24AIM111- INTRODUCTION TO DATA STRUCTURE AND ALGORITHMS

23MAT112- MATHEMATICS FOR INTELLIGENT SYSTEMS 2

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FACE RECOGNITION SYSTEM

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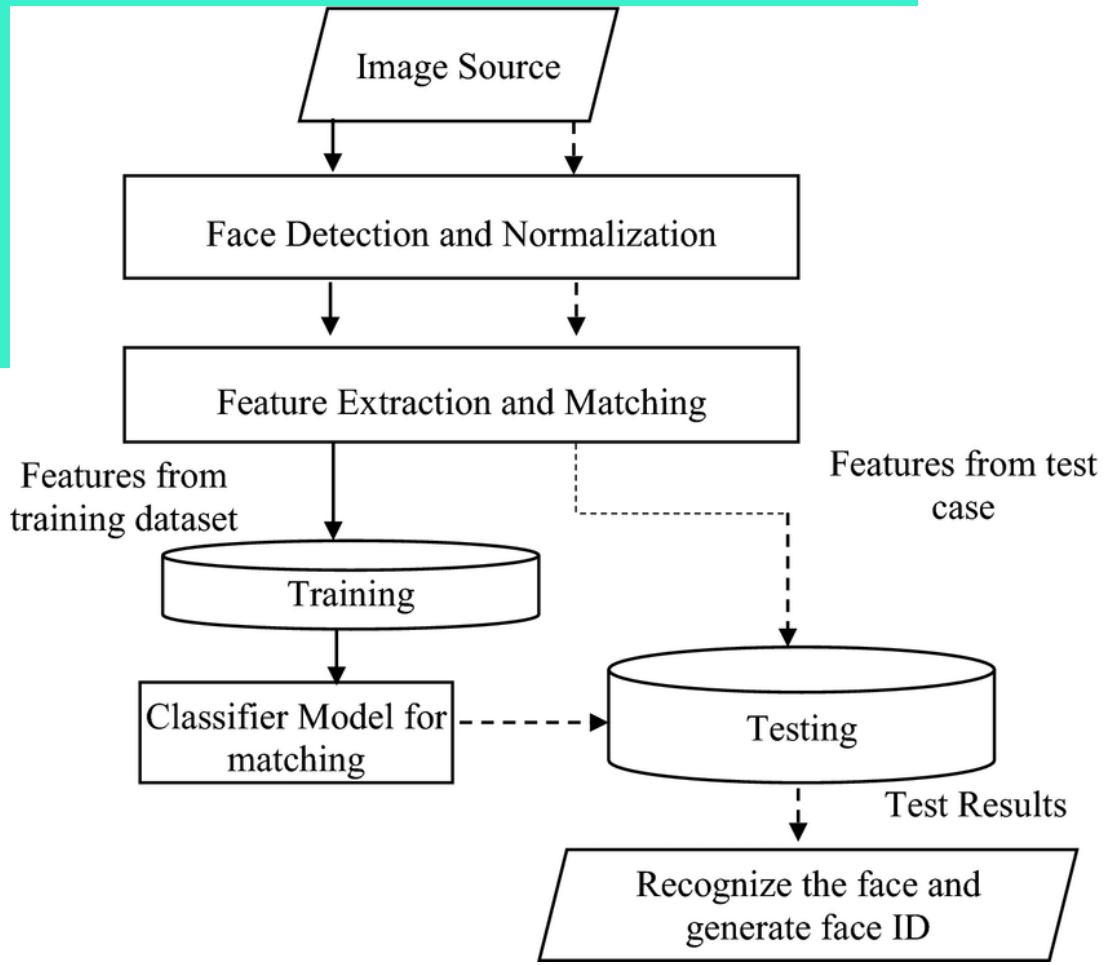
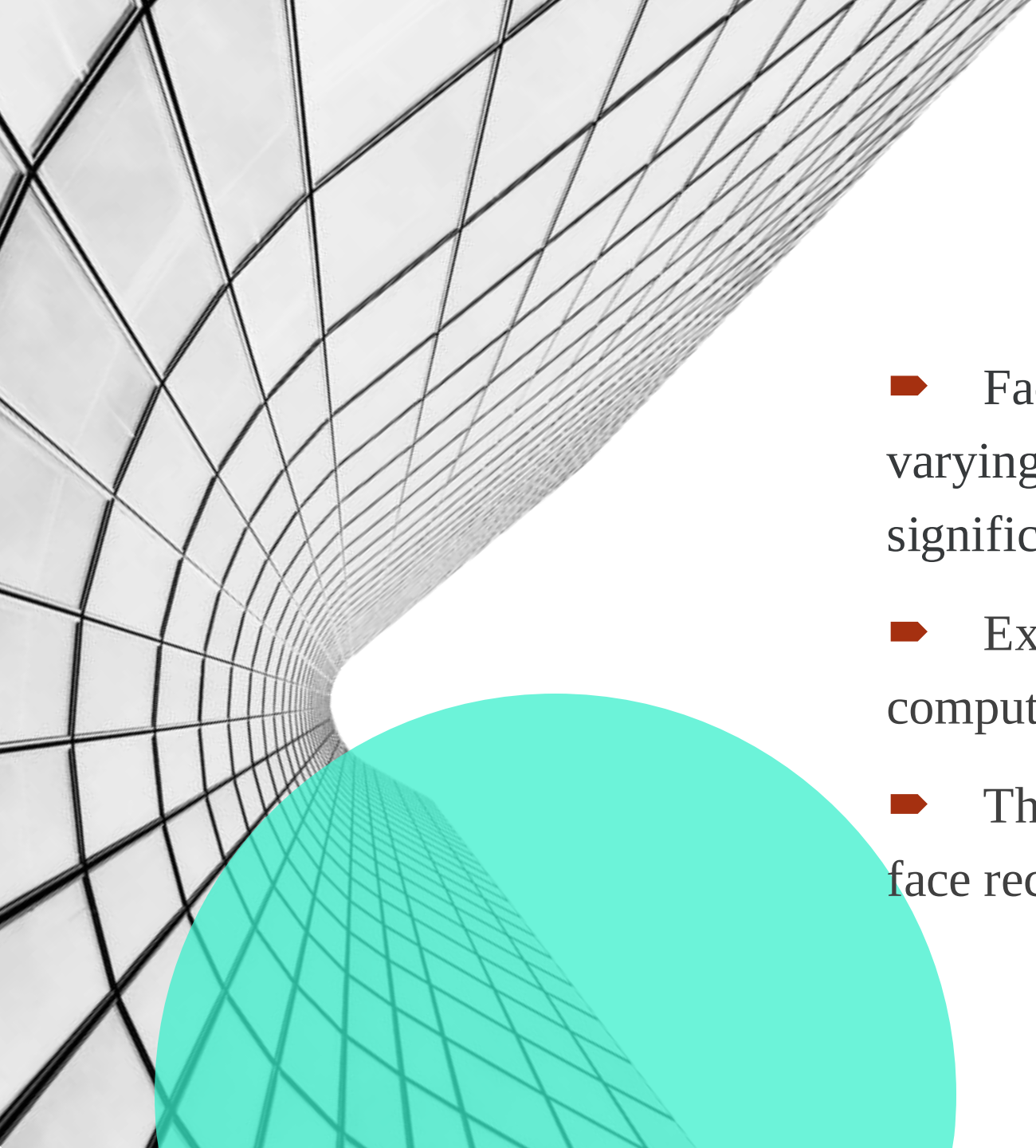
CONTENTS

