AI-Based Missing Person Identification Using Deep Learning and Facial Recognition

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ABSTRACT

Finding people who have gone missing is a very important problem for both the public and police. The usual ways of looking – manually going through lots of pictures and reports – take a long time and aren't usually very good when there are big collections of images and information from the public. This paper describes an AI Missing Person Identification System, which uses deep learning and computer vision to find and pair faces in pictures people put in, with the faces in a database of people reported missing. The system combines face finding, getting the key features of faces, and comparing how alike faces are, all using convolutional neural networks. There is a website which lets people put up photos, put in reports about missing people, and do the automated matching. Testing showed the system is very good at finding matches, even if the light, how the person is turned, or the picture's size isn't ideal. This is a cheap solution, can be increased in size, and is good for organisations and the community to use.

Keywords: Missing person detection, facial recognition, deep learning, computer vision, AI search system, image matching

INTRODUCTION

More and more people are going missing all over the world, and it is vital to identify them quickly, so they can be rescued and investigations can be carried out. At the moment, systems depend a great deal on people checking photos and reports by hand, which doesn't work well with large amounts of data. However, developments in deep learning and facial recognition now allow for automatic identity matching from pictures and video.

This study puts forward an AI platform for finding missing people, which automates finding and comparing similarity, with the help of neural networks which have already been trained. The system cuts down the time taken to search, makes accuracy better, and lets the public get involved using a website.

The things this work adds:

An AI system for automatically matching faces of missing people

A deep learning pipeline for comparing facial embeddings

A website for putting in reports of cases and searching

A database matching structure which can be increased in size

Cheap deployment using open-source tools

Related Work

New studies in face recognition use deep CNN models – such as FaceNet, ResNet and ArcFace – to get the identity embeddings. Police forces use biometric matching, but this often needs costly equipment.

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Because open-source AI models now permit light, very good recognition – good enough for schools and public services – this project is a response to the fact that a lot of the tools available do not have a single system for registering cases, searching, and then finding matches.

METHODOLOGY

System Overview

The system works like this:

Image or video frame goes in Faces are found Faces are straightened and prepared Unique feature numbers are got from each face Comparison with database Scores for how alike faces are Matches are shown on a website

Face Detection

We find faces using a deep-learning finder (MTCNN / YOLO-face / Haar cascade as a backup). The faces found are cut out of the picture and made the same size, so feature numbers can be got.

Feature Extraction

A deep neural network which was trained before (FaceNet / a ResNet50 model) changes each face into a set of numbers – a 'vector' – which shows what makes the face, that person, unique.

Example vector size: 128 – 512 numbers

Similarity Matching

How alike the face in the query and the faces in the database are, is worked out using:

1. Cosine similarity
2. Euclidean distance

If the 'alikeness' score is above a certain level, a possible match is shown.

Database Design

Each record of a missing person has:

Name

Age

Last place they were known to be Many face pictures Feature vectors Case number Having several vectors makes the system better at dealing with faces which are at different angles, or in different light.

Web Application Layer

The system has:

A form to register missing person cases

A way to upload a picture and search Automatic showing of matches A panel for people in charge to check matches The back end is Python + Flask / Streamlit The front end is HTML/CSS Storage is a local DB / SQLite / Cloud DB

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Implementation

Technology Stack

Programming language: Python

Deep Learning: PyTorch / TensorFlow

Face Model: FaceNet / ResNet

Detection: MTCNN / YOLO

Back end: Flask / Streamlit

Database: SQLite / JSON / MongoDB

Processing Flow

User puts in a picture

Face is found and cut out

Unique numbers are created

Compared with numbers stored

List of matches, in order, is shown

Admin can confirm matches

Experimental Evaluation

Dataset

We got a set of face pictures

Many angles for each person

Different light levels

Size: 224x224, made the same

Metrics

How often the system matches correctly

How often the system makes a wrong match

- Embedding Distance Score
- Processing Time per Image

Sample Results (Replace With Your Real Numbers)

Metric	Result
Matching Accuracy	93%
False Positive Rate	4%

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Average Processing Time 0.8 sec

Multi-angle Robustness High

Limitations

- Heavy occlusion reduces accuracy
- Masks and sunglasses affect embeddings
- Aging variation impacts similarity
- Requires good frontal face quality

Future Work

- CCTV live stream integration
- Age progression modeling
- Mobile app version
- Law-enforcement API integration
- Multi-modal biometric matching

CONCLUSION

This paper presented an AI-based missing person identification system using deep learning facial recognition. The system automates detection and matching, reducing manual workload and improving search efficiency. The web-based architecture makes it accessible and scalable. With further dataset expansion and model refinement, this approach can significantly assist search operations and public safety initiatives.

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