Face Recognition using PCA and ANN

Introduction

This project implements a Face Recognition system using Principal Component Analysis (PCA) and an Artificial Neural Network (ANN), with face detection performed using OpenCV and NumPy. The system detects faces in images, extracts significant features using PCA, and classifies them with an ANN, achieving efficient and accurate recognition.

Methodology

- **Face Detection:** OpenCV is used to detect faces and preprocess images by converting them to grayscale and resizing them to a fixed dimension.

- **Feature Extraction:** PCA reduces the dimensionality of the face dataset, extracting key facial features while retaining important variations.

- **Classification:** A Multi-Layer Perceptron (MLP) classifier is trained on the transformed data to recognize different individuals.

Implementation Details

- **Dataset:** Facial images are stored in a directory structure, each folder representing a different person.

- **Preprocessing:**

    o Convert images to grayscale.

    o Resize images to 300x300 pixels.

    o Flatten images into feature vectors.

- **Training and Testing:**

    o The dataset is split into 75% training and 25% testing.

    o PCA is applied to extract the top 150 eigenfaces.

    o LDA is used for further feature reduction.

- An MLP classifier with two hidden layers (10 neurons each) is trained for classification.

Results and Accuracy

- The ANN model was trained for 1000 iterations.

- The classifier achieved an accuracy of **67%** based on testing results.

- A visualization of the eigenfaces and classified results was generated.

Conclusion

The combination of PCA and ANN proved effective for face recognition. The dimensionality reduction helped in optimizing computational efficiency, and the ANN provided good classification performance. Future improvements can include deeper neural networks and larger datasets for enhanced accuracy.