Hand Biometrics Feature Extraction.

Sagaf Youssouf

Université Paris-Est Créteil (UPEC)
International Master of Biometrics and Intelligent Vision
https://www.international-master-biometrics-intelligent-vision.org/

1 Introduction

Hand carries a set of features that may be used in an identification or authentication system. One seeks to extract relevant and reliable characteristics that should help to identify one person to another. In terms of hand feature extraction, several methods exist in the scientific literature. Here we want to create a unique feature vector by detecting minutiae (i.e. ridge ending and ridge bifurcation). This is preceded by a set operation in order to extract minutiae from a forearm image. For this, we used Matlab to acquire, visualize, and process images. We then built a graphical interface to visualize all the process. In the following sections, we will see the steps followed to reach the final goal.

Fig. 1: Original image of the hand

2 Methods and materials

Characterization by minutiae extraction is composed of 4 majors phases :

2.1 Histogram equalization

The purpose of the histogram equalization process is to improve the contrast of the input image. This makes the step of binarization easy to process. Given the original image in figure 1, the result of a small cropped part of the hand is shown in figure 2.

Fig. 2: Result of histogram equalization

2.2 Binarization

As its name implies, binarization consists of creating a binary image from the image obtained after the histogram equalization process. The result of this step is given in figure 3. As we can see, the ROI (i.e. vein line) appears to be in black, whereas the rest of the image is in white. To achieve this operation, the function `im2bw` from `Matlab` by setting a threshold level.

Fig. 3: Binarized image

2.3 Skeletonization

This mathematical morphology operation allows us to highlight some particular features. The idea is to reduce the thickness of the curves representation of the veins given a binarized image. The following image is the performed result after skeletonization. To achieve this, the following instructions have been used :

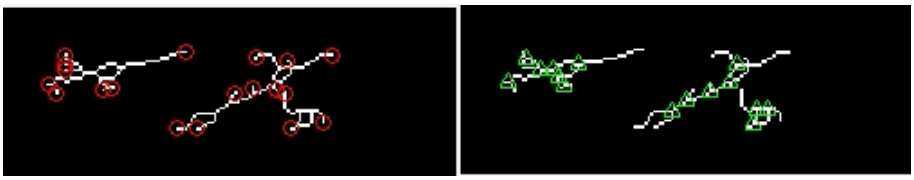
```
squelet = bwmorph(~I,'thin','inf');
squelet = bwareaopen(squelet, 30);
```

The result obtained from this process is given below :

Fig. 4: Binarized image

2.4 Minutiae detection

The detection of minutiae is the last step of characterization. Here we want to determine the position of each bifurcation point and also the endpoint positions. For this, a filter of size 3x3 is used. One has to deduce the behavior of the central pixel. Figure 5 illustrate the results obtained after the minutiae detection. On the left, we have the bifurcations and on the right the endpoints.



(a) Bifurcations (b) Endpoints

Fig. 5: Image after the detection of minutiae

2.5 Final graphical interface

Figure 6 shows the designed graphical interface for this assignments. One have to click on the browse button in order to load an image. The next step consists of drawing the desired rectangle with the mouse to crop the part of the image to be processed. The result of all the described steps has been displayed.

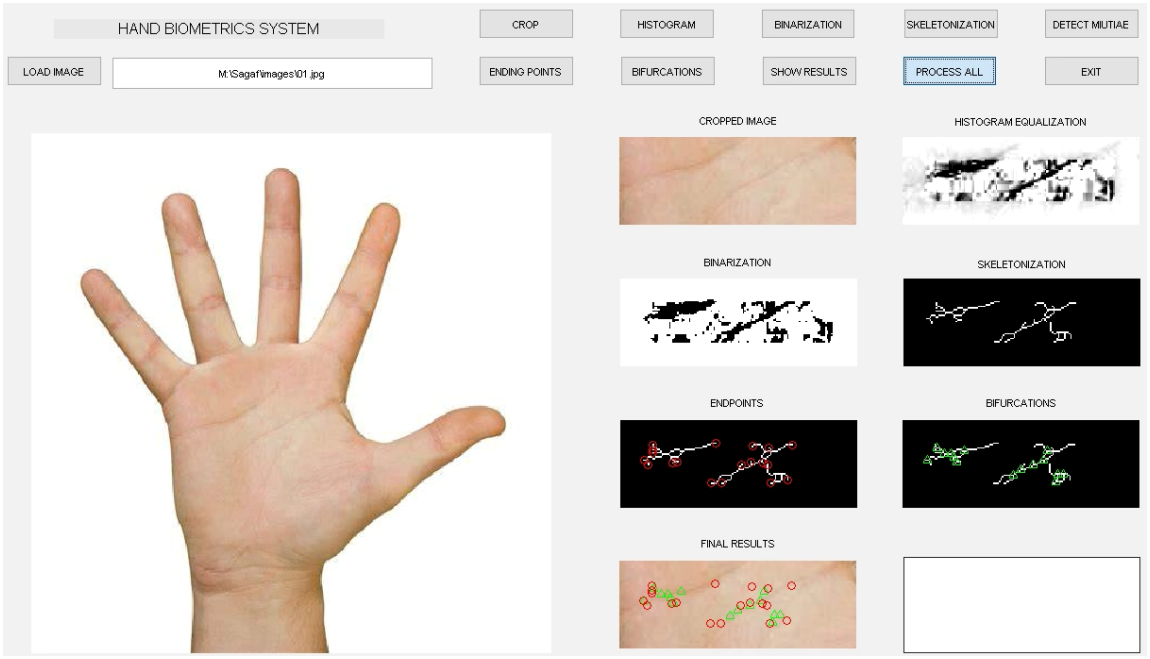


Fig. 6: Graphical interface

3 Conclusion

In this lab, we saw how to perform minutiae detection from a set of features of the hand. To do so, we need to pass through fours phases: histogram equalization, binarization, skeletonization and, detection of minutiae. The next step can be matching to identify or authenticate an individual from a set of minutiae. This lab enabled us to review the basics of image processing in Matlab and to highlight our skills in terms of minutiae feature extraction.