Secure Sight: Real-Time Criminal Identification and Tracking System

Om Bankar[1], Kaushal Chandratre[2], Sahil Badgujar[3], Tanuja Bhalerao[4], Prof. Pranali Shinde[5]

K. K. Wagh Institute of Engineering, Education & Research

Abstract

This project is to develop an advanced criminal identification system leveraging deep learning techniques to enhance the efficiency and accuracy of suspect identification for law enforcement, military, and security forces. Despite the adoption of various technologies, existing systems often struggle with visual data that is limited or of poor quality. To address this, the proposed solution employs a combination of Convolutional Neural Networks (CNN) and the Histogram of Oriented Gradients (HOG) algorithm to analyze key visual features, including facial characteristics. By focusing on improving performance under challenging conditions, this system is designed to be applicable in real-world scenarios. Additionally, the project will investigate the integration of the identification system into existing security frameworks, aiming to create a scalable, reliable tool that can operate in real-time or near-real-time, thereby supporting quick and informed decision-making by authorities.

Keywords: Criminal Identification System, Deep Learning Techniques, Suspect Identification, Law Enforcement, Military and Security Forces, Visual Data Analysis, Poor Quality Data Handling, Convolutional Neural Networks (CNN), Histogram of Oriented Gradients (HOG), Facial Characteristics Analysis

INTRODUCTION

In recent years, identifying criminals and suspects has become a top priority for law enforcement, military, and security agencies. Despite advancements in technology, existing identification systems often face challenges, especially when dealing with visual data of poor quality, such as low-resolution images or unclear footage. To address these issues, this project aims to develop an advanced criminal identification system leveraging deep learning techniques to enhance the efficiency and accuracy of suspect recognition.

The proposed system combines Convolutional Neural Networks (CNN) and Histogram of Oriented Gradients (HOG) algorithms to extract and analyze key visual features, focusing particularly on facial characteristics. By doing so, it aims to improve performance even under challenging conditions like poor lighting or occlusions. This approach not only enhances recognition accuracy but also ensures the system's applicability in real-world scenarios.

Furthermore, the project explores the integration of this identification system into existing security frameworks. The goal is to create a scalable and reliable tool that can operate in real-time or near-real-time, supporting quick and informed decision-making by authorities. With its potential for real-time application, this system could significantly aid in suspect identification and tracking, making it a valuable asset for crime prevention and public safety.

PROBLEM DEFINATION

The problem addressed in this project is the inefficiency and inaccuracy of current criminal identification systems, particularly when dealing with poor-quality or limited visual data. In high-stakes scenarios, such as crime and terrorism prevention, law enforcement agencies require a more reliable and scalable system. By utilizing deep learning techniques like CNNs and HOG algorithms, the project aims to enhance the identification process, enabling effective recognition of suspects even under challenging conditions, ensuring timely and informed decision-making.

LITERATURE SURVEY

1. "Real-time Crowd Monitoring—Estimating Count, Speed and Direction of People Using Hybridized YOLOv4", oval approach to crowd surveillance by integrating a pruned version of YOLOv4 with advanced methods for estimating crowd count, movement speed, and direction. The authors enhance the YOLOv4 model by applying L1-based pruning to improve computational efficiency while maintaining accuracy. The system is trained on the JHU dataset, known for diverse crowd scenarios. This research addresses gaps in existing systems, particularly in estimating movement details beyond just counting, IEEE Access Year of Publish: 2023

2. "The Limo-Powered Crowd Monitoring System: Deep Life Modeling for Dynamic Crowd With Edge-Based Information Cognition ", The paper introduces an edge-based system that improves realtime crowd monitoring using deep life modeling and information cognition, aimed at dynamic and complex environments, IEEE Sensors Journal Year of Publish: 2021.

3. "Development and Deployment of Crowd Monitoring System Using Nodejs and Redis on Infrastructure as a Service Model ", This paper focuses on the development of a scalable crowd monitoring system using Node.js and Redis, leveraging cloud infrastructure for deployment, IEEE Access Year of Publish: 2023.

4."Poster Abstract: Listen and Then Sense: Vibration-based Sports Crowd Monitoring by Pre-training with Public Audio Datasets", Explores using vibration and audio pre-training for sports crowd monitoring, demonstrating a novel method for detecting crowd dynamics, IEEE Year of Publish: 2022.

METHODOLOGY

The methodology for this project involves utilizing a combination of Convolutional Neural Networks (CNN) and the Histogram of Oriented Gradients (HOG) algorithm to enhance criminal identification accuracy. First, facial features are extracted from input images using the HOG algorithm, which detects essential structural elements of the face. Then, CNN models are trained to classify these features by learning patterns specific to criminal suspects. The system is designed to handle poor-quality data and be scalable for real-time or near-real-time integration into law enforcement frameworks. Evaluation will be based on performance metrics like accuracy and processing speed to ensure reliability.

