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Proceedings

In Memory of ***Professor Yasuhiko Dote***

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Table of Contents

The Fifth International Conference on Soft Computing as Transdisciplinary Science and Technology

Technical Sponsors iii
Honorary Chair Foreword xvii
Chairs Welcome Message xix
Workshop Editorial Messages xxi
CSTST'08 Conference and Workshop Committees xxv

Keynotes

Proximity-based ad hoc Federation among Smart Objects and its Applications 1
Yuzuru Tanaka

Evolutionary Multiobjective Optimization and Multiobjective Fuzzy System Design 3
Hisao Ishibuchi

Chance Discovery as Value Sensing by Data based Meta Cognition 5
Yukio Ohsawa

Conference Sessions

CLA: Classification

Document Classification System Based on HMM Word Map 7
Nikos Tsimboukakis, George Tambouratzis

Building Classification Rules for Case Based Classifier using Fuzzy Sets and Formal Concept Analysis 13
Jirapond Tadrat, Veera Boonjing, Puntip Pattaraintakorn

Intelligent Hybrid System for Pattern Recognition and Classification 19
Ivan Jordanov, Antoniya Georgieva

FUZ: Fuzzy Applications

Voice Quality Measurement System for Telephone Service 25
Ilgu Jung, Eunjin Ko , Hyunchul Kang, Gilhaeng Lee

Fuzzy Control of Undersea Robotic Vehicle in Plane Motion 31
Jerzy Garus

Recognizing Unexpected Recurrence Behaviors with Fuzzy Measures in Sequence Databases 37
Dong Haoyuan Li, Anne Laurent, Pascal Poncelet

Hybrid approach Using Ant Colony Optimization and Fuzzy Logic to Solve Multi-criteria Hybrid Flow Shop Scheduling Problem..... 44
Safa Khalouli, Fatima Ghedjati , Abdelaziz Hamzaoui

SEC: Security

Improving Performance of Intrusion Detection System by Applying a New Machine Learning Strategy 51
Zou Tao, Yimin Cui, Minhuan Huang, Cui Zhang

Network Security Simulation and Evaluation 55
Yimin Cui, Tao Zou, Lufeng Zhang, Jinjing Zhao

A Novel approach in Securing DDoS Attack..... 59
Yi-Tung Chan, Galyna A. Akmayeva, Charles Shoniregun

Extending Web Applications with a Lightweight Zero Knowledge Proof Authentication 65
Sławomir Grzonkowski, Wojciech Zaremba, Maciej Zaremba, Bill Mcdaniel

ROB & ANN: Robotics And Neural Networks

Implementation of a Neural-based Navigation Approach on Indoor and Outdoor Mobile Robots..... 71
Ouahiba Azouaoui, Mohamed Kadri, Noureddine Ouadah

A Human-Machine Interface Design for Direct Rehabilitation using A Rehabilitation Robot.....78
Erhan Akdogan, Mehmet Arif Adli, Nureddin Bennett

Counter-Ant Algorithm for Evolving Multirobot Collaboration..... 84
Abdelhak Chatty, Ilhem Kallel, Adel M. Alimi

Persian On-line Handwritten Character Recognition by RCE Spatio-Temporal Neural Network..... 90
Mehdi Moghadam Fard, Maryam Moghadam Fard, Behrouz Minaei Bidgoli, Masroor Hussain

Distributed Real-Time Neural Networks In Interactive Complex Systems 95
Lagarde Matthieu, Andry Pierre, Gaussier Philippe

MED: Medical Applications

Distant Learning Case-Study: Nurse Training in Diabetes Problems..... 101
Jozef Bohdan Lewoc, Antoni Izworski, Sławomir Skowronski

Wireless Device for People affected by Neurodegenerative Diseases 106
Paul Bustamante, Gonzalo Solas, Karol Grandez

Covered Body Analysis in Application to Patient Monitoring 112
Ching-Wei Wang

Fundamental Research for Brain Machine Interface by use of
EEG from Right Frontal Gyrus 118
Takahiro Yamanoi, Hisashi Toyoshima, Toshimasa Yamazaki, Shin-Ichi Ohnishi, Michio Sugeno, Elie Sanchez

Swarm Intelligence of Gene Networks Forms Behavioral Rules for
Biological Cells Serving as Agents of the Next Level Organ-Forming SI 125
Igor Tsigelny, Valentina Kouznetsova, Sanjay Nigam

Calculating Accurate Volume of Spontaneous Intracerebral Hematoma 131
Radoslaw Cichocki, Martin Tabakow, Halina Kwasnicka

ANS 1: Architectures, Network Applications and Services

HMM-Embedded Bayesian Network for Heterogeneous Command
Integration: Applications to Biped Humanoid Operation over the Network 138
Yasuo Matsuyama, Youichi Nishida

Design of a P2P Infrastructure to Support Plagiarism Detection Mechanisms..... 146
Juan Mussini, Lau Lung, Fabio Favarim

Complex Federation Architectures: Stakes, Tricks & Issues..... 152
Mikaël Ates, Christophe Gravier, Jeremy Lardon, Jacques Fayolle

