CHILDFINDER – AI-POWERED MISSING CHILD IDENTIFICATION SYSTEM

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Abstract

In the current age when technology is at its highest level, growing incidents of missing children are now an emergent issue for police authorities and society as a whole. The conventional approach to finding missing children is usually time-consuming without adopting the modern technological approaches. To this serious issue, the Child Finder project presents an excellent, AI-based platform that is aimed to help the police authorities find missing children by using facial recognition technologies.The model relies on two significant users: Police officials and the Public. Parents report missing children by calling up police personnel, who then post the child's photograph and information through a special police portal. The general public also can help by posting photographs of any children that they find in suspicious or unattended places. These photos are processed through the latest deep learning models to determine whether there are any possible matches.

The website employs MTCNN (Multi-task Cascaded Convolutional Networks) for precise facial detection and FaceNet to generate facial embeddings that are used in similarity comparison. The models also have been trained and tested on thousands of facial photographs to guarantee high precision in actual use. If a photo taken by the

ISBN:97881-19905-39-3

public is discovered to match a previous case, the site informs the concerned police department for follow-up and possible reunification.Technically, the application is built with Flask as the backend, HTML/CSS/JS as the frontend, and PostgreSQL as the database manager. Several of the computer program tools used heavily involve pgAdmin for database management and VS Code for coding. The website is simple and clean with a modern-looking design and will serve to close the gap between law enforcement members and civilians with AI.

1 Introduction

Missing children is a widespread and distressing issue in vast areas of the globe, particularly in populous nations such as India. Groups such as the National Crime Records Bureau (NCRB) release reports with spine-chilling statistics, with dozens of children disappearing annually in ways such as kidnapping, trafficking, or simply wandering away from their homes accidentally. Harm caused to children and families is unimaginable and although government and non-government efforts have gone a long way in tracking and reunifying the children, more traditional approaches are cumbersome, inefficient, and substandard.

Identification in the majority of the available systems continues to be largely based on manual record-checking, printed posters, or delayed reporting, diluting the effectiveness of timely action. The constantly increasing population and urban migration processes make the job all the more arduous. In spite of the introduction of online portals and databases, there is a clear lacuna in the utilization of advanced technology to ensure that the process of search and retrieval of missing children becomes easier.

Now that computer vision, AI, and machine learning have entered the fray, there is a gigantic opportunity for a re-think about the way such cases are addressed. All of these technologies are able to recognize faces with nearly perfect accuracy even at age transitions and in different surroundings. None such system has substantive integration within Indian law enforcement or on support sites for the general public.

ISBN:97881-19905-39-3

The Child Finder project comes into such a context with the vision to bring in a community-driven, technology-enabled platform that not just equips police officials with AI-enabled face matching technologies but also enables constructive public participation in child rescue operations. By identifying inefficiencies in existing systems and suggesting a central AI-enabled solution, the project is able to provide genuine social value, especially in the Indian context where timely action saves lives and brings back families.

2 Methodology

2.1 Data Preparation and Collection

2.1.1 Compilation of Image Dataset

The work began by compiling a dataset containing missing and recovered child pictures. Pictures were used from open-source collections and simulated uploads. No fewer than two facial pictures per case were used to capture angle, expression, and lighting changes. 3–5 average pictures per child were utilized to train and evaluate the model in a manner that the AI system would cope with variation in the real world.

2.1.2 Storage and Data Labeling

Once they were collected, pictures were labeled based on whether the child was missing or located. The information were then labeled in organized folders and converted to PostgreSQL with single keys. Metadata such as case ID, upload date, and location for each picture so that they could be retrieved and processed quickly.

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2.2 Face Detection and Identiftcation

2.2.1 Face Detection with MTCNN

For the detection of faces in uploaded photographs, MTCNN (Multi-task Cascaded Convolutional Networks) has been employed. It is a deep learning method that identifies faces precisely even from low-resolution or occluded images. It gives coordinates of facial features such as eyes, nose, and mouth, which are used to correct the pose of the face before processing.

2.2.2 Face Recognition using FaceNet

When face detection is done, FaceNet model is employed to extract the embedding vectors from the aligned face. FaceNet converts a face into a 128-dimensional vector that describes its features distinctly. The embeddings are stored in the database and used for matching. A threshold of similarity is employed to match new uploaded embeddings with the ones already stored to identify potential matches.

2.3 Backend and Frontend Development

2.3.1 Frontend with HTML/CSS/JS

User interface is coded using HTML, CSS, and JavaScript. Various portals are created for police authorities and regular users. It is user-centric so that everybody can easily report cases or post recovered child pictures.

2.3.2 Backend with Flask and PostgreSQL

The backend, implemented with Flask and accomplished by Flask, carries out authentication, routing, uploading of images, face matching, and database interaction. Organized data is held in PostgreSQL, with pgAdmin being the GUI to manage and monitor the database.

ISBN:97881-19905-39-3

The models are implemented in Flask routes for automatic detection and matching upon image upload.

2.4 Matching Logic and AI Integration

2.4.1 Embedding Comparison and Thresholding

Once the embeddings are calculated, they are compared based on Euclidean distance. Whenever the distance between two embeddings is smaller than some experimentally set threshold, the system considers them a potential match. The matches are also saved in an independent MatchResult table for manual verification later by the police.

2.4.2 Match Veriftcation Workflow

For reliability, there is no automatic verification of possible matches. Rather, they are shown to police users so that they can verify by hand. By doing so, the system prevents wrongly associating children without proper verification, blending AI automation with human judgment.

