The 2nd World Conference on Soft Computing

dedicated to the research heritage of

Lotfi A. Zadeh

University of California, Berkeley, California

PROGRAM

organized and sponsored by

MINISTRY OF COMMUNICATIONS AND INFORMATION TECHNOLOGIES OF THE REPUBLIC OF AZERBAIJAN

December 3-5, 2012
Baku, Azerbaijan

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University of California, Berkeley

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Carol Walker (USA)
Elbert Walker (USA)
Paul Wang (USA)
Bernard Widrow (USA)
Ronald R. Yager (USA)
Hao Ying (USA)
Slawomir Zadrozny (Poland)
Hans Zimmermann (Germany)

Schedule at Glance

Sunday, December 2nd 2012

Time: 7:00pm - 10:00pm

Welcome Reception

Location: **Golden Cage Restaurant**
Kempinski Hotel Badamdar, Baku

Monday, December 3rd 2012

location: **Kempinski Hotel Badamdar**

8:00am 9:00am	Registration and Coffee		
9:00am 9:45am	**Social Network Computing** *Ronald R. Yager* *Qabala Ballroom A*		
9:45am 10:30am	**Computing with words: past, present and future challenges** *Janusz Kacprzyk* *Qabala Ballroom A*		
10:30am 10:45am	Coffee Break		
10:45am 11:30am	**Fuzzy modeling, a bridge to linguistic expressiveness** *Bernadette Bouchon-Meunier* *Qabala Ballroom A*		
11:30am 12:50pm	**Fusion, Reasoning and Preferences** *Qabala Ballroom A*	**Knowledge Management and Experimental Analysis** *Qabala Ballroom B*	**Fuzziness in Analysis of Human and Social Behaviours** *Qabala Ballroom C*
12:50pm 2:15pm	Lunch (provided)		

Location: **Azerbaijan Technical University**

3:00pm 4:00pm	**Opening Session** Lotfi A.Zadeh, Ali M. Abbassov, Ronald Yager, Mahmud Kerimov, Mo Jamshidi, Havar Mammadov, Burhan Türkşen, Shahnaz Shahbazova
4:00pm 5:00pm	**A Restriction-Centered Theory of Reasoning and Computation** *Lotfi A. Zadeh*
5:00pm 6:00pm	**Ceremony of the Honorary Degree upon Dr. Ronald R. Yager**

Time: 7:30pm – 10:00pm
Dinner
Location: Absheron Hotel, Sharg Hall

Tuesday, December 4th 2012

Location: **Kempinski Hotel Badamdar**

<table>
<tr><td>9:00am
9:45am</td><td colspan="3">Intelligent robust distributed system for monitoring and control of seismic stability of high-rise buildings and monitoring of origin of anomalous seismic processes
Telman A. Aliev
Qabala Ballroom A</td></tr>
<tr><td>9:45am
10:30am</td><td colspan="3">Why can we think?
Michio Sugeno
Qabala Ballroom A</td></tr>
<tr><td>10:30am
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<tr><td>10:45am
12:05pm</td><td>Fuzzy Recognition/ Classification and Image Processing
Qabala Ballroom A</td><td>Management Applications and Group Decision-Making
Qabala Ballroom B</td><td>Transportation and Mobile Applications, Customer (CRM) Applications
Qabala Ballroom C</td></tr>
<tr><td>12:05pm
1:25pm</td><td>Operational Research
Qabala Ballroom A</td><td>Applications in Supply and Inventory Management
Qabala Ballroom B</td><td>Industrial Applications: Oil Wells, Seismic Stability, and Power Network
Qabala Ballroom C</td></tr>
<tr><td>1:25pm
3:00pm</td><td colspan="3">Lunch (provided)</td></tr>
<tr><td>3:00pm
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Mo Jamshidi
Auditorium</td></tr>
<tr><td>3:45pm
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Witold Pedrycz
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Luis Magdalena
Auditorium</td></tr>
<tr><td>5:30pm
6:15pm</td><td colspan="3">From Booleanity to Fuzziness
Antonio Di Nola
Auditorium</td></tr>
<tr><td>6:15pm
7:00pm</td><td colspan="3">Data and Variable Compression with Fuzzy Extended Logic in Statistical Modeling
Vesa A. Niskanen
Auditorium</td></tr>
</table>

Time: 7:30pm – 10:00pm
Banquet
Location: Hilton Hotel, Sevda Hall

Wednesday, December 5th 2012

Location: **Kempinski Hotel Badamdar**

9:00am 9:45am	**Type 1, …, full type N fuzzy system models** *I. Burhan Türksen* *Qabala Ballroom A*		
9:45am 10:30am	**Need for Expert Knowledge (and Soft Computing) in Geosciences** *Vladik Kreinovich* *Qabala Ballroom A*		
10:30am 10:45am	Coffee Break		
10:45am 11:30am	**Representing and Analyzing the Look-up Table Controllers via Mamdani Fuzzy Control** *Hao Ying* *Qabala Ballroom A*		
11:30am 12:50pm	**Fuzziness and Applications** *Qabala Ballroom A*	**Fuzzy Sets and Logic** *Qabala Ballroom B*	**Optimization and Algorithms-I** *Qabala Ballroom C*
12:50pm 2:00pm	Lunch (provided)		
2:00pm 3:40pm	**Special Session: Industrial Applications** *Qabala Ballroom A*	**Fuzzy Control, and Intelligent Monitoring** *Qabala Ballroom B*	**Neural Networks: Construction and Application** *Qabala Ballroom C*
3:40pm 3:55pm	Coffee Break		
3:55pm 5:15pm	**Data Mining Applications and Systems** *Qabala Ballroom A*	**Temporal Issues and Data Analysis** *Qabala Ballroom B*	**Optimization and Algorithms-II** *Qabala Ballroom C*
5:15pm 6:00pm	**Mathematical model of the applicability of expert systems based on neural networks technology and hybrid systems for decision-making** *Shahnaz N. Shahbazova* *Qabala Ballroom A*		

Time: 7:30pm – 10:00pm
Dinner
Location: Yacht Club

Sunday
December 2nd, 2012

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Monday
December 3rd, 2012

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Location: *Kempinski Hotel Badamdar, Qabala Ballroom A*

