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CRIMINAL FACE DETECTION USING 2D IMAGE

1St Kharche Rutuja Bhanudas
Department of Computer Engineering
Genba Sopanrao Moze College Of
Engineering Balewadi,Pune – India
rutujakharche21@gmail.com

2nd Kondalkar Sakshi Kiran
Department of Computer Engineering
Genba Sopanrao Moze College Of
Engineering Balewadi, Pune - India
sakshikondalkar04@gmail.com

3rd Muluk Sayali Siddheshwar
Department of Computer Engg.
Genba Sopanrao Moze College
Engineering Balewadi,Pune – India
Sayalimuluk2115@gmail.com

4th Sawai Komal Kadunath
Department of Computer Engg.
Genba Sopanrao Moze College
of Engg. Balewadi,Pune – India
komalsawai08@gmail.com

5th Prof Neelam Jadhav
Department of Computer Engg.
Genba Sopanroa Moze College
of Engg. Balewadi,Pune - India
nj24sep90@gmail.com

ABSTRACT

A criminal record contains both personal information about a person and an image of that person. To identify a criminal, we need personal information about that person, which an eyewitness can supply. Fingerprints, eyes, and DNA are all methods for identifying someone. One of the uses is face recognition. The face is our primary focus of attention in social interactions, and it plays a vital role in communicating identity and emotion. Although it is impossible to discern intelligence or character from a person's face, humans have an exceptional ability to remember and distinguish faces. An automatic facial recognition system for criminal records was proposed using the well-known Principal Component Analysis technique. This technology will be able to detect and distinguish faces automatically. If there is no thumbprint on the scene, law enforcement will have an easier time locating or identifying the suspect. The goal of this project is to examine several techniques to face detection and recognition in order to create a full solution for image-based face detection and recognition that is more accurate, has a better response rate, and may be utilized as a first step in video surveillance. The proposed solution is based on testing results from multiple face-rich datasets in terms of subjects, position, emotions, and light.

Keywords: CIS, CNN, Deep learning, criminals, Criminal face detection

I. INTRODUCTION

A criminal record contains both personal information about a person and an image of that person. To identify a criminal, we need personal information about that person, which an eyewitness can supply. Fingerprints, eyes, and DNA are all methods for identifying someone. One of the uses is face recognition. The face is our primary focus of attention in social interactions, and it plays a vital role in communicating identity and emotion. Although it is impossible to discern intelligence or character from a person's face, humans have an exceptional ability to remember and distinguish faces. This strategy is intended to assist any investigation department in detecting offenders. We save photographs of criminals in our database alongside their information, and these images are then divided into four slices: the brow, eyes, nose, and lips. These photographs are then stored in a separate database record to help with identification. The slices that show on the screen will be selected by eyewitnesses, and we will use them to retrieve the facial image from the database. As a result, if the criminal's record is found in the database, this technology produces a highly comfortable

environment in which both the operator and the eyewitness may easily identify the offender.

II.DATA PREPARATION

For this project we have Synthesis Data. It may not be feasible or ethical to use real criminal data due to privacy concerns. By synthesizing a dataset, personal information can be anonymized or de-identified, ensuring the privacy of individuals involved in criminal activities while still allowing researchers and organizations to work with relevant data.

Government criminal databases often contain sensitive information, making access to these datasets subject to strict privacy regulations and legal restrictions. Governments are obligated to protect individuals' privacy and personal data, which can limit public access to criminal datasets.

Criminal databases are highly sensitive repositories of information and are carefully guarded to prevent unauthorized access. Granting access to such databases can pose security risks if not managed properly, potentially compromising ongoing investigations or sensitive intelligence.

III.FEATURE EXTRACTION

Crime prediction using face recognition involves several steps, including feature extraction from facial images. Feature extraction is a critical step in the process because it involves identifying relevant patterns or features in an image that can be used to distinguish one individual from another.

Some common feature extraction techniques used in face recognition include:

Eigenfaces: Eigenfaces is a technique that uses principal component analysis (PCA) to identify the most significant features in a set of facial images. This technique involves computing the eigenvectors of the covariance matrix of the face image dataset.