OBJECTIVE

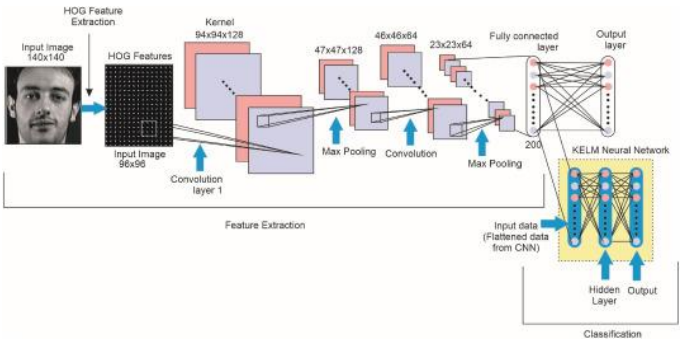
1. To enhance the accuracy of criminal identification using deep learning techniques like CNN and HOG algorithms.

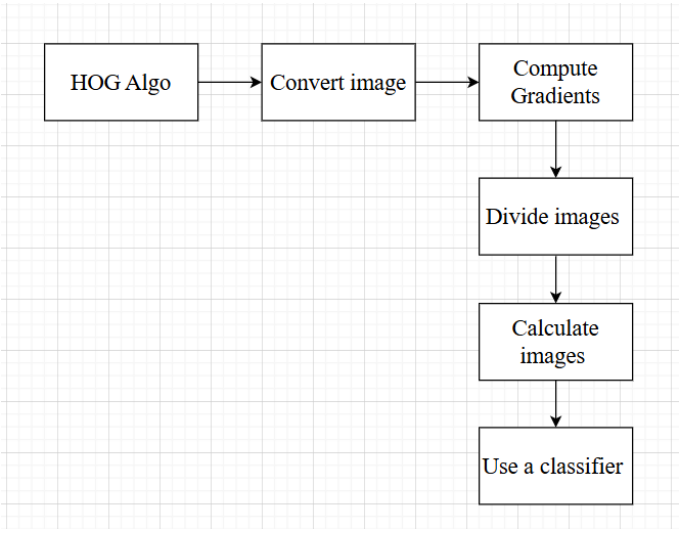
2. To improve the system's performance in identifying suspects from poor-quality or low-resolution visual data.

3. To create a scalable identification system that integrates seamlessly into existing law enforcement frameworks.

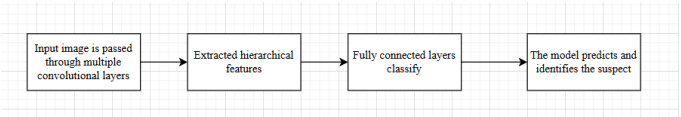
4. To enable real-time or near-real-time suspect identification to support faster decision-making by authorities

HOG Algorithm





CNN Algorithm



Integrating multi-camera support and an efficient tracking system is pivotal in enhancing the effectiveness of criminal identification systems. These features collectively improve the accuracy of suspect identification and enable continuous monitoring across various surveillance points.

Multi-Camera Support

Multi-camera systems are designed to track individuals across different camera feeds, ensuring seamless surveillance coverage. This capability is particularly crucial in environments like public spaces, transportation hubs, and large facilities where a single camera cannot cover all areas.

Tracking System Details

An effective tracking system within a criminal identification framework enables real-time monitoring and historical analysis of individuals' movements. Key components of such a system include:

Real-Time Processing: Utilizing algorithms capable of processing live video feeds to detect and track individuals as they move through different areas. This real-time capability is essential for prompt responses by law enforcement agencies.

Data Integration: Combining data from various sources, such as facial recognition systems, biometric databases, and surveillance footage, to create a comprehensive profile of suspects. This integration aids in accurate identification and tracking over time.

Scalability: The system should efficiently handle data from numerous cameras and high-density areas without compromising performance. Scalability ensures that the system remains effective as surveillance infrastructure expands.

Short clip details

1. Camera Feeds: Multiple cameras capture video streams from different locations.

2. **Pre-processing:** Each video feed undergoes pre-processing, including resizing and normalization, to prepare the data for analysis.

