

Detection and Analysis of Criminal Profiles using Artificial Intelligence

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Abstract - Introduction: Increase in crime rate and number of criminals, there is need of effective criminal identification technique. One of the fundamental aspect of criminal identification is physical description. This include details about their appearance like height, weight, hair color, eye color or distinctive features. Modern criminal identification technique depend on biometric data, fingerprint, facial expression and voice recognition. Camera and photographs taken at crime scenes provide valuable evidence of identifying criminal. Criminal identification technique not only use for finding criminal but also to protect right individuals who may be wrongly accused.

Objective: The objective of criminal identification is to establish identity of individuals involved in criminal activities to protect innocent and maintain public safety. Criminal identification helps laws enforcement agencies locate and apprehend suspects, as well as gather information about individuals involved in criminal activities. Accurate identification is crucial for building a case against a suspect.

Methods: criminal identification technique involves various methods to identify of individuals involved in criminal activities. Fingerprint identification is one of the oldest methods to find identification. Iris or retinal scans these biometric methods involve capturing detailed images of iris or retina to establish person's identity. They are used in high security environments like government facilities and secure facilities. Facial recognition is used analyze facial expression and matches them database of known individuals. It is used in public places and airports to identify persons of interest.

Result: The result of criminal identification can have various outcome depending upon the accuracy and validity of the identification process. The primary result of criminal identification is the identification of suspect who is believed to be involved in a criminal activities. These based on physical evidence, or biometric data such as fingerprint and DNA.

Conclusion: criminal identification plays a vital role in the functioning of criminal justice system. Its primary objective is to accurately establish the identity of individuals involved in criminal activities. The implemented criminal model is capable to correctly recognize features from images. The advantages of this models is that it can recognize the blurred image and side face that other conventional model can't recognize. After passing an image, we get a label whether image is criminal or not.

Keywords- CNN, Face Detection, Face Recognition, Criminal Identification, Criminal Profiling

I. INTRODUCTION

Convolutional Neural Network are designed to figure with grid- structured inputs, which have strong spatial dependences in original regions of the grid. the foremost egregious illustration of grid- structured data may be a 2-dimensional image. the introductory difference between completely connected and convolutional neural network is that the pattern of connection between successive layers.

In completely connected case, each unit is connected to any or all of the units within the former subcaste. in an exceedingly convolutional subcaste of a neural network, on the contrary hand, each unit is connected to a (generally small) number of near units within the former subcaste. likewise, all units are connected to the former subcaste within the same way, with the precise same weights and structure. The inviting maturity of operations of CNN specialize in Image data. Object Discovery, Optical

Character Recognition, Image Bracket, Face Recognition, etc. are some real time samples of CNN. Our design aims to use Face Recognition fashion for Criminal Face Identification. Felonious record contains particular information about a particular person together with snap. To spot any felonious, we would like identification regarding that person, which are given by the viewer. Biometric ways like point, DNA, Iris etc. are effective modes of Identification. But Face Identification fashion is kind of simpler than them as Face is primary focus of attention in social intercourse. Also, data needed to produce Face Identification model may be available fluently through felonious records, videotape footages and lots of further. Face Identification has operations in colorful other fields too. moment, payment companies like MasterCard, Alipay have developed a system within which stoner will pay by taking selfies. nearly all told smartphones, there is a point of Face cinch. The goal of this approach is to locate the guilty parties in any inquiry division. In this method, the photos of the offenders are stored in our database together with their personal information. The photographs are further divided into four segments: the face, eyes, nose, and lips. To facilitate identification, these photos are once more kept in a different database record. The slices that show on the screen will be selected by viewers, and we will use it to retrieve the image of the face from the database. As a result, if the offender's record is in the database, this method offers a very user-friendly way for the motorist and the spectator to quickly and accurately identify the criminal. The purpose of this design is to use the preliminary photos to identify a person. Additionally, the sophisticated technology serves as a pioneer in face recognition and discovery for surveillance on videotape.