Optimizing Communications in Vehicular Ad hoc Networks
Using Evolutionary Computation and Simulation 158
Wahabou Abdou, Adrien Henriet, Dominique Dhoutaut, Francois Spies,Christelle Bloch

Automatic Generator of XML Documents Editors based on Attributed Grammars **166**
Kablan Barbar

ANS 2: Architectures, Network Applications and Services

Service Diffusion in the Market Considering Consumers' Subjective Value **173**
Kousuke Fujita, Takeshi Takenaka, Kanji Ueda

A Multi-Swarm Approach to Neighbor Selection in Peer-to-Peer Networks **178**
Ajith Abraham, Youakim Badr, Hongbo Liu, Crina Grosan

Global Consensus Emergence in an Unstructured Semantic Network **185**
Gabriele Gianini, Antonia Azzini, Ernesto Damiani, Stefania Marrara

Novel Cache Management Strategy for Semantic Caching in Mobile Environment **192**
Kami Makki, Xunhang Zhou

DM 1: Data Mining

Discovery of Underlying Morphological Bonds Using an Agglomerative Clustering Algorithm **198**
Zacharias Detorakis, George Tambouratzis

Fast Extraction of Gradual Association Rules: A Heuristic Based Method **205**
Lisa Di Jorio, Anne Laurent, Maguelonne Teisseire

Web Opinion Mining: How to Extract Opinions from Blogs? **211**
Ali Harb, Michel Plantié, Mathieu Roche, Gérard Dray, Pascal Poncelet, François Trousset

Recursive Data Mining for Role Identification **218**
Vineet Chaoji, Apirak Hoonlor, Boleslaw Szymanski

DM 2: Data Mining

Text Summarization with Harmony Search Algorithm-Based Sentence Extraction **226**
Ehsan Shareghi, Leila Sharif

Mining Social Network for Extracting Topic of Textual Conversations **232**
Pooya Moradian Zadeh, Maryam Mohi, Mohsen Sadighi Moshkenani

Mining Competitive Technical Intelligence of High-tech Products with Self-Organizing Map **238**
Gang Li, Lu An

ALG: Algorithms

On Stability of the Chemotactic Dynamics in Bacterial Foraging Optimization Algorithm **245**
Swagatam Das, Sambarta Dasgupta, Arijit Biswas, Ajith Abraham, Amit Konar

Data Pre-processing: A new algorithm for Feature Selection and Data Discretization **252**
Marcela Ribeiro, Monica Ferreira, Caetano Traina Jr, Agma Traina

Memetic Programming with Adaptive Local Search Using Tree Data Structures **258**
Emad Mabrouk, Abdel-Rahman Hedar, Masao Fukushima

Tuning an Evolutionary Algorithm with Taguchi Methods and Application to the Dimensioning of an Electrical Motor **265**
Jean-Laurent Hippolyte, Christelle Bloch, Pascal Chatonnay, Christophe Espanet, Didier Chamagne, Geneviève Wimmer

ISA: Intelligent Systems and Applications

Knowledge Revision in Systems Based on an Informed Tree Search Strategy: Application to Cartographic Generalization **273**
Patrick Taillandier, Duchêne Cécile, Drogoul Alexis

A Multi-agent Approach for an UWB Location Embedded Software Architecture **279**
Michel Occello, Jean-Paul Jamont, Manuel Pezzin, Régis Guillermin

Verification of Communication Protocols in a Multi-agent System **286**
Marina Bagic, Aleksandar Babac, Marijan Kunstic

Constraints Satisfaction Problems in Data Modeling **292**
Djamel Berrabah, Faouzi Boufarès

HCI: Human-Computer Interaction

FreeTagpaper: A Pen-and-Paper-Based Collaboration System Using Visual Tags Printed on Paper **298**
Satoshi Iwaki, Hiroaki Kawata, Tamotsu Machino, Manabu Motegi, Shin-Yo Muto, Yoshito Nanjo

Resources Annotation, Retrieval and Presentation **303**
M. Albert, Ceddrik Allery, Nicolas Freiss,Gregory L'Azou, A. Moreau, Jonathan Piron, Vincent Ribaud, Philippe Saliou

Policy Based Access for Home Contents and Services **310**
Mohammad Chowdhury, Sarfraz Alam, Josef Noll

OPT: Optimization Problems

A Novel Particle Swarm Optimization for Multiple Campaigns Assignment Problem **317**
Satchidananda Dehuri, Sung-Bae Cho

Fatigue Level Estimation of Bill Based on Feature-Selected Acoustic Energy Pattern by Using Supervised SOM **325**
Masaru Teranishi, Sigeru Omatu, Toshihisa Kosaka

Ant Colony Optimization for Steiner Tree Problems **331**
Markus Prossegger, Abdelhamid Bouchachia

Evolving Feasible Linear Ordering Problem Solutions **337**
Pavel Kromer, Vaclav Snasel, Jan Platos

KM: Knowledge Management

Strategic Decision Making on Group Collaboration under Temporary Constraints **343**
Hideyasu Sasaki