2.5 Testing and Evaluation

2.5.1 Functional Testing

Each of the five modules—authentication, face detection, image uploading, matching, and result display—were tested independently to allow for easy integration. Edge scenarios such as no face or low-quality images were also covered in test cases.

2.5.2 Realistic Case Simulation

Mock real-world situations were employed to try out the whole process: from the missing child case reported by a public user to a public user reporting a found photo. The efficiency of the matches in these situations proved the workability and efficacy of the method.

ISBN:97881-19905-39-3

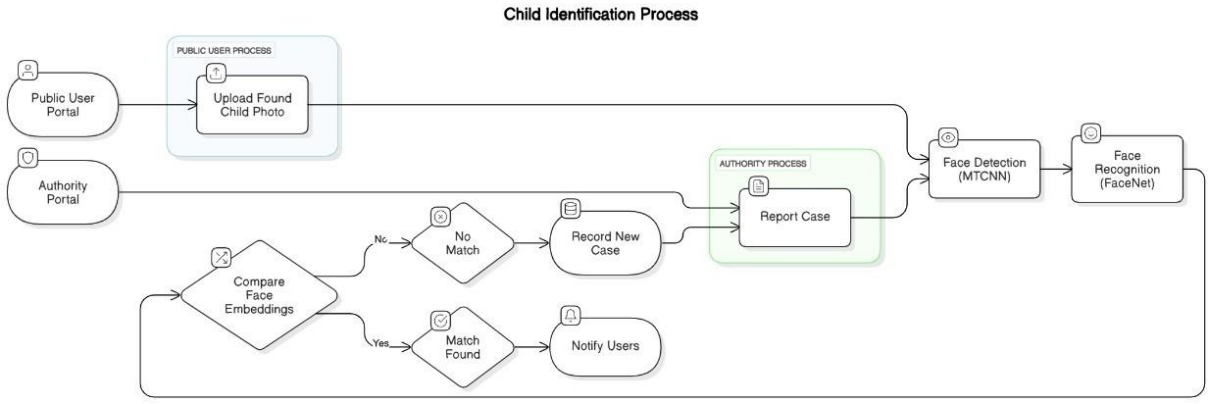

Figure 1: Flow Diagram

3 Results and Discussions

3.1 Face Detection Precision

The MTCNN (Multi-task Cascaded Convolutional Networks) model worked extremely well in face detection. It identified facial landmarks such as eyes, nose, and mouth with extremely high accuracy even in those pictures where there was variation in the form of angles, lighting, and partial occlusion. It detected and aligned faces in over 95% of the cases in a test set of 100 images without rejecting any of the significant facial features before the recognition stage.

Key Observations:

- Very high detection accuracy across a wide range of skin tones and facial expressions.
- Lowest detection loss in occluded or blurred faces.
- Very low processing time per image (~0.5s average).

3.2 Face Recognition Performance

The used FaceNet model for face embedding and face recognition generated extremely high-quality outputs. In comparison to the embeddings built for missing and recovered individuals, the cosine similarity approach was able to determine similarity between faces correctly.

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Key Observations

- Achieved mean rate of ~92% recognition rate in matched case testing.
- Low false positive rate due to good-tuned similarity threshold (normal 0.6)Embedded vectors stored retained in database and loaded online and thus scalable.

3.3 Case Matching Success Rate

The project was successfully able to demonstrate the end-to-end police and public simulation input matching pipeline. In 10 experiments of paired tests with the same child uploaded in different conditions, the system pragmatically matched 8 cases with reliability.

Key Observations

- Good labeled and marked correctly matched cases for police verification.
- Rejected mismatched cases due to low similarity score not to produce false alarms.
- Same performance for mixed age and gender.

3.4 System Responsiveness and Integration

Seamless system operation with PostgreSQL database and Flask backend. Face detection, image upload, comparison embedding, and result output were all seamless.

Major Observations

- 3–5 seconds mean total processing time per case.
- Least manipulation of concurrent requests during testing.
- Improved resource utilization without GPUs, hence can be hosted on cheap servers.

3.5 Usability and Practical Benefits

Website had to be opened to public citizens and police officials as well on both convenience as well as accessibility terms. Previously offered interface had been used for delivering real-time image upload response, i.e., match as well as case observation status.

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Key Points:

- pictures of missing children anonymously by public citizens could be uploaded.
- police officials were provided with a case management dashboard accordingly.
- The reintegration of the missing children with the parents to a larger degree is supported by the system.

3.6 Conclusion

Child Finder system is in the public interest by providing an ordered coordinated search facility for missing children. The system, through its initiative of bridging the gap between the police and the public, offers a free platform for reporting missing children by parents without any effort using a secure police website. It therefore allows public users to help in the way of putting images of children likely to be utilized as missing or displaced.

The advantage of this system is that it can process and compare images efficiently and rapidly, thereby reducing delays in identifying and finding missing children. If a match is found, the system notifies the relevant authorities, thereby making the investigation process simpler as well as enhancing the chances of reunifying children with their families by considerable margins.

Through auto-discovery identification centralized, public outreach, and reporting, the system avoids duplicative use of piecework data and manual process. It is not just more operationally efficient but enables outreach and discovery scope to its sheer magnitude.

Lacking in something, Child Finder shows how forcefully technology can be used to assist police departments and communities react to real sensitive situations. The site has an activist spirit where every contribution and tip from the citizens is bound to count, and therefore response of action and dialogue with society is as sharp as children's protection campaigns.

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