

School of Engineering and Applied Science (SEAS),  
Ahmedabad University

**ECE501: Digital Image Processing**

**Group Name: Humans.exe**

**Project 2: Person Retrieval**

**Team Members:**

- Chaudhari Isha Rajeshkumar - AU2340147
- Chaklasiya Shrey Pareshbhai - AU2340106
- Mangukiya Ramkrishna Anantray - AU2340052
- Vachhani Hitarth Miralbhai - AU2340096

## **I. Introduction**

- **Goal:** Develop a classical person retrieval system capable of identifying and retrieving all images of a person from a database using traditional Digital Image Processing techniques.
- **Our Approach:** A non-machine-learning-based pipeline built purely with mathematical and statistical image operations such as histogram analysis, Local Binary Pattern (LBP), Discrete Cosine Transform (DCT), and Principal Component Analysis (PCA).
- **Current Status:** We have started implementing the full pipeline — including pre-processing, feature extraction, and similarity computation — and have begun testing it on our image dataset.
- **Challenges Faced:** During integration, a few feature extraction and similarity comparison errors were observed, which the team is currently debugging and optimizing.

## II. Objectives

The current objective is to build a working prototype of a classical person retrieval system and ensure accurate face matching across multiple images of the same person under different lighting and expressions. The implementation focuses on:

- Integrating all preprocessing, feature extraction, and similarity modules into a single executable pipeline.
- Debugging existing PCA and similarity computation errors to ensure consistent feature vector dimensions.
- Analyzing the impact of combining multiple features (LBP, DCT, PCA) on overall retrieval accuracy.
- Optimizing computational efficiency and testing scalability with an expanded dataset.

## III. What has been done so far (Progress)

The team has begun coding the classical person retrieval pipeline and successfully implemented the following:

- **Preprocessing:** Conversion of input images to grayscale, resizing, and histogram equalization to normalize lighting and contrast.
- **Feature Extraction:**
  - Local Binary Pattern (LBP) feature generation.
  - Discrete Cosine Transform (DCT) coefficients extraction.
  - PCA implementation for dimensionality reduction.
- **Similarity Computation:** Euclidean and cosine similarity functions have been added for comparing query and database image features.
- **Dataset:** A dataset of 20 images (4 persons  $\times$  5 images each) has been used for testing.

However, some technical issues remain:

- PCA sometimes gives dimension mismatch during feature projection.
- Cosine similarity gives incorrect ranking when normalization is inconsistent.
- LBP results are less discriminative for certain lighting conditions.
- File path and image format inconsistencies cause read errors for a few samples.

## IV. What is planned for next week

- Resolve PCA projection errors and verify feature dimensions for both database and query images.
- Normalize all feature vectors before applying similarity measures to ensure consistent comparison.
- Implement Haar Cascade-based face detection to isolate the face region and reduce background noise.
- Fine-tune the feature extraction parameters (e.g., LBP radius, number of PCA components) for optimal results.
- Test the complete system on additional datasets to evaluate accuracy and robustness.
- Begin work on visualization of retrieval results — showing top matching faces ranked by similarity score.

## References

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