An NLP-based Ontology Population for a Risk Management Generic Structure **350**
Jawad Makki, Anne-Marie Alquier, Violaine Prince

Estimation of Relevance and Fusion of Data Sources Using Belief Function Theory: Application to Bioprocess **356**
Sébastien Regis, Andrei Doncescu, Jacky Desachy

Metadata Domain-knowledge Driven Search Engine in "HyperManyMedia" E-learning Resources 363
Leyla Zhuhadar, Olfa Nasraoui, Robert Wyatt

COS: Control and Security

Fed-Batch Fermentation Controller Design with Evolutionary Computation 371
Andri Riid, Ennu Rüstern

A Software Based Approach for Autonomous Projectile Attitude and Position Estimation 378
Bertrand Grandvallet, Ali Zemouche, Mohamed Boutayeb, Sébastien Changey

Cluster-based MDS for Nodes Localization in Wireless Sensor Networks with Irregular Topologies..... 384
Biljana Stojkoska, Danco Davcev, Andrea Kulakov

Optimistic Path-Based Concurrency Control over XML Documents 390
Djamel Berrabah, Stéphane Gançarski, Sarah Kaddour Chikh, Cecile Le Pape

A Face-House Paradigm for Architectural Scene Analysis 397
Stephan Chalup, Kenny Hong, Michael J. Ostwald

Workshop Sessions

FiS: Workshop Fuzzy is Scalable: Managing Huge Databases Using Fuzzy Methods

Fuzzy Logic to Cope with Complex Problems: Some Examples of Real-World Applications 404
Bernadette Bouchon-Meunier

Identification of Association Rules between Clusters 406
Marco Pagani, Gloria Bordogna

High Scale Video Mining with Forests of Fuzzy Decision Trees 413
Christophe Marsala, Marcin Detyniecki

FFTM: Optimized Frequent Tree Mining with Soft Embedding Constraints on Siblings..... 419
Manel Sghaier, Sadok Ben Yahia, Anne Laurent, Maguelonne Teisseire

Modified Bacterial Memetic Algorithm used for Fuzzy Rule Base Extraction 425
László Gál, János Botzheim, László T. Kóczy

CIMI-I: Workshop on Computational Intelligence in Medical Imaging

Region Analysis of Abdominal CT Scans using Image Partition Forests 432
Stuart Golodetz, Irina Voiculescu, Stephen Cameron

Anisotropic Mean Shift Based Fuzzy C-Means Segmentation of Skin Lesions 438
Huiyu Zhou, Gerald Schaefer, Abdul Sadka, M. Emre Celebi

Automatic 3D Skull Reconstruction using Invariant Features 444
Lucia Ballerini, Marcello Calisti, Sergio Damas, Oscar Cordon, Jose Santamaria

Identifying Histological Elements with Convolutional Neural Networks 450
Christopher Malon, Matthew Miller, Harold Christopher Burger, Eric Cosatto, Hans Peter Graf

CIMI-II: Workshop on Computational Intelligence in Medical Imaging

Fuzzy Rule-Based Classification System for Computer-Aided Diagnosis in Contact Endoscopy Imaging 457
Wojciech Tarnawski, Marcin Fraczek, Tomasz Krecicki, Michal Jelen

Morphological Analysis and Reconstruction Techniques in Computer Tomography 464
Victor E. Asadchikov, Alexey I. Chulichkov, Alexey Buzmakov, Marina V. Chukalina, Dmitry P. Nikolaev, Roman A. Senin

WT-SOM network Implementation on FPGA for the Medical Images Compression 468
Fatiha Alim-Ferhat, Sofiane Seddiki, H. Bessalah, M. Issad, H. Salhi, O. Kerdjidj

ASBS-I: Workshop on Autonomous & Autonomic Software-based Systems

Operating System Support for Distributed Applications in Real Space-Time 473
Matthias Werner, Dirk Müller, Martin Däumler, Jan Richling, Gero Mühl

Automatic Configuration for the Component Selection Problem 483
Andreea Vescan, Horia Florin Pop

Implementing a Rule-Driven Approach for Architectural Self Configuration in Collaborative Activities using a Graph Rewriting Formalism 488
Ismael Bouassida Rodriguez, Karim Guennoun, Khalil Drira, Christophe Chassot, Mohamed Jmaiel

GSpace: An Architectural Approach for Self-Managing Extra-Functional Concerns..... 496
Giovanni Russello, Naranker Dulay, Michel Chaudron, Maarten Van Steen

ASBS-II: Workshop on Autonomous & Autonomic Software-based Systems

Towards Modelling and Analysis of a Coordination Protocol for Dynamic Software Adaptation 503
Najla Hadj Kacem, Ahmed Hadj Kacem, Mohamed Jmaiel, Khalil Drira

Modeling of Correct Self-Adaptive Systems: A Graph Transformation System Based Approach 512
Basil Becker, Holger Giese

Dynamic Adaptive Software Components: the MOCAS Approach..... 520
Cyril Ballagny, Nabil Hameurlain, Franck Barbier

