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Face Recognition for Missing/Criminal Person Detection and Alerting

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Abstract: Crimes are at rise and becoming difficult for police to identify and rescue the Missing Persons. Our Proposed System will use Face Recognition Algorithms to detect Missing Persons. Face Recognition begins with extracting the coordinates of features such as width of mouth, width of eyes, pupil, and compare the result with the measurements stored in the database and return the closest record (facial metrics). Nowadays, there are a lot of face recognition techniques and algorithms found and developed around the world. Facial recognition becomes an interesting research topic. It is proven by numerous numbers of published papers related with facial recognition including facial feature extraction, facial algorithm improvements, and facial recognition implementations. We will be using advance algorithms like LBPH for our system and also compare to other older algorithms to prove higher accuracy of our system.
Keywords: Facial Recognition, LBPH (Local Binary Pattern Histogram),Haar Cascade Classifier, Criminal Identification System, Missing Person Detection, Face Detection, Real-Time Surveillance, Law Enforcement Technology, Biometric Identification, Human Face Matching.

I. INTRODUCTION

In today's world, the number of criminal activities and missing person cases continues to grow, making it increasingly difficult for police and law enforcement agencies to keep up. Locating missing individuals using traditional methods often takes a lot of time and effort, and sometimes these efforts fall short, especially when information is limited or outdated. To help improve this process, we propose using facial recognition technology to support authorities in identifying and tracking missing people more quickly and accurately.

Facial recognition works by identifying unique features on a person's face—like the distance between the eyes, the width of the mouth, and the shape of the jaw. These measurements are turned into a kind of digital code, which the system then compares to images stored in a database. If the system finds a match, it can quickly point investigators to the most likely identity of the person in question. This makes facial recognition especially useful in urgent cases where time is critical.

Over the years, researchers around the world have developed many facial recognition methods. Some of the earlier techniques include Eigenfaces and Fisherfaces, but more recent ones—like the Local Binary Patterns Histogram (LBPH) have gained attention because of their ability to handle different lighting conditions and facial variations. In our project, we are using the LBPH algorithm as the main method for recognizing faces. It's simple, efficient, and has proven to be reliable in many scenarios.

II. LITERATURE REVIEW

[1] Nurul Azma Abdullah proposed an automated facial recognition system utilizing Principal Component Analysis (PCA) to support criminal identification tasks, especially in scenarios where conventional biometric traits such as fingerprints are unavailable. PCA is a statistical method that transforms high-dimensional data into a lower-dimensional space, preserving the most critical variations within facial images. By projecting faces into a set of orthogonal eigenfaces, the system simplifies feature matching and reduces computational complexity. This approach enables efficient identification of individuals based on key facial landmarks such as eye width, nose bridge, and mouth dimensions. The primary strength of this method lies in its simplicity and speed, making it suitable for constrained environments with limited resources, such as embedded law enforcement systems.

[2] Apoorva and Impana explored the use of Haar-like features and cascade classifiers for robust facial recognition in environments with varying lighting, orientation, and resolution [2]. Their system applies to a sequence of weak classifiers that operate collectively to detect facial regions quickly and accurately. The Haar classifier is well known for its implementation in the Viola-Jones object detection framework, which enables real-time performance by rejecting non-face regions in early stages of classification. This

technique enhances speed and computational efficiency while maintaining good accuracy, especially in surveillance applications. Its robustness to image distortions and occlusions makes it particularly effective for detecting faces in unconstrained environments.

[3] Kavushica Rasanayagam introduced a facial recognition solution that combines deep learning using Convolutional Neural Networks (CNNs) with cloud computing infrastructure to handle large-scale datasets like IMDb [3]. CNNs are capable of learning hierarchical feature representations from raw pixel data, which significantly enhances recognition accuracy. To support scalability, the system is deployed on Amazon Web Services (AWS), enabling on-demand resource allocation and distributed processing. The use of cloud services ensures that high-performance computational resources are available, supporting real-time inference and large dataset processing. This approach demonstrates the potential of integrating AI with cloud technologies to build scalable, accurate, and responsive recognition systems suitable for enterprise and security applications.