INTRODUCTION



- Face recognition is a critical technology used in security, surveillance, and social media.
- This project aims to develop a robust face recognition system using two key techniques – PCA and LBP.

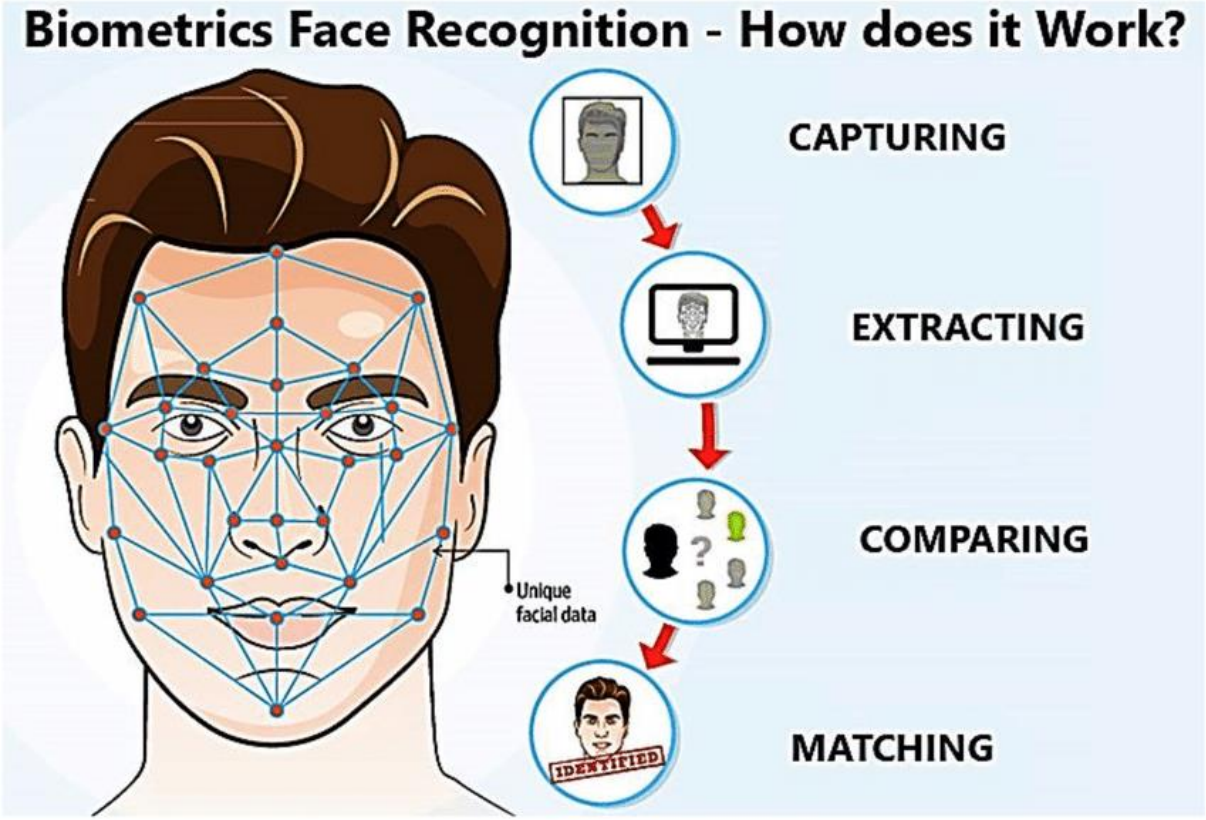


PROBLEM STATEMENT

- Face recognition systems often struggle with varying lighting conditions, which can significantly affect the accuracy of recognition.
- Existing techniques suffer from high computational costs or are limited by accuracy.
- The challenge is to create a fast and accurate face recognition system using PCA.

OBJECTIVES

- Apply PCA to reduce the dimensionality of facial image data while preserving essential features.
- Apply LBP to capture local texture information from facial images, enhancing the system's ability to differentiate between various faces.
- enhance accuracy and computational efficiency in identifying faces from large datasets.



LITERATURE REVIEW

PAPER	METHODOLOGY	KEY FINDINGS	SOURCE
Enhancing Facial Recognition Accuracy through KNN Classification with PCA and LBP	PCA and LBP for feature extraction; KNN for classification.	Combined PCA and LBP improved accuracy significantly, achieving 91% with KNN.	forexjournal.co.in
Real-Time Face Recognition System Using KPCA, LBP, and Support Vector Machine	KPCA and LBP for feature extraction; SVM for classification.	High recognition rates were achieved on Yale and ORL databases, demonstrating the effectiveness of KPCA and SVM.	academia.edu
Local Binary Pattern and Principal Component Analysis for Low-light Face Recognition	Feature extraction using LBP and PCA specifically designed for low-light conditions.	Highlighted the effectiveness of combining LBP and PCA in challenging lighting conditions for face recognition.	ieee.org

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❑ **Arrays and Matrices:**

1. **Image Representation :** Each face image is stored as a 2D array (matrix).
2. **Feature Vectors :** After applying PCA or LBP, features are stored in 1D arrays (feature vectors) for classification.

