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

ECE501: Digital Image Processing

Group Name: Humans.exe

Project 2: Person Retrieval

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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 preprocessing, 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 × 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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