II. MOTIVATION

Detecting potential criminals within a large crowd or preemptively assessing someone's intentions to commit a crime is an exceedingly challenging endeavor. Nonetheless, it is a widely held belief that one's facial appearance can offer insights into their mental processes, a notion supported by Lombroso's physiological study. Lombroso's research demonstrated that individuals with criminal tendencies often exhibit specific facial traits or features. These characteristics, if accurately identified, can be employed to discern potential criminal tendencies in individuals unknown to the observe. Lombroso's method was clinical and descriptive, with a meticulous focus on details such as skull dimensions and other anatomical attributes. He maintained that certain criminals could be distinguished by particular features, including a sloping forehead, unusually sized ears, facial asymmetry, prognathism, excessive arm length, cranial asymmetry, and other physical stigmata. However, manually capturing these features can be a daunting task

Thanks to the rapid advancements in machine computational capabilities, deep learning-based neural network architectures have gained widespread popularity

in addressing complex and practical problems related to classification and identification. This progress has spurred our motivation to explore various deep learning-based models in this study. Our goal is to present a comprehensive performance analysis for the detection of criminal tendencies using facial images. For visual perception, here is a representation of multiple images depicting individuals with criminal and non-criminal tendencies or records In fig a, b and c

III. RELATED WORK

The objective of criminal identification is to establish identity of individuals involved in criminal activities to protect innocent and maintain public safety. Criminal identification helps laws enforcement agencies locate and apprehend suspects, as well as gather information about individuals involved in criminal activities. Accurate identification is crucial for building a case against a suspect.

Convolutional Neural Networks (CNNs) were inspired by studies on how a cat's visual cortex works. This natural system has cells that respond to specific visual features like shapes and orientations. The earliest neural model, called the neocognitron, was based on this idea. However, it didn't include a key feature of modern CNNs: weight sharing. A significant advancement was the development of LeNet-5, one of the first fully convolutional networks. It was used by banks to read handwritten numbers on checks. While the basic CNN concept hasn't changed much, today's models have more layers and use better activation functions like ReLU. They benefit from advanced training techniques and powerful hardware, making them more effective for deep learning on large datasets. CNNs have been successfully applied in various fields, such as face recognition, object detection, and image captioning. Complex models like R-CNN, Fast RCNN, and Faster R-CNN have been developed for tasks like object detection in autonomous vehicles and facial recognition

Authors in [1] This research focuses on face recognition systems (FRS) using CNN models. Recent studies reveal FRS vulnerabilities to fake images from social networks like Facebook and Instagram. Image classification relies on feature extraction, such as scaling, thresholding, and contrast enhancement with deep neural networks, improving efficiency and accuracy. This paper emphasizes CNN-based feature extraction for face recognition, summarizing various research techniques. The study utilized the Flickr-Faces-HQ Dataset (FFHQ) and real-time images from devices like mobile cameras. The CNN model, implemented in Google Colab, achieved a 96% accuracy rate in matching faces.

The researchers in [2] Interpersonal violence, like abuse and harassment, often lacks proper evidence for trials. This study introduces a novel approach using a convolutional neural network (CNN) and transfer learning to identify

crimes and recognize criminals from the corneal reflected "Purkinje image" of victims. The research demonstrates that even low-resolution and noisy images can provide valuable information with CNNs. The approach was validated on datasets containing images from various situations, and it achieved a 95.41% accuracy in recognizing criminals from corneal reflection images, potentially aiding in solving crimes with limited photographic evidence.

Authors in [3] Recent advancements in deep learning have improved image pattern recognition, enabling the estimation of emotional states and character traits from facial images. This study aims to predict criminal tendencies from facial images using two deep learning

models: a standard convolutional neural network (CNN) and pre-trained models (VGG-16, VGG-19, InceptionV3). Comparative analysis revealed the superior performance of VGG CNN models in capturing criminal traits. The study's effectiveness was assessed using the National Institute of Standards and Technology (NIST) public database, exclusively utilizing male images.

