PREFACE

Computational Intelligence (CI), as a new paradigm of development of intelligent systems has resulted from a synergy between neural networks, fuzzy sets, rough sets, and evolutionary computation (Bezdek, 1992; Pedrycz, 1996). This emerging area, even at its very early stage, has already attracted significant attention of researchers and practitioners. New avenues such as knowledge discovery, artificial life, to name a few, have already materialized as vivid research landmarks.

When any new concept, methodology or algorithm arise, they always trigger a natural reaction of looking backwards at some other already well established research endeavors and contrast these with the emerging area. Here the closest seems to be Artificial Intelligence (AI). The differences between AI and CI are self-evident. From the very inception, the AI community has been very much devoted to symbolic computation. While justifiable and successful to some extent, this attitude leaves out some interesting real-world domains in which numeric processing tends to play a significant role. Interestingly enough, some recent issues of flagship AI journals have embarked on a numeric facet of computing by looking more thoroughly at neural networks. Nevertheless, these trends are still peripheral even to the current research agenda of AI. The conceptual platform of CI differs a lot in this regard embracing a broad spectrum of paradigms spread between symbolically and numerically driven approaches. An interesting comparative study contrasting AI and CI both in terms of their main methodologies as well as the pace of growth of these two areas is succinctly outlined by Marks (1994).

This special issue of *Applied Mathematics and Computer Science* provides the reader with a wealth of ideas stemming from the area of neural networks, fuzzy sets, and evolutionary computing. While at some point the synergy between these is not strongly articulated, it is evident that this leitmotif visibly permeates the issue as a whole.

The issue comprises 11 contributions coming from all over the world. The first two papers are devoted to evolutionary computing and genetic algorithms, in particular. The paper by Michalewicz and Michalewicz provides a comprehensive overview of the area and delivers in–depth discussion on the main paradigms such as genetic algorithms, evolution strategies, evolutionary programming, and genetic programming. The next paper by Kubota, Shimojima and Fukuda looks into genetic computing based on virus theory of evolution and studies new mechanisms of inheritance of genetic information across populations. The area of neurocomputing

is discussed in three papers. The contribution by Rutkowski and Cierniak investigates the application of neural networks (competitive learning) to image compression and predictive vector quantization. Modularity of neural networks becomes an important feature while dealing with problems of higher complexity – this issue is raised by the contribution authored by Materka. A new approach to neurocontrol based on Fourier analysis and nonuniform multi-dimensional sampling is presented by Dzieliński and Żbikowski. The realm of fuzzy sets is represented primarily by four papers. The first one is a contribution by Dubois and Prade. It comes as an authoritative and brief, yet highly informative, introduction to fuzzy sets and fuzzy systems. The question of repetitive and negative form of information to be captured by fuzzy sets is discussed by Homenda; he proposes a new class of so-called algebraic operators that are geared specifically to these particular facets of information processing. The paper by Gebhardt and Kruse introduces possibilistic networks regarded as an efficient conceptual vehicle aimed at an efficient treatment of uncertain and imprecise information in knowledge–based systems. Subsequently, Lim and Bien deal with more applied aspect of fuzzy sets and expose the reader to the systematic design of fuzzy controllers carried out in the presence of multiple objectives. The two remaining papers are directly devoted to an important symbiosis of the technology of fuzzy sets and neurocomputing. The issue of self organization of neurofuzzy control of complex systems is posed and studied by Fabro and Gomide. The problem of position/force control for robot manipulators formulated in the same neurofuzzy framework is investigated by Kiguchi and Fukuda.

The authors and reviewers deserve our sincere gratitude: the former for furnishing the research community with their most recent research achievements; the latter for putting so much constructive criticism into the review process and making these submissions highly readable. We have really enjoyed working on the special issue; our hope is that the reader will find the material highly informative, thought-provoking, and intellectually stimulating.

Witold Pedrycz and Józef Korbicz

References

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