

Lecture Notes in Artificial Intelligence

695

Subseries of Lecture Notes in Computer Science

Edited by J. Siekmann

Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis



E. P. Klement W. Slany (Eds.)

Fuzzy Logic in Artificial Intelligence

8th Austrian Artificial Intelligence Conference,
FLAI '93

Linz, Austria, June 28-30, 1993

Proceedings

Springer-Verlag

Berlin Heidelberg New York

London Paris Tokyo

Hong Kong Barcelona

Budapest

Series Editor

Jörg Siekmann
University of Saarland
German Research Center for Artificial Intelligence (DFKI)
Stuhlsatzenhausweg 3, D-66123 Saarbrücken 11, FRG

Volume Editors

Erich P. Klement
Fuzzy Logic Laboratory Linz
Department of Mathematics
Johannes Kepler University
A-4040 Linz, Austria

Wolfgang Slany
Christian Doppler Laboratory for Expert Systems
Information Systems Department (E184-2)
Technical University of Vienna
Paniglgasse 16, A-1040 Vienna, Austria

CR Subject Classification (1991): I.2, J.2, J.3

ISBN 3-540-56920-0 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-56920-0 Springer-Verlag New York Berlin Heidelberg

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1993
Printed in Germany

Typesetting: Camera ready by author
Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.
45/3140-543210 - Printed on acid-free paper

Preface

The Eighth Austrian Artificial Intelligence Conference took place at the Bildungszentrum St. Magdalena, Linz, Austria, June 28-30, 1993. Taking into account the sharply increasing importance of fuzzy logic in many areas of applications, it was decided to focus during this conference on "Fuzzy Logic in Artificial Intelligence".

Out of 34 papers submitted in total, 17 were finally accepted by the international Program Committee for presentation during the conference, all of which are reprinted in this volume. The contributions cover a wide range of areas where fuzzy logic and artificial intelligence meet in current research: theoretical issues, machine learning, expert systems, robotics & control, applications to medicine, and applications to car driving.

In addition to the contributed papers, the conference also featured invited talks by Lotfi A. Zadeh, speaking about "The Role of Fuzzy Logic and Soft Computing in the Conception and Design of Intelligent Systems", and by Irina Ezhkova, speaking about "A Contextual Approach for AI Systems Development". We very much appreciate that both supplied abstracts of their plenary talk for this volume.

Additionally, you will find descriptions of the four workshops that took place during the conference. Johann Gamper and Bernhard Moser organized the "Workshop for Doctoral Students in Fuzzy-Based Systems", Andreas Geyer-Schulz and Peter Kotauczek the one about "Fuzzy Logic for Commercial and Industrial Applications", Rainer Born the one on "Karl Menger, Fuzzy Logic and Artificial Intelligence – An Experiment in Reflection", and Roger Kerr the one on "Fuzzy Scheduling Systems". The conference also included two tutorials, one on "Fuzzy Logic and Applications (in particular to Expert Systems)" by Hans-Jürgen Zimmermann, and one on "Fuzzy Control" by Rudolf Kruse. We are very obliged to all of them for their help in making the conference attractive to all participants.

We are indebted to the members of the Program Committee not only for providing the basis for a fair selection from the initial contributions, but also for many useful comments and suggestions concerning the accepted papers, thus enabling the authors to prepare improved final versions of their contributions.

Finally we would like to thank the supporting companies and institutions and all those persons whose assistance in organizing this conference considerably contributed to its eventual success.

Linz, June 1993

Erich Peter Klement, Wolfgang Slany

Conference Organizer

Österreichische Gesellschaft für Artificial Intelligence /
Austrian Society for Artificial Intelligence

Program Committee

K.-P. Adlassnig (Austria)	D. Dubois (France)
M. Fedrizzi (Italy)	A. Geyer-Schulz (Austria/Germany)
V. H. Haase (Austria)	R. Kruse (Germany)
R. Lopez de Mantaras (Spain)	M. Reinfrank (Germany)
Ph. Smets (Belgium)	H. Takagi (Japan/USA)
R. R. Yager (USA)	M. Zemankova (USA)
H.-J. Zimmermann (Germany)	