Time : 9:00am – 10:30am

Social Network Computing
Ronald R. Yager

Computing with words: past, present and future challenges
Janusz Kacprzyk

Chair: I. Burhan Türkşen
Location: *Qabala Ballroom A*

Time : 10:30am – 10:45am

COFFEE BREAK

Time : 10:45am – 11:30am

Fuzzy modeling, a bridge to linguistic expressiveness
Bernadette Bouchon-Meunier

Chair: Michio Sugeno
Location: *Qabala Ballroom A*

Time : 11:30am – 12:50pm

Fusion, Reasoning and Preferences

Chair: Janusz Kacprzyk
Location: *Qabala Ballroom A*

Knowledge Fusion in Context-Aware Decision Support: Ontology-Based Modeling and Patterns
Alexander Smirnov, Tatiana Levashova, Nikolay Shilov, and Andrew Krizhanovsky
Probabilistic reasoning with vague information
Giulianella Coletti and Barbara Vantaggi
A new preference approach for ranking fuzzy numbers
Soheil Salahshour and Tofigh Allahviranloo
Preference Function Reconstruction for Multiple Criteria Decision Making Based on Machine Learning Approach
Leonid Lyubchyk and Galyna Grinberg

Knowledge Management and Experimental Analysis

Chair: Mo Jamshidi
Location*: Qabala Ballroom B*

Simulation of Building of the Complex on Intelligent Information Systems Training and Knowledge Control (IISTKC)
Havar Mammadov, Shahnaz Shahbazova, Qassan Quseynov, and Mustafa Babanli
Visualization of Measuring Experiments in a Context of Acceptance of Decisions
Bahram Ismailov
Fuzzy Model of Knowledge and Its Application to Learning
Adalat Pashayev and Elkhan Sabziev
Application of fuzzy multi-criteria method in decision-making support of personnel management problems
Masuma Mamedova and Zarifa Jabrailova

Fuzziness in Analysis of Human and Social Behaviours

Chair: Antonio DI NOLA
Location*: Qabala Ballroom C*

Fuzzy Approach to Identification of Human Emotions Based on Recognition and Analysis of Body Movements
Artem S. Bobkov, Vladimir L. Rosaliev, Alla V. Zaboleeva-Zotova, and Alexey B. Petrovsky
Fuzzy Analyzes of Quality Socioeconomic System
G.C. Imanov
Evaluation of e-Government Benefits in the Republic of Azerbaijan by Using Fuzzy Model
N. J. Hajiyev
Use mathematical model for improvement of municipal management in Azerbaijan and forecasting its future
A.I. Mehdialiyev

Time : **12:50pm – 2:15pm**

LUNCH

Location: **Azerbaijan Technical University**

Time : 3:00pm – 4:00pm

Opening Session

Chairs: Marek Reformat and Shahnaz Shahbazova
Location: ***Azerbaijan Technical University***

Lotfi A.Zadeh, *Professor, University of California, Berkeley*

Ali M. Abbasov, *Minister of Communications and Information Technologies of the Republic of Azerbaijan*

Ronald Yager, *Iona College New York, USA*

Mahmud Kerimov, *President of Azerbaijan National Academy of Sciences, Azerbaijan*

Mo Jamshidi, *Professor, University of Texas, San Antonio*

Havar Mammadov, *Rector of Azerbaijan Technical University, Azerbaijan*

Burhan Türkşen, *Professor, University of Toronto, Canada*

Shahnaz Shahbazova, *Azerbaijan Technical University***,** *Azerbaijan*

Time : 4:00pm – 5:00pm

A Restriction-Centered Theory of Reasoning and Computation

Lotfi A. Zadeh

Chair: Mo Jamshidi
Location: Azerbaijan Technical University

Time : 5:00pm – 6:00pm

Ceremony of the Honorary Degree upon Dr. Ronald R. Yager

Chairs: H.Mammadov
Location: Azerbaijan Technical University

Time : 7:30pm – 10:00pm

DINNER
Location: Absheron Hotel Sharg Hall

Tuesday
December 4th, 2012

Time : 9:00am – 10:30am

Intelligent robust distributed system for monitoring and control of seismic stability of high-rise buildings and monitoring of origin of anomalous seismic processes

Telman A. Aliev

Why can we think?

Michio Sugeno

Chair: Ronald R. Yager
Location: *Qabala Ballroom A*

Time : 10:30am – 10:45am

COFFEE BREAK

Time : 10:45am – 12:05pm

Fuzzy Recognition/Classification and Image Processing

Chair: Vesa A. Niskanen
Location: *Qabala Ballroom A*

Spatiotemporal Human Brain Activities on Recalling Body Names II
Takahiro Yamanoi, Yoshinori Tanaka, Mika Otuki, Shin-Ichi Ohnishi, Toshimasa Yamazaki, and Michio Sugeno
Novel Image Fusion Based on F-transform
Irina Perfilieva and Marek Vajgl
Improving the Accuracy of a Fuzzy-Based Single-Stroke Character Recognizer by Antecedent Weighting
Alex Tormási and László T. Kóczy
The Development of an Algorithmic Model for Object Recognition From Visual and Sound Information Based on Neuro-Fuzzy Logic
Sabina Shahbazzade
Image thresholding by grouping functions. Application to MRI images
Aranzazu Jurio, Daniel Paternain, Miguel Pagola, and Humberto Bustince

Management Applications and Group Decision-Making

Chair: Fernando Gomide
Location*: Qabala Ballroom B*

Group Multiple Criteria Decision Making: Multiset Approach
Alexey Petrovsky
Models of management and the prognostication of water balance in rivers and reservoirs.
Faik Nagiyev, Gazanfar Orujov, and Almaz Aliyeva
A New Multi-Objective Programming Model for Recovery Planning Problem under Uncertainty
Navid Sahebjamnia, Ali Torabi, and Nima Salehi
A new bi-objective model for locating backup facilities in multi branch companies considering spatial dispersion and concentration risks
Nima Salehi, Aida Khayatian, and Reza Tavakkoli-Moghaddam

Transportation and Mobile Applications, Customer (CRM) Applications

Chair: Bernadette Bouchon-Meunier
Location: *Qabala Ballroom C*

Fuzzy Logic for Optimization of Transportation Problems
Yuriy Kondratenko, Galyna Kondratenko, Igor Atamanyuk, and Ievgen Sidenko
An Imperialist Competitive Algorithm for Vehicle Routing Problem in Cross-docking with Soft Time Windows
Asefeh Hasani-Goodarzi and Reza Tavakkoli-Moghaddam
A new approach based on soft computing for solving an open transportation problem of linear programming
Afik Allahverdiyed
Automatic Ball Tracking in Mobile Robot Soccer
Michael Scopchanov and Oved Farhi

