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Deep Learning Model based Criminal Identifications System for Law Enforcement Department

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ABSTRACT :

Criminal record generally contains all the information both personal and criminal with the photograph of the person. In order to recognize Criminal, identification of some sort is required, designated by eyewitnesses. In most cases the resolution or/and quality of the recorded image sections is unsatisfactory and is difficult to recognize the face. Recognition can be achieved in various different ways like DNA, eyes, finger print, etc. One of the ways is face identification. Since facial recognition technology is powered by artificial intelligence, it can provide excellent results in identifying criminals. Even considering that most people, when committing an illicit activity, try to hide their identity: hiding their faces or covering their faces with scarves, masks, etc. In such cases, AI uses deep learning methods to identify the individual. In this project, proposed a CrimeNet an automatic criminal identification system for Police Department to enhance and upgrade the criminal classification into a more effective and efficient approach using Convolutional neural network algorithms. In our proposed methodology, a database is created by storing both full and sliced images of the criminals along with all the personal and criminal details. The captured images of the person get compared with the criminal data Law Enforcement Agencies have in their database. The Yolo v8 involves mapping the face with some facial points, allowing the true identity of the individual to be revealed. Using technology, this idea will add plus point in the current system while bringing criminals spotting to a whole new level by automating tasks. Law enforcement receive alerts when an individual claimed by the authorities is identified by our technology, speeding up their arrest and preventing new crimes. Customize notifications and alarms based on a variety of detection or recognition events and program automated security response workflows and SMS and email notifications.

Keywords: Law Enforcement Agencies, Automated Criminal Identification, Convolutional Neural Network, Facial Recognition, Deep Learning, YOLO v8, CrimeNet .

INTRODUCTION :

This project aims to revolutionize criminal identification and surveillance by utilizing advanced Deep Convolutional Neural Networks (DeepCNN) and the YOLOv8 algorithm for real-time criminal face detection. The CrimeNet Model, developed through this integration, is designed to enhance law enforcement capabilities by providing swift and accurate recognition of suspects both within police stations and in public surveillance systems. The primary goal is to improve the efficiency and precision of criminal identification, minimizing false positives and negatives, while ensuring that law enforcement agencies can quickly and accurately identify potential threats. The scope of the project extends beyond mere identification; it includes the implementation of the system within police stations for enhanced on-premises security, as well as its deployment in external surveillance networks to monitor public spaces for criminal activities. This dual approach ensures comprehensive monitoring and contributes to crime prevention efforts by enabling real-time detection and tracking of individuals with a history of criminal behavior. By automating the identification process and providing real-time updates to criminal records, the system also streamlines investigative procedures, allowing law enforcement to focus resources more effectively on solving and preventing crimes. Ethical considerations are central to the project's design, with a strong emphasis on privacy protection and system security. The system is built to be scalable and adaptable, capable of continuous improvement through regular updates and audits. This ensures that the CrimeNet Model remains a cutting-edge tool for law enforcement, balancing technological advancements with the need for ethical and responsible use in criminal face identification and surveillance.

LITERATURE SURVEY :

Recent advancements in cross-domain person re-identification have addressed several critical issues, though challenges persist. One significant problem is the presence of background noise in domain adaptation, and a lack of correlation between features across domains and within domains [1–3]. To tackle these issues, a Graph-based Local Feature Adaptation (GLFA) framework has been proposed. This method utilizes graph convolutional networks to better adapt and align local features between domains, enhancing the precision of person re-identification. Another challenge is the efficient tracking and re-identification of individuals from short and low-quality video segments. Recent research introduces a regional-LSTM learning model designed to process brief 2-second gait sequences for recognition. This model effectively maps gait features into an embedded space, improving the accuracy of identification

even with limited input data. Additionally, person re-identification methods often struggle with viewpoint changes, pose variations, and background clutter. To address these, a multi-stream refining network has been developed, focusing on salient features across multiple stages to enhance retrieval performance. This model aggregates discriminative features to improve identification accuracy. Moreover, an Adversarial Erasing Attention (AEA) method has been proposed to enhance feature extraction by addressing non-salient parts of pedestrian images. This technique utilizes adversarial erasing to generate diverse training samples, which improves the generalization and effectiveness of person re-identification systems. Lastly, a novel approach using Conditional Translated Networks based on Generative Adversarial Networks (GANs) has been introduced [4–6]. This method simulates human-like viewpoint transfer by translating images to the viewpoint with the largest domain gap before matching, which helps in overcoming discrepancies caused by different camera views [7–10].

III. PROPOSED SYSTEM :

The proposed system aims to revolutionize criminal face identification for law enforcement through the integration of advanced technologies, specifically Deep Convolutional Neural Networks (DeepCNN) and YOLOv8. The project envisions a comprehensive system that addresses the limitations of existing methods and leverages state-of-the-art techniques for enhanced performance.

