LAB 4 - FACE RECOGNITION
Project Description

1. Introduction

The objective of this group project is producing an automatic face recognition system that works in Matlab or Python and achieves the specified performance on a test set of 1200 facial images (these images will NOT be provided with the challenge material).

Given an input image, the automatic system is expected to determine if any users specified in the training database is present or not in the image. If he/she is present, the system should return his/her identity; otherwise it should return "-1". The latter includes both the case when there are no faces in the image or when there are faces in the image, but none corresponds to the identities specified in the training database.

Team work

This project must be carried out in teams. Each team will have at least 2 members and at most 3 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.

Materials

There will be two different datasets for this project: 1) the Training Dataset; 2) the Test Dataset. Both these datasets will have 3 types of images:

- Images from 80 people identified by a number, which we will refer to as "users".
- Images from other people, different from the 80 users that we will refer to as "impostors".
- Images without a face.

Training and Test datasets:

- The Training Dataset is composed by 1200 images that will be provided to the students for their own development and evaluation of the recognition system. The performance obtained in this dataset is expected to serve as indicative performance to students themselves but will not be taken into account for the actual evaluation of the system. For each image in this dataset the following information is provided:
    - The bounding box of the face (as in Project 1)
    - The identity of the first face in the image. The "first face" is the one specified by the first bounding box. If this face corresponds to a "user" then the identity

will be a number between 1 and 80. Otherwise (no face or impostors) the identity value will be "-1".

- The Test Dataset is composed by 1200 images that differ from the images in the Training Dataset but were obtained from the same source and following a similar procedure. Therefore, system performance on the Test Database is expected to be similar to -but not exactly the same as- the performance on the Training Database. The Test Database will be used to calculate the final performance of the recognition system for the purpose of evaluation. This database will not be made available to students. Please note that the coordinates of the bounding boxes for the faces in the test dataset will not be available at any time, which implies that the recognition system must contain (internally) a face detection block.

2. Performance specifications

The automatic face recognition system must fulfill the following performance metrics (when evaluated in the Test Database):

- Accuracy: F1-score ≥ 0.20
- Speed: Average processing time ≤ 3 seconds per image
- Implementation: Must execute in MATLAB or Python with no errors or exceptions
- Model size: The maximum size of the code and associated model files must not exceed 80 MB.

- Model depth: The maximum number of layers in deep learning-based models must not exceed 10 layers and 2 submodels.
- Model parameters: The model must contain less than 1 million parameters.

Accuracy

Accuracy will be measured in terms of the F1-score, which is defined as follows:

$$F = \frac{2 \times TruePositives}{2 \times TruePositives + FalseNegatives + FalsePositives}$$

True positives: images where the identity returned by the automatic system matches the actual identity in the input image.

False positives: images where the automatic system returns an identity that is different from the one present in the input image.

False negatives: images where the automatic system returns "-1" (no user found) while the input image contains the face of one of the 80 users.

A MATLAB/Python function to compute the recognition score as indicated above is provided in CHALL_AGC_ComputeRecognScores

Speed

The evaluation of the recognition system on the whole Test Database cannot take more than <u>one hour</u>. Therefore, the average processing time must not exceed 60 minutes / 1200 images, i.e. 3 seconds per image.

Implementation

Since students will not have access to the Test Database, the recognition system will be evaluated by the teachers. Therefore, the following must be fulfilled:

- The system must run in MATLAB or Python, accepting an image and a model as the only input arguments and returning a positive integer representing an identity (or -1 for no-user found). An indicative script to use as starting point is provided in CHALL_AGC_FRbasicScript
- For the current edition of the Recognition Challenge, if there are more than 2 faces in a given image, only the 2 biggest ones will be considered. If any of these matches one of the users in the database, his/her identity must be returned. There are no images with more than one user in them. Only a single identity value must be returned for each image.
- Any external source that is not part of the standard MATLAB or Python installation, will need to be appropriately referenced with clear indications for any required installation for the detection system to run. If the team intends to use external non-MATLAB or Python sources, it is strongly advised to ask the teacher(s) about it.
- All the code, models and any associated library must be submitted through Aula Global as a unique submission that does not exceed the maximum allowed size of 80 MB.

3. Project submission

For a project to be complete, each team must submit the following material strictly before the deadline (20-Feb-2024 23:59h):

- The recognition system (Matlab or Python code, fulfilling the instructions from the previous section).

Only one submission per team will be accepted (e.g. there will be no preliminary evaluation on the Test Database). Teams are advised to ensure that their performance results on the Training Database are sufficiently above the minimum requirements to guarantee a successful evaluation.

The project will be marked considering that it fulfills the minimum requirements, higher performance will be awarded higher marks. If minimum requirements are not met, the project will be marked 'F' regardless of the other elements in the list.