

Abstract: The understanding of water quality and its underlying processes is important for the protection of aquatic environments. With the rare opportunity of access to a domain expert, an explainable AI (XAI) framework is proposed that is applicable to multivariate time series. The XAI provides explanations that are interpretable by domain experts. In three steps, it combines a data-driven choice of a distance measure with supervised decision trees guided by projection-based clustering. The multivariate time series consists of water quality measurements, including nitrate, electrical conductivity, and twelve other environmental parameters. The relationships between water quality and the environmental parameters are investigated by identifying similar days within a cluster and dissimilar days between clusters. The framework, called DDS-XAI, does not depend on prior knowledge about data structure, and its explanations are tendentially contrastive. The relationships in the data can be visualized by a topographic map representing high-dimensional structures. Two state of the art XAIs called eUD3.5 and iterative mistake minimization (IMM) were unable to provide meaningful and relevant explanations from the three multivariate time series data. The DDS-XAI framework can be swiftly applied to new data. Open-source code in R for all steps of the XAI framework is provided and the steps are structured application-oriented.