Introduction to the “Soft Computing and Intelligent Data Analysis” Minitrack

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Soft computing refers to a collection of computational techniques in computer science, artificial intelligence, machine learning and some engineering disciplines, which attempt to study, model, and analyze very complex phenomena: those for which more conventional methods have not yielded low cost, analytic, and complete solutions. Earlier computational approaches could model and precisely analyze only relatively simple systems. More complex systems arising in biology, medicine, the humanities, management sciences, and similar fields often remained intractable to conventional mathematical and analytical methods. That said, it should be pointed out that simplicity and complexity of systems are relative, and many conventional mathematical models have been both challenging and very productive.

To react quickly and successfully is a matter of knowledge and the task to provide relevant, updated and useful knowledge for management is the arena for developing, building and implementing intelligent support systems.

Intelligent support systems should help managers and knowledge workers to a more intuitive, practical and effective use of knowledge and information in problem solving, planning and decision-making, and should help to build innovative and creative support for operations and management. When intelligent support is built on fuzzy logic and soft computing it is being more useful for practical purposes as both short- and long-term management processes have to cope with dynamic and imprecise data and knowledge: Especially in long-term and strategic planning, in foresight and scenario building the data and information which cover 10-15 year planning horizons are bound to be uncertain and imprecise which motivates the use of soft computing models, methods and technologies.

The following four papers will be presented in this year’s minitrack on Soft Computing and Intelligent Data Analysis.

The paper “A Soft Computing Approach to Mastering Paper Machines” addresses the question what factors should be increased, or decreased, in order to obtain a different or better output. The proposed method is based on an integer linear goal-programming optimization problem whose parameters come from a given fuzzy ontology.

The problem of constrained optimization is handled in the paper “Modified Hybrid Multiagent Swarm Optimization Algorithms for Mixed-Binary Nonlinear Programming”. The authors present three types of constrained hybrid multiagent swarm optimization (HMSO) algorithms to address the constrained optimization problem by incorporating the fly-back mechanism into the update formula for the particle’s position.

The paper “Enhancing Battlefield Situational Awareness Through Fuzzy-Based Value of Information” deals with the ability to shorten cycle time from data gathering to decisions. Today, military operations require information from an unprecedented number of sources resulting in an unprecedented volume of collected data. The proposed improvement is based on a fuzzy approach in computing Value of Information for collected data.

The visualization of dynamic behavior is focused in the paper “Analysis and Visualization of Dynamic Clusterings”. The authors present a method to show how clusters are developing and interacting over time.