[4] Liping Chang proposed a hybrid feature extraction model that combines both deep learning-based and handcrafted features to improve recognition accuracy in complex image environments [4]. The system uses a Stacked Convolutional Autoencoder (SCAE) to learn compact and deep discriminative features. These are further enhanced by incorporating Sparse Representation-based Classification (SRC) and Local Binary Projection (LBP) features, which capture local textures and spatial information. The hybrid approach addresses the limitations of individual methods by leveraging their complementary strengths: deep learning for abstraction and handcrafted methods for robustness in small datasets or noisy conditions. This methodology is particularly effective in scenarios involving occluded or low-resolution facial images, making it ideal for surveillance and forensic applications.

III.EXISTING SYSTEM

Facial recognition technologies have been extensively studied and developed over the past two decades, particularly within academic and experimental environments. Most existing systems rely on traditional machine learning algorithms such as Support Vector Machines (SVM), k-Nearest Neighbors (k-NN), and Eigenfaces for classification and identification tasks. These algorithms function well under controlled conditions but tend to exhibit significant performance limitations when applied to real-world scenarios. Challenges such as variations in lighting, occlusions, head pose, and facial expressions negatively impact recognition accuracy. Moreover, these conventional systems typically lack the ability to learn from new or unseen data dynamically, making them less adaptive to evolving recognition tasks.

The working of traditional facial recognition systems typically involves a sequential pipeline that begins with face detection, followed by feature extraction and matching. Detection is often performed using Haar classifiers or similar approaches, while feature extraction may rely on techniques like Principal Component Analysis (PCA) or Local Binary Patterns (LBP). Finally, a classification algorithm, such as SVM, attempts to match the extracted features with entries in a pre-existing database. This process is computationally intensive and highly sensitive to the quality and diversity of the training data.

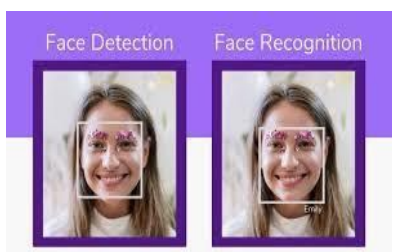

Figure No 1: Working of face detection in existing system

A. Block Diagram / System Architecture

The architectural structure of legacy facial recognition systems typically includes several sequential modules:

- Image Acquisition: Capturing the input image using a digital camera or video frame.
- Preprocessing: Enhancing the input image by normalizing brightness, contrast, and noise levels.
- Face Detection: Identifying and cropping the face region from the input using techniques like Haar cascade classifiers.
- Feature Extraction: Computing unique descriptors of facial attributes using methods such as PCA, LBP, or Gabor filters.
- Classification: Matching the extracted features against a known dataset using algorithms like SVM or distance-based methods.
- Decision Making: Generating the final identity prediction or verification outcome.

This pipeline functions under the assumption of high-quality inputs and stable environmental conditions.

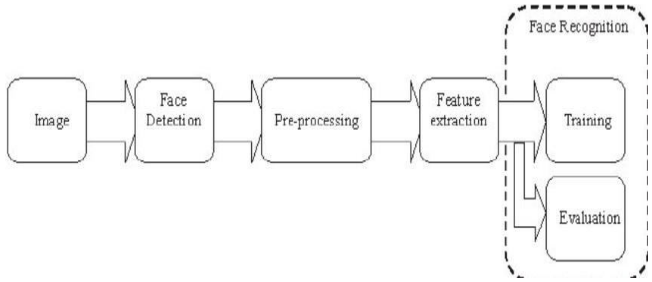

Figure No 2: Block diagram of the existing system

B. Disadvantages of the Existing System

- Inaccuracy
- Data-Dependency
- Rigidity
- Complexity
- Unregulated
- Instability

IV. PROPOSED SYSTEM

The proposed facial recognition system is designed to enhance the accuracy, usability, and applicability of criminal and missing person identification. The system integrates advanced algorithms, specifically the Local Binary Patterns Histogram (LBPH), to improve recognition performance under real-world conditions. Depending on empirical results, alternate algorithms may also be explored and adopted if they demonstrate superior accuracy. The system is implemented within a Graphical User Interface (GUI)-based application to ensure accessibility for users across different technical backgrounds. Through the integration of facial detection, feature extraction, and classification modules, the system aims to provide a comprehensive solution for law enforcement and public safety use cases.