Additonal Referees

F. Esteva (Spain)	E. Gersthofer (Austria/Germany)
L. Godo (Spain)	A. Hecht (Germany)
H. Hellendoorn (Germany)	T. Hessberg (USA)
N. Honda (USA)	J.-S. Jang (USA)
P. S. Khedkar (USA)	H. Leufke (Germany)
R. Palm (Germany)	R. Rehbold (Germany)
U. Rehfuß (Germany)	M. Reiter (Austria)

Cooperating Institutions

Fuzzy Logic Laboratorium Linz
Christian Doppler Labor für Expertensysteme, Wien

Supporting Companies and Institutions

BEKO - Ing. P. Kotauczek GesmbH., Wien
Technologie und Marketing GesmbH., Linz
European Coordinating Committee for Artificial Intelligence

Table of Contents

Abstracts of Invited Talks

The Role of Fuzzy Logic and Soft Computing in the Conception and Design of Intelligent Systems <i>Lotfi A. Zadeh</i>	1
--	---

A Contextual Approach for AI Systems Development <i>Irina V. Ezhkova</i>	2
---	---

Theoretical Issues

Typicality of Concept Instances: A Semiotic Way for Its Evaluation <i>Anio O. Arigoni</i>	3
---	---

Non-Conventional Conjunctions and Implications in Fuzzy Logic <i>János C. Fodor and Tibor Keresztfalvi</i>	16
---	----

A Comparative Fuzzy Modal Logic <i>Petr Hájek and Dagmar Harmanová</i>	27
---	----

Machine Learning

Combining Neural Networks and Fuzzy Controllers <i>Detlef Nauck, Frank Klawonn and Rudolf Kruse</i>	35
--	----

A Reinforcement Learning Algorithm based on ‘Safety’ <i>Ann Nowé and Ranjan Vepa</i>	47
---	----

GAITS: Fuzzy Set-Based Algorithms for Computing Strategies Using Genetic Algorithms <i>Mohamed Quafafou and Mohammed Nafia</i>	59
--	----

Neural Networks and Genetic Algorithm Approaches to Auto-Design of Fuzzy Systems <i>Hideyuki Takagi and Michael Lee</i>	68
---	----

Symbolic and Numeric Data Management in a Geographical Information System: A Fuzzy Neural Network Approach <i>El-hadi Zahzah and Jacky Desachy</i>	80
--	----

Expert Systems

Approximate Reasoning in the Modeling of Consensus in Group Decisions <i>Luisa Mich, Mario Fedrizzi and Loris Gaio</i>	91
--	----

Fuzzy Logic-Based Processing of Expert Rules Used for Checking the Creditability of Small Business Firms <i>Heinrich J. Rommelfanger</i>	103
--	-----

Robotics & Control

Fuzzy Control in Real-time for Vision Guided Autonomous Mobile Robots <i>Bernhard Blöchl</i>	114
Robot Motion Coordination by Fuzzy Control <i>Vahe Khachatouri Yeghiazarians and Bernard Favre-Bulle</i>	126
Fuzzy Control Schemes for Active Magnetic Bearings <i>Harri Koskinen</i>	137

Applications to Medicine

An Adaptive Fuzzy Control Module for Automatic Dialysis <i>Silvio Giove, Maurizio Nordio and Alessandro Zorat</i>	146
A Combination Scheme of Artificial Intelligence and Fuzzy Pattern Recognition in Medical Diagnosis <i>Ludmila I. Kuncheva, Roumen Z. Zlatev, Snezhana N. Neshkova and Hans Gamper</i>	157

Applications to Car Driving

Fuzzy Concepts for Predicting the Behaviour of Other Drivers on a Highway <i>Friedhelm Mündemann</i>	165
Design of a Fuzzy Car Distance Controller <i>Alexandra Weidmann</i>	174

Workshop Descriptions

Karl Menger, Fuzzy Logic and Artificial Intelligence – An Experiment in Reflection <i>Rainer Born</i>	188
Workshop for Doctoral Students in Fuzzy-Based Systems <i>Johannes Gamper and Bernhard Moser</i>	189
Industrial and Commercial Applications of Fuzzy Logic <i>Andreas Geyer-Schulz and Peter Kótauczek</i>	190
Fuzzy Scheduling Systems <i>Roger Kerr</i>	192