
Preface

Information granules and their processing permeate a way in which we perceive the world, carryout processing at the conceptual (abstract) level, and communicate our findings to the surrounding environment. The importance of information granulation becomes even more apparent when we are faced with a rapidly growing flood of data, become challenged to make decisions in complex data settings and are required to appreciate the context from which the data is derived. Human centricity of systems that claim to be “intelligent” and the granular computing come hand in hand. It is not surprising at all to witness that the paradigm of Granular Computing has started to gain visibility and continues along this path by gathering interest from the circles of academics and practitioners. It is quite remarkable that the spectrum of application and research areas that have adopted information granulation as a successful strategy for dealing with information complexity covers such diverse fields as bioinformatics, image understanding, environmental monitoring, urban sustainability, to mention few most visible in the literature.

Undoubtedly, there are two important aspects of Granular Computing that are worth stressing. First, there are several formalisms in which information granules are articulated so be intervals (sets), fuzzy sets, rough sets, soft sets, approximate sets, near sets and alike. They are complementary and each of them offers some interesting views at the complexity of the world and cyberspace. All of them are the key players of Granular Computing by enriching the conceptual, methodological and algorithmic landscape of the area. While there are some signs of vital synergy (manifesting through e.g., hybrid constructs such as rough fuzzy sets, fuzzy rough sets and alike), one has to admit that there is a long way to go before we reach a point of a fully coherent and unified theory of information granules, information granulation and processing of such constructs. In this sense, the period of growth we are witnessing today is the most exciting stage of the development of the new computing paradigm. Second, the granularity of information leads us immediately to a hierarchy of concepts, models and associated computing machinery. A suitable selection of the level of granularity is crucial to the effective realization of all cognitive and computing faculties. The computational framework for processing information granules is likely to evolve alongside the algorithmic developments of information granulation and granular modeling. Novel, ubiquitous or biologically inspired computational machinery is actively researched in the form of simulated environments and is likely to lead to physical hardware implementations upon successful demonstration of granular information processing potential.

This volume is fully reflective of the diversity of Granular Computing both in terms of the underlying methodology as well as algorithms and applications. There is a well-delineated group of contributions (Nguen and Skowron; Yao; Peters and Rammanna; Zhang et al.) which embarks on the fundamentals of Granular Computing by casting them in a new and illuminating perspective. The issues of constructing information granules have always been one of the focal points of Granular Computing. The contributions authored by Mencar, Fazendeiro and Valente de Oliveira emphasize the aspect of interpretability of information granules no matter in which way they were formed. Fuzzy sets and their generalizations such as Type-2 fuzzy sets have occupied a visible position in Granular Computing. Interestingly, there are a number of contributions (Gottwald; John and Coupland; Castillo and Melin) which elaborate on the concepts and algorithmic machinery of fuzzy sets. The applied end of the Granular Computing is fully reflected in the volume through a series of papers (Apolloni, Bassis, and Zippo; Acampora, Loia, and Vasilakos; Pizzi; Das and Mitra; Burczynski and Orantek; Sawase, Nobuhara and Bede) – those contributions are a convincing testimony to the diversity of applications of Granular Computing. The contribution from Greensmith and Aickelin is a representative of the growing research trend into bio-inspired computing environments for granular information processing.

Our sincere gratitude goes to the authors who enthusiastically responded to our project and offered their expertise and shared their recent research findings with the research community. The reviewers, who provided objective and sometimes critical but always constructive comments, played an important role in shaping up the book—we are definitely grateful for all the input we received from them during the realization of this project.

We definitely enjoyed working on this volume by seeing how new ideas come into existence. It is our hope that the readers will find this volume both intellectually stimulating in their research and practical pursuits.

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