A. Block Diagram / System Architecture

The architecture of the proposed system includes the following key components:

1) Image Acquisition: Captures live images or video streams through a webcam or surveillance camera.
2) Preprocessing: Normalizes the captured images by adjusting contrast, removing noise, and resizing for consistency.
3) Face Detection: Identifies human faces in the frame using Haar cascades or similar detection models.
4) Feature Extraction: Utilizes LBPH to extract unique texture-based features from the detected face region.
5) Recognition & Classification: Matches extracted features against a stored database of known individuals (criminals or missing persons) and classifies the result accordingly.
6) GUI Interface: Presents the recognition output to the user through a user-friendly and interactive interface, allowing for real-time feedback and updates.

B. Advantages

1) User-Friendly: The system includes a graphical user interface, making it simple and intuitive to operate.
2) High Performance: Compared to general neural network models, the system demonstrates faster and more accurate results using optimized algorithms like LBPH.
3) Dual Functionality: Capable of identifying both missing persons and criminal suspects from facial data.
4) Advanced Recognition Algorithm: Incorporates LBPH, which excels in distinguishing fine-grained textures, enhancing facial recognition accuracy.
5) Multi-Angle Recognition: Effectively identify faces captured from different angles, including left and right profiles, improving its utility in dynamic environments.

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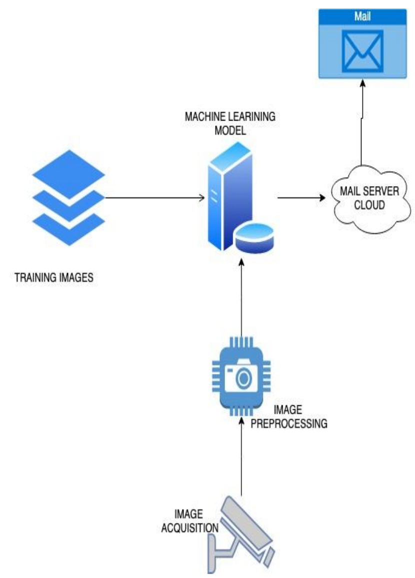

Figure No 3: Block diagram of Proposed System

V. MODEL

To implement effective facial recognition within the proposed system, the Local Binary Pattern Histogram (LBPH) algorithm has been utilized. LBPH is known for its robustness in texture classification and its effectiveness in capturing local facial features. It operates by analyzing the spatial structure of an image at the pixel level, making it particularly suitable for real-world applications where facial orientation, lighting, and expression may vary.

The core idea behind LBPH is to describe the texture of an image by comparing each pixel to its surrounding neighbors. The local neighborhood of a pixel is thresholded, producing a binary pattern that encodes local textures. These binary patterns are then converted into decimal values and aggregated into histograms, which serve as compact and discriminative feature descriptors for facial recognition.

A. Integration with Haar Cascade for Face Detection

In the proposed system, Haar Cascade classifiers are used to detect and locate facial regions within an image before applying the LBPH algorithm. The Haar classifier, based on the Viola-Jones framework, efficiently scans the image at different scales and locations to identify facial features using a cascade of simple classifiers trained on positive and negative face samples. Once a face is detected, the region of interest is passed to the LBPH module for feature extraction and recognition.

B. LBPH Parameters and Their Role

The LBPH algorithm relies on four primary parameters that govern the granularity and sensitivity of the facial feature extraction process:

1) Radius: Defines the radius of the circular neighborhood around each central pixel. This parameter influences how far around each pixel the algorithm should look when constructing the local binary pattern. A typical value is 1.
2) Neighbours: Refers to the number of points sampled in the circular neighborhood. A standard setting is 8. Increasing the number of neighbors can improve accuracy but also raises computational complexity.
3) Grid X (Horizontal Division): Specifies the number of divisions along the horizontal axis of the image. This parameter determines how many histogram segments are created horizontally. A common value is 8, allowing the model to extract more detailed spatial features.
4) Grid Y (Vertical Division): Similar to Grid X, this parameter defines the number of segments in the vertical direction. Typically set to 8, it allows the system to better capture local variations across different vertical sections of the face.
5) The feature vectors resulting from each grid cell are concatenated to form a single descriptor representing the entire face. During recognition, this descriptor is compared with those stored in the database using distance metrics (e.g., Euclidean or Chi-square distance).

