Fuzzy Equivalences in Time Series Classification

Przemyslaw Grzegorzewski[1,2][0000−0002−5191−4123], Anna Król[3][0000−0003−4815−7739], Piotr Grochowalski[3][0000−0002−4124−412X], and Wojciech Rząsa[3][0000−0003−4502−7146]

[1] Faculty of Mathematics and Information Science, Warsaw University of Technology, Koszykowa 75, 00-662 Warsaw, Poland
[2] Systems Research Institute, Polish Academy of Sciences, Newelska 6, 01-447 Warsaw, Poland
przemyslaw.grzegorzewski@pw.edu.pl
[3] University of Rzeszów, Institute of Computer Science, Pigonia 1, 35-310 Rzeszów, Poland
akrol@ur.edu.pl

Abstract. Time series classification is an important and still challenging task in data analysis. Although many algorithms have been proposed to cope with this problem it seems that the best method which is simultaneously simple and efficient is the 1NN classifier. An exhaustive comparison of distance measures used in time series classification with the 1NN method is available in [2]. We propose another approach to the time series classification which combines the 1NN method with fuzzy equivalences and aggregation techniques. Fuzzy equivalences can be interpreted both as fuzzy relations or fuzzy connectives. In this contribution, we consider fuzzy equivalences defined by Fodor and Roubens [1]. More precisely, we consider various compositions of fuzzy equivalences and aggregation functions as a closeness measure, which serves as an alternative to the standard distance metrics. This approach that has already been examined in some data mining problems (see e.g. [3, 4]) seems to be also successful in time series analysis.

Keywords: Classification · Time series · Fuzzy equivalence · Aggregation functions

References

1. Fodor, J., Roubens, M.: Fuzzy preference modelling and multicriteria decision Support, Kluwer, Dordrecht (1994)
2. Górecki, T., Łuczak, M., Piasecki, P.: An exhaustive comparison of distance measures in the classification of time series with 1NN method, Journal of Computational Science 76, 102235 (2024)
3. Grochowalski P., Król, A., Rząsa W.: Radius kNN Classifier Using Aggregation of Fuzzy Equivalences, 2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), July 11-14, 2021, Luxembourg, Luxembourg, 1-6 (2021)
4. Król, A., Rząsa W., Grochowalski P.: Aggregation of Fuzzy Equivalences in Data Exploration by kNN Classifier, IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2020), Glasgow, UK, July 19-24, 2020, pp. 1-8 (2020)