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Applied Decision Support with Soft Computing

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# Applied Decision Support with Soft Computing



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# Preface

Today few organizations can survive without the support of automated assistance. The complexity of modern decisions has caused organizations to become increasingly dependent on advanced information technologies to quickly process large quantities of data. Computerized decision support has been and will always be the key for the success of any organization.

Soft computing has provided sophisticated methodologies for the development of intelligent decision support systems. Fast advances in soft computing technologies, such as fuzzy logic and systems, artificial neural networks and evolutionary computation, have made available powerful problem representation and modelling paradigms, and learning and optimisation mechanisms for addressing modern decision making issues.

There have been substantial developments in the soft computing technologies for decision support over the last few years, which have been extensively reported in the literature through numerous technical journals and books.

Different from most existing books, this volume will predominately focus on "applied" decision support with soft computing, that is, the real applications of soft computing in decision support. Areas covered in this book include planning, management, finance and administration in both the private and public sectors.

The first part of the volume is concerned with more general paradigms, solutions and analyses related to a broadly perceived decision support using some soft (and also hard) computing tools and techniques. In line with an application oriented character of the volume, discussions are always illustrated on examples and applications.

We begin with the chapter "Modeling Knowledge: Model-Based Decision Support and Soft Computations" by M. Makowski and A.P. Wierzbicki which provides an overview of foundations, rationale, tools and techniques, architectures, etc. of a model-based support for modern decision making, with remarks and comments on the role of soft computing.

W. Cheetham, K. Goebel and P. Bonissone in the paper "benefits of Decision Support Using Soft Computing" show, on the basis of successful applications, advantages of using soft computing tools that have allowed developers at General Electric to maximize the benefits and minimize the costs of decision support

systems they have created, reducing costs of design, automation, maintainance, and maximizing the value of the decision process. These benefits are shown on two applications.

In the chapter “Evolving Connectionist-Based Decision Support Systems”, N. Kasabov gives, first, some background information on decision support systems and then introduces a framework for building dynamic, adaptive decision support systems that evolve their structure and improve their knowledge-base through a continuous learning from data and through interaction with the environment; they use evolving connectionist systems (ECOS), adaptive learning neural network models, thus their name is evolving connectionist based decision systems (ECBDS).

In the paper “An Agent-Based Soft Computing Society with Applications in Financial Investment Planning”, Chengqi Zhang and Zili Zhang, propose an agent based soft computing society framework that can be of use for the construction of decision support systems in various domains. For illustration, an application in financial investment planning tasks is presented.

In her paper “A Rough Sets/Neural Networks Approach to Knowledge Discovery for the Development of Decision Support Systems”, I. Jagielska proposes a conceptual and a technological framework for adaptive development of decision support systems (DSS) through knowledge discovery from historical data, advocating the use of hybrid rough sets/neural networks framework. For illustration, an example related to industrial and business decision problems where historical data exists is shown.

The next paper concern applications and implementations of decision support systems applied to various domains exemplified by socio-economic, technological, environmental, agricultural, etc. problems. This emphasis on applications is what makes the volume special in the existing literature on the subject.

In “Decision Support Systems in Healthcare: Emerging Trends and Success Factors,” written by T.-L. Leong, a comprehensive survey of developments of decision support systems in healthcare, including applications of soft computing techniques, is given.

The chapter “Relational Structures for the Analysis of Decision Information in an Electronic Market” by Bartel van der Walle is concerned with electronic markets , i.e. web-based information systems that provide communication and decision support for online business activities of buyers and sellers, and focuses on a relatively small but active electronic job market for students (the buyers) and companies (the sellers) who had registered for a forthcoming university career fair.

In their paper “A Fuzzy Evaluation Model: A Case for Intermodal Terminals in Europe”, R.A. Ribeiro, A.M.D. Moreira and E. Declercq are concerned with an analysis of development of a friendly transport concept, an intermodal terminal selection, to minimize possible negative effects of an expected increase of the commercial freight transport due to a continuously increasing demand for speed, reliability, reduced transportation costs and value added services.

H. Bury and D. Wagner discuss, in their paper “Application of Kemeny’s Median for Group Decision Support”, general problems concerned with the choice of a method of group judgement for expert opinions given in the form of preference orders, with a special attention Kemeny’s median and its modification proposed by Litvak. Heuristic computational algorithms are proposed, and a real-life example for ranking university professors is described.

The chapter “An Internet-based Group Decision and Consensus Reaching Support System” by Sławomir Zadrozny and Janusz Kacprzyk is concerned with a group decision making and consensus reaching decision support system and its implementation within the framework of the Internet (WWW), with emphasis on consensus reaching, under linguistic preferences and majority.

J.I. Peláez, M.T. Lamata and F.J. Fuentes present, in their paper “Limpio: A DSS for the Urban Waste Collection Problem”, a decision support system for a company involved in urban waste collection, taking into account problems such as the initial volume of information needed to run the systems, the direction of traffic in the city, or the measures needed to establish how valid a solution is.

In their paper, “A Decision Support System for Air Quality Control Based on Soft Computing Methods”, P. Holnicki and A. Kałuszko show how to support an optimal allocation of financial means for emission reduction in a given set of power and heating plants in a region, with emphasis on sulfur. A case study reported concerns a set of major power plants in the Silesia Region (Poland).

R. Alcalá, J.M. Benítez, J. Castillas, J.L. Castro, O. Cerdón, A. Gonzàles, F. Herrera and R. Pérez discuss, in their chapter “Multicriteria Genetic Tuning for the Optimization and Control of HVAC Systems”, the use of genetic algorithms for the optimization and control of heating, ventilation and air conditioning (HVAC) systems employing fuzzy controllers to increase efficiency and performance..

K.P.Lam’s chapter “Intelligent Information Systems for Crime Analysis” discusses a recent development of in the use of intelligent techniques for crime analysis, in particular related to crime map and facial identification. An integrated man-machine approach is described. An application in Hong Kong is presented.

The chapter “Fuzzy Decision Trees Application to Reservoir Recognition” by X. Z. Wang, D. S. Yeung, E. C. C. Tsang, J. W. T. Lee, outlines an application of fuzzy decision trees in reservoir recognition for an oilfield in Northern China.

In their paper “A Decision Support System for the Construction of Cattle Diets”, D.A. Pelta, J.L. Verdegay and J.M. Cadenas discuss the problem of determining a best diet for cattle, a important problem plagued by uncertainty, imprecisely known parameters and lack of data. Fuzzy logic is employed, and an application for an Argentinian farms, where the cattle is not confined, is shown.

In the paper “Prediction of Parthenium Weed Dispersal using Fuzzy Logic on GIS Spatial Image,” written by A. Chiou and X. Yu, the application of fuzzy logic in the prediction of parthenium weed dispersal based on GIS spatial image for Australia’s Central Queensland region is discussed, a project funded by the Australia’s Commonwealth Government.

Overall, this book provides a comprehensive coverage of up to date conceptual frameworks in broadly perceived decision support systems, and successful applications.

We are sincerely grateful to the many contributors who have given their valuable time and expertise to this project, without whom, this collection of contributions would not have been possible. We want to particularly thank them for bearing with us a lengthy period of editing process for the book. Finally special thanks to our families for their support and devotion.

Melbourne, Australia  
Warsaw, Poland  
January, 2002

Xinghuo Yu and Janusz Kacprzyk



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