ICMASE 2025

SOFT SET-BASED REPRESENTATION OF TIME SERIES AND ANALYSIS

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ABSTRACT

Soft set theory, originally introduced by Molodtsov in 1999 in [4], presents a powerful and flexible mathematical framework for dealing with uncertainties, imprecisions, and vagueness commonly encountered in real-world problems. Its parameterized structure allows it to effectively model situations in which traditional mathematical tools, such as fuzzy sets or probability theory, may face limitations. Despite its widespread applications across fields such as decision-making, engineering, medical diagnosis, and economics, its integration with time series analysis remains relatively under-explored.

The aim of this study is to bridge this gap by proposing two different methods to represent time series data within the soft set framework: the Frequency Threshold Soft Set and the Recurrence Threshold Soft Set. These approaches offer different perspectives for identifying cyclic behaviors or steady patterns and for highlighting dominant periodicities or oscillations in time-dependent data.

To validate the proposed methods and the associated similarity measure, a real or simulated time series dataset is used as a case study. The dataset is processed using both soft set representations, and similarities between different time intervals or recurring patterns are computed using the soft set-based similarity measure. The results are then analyzed and discussed in terms of their interpretability and their effectiveness in capturing meaningful temporal structures.

Keywords Soft Sets · Soft Set-Based Representation of Time Series · Application of Soft Sets

References

[1] Balcı, M.A., Batrancea, L.M., Akgüller, Ö. Network-induced soft sets and stock market applications. Mathematics 10(21), 3964 (2022) https://doi.org/10.3390/math10213964

[2] Gifu, D. Soft sets extensions: Innovating healthcare claims analysis. Applied Sciences 14, 8799 (2024) https://doi.org/10.3390/app14198799

[3] Maji, P.K., Biswas, R., Roy, A.R. Soft set theory. Comput. Math. Appl. 45(4-5), 555–562 (2003) https://doi.org/10.1016/S0898-1221(03)00016-6

[4] Molodtsov, D. Soft set theory-first results. Comput. Math. Appl. 37(4-5), 19–31 (1999) https://doi.org/10.1016/S0898-1221(99)00056-5

[5] Sulaiman, N.H., Mohamad, D. A jaccard-based similarity measure for soft sets. In: 2012 IEEE Symposium on Humanities, Science and Engineering Research, pp. 659–663 (2012)

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