Face ID Authentication System

Using FaceNet and MTCNN for Facial Recognition

by Abdullah Mian

Introduction and Problem Description

Problem Statement:

> Traditional authentication methods are susceptible to security breaches

Challenges:

- Password management issues
- PIN/token theft
- Need for more natural, secure authentication

Solution Approach:

Biometric facial recognition using deep learning

Project Goal:

Create a robust face authentication system with minimal hardware requirements

Dataset Description

Data Collection Method:

- Real-time webcam capture
- Multiple samples per user (5 samples)
- Face images stored in organized directories

Data Processing:

- Face detection using MTCNN
- Storage of facial embeddings rather than raw images
- Dynamic user registration system

Data Structure:

- Organized dictionary of name-to-embedding mappings

Visual:

Show sample face detection with bounding boxes

Algorithm Description

Face Detection:

- MTCNN (Multi-task Cascaded Convolutional Networks)
- Efficient facial landmark detection
- Bounding box prediction

Feature Extraction:

- InceptionResNetV1 pre-trained on VGGFace2
- 512-dimensional face embeddings
- Transfer learning approach

Authentication Process:

- Embedding normalization and comparison
- Cosine similarity for face matching
- Threshold-based authentication (0.6)

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Visual:

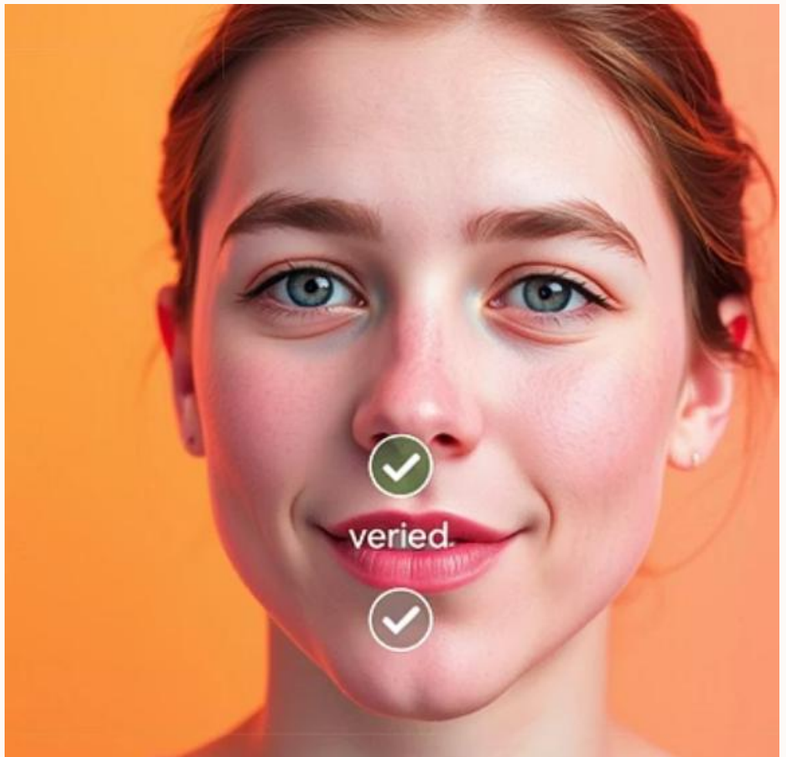
Flow diagram of the recognition process

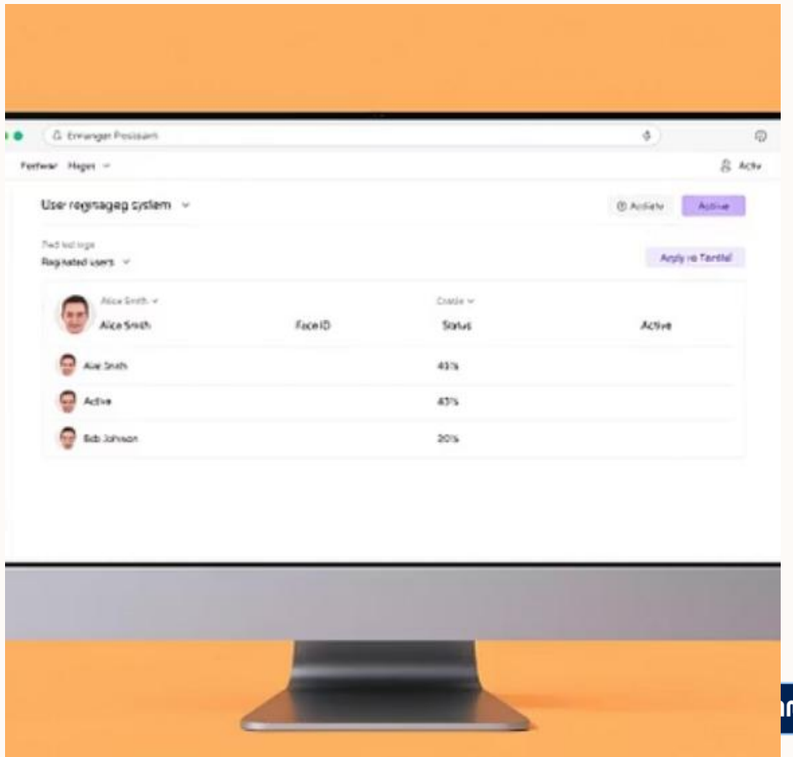
Results System Performance:

- Real-time face detection and verification
- Multiple user registration capability
- Face verification accuracy metrics

Feature Demonstration:

- User registration interface
- Authentication process
- User management system





Analysis

Strengths:

- Transfer learning reduces training requirements
- Multiple sample registration improves accuracy
- Simple interface with minimal setup

Limitations:

- Lighting sensitivity
- Single-face focus
- Fixed threshold may require tuning

Summary and Conclusion

Key Achievements:

- Functional face authentication system
- User-friendly registration process
- Persistent storage of embeddings

Future Improvements:

- Multi-face recognition
- Anti-spoofing measures
- Adaptive thresholding

Conclusion:

> Effective demonstration of modern deep learning for biometric authentication

Visual:

Final system architecture diagram