CAML-I: Workshop on Context-Aware Mobile Learning

Agent-based Ubiquitous m-Learning Portal for K-12 Teachers 529
Shuangbao Wang, Qing Chen, Michael Behrmann

ContAct-Us: a Context-Activity Adaptive Modeler for Ubiquitous Learning Systems 534
Jihen Malek, Mona Laroussi, Alain Derycke

Context Modeling to Support the Design of Mobile Learning..... 540
Arianit Kurti

PerZoovasive: Contextual Pervasive QR Codes as Tool to Provide an Adaptive Learning Support..... 546
José Rouillard, Mona Laroussi

CAML-II: Workshop on Context-Aware Mobile Learning

Multi-Agent Architecture for Context-Aware mLearning Provision via InfoStations..... 553
Stanimir Stoyanov, Ivan Ganchev, Mairtin O'Droma, D. Mitev, I. Minov

Context Aware Mobile Muslim Companion **557**
Mohamed Al Ali, Jawad Berri, Mohamed Jamal Zemerly

Location-Aware Classroom Services on the Semantic Web **563**
Kris Scott, Rachid Benlamri

SW-I: Workshop of Doctoral Students

Dynamics of Reproduction in Artificial Bacterial Foraging System: Modeling and Stability Analysis **568**
Arijit Biswas, Swagatam Das, Sambarta Dasgupta, Ajith Abraham

The Macroscopic LWR Model of the Transport Equation Viewed as a Distributed Parameter System **576**
Milka Uzunova, Daniel Jolly, Emil Nikolov, Kamel Boumediene

Green Function Analytical Method of Solution of Transport Equation. Modeling and Simulation of the Macroscopic LWR Model as a Distributed Parameter System **581**
Milka Uzunova, Daniel Jolly, Emil Nikolov, Kamel Boumediene

From Scheduling Theory to Practice: A Case Study **585**
Ghislain Charrier

A Study and Implementation of Self-Adaptive Allocation Algorithm for Parallel Program **587**
Ergude Bao, Yang Yang, Hui Chen, Yuan-Yuan Lu, Xiao Liu, Wei-Sheng Li

SW-II: Workshop of Doctoral Students

Diagnosis in Systems Based on an Informed Tree Search Strategy: Application to Cartographic Generalization **593**
Patrick Taillandier

From Prepared Speech to Spontaneous Speech Recognition System: A Comparative Study Applied to French Language **599**
Richard Dufour

Semi-Materialized Framework: a Hybrid Approach to Data Integration **604**
Shokoh Kermanshahani

More Expressive Extensions of TQL **611**
Wissam Khalil

WAODS: Workshop on Applied Ontologies in Distributed Systems

Ontology Driven Road Network Analysis based on Analytical Network Process Technique **617**
Abolghasem Sadeghi-Niaraki, Kyehyun Kim, Cholyoung Lee

Design of an Event System adopting Ontology-based Event Model for Ubiquitous Environment **624**
Heeman Park, Younglok Lee, Hyunghyo Lee, Bongnam Noh

How Can Ontologies Support Enterprise Digital And Paper Archives? A Case Study **631**
Ugo Barchetti, Alberto Bucciero, Luciano Capone, Anna Lisa Guido, Luca Mainetti, Roberto Paiano, Enrico Pulimeno, Stefano Santo Sabato

Towards a First Ontology for Customer Relationship Management **641**
Diego Magro, Anna Goy

A Peer-to-Peer System to Share Ontology in the Semantic Web **648**
Antonio M. Rinaldi

A Semantic-driven Auto-adaptive Architecture for Collaborative Ubiquitous Systems **654**
German Sancho, Said Tazi, Thierry Villemur

AASN: Workshop on Automated and Autonomous Sensor Networks

ComPass System: An Low Power Wireless Sensor Network System and its Application to Indoor Positioning **660**
Takeshi Ikeda, Yutaka Inoue, Akio Sashima, Kiyoshi Yamamoto, Tomohisa Yamashita, Koichi Kurumatani

Dynamic Optimization of Bluetooth Networks for Indoor Localization **667**
Markus Jevring, Robert De Groote, Cristian Hesselman

Using Multi-Agent Geo-Simulation Techniques for Intelligent Sensor Web Management **673**
Mehdi Mekni, Moulin Bernard

A New Energy Efficient Data Transmission Method for Underwater Wireless Sensor Networks **679**
Sangbo Seo, Seungmi Song, Eunsook Kim, Sungun Kim

Adaptive Sensor/Actuator Networks for Tracking Environment Control Behaviors 686
Masayuki Nakamura, Atsushi Sakurai, Takumi Yamada, Jiro Nakamura

Self-Adapting Maxflow Routing Algorithm for WSNs: Practical Issues and Simulation-Based Assessment 692
Andrea Seraghiti, Emanuele Lattanzi, Saverio Delpriori, Alessandro Bogliolo

Foreword

As a longtime participant in CSTST conferences and as a close friend and admirer of Professor Yasuhiko Dote, I am pleased to have an opportunity to share my thoughts on soft computing with the readers of this Volume.