Local Binary Patterns (LBP): LBP is a technique that extracts texture information from facial images by comparing each pixel in the image to its surrounding pixels. The technique creates a binary code for each pixel based on the comparison, and these codes are used to extract features from the image.

Convolutional Neural Networks (CNNs): CNNs are a type of deep learning model that can automatically learn and extract features from images by using multiple layers of convolutional filters. These filters are designed to detect different types of features, such as edges, lines, and curves, in the image.

Once the features have been extracted from facial images, machine learning algorithms can be used to train predictive models that can classify individuals based on their facial features and predict the likelihood of their involvement in criminal activity. However, it is important to note that the accuracy and effectiveness of these models depend heavily on the quality of the training data, the feature extraction techniques used, and the algorithmic approach taken. Moreover, the use of facial recognition for crime prediction raises significant ethical and privacy concerns, and it is important to consider these issues carefully before implementing such technologies.

IV.DEEP LEARNING MODEL

Deep learning models have become increasingly popular for face recognition and crime prediction due to their ability to automatically learn complex features from data. Some deep learning models that have been used for crime prediction using face recognition include:

Convolutional Neural Networks (CNNs): CNNs are a type of deep learning model that can automatically learn and extract features from images by using multiple layers of convolutional filters. These filters are designed to detect different types of features, such as edges, lines, and curves, in the image. CNNs have been used for face recognition and crime prediction by training them on large datasets of facial images and using them to classify individuals as potential suspects or non-suspects based on their facial features.

Recurrent Neural Networks (RNNs): RNNs are a type of deep learning model that are designed to process sequences of data, such as time-series or text data. They can be used for crime prediction by processing sequences of facial images over time, such as from surveillance footage, to identify potential suspects or criminals based on their facial features and behavior.

Siamese Neural Networks: Siamese neural networks are a type of deep learning model that are designed to compare two inputs and output a similarity score. They have been used for face recognition and crime prediction by training them on pairs of facial images, such as before and after images of a suspect, and using them to compare the similarity between individuals based on their facial features.

It is important to note that the use of deep learning models for crime prediction using face recognition raises significant ethical and privacy concerns, and it is important to consider these issues carefully before implementing such technologies. Moreover, the accuracy and effectiveness of the deep learning models depend heavily on the quality of the data, the feature extraction techniques used, and the algorithmic approach taken.

V.LITERATURE REVIEW

[1] Face Recognition and Detection for Criminal ID Systems Finding and identifying a criminal is a difficult and time-consuming task. In recent years, criminals have improved their cunning, leaving no biological evidence or fingerprints at the scene of the crime. Modern facial identification technology can be used as a quick and easy solution. Thanks to developments in security technology, CCTV cameras are now installed for monitoring reasons at the majority of buildings and traffic lights. The video records from the camera can be used to identify suspects, offenders, runaways, and missing people. This study explores the development of a criminal identification system using deep neural networks and machine learning. The technique outlined below can be used to facilitate law enforcement

[2] Identification of Criminals and Missing Children Using Face Recognition and Web Scraping Face recognition is a biometric method that maps a person's facial characteristics using mathematics and stores the data as a face print. In order to translate an item into a series of numbers, it analyzes the image using machine learning. This technique is used by companies like Google and Facebook to create digital profiles of Their users. The objective of this project is to use this technology to locate fugitive criminals based on their criminal histories. The National Crime Records Bureau (NCRB) conducted research that found that the same people commit 70% of crimes. These offenders can be recognized using face recognition from an image or video frame captured by cameras placed in various locations, and it can also be used to locate missing children.

[3] Face recognition for automated criminal identification using open computer vision classifiers This paper presents a real-time facial recognition system based on an automated security camera. The four-step process of the proposed method includes training real-time

photos for face detection using a Haar-classifier, comparing trained real-time photos with photos from a security camera, and calculating the result based on the comparison. An important application of interest is automated surveillance, which has the objective of identifying people on a watch list.

