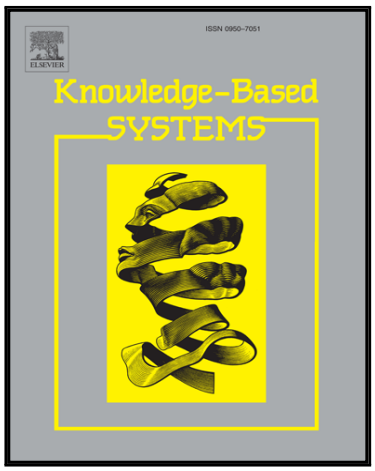


# Development of Granular Models Through the Design of a Granular Output Spaces

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# Development of Granular Models Through the Design of a Granular Output Spaces

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**Abstract** It becomes apparent that there are no ideal numeric models. Bringing a concept of information granularity to the original numeric model makes it well aligned with the experimental data and helps deliver a better insight into the credibility of the results provided by the model. Information granularity is regarded as a crucial design asset being optimally allocated across the numeric parameters of the originally constructed model. The underlying objective of this study is to propose a concept of a granular output space and develop an optimization process of allocation of information granularity across this space. The optimization is carried out by optimizing output information granules produced by the granular model by considering a product of the essential criteria describing information granules, namely specificity and coverage. The detailed optimization procedure involving Particle Swarm Optimization (PSO) is presented. We stress a generality of the approach that cuts across a variety of classes of models. A collection of experimental studies involving interval information granules is reported demonstrating the main features of the proposed approach.

**Keywords** information granularity, information granules, intervals, optimal allocation of information granularity, granular output space, fuzzy rule-based models, particle swarm optimization.

## 1. Introduction

Granular computing and granular modeling [1][2] have emerged as a general paradigm of system modeling in which results come as information granules instead of numeric entities being commonly encountered in various classes of models, including fuzzy rule-based models and neural networks among others [3]-[6]. The motivation behind developing granular models is that there are no ideal models that fully capture all numeric target data. Therefore, we give up establishing a more precise numeric model but focus on making the model granular, and the granular output can capture the crucial target information. The essence of granular models can be summarized as follows. Having the original (numeric) model constructed so far, the parameters of this model are augmented by generalizing them into the form of information granules. Information granularity is