Science deals not with reality but with models of reality. In large measure, scientific progress is driven by the need for better models of reality. What is not widely recognized is that it is this need that motivated the genesis of soft computing and continues to spur its progress and development. In the following, I will elaborate on this point, with emphasis on the role of fuzzy logic in construction of better models of reality.

Generally, a model, M(S), of a system, S, is described in a language, L—call it a modelization language—which is a branch of mathematics. Familiar examples are the language of differential equations, the language of difference equations and the language of probability theory. An important metric of M(S) in relation to S is its cointension, C(M(S), S). Cointension is a qualitative measure of the proximity—in some specified sense of proximity—of M(S) to S. A model, M(S), is cointensive if its cointension in relation to S is high.

The cointensive power of L in relation to a system, S, is a qualitative measure of the capability of L to serve as a basis for construction of cointensive models of S. More generally, the cointensive power of L in relation to a class of systems, S*, is the capability of L to serve as a basis for construction of cointensive models of systems in S*—call it a domain of L. A language, L, is cointensive in relation to S* if its cointensive power in relation to S* is high. To illustrate, the language of linear differential equations is cointensive for linear electrical networks but not for relay networks or for finite-state systems.

Let (L_1,L_2) be a combination of L_1 and L_2, with the understanding that (L_1,L_2)—call it a coalition of L_1 and L_2—is more general than either L_1 or L_2 in isolation. As an illustration, if L_1 is the language of difference equations and L_2 is the language of differential equations, then (L_1,L_2)—the language of difference—differential equations—is more general than either the language of difference equations or the language of differential equations. By virtue of greater generality of (L_1,L_2), the cointensive power of the coalition of L_1 and L_2 is at least as high, and generally significantly higher than the cointensive powers of L_1 and L_2 in isolation. In short, coalition of modelization languages enhances cointensive power and enlarges the domain of coalition.

In this perspective, soft computing may be viewed as a coalition of fuzzy logic, neurocomputing, evolutionary computing and probabilistic computing. Viewed as a modelization language, the enhanced cointensive power and the enlarged domain of soft computing is its principal raison d'etre. Soft computing is an open coalition in the sense that any methodology may be added to it.

Within soft computing, each of its members has a special role to play. The domain of fuzzy logic is the class of systems in which imprecision, uncertainty, incompleteness of information and partiality of truth play prominent roles. The domain of neurocomputing is the class of nonlinear self-learning systems which lend themselves to representation as systems with a connectionist architecture, such as multilayer networks. Evolutionary computing is a model-improvement language which employs systematized random search. The domain of probabilistic computing is the class of systems in which randomness plays an important role. The guiding principle of soft computing is: For best results in system design, members of the soft computing coalition should be used in combination rather than in stand-alone mode. In applications of soft computing, the most widely used combinations are neuro-fuzzy and fuzzy-genetic.

Insofar as fuzzy logic is concerned, it has a feature which is of particular importance. Most specifically, fuzzy logic (FL) may be employed to generalize any bivalent-logic-based theory, T, through what is referred to as FL-generalization. FL-generalization involves addition to T of concepts and techniques drawn from fuzzy logic, in particular the concept of a fuzzy set—a class with a fuzzy boundary. Most human concepts and perceptions fall into this category. FL-generalization of T results in a theory which is labeled as fuzzy T. Familiar examples are fuzzy set theory, fuzzy arithmetic, fuzzy control, etc. What is important to note is that FL-generalization involves addition to, rather than replacement of, concepts and techniques in T.

By construction, the cointensive power of fuzzy T is at least as great as, and generally significantly greater than, the cointensive power of T. This is one of the principal contributions of fuzzy logic.

Over the years, CSTST conferences have contributed in many important ways to the advancement of soft computing and a better understanding of what it is and what it has to offer. The papers presented at CSTST'08 constitute an important step in the same direction. In addition, they serve to throw much light on the relationship between soft computing and rough set theory—an important theory which was initiated by the eminent scientist, the late Professor Z. Pawlak, and developed further by some of the prominent contributors to this Volume.

Lotfi A. Zadeh, *Honorary Chair, CSTST 2008*

Welcome Message

Soft Computing (SC) has an evolving collection of methodologies, which is aimed to exploit tolerance for imprecision uncertainty, and partial truth to achieve robustness, tractability, and low cost. SC provides attractive opportunity to represent the ambiguity in human thinking with real life uncertainty. Fuzzy logic (FL), Neural Networks (NN), and Evolutionary Computation (EC) were the core methodologies of soft computing. Later chaos computing, fractal theory, wavelet transformation, cellular automaton, percolation models, and immune network theory were added to enhance soft computing. However, they should not be viewed as competing with each other, but synergistic and complementary, instead. SC was actually the combination or fusion of each methodology which yielded new computational capabilities (hybrid systems). Soft computing is currently causing a paradigm shift (breakthrough) in science and technology.

