

This project entailed the reporting of outputs of several different inputs after coding the necessary blocks to solve for the mean vectors, genuine and impostor scores, and the false reject rate and impostor pass rate. With these sections of code in place, several different values of N were tested. This is the number of samples needed to build the template (mean vectors). There are also different threshold values that were tested to evaluate the best tradeoff between false accept and impostor pass rates.

*Note = The data for this was preprocessed such that the down-down columns were eliminated from the data set. The only two keystroke latencies utilized for this project were up-down (UD) and key hold (H) times.

A) Impostor Pass and False Reject Rates for N = 200

For this portion of the project task entailed two deliverables. When the number of samples needed to build the template was set to 200, there were 10,200 genuine scores and 510,000 impostor scores generated. The minimum and maximum genuine scores (rounded to the nearest tenth) were 0.25 and 7.59 while the minimum and maximum impostor scores were 0.27 and 34.63.

To determine the threshold values, I used the linspace function available in the numpy package in Python. After combining the two lists of genuine and impostor scores, I found the overall minimum and maximum, input them into the linspace functions and asked for 5 values in this range, all equidistant from each other. This was done to ensure an equal spread across the scores.

To determine the impostor pass and false reject rates, we needed five threshold values to work with. In the table below are the threshold values with their corresponding rates.

Impostor Pass Rate

Threshold Value	Impostor Pass Rate (IPR)
0.255	0
8.848	1.961e-6
17.442	1.961e-6
26.036	1.961e-6
34.630	1.961e-6

False Reject Rate

Threshold Value	False Reject Rate (FRR)
0.255	9.804e-5
8.848	0
17.442	0
26.036	0
34.630	0

With the false reject and impostor pass rates being values that are either close to or equal to zero, this indicates that a very robust system that utilizes very effective machine learning techniques that are good at distinguishing impostors from genuine users.

B) False Accept Rate when False Reject Rate is 0 and N = 100, 200, 300

For this portion of the project, we were responsible for finding the false reject accept rate when the false reject was zero. This was to be found when the number of samples used to make the template was 100, 200, and 300. The outputs for each value of N and threshold can be seen in the screenshot below.

```
False Accept Rate at Zero False Reject Rate for 100 at threshold 9.085073 is 0.9960196078431373
False Accept Rate at Zero False Reject Rate for 200 at threshold 8.5907379999999998 is 0.9971803921568627
False Accept Rate at Zero False Reject Rate for 300 at threshold 15.098206000000001 is 0.9998274509803922
```

The relationship between the false reject rate and the impostor pass rate is one that acts a tradeoff. When the false accept rate is very low, it means that the system can be very strict and allow little to no users to access it. As a result, genuine attempts are denied and erroneously labelled as impostors. Therefore, the false reject rate will be very high and will be nearly 100 percent.

In this scenario when the false reject rate is zero, the system will be much more prone to impostors accessing the system. This is why the false accept rate will have probabilities as high as 99 percent, seen in the attached screenshot above.