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AI-Based Missing Person Identification System

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Abstract. *The swift rise in the number of missing persons globally highlights the acute need for technology-driven solutions to support faster identification and recovery. Traditional search methods often face delays, reduces the chances of safe recovery. In this work, we propose a web-based system that integrates deep learning based facial recognition with advanced computer vision techniques to detect missing individuals. The system employs Media pipe for efficient real-time facial landmark detection and Deep Face for robust facial recognition and feature embedding. Developed on the Streamlit framework, the application enables families, citizens, and authorities to upload photographs, which are then compared against a secure database of reported missing persons. When a match is identified, alerts are sent to stakeholders in real time. Experimental estimation conveys reliable performance across various conditions, establishing this approach as a promising step toward deploying AI-based solutions for social good. The system indicates strong potential to perform faster search operations, enhance collaboration among communities and reduce human error in identification tasks.*

Keywords: Facial recognition, computer vision, missing person detection, AI, surveillance systems, image processing.

Introduction

The missing reports of people really mess things up for families and whole communities, it seems like this is a huge problem that just lingers. I mean, when someone goes missing, it hits hard and leaves everyone searching desperately. The usual ways to find them by putting up posters everywhere or staring at CCTV videos for hours, but it takes longer time and you can easily miss something very important.

Artificial intelligence and machine learning, handles complex tasks easily like spotting patterns or classifying images, even watching surveillance in real time [3], [8]. It seems like these tools could change how we search for missing folks, making it faster and more reliable somehow. This paper talks about building a system that pulls together technologies like MediaPipe and DeepFace into a web setup using Streamlit, so it can automatically spot and report on missing persons.

The idea is to make detection quicker with better accuracy, I think that's the main point. And it's supposed to be something that grows easily, stays secure, and is not too hard for people to use. Real time

alerts would go out, and it lets the public and police work together on it, which might help fill in gaps that regular methods leave. Some parts of this still feel a bit unclear to me, like how exactly the collaboration plays out in practice, but overall it points toward a more efficient way to handle these cases.

2. Literature Review

Table 1: Literature Review

Paper Title	Author(s)	Year	Findings
Finding Missing Person Using Artificial Intelligence	Ponmalar et al.	2022	This study proposes an AI-based system using facial recognition to identify missing individuals, improving search speed and reducing manual effort.
Missing Person Detection Using AI	Dhanush M. et al.	2022	Focuses on using machine learning and AI techniques to automate missing person detection and reduce investigation time.
Tracking Missing Persons Using Facial Recognition	Gupta et al.	2023	Demonstrates the use of facial recognition in surveillance systems to track individuals across multiple camera feeds.
Finding Missing Person using AI	Lahoti et al.	2023	Highlights AI-based identification systems that improve efficiency and accuracy in locating missing persons.
AI-Supported Detection of Missing Persons	Patil et al.	2024	Uses deep learning models to analyze facial features and match individuals from multiple data sources with improved accuracy.
AI-Assisted Missing Person Finder System	Various Authors	2024	Combines machine learning with surveillance systems to enhance search operations and improve real-time identification.
Finding Missing Persons Using AI Techniques	AIP Conference Study	2024	Explores AI-based frameworks that assist in locating missing individuals through automated detection and analysis.
Tracing Missing Person Through Deep Learning	Sattibabu et al.	2024	Implements deep learning models for facial recognition, improving identification accuracy in surveillance environments.
AI-Powered Missing Person Detection System	Nandy et al.	2025	Proposes a real-time AI system using computer vision and neural networks for fast and accurate identification in crowded environments.
Missing Person Identification Using Deep Learning	Recent Study	2025	Uses CNN-based models and real-time video processing to achieve high accuracy (~98%) in identifying missing persons.

3. Proposed System Architecture

The system they propose looks like this modular setup in the figure, and it seems designed to handle a lot of stuff for finding missing people. [1], [3]. It pulls together different parts for processing things, storing data, and identifying individuals, all in a way that can scale up if needed. I think the pipeline idea makes sense here, where each component does its own job but still connects smoothly with the others that modular part is key, because it means you can add or change things without messing up the whole thing. Like, flexibility is built in. By mixing computer vision with database stuff and some smart matching, it automates the identification pretty reliably. Not sure if it covers every edge case, but it feels like a solid base for that process. The architecture just flows through these steps, keeping everything efficient.

A. System Overview

The system works by going through a series of clearly defined steps, such as entering data, finding faces, extracting features, storing data, and matching [2], [10]. At first, users can upload images or frames from CCTV footage to provide input data. Then, the system processes this visual data to find human faces and pull out useful features. To find possible matches, these features are compared to records that have already been stored. The architecture can handle both still images and video streams that keep going, which makes it good for real-world surveillance. The system is also an intelligent platform that not only automates detection but also lets users interact with it by letting the public and authorities add data for identification [8].

B. Core Components

The proposed system consists of the following key components, each designed to perform a specific function within the overall identification pipeline:

1. Data Registration Module:

This module is the starting point of system for gathering and storing information about missing people. It documents important information like name, age, gender, physical description, and last known location. Also, various pictures of the person's face are uploaded to make it easier to recognize them in different situations, like when the lighting, pose, or expression changes. The module makes sure that data is stored safely and in an organized way, which is the basis for accurate identification [1].

2. Face Detection Module:

The face detection module observes and find human faces in images and video frames taken from CCTV footage or uploaded by users. It uses computer vision algorithms to find the difference between the background and the facial areas. This step is very important because it eliminates the information that isn't useful and only looks at the face part of the input. This module is made to work with real-life problems like changing light levels, things getting in the way, and different camera angles using various ML techniques [4].