The stage for the Fifth IEEE/ACM International Conference on Soft Computing as Transdisciplinary Science and Technology (CSTST'08) has been set. This edition is dedicated to commemorate the memory of Professor Yasuhiko Dote, Founding Chair of WSTST series of meetings. In essence, CSTST'08 is built on the success of the previous four events held in Muroran, Japan namely the IEEE International Workshop on Neuro Fuzzy Control, in 1993; IEEE International Workshop on Soft Computing in Industry, in 1996, the IEEE International Workshop on Soft Computing in Industry, in 1999 and International Workshop on Soft Computing as Transdisciplinary Science and Technology (WSTST'2005). CSTST'08 is hosted by Université de Cergy Pontoise, France and is technically co-sponsored by IEEE Systems Man and Cybernetics Society, ACM SIGAPP (French Chapter), IEEE French Section, World Federation on Soft Computing, European Society for Fuzzy Logic and Technology and International Fuzzy Systems Association. On behalf of the CSTST'08 program committee, we wish to extend a very warm welcome to this edition in Cergy-Pontoise/Paris, France. The conference program committee has organized an exciting and invigorating program comprising presentations from distinguished experts in the field, and important and wide-ranging contributions on state-of-the-art research that provide new insights into current cutting edge results on 'Soft Computing as Transdisciplinary Science and Technology'.

This year, we received over 212 regular submissions and we are really gratified by the international diversity of this conference: authors of submitted work hail from no less than 30 countries including Vietnam, Egypt, Bulgaria, Turkey, Russia, Netherlands, Austria, Malaysia, Sweden, Croatia, Kuwait, Cyprus, Belgium, Estonia, Latvia, Lebanon, Macedonia, Singapore, Argentina, United Arab Emirates, Thailand, Ukraine, Hungary, Ireland, Czech, Republic, Spain, Norway, Taiwan, Canada, Libya, Romania, Mexico, Greece, Brazil, Pakistan, Germany, Australia, Tunisia, India, United States of America, Italy, Korea, Poland, Algeria, Japan, United Kingdom, Iran, China, Portugal, and France. The technical program of CSTST'08 conference comprises of 63 papers. The conference program committee had a very challenging task of choosing high quality submissions. Each paper was peer reviewed by at least three or more independent referees of the program committee and the papers were selected based on the referee recommendations. The papers offer stimulating insights into emerging intelligent technologies and their applications in Internet security, chance discovery, humanized computational intelligence, web intelligence, data mining, image processing, swarm intelligence, optimization and so on.

Similarly, after a peer review, 46 papers were selected for oral presentation in the following workshops:

- Workshop on Automated and Autonomous Sensor Networks (AASN)
- Workshop on Autonomous & Autonomic Software-based Systems (ASBS)
- Workshop on Context-Aware Mobile Learning (CAML)
- Workshop on Computational Intelligence in Medical Imaging (CIMI)
- Workshop of Doctoral Students (DS)
- Workshop Fuzzy is Scalable: Managing Huge Databases Using Fuzzy Methods (FiS)
- Workshop on Applied Ontologies in Distributed Systems (WAODS)

The conference and workshop sessions are scheduled to allow participants to choose among parallel sessions. We also offer two tutorials during which presenters will distill the essence of their topics into half-day tutorials. This edition of CSTST'08 is blessed to have the presence of the following plenary speakers:

Yukio Ohsawa, The University of Tokyo, Japan
Yuzuru Tanaka, Hokkaido University, Japan
Hisao Ishibuchi, Osaka Prefecture University, Japan

The success of this year's meeting is due to the hard work and effort of many people. We would like to express our sincere thanks to the members of the local organizing committee. We thank the members of the program committee and external reviewers for their timely evaluation of the submitted papers. We are very grateful to several institutions and corporations for their sponsorship and assistance. Finally, we hope that you will find these proceedings to be a valuable resource in your professional, research, and educational activities whether you are a student, academic, researcher, or a practicing professional.

General and Program Chairs

Youakim Badr, Ajith Abraham, Yukio Ohsawa

Richard Chbeir, Fernando Ferri, Dominique Laurent, Mario Koeppen

Workshop Editorial Messages

Workshop on Automated and Autonomous Sensor Networks

Thanks to technological advances, wired and wireless sensor networks are attracting an increasing attention that promotes their large-scale deployments in many applications, such as environmental monitoring, military surveillance, and scientific exploration. Continuous improvements are motivating works in addressing specific sensor network issues spanning hardware, network protocols, architecture, operating systems, and applications. Furthermore, emergent needs to fulfil a variety of heterogeneous requirements are highlighting the importance of multidisciplinary networks that control their processing and manage their resources by means of self-organizing techniques. These techniques particularly require sharing the decision-making process over hundreds of low-power, short lifetimes sensors. The achievement of this goal is still facing an urgent and challenging question on how to provide these spatially distributed sensors with reasonable autonomy that help them in performing the right action, at the right time for the sake of fulfilling current requirements while increasing the lifetime of the entire sensor network and guaranteeing reliable and enduring pathway communications. Automating the sensor network activities is also an urgent and challenging issue especially that commonly sensing devices are operating unattended in remote and hostile areas where manual maintenance is nearly impossible. Since predefined and late decisions do not help much in improving the efficiency of networked sensing devices, automation and autonomy are very important mechanisms in addressing upcoming developments that target multi-services, collaborating, or competing sensor networks. To reach these goals, we have launched the first International Workshop on Automated and Autonomous Sensor Networks seeking novel ideas in these topics.

