

Project Descriptions – PhD in Computer Science

Project B1 FBK: Evolving Fuzzy Systems with Interpretability and Trustworthiness for Regression Problems

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Project Description: The field of machine learning and computational intelligence has seen significant advancements in the development of models for regression problems. However, there is a growing demand for models that not only provide accurate predictions but also offer interpretability and trustworthiness, especially in domains where decision-makers require a clear understanding of the underlying reasoning process. This research aims to explore and develop evolving fuzzy systems that address these challenges, focusing on regression problems.

Objectives:

1. To design evolving fuzzy systems capable of handling regression problems with an emphasis on interpretability and trustworthiness in the generated models.
2. To integrate mechanisms for the evolving aspect in fuzzy systems applied to regression problems, allowing them to adapt to changes in the data distribution and problem dynamics.
3. To investigate and incorporate techniques that enhance the interpretability of fuzzy systems, making the reasoning process transparent and understandable to non-experts.
4. To develop methodologies for assessing and quantifying the trustworthiness of fuzzy systems, ensuring robust and reliable predictions.

Research Questions:

RQ1. How can evolving fuzzy systems be designed to effectively handle regression problems?

RQ2. What mechanisms can be employed to enhance the interpretability of evolving fuzzy systems for regression?

RQ3. How can the trustworthiness of fuzzy systems in regression be assessed and quantified?

METHODOLOGY

Model Design: Develop evolving fuzzy systems based on adaptive mechanisms that allow continuous learning and adaptation to changes in the regression problem.

Interpretability Enhancement: Explore and implement techniques such as feature relevance analysis, rule simplification, and linguistic interpretation to improve the transparency of the evolving fuzzy systems.

Trustworthiness Assessment: Propose methodologies for evaluating the trustworthiness of fuzzy systems, considering factors such as uncertainty, model stability, and prediction reliability.

Empirical Evaluation: Conduct extensive experiments and comparisons with existing regression models using real-world datasets to validate the effectiveness, interpretability, and trustworthiness of the proposed evolving fuzzy systems.

Expected Contributions:

Novel evolving fuzzy systems tailored for regression problems.

Techniques for improving the interpretability of fuzzy systems in regression.

Methodologies for assessing the trustworthiness of evolving fuzzy systems.

Insights into the practical applications of evolving fuzzy systems in real-world regression scenarios.
