Assignment 4: Deep Face Recognition
Deadline: 21/06/2023

In this assignment, you will implement a "closed-world" face recognition system based on **deep learning.** Your goal is to **deepify** as much as possible the work you have done in **Assignment 2.**
If possible, use the same test video and identities used in the assignment 2. If for some reason, you cannot use the same set of identities, you may change the dataset you have.
You will **produce a video** of persons moving in the lab. At each frame, close to the detected faces, you will show labels with the names of the recognized persons. For instance:

Here some hint on how you may solve the problem:

a. Search for a **pretrained deep learning-based method to detect faces** in images (you may want to search for Yolo Faces, but other models are available).
b. As in the previous assignment, you need to **build a dataset of cropped faces** of the 4 identities you want to recognize. I suggest collecting long videos of the persons in your gallery, since they are needed to train your model. You can collect the data for the training set with any camera, just guarantee to see the face under varying conditions (pose and, possibly, illumination and background). *Depending on the method you decide to implement, you may also use images in other face datasets and background image crops as negative samples (if you want to add the class unknown). This is up to you.*
c. You will have to **design your model to recognize identities** in each image. You are free to decide if training a Siamese network and then use KNN to classify the identities, or directly implement a classification network. *You could also mix the two approaches (Siamese + classification head).* You are free to decide if using some strategy to pretrain the network's weights (for instance autoencoders or train on a classification dataset first). If you wish, you can also use a pre-trained backbone.
d. Very likely, you will need some data augmentation technique (rotate images at random, shift, change contrast, add noise… search in Keras documentation!).

A part for the (non-annotated) test video, **the set of (annotated) collected faces (just the crop) must be split into 3 sets:** 1) training set to learn the models; 2) validation set for model selection purposes; 3) an additional test set to compute some performance.

Expected Results:
You will have to **prepare a Jupiter notebook** to solve the problem. The code must be properly commented, and implementation details clearly stated.
It is mandatory to include, in the proposed solution, **an analysis of the achieved results** on the test set (cropped faces) in terms of categorical accuracy when varying the hyper-parameters/network structure/loss or whatever you found determinant for reaching the results. [In practice, I am expecting some form of comparison!!]

Finally, by using the test video, **prepare a video of the 4 persons** moving around a room in a similar way you have already done in Assignment 2.