

# Granular Modeling: The Synergy of Granular Computing and Fuzzy Logic

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**Abstract:** Logic is a universal language of abstract concepts of two-valued world. Fuzzy logic is a cornerstone of abstraction of real (continuous) world. Granular Computing is aimed at the development, processing and exchanging information granules. Viewing such granules as abstractions of real world, their manipulation is ultimately governed by the mechanisms of logic, and fuzzy logic in particular.

In this talk, we focus on a general platform of granular modeling – a paradigm that seamlessly combines the concepts of information granules with their logic processing cast in the operational framework of fuzzy sets. First, we outline the research agenda of granular modeling. Second, we elaborate on the architectural and algorithmic issues of granular models.

The talk offers a systematic view at the development of information granules (realized as fuzzy sets and fuzzy relations) through descriptive, prescriptive, and hybrid approaches. Those approaches arise under the rubric of clustering and knowledge-based clustering. The processing core handling processing information granules involves a spectrum of logic constructs. Those include OR, AND, OR/AND fuzzy neurons. In conjunction to their basic logic characteristics articulated by means of “standard” logic operators (being realized via some t- and s-norms), we show how their underlying functionality could be augmented through more advanced constructs such as cardinal sums and uninorms. We discuss several categories of processing units aimed at referential processing supported by matching, inclusion, dominance, and difference fuzzy neurons. In the sequel, we present fundamental topologies of logic networks including logic processors, fuzzy multiplexers, and referential processing units.

The issue of transparency-accuracy tradeoffs of granular models is presented along with various mechanisms of pruning logic networks and their underlying quantification aspects (articulated in the sense of the approximation error and being viewed vis-à-vis structural complexity of the resulting logic description).