Time : 12:05pm - 1:25pm

Operational Research

Chair: Vladik Kreinovich
Location: *Qabala Ballroom A*

Scheduling Non-Permutation Flow Shop Problem with machine Availability Constraints and Learning Effects: Hybrid Meta-Heuristic
Behdin Vahedi Nouri, Reza Ramezanian, Parviz Fattahi, and Reza Tavakkoli-Moghaddam
Declining Total of the Maximum Delay and Maximum Promptitude: Parallel Machine Programming with Assumptive Actions
Ali Azadeh, Alireza Faed, Morteza Saberi, and Elizabeth Chang
Multi-product multi-period capacitated lot-sizing and scheduling problem: Firefly algorithm
Reza Ramezanian and Mohammad Saidi-Mehrabad

A Fuzzy Multi-Objective Linear Program for Solving Capacitated Lot Sizing Problem in a Mixed-assembly Shop
Navid Sahebjamnia, Ali Torabi, and Nima Salehi

Applications in Supply and Inventory Management

Chair: Hao Ying
Location: *Qabala Ballroom B*

A New Network Optimization and Supplier Selection Model Considering Price and Quality
Amirhossein Meisami, Nima Salehi, and Mahbod Amouie
A fuzzy stochastic programming approach for multi-level capacitated lot-sizing problem under uncertainty
Navid Sahebjamnia, Ali Torabi, and Nima Salehi
Single-Echelon Inventory Management Using a Reinforcement Learning Technique
Masoud Mahootchi, Zahra Saberi, and Behroz Karimi
Decision-Making Based on Fuzzy Estimation of Quality Level for Cargo Delivery
Yuriy Kondratenko and Ievgen Sidenko

Industrial Applications: Oil Wells, Seismic Stability, and Power Network

Chair: Luis Magdalena
Location: *Qabala Ballroom C*

Robust Technology for Determining of Flow Rate of Oil Wells
Telman Aliyev, Gambar Guluyev, Asif Rzayev, Fahrad Pashayev, Rauf Gadimov, and Ismat Sattarov
System for monitoring of seismic stability of complexes of building structures
Telman Aliev, Naila Musayeva, Elchin Aliev, Ulkar Sattarova, and Rauf Gadimov
The Synthesis of Optimal System of Oil Quality Control
Teodor Kopisitsky and Yusif Rzayev
About Application of Artificial Intelligence's Methods for Estimation of Power Losses in Distributive Electric Networks
A.B. Balametov and E.D. Halilov

Time : 1:25pm - 3:00pm

LUNCH

Time : 3:00pm – 4:30pm

Intelligent Management Decisions for a System of Conventional and Sustainable Energy Systems with Air Pollution Constraints

Mo Jamshidi

Fuzzy Modeling: A Retrospective View and Future Directions

Witold Pedrycz

Chair: *Vladik Kreinovich*
Location: *Auditorium*

Time : 4:30pm – 4:45pm

COFFEE BREAK

Time : 4:45pm – 7:00pm

On fuzziness and the interpretability-accuracy trade-off

Luis Magdalena

From Booleanity to Fuzziness

Antonio Di Nola

Data and Variable Compression with Fuzzy Extended Logic in Statistical Modeling

Vesa A. Niskanen

Chair: Ronald R. Yager
Location: *Auditorium*

Time : 7:30pm –10:00pm

BANQUET
Location: Hilton Hotel, Sevda Hall

Wednesday
December 5th, 2012

Time : 9:00am – 10:30am

Type 1, …, full type N fuzzy system models
I. Burhan Türksen

Need for Expert Knowledge (and Soft Computing) in Geosciences
Vladik Kreinovich

Chair: Mo Jamshidi
Location: *Qabala Ballroom A*

Time : 10:30am – 10:45am

COFFEE BREAK

Time : 10:45am – 11:30am

Representing and Analyzing the Look-up Table Controllers via Mamdani Fuzzy Control
Hao Ying

Chair: Telman Aliev
Location: *Qabala Ballroom A*

Time : 11:30am – 12:50pm

Fuzziness and Applications
Chair: Ashok Deshpande
Location: *Qabala Ballroom A*

Fuzzy difference and differential-difference equations
Tofigh Allahviranloo and Soheil Salahshour
A New Approach to Solving Decision Making Problem with Z-Information under Uncertain Environment
Latafat A. Gardashova
Diagnosing of Systems under Ekspert-Estimated Fuzzy Binary Relations (FBR)
T.Q. Rzayev, A.T. Iskenderova, and A.G. Alibalaeva

Approximate Z-Number Evaluation based on Categorical Sets of Probability Distributions
S. Tadayon and B. Tadayon

Fuzzy Sets and Logic

Chair: Shinichi Onishi
Location: Qabala Ballroom B

Solution method for a non-homogeneous fuzzy initial value problem
Nizami Gasilov, Sahin Emrah Amrahov, Afet Golayoglu Fatullayev, and Ilyas Hashimoglu
A New Type Reduction Method for Piecewise Linear Interval Type-2 Fuzzy Sets
Cenk Ulu, Mujde Guzelkaya, and Ibrahim Eksin
Probabilistic-Statistical Methods of the Decision Tasks of the Theory of Fuzzy Sets
T.Q. Rzayev
Study and Application of Smooth Class of Membership Functions for Fuzzy Sets
N. T. Ismayilova

Optimization and Algorithms-I

Chair: Tadanari Taniguchi
Location: Qabala Ballroom C

Behavior of Tsetlin's Learning Automata in a Fuzzy Environment
Vadim Stefanuk
A New Heuristic Algorithm for Solving the Dominating Subset with Minimal Weight Problem
Can Atilgan, Burak Ordin, and Urfat Nuriyev
A New Hybrid Algorithm Inspired By Astrophysics for Numerical Optimization
Soroor Sarafrazi and Hossein Nezamabadi-Pour
On a solution of one fuzzy logic problem
R. Y. Shikhlinskaya and B. M. Qasımov