[4] Face recognition system design the most widely used and sought-after technology in the modern world is facial recognition. Giving a Machine vision makes sense so that it can communicate with people more effectively. We shall see a reflection of our way of life if machines can read our faces. A new era in human history will begin thanks to the facial recognition technology. Finding security and identity will be beneficial in many ways. In this study, face recognition is suggested for sophisticated applications including payments, criminal identification, access and security, and so on.

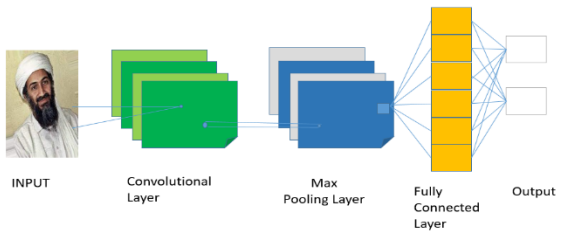
[5] The facial recognition system will usher in a new era in human history. Finding identity and security will be advantageous in a variety of ways.Face recognition is proposed in this study for advanced applications such as access and security, payments, criminal identification, and so on. Face recognition will be used to identify people, and it will be broken down into three steps: face detection, feature extraction and categorization, and real-time recognition

[6] Police, military, and security personnel are tasked with identifying criminals and terrorists. Terrorist attacks and crime had escalated at an unusually high rate. All security departments face a difficult task in combating them. These departments are currently employing cutting-edge technology. However, they are not as efficient or precise as they had hoped. The culprits in this study were identified through the analysis of faces, emotions, ages, and genders. Deep learning-based CNN techniques are used to implement face recognition, emotion, age, and gender identification. The LeNet architecture is used to identify suits. The Keras deep learning package, which is built on top of Tensorflow, is utilised in the implementation phase for categorization. The dataset used for the entire training process is IMDb. Instead of using local workstations, training is done in the AWS cloud, which is a more powerful and competent means of training.

[7] Face recognition is a biometric-based technique that uses mathematics to map an individual's facial traits and saves the information as a face print. It uses Machine Learning to analyse the image and create a feature vector that translates an object to a set of numbers. Organizations like Google and Facebook use this technology to construct a digital profile for its consumers. The goal of this research is to use this technology to identify offenders on the run based on their previous records. According to a research by the NCRB (National Crime Records Bureau), 70 percent of crimes are perpetrated by the same individuals. Face recognition from an image or video frame acquired by cameras positioned in various locations can be used to identify these offenders, and it can also be used to identify missing children.

VI.METHODOLOGY

The system receives input from the user, trains and tests the data using the CNN algorithm, and then identifies the culprit.



CNN: A convolutional neural network (CNN) is a network architecture for deep learning that learns directly from data. CNN are particularly useful for finding patterns in images to recognize objects, classes, and categories. CNN have ability to automatically learn and extract features from raw input data, without need for manual feature engineering.

1. Input Layer: It is responsible for reducing the input image and process it for further process. Input Layer accept the pixel of criminal image of the input in the form of array. Resize the image (224,224).

Size (224,224)

2. Convolutional Network: Convolutional layer applies the set of filters on the input image for extract feature. The matrix filter and performs convolutional operation or detect pattern in the Criminal image. In this layer mathematical operations of convolutional is performed between the input image and filter of particular size. A matrix filter that runs convolutional operations on an image of a criminal to find patterns. Convolutional layer applies the set of filters on the input image for extract feature. The matrix filter and performs convolutional operation or detect pattern in the Criminal image. In this layer mathematical operations of convolutional is performed between the input image and filter of particular size.

3. Pooling Layer: It is reducing the dimensions of the feature map. Pooling layer is used multiple filters of criminal edges, color, shape, eyes etc. Pooling layer prevents the overfitting. In this layer work is done by applying the pooling operations to the small region of input image.

4. Fully Connected Layer: Convolutional Operation forms the basis of any convolutional neural network. In CNN Criminal Image is represented in the form of array of pixel value.

