

# **STUDIES IN *FUZZINESS* AND *SOFT COMPUTING***

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Editors

## **Soft Computing for Intelligent Robotic Systems**

Springer-Verlag  
Berlin Heidelberg GmbH



# Soft Computing For Intelligent Robotic Systems

**Toshio Fukuda**



## **Soft Computing For Intelligent Robotic Systems:**

**Soft Computing for Intelligent Robotic Systems** Toshio Fukuda,1998-12-04 Research results using some of the most advanced soft computing techniques in intelligent robotic systems are presented The main purpose of this book is to show how the power of soft computing techniques can be exploited in intelligent robotic systems The main emphasis is on control system for a mobile robot behavior arbitration for a mobile robot reinforcement learning of a robot manipulation of a robot collision avoidance and automatic design of robots This book will be useful for application engineers scientists and researchers who wish to use some of the most advanced soft computing techniques in robotics *Soft Computing for*

*Intelligent Robotic Systems* Toshio Fukuda,2014-03-12 Research results using some of the most advanced soft computing techniques in intelligent robotic systems are presented The main purpose of this book is to show how the power of soft computing techniques can be exploited in intelligent robotic systems The main emphasis is on control system for a mobile robot behavior arbitration for a mobile robot reinforcement learning of a robot manipulation of a robot collision avoidance and automatic design of robots This book will be useful for application engineers scientists and researchers who wish to use some of the most advanced soft computing techniques in robotics *Soft Computing for Intelligent Robotic Systems* Toshio

Fukuda,2013-04-17 Research results using some of the most advanced soft computing techniques in intelligent robotic systems are presented The main purpose of this book is to show how the power of soft computing techniques can be exploited in intelligent robotic systems The main emphasis is on control system for a mobile robot behavior arbitration for a mobile robot reinforcement learning of a robot manipulation of a robot collision avoidance and automatic design of robots This book will be useful for application engineers scientists and researchers who wish to use some of the most advanced soft computing techniques in robotics **Autonomous Robotic Systems** Changjiu Zhou,Darío Maravall,Da Ruan,2013-03-20

This book contains an edited collection of eighteen contributions on soft and hard computing techniques and their applications to autonomous robotic systems Each contribution has been exclusively written for this volume by a leading researcher The volume demonstrates the various ways that the soft computing and hard computing techniques can be used in different integrated manners to better develop autonomous robotic systems that can perform various tasks of vision perception cognition thinking pattern recognition decision making and reasoning and control amongst others Each chapter of the book is self contained and points out the future direction of research It is a must reading for students and researchers interested in exploring the potentials of the fascinating field that will form the basis for the design of the intelligent machines of the future Madan M Gupta [Intelligent Control of Robotic Systems](#) D. Katic,M. Vukobratovic,2013-03-14 As robotic systems make their way into standard practice they have opened the door to a wide spectrum of complex applications Such applications usually demand that the robots be highly intelligent Future robots are likely to have greater sensory capabilities more intelligence higher levels of manual dexterity and adequate mobility compared to humans In order to ensure high

quality control and performance in robotics new intelligent control techniques must be developed which are capable of coping with task complexity multi objective decision making large volumes of perception data and substantial amounts of heuristic information Hence the pursuit of intelligent autonomous robotic systems has been a topic of much fascinating research in recent years On the other hand as emerging technologies Soft Computing paradigms consisting of complementary elements of Fuzzy Logic Neural Computing and Evolutionary Computation are viewed as the most promising methods towards intelligent robotic systems Due to their strong learning and cognitive ability and good tolerance of uncertainty and imprecision Soft Computing techniques have found wide application in the area of intelligent control of robotic systems

**Aspects of Soft Computing, Intelligent Robotics and Control** János Fodor, 2009-08-20 Soft computing as a collection of techniques exploiting approximation and tolerance for imprecision and uncertainty in traditionally intractable problems has become very effective and popular especially because of the synergy derived from its components The integration of constituent technologies provides complementary methods that allow developing flexible computing tools and solving complex problems A wide area of natural applications of soft computing techniques consists of the control of dynamic systems including robots Loosely speaking control can be understood as driving a process to attain a desired goal Intelligent control can be seen as an extension of this concept to include autonomous human like interactions of a machine with the environment Intelligent robots can be characterized by the ability to operate in an uncertain changing environment with the help of appropriate sensing They have the power to autonomously plan and execute motion sequences to achieve a goal specified by a human user without detailed instructions In this volume leading specialists address various theoretical and practical aspects in soft computing intelligent robotics and control The problems discussed are taken from fuzzy systems neural networks interactive evolutionary computation intelligent mobile robotics and intelligent control of linear and nonlinear dynamic systems