❑ **Graphs:**

- **Facial Feature Relationships :** Can be used to represent relationships between facial landmarks (e.g., eyes, nose, mouth) as nodes connected by edges.

❑ **FaceList:**

- Used for storing multiple face images for comparison, allowing efficient retrieval during recognition tasks.

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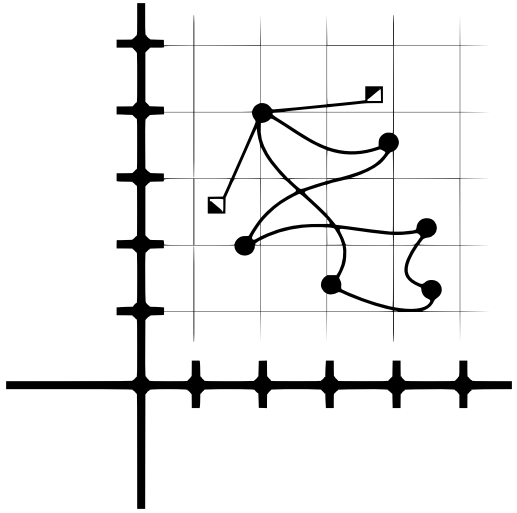
- **Eigenvectors and Eigenvalues:** PCA computes the covariance matrix and finds eigenvectors (principal components).

$$C = \frac{1}{n-1}(X-\mu)^T(X-\mu)$$

- **Local Binary Patterns (LBP):** Extracts the local features from images.

$$LBP(x_c, y_c) = \sum_{p=0}^{P-1} s(g_p - g_c) \cdot 2^p$$

- **Support Vector Machine (SVM):** Classify the extracted features and find the optimal hyperplane that separates classes in the feature space.



RECOGNITION PROCESS

Get Training Data

Preprocessing and Finding the Mean image

- Convert images to grayscale.
- Normalize image sizes.

PCA (Principal Component Analysis)

- Compute the covariance matrix.
- Extract principal components.

LBP (Local Binary Patterns)

- Apply LBP to extract local texture features.

Classification

- Use SVM (Support Vector Machine) to classify the extracted features.

User Interface

- A basic UI that allows users to upload a photo and displays the result.

