



Exercise Sheet 5

Intelligent Systems

Similarities

This exercise sheet will be discussed on January 06, 2020

Exercise 1 - Similarity Measures

- A. What is the Minkowski distance? How can it be applied on time series data?
- B. Calculate the distance of the two time series in Figure 1 according to the following distance measures:
- Manhattan distance
 - Euclidean distance
 - Cosine distance
 - Hamming distance
- C. Find two time series, similar as in Figure 1 with a Cosine distance of 0.

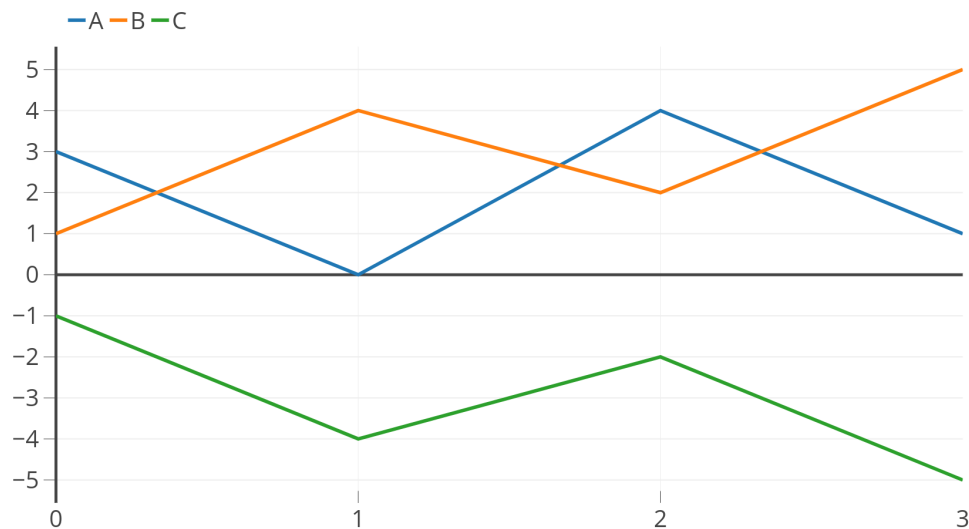


Abbildung 1: Some timeseries

Exercise 2 - Dynamic Similarity Measures

- A. What is the benefit of dynamic similarity measures?
- B. Calculate the *LCSS* of the the following two series:
- Sequenz A = z,e,i,t,r,e,i,h,e
 - Sequenz B = r,e,i,t,z,e,i,t
- C. Explain the steps of the *LCSS* on time series in your own words.
- D. In Figure 2, there are given two time series. Calculate the *DTW* path with the means of a *DTW* matrix and the backtracking algorithm by using an Euclidean distance.
- E. Which problems can arise from backtracking? Which conditions guarantee reasonable paths during backtracking?

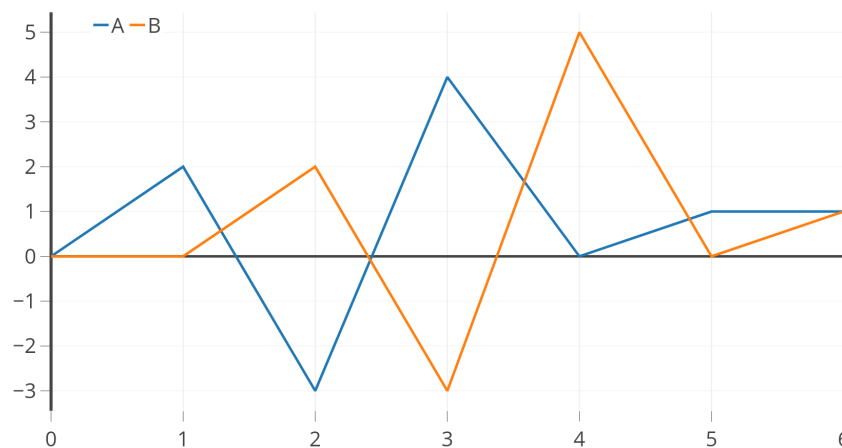


Abbildung 2: Some timeseries

Exercise 3 - Segmentation

- A. Name four different application scenarios where segmentation of time series plays a role.
- B. What is the difference between offline learning and online learning?
- C. Name three criteria for segmentation.
- D. Explain the offline and online segmentation techniques for segmentation in your own words.

Exercise 4 - Comparing Time Series using Python

- A. Download the Jupyter Notebook file ***DTW.ipynb*** from Open Olat. First, calculate the Euclidean, Manhattan, and Cosine distance of the two time series. Evaluate your results. What can you observe?
- B. Implement the DTW algorithm and compare your results with the distances calculated in the previous step. Why is the usage of DTW reasonable for this case?