FACE & GESTURE ANALYSIS
GROUP PROJECT 2

PRINCIPAL COMPONENT ANALYSIS
Project Description

1. Introduction

The objective of this group project is to extract representative facial bases from two types of data: a) facial images (i.e. following the eigenfaces algorithm); b) facial landmarks. The dataset will be selected by the team. The landmark points can come from the dataset owners or can be annotated manually or using landmarking software.

Materials

Each team will be responsible to choose the appropriate dataset to accomplish the project, so that the algorithm can extract 10 "meaningful" bases or principal components. It shall be emphasized that:

1. Being able to extract 10 principal components from a dataset does not necessarily mean that these will be meaningful. The extraction of principal components must follow the process explained in theory (PCA() MATLAB function or any already implemented Python function is not allowed).

2. The interpretation of "meaningful" in this context can be ambiguous. In general, it relates to the criterion used to determine the number of Principal Components to retain. Each team must choose a criterion to validate the 10 extracted bases. This choice must be justified, clearly specifying in what sense these 10 bases are "meaningful"; for example, one possible criterion is to select 10 bases that are statistically significant (with respect to an equivalent random dataset), or to extract the 10 basis that produce the highest score in a face recognition task.

Team work

This project must be carried out in teams. Each team will have at least 2 members. Each team member is expected to understand all the work that the team performs, so that he/she would be able to answer any question about the presented work if requested by the teacher(s). Failure to meet this requirement will result in a sanction that will be applied equally to all team members.

2. Project submission

For a project to be complete, each team must submit the following material strictly before the deadline (28-Jan-2025, 23:59 CET):

- A report describing the work that was done. The report must include
  - A small literature review of related work.
  - A brief description of the eigenfaces algorithm, including (if any) the pre-processing steps that were used.
  - Description and justification of the criterion used to determine meaningfulness of the extracted bases.
  - A representation of the 10 extracted bases in each feature space (for images and for landmarks), explaining (if possible) the interpretation that could be assigned to each of them.

The report will be in **.doc, .rtf or .docx** format (no other format, including pdf, will be accepted) and will be limited to a maximum of 4 pages, including figures, plus up to one additional page for references. All pages will have margins of at least 1.5cm (top, bottom and both sides) and the font will be either Arial or Times New Roman no smaller than 11 pts.

Marks

The project will be marked with the following criteria:

Introduction and justification of the practice	1 pts
Dataset description	1 pts
Explanation of the PCA algorithm	2 pts
Justification of the criterion to determine the meaningful bases	2 pts
Results presentation and interpretation	2 pts
Organization and formatting	1 pts
Originality and critical thinking	1 pts