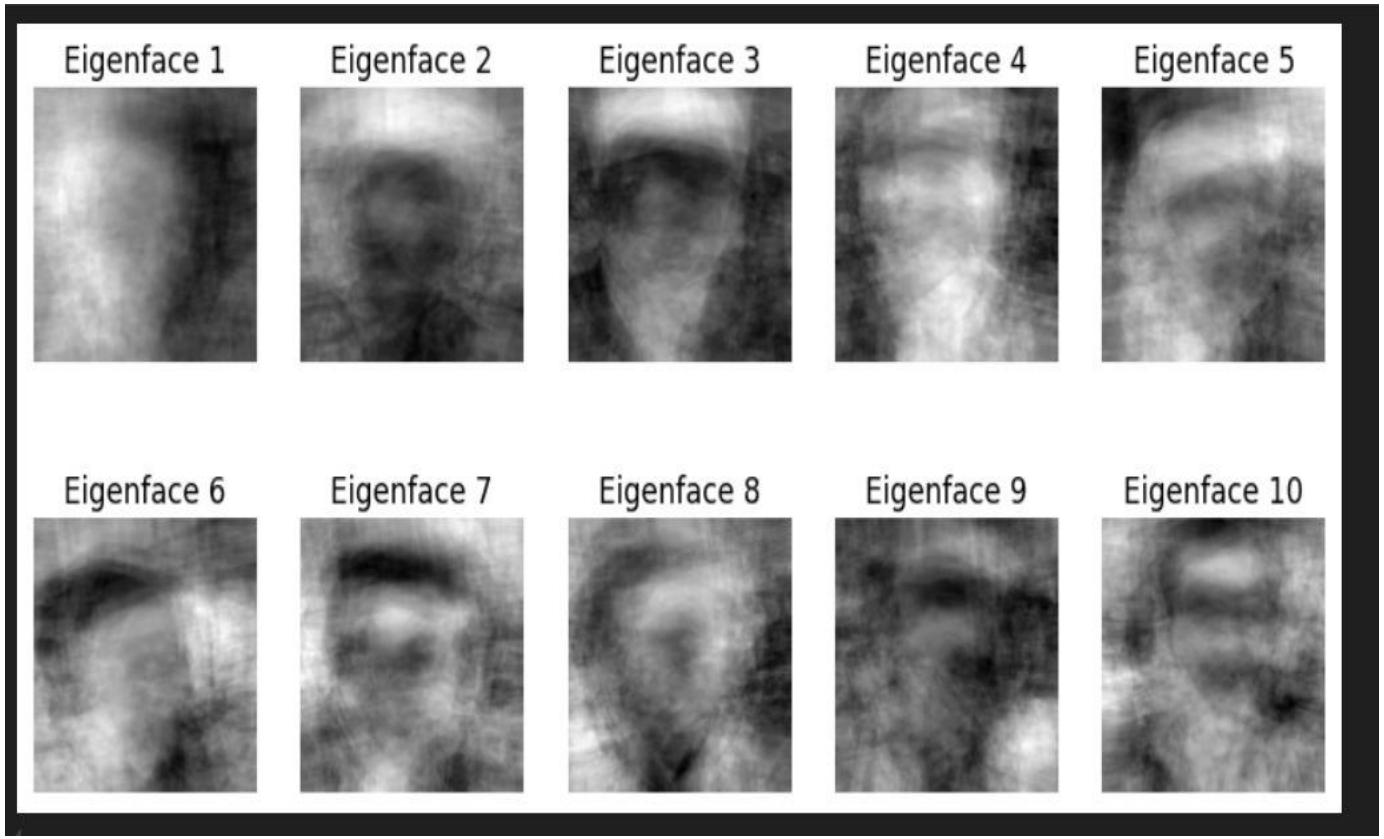
PROGRESS SO FAR

Preprocessing

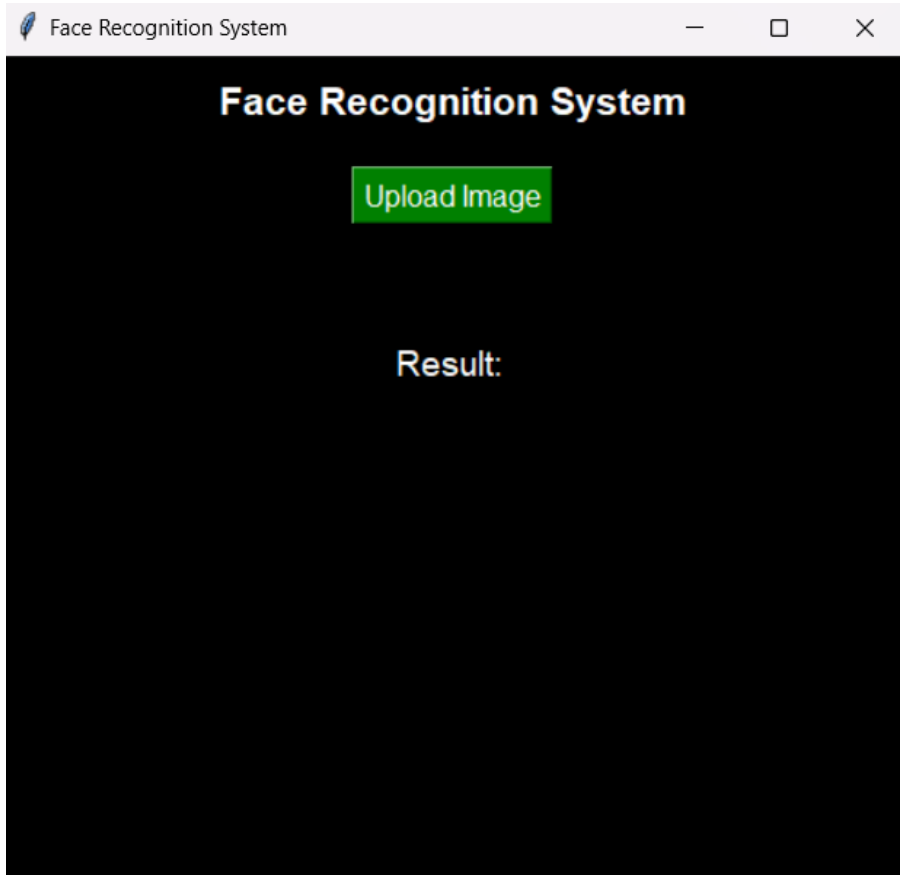
•Collected and organized dataset with 100 images and done preprocessing (grayscale conversion, resizing to 200x200,normalization).

