CV project
Face recognition using Deep Learning

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The project

The aim of the project I have chosen is control access to a private place using face recognition. With the term "private place" I mean a door, a PC, a house, or whatever that needs control access. The correct behaviour of the system will be: there is a camera next to a closed door, a person who wants to enter stands in front of the camera and click a button, the system takes photos of his face and compare them with the database of authorized faces. If the comparison is satisfactory the system opens the door and register in a database who has accessed and at what time; if the comparison is not satisfactory the system doesn't open the door, because the user is not authorized. Additionally, a speaker could be connected to the system in order to say hello to the identified user (i.e., "Welcome Jesús Moncada") and to refuse unauthorized users (i.e., playing an audio: "User is not authorized").

The database of faces I have spoken about is not actually a database. It is a dataset of photos of authorized users that the system processes using deep learning. An authorized users must provide a set of photos of himself (labelled with his name), in different perspectives, with different illumination, with different values of contrast and brightness… the more quantity of photos, the better face recognition. The system will use a technique called *deep metric learning*; this method generates vectors of 128 numbers for each computed photo (using a neural network trained by Davis King with 99,38% accuracy); the vectors of two photos of the same user will be very similar; we will use that property to identify users.

Motivation for the project

The main motivation to create this project is several scenes from some futuristic (and other not so futuristic movies) movies that implement that system. The main character gets to the Pentagon, and ¿is he going to open the door of his office with a key? No, there is a face detection algorithm that detects the face of the coronel and allows him to enter. This method is cool, but it is also fast and secure (if we got a perfect face recognition algorithm).

The motivation also came to me because a new I read in *La Opinión de Málaga*. It said that the future train station won't need tickets to identify passengers, the only authorization a person will need to get on a train will be his face. It was related to a new face recognition system that is being proved in the *Maria Zambrano Train Station*. Facial recognition is exciting!

Implementation and performance details

I will follow this tutorial I found on the internet. Furthermore, I will read several articles of the creators of the libraries I'm going to use: *High Quality Face Recognition with Deep Metric Learning* and *Machine Learning is Fun! Part 4: Modern Face Recognition with Deep Learning*.

The project will be made up of a *Jupyter Notebook* file explaining all the work I did, but I also want to make a working implementation in a Raspberry Pi. Raspberry Pi has ports for connecting a camera module, a Jack 3.5 port to connect a speaker and some GPIO ports to connect coloured LEDs. I will use the *Raspbian* OS and the *Python* programming language. The opening/closing of a protected door will be simulated with some LEDs on or off, but we also could use a relay.