

System Modeling: from Transparent Linguistic Interface in Fuzzy System to Kernel-Based Modeling

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Abstract

System modeling is to construct a system for the purpose of study, analysis, control and optimization using interdisciplinary approaches. A typical approach is to consult the experts in the field to build up the system. Moreover, a viable approach is to utilize learning mechanisms from collected historical data. Among these, classification, forecasting, and clustering are three typical learning tasks and have been studied intensively by researchers from different communities in machine learning, pattern recognition, and computational intelligence.

Modeling using fuzzy systems has been studied extensively and its effectiveness has been considerably demonstrated. However, the shortcomings of previous studies on transparency, performance, and usability have not been discussed thoroughly. A new transparent linguistic interface generation method for fuzzy systems is introduced. With the new linguistic interface, the system demonstrates better interpretability and superior performance. Extending this approach, a new multiple kernel fuzzy c-means is proposed. This multiple kernel fuzzy c-means approach offers us a great vehicle to fusion information from multiple heterogeneous or homogeneous sources. Applications in image segmentation problems demonstrate the great advantages and potentials of the proposed multiple kernel fuzzy c-means modeling.