

AI-Driven Facial Image Matching Framework for Missing Person Identification and Search Assistance

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Abstract- Finding missing persons is a challenging task that often requires significant time, manual investigation, and coordination between authorities and the public. This paper presents an AI-assisted missing-person identification system that uses face recognition and machine learning to support the search and identification process. The proposed system allows authorized personnel to register missing-person cases by storing details such as name, age, contact information, location, and photographs in a centralized database. The system also provides a user interface through which the public can submit photographs of unidentified or potentially missing persons along with relevant information. The submitted images are processed and compared with the registered missing-person photographs using facial feature matching techniques. When a suitable match is identified, the system provides the corresponding case information and supports notification to the concerned user or authority. The application is implemented using Python, PyQt5, PostgreSQL, and machine learning-based face recognition techniques, providing an integrated platform for case management, image matching, and search assistance. The proposed system aims to reduce manual effort, improve the speed of image-based identification, and support police and public participation in locating missing persons.

Keywords- Missing Person Identification, Face Recognition, Artificial Intelligence, Machine Learning, Image Matching, Facial Feature Extraction, Missing Children, Centralized Database, PyQt5, PostgreSQL

I. INTRODUCTION

Missing-person cases, particularly those involving children, require timely reporting, systematic record management, and effective identification methods. Traditional approaches largely depend on manual reporting, documentation, police investigation, and searching through stored records. These processes can require considerable time, especially when a large number of cases and photographs must be examined. Therefore, the use of artificial intelligence and image-based identification techniques can provide additional support for locating missing individuals.

Face recognition has become an important area of computer vision and machine learning, with deep learning techniques being widely explored for identifying individuals from facial images. Parkhi et al. demonstrated the use of deep convolutional neural networks for face recognition and showed their effectiveness on standard face-recognition benchmarks [1]. Such techniques provide a foundation for applications in

which a newly obtained photograph needs to be compared with previously registered facial images.

In the context of missing-person identification, face recognition can be used to compare photographs submitted by the public with photographs maintained in a missing-person database. Previous work has explored the use of CNN-based feature extraction and classification techniques for missing-child identification, demonstrating the potential of automated facial matching for this application [2]. Other studies have also investigated face-recognition-based systems for identifying lost or missing people, indicating the usefulness of image-based comparison in reducing dependence on completely manual searches [3], [4].

The management of missing-person information is another important aspect of the identification process. Details such as the person's name, age, parent's or guardian's information, contact details, location, and photograph need to be stored in an organized manner so that authorized personnel can retrieve and

update case information efficiently. A centralized database can help bring these details together and provide a structured source for image-based searching and case management.

To address these requirements, this work presents an AI-Assisted Search for Missing Persons system that combines case registration, centralized data storage, image processing, and facial-image comparison. The system allows authorized personnel to register missing-person cases and store the associated personal details and photographs. It also provides a mechanism through which photographs of unidentified or potentially missing individuals can be submitted along with relevant location information. The submitted image can then be compared with registered photographs to identify potential matches.

The proposed system is intended to assist police personnel, authorized users, and the public by reducing the effort involved in manually searching through missing-person records. By integrating image-based matching with structured case information, the system provides a centralized and technology-assisted approach to missing-person identification. The implementation described in this work uses Python-based application components, a database for storing case information, and machine-learning-based facial comparison techniques to support the search process.

II. LITERATURE SURVEY

Research on missing-person identification has increasingly focused on face recognition, deep learning, and image-based matching techniques. The following studies provide the foundation for developing automated systems that can assist authorities in identifying missing individuals from photographs.

1. Deep Face Recognition

Parkhi et al. presented a deep face-recognition approach based on convolutional neural networks (CNNs) for identifying individuals from facial images [1]. The study investigated the use of large-scale image data and deep learning models for unconstrained face recognition. The work demonstrated the importance of learning discriminative facial features for reliable image-based identification.

2. Missing Child Identification Using Face Recognition

Satle et al. proposed a missing-child identification system using face recognition techniques [2]. The system allows photographs of potentially missing children to be submitted and compared with registered photographs in a missing-child database. CNN-based feature extraction using the VGG-Face architecture was combined with an SVM classifier for identification. The study reported a classification performance of 99.41% on a dataset containing 43 child cases, demonstrating the potential of deep-learning-based facial feature extraction for missing-child identification.