Time : 12:50pm – 2:00pm

LUNCH

Time : 2:00pm –3:40pm

Special Session: Industrial Applications

Chair: Shahnaz Shahbazova
Location: *Qabala Ballroom A*

Efficacy of selected Soft Computing techniques in Ranking of Sites for Hazardous Industrial Installation
Kalyani Sambhoo Salla, Dr Sanjay Kadam, and Dr Ashok Deshpande

Initial Screening of Gynecological Diseases in a Patient, Expert's Knowledgebase and Fuzzy Set Theory: A Case Study in India
Anjali Sardesai, Vilas Kharat, Ashok Deshpande, and Pradip Sambarey
Fuzzy resolution with similarity-based reasoning
Banibrata Mondal and Swapan Raha
Development of Environment Friendly Air Conditioner using Fuzzy logic
Roshan Kshirsagar, Chetankumar Patil, and Ashok Deshpande
Fuzzy set in gene expression
Dipankar Mazumdar and Swapan Raha

Fuzzy Control and Intelligent Monitoring

Chair: Takahiro Yamanoi
Location: Qabala Ballroom B

Fuzzy Control as the entrance door to Control Theory
Antonio Dourado
Nonlinear Control for Multiple-Input and Multiple-Output Nonlinear Systems with PB Models Based on I/O Linearization
Tadanari Taniguchi, Luka Eciolaza, and Michio Sugeno
Feedback Error Learning through Piecewise Bilinear Models
Luka Eciolaza, Tadanari Taniguchi, and Michio Sugeno
Problem of Optimal Control of Gas Lift with Fuzzy Initial Conditions
F.A. Aliev, A.A.Niftiev, M.M. Mutallimov, and M.A.Namazov
Intelligent robust distributed system for monitoring and control of seismic stability of high-rise buildings and monitoring of origin of anomalous seismic processes
Telman Aliev, Ali Abbasov, Gambar Guluyev, Fahrad Pashayev, and Ulkar Sattarova

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Neural Networks: Construction and Application

Chair: A. V. Smirnov
Location: Qabala Ballroom C

Uninorm-Based Fuzzy Neural Networks and Approximation
Fernando Bordignon and Fernando Gomide
Combining Neural Networks, Fuzzy Regression and Genetic Algorithm to Optimize Real Value of Ambiguous Inputs in Production
Ali Azadeh, Alireza Faed, Morteza Saberi, and Elizabeth Chang
A Hybrid ANN-Fuzzy Inference System Approach to Intensify Transformation and Variance Stabilization Using Noisy and Uncertain Data
Ali Azadeh, Alireza Faed, Morteza Saberi, and Elizabeth Chang
Improving the Model Convergence Properties of Classifier Feedforward MLP Neural Networks
Annamária R. Várkonyi-Kóczy and Balazs Tusor
Chaotic Systems Predictability using Neuro-Fuzzy Systems and Neural Networks with Bred Vectors
Pettras Dos Santos, Haroldo Campos Velho, Rosangela Cintra, and Sandra Sandri

Time : 3:40pm – 3:55pm

COFFEE BREAK

Time : 3:55pm –5:15pm

Data Mining Applications and Systems

Chair: Valery B. Tarassov
Location: Qabala Ballroom A

Poincare Return Times in the Interaction of Chaotic and Stochastic Systems
Eduard Vladimirsky
Data Mining Application in Analysis of Knowledge Management Gaps
Maryam Nazaridoust and Jalal Rezaienour
Data Mining of Associate Degree Accepted Candidates By Using Unsupervised Paradigm
Maryam Nazaridoust and Behrouz Minaie Bidgoli
Context-Dependent Interpretation of Medical Data
Mila Kwiatkowska and N. T. Ayas

Temporal Issues and Data Analysis

Chair: Guy De Tré
Location: *Qabala Ballroom B*

A Flexible Algorithm for Fault Diagnosis in a Centrifugal Pump with Corrupted Data and Noise
Morteza Saberi, Ali Azadeh, Elizabeth Chang, Ahmad Kazem, and Zahra Saberi
Visualising and Handling Uncertain Time Intervals in a Two-Dimensional Triangular Space
Guy De Tré, Antoon Bronselaer, Christophe Billiet, Yi Qiang,
Nico Van de Weghe, Philippe De Maeyer, Jose Enrique Pons, and Olga Pons
Time Series Trend Extraction and its Linguistic Evaluation Using F-Transform and Fuzzy Natural Logic
Vilem Novák, Viktor Pavliska, Martin Štepnicka, and Lenka Štepnicková
Using Zadeh's Granulation Concept: Granular Logics and Their Application to Sensor Data Analysis
Valery B. Tarassov and Maria N. Svyatkina

Optimization and Algorithms-II

Chair: Bijan Tadayon
Location: *Qabala Ballroom C*

A New Hyperheuristic Algorithm for Solving Traveling Salesman Problem
Fidan Nuriyeva and Gozde Kizilates

A Flexible Intelligent Algorithm for Assessment and Optimization of Gas Transmission Systems Performance Based on Dynamic Decision Making Styles and Safety Factors
Mohamad Ali Azadeh, Fereshteh Valianpour, Morteza Saberi, and Behzad Ashjari
On The Optimization of the Bandpass Length for the Bandpass Problem
Arif Gürsoy, Mehmet Kurt, Hakan Kutucu, and Urfat Nuriyev

Time : 5:15pm – 6:00pm

Mathematical model of the applicability of expert systems based on neural networks technology and hybrid systems for decision-making

