Kiel University
Christian-Albrechts-Universität zu Kiel

Exercise Sheet 6
Intelligent Systems
December 02, 2019

Similarities

Exercise 1 - Similartiy 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, similiar as in Figure 1 with a Cosine distance of 0.

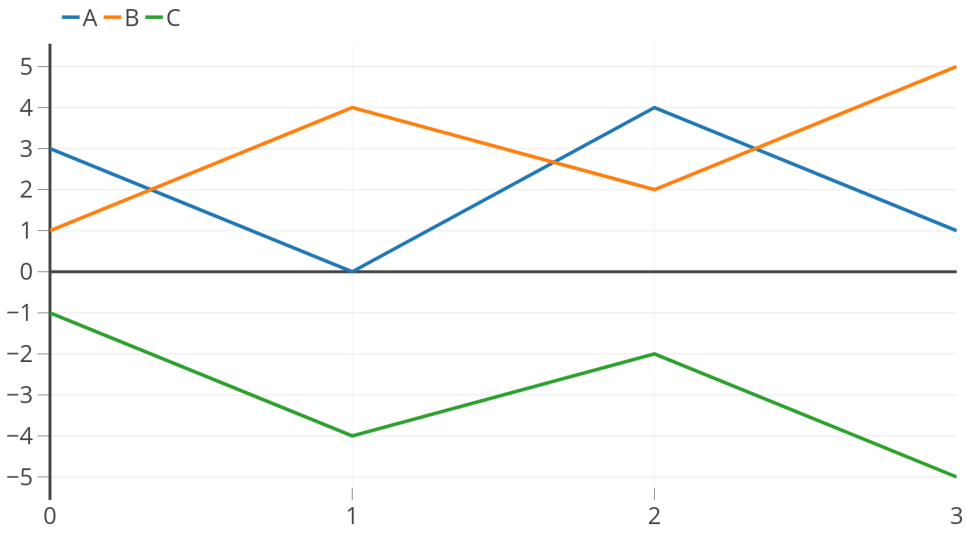

Figure 1: Some timeseries

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?

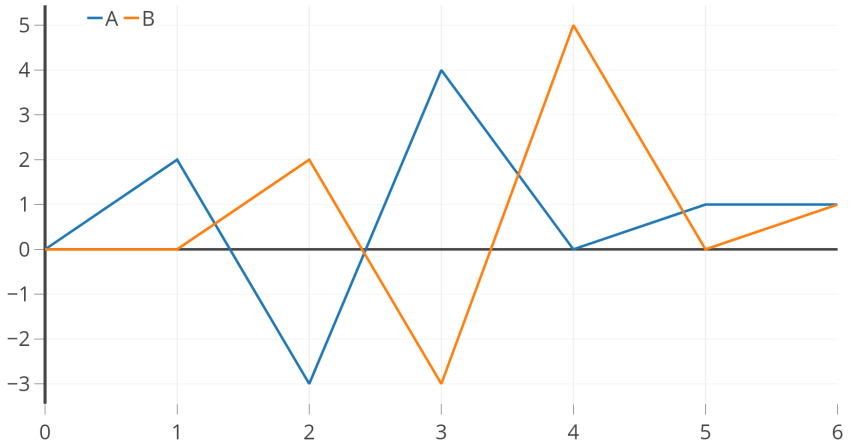

Figure 2: Some timeseries

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 segementation techniques for segmentation in your own words.

Exercise 4 - Comparing Time Series using Python

A. Download the Jupyter Notebook file ***7_ DTW.ipynb*** from Open Olat. First, calculate the Euclidean, Manhatten, 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?