

Practical 11 – Mouse Dynamics

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Signature Recognition

1. Describe the following topics related to Signature recognition.

- (a) 2 points What is the difference between online and offline capture?

Answer:

- i. Offline: Captured with pen and paper or similar manual tools. We have to use a scanner to get the electronic version of the captured data. The manual tools limit the number of metrics that can be captured, as we only capture the shape of the signature. This method is often used in human signature recognition
- ii. Online: Captured using digital tools like a special pen or tablet. The capture is stored as an electronic sample so there is no scanning needed. The digital capture enables us to collect different metrics like the shape, the speed of the writing, the pressure used by the person, or even how tilted the pen was when the person was writing. The digital sample can even let us replay the signature. This is more applicable for verification purposes as it has more information available.

- (b) 3 points What is the difference between a random and a skilled forgery?

Answer:

- i. Random forgery (zero effort): Never seen the signature of the genuine person. May or may not know the name of the person. Comparing signature of person A against signature of person B: KD analogy: all users own password
- ii. Skilled forgery: The forger has the signature of the person. May have been present during the signature process. May have practiced writing the signature “offline”

Mouse Dynamics

2. Answer the following questions related to Mouse Dynamics (MD).

- (a) 2 point Describe what displacement is, using a drawing

Answer: Figure 1 show an representation of a mouse movement done by a user (curve) compared to the reference line (x-axis). When we talk about displacement we refer to the measurement of how much the curve of the recorded mouse movement deviates from that stored for the genuine user.

With the displacement, we can look at different measurements like the distance from the curve to the stored line (x-axis), as shown in the figure, but also other mathematical aspects. These might be the area under the curve, the mean, minimum or maximum displacement, or the ratio of the “traveled” distance, e.g. the distance or length of the recorded sample, and the stored line. The

common denominator is that they all give a measurement of the displacement between the two lines (sample vs. reference).

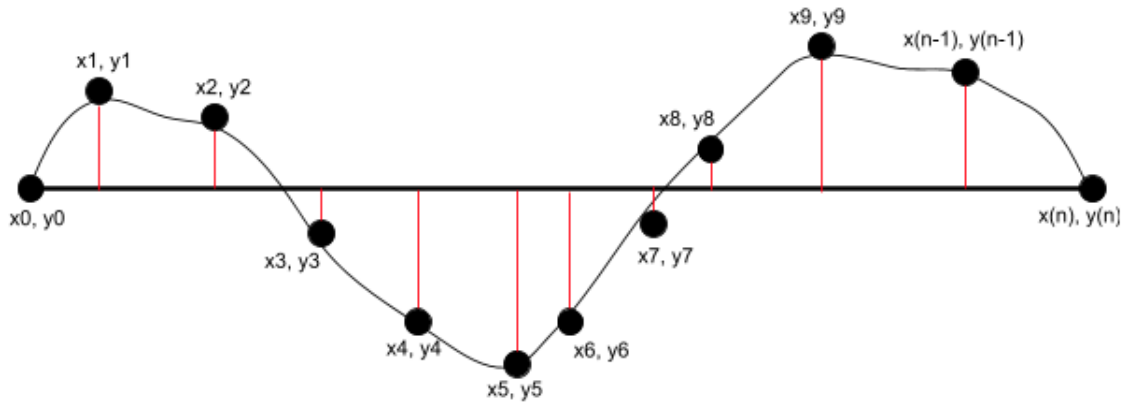


Figure 1: MD Displacement

- (b) 3 point Calculate the DTW distance between “autorisation” and “authentication”. Explain how to reach this distance.

Answer: We start with the two words:

autorisation

authentication

The top word is to be changed into the bottom word using DTW. Dynamic time warping has three operations:

- i. Change a symbol
- ii. Delete a symbol
- iii. Insert a symbol

Step 1. To turn “autorisation” into “authentication” we have to insert two symbols as the length difference of the two are 2. We add “H” and “T” as shown below (the changes are highlighted by uppercase letters):

autHorTisation

authentication

Step 2. We now have to change the letters in the word to get the correct spelling. We change “o” to “E”, “r” to “N”, and “s” to “C”, as shown below:

authENTiCation

authentication

Thus in two steps using DTW we have calculated the DTW distance between “autorisation” into “authentication”.

The way one would give a distance value to this operation is not entirely clear given the presentation. However, if we assume that the distance here is a measure of the changes that are needed to turn the word into the other we see that it is five since it takes five operations to achieve this. We might also count the distance as a measure of the different operations used, in that case, the

distance would be two as we only need to add and change letters. This way of measuring the distance would however have a lower granularity.