Biometrics (COMP 388-002/488-002)
Loyola University Chicago, Fall 2023
Assignment 4: Iris Recognition
Due date: December 04, 11:59 PM CT
Total: 10 points

1. Introduction

The purpose of this assignment is to train and evaluate the students' capabilities to use, set the operating point, and perform biometric verification with a third-party library of iris recognition, leveraging the NIR irises collected in class. To do so, the iris recognition library and one zip file containing the collected irises are being provided.

1.1. Iris dataset

The iris dataset is available at https://bit.ly/3GaiQix and is password protected. To obtain the password, please contact the instructor (Daniel Moreira) through e-mail (dmoreira1@luc.edu). **This dataset must not be shared by the students with anybody and must be deleted right before the end of the course. Anyone breaking these rules will automatically fail the course.** Please refer to Prof. Moreira if you have any questions.

The iris dataset is organized into two folders, namely "dataset" and "queries". The "dataset" folder contains 16 NIR images depicting 8 unique irises (two images per iris), whose names obey the following format: "`<IRIS_ID>_<CAPTURE>.png`". As a consequence, two files with the same `<IRIS_ID>` depict the same eye and comprise a genuine pair. Figure 1 provides the content of "dataset" with the 16 images.

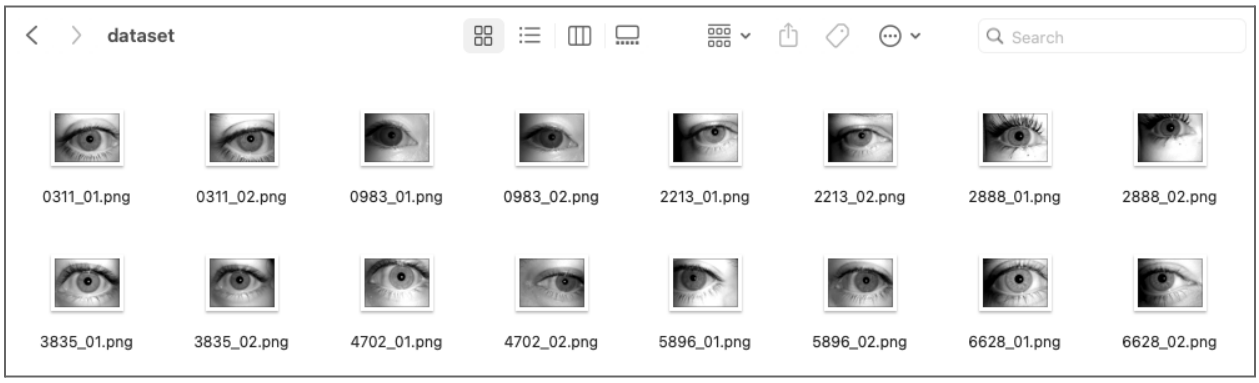

Figure 1. Content of the "dataset" folder.

The "queries" folder, in turn, contains five image files whose names obey the format "`<CLAIMED_IRIS_ID>.png`". These five images do not have exact copies within the "dataset" folder, and `<CLAIMED_IRIS_ID>` expresses their respective claimed eye in a biometric verification scenario over the content of the "dataset" folder. Figure 2 depicts the content of "queries".

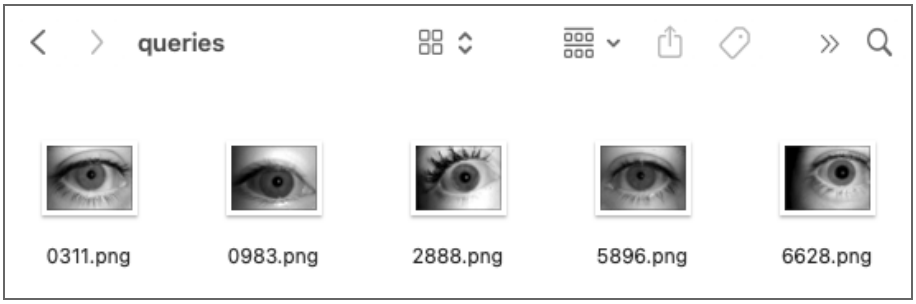

Figure 2. Content of the “queries” folder.

1.2. Iris recognition and metrics libraries

The iris recognition library is available as a Google Colab notebook (https://bit.ly/3SxPthB), which was explained in class. In addition to this implementation, you will also need either the first assignment’s notebook (metrics’ implementation, available at https://tinyurl.com/bdjeeh5k) or the *scitkit-learn* (https://tinyurl.com/nsyu2k9b) library to compute the proper metrics and analyze the performance of the system.

1.3. Assignment directions

To complete this assignment, access the Google Colab notebook (https://bit.ly/3SxPthB) and make your own copy. After downloading and unzipping the dataset file from Sakai to your local computer, upload them to your Google Colab notebook copy. Lastly, follow the instructions and answer the questions presented in Sec. 2.

There is no formal template for providing your answers. You may use the editor you like. The following submission is expected:

- A single PDF file or Word document containing your answers.

Please submit your file through the respective open assignment in Sakai by December 04, 2023, 11:59 PM CT.

2. Questions

2.1. As explained in class, the provided third-party iris recognition library is able to extract the binary code from a given NIR iris image, as well as to calculate the distance between two computed iris binary codes. The expected behavior for the software is to generate small distances for two iris images that depict the same eye (genuine pair), and large distances for two iris images that depict different eyes (impostor pair).

Leveraging the content of **only** the “dataset” folder within the iris dataset, the third-party iris recognition library, and metrics learned on class, please determine **what is a good binary iris code distance threshold to separate genuine from impostor pairs**. While providing your answer for the distance threshold, please explain in details how you computed it. (4 points)

Answer tips: good answers will describe what you did, such as “I generated *x* genuine and *y* impostor pairs, and observed FNMR and FMR at EER…”, etc.

2.2. By leveraging the distance threshold computed above, please classify each one of the five iris images provided within the “queries” folder of the iris dataset as either **genuine** (i.e., the `<CLAIMED_IRIS_ID>` is correct) or **impostor** (i.e., the `<CLAIMED_IRIS_ID>` is incorrect). Please justify your answer for each case by providing the distances obtained with the iris recognition library and comparing them to the distance threshold. In the occasion of being possible to obtain more than one iris code distance for a particular `<CLAIMED_IRIS_ID>`, please base your decision on the minimum distance as the best effort to perform biometric verification. (6 points)