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VI.RESULTS

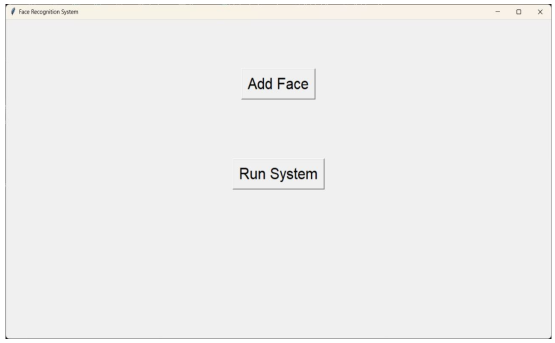

Figure No 4: System options

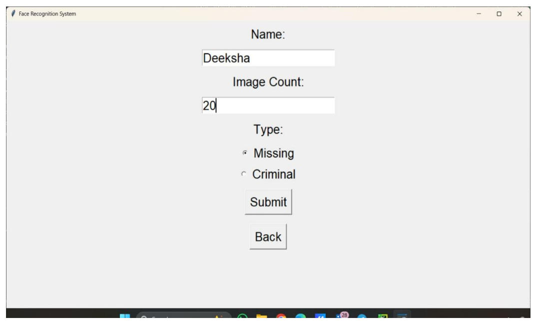

Figure No 5: Adding details of people

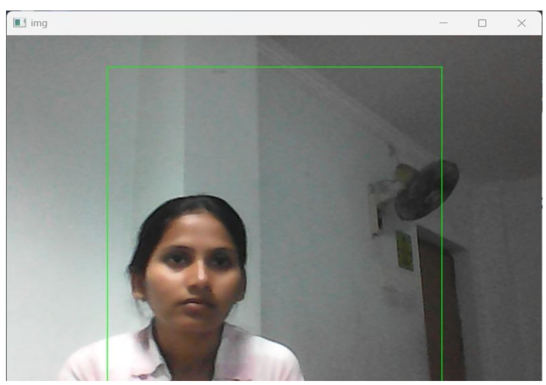

Figure No 6: Adding images of person

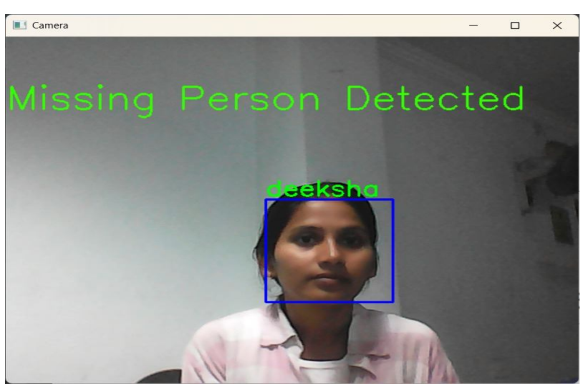

Figure No 7: Detection of missing person

VII. CONCLUSION

We developed a facial recognition system capable of identifying both missing and criminal individuals through real-time image capture using surveillance cameras. Once a match is detected, the system is designed to immediately alert the nearest police station by triggering a siren or notification signal. The core of the system utilizes the Local Binary Pattern Histogram (LBPH) algorithm, which enables accurate recognition even when facial profiles are captured from either side. This enhances the system's robustness in practical scenarios where full frontal facial views may not always be available.

The entire system was implemented, integrated with a notification mechanism, and evaluated across a variety of test cases. The results demonstrated that all key functionalities — including detection, recognition, and alert generation — performed reliably under the given conditions. Based on the successful validation, it can be concluded that such a system holds strong potential for real-world deployment in public spaces, transportation hubs, or other high-security areas. With further refinement and integration into existing law enforcement infrastructure, it could significantly aid in identifying and recovering missing individuals and apprehending wanted suspects.