**Soft Computing in Advanced Robotics** Yong-Tae Kim, Ichiro Kobayashi, Euntai Kim, 2014-07-08 Intelligent system and robotics are inevitably bound up intelligent robots makes embodiment of system integration by using the intelligent systems We can figure out that intelligent systems are to cell units while intelligent robots are to body components The two technologies have been synchronized in progress Making leverage of the robotics and intelligent systems applications cover boundlessly the range from our daily life to space station manufacturing healthcare environment energy education personal assistance logistics This book aims at presenting the research results in relevance with intelligent robotics technology We propose to researchers and practitioners some methods to advance the intelligent systems and apply them to advanced robotics technology This book consists of 10 contributions that feature mobile robots robot emotion electric power steering multi agent fuzzy visual navigation adaptive network based fuzzy inference system swarm EKF localization and inspection robot This edition is published in original peer reviewed contributions covering from initial design to final prototypes and authorization

Design and Control of Intelligent Robotic Systems Dikai Liu, Lingfeng

Wang, Kay Chen Tan, 2009-03-05 With the increasing applications of intelligent robotic systems in various fields the sign and control of these systems have increasingly attracted interest from researchers This edited book entitled Design and Control of Intelligent Robotic Systems in the book series of Studies in Computational Intelligence is a collection of some advanced research on design and control of intelligent robots The works presented range in scope from design methodologies to robot development Various design approaches and algorithms such as evolutionary computation neural networks fuzzy logic learning etc are included We also would like to mention that most studies reported in this book have been implemented in physical systems An overview on the applications of computational intelligence in bio inspired robotics is given in Chapter 1 by M Begum and F Karray with highlights of the recent progress in bio inspired robotics research and a focus on the usage of computational intelligence tools to design human like cognitive abilities in the robotic systems In Chapter 2 Lisa L Grant and Ganesh K Venayagamoorthy present greedy search particle swarm optimization and fuzzy logic based strategies for navigating a swarm of robots for target search in a hazardous environment with potential applications in high risk tasks such as disaster recovery and hazardous material detection

### **Aspects of Soft Computing, Intelligent Robotics and Control**

János Fodor, 2009-10-13 Soft computing as a collection of techniques exploiting approximation and tolerance for imprecision and uncertainty in traditionally intractable problems has become very effective and popular especially because of the synergy derived from its components The integration of constituent technologies provides complementary methods that allow developing flexible computing tools and solving complex problems A wide area of natural applications of soft computing techniques consists of the control of dynamic systems including robots Loosely speaking control can be understood as driving a process to attain a desired goal Intelligent control can be seen as an extension of this concept to include autonomous human like interactions of a machine with the environment Intelligent robots can be characterized by the ability to operate in an uncertain changing environment with the help of appropriate sensing They have the power to autonomously plan and execute motion sequences to achieve a goal specified by a human user without detailed instructions In this volume leading specialists address various theoretical and practical aspects in soft computing intelligent robotics and control The problems discussed are taken from fuzzy systems neural networks interactive evolutionary computation intelligent mobile robotics and intelligent control of linear and nonlinear dynamic systems

### Modeling and Simulations of Robotic Systems Using Soft

Computing Rega Rajendra, Dilip Kumar Pratihara, 2012-10-06 *Soft Computing for Intelligent Control and Mobile Robotics*

Oscar Castillo, Witold Pedrycz, 2010-10-05 This book describes in a detailed fashion the application of hybrid intelligent systems using soft computing techniques for intelligent control and mobile robotics Soft Computing SC consists of several intelligent computing paradigms including fuzzy logic neural networks and bio inspired optimization algorithms which can be used to produce powerful hybrid intelligent systems The prudent combination of SC techniques can produce powerful hybrid intelligent systems that are capable of solving real world problems This is illustrated in this book with a wide range of

applications with particular emphasis in intelligent control and mobile robotics The book is organized in five main parts which contain a group of papers around a similar subject The first part consists of papers with the main theme of theory and algorithms which are basically papers that propose new models and concepts which can be the basis for achieving intelligent control and mobile robotics The second part contains papers with the main theme of intelligent control which are basically papers using bio inspired techniques like evolutionary algorithms and neural networks for achieving intelligent control of non linear plants The third part contains papers with the theme of optimization of fuzzy controllers which basically consider the application of bio inspired optimization methods to automate the design process of optimal type 1 and type 2 fuzzy controllers The fourth part contains papers that deal with the application of SC techniques in times series prediction and intelligent agents The fifth part contains papers with the theme of computer vision and robotics which are papers considering soft computing methods for applications related to vision and robotics