This first edition of the AASN workshop includes six accepted papers. We seize this opportunity to thank the TPC members and the reviewers who have contributed to the thorough reviewing process.

AASN Chairs,
Nafaâ Jabeur, Dhofar University, Oman
Youssef Iraqi, Dhofar University, Oman

ASBS: Workshop on Autonomous and Autonomic Software-Based Systems

Autonomous and autonomic software-based systems are merging as a hot research topic. Autonomous software are self-contained and capable of making independent decisions, and taking actions to satisfy internal goals based upon their perceived environment.

To be autonomic, a system must know itself as well as its boundaries and environment, configure and reconfigure itself, continually optimize itself, recover or heal from malfunction, protect itself, and functions in a heterogeneous world—while keeping its complexity hidden from the user. Therefore, the inherent properties and complexity of autonomous software pose new challenges throughout software lifecycle. For examples, architects and designers need new or specific architectural and design models and languages supporting design and implementation of autonomous software. Middleware and languages must integrate adequate properties facilitating autonomous software implementation. In addition, as autonomous software operate always in critical environment, it is necessary to be able to evaluate effects generated by software actions.

ASBS'2008 workshop covers a wide range of topics in Autonomous & Autonomic Software-based systems. ASBS'2008 in conjunction with CSTST'2008 provides an excellent opportunity for researchers to exchange leading-edge research in the dynamic field of Autonomous & Autonomic systems in general.

Seven papers were selected for presentation in this workshop. They cover both theoretical and practical aspects of autonomous and autonomic systems.

The organizers would like to thank the program committee members for the time they spent for reviewing and providing valuable remarks and comments to the authors.

ASBS 2008 Chairs,
Abdelhak-Djamel Seriai, Université de Montpellier 2, France
Salim Ferraz, Alcatel-Lucent, France
Soraya Kouadri Mostéfaoui, The British Open University, United Kingdom

Workshop on Context-Aware Mobile Learning

As mobile technologies become widespread, new challenges are facing the research community to develop lightweight learning services capable of providing content tailored to the learner's context, current activity, preferences, and competency. Mobile learners expect to access such learning services from various ubiquitous setups (workplace, home, on the move, etc.) under different operational environments. It is therefore necessary to design such learning services with a certain degree of pro-activity that allows sensing both system-centric and user-centric context and act accordingly for better personalization of the learning task. We believe that many research efforts need to be accomplished to build such intelligent m-learning systems. Indeed many existing systems have been designed with focus on technological aspects only, while they should equally address the knowledge aspects of mobile learning. In particular, several obstacles still hinder personalization of mobile learning services, such as: (i) current mobile learning services act as passive components rather than active components that can be embedded with context awareness mechanisms, (ii) existing approaches for service discovery neglect contextual information on surrounding environment, and (iii) lack of theory and models for m-learning design. The aim of this workshop is to advance the state-of-the-art in m-learning theories and design, context-awareness in m-learning, and knowledge management for m-learning. The main goal is to provide a forum for researchers and practitioners to present and discuss their research and experience in this field. Seven papers were selected for presentation in this workshop. They cover both theoretical and practical aspects of m-learning systems.

The workshop co-chairs would like to thanks the members of the Program Committee for their time, valuable work in the reviewing process, and constructive comments to the workshop authors. We also would like to thank the CSTST conference chairs for giving us the opportunity to organize this workshop.

CAML Chairs,
Rachid Benlamri, Lakehead University, Ontario, Canada
Jawad Berri, Khalifa University, United Arab Emirates

Workshop on Computational Intelligence in Medical Imaging

Nowadays medical imaging provides major aid in many branches of medicine and enables and facilitates the capture, transmission and analysis of medical images as well as provides assistance towards medical diagnoses. Medical imaging is still on the rise with new imaging modalities being added and continuous improvements of devices' capabilities. Recently, computational intelligence techniques (such as neural networks or fuzzy logic) have been employed in various applications in the area of medical imaging. Approaches

based on computational intelligence have been shown to be advantageous compared to classical approaches, in particular when classical solutions are hard or impossible to formulate and analyse.

After a successful session at the IEEE Symposium Computational Intelligence in Image and Signal Processing (CIISP) last year, this is the First Int. Workshop on Computational Intelligence in Medical Imaging (CIMI) which provides a compilation of the latest trends and developments in this field. All submissions to the workshop were rigorously reviewed by 4 expert reviewers each. Finally the best 8 of the 17 submissions were selected for inclusion in the workshop and it is the revised version of these contributions that are compiled in this volume.

As workshop organisers we are grateful to the authors and reviewers as well as to the organisers of the International Conference on Soft Computing as Transdisciplinary Science and Technology (CSTST) in conjunction with which the CIMI workshop is run.