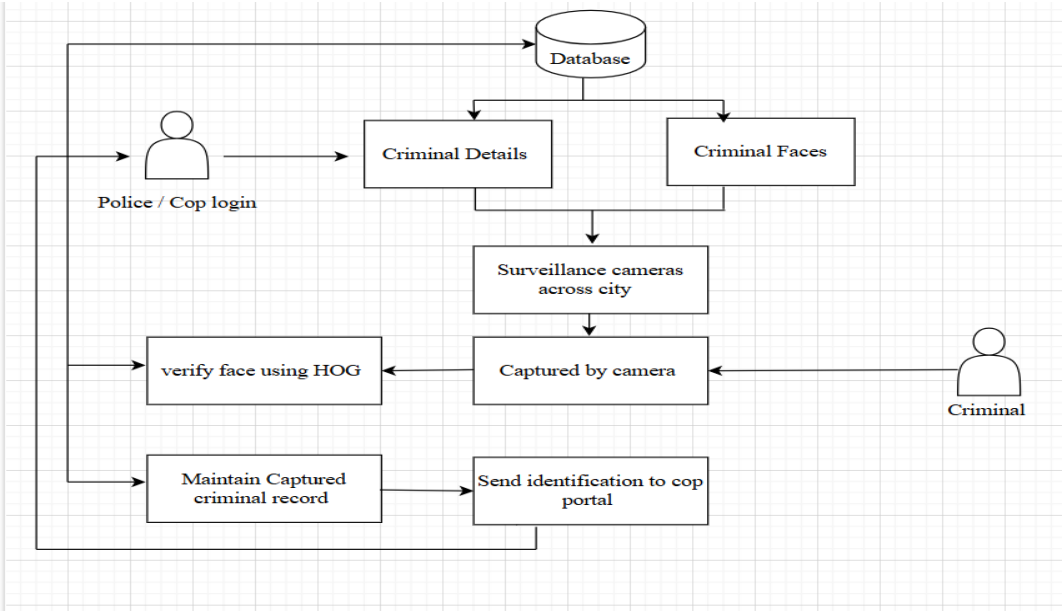
3. Feature Extraction: Techniques such as Convolutional Neural Networks (CNNs) or Histogram of Oriented Gradients (HOG) extract distinctive features from the video frames.

4. Feature Matching and Re-Identification: The system compares extracted features to identify and match individuals across different camera feeds.

5. Tracking across Cameras: Once identified, the system tracks individuals as they move through various camera views, maintaining consistent identification.

6. **Alert Generation and Integration:** If a person of interest is detected, the system generates alerts and integrates with existing security frameworks to facilitate real-time responses.

SYSTEM ARCHITECTURE



FUCTIONAL REQUIREMENTS

1. The system should capture and process facial images from various sources (e.g., surveillance footage).

2. It should extract facial features using the HOG algorithm for initial processing.

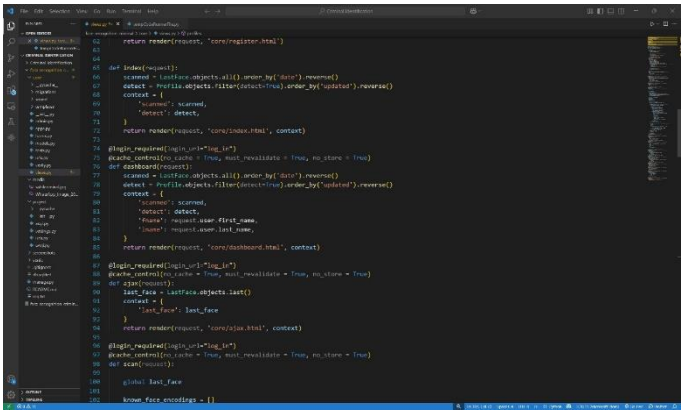
3. The system should classify and identify suspects using a CNN model trained on criminal datasets.

4. It should provide real-time identification and alerts to law enforcement agencies.

NON FUCTIONAL REQUIREMENTS

1. The system should maintain high accuracy even with low-quality input data.
2. It must be scalable to support large datasets and real-time processing.
3. The system should offer a user-friendly interface for easy operation.
4. It must ensure data security and confidentiality, especially when handling sensitive information.

SNAPSHOTS



CONCLUSION

In conclusion, the proposed criminal identification system leverages advanced deep learning techniques to significantly enhance the accuracy and efficiency of suspect recognition, even under challenging conditions such as low-quality visual data. By integrating Convolutional Neural Networks (CNN) with the Histogram of Oriented Gradients (HOG) algorithm, the system is designed to process facial features effectively, offering a reliable tool for law enforcement agencies in real-time scenarios. The project aims not only to address existing gaps in current identification systems but also to provide a scalable solution that can be seamlessly integrated into existing security frameworks. By ensuring high performance and compliance with privacy regulations, this system can facilitate quicker decision-making, ultimately contributing to improved public safety and security.a

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