*Fuzzy and Neural: Interactions and Applications*  
James J. Buckley, Thomas Feuring, 2013-06-05 The primary purpose of this book is to present information about selected topics on the interactions and applications of fuzzy neural Most of the discussion centers around our own research in these areas Fuzzy neural can mean many things 1 approximations between fuzzy systems and neural nets Chapter 4 2 building hybrid neural nets to equal fuzzy systems Chapter 5 3 using neural nets to solve fuzzy problems Chapter 6 4 approximations between fuzzy neural nets and other fuzzy systems Chapter 8 5 constructing hybrid fuzzy neural nets for certain fuzzy systems Chapters 9 10 or 6 computing with words Chapter 11 This book is not intended to be used primarily as a text book for a course in fuzzy neural because we have not included problems at the end of each chapter we have omitted most proofs given in the references and we have given very few references We wanted to keep the mathematical prerequisites to a minimum so all longer involved proofs were omitted Elementary differential calculus is the only prerequisite needed since we do mention partial derivatives once or twice

*Recent Issues on Fuzzy Databases* Gloria Bordogna, Gabriella Pasi, 2013-03-19 First of all I would like to congratulate Gabriella Pasi and Gloria Bordogna for the work they accomplished in preparing this new book in the series Study in Fuzziness and Soft Computing Recent Issues on the Management of Fuzziness in Databases is undoubtedly a token of their long lasting and active involvement in the area of Fuzzy Information Retrieval and Fuzzy Database Systems This book is really welcome in the area of fuzzy databases where they are not numerous although the first works at the crossroads of fuzzy sets and databases were initiated about twenty years ago by L Zadeh Only five books have been published since 1995 when the first volume dedicated to fuzzy databases published in the series Study in Fuzziness and Soft Computing edited by J Kacprzyk and myself appeared Going beyond books strictly speaking let us also mention the existence of review papers that are part of a couple of handbooks related to fuzzy sets published since 1998 The area known as fuzzy databases covers a bunch of topics among which flexible queries addressed to regular databases the extension of the notion of a functional dependency data mining and fuzzy summarization querying databases containing imperfect attribute

values represented thanks to possibility distributions

**Fuzzy Classifier Design** Ludmila I. Kuncheva, 2012-11-08 Fuzzy sets were first proposed by Lotfi Zadeh in his seminal paper 366 in 1965 and ever since have been a center of many discussions fervently admired and condemned Both proponents and opponents consider the arguments pointless because none of them would step back from their territory And still discussions burst out from a single sparkle like a conference paper or a message on some fuzzy mail newsgroup Here is an excerpt from an e mail message posted in 1993 to fuzzy mail vexpert dbai twvien ac at by somebody who signed Dave Why then the logic in fuzzy logic I don't think anyone has successfully used fuzzy sets for logical inference nor do I think anyone will In my admittedly neophyte opinion fuzzy logic is a misnomer an oxymoron I would be delighted to be proven wrong on that I came to the fuzzy literature with an open mind and open wallet high hopes and keen interest I am very much disillusioned with fuzzy per se but I did happen across some extremely interesting things along the way Dave thanks for the nice quote Enthusiastic on the surface are not many of us suspicious deep down In some books and journals the word fuzzy is religiously avoided fuzzy set theory is viewed as a second hand cheap trick whose aim is nothing else but to devalue good classical theories and open up the way to lazy ignorants and newcomers

**Large Scale Interactive Fuzzy Multiobjective Programming** Masatoshi Sakawa, 2012-12-06

Simultaneous considerations of multiobjectiveness fuzziness and block angular structures involved in the real world decision making problems lead us to the new field of interactive multiobjective optimization for large scale programming problems under fuzziness The aim of this book is to introduce the latest advances in the new field of interactive multiobjective optimization for large scale programming problems under fuzziness on the basis of the author's continuing research Special stress is placed on interactive decision making aspects of fuzzy multiobjective optimization for human centered systems in most realistic situations when dealing with fuzziness The book is intended for graduate students researchers and practitioners in the fields of operations research industrial engineering management science and computer science