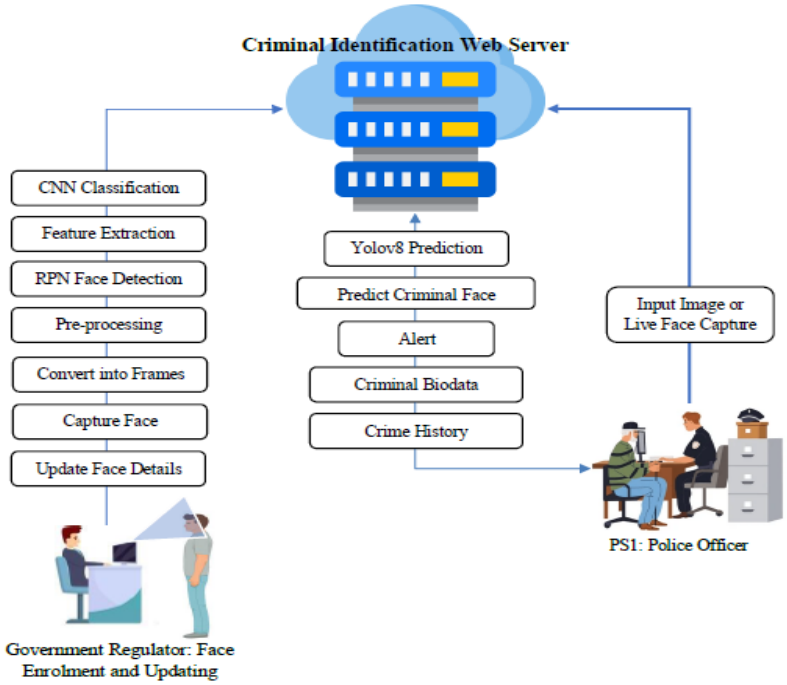

Figure 1: System Architecture of the proposed system

3.1 IMPLEMENTATION

This project is a multifaceted solution, employing state-of-the-art technology to empower law enforcement agencies in the identification, tracking, and real-time monitoring of criminals. At its core is the user-friendly Criminal Identification Web App, a web-based tool developed with Python Flask and Tensor Flow, providing a robust platform for seamless criminal identification. The End User Dashboard serves as the interface for both Web Admin and Law Enforcement Officers. The Web Admin module, responsible for system management and database configuration, operates at the backend. In contrast, Law Enforcement Officers access the frontend, enabling database searches, image uploads, and receipt of identification results. The Crime Net Model, a Deep Convolutional Neural Network (DCNN), is the engine for criminal face classification. The training process involves uploading datasets or live feeds, frame conversion, pre-processing (including RGB to Grey Scale Conversion, Noise Filter, and Binarization), face detection via the Region Proposal Network (RPN), feature extraction using Local Binary Pattern (LBP), and face recognition and classification using a dedicated CNN model, CrimeNet. Once trained, CrimeNet is seamlessly deployed into the Criminal Identification Web App for real-time operations. The Criminal Face Identification module captures video footage of suspected criminals, predicts potential frames with significant facial features, and undergoes pre-processing for image enhancement. Utilizing advanced face detection algorithms like Yolo v8, feature extraction techniques, and the CrimeNet Model for comparison, the system confirms the identity of criminals with a high degree of confidence. The Criminals Crime Record Finder plays a pivotal role in law enforcement by confirming criminal identities and accessing comprehensive criminal histories from the Criminal Database [11]. This module provides invaluable insights into past offenses, arrests, and relevant details crucial for effective decision-making and investigation. The Criminals Surveillance System integrates the CrimeNet Model with public CCTV cameras for real- time facial recognition and monitoring. This includes continuous monitoring of live video streams, integration with the Criminal Database for comprehensive history access, and specific modules for theft and murder detection, missing criminal's identification, and Geographic Information System (GIS) integration for spatial visualization. The Alert Generation and Notification System ensures timely communication with law enforcement officers in critical situations. Alerts are triggered for wanted criminals, missing persons, potential

matches in investigations, known associates, or individuals on watch lists. Each alert provides essential details such as names, photos, criminal history, enabling officers to take swift and informed action. The proposed Criminal Identification and Surveillance System amalgamates cutting-edge technologies into a cohesive framework, empowering law enforcement with efficient tools for criminal identification, surveillance, and proactive crime prevention [12].

RESULTS AND DISCUSSION :

Recent approaches, such as the Graph-based Local Feature Adaptation (GLFA) framework, enhance domain adaptation by correlating semantic features across domains, though complexity in training and reliance on specific models can limit generalizability. Similarly, the regional-LSTM learning model effectively uses short gait sequences for identification, demonstrating high efficiency but potentially limited by the quality of input data. The multi-stream refining network addresses viewpoint and background variations by leveraging salient features across multiple stages, though it is computationally intensive. The Adversarial Erasing Attention (AEA) method improves feature extraction by focusing on non-salient areas, enhancing model generalization.

