

# **Content-Rich Information Granules as Fundamental Design Constructs of Granular Computing**

**Witold Pedrycz**

*Abstract*

We have been witnessing an emergence of information granules being treated as conceptually justifiable constructs of numerous architectures of intelligent systems. They have established predominant visibility in various human-centric architectures of Granular Computing.

To fully benefit from the use of information granules and the ensuing constructs, such granules have to capture the nature of the data as well as effectively contribute to the functionality of the designed systems. Clustering (including also fuzzy clustering, rough clustering, and algorithms exploiting other formal frameworks of information granularity) offers a comprehensive framework for building data-driven constructs. In spite of the existing plethora of the optimization methods currently used in clustering, there are several limitations in the conceptual setup of the methodology as well as limitations of the resulting constructs (clusters). There is a need for a paradigm shift: information granules have to be developed in the presence of sources of knowledge of different nature (quite often auxiliary to the knowledge residing within locally available data). This gives rise to the concept of *knowledge-oriented* and *content-rich* information granules.

A fundamental question emerges about an efficient conceptual setup in which the sources of auxiliary knowledge, especially functionality requirements, may contribute to the designed systems. Both the content and the underlying semantics of obtained information granules require a thorough exploration so that their properties could be effectively utilized in the realization of the system.

The objective of this presentation is to discuss fundamental ways of augmenting the existing conceptual and algorithmic setup of building information granules (clusters) by accommodating domain knowledge and forming mechanisms of usage of the content of information granules in system design. Specific schemes of condition-based clustering, collaborative clustering and higher-order clustering are elaborated on.