CIMI Chairs,

Gerald Schaefer, Aston University, UK
M. Emre Celebi, Louisiana State University, USA
Marina Chukalina Russian Academy of Sciences, Russia
Dmitry Nikolaev, Russian Academy of Sciences, Russia

Workshop of Doctoral Students

This workshop of Doctoral Students was started with the aim to provide a forum for presenting offer the opportunity to present pre-doctoral work and introduce new research topics. It's been an outstanding success receiving contributions from all parts of the World. After a double review process, we decided to select 9 papers. The selected papers deal with a wide variety of applied computing issues including those listed below:

Modeling and analysis of biological systems
Speech recognition systems
Data Integration
LWR model applied to transport equation

The aim is not to have straight presentations, but to grant enough time to discuss central issues of each thesis. A motivation for the research in the selected area and a review of related work (approaches, standards, etc) have been preferred for contributions. We are certain that these discussions afford rich opportunities for the benefit of the student and that this workshop will continue to be a success in future editions of CSTST.

The organizers would like to warmly thank Bertrand Cuissart, member of GREYC laboratory, for having accepted our invitation to chair the session, and provide valuable remarks and comments to the authors. Finally, many thanks to the PC members and additional reviewers for their valuable work and to the CSTST 2008 Workshop Chairs for their help and guidance throughout the preparation of this workshop.

We hope you will enjoy participating in this workshop and interact with these young researchers!

WDS Chairs,

Virginie Sans, ETIS/CNRS Laboratory, France
Nicolas Lumineau, Université Lyon, France

Workshop Fuzzy is Scalable: Managing Huge Databases Using Fuzzy Methods

Fuzzy methods are in common use nowadays, as they provide tools to handle data sets in a relevant, robust and interpretable way. Yet they often suffer from the perception that they cannot address huge data bases, although it is not the case, as many applications, including industrial success stories, have shown: fuzziness and scalability are not antagonistic concepts. The scalability issue indeed appears to be challenging when considering fuzzy methods as opposed to crisp ones, which is a counterpart to their improved flexibility and expression power. The application of fuzzy methods to huge data bases is often considered as inappropriate.

This issue has received attention from the research community and many methods have been proposed to address it from several points of view, including implementation of data structures and algorithmic approaches to handle complexity.

The workshop reviews diverse such scalable fuzzy methods, up-to-date methods and algorithms that address this problem, showing that fuzzy logic is a very powerful approach to provide relevant results also for very large data bases within reasonable time and memory use.

The organizers would like to thank the program committee members for the time they spent for reviewing and providing valuable remarks and comments to the authors.

For this first edition of the workshop, five papers are presented, aiming at covering a wide scope of research areas using to fuzzy logic: they address several machine learning problems, such as clustering and rule extraction, and consider several application domains, among which video mining and XML document mining.

Success stories in various domains are presented in an invited talk to illustrate and highlight the possibilities of building scalable fuzzy methods. In this respect, we would like to warmly thank Prof. Bernadette Bouchon-Meunier for having accepted our invitation to present her successful results. Director of research at the National Center for Scientific Research, head of the department of Databases and Machine Learning in the Computer Science Laboratory of the University Paris 6 (LIP6), Bernadette Bouchon-Meunier was a pioneer in the use of the fuzzy set theory to cope with complex problems from real world applications.

Wishing you a pleasant workshop,

FiS Chairs,

Anne Laurent, LIRMM, University of Montpellier 2, France
Marie-Jeanne Lesot, LIP6, University of Paris 6, France

WAODS: Workshop on Applied Ontologies in Distributed Systems

The first Workshop on Applied Ontologies in Distributed Systems (WAODS), is taking place from 26 to 30 October 2008 in Cergy, France, and focuses on innovative ontologie-driven software in the field of distributed architectures.

WAOS main topics encompass research advances around ontologies applications, interoperability, knowledge sharing and ubiquitous computing. This session gives the opportunity to researchers to share their point of view on the usage of ontologies in differents areas and to evaluate how it performs in practice. In fact, researchers in this domain share their results, findings and tools that may contribute to the growth of this evolving field.

The following selected papers, published in these CSTST proceedings, give an accurate insight into the discussions that will take place during this workshop hosted by the 5th IEEE CSTST International Conference. All submitted papers have been carefully peer-reviewed by at least two reviewers for technical merit, originality, significance and relevance to WAODS topics. We would like also to thank all the researchers who submitted a manuscript, and we wish the best for the researchers whose papers could not pass the review process this time (nearly 1 out of 2).

Moreover, we would like to deeply thank all the people who served as member for the Program Committee of the WAODS workshop. The quality of this Program Committee guarantees all the seriousness in the review process undergone by WAODS papers.

Finally, we want to thank CSTST conference chairs for their confidence in WAODS, and for giving us the opportunity to organize this workshop in the best conditions.

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Matt-Mouley Bouamrane, University of Manchester, UK
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ASBS: Workshop on Autonomous and Autonomic Software-Based Systems

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