VII. PROPOSED SYSTEM

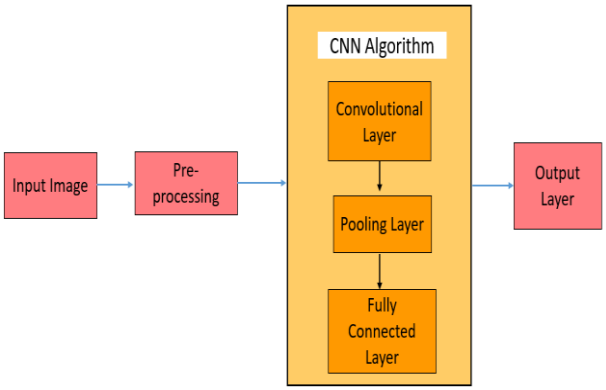


Fig.7.1: Proposed System

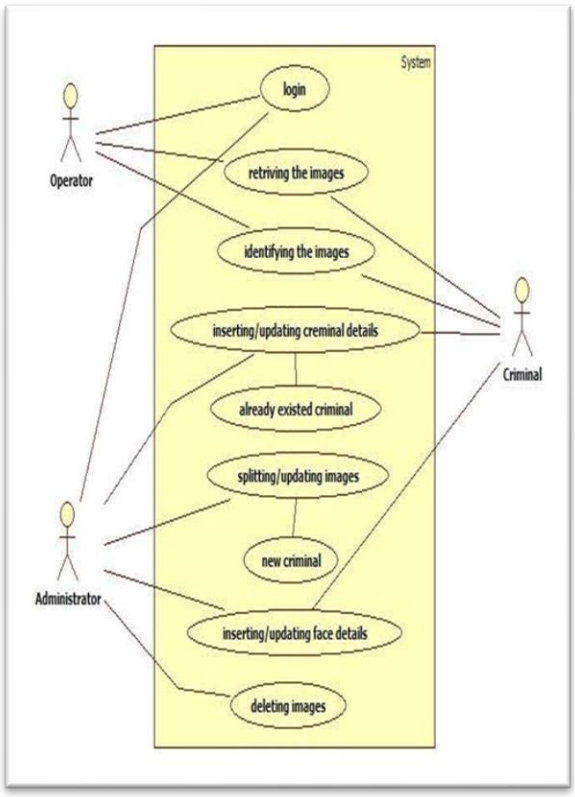


Fig.7.2: Use Case Diagram

Unified Modeling Language (UML) is a general purpose modelling language. The main aim of UML is to define a standard way to visualize the way a system has been designed. It is quite similar to blueprints used in other **fields** of engineering.

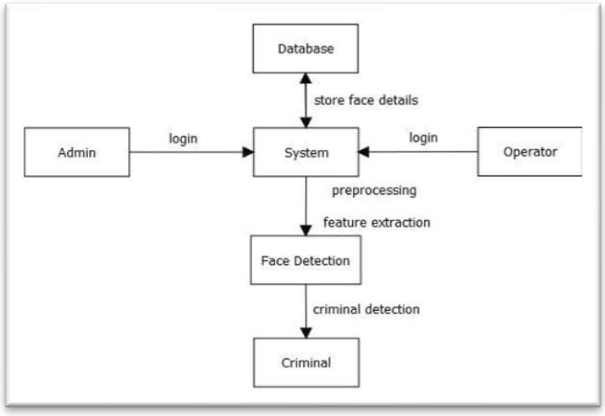


Fig.7.3: Flow Diagram

In 1-level DFD, a context diagram is decomposed into multiple blocks/processes. In this level, we highlight the main objectives of the system and breakdown the high-level process of 0-level DFD into sub processes.

TABLE 1

PERFORMANCE ACCURACY OF MODEL

CONTENT	OUTPUT
Training Accuracy	70%
Testing Accuracy	30%
CNN Algorithm Accuracy	97%

Train/Test is a method to measure the accuracy of your model. It is called Train/Test because you split the data set into two sets: a training set and a testing set. 80% for training, and 20% for testing. You train the model using the training set. You test the model using the testing set.

TABLE 2

PERFORMANCE OF MODEL WITH VARIOUS EVALUATION MERTICS

CONTENT	OUTPUT
F1 Score	0.9%
ROC AUC	0.92%
Precision	0.90%
Recall	0.91%

F1 score is a machine learning evaluation metric that measures a model's accuracy. AUC stands for "Area under the ROC Curve." That is, AUC measures the entire two-dimensional area underneath the entire ROC curve (think integral calculus) from (0,0) to (1,1). Precision and recall are two evaluation metrics used to measure the performance of a classifier in binary and multiclass classification problems.