IV. METHODS

criminal identification technique involves various methods to identify of individuals involved in criminal activities. Fingerprint identification is one of the oldest methods to find identification. Iris or retinal scans these biometric methods

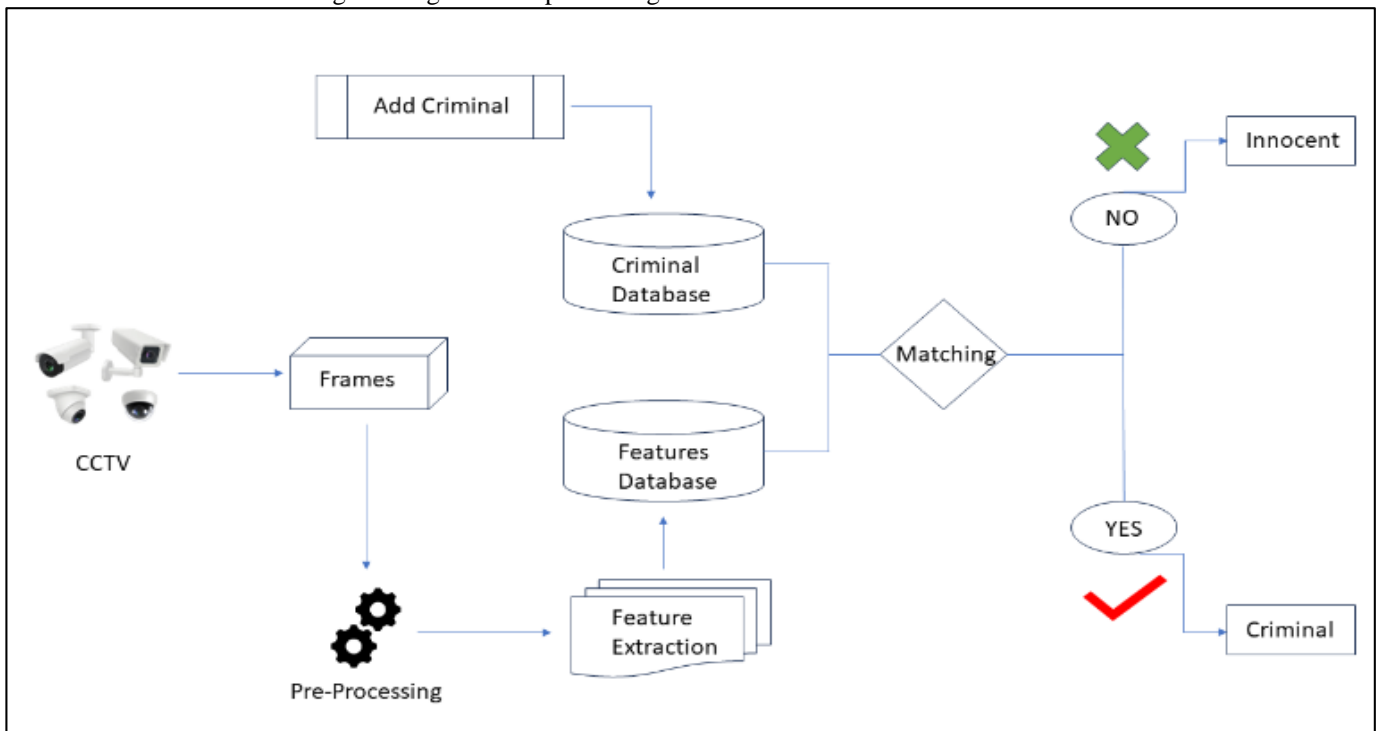


Fig 1.

involve capturing detailed images of iris or retina to establish person's identity. They are used in high security environments like government facilities and secure facilities. Facial recognition is used analyze facial expression and matches them database of known individuals. It is used in public places and airports to identify persons of interest.

V. SYSTEM ARCHITECTURE

The diagram outlines a data processing and classification system utilizing CCTV footage. Here's a more detailed breakdown:

1. CCTV cameras capture data in the form of frames, continuously recording the surroundings for surveillance purposes.
2. The captured data, typically consisting of video frames, undergoes a pre-processing stage. During this phase, various techniques are applied to enhance the quality and usability of the data. This may include

tasks like noise reduction, image stabilization, and frame alignment to ensure consistent and reliable input.