3. Robust Face Recognition for Missing Persons

Pate proposed a robust face-recognition system designed to identify and locate missing persons, children, and other individuals using photographs captured through cameras and mobile devices [3]. The study considered variations in facial appearance, lighting conditions, and expressions. It also explored the possibility of generating alerts when a potential match is detected, showing how facial recognition can be integrated with notification mechanisms.

4. Face Recognition for Identifying Lost People

Balar et al. developed an efficient face-recognition system for identifying lost people [4]. The research investigated automated facial comparison as an alternative to conventional approaches that depend heavily on manual searching. The study highlights the usefulness of facial features for matching photographs of lost individuals with available records.

5. LBPH-Based Missing-Person Identification

Muyambo investigated the use of the Local Binary Pattern Histogram (LBPH) algorithm for face recognition in the identification of missing people in Zimbabwe [5]. The work demonstrates the application of traditional facial-feature techniques to missing-person identification and provides an alternative to computationally intensive deep-learning approaches.

6. Face Recognition and Adaptive Thresholding

Research on data-specific adaptive thresholds has addressed the challenge of selecting appropriate decision thresholds in practical face-recognition systems [6]. Although modern deep-learning models can produce discriminative facial features, determining whether two facial representations belong to the same individual remains an important practical consideration.

Adaptive thresholding can therefore be useful when designing systems for real-world image matching.

7. Finding Missing Persons Using AI

Research on AI-based missing-person identification has explored the use of artificial intelligence and face-recognition technologies to support the search for missing individuals [7]. The study discusses the use of facial recognition as a way of automating image comparison and reports the potential of AI-based approaches to improve identification compared with some conventional machine-learning methods.

8. Android-Based Missing Person Finder

An Android-based missing-person finder system was proposed to simplify the reporting and sharing of missing-person complaints [8]. The application allows users to submit complaints and makes the information available through a centralized server. Such systems demonstrate the importance of public participation and mobile accessibility in missing-person search applications.

9. Advanced Facial Representation Methods

SphereFace introduced an angular-margin-based approach for learning discriminative facial representations [9]. The method aims to reduce the distance between facial representations of the same person while increasing the distinction between different individuals. Such representation-learning techniques are relevant to applications requiring reliable facial comparison.

10. Deep Feature Interpolation

Deep Feature Interpolation investigated the manipulation of high-level image characteristics using features extracted from pretrained convolutional networks [10]. Although the study is not specifically designed for missing-person identification, it demonstrates the ability of deep facial and visual features to represent meaningful variations in images, which is relevant to systems that must handle changes in age, expression, and other facial characteristics.

Overall, the reviewed studies indicate that face recognition, machine learning, and centralized information management can provide useful support for missing-person identification. Existing research has explored different approaches, including CNNs, VGG-Face, SVM, KNN, LBPH, PCA, and advanced deep-feature methods [1]–[10]. However, practical missing-person systems also need to consider image-quality variations,

accessibility, organized case management, and the integration of submitted photographs with registered records. These observations provide the basis for developing the proposed AI-assisted search system that combines missing-person case management with image-based facial comparison.

III. SYSTEM ANALYSIS

1. Related Work

The existing system for identifying and locating missing persons mainly depends on manual reporting, documentation, police investigation, and conventional database-based searching. When a person is reported missing, the available personal details and photographs are collected and stored by the concerned authorities. Police personnel or other authorized individuals then use these records to investigate and search for the missing person.

Some existing applications provide web- or mobile-based mechanisms for registering missing-person complaints. The reported information can be uploaded to a server and accessed by authorized users, police personnel, or participating organizations. These applications support information sharing and allow complaints to be maintained digitally, helping different users participate in the search process.

Face detection and face recognition techniques have also been incorporated into existing missing-person identification systems. In these systems, photographs of missing persons are stored in a database, while photographs of unidentified or potentially missing individuals can be submitted for comparison. The submitted photograph is processed and compared with stored photographs using facial features or face encodings.