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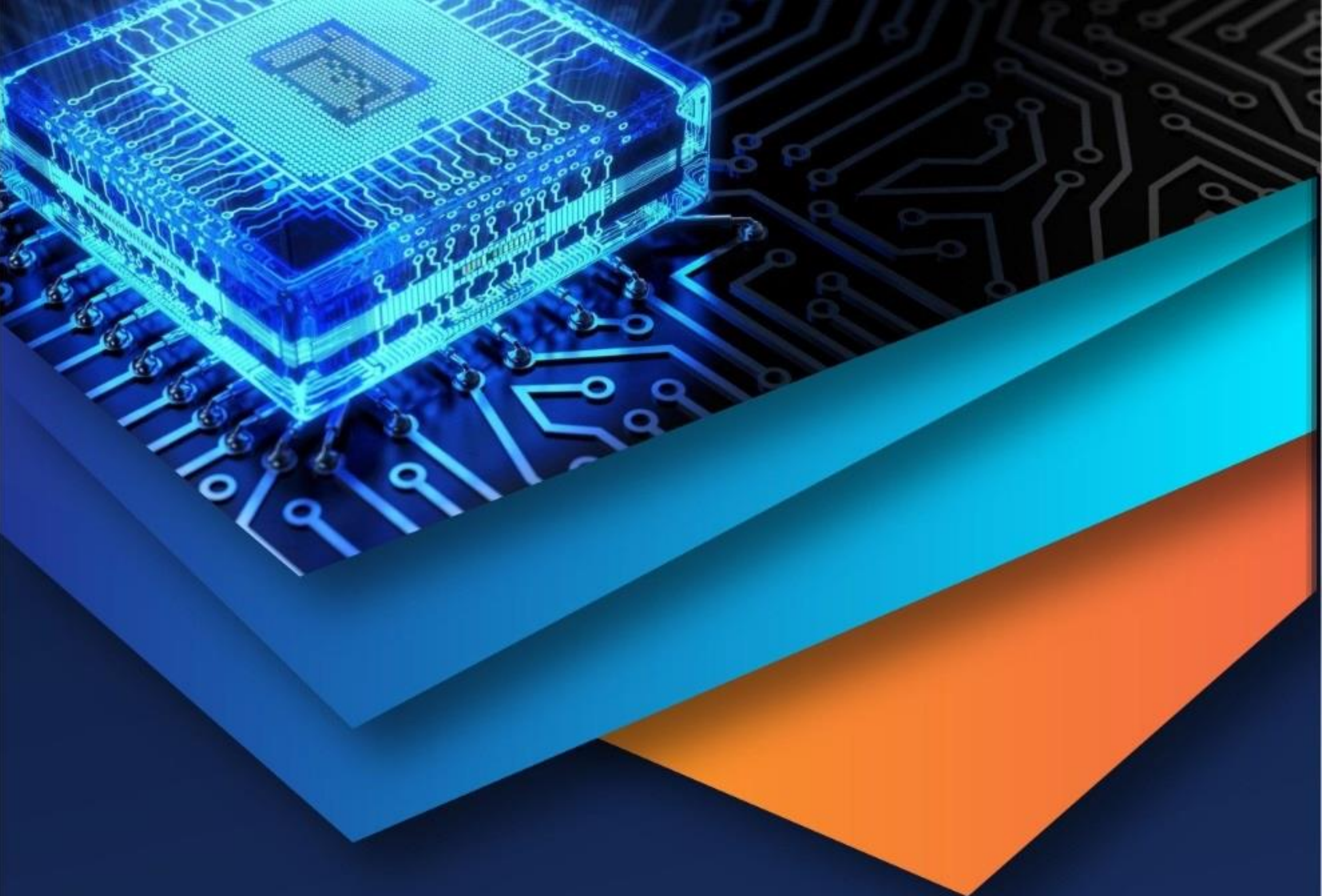

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