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AI-DRIVEN SECURITY SOLUTIONS FOR CRIME PREVENTION

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ABSTRACT

This project applies Python to crime detection using image processing and machine learning techniques. Crimes include social disturbances, home intrusions, and gunfire detection. K-means clustering helps identify crime patterns from real-time data, improving response speed. Semi-supervised AI techniques and knowledge discovery from crime records enhance predictive accuracy, supporting faster investigations and better decision-making.

Keywords: Crime Analysis, Investigation, AI, Machine Learning, Clustering, Image Processing.

I. INTRODUCTION

Modern police investigations increasingly rely on artificial intelligence to analyze video and audio from surveillance cameras. These advanced systems are capable of detecting people, vehicles, objects, and suspicious activities in real time. Security contractors configure the software to define restricted zones within the camera's field of view, such as private areas, parking lots, or sections of a building that are off-limits after certain hours.

Rules can be programmed based on time—for instance, areas that should remain unoccupied after business hours. If the AI detects movement in these zones during restricted periods, it immediately sends an alert to authorities or security personnel. This functionality is powered by machine vision, a core component of AI that interprets visual data from cameras.

Machine vision works through a series of algorithms designed to recognize shapes, patterns, and movements. The system compares what it sees with thousands of stored reference images of humans in different postures, angles, and motions. It analyzes whether the observed object moves like a human, shares similar proportions, and has identifiable features such as two arms and two legs.

The AI also evaluates movement speed, body orientation, and whether the object appears upright or horizontal. These assessments help determine whether the object is a person or something else. Ultimately, this technology enables faster, more accurate detection of threats, supporting proactive crime prevention and enhanced public safety.

II. MODELING AND ANALYSIS

Facial recognition technology operates through a series of interconnected processes: face detection, face capture, and face matching. The process begins with face detection, which is a crucial step that involves identifying and locating human faces within digital images or video frames. This step ensures that the system accurately focuses on the facial region for further analysis.

Following detection, the face capture phase takes place. In this stage, the system transforms the visual information of a person's face into a digital format. This is done by extracting and encoding unique facial features and expressions, effectively converting analog facial characteristics into structured digital data.

Finally, the face matching process is conducted to verify identity. This involves comparing the captured digital facial data with existing data to determine whether the two sets of facial features belong to the same individual. Through this systematic approach, facial recognition technology enables accurate identification and verification of individuals based on their facial features.

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Figure 1: Face Recognition

Figure-2: Face Recognition

The detection and tracking of individuals form the core of many current and emerging applications in computer vision. One key approach involves background subtraction, a method designed to identify moving objects under a wide range of environmental conditions. In addition, a secondary system can detect object presence even in front of dynamically changing backgrounds. Once moving objects or individuals are detected, foreground regions are monitored through a tracking system capable of triggering real-time alerts. This system also generates an intelligent surveillance index, allowing stored video to be searched efficiently for notable or suspicious events.

Key Biometric Matching Technology Providers

In May 2018, the U.S. Department of Homeland Security's Science and Technology Directorate released the results of performance evaluations conducted at the Maryland Test Facility (MdTF) in March of the same year. These real-world assessments focused on the capabilities of twelve facial recognition systems, tested in a corridor measuring 2 meters by 2.5 meters. Thales emerged as a leading provider, showcasing its biometric authentication software, LFIS, which delivered outstanding results. The system achieved a facial acquisition rate of 99.44% in under five seconds, significantly higher than the average of 68%. Moreover, it demonstrated a vendor True Identification Rate of 98%—well above the average of 66%—and maintained an error rate of just 1%, compared to the average error rate of 32%.

III. RESULTS AND DISCUSSION

Through extensive experimentation with various network architectures and the fine-tuning of hyperparameters, we achieved an optimal classification accuracy of 98%. Based on these results, we developed a user-friendly front-end interface that allows users to upload a video and initiate real-time classification. As the video plays, the system dynamically updates the detected categories, along with the classification accuracy for each category, every three seconds until the video concludes.

One practical application of this video classifier is its integration with security camera systems for continuous real-time monitoring. Upon detecting any criminal or suspicious behavior, the system can automatically trigger alarms or alert law enforcement authorities.

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Moreover, this system can be trained with domain-specific datasets to recognize different types of activities in various contexts. For instance, when installed in a school environment, the classifier could be tailored to identify incidents of bullying, thereby enhancing safety and providing timely intervention.

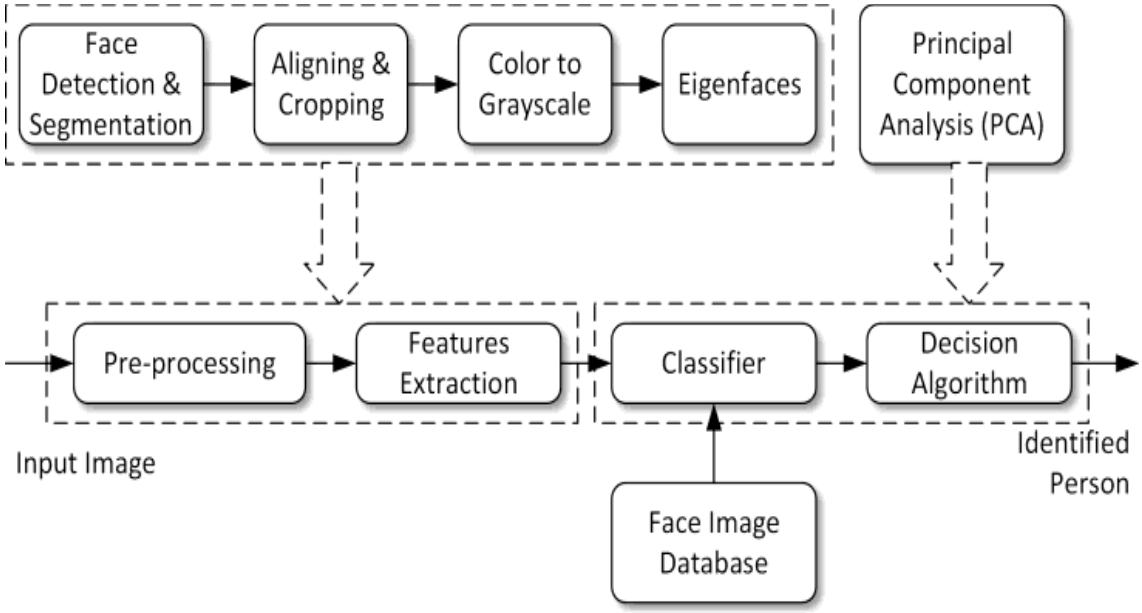

Figure-3: Mapping Diagram

IV. CONCLUSION

While the system performs well, there are several straightforward ways to enhance its accuracy. Techniques like color processing, edge detection, and data augmentation can significantly improve recognition. Collecting more images per person—ideally from varied angles and lighting—or generating new ones from existing data also boosts performance. These improvements can make the system more robust and adaptable to real-world scenarios.

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