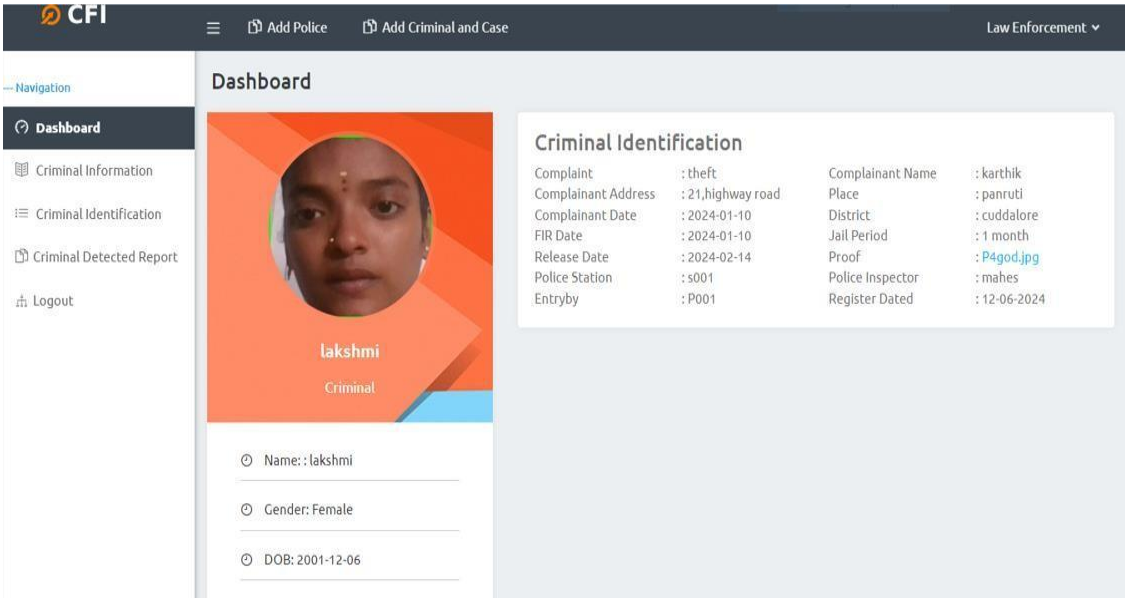

Figure 2: Criminal Case Details

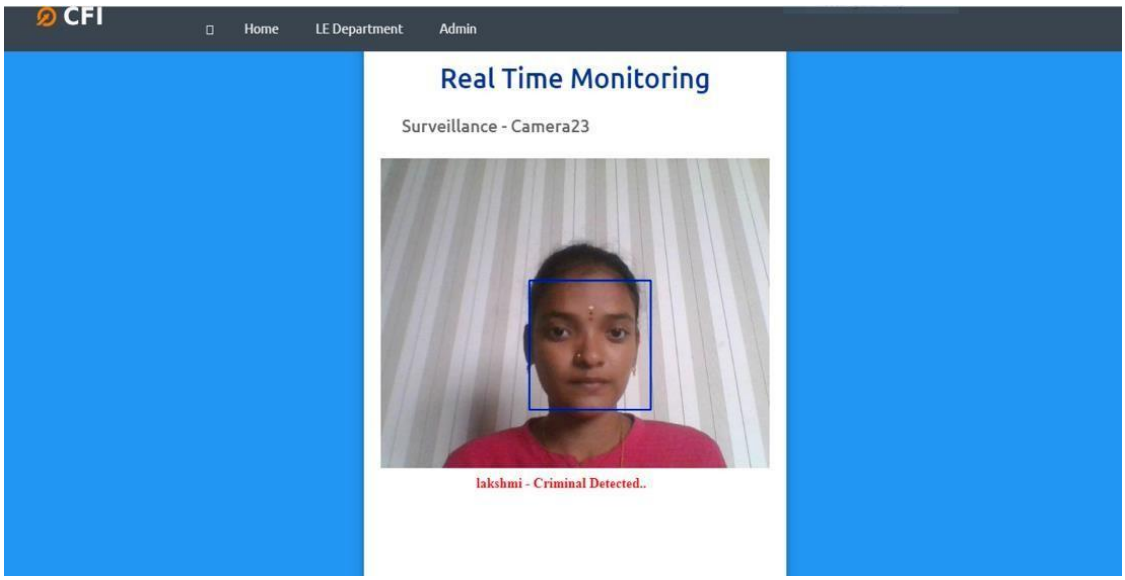

Figure 3 : CrimeNet Model: Build and Train

CONCLUSION :

The integration of the CrimeNet Model, trained through meticulous processes such as dataset collection, preprocessing, face detection, feature extraction, and CNN-based classification, enables swift and accurate identification of potential suspects. The Criminals Crime Record Finder module seamlessly integrates with the Criminal Database, providing law enforcement with historical data on identified individuals.

FUTURE ENHANCEMENT :

Future enhancements to this project can focus on refining its capabilities, improving efficiency, and ensuring ethical use.Multimodal Biometrics,Expand the system to incorporate multimodal biometrics, such as voice recognition and gait analysis,for a more comprehensive identification approach. This can enhance accuracy and mitigate challenges related to variations in facial features.

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