Several machine-learning and deep-learning approaches have been explored for facial comparison in such systems. CNN-based feature extraction, VGG-Face, SVM, KNN, PCA, and other facial-recognition techniques have been used to identify similarities between facial images. These approaches provide an automated method for comparing an input photograph with photographs maintained in a missing-person database.

Existing systems also support different forms of user participation. Police or authorized personnel can register missing-person cases and maintain their associated

information, while members of the public can contribute photographs or complaint information when they encounter a potentially missing or unidentified person. Some systems additionally provide location information and notification mechanisms when a possible match is identified.

Overall, existing systems combine conventional case management, centralized information storage, mobile or web-based complaint registration, and facial-recognition techniques to support the search and identification of missing persons. These approaches form the technological foundation for the development of an AI-assisted missing-person search system.

2. Proposed Approach

The proposed system presents an AI-Assisted Search for Missing Persons that integrates case registration, centralized data management, image processing, and facial-image comparison into a single platform. The system is designed to support police personnel and authorized users in registering missing-person cases and searching for potential matches using submitted photographs.

The system allows authorized personnel to create a new missing-person case by entering relevant information such as the person's name, parent's or guardian's details, age, contact information, location, and photograph. The collected information is stored in a centralized database, making the case details available for further search and management.

A photograph of an unidentified or potentially missing person can also be submitted through the user interface. The submitted image is processed by the system and compared with photographs associated with registered missing-person cases. Facial features or image representations are used to determine potential similarities between the submitted photograph and stored photographs.

The proposed system uses a classification-based machine-learning approach, with K-Nearest Neighbors (KNN) described in the project as the classification algorithm. KNN compares a new input with existing data based on similarity and assigns the input to the most similar category. In the proposed application, this approach supports the comparison and identification process for submitted facial images.

The system also incorporates PyQt5 for developing the graphical user interface and PostgreSQL for storing and

managing missing-person records. The database maintains the relevant personal information and photographs required for the search process. This combination provides a structured environment for case registration, record management, image submission, and matching.

The proposed system further supports public participation by allowing users to submit photographs of unidentified or potentially missing individuals along with relevant information such as location. When a potential match is identified, the corresponding missing-person information can be displayed to assist authorized personnel in further investigation.

The overall workflow of the proposed system consists of case registration, photograph storage, image submission, facial-image processing, comparison with registered records, potential match identification, and presentation of relevant case information. By integrating these functions into one system, the proposed approach provides an AI-assisted mechanism for supporting the search and identification of missing persons.

IV. SYSTEM DESIGN

System Architecture

Below diagram depicts the whole system architecture.

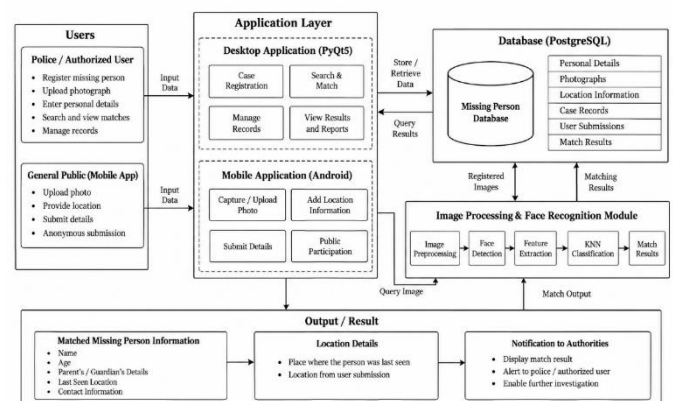


Fig 1. Methodology followed for proposed model

V. SYSTEM IMPLEMENTATION MODULES

1. Data Collection Module

The Data Collection Module gathers information related to missing persons and submitted unidentified-person cases. The collected information includes personal details, contact

information, location, photographs, and other relevant case details. Photographs provided by authorized personnel or users are stored along with the associated case information for further processing.

2. Data Preprocessing Module

The Data Preprocessing Module prepares the submitted photographs for facial analysis. The input image is processed so that the relevant facial information can be used for comparison with photographs stored in the missing-person database. This stage helps provide a suitable input for the subsequent face-matching process.