3. The next step involves the extraction of crucial features from the pre-processed data. Feature extraction is a critical process where relevant information, patterns, or objects of interest are identified within the frames. These features might include identifying individuals, objects, movements, or specific actions.
4. The extracted features are then stored in a database for further analysis and reference. This database serves as a repository of valuable information derived from the CCTV footage, making it readily accessible for future investigations or queries.
5. Manual data input complements the automated process. Human operators or administrators can contribute

6. additional information to the system. This data might include specific incident details, individuals of interest, or other contextual information that enhances the system's understanding of the surveillance data.
7. The system combines the automatically extracted features and the manually provided data to perform a comprehensive analysis of the stored information.
8. Classification is a crucial step where the system evaluates the collected data to determine whether it indicates criminal activity. This assessment relies on the extracted features and the context provided, allowing the system to make informed decisions.
9. The classification process results in two categories: one for data indicating potential criminal activity and another for non-criminal data. This segregation helps in identifying suspicious events or individuals within the CCTV footage.

VI. RESULTS

The result of criminal identification can have various outcome depending upon the accuracy and validity of the identification process. The primary result of criminal identification is the identification of suspect who is believed to be involved in a criminal activity. These based on physical evidence, or biometric data such as fingerprint.



Fig. a: Testing Actual and Predicted images



Fig.b Detecting Criminal using image



Fig.c Detecting criminal using video image

VII. CONCLUSION

criminal identification plays a vital role in the functioning of criminal justice system. Its primary objective is to accurately establish the identity of individuals involved in criminal activities. The implemented model is highly

proficient at accurately identifying faces within images. Its capabilities extend across a diverse range of pictures, and it exhibits remarkable resilience in the face of fluctuations in face appearance, orientation, lighting conditions, and various other variables. The advantages of this models is that it can recognize the blurred images and side face that other conventional model cannot recognize. After passing an image, we get a label whether image is criminal or not.

Table I Classification Report of Our CNN Model

-	Precision	Recall	AUC	Accuracy
CNN Model	0.995	0.980	0.996	99.6%
VGG-16	0.980	0.978	0.997	99.5%
VGG-19	0.984	0.985	0.996	99.4%
Inception-V3	0.914	0.904	0.928	91%

Table II Confusion Matrix

Criminal	20	0.1
Non-Criminal	0	5

REFERENCE

- [1] N. Marriwala, C. C. Tripathi, S. Jain, and D. Kumar, in Mobile Radio Communications and 5G Networks Proceedings of second MRCN 2021, Singapore: Springer Nature, 2022
- [2] Mohammad. Reduanul Haque, Rubaiya Hafiz, Alauddin Al Azad, Yeasir Adnan, Sharmin Akter Mishu, Amina Khatun, Mohammad Shorif Uddin "Crime Detection and Criminal Recognition to Intervene in Interpersonal Violence Using Deep Convolutional Neural Network With Transfer Learning" IEEE 2021
- [3] Harsh Verma Siddharth Lotia; Anurag Singh "Convolutional Neural Network Based Criminal Detection" IEEE 2020\
- [4] Qassim, Hussam, Abhishek Verma, and David Feinzimer."Compressed residual-VGG-16 CNN model for big data places image recognition." 2018 IEEE 8th Annual Computing and Communication Workshop and Conference(2018).
- [5] Lee, Chen-Yu, Patrick W. Gallagher, and Zhuowen Tu."Generalizing pooling functions in convolutional neural networks: Mixed, gated, and tree." Artificial intelligenceand statistics. (2016.)
- [6] Szegedy, Christian, et al "Rethinking the inception architecture for computer vision."conference on computer vision and pattern recognition.(2016).
- [7]. Alireza Chevelwalla, Ajay Gurav, Sachin Desai,Prof. Sumitra Sadhukhan, " Criminal Face Recognition System" (2015)