Shahnaz N. Shahbazova

Chair: Burhan Türkşen
Locatin: *Qabala Ballroom A*

Time : 7:30pm – 10:00pm

DINNER
Location: Yacht Club

Plenary Talks

A Restriction-Centered Theory of Reasoning and Computation

Lotfi A. Zadeh

Department of Electrical Engineering and Computer Sciences
University of California
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Abstract: The theory which is outlined in this lecture, call it RCC for short, is a system of reasoning and computation which is not in the traditional spirit. In large measure, RCC is oriented toward reasoning and computation in an environment of uncertainty, imprecision and partiality of truth. The centerpiece of RCC is the concept of a restriction—a basic concept which is deceptively simple. Informally, a restriction is an answer to a question of the form: What is the value of a variable, X? More concretely, a restriction, R(X), is a limitation on the values which X can take. A restriction is precisiated if R(X) is mathematically well defined; otherwise it is unprecisiated. Generally, restrictions which are described in a natural language are unprecisiated. A restriction is precisiable if it lends itself to precisiation. A restriction is singular if R(X) is a singleton; otherwise it is nonsingular. Nonsingularity implies uncertainty. Examples. Robert is staying at a hotel in Berkeley. He asks the concierge, "How long will it take me to drive to SF Airport?" Possible answers: one hour; one hour plus minus fifteen minutes; about one hour; usually about one hour, etc. Each of these answers is a restriction on the variable, Driving time. The first two answers are precisiated restrictions. The last two answers are unprecisiated. Another example. Consider the proposition, p: Most Swedes are tall. What is the truth-value of p? Possible answers: True; 0.8; about 0.8; high; likely high, etc. In this case, the first two answers are precisiated restrictions; the rest are unprecisiated. The concept of a restriction is closely related to the concept of information granule—a concept which was introduced in my 1979 paper on information granularity.

The concept of a restriction is considerably more general than the concept of an interval, set, fuzzy set and probability distribution. In one form or another, much of human cognition involves restrictions, particularly in the realms of everyday reasoning and decision-making. Humans have a remarkable capability to reason and, to some degree, compute with restrictions. What is needed is a theory which formalizes this capability. RCC may be viewed as a step in this direction. What should be noted is that existing approaches to reasoning and computation, other than RCC, do not have the capability of reasoning and computation with restrictions which are described in a natural language.

The canonical form of a restriction is an expression of the form X isr R, where X is the restricted variable, R is the restricting relation and r is an indexical variable which defines the way in which R restricts X.

There are two principal issues which are addressed in RCC. First, how can a semantic entity, e.g. a proposition, be represented as a restriction? Second, how can restrictions be reasoned and computed with? In RCC, for computation with restrictions what is employed is the extension principle. The extension principle is a collection of computational rules which address the following problem. Assume that Y=f(X). Given a restriction on X and/or a restriction on f, what is the restriction on Y, R(Y), which is induced by R(X) and R(f)? Basically, the extension principle involves propagation of restrictions. In essence, in RCC the objects of reasoning and computation are not values of variables, but restrictions on values of variables. A key to understanding of RCC is that in RCC the focus of attention is shifted from reasoning and computation with values of variables to reasoning and computation with restrictions on values of variables. This shift has wide-ranging ramifications. Representation and computation with restrictions are illustrated with examples.

Lotfi A. Zadeh joined the Department of Electrical Engineering at the University of California, Berkeley, in 1959, and served as its chairman from 1963 to 1968. Earlier, he was a member of the electrical engineering faculty at Columbia University. In 1956, he was a visiting member of the Institute for Advanced Study in Princeton, New Jersey. In addition, he held a number of other visiting appointments, among them a visiting professorship in Electrical Engineering at MIT in 1962 and 1968; a visiting scientist appointment at IBM Research Laboratory, San Jose, CA, in 1968, 1973, and 1977; and visiting scholar appointments at the AI Center, SRI International, in 1981, and at the Center for the Study of Language and Information, Stanford University, in 1987-1988. Currently he is a Professor in the Graduate School, and is serving as the Director of BISC (Berkeley Initiative in Soft Computing).

Until 1965, Dr. Zadeh's work had been centered on system theory and decision analysis. His 1965 paper on fuzzy sets has received over 26,000 Google Scholar citations and is by far the highest cited paper in Information and Control. Since 1965, his research interests have shifted to the theory of fuzzy sets and its applications to artificial intelligence, linguistics, logic, decision analysis, control theory, expert systems and neural networks. Currently, his research is focused on fuzzy logic, soft computing, computing with words, and the newly developed computational theory of perceptions and precisiated natural language.

An alumnus of the University of Tehran, MIT, and Columbia University, Dr. Zadeh is a fellow of the IEEE, AAAS, ACM, AAAI and IFSA, and a member of the National Academy of Engineering. He held NSF Senior Postdoctoral Fellowships in 1956-57 and 1962-63, and was a Guggenheim Foundation Fellow in 1968. Dr. Zadeh was the recipient of the IEEE Education Medal in 1973 and a recipient of the IEEE Centennial Medal in 1984. In 1989, Dr. Zadeh was awarded the Honda Prize by the Honda Foundation, and in 1991 received the Berkeley Citation, University of California.

In 1992, Dr. Zadeh was awarded the IEEE Richard W. Hamming Medal "For seminal contributions to information science and systems, including the conceptualization of fuzzy sets." He became a Foreign Member of the Russian Academy of Natural Sciences (Computer Sciences and Cybernetics Section) in 1992, and received the Certificate of Commendation for AI Special Contributions Award from the International Foundation for Artificial Intelligence. Also in 1992, he was awarded the Kampe de Feriet Prize and became an Honorary Member of the Austrian Society of Cybernetic Studies.

In 1993, Dr. Zadeh received the Rufus Oldenburger Medal from the American Society of Mechanical Engineers "For seminal contributions in system theory, decision analysis, and theory of fuzzy sets and its applications to AI, linguistics, logic, expert systems and neural networks." He was also awarded the Grigore Moisil Prize for Fundamental Researches, and the Premier Best Paper Award by the Second International Conference on Fuzzy Theory and Technology. In 1995, Dr. Zadeh was awarded the IEEE Medal of Honor "For pioneering development of fuzzy logic and its many diverse applications." In 1996, Dr. Zadeh was awarded the Okawa Prize "For outstanding contribution to information science through the development of fuzzy logic and its applications."

