Review Article

Knowledge base to fuzzy information granule: A review from the interpretability-accuracy perspective

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ABSTRACT

Fuzzy information granules indicate sufficiently interpretable fuzzy sets for achieving a high level of human cognitive abstraction. Furthermore, granularity, complexity, and accuracy are associated with fuzzy information granules. Measuring granularity is a promising means of verifying the effectiveness of the fuzzy granular model. Higher granularity indicates fine partitions, whereas coarser partitions suggest lower granularity. Therefore, accuracy is directly proportional to the granularity, such that, the higher the granularity, the more accurate and more complex the model is. Consequently, the granularity-simplicity tradeoff is also a significant criterion in considering the interpretability-accuracy tradeoff.

This paper thoroughly reviews diverse ideas to understand the fuzzy information granule and addresses a sensible compromise between interpretability-accuracy and granularity-simplicity. Those requirements contradict each other, thus certain conceptual and mathematical considerations are necessary in designing a granular framework. Moreover, a double axis taxonomy is introduced in this paper: "complexity-based granularity versus semantic-based granularity" (which considers granularity measures) and "granular partition level versus granular rule base level" (regarding knowledge base stages). However, several constraints should be considered in designing a granular framework such as the granularity-accuracy dilemma, the overfitting/underfitting situation, the granular rule base level conflict, the interpretability constraint threshold, the stability-plasticity dilemma, and the parameter optimization. This paper primarily aims to present a conceptual framework to better understand existing methods, as well as how these methods can inspire future research.

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