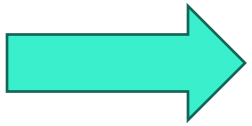
Feature Extraction

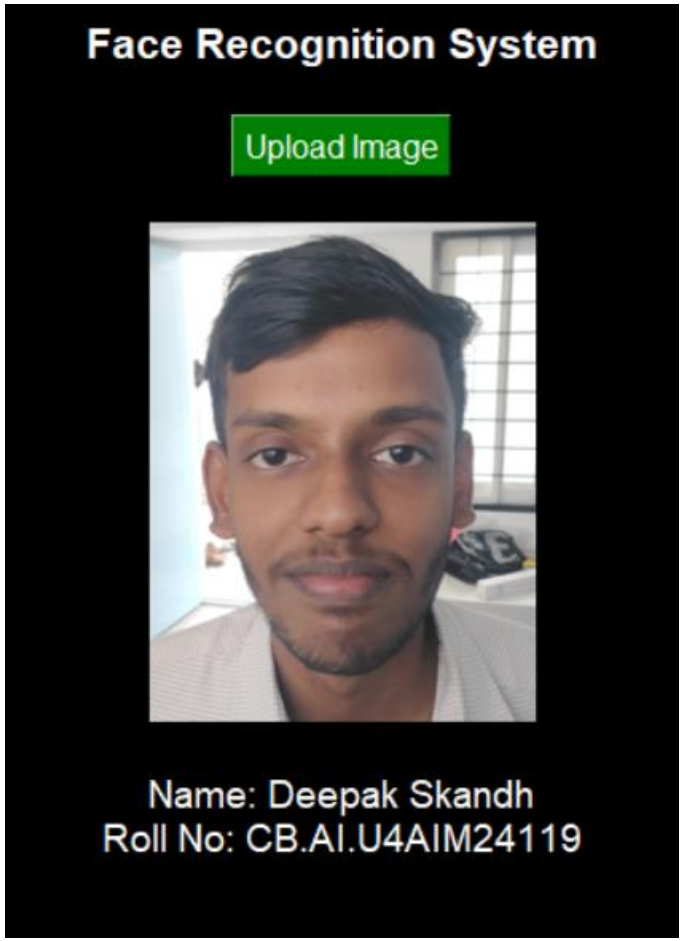
- Implemented PCA (Principal Component Analysis) for dimensionality reduction.



USER INTERFACE







- ✅ **Upload Image** – Opens file dialog to choose an image
- ✅ **Displays Image** – Shows uploaded image in the UI
- ✅ **Displays Name & Roll No**

REFERENCE

- Gaur, Sachin, et al. "Enhancing Facial Recognition Accuracy through KNN Classification with Principal Component Analysis and Local Binary Pattern." International Journal of Electrical and Electronics Research 12.3 (2024): 791-798.
- Firas, A. M., and Mustafa Zuhaer Nayef AL-Dabagh. "Real-Time Face Recognition System Using KPCA, LBP and Support Vector Machine." International Journal of Advanced Engineering Research and Science 4.2 (2017): 237062.
- Masyitoh, Silvia Larasatul, Khakam Ma'ruf, and Rizal Justian Setiawan. "Local Binary Pattern and Principal Component Analysis for Low-light Face Recognition." 2024 11th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI). IEEE, 2024.

THANK YOU