In 1997, Dr. Zadeh was awarded the B. Bolzano Medal by the Academy of Sciences of the Czech Republic "For outstanding achievements in fuzzy mathematics." He also received the J.P. Wohl Career Achievement Award of the IEEE Systems, Science and Cybernetics Society. He served as a Lee Kuan Yew Distinguished Visitor, lecturing at the National University of Singapore and the Nanyang Technological University in Singapore, and as the Gulbenkian Foundation Visiting Professor at the New University of Lisbon in Portugal. In 1998, Dr. Zadeh was awarded the Edward Feigenbaum Medal by the International Society for Intelligent Systems, and the Richard E. Bellman Control Heritage Award by the American Council on Automatic Control. In addition, he received the Information Science Award from the Association for Intelligent Machinery and the SOFT Scientific Contribution Memorial Award from the Society for Fuzzy Theory in Japan. In 1999, he was elected to membership in Berkeley Fellows and received the Certificate of Merit from IFSA (International Fuzzy Systems Association). In 2000, he received the IEEE Millennium Medal; the IEEE Pioneer Award in Fuzzy Systems; the ASPIH 2000 Lifetime Distinguished Achievement Award; and the ACIDCA 2000 Award for the paper, "From Computing with Numbers to Computing with Words—From Manipulation of Measurements to Manipulation of Perceptions." In addition, he received the Chaos Award from the Center of Hyperincursion and Anticipation in Ordered Systems for his outstanding scientific work on foundations of fuzzy logic, soft computing, computing with words and the computational theory of perceptions. In 2001, Dr. Zadeh received the ACM 2000 Allen Newell Award for seminal contributions to AI through his development of fuzzy logic. In addition, he received a Special Award from the Committee for Automation and Robotics of the Polish Academy of Sciences for his significant contributions to systems and information science,

development of fuzzy sets theory, fuzzy logic control, possibility theory, soft computing, computing with words and computational theory of perceptions. In 2003, Dr. Zadeh was elected as a foreign member of the Finnish Academy of Sciences, and received the Norbert Wiener Award of the IEEE Society of Systems, Man and Cybernetics "For pioneering contributions to the development of system theory, fuzzy logic and soft computing." In 2004, Dr. Zadeh was awarded Civitate Honoris Causa by Budapest Tech (BT) Polytechnical Institution, Budapest, Hungary. Also in 2004, he was awarded the V. Kaufmann Prize by the International Association for Fuzzy-Set Management and Economy (SIGEF). In 2005, Dr. Zadeh was elected as a foreign member of the Polish Academy of Sciences, Korea Academy of Science & Technology and Bulgarian Academy of Sciences. He was also awarded the Nicolaus Copernicus Medal of the Polish Academy of Sciences and the J. Keith Brimacombe IPMM Award. In 2006, he was elected as a foreign member of the National Academy of Sciences of Azerbaijan and was awarded the Pioneer Award for Outstanding Contributions to Soft Computing, Georgia State University, Atlanta, Georgia and the Silicon Valley Engineering Hall of Fame. In 2007, he was awarded the Egleston Medal, Columbia University, New York and became a member of the International Academy of Systems Studies (IASS). In 2009, he was awarded the Franklin Institute Medal, Philadelphia. In 2011, he was awarded the Medal of the Foundation by the Trust of the Foundation for the Advancement of Soft Computing, Spain, the High State Award 'Friendship Order', from the President of the Republic of Azerbaijan and the Transdisciplinary Award and Medal of the Society for Design and Process Sciences, Korea.

Dr. Zadeh is a recipient of twenty-four honorary doctorates from: Paul-Sabatier University, Toulouse, France; State University of New York, Binghamton, NY; University of Dortmund, Dortmund, Germany; University of Oviedo, Oviedo, Spain; University of Granada, Granada, Spain; Lakehead University, Canada; University of Louisville, KY; State Oil Academy of Azerbaijan; Baku State University, Azerbaijan; the Silesian Technical University, Gliwice, Poland; the University of Toronto, Toronto, Canada; the University of Ostrava, the Czech Republic; the University of Central Florida, Orlando, FL; the University of Hamburg, Hamburg, Germany; the University of Paris(6), Paris, France; Jahannes Kepler University, Linz, Austria; University of Waterloo, Canada; the University of Aurel Vlaicu, Arad, Romania; Lappeenranta University of Technology, Lappeenranta, Finland; Muroran Institute of Technology, Muroran, Japan; Hong Kong Baptist University, Hong Kong, China; Indian Statistical Institute, Kolkata, India; University of Saskatchewan, Saskatoon, Canada; the Polytechnic University of Madrid, Madrid, Spain and Ryerson University, Toronto, Ontario, Canada.

Dr. Zadeh has single-authored over two hundred papers and serves on the editorial boards of over seventy journals. He is a member of the Advisory Committee, Center for Education and Research in Fuzzy Systems and Artificial Intelligence, Iasi, Romania; Senior Advisory Board, International Institute for General Systems Studies; the Board of Governors, International Neural Networks Society; and is the Honorary President of the Biomedical Fuzzy Systems Association of Japan and the Spanish Association for Fuzzy Logic and Technologies. In addition, he is a member of the Advisory Board of the National Institute of Informatics, Tokyo; a member of the Governing Board, Knowledge Systems Institute, Skokie, IL; and an honorary member of the Academic Council of NAISO-IAAC.

Social Network Computing

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Abstract: Computer mediated social networks are now an important technology for world-wide communication, interconnection and information sharing. Our goal here is to enrich the domain of social network modeling by introducing ideas from fuzzy sets and related granular computing technologies. We approach this extension in a number of ways. One is with the introduction of fuzzy graphs representing the networks. This allows a generalization of the types of connection between nodes in a network from simply connected or not to weighted or fuzzy connections. A second and perhaps more interesting extension is the use of the fuzzy set based paradigm of computing with words to provide a bridge between a human network analyst's linguistic description of social network concepts and the formal model of the network. We also will describe some methods for sharing information obtained in these types of networks. In particular we discuss linguistic summarization and tagging methods.

Ronald R. Yager is Director of the Machine Intelligence Institute and Professor of Information Systems at Iona College. He is editor and chief of the International Journal of Intelligent Systems. He has published over 500 papers and fifteen books in areas related to fuzzy sets, human behavioral modeling, decision-making under uncertainty and the fusion of information. He is among the world's top 1% most highly cited researchers with over 27000 citations. He was the recipient of the IEEE Computational Intelligence Society Pioneer award in Fuzzy Systems. He received the special honorary medal of the 50-th Anniversary of the Polish Academy of Sciences. He received the Lifetime Outstanding Achievement Award from International the Fuzzy Systems Association. He received an honorary doctorate degree, *honoris causa,* from the State University of Information Technologies, Sofia Bulgaria. Dr. Yager is a fellow of the IEEE, the New York Academy of Sciences and the Fuzzy Systems Association. He has served at the National Science Foundation as program director in the Information Sciences program. He was a NASA/Stanford visiting fellow and a research associate at the University of California, Berkeley. He has been a lecturer at NATO Advanced Study Institutes. He is a visiting distinguished scientist at King Saud University, Riyadh Saudi Arabia. He is a distinguished honorary professor at the Aalborg University Denmark. He received his undergraduate degree from the City College of New York and his Ph. D. from the Polytechnic University of New York.