3. Feature Extraction Module:

This module finds the face and then pulls out unique and distinguishing facial features that can be used to identify someone. To acquire detailed facial landmark points or features which shows the geometry and structure of the face, advanced techniques like MediaPipe Face Mesh are used [4]. These landmarks are

then turned into numerical feature vectors, which make a unique digital version of each person. This step makes sure that faces can be told apart with great accuracy [5], [10].

4. Database Storage:

The structured database stores the extracted feature vectors and the personal information that goes with them. The database is built to make it easy to index, find, and compare data. When data is organized properly, the system can handle huge amount of records without slowing down the process. This part is very important for keeping scalability and allowing real-time identification. That is why, the database is built to make it easy to index, find, and compare data.

5. Matching Module:

The matching module observes the new facial features and compares them to those that are already present in database to find possible matches. The system thinks it's a possible match if the similarity score is higher than a definite level. It uses methods for measuring similarity, like comparing the distance between two feature vectors, to see how closely they match. This automated matching process lessen the time it takes to check things manually and makes everything run more smoothly [10],]13].

6. Alert System

Alert system will be used when there is a detection of a matching through the matching engine. In this instance, an alert will be generated together with the details of the matched person and forwarded to the concerned authorities or individuals. This helps in effective acknowledgement within the shortest time possible [7], [9].

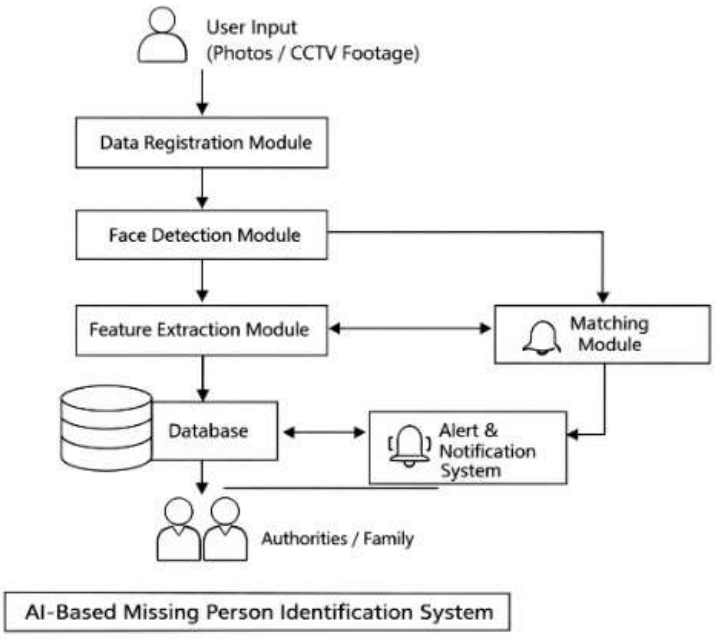

Figure 1: System Architecture

4. Results and Discussion

The AI-driven missing persons identification system proves to be more effective and efficient in comparison to conventional ways of solving such cases [7-8]. First, through automating the processes of image analysis, the system minimizes human intervention and increases efficiency. Secondly, by incorporating face recognition and feature matching technology, the system manages to handle many visual pieces of information in much less time. For that reason, there are higher chances to recognize missing people, mainly in acute circumstances. This system offers a systematic way of approaching such cases which is why it can be applied to practices [10], [13].

A. Performance Analysis

There is a direct comparison between the Traditional method and the Proposed AI System as shown in Table 2 which helps us to find missing persons. The proposed system produces superior accuracy results than standard methods because it operates on feature identification before conducting similarity comparison operations [10], [13].

Table 2: Performance Comparison of Traditional and Proposed System

Variable	Traditional Method	Proposed AI System
Processing Time	High	Low
Manual Effort	High	Slightest
Accuracy	Moderate	High
Scalability	Limited	High
Real-Time Capability	Not Supported	Supported

B. Practical Advantages

Table 3 presents that the system operates on real-time data which enables it to find missing persons right away through its active video monitoring which requires immediate response [10], [6].

Table 3: Practical Advantages of Proposed System

Aspect	Description
Real-Time Processing	Enables immediate identification from live data.
Crowd Participation	Permit public and NGOs to contribute data.
Public Safety	Improves response time and coordination.

C. Limitations

Table 4 highlights the limitations of the proposed system. The evaluation of the system completely depends on the quality of images as poor image quality results in errors through insufficient resolution and distorted visual elements which harm system operation [5], [10].

Table 4: Limitations of Proposed System

Limitation	Interpretation
Image Quality	Low-quality images affect detection accuracy.
Lighting & Angles	Variations can reduce recognition performance.
Scalability Issues	Requires optimization for large-scale data.

5. Conclusion and Future Work

The study has proposed an AI-based missing persons identification system which uses computer vision technology to recognize persons automatically from the images and videos which are recorded by surveillance systems [5], [10]. Such systems makes use of several elements including face detection, feature extraction, database, storage, and match-based on the degree of similarity between faces. Using such a system would help to reduce the time and labor needed to identify a person from surveillance camera data because it replaces the old method of manually analyzing CCTV data. Moreover, these kind of system uses advanced techniques to extract the facial features of a person, thereby helping accurately identify faces from CCTV footage and photographs taken in different environments. The implementation of advanced deep learning techniques would improve performance when dealing with subjects in low light and obscured images. Even though the system is highly effective, room remains for improvement and expansion of the same. Firstly, the system needs to incorporate live CCTV feed that would allow for constant monitoring of the subject matter. The system would benefit from deployment in cloud-based platforms that would allow for easier management of huge amounts of data. The integration of mobile application in the software would ease the process of reporting and uploading images [7], [11]. Lastly, the system should be able to integrate with databases in the country holding information on crimes committed as well as missing persons.

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