3. Face Detection and Feature Extraction Module

This module identifies the face present in the input photograph and extracts relevant facial features for comparison. The extracted facial representation is used as the basis for determining similarity between the submitted photograph and registered missing-person photographs.

4. Face Matching and Classification Module

The Face Matching and Classification Module compares the facial information obtained from the submitted image with the registered photographs in the database. The proposed system uses the K-Nearest Neighbors (KNN) classification approach to determine similarity between the input and existing records. The matching process produces a potential matching result when sufficient similarity is identified.

5. Database Management Module

The Database Management Module maintains the centralized records of missing persons and submitted cases. It stores personal information, photographs, location details, case records, and matching status. The system also supports updating and maintaining the stored records when case information changes.

6. Match Result and Notification Module

The Match Result and Notification Module presents the outcome of the image comparison process. When a potential match is identified, the corresponding missing-person information and available location details can be displayed to the authorized user. The result can then support further investigation and communication with the concerned parties.

VI. RESULTS AND DISCUSSION

The proposed AI-Assisted Search for Missing Persons system was implemented to provide an integrated approach for managing missing-person cases and assisting in their identification through facial image comparison. The developed system supports the registration of missing-person details, storage of photographs and related information, submission of photographs by users, and comparison of submitted images with registered case photographs.

During the operation of the system, registered case information is maintained in a centralized database, allowing the stored records and photographs to be accessed during the search process. A user can submit a photograph of a potentially missing or unidentified person, after which the system processes the image and performs facial comparison with the available registered photographs. The matching component uses the implemented facial comparison and KNN-based classification approach to determine whether a suitable match is obtained.

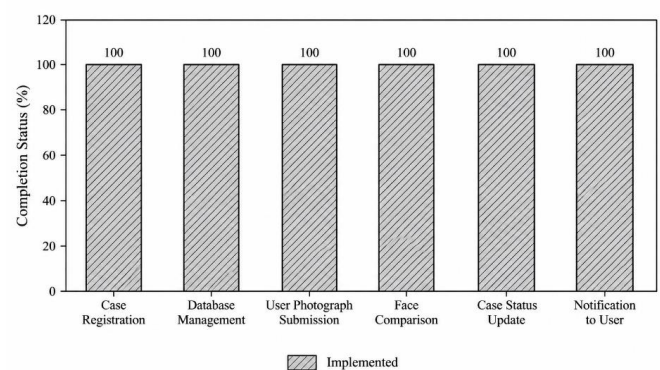


Fig. 2. Functional Verification of the Proposed System

When a matching person is identified, the corresponding case is updated from “Not Found” to “Found.” The system also provides a notification mechanism for communicating the result to the concerned user. If a suitable match is not obtained, the case remains in the “Not Found” state and can be considered for further investigation. This workflow connects image submission, facial matching, case management, and result notification within a single system.

The implementation demonstrates the practical feasibility of using AI-assisted facial matching to support the search for

missing persons. By combining centralized case records with user-submitted photographs, the system provides a more organized image-based search process and can assist authorities and the public in identifying potential matches. However, the available project implementation does not contain sufficient standardized experimental data to report quantitative measures such as accuracy, precision, recall, F1-score, or ROC-AUC. Therefore, the results in this study are discussed primarily in terms of the functional operation of the developed system rather than unsupported numerical performance claims.

VII. CONCLUSION AND FUTURE WORK

The proposed AI-Assisted Search for Missing Persons system provides an integrated approach for registering, managing, and searching for missing-person cases using facial image comparison. The system combines centralized case information, photograph storage, user-submitted images, facial matching, and case-status management within a single application. The developed workflow allows photographs submitted by users to be compared with registered missing-person photographs, and potential matches can be used to update the corresponding case status and support notification. The implementation demonstrates the practical use of artificial intelligence and facial recognition techniques to assist authorities and the public in the search and identification process.

The system can be further enhanced by developing Flask-based APIs to connect its functionality with different client applications and services. A complete web-based application can also be developed to improve accessibility through web browsers. In addition, TensorFlow-based facial recognition and image-processing techniques can be integrated to extend the identification capabilities of the system. These enhancements can help transform the current implementation into a more accessible and scalable platform for missing-person search and identification.

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