IFQ Guided OWA Operator for Missing data Imputation using IFRS Approach

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Abstract. Missing data imputation plays a crucial role in data analysis, where incomplete datasets are common in various real-world scenarios. In recent times, with the increasing prevalence of data-driven decision-making, the need for accurate imputation methods has become increasingly pronounced. Additionally, intuitionistic fuzzy data, which capture uncertainty and ambiguity more effectively than traditional crisp data, have gained prominence in handling complex real-world datasets. This article presents a novel approach to imputing missing values in datasets containing intuitionistic fuzzy values.

In this study, we first define the Ordered Weighted Average (OWA) operator based on Intuitionistic Fuzzy Quantifiers and investigate its properties as an aggregation operator. Acknowledging the efficacy of k-Nearest Neighbourhood (KNN) algorithms in missing data imputation, we integrate this established algorithm into the intuitionistic fuzzy rough set (IFRS) framework to further enhance the imputation process. Subsequently, we incorporate this proposed OWA operator augmented with the KNN algorithm into the IFRS framework to impute missing values within datasets. To validate the effectiveness of our proposed algorithm, experiments are conducted on real-valued datasets, comparing its performance against several existing methods. Furthermore, statistical validation is performed using non-parametric statistical tests to ascertain the robustness and reliability of the proposed approach.

This research contributes to the field by offering a comprehensive methodology for imputing missing values in datasets containing intuitionistic fuzzy data. By leveraging the OWA operator and integrating the KNN algorithm into the IFRS framework, our approach not only addresses the inherent uncertainty and ambiguity in such datasets but also demonstrates promising performance compared to existing methods. These findings provide valuable insights for data analysis and decision-making processes in various domains.

Keywords: Intuitionistic fuzzy quantifier, OWA aggregation operator, Intuitionistic fuzzy rough sets, missing data imputation.