Intelligent robust distributed system for monitoring and control of seismic stability of high-rise buildings and monitoring of origin of anomalous seismic processes

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Abstract: Technologies and systems are offered, in which seismic-acoustic information from deep strata of the earth is received by means of acoustic sensors (hydrophones) installed at heads of suspended oil wells. The information on the state of seismic stability of construction objects is sent from sensors to local systems. Robust noise analysis of both seismic-acoustic data and the data received from all local systems carried out on the system server is used to perform monitoring of the beginning of origin of anomalous seismic processes and change in seismic stability of most vulnerable construction objects. Dealing with the problems of monitoring of seismic stability and identification of change in seismic processes facilitates minimization of damage caused by destructive earthquakes.

Telman Abbas oglu ALIEV was born on the 2nd of May 1935 in Geranbey District of Azerbaijan in an office worker's family. From 1943 till 1953 he learned at a school of Geranbey District of Azerbaijan. In 1953 he entered the Azerbaijan Industrial Institute named after M. Azizbekov. He graduated from the Institute in 1958. After graduating from the Institute, he was sent to the Computer Centre (now it is the Institute of Cybernetics). He worked there as a technician, engineer, senior engineer till 1962. In 1962 he entered his post-graduate courses (Professor Vladimir Victorovich Salodovnikov from the MVTU named after Bauman was his scientific chief). In November 1966 he became Ph. D., Computer Hardware. The theme of his thesis was "Correlation analysis of the standard processes of petroleum refining".
In 1977 he became the Doctor of Computing Sciences. The theme of his thesis was "Correlation analysis and coding of multidimensional processes in real time scale". In 1983 he was elected a corresponding member of the Academy of Sciences of Azerbaijan, and in 2001 he became the full member of Azerbaijan National Academy of Sciences. In 1985 he has been given a title of Professor.
In 1982 he was appointed the deputy director of scientific work in the Institute of Cybernetics. From 1984 till May, 1988 he worked as a head of sub-faculty of the Azerbaijan Construction Institute. From 1988 up to now he works as a director of the Institute of Cybernetics.
He is married and has two children. His wife, Tamilla Mamed gizi ALIEVA, born in 1941, works as an associate professor at Azerbaijan State Petroleum Academy. His daughter, Rzayeva Vafa, born in 1963, Ph.D., Medicine, the teacher of medical secondary school №2. His son, Aliev Elkhan, an economist, works in FAO UN (food and agriculture organization of the United Nations).
Telman Aliev is the author of some fundamental works which are performed on a joint of cybernetics, computer science and physics. From them it is possible to note the following works:

- Theory and technology of robust correlation and spectral analysis of noisy signals allowing eliminating the influence of the noise on processing results under the lack of obedience to such classical conditions as the normal distribution law and the absence of the correlation between the noise and the useful signal.
- Theory and technology of improving the adequacy of identification, recognition and diagnostics under the lack of obedience to such classical conditions as the normal distribution law and the absence of the correlation between a noise and a useful signal.

- Technology of improving the stipulation of correlation matrices with balancing relative errors of their elements.
- Adaptive position-selective technology of discretization of continuous signals allowing determining the quantization of time proceeding from the high frequency spectrum of a noise. That makes it possible to eliminate losses of a certain part of information that is typical for traditional principles of analog-digital conversion.
- Theory and technology of the analysis of a noise as a carrier of useful information.
- Theory and position-binary technology of the analysis of cyclic noisy signals and noises.
- Theory and technology of the noise monitoring of the latent period of the origin of a defect and the noise monitoring of failures.
- Principles of realizing multichannel analog-digital converters with synchronous mini code delta modulation and with compression of multidimensional continuous signals.
- Technology and system of receiving and analysis of seismic acoustic information from deep layers of the ground by means of steel tables of preserved deep oil wells of exhausted deposits which allow one to realize noise monitoring of the origin of abnormal seismic processes in regions with high seismic activity.
- The distributed intellectual system of noise monitoring of the technical condition of high-altitude buildings and strategic objects of cities of regions with high seismic activity.
- Technology and system of noise monitoring of the latent initial stage of the origin of cardiovascular diseases.

  The total number of the published works is more than 350. Many of his works are published in journals "Theory and Control System" №3 1995, №3, 1997, №1 1998, №5, 1998, №6, 1998, "Electrichestvo" №11 1966, №10 1996, "Avtometriya" №4,5 1974, №1 1975, №4 1977, №4 1995, №3 1997, №2, 1998, №5, 2001, "Cybernetics and Systems Analysis", №4, 2008, "Avtomatika i Telemechanika", №5, №6 1998, "Avtomatika i Vychislitelnaya Technika", №2,5 1998, №5, 1999, №1,4,5, 2000, №1,2,4 2001, №1,6 2002, №2,3,6 2003, №3, 2004, №4,6 2005, №5, 2006, №2, 2007, №1, 2008, "Oil Equipment" №1, 2000, №3, 2001, №3, 2002, №11, 2004, "Pribory i Sistemy Upravleniya" №8 1969, №3 1971, №7 1973, №7 1978, №8 1996, №12, 1997, "Measurement Technique", №3 1970, №8, 1972, "Devices and Experiment Technique", №6, 1973, DAS, NAS of Azerbaijan, №1, 1976, №4,5, 1990, №2, 1998, №3,4, 1999, №1-3, 4-6, 2001, №3-4, 2002, Bulletin of inventions of the USSR №22, 1974, №12, 1976, №8, 1980, №27, 1981, №9, 1982, №2,4,7,13,27,40, 1983, №27, 1984, №23, 25, 1985, №23,37,1986, №23,1988, №40, 1999, Patent No I20080050, 2005, Patent No İ20080049, 2006, Inernational Application No PCT/AZ2005/000006, 2006, Inernational Application No PCT/AZ2006/00000, 2007.
- He is the author of 10 monographs. It is possible to note the following ones: Experimental Analysis, Mashinostroenie, Moscow, 1991, 242p., Robust Technology with Analysis of Interference in Signal Processing, Kluwer Academic/Plenum Publishers, New York 2003, 199p., Digital Noise Monitoring of Defect Origin, Springer-Verlag, London 2007, 235 p.
- He is also the author of 60 patents. Under his direction more than 30 postgraduates became Ph.D. of Computer Science and 6 scientists became Doctors of Computer Sciences.
- Telman Aliev was the main organizer and till 1976 the head of the laboratory, "Computer", which was created in 1958-1960. It was the second laboratory among the Soviet Republics after the analogous one in the Ukraine. It played decisive role in the development of information science in Azerbaijan. He was the member of the board of the society of Information Science and Computer Technique, the member of the expert council on Information Science, Computer technique and Cybernetics in the USSR.
- In 1991 Telman Aliev was awarded with the medal named after Keldish. From 1994 he is included in the number of the experts of "UNESCO" on information science. In 2004 he was awarded with the Order of Glory of Azerbaijan Republic.

