A close up of a map

Description automatically generated

Figure 1: Cycle for Gen-Train for User 1

By using SciPy’s find\_peak function and setting the minimum distance between peaks as 6, we were able to locate the peaks of interest. Following which, we took the last two peaks in each cycle segment before trimming it to form the shape shown in Figure 1 and 2. Most of the trimmed segments form a smiley face shape as they contain a single minima between them.

A close up of a map

Description automatically generated

Figure 2: Cycle for Imp-Test for User 1

For the Imp-Test cycles, it is noteworthy that the smiley faces are at different amplitudes because they belong to different imposter users. However, all of them share the same shape despite their different values and have a similar width, also known as period. This makes perfect sense because most people walk at a similar pace albeit with different styles (leading to different acceleration values).

A screenshot of a cell phone

Description automatically generated

Figure 3: Sliding Window for Gen-Test for User 1

The Sliding Window segmentation does not have clear smiley faces because it contains data that spans across several periods. Because they are all coming from the same user (for Figure 3), it is clear that they share similar y-axis values. However, it is also clear that there are some outliers which fall outside of the amplitude which could have been recorded when User 1 had to change his walking style because of certain environmental factors.

A screenshot of a cell phone

Description automatically generated

Figure 4: Sliding Window for Imp-Test for User 1

Similar to Figure 2, Figure 4’s different y-axis values show how the walking pattern differs between the different imposters. This information suggests that there might be a difference in age profile or mobility between the users.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Pointwise** | **DTW** | **Histogram** |
| **Cycle** | IMP SCORES 11.906569095123547 GEN SCORES 6.473995894474292 | IMP SCORES 38.7599068142119 GEN SCORES 17.677490688505628 | IMP SCORES  0.5  GEN SCORES 0.46153846153846156 |
| **Window** | IMP SCORES 69.67916800727747 GEN SCORES 43.821042756733554 | IMP SCORES 492.646288474401 GEN SCORES 211.57577355702716 | IMP SCORES 0.6772908366533864 GEN SCORES  0.75 |

Figure 5: Median Scores for the different comparison and segmentation schemes for User 1

These are the tentative imposter and genuine scores for the different comparison and segmentation schemes. Even though we have yet to normalize the scores with any statistical technique, it is already clear that DTW is the best biometric method to identify the differences between the imposters and genuine users followed by Pointwise and then Histogram. This can be seen from how DTW’s GEN SCORES are less than 50% of its IMP SCORES whereas Pointwise’s GEN SCORES are a bit more than 50% of its IMP SCORES. Since a larger distance would imply a greater separation from what is actually genuine, it is clear that DTW is the better method. However, DTW does have its drawback for being slower than Pointwise and Histogram. Hence, Pointwise might actually be more useful in certain context where time complexity is important. Histogram is definitely the worst since the GEN SCORES and IMP SCORES are extremely close to one another. There is a high chance that an imposter would be able to pass off as a genuine user and that a genuine user would be falsely rejected.