Face Recognition System Project Report

Overview

This project implements a complete face recognition system using traditional computer vision techniques (HOG features and Haar cascades) with machine learning classification. The system includes data collection, preprocessing, feature extraction, model training, and real-time recognition capabilities.

1. Data Collection Module (data_collection.py)

Purpose: Captures facial images from webcam for training

Functionality: Creates directory structure for storing face data

Parameters: Person name, number of samples (default: 30)

2. Utility Functions (utils.py)

This module provides tools for face detection, feature extraction using HOG descriptors, and basic face recognition capabilities.

3. Preprocessing Module (preprocessing.py)

Purpose: Standardizes all training images

Functionality: Detects faces in all collected images Extracts, aligns, and resizes faces

4. Feature Extraction Module (feature_extraction.py)

Purpose: Extracts features from all preprocessed images

Functionality: Processes all images in the known_faces directory, stores features and labels in a pickle file for training

5. Model Training Module (model_training.py)

Purpose: Trains a classifier on extracted features

Algorithm: Random Forest Classifier with standardization

Features: Uses stratified train-test split (80-20)

Implements cross-validation for accuracy estimation

Saves trained model and label encoder

6. Real-time Recognition Module (realtime_recognition.py)

Purpose: Performs live face recognition using webcam

Functionality: Detects faces in video stream

Displays recognition results with bounding boxes

Areas for Improvement

- Improved Feature Extraction: Implement FaceNet, OpenFace, or DeepFace models for better embeddings

- User Experience: Create a GUI for easier interaction with the system

Conclusion

This face recognition system provides a solid foundation with a complete end-to-end pipeline. While the current implementation uses traditional computer vision approaches, the modular design makes it easy to upgrade components (especially the feature extraction method) with more advanced techniques. With the recommended enhancements, this could be developed into a production-ready face recognition system.