

Missing Person Detector AI-Powered Real-Time Person Detection from Video & Webcam

1. Introduction

Missing person cases require rapid identification, but manual video inspection is slow and error-prone. Our project automates this process using AI-powered real-time video and webcam-based person detection.

2. Problem Statement

2.1 Challenges

- CCTV footage is lengthy and manual checking is inefficient.
- Human error leads to missed detections.
- Real-time identification is nearly impossible with traditional methods.

2.2 Need

An automated, fast, and accurate system that can detect missing persons from video streams and webcam feeds.

3. Proposed Solution

3.1 Overview

- Upload reference images of missing persons.
- Analyze video/webcam frames to detect faces.
- Use Facenet embeddings for fast, reliable face matching.
- Provide real-time detection with bounding boxes.
- Export processed videos with results.

3.2 Technology Stack

- Python
- DeepFace (Facenet model)
- OpenCV
- Streamlit
- Numpy

4. System Architecture

4.1 Workflow

- Reference Image Upload
- Create Face Embedding (DeepFace)
- Extract Frames from Video/Webcam
- Face Detection & Cropping
- Generate Embeddings
- Compare Embeddings (Cosine Similarity)
- Threshold-based Match (>0.7)
- Display & Store Detection Results

5. Embedding Comparison Logic

5.1 Facenet Embeddings

128-dimensional vectors used to represent faces.

5.2 Similarity Metric

Cosine Similarity: $A \cdot B / (||A|| \times ||B||)$

5.3 Threshold

Match if similarity > 0.70.

5.4 Benefits

- Fast and mathematically robust
- Resistant to lighting and angle variations

6. Features Implemented

6.1 Video Detection

- Upload reference image and video
- Automatic frame skipping
- Highlight matched faces
- Export processed video

6.2 Webcam Detection

- Real-time matching
- Live bounding boxes and labels

6.3 UI Design

- Dark/Light themes
- Animated gradients
- Downloadable outputs

7. Performance Optimizations

- Frame skipping (every 2–5 frames)
- Downscaled detection
- Efficient cosine similarity
- Lightweight Facenet model

Result: Up to 70% faster processing without accuracy loss.

8. Challenges and Solutions

8.1 Challenges

- Slow full-frame processing
- False positives in poor lighting
- Multiple faces per frame
- Real-time constraints

8.2 Solutions

- Frame skipping
- High-precision embeddings
- Improved UI & bounding box scaling

9. Future Enhancements

- Multi-person detection
- Central person database
- Notification system (SMS/Email)
- Age progression AI
- Geo-tagged CCTV integration
- Mobile app
- Face tracking & re-identification

10. Conclusion

A fast, accurate, AI-based solution for missing person detection in real-time video and webcam feeds, capable of supporting authorities and saving lives.

11. References

- DeepFace
- Facenet
- OpenCV
- Streamlit