projection and SRC (LBP). It is suggested to use a multi-task Convolutional neural network (CNN) for face recognition, withside tasks for estimating expression, illumination, and position and identity classification as the main job. It solves an essential MTL problem by creating a dynamic weighting scheme thatautomatically assigns loss weight to each side job.

Ming[6] by simulating based on 2D photos, Ju-wang reveals a 3D method forselecting faces. It can also dynamically recognize several faces in a variety of settings. A suggested face identification method based on intelligent photographs extracts the signature elements of a face and samples data about the pupil, eyelid, facial features, and facial expression. The simulation results show that the suggested technique is more precise and has thepotential to improve face recognitionresolution and accuracy.

Siddiqui M.[7] approaches Principal Component Analysis and various fusion to reflect the original face and train the faces effectively utilizing symmetrical and mirror images. The lack of sufficient trainingimages for face recognition is the main roadblock. By taking advantage of the face'saxis symmetrical structure, a strategy to generate various symmetrical face images is proposed. Experiments demonstrate that the proposed method improves recognitionaccuracy.

Hyung-Il K.[8] explains how to evaluatethe objective visual quality of a face image as it improves. It eliminates a technique for automatic face recognition and improves theface picture quality (FIQ). To create a strong and reliable face recognition system, it suggests a novel way for assessing thequality of a face image. The suggested methodology is trustworthy and adaptable toface recognition systems by utilising a learntassessment..

Kakkar P.[9] describes how to extractimages of faces from videos, normalize the derived image quality, then identify and compare the faces. It employs a largenumber of datasets from many nations, which slows down performance. Using a Haar feature-based classifier, a proposed automated facial recognition system forcriminal identification is proposed. Face recognition and automatic detection will be possible in real time with this system. It usesan automated surveillance camera to capturea person's face at the scene of a crime. Elrefaei L [10] implemented in Android lollipop using optical flow networks, which are used to describe a client-server strategy for real-time tracking. It collects details from a picture, including regular and corner details. For the camera-based surveillance, itemploys the Adaptive Mean Algorithm. Police personnel are advised to use acriminal detection framework that might help them identify the criminal or suspect's face. A real-time client-server video surveillance system is called Framework. It makes use of Android Studio and theOpenCV library and was tested on a Sony Xperia Z2 Android 5.1 Lollipopsmartphone.

Short discription of literature survey displayed in table 1.1

III. DISCUSSION

Because the entire system is functioning as anticipated, the study's goals, which were to design, develop, and test a facial recognition system for criminal identification, were successfully attained.

Programming for imageidentification, the main function of FRCI,included picture detection, extraction, projection, and recognition. In order to identify the image in the recognition process,the user must enter it. When the picture has been identified, detected, and extracted, the necessary characteristics are extracted for identification. FRCI provides advantagesthat can help society, despite the fact that many different programmers provide the same capability. developing a facerecognition system for computers.

IV. CONCLUSION

We conducted research in several applications after taking into account all the information in the introductory part and came up with a solution. A real-time criminal identification system will assist police in reducing crime. They benefit from this application in several ways. Usingplacement of cameras in public spaces and advancements in security technology will make it simpler for police officers to monitor, track, and locate offenders fromthe police control room utilizing this application. Future results can be improved by utilizing sophisticated facial recognition algorithms, and a login page must bedeveloped so that any police employee can remotely use this programmer. Additionally,alarm messages should be sent to adjacent police stations if a criminal is discovered ina certain area. The created application is straightforward and user-friendly. The UI of the programmer may be made more in line with user needs by utilizing sophisticatedCSS styles and various front-end technologies

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Table 1.1 Literature Review

Reference	Publisher	Method Used	Strength	Weakness	ToolUsed	Dataset
[1]	AIP Conference Proceedings	Principal Component Analysis technique	Quick	Relatively Expensive	PythonIDE	Thumbprint
[2]	IEEE 2019	Haar Classifier	Relativelyquick	Only Detection	Python	Haar Cascade
[3]	IGI Global	Video-call Based	Quick	Very inaccurate	PythonIDE	Video Stream
[4]	IEEE 2018	Haar Cascade And Eigen Faces	Most Successful	Takes moretime	NA	Eigen Faces
[5]	IEEE 2015	Stacked convolution auto encoder	High recognition	More details	python	Stacked convolution auto encoder

Table 1.1

Gaikwad A, et. al. "Face Detection and Recognition on Real-Time Streaming Cctv Data For Police Investigation." *IOSR Journal of Business and Management (IOSRJBM)*, Vol.25, No. 04, 2023, pp. 17-22.