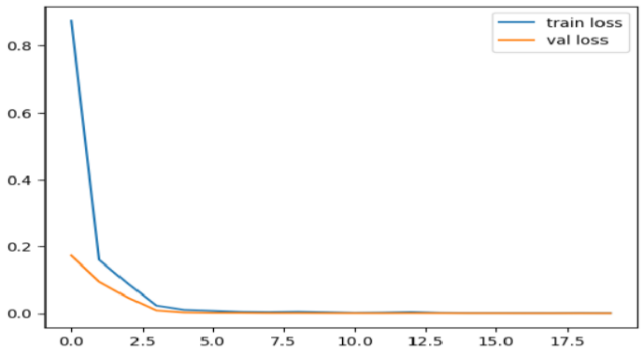


Fig.7.4: Train Loss of Model

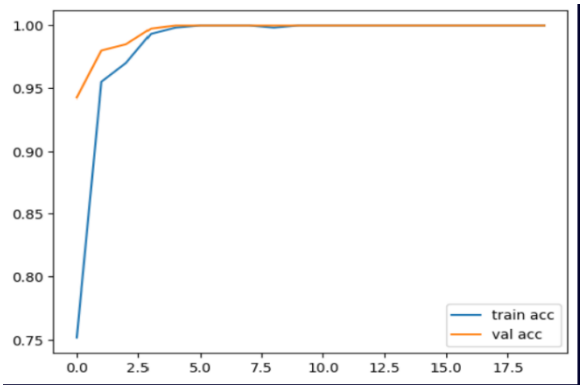


Fig.7.5. Train Accuracy of Model

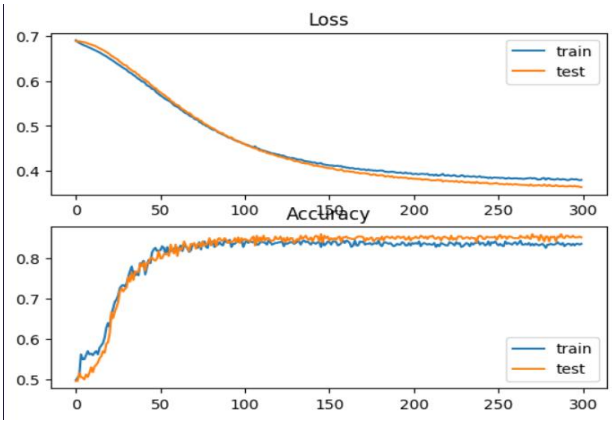


Fig.7.6: Loss and Accuracy of Model For Test And Train

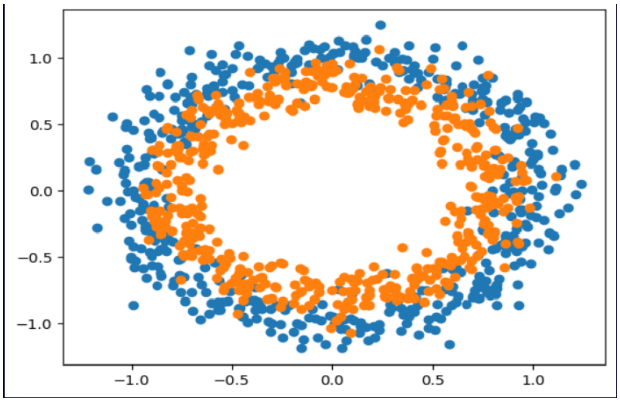


Fig.7.8: Scatter Plot of Model

VIII.CONCLUSION

In order to improve the detector's performance and accuracy, the input image is scanned at virtually every pixel location and scale. We divided image processing techniques into three categories: low, medium, and high. Based on the suggested system's facial recognition procedure, this work has provided a superior technique for criminal identification. In this project, we took a previously captured photograph and processed it. In the future, we intend to take a genuine photograph and do "real time image processing" on it.

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