**Fuzzy Techniques in Image Processing** Etienne E. Kerre, Mike Nachttegaal, 2013-03-19 Since time immemorial vision in general and images in particular have played an important and essential role in human life Nowadays the field of image processing also has numerous scientific commercial industrial and military applications All these applications result from the interaction between fundamental scientific research on the one hand and the development of new and high standard technology on the other hand Regarding the scientific component quite recently the scientific community became familiar with fuzzy techniques in image processing which make use of the framework of fuzzy sets and related theories The theory of fuzzy sets was initiated in 1965 by Zadeh and is one of the most developed models to treat imprecision and uncertainty Instead of the classical approach that an object belongs or does not belong to a set the concept of a fuzzy set allows a gradual transition from membership to nonmembership providing partial degrees of membership Fuzzy techniques are often complementary to existing techniques and can contribute to the development of better and more robust methods as has

already been illustrated in numerous scientific branches With this volume we want to demonstrate that the introduction and application of fuzzy techniques can also be very successful in the area of image processing This book contains high quality contributions of over 30 field experts covering a wide range of both theoretical and practical applications of fuzzy techniques in image processing

*Innovations in ART Neural Networks* Beatrice Lazzerini,Ugur Halici,2013-06-05 In the last two decades the artificial neural networks have been refined and widely used by the researchers and application engineers We have not witnessed such a large degree of evolution in any other artificial neural network as in the Adaptive Resonance Theory ART neural network The ART network remains plastic or adaptive in response to significant events and yet remains stable in response to irrelevant events This stability plasticity property is a great step towards realizing intelligent machines capable of autonomous learning in real time environment The main aim of this book is to report a very small sample of the research on the evolution of ART neural network and its applications Interested readers may refer literature for many more innovations in ART such as Fuzzy ART ART2 ART2 a ARTMAP ARTMAP PI ARTMAP DS Gaussian ARTMAP EXACT ART and ART EMAP

**Knowledge Management in Fuzzy Databases** Olga Pons,Maria A. Vila,2013-11-11 1 When I was asked by the editors of this book to write a foreword I was seized by panic Obviously neither I am an expert in Knowledge Representation in Fuzzy Databases nor I could have been beforehand unaware that the book's contributors would be some of the most outstanding researchers in the field However Amparo Vila's gentle insistence gradually broke down my initial resistance and panic then gave way to worry Which paving stones did I have at my disposal for making an entrance to the book After thinking about it for some time I concluded that it would be pretentious on my part to focus on the subjects which are dealt with directly in the contributions presented and that it would instead be better to confine myself to making some general reflections on knowledge representation given by imprecise information using fuzzy sets reflections which have been suggested to me by some words in the following articles such as graded notions fuzzy objects uncertainty fuzzy implications fuzzy inference empty intersection etc

**Deep Fusion of Computational and Symbolic Processing** Takeshi Furuhashi,Shun'Ichi Tano,Hans-Arno Jacobsen,2012-12-06 Symbolic processing has limitations highlighted by the symbol grounding problem Computational processing methods like fuzzy logic neural networks and statistical methods have appeared to overcome these problems However they also suffer from drawbacks in that for example multi stage inference is difficult to implement Deep fusion of symbolic and computational processing is expected to open a new paradigm for intelligent systems Symbolic processing and computational processing should interact at all abstract or computational levels For this undertaking attempts to combine hybridize and fuse these processing methods should be thoroughly investigated and the direction of novel fusion approaches should be clarified This book contains the current status of this attempt and also discusses future directions

*Preferences and Decisions under Incomplete Knowledge* Janos Fodor,Bernard De Baets,Patrice Perny,2013-11-11 Nowadays decision problems are pervaded with incomplete knowledge i.e imprecision and or



uncertain information both in the problem description and in the preferential information In this volume leading scientists in the field address various theoretical and practical aspects related to the handling of this incompleteness The problems discussed are taken from multi objective linear programming rationality considerations in preference modelling non probabilistic utility theory data fusion group decision making and multicriteria decision aid The book is oriented towards researchers graduate and postgraduate students in decision analysis fuzzy sets and fuzzy logic and operations research management science

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