Fuzzy modeling, a bridge to linguistic expressiveness

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Abstract: Fuzzy set-based modeling has always been regarded as an interface between numerical data and symbolic descriptions. There exist many works on fuzzy system representation and interpretability. Modern technologies such as the web, videos or distributed databases introduce a challenge due to both the very large amounts of data they handle, and the expectations of users.
The capacity of fuzzy sets to provide a synthesis of numerical data enables them to be involved in the management of complex systems. In addition, the linguistic labels they carry can be considered as a bridge to natural language, which can be refined with natural language processing or generation techniques.
Fuzzy logic is part of solutions to some of the crucial problems we have to solve, for instance linguistic summarization of huge data, in particular temporal data, or automatic labelling or mining of images. Subjective information is among the most difficult elements we have to cope with because of its complexity, but users are inclined to expect machines to understand emotions in texts or multimedia supports. In addition, to detect emotions or psychological states is useful in a number of applications, from eldercare to business intelligence, by mining either texts, images or sensor results.
We review methods involved in fuzzy set-based modeling in the perspective of linguistic expressiveness. We illustrate their use in some case studies.

Bernadette Bouchon-Meunier is a director of research at the National Centre for Scientific Research, head of the department of Databases and Machine Learning in the Computer Science Laboratory of the University Paris 6 (LIP6). Graduate from the Ecole Normale Superieure at Cachan, D. Sc. in Computer Science, she is the Editor-in-Chief of the International Journal of Uncertainty, Fuzziness and Knowledge-based Systems, the (co)-editor of 24 books and the (co)-author of five. Co-executive director of the International Conference IPMU held every other year, she served as the FUZZ-IEEE 2010 Program Chair, the IEEE Symposium Series on Computational Intelligence (SSCI 2011) General Chair, the FUZZ-IEEE 2012 Conference Chair and she is presently the Program Chair of FUZZ-IEEE 2013, to be held in Hyderabad (India). She is also presently an Adcom member of the IEEE Computational Intelligence Society, chair of the Fuzzy Systems Technical Committee and a member of the IEEE Women in Engineering Committee. She is an IEEE fellow and an International Fuzzy Systems Association fellow.
Her present research interests include approximate reasoning and applications of fuzzy logic and machine learning techniques to decision-making, data mining, risk forecasting, information retrieval and user modelling.

From Booleanity to Fuzziness

Prof. Antonio Di Nola

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Abstract: We display the deep consequences on mathematical structures coming from the step moving from Boolean framework to Fuzzy framework. Actually we will focus on the models of Lukasiewicz fuzzy logic.

From 1977 to 1990 **Prof. Antonio Di Nola**'s main scientific interests were the theory of fuzzy sets and fuzzy relations. Since 1990, his interest is mainly devoted to the study of MV-algebras, the algebraic models of Lukasiewicz Logic. In this area he has studied varieties of MV-algebras, functional representation problems for classes of MV-algebras, normal forms and connections between MV-algebras and Abelian lattice-ordered groups.
Currently he is pursuing the following research lines: an algebraic theory for operators on MV-algebras that mimic probability operators in the framework of many-valued logics, a description of MV-algebras in terms of semirings, the study of Forcing methods in Lukasiewicz Logic, sheaf representation of MV-algebras, application of MV-algebras to digital image processing.
He is author/coauthor of more than 100 scientific works, published on international journals of logic, algebra and computer science.
He has been invited speaker in many national and international conferences
He has been, and is, in the Editorial Board of several international scientific journals, among which: Journal of Mathematical Analysis and Applications, Fuzzy Sets and Systems, Mathematica Slovaca, Fuzzy Optimization and Decision Making.
He is Editor in Chief of the international journal "Soft Computing", Springer-Verlag.
He is coauthor of the monography "Fuzzy Relation Equations and Their Applications to Knowledge Engineering" (A. Di Nola, W. Pedrycz, S. Sessa, E. Sanchez - Kluwer Acad. Publ.) and co-editor of the volume "Lectures on Soft Computing and Fuzzy Logic", Springer.
He has been visiting professor in many prestigious universities such as Oxford University, Hunter College - City University of New York, Beijing Normal University, University of California at Berkeley, Centre d'Estudis Avançats de Blanes (Spain), University of Barcelona, Academy of Sciences of the Republic of Georgia, University of Patras, University of Helsinki, University of Ostrava, University of Bucharest, and Academy of Sciences of the Slovak Republic.

Intelligent Management Decisions for a System of Conventional and Sustainable Energy Systems with Air Pollution Constraints

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Abstract: Fuzzy Logic-based decision-making framework is implemented for energy management in microgrid systems in order to meet targets such as providing local consumers with required energy demand and making good revenue for the microgrid owner under a time-varying electricity cost policy while helping reduce negative environmental effects due to air polluting sources of electrical energy such as coal fire plants which operate in the main grid in order to provide energy for the whole region of interest. Typically, a microgrid system has two modes of operation. It either works synchronously with the main grid or operates independently from the main grid in an isolated, i.e. islanded, mode. Distributed renewable energy resources including solar and wind in association with batteries and main grid supply power to the consumer in the microgrid network. One-day period is divided to a finite number of time-slots. The Fuzzy intelligent approach implemented in this article determines the rate at which power has to be delivered to/taken from the storage unit during the next time-slot depending on the electricity price per kWh of energy, local load demand, electricity generation rate through renewable resources, and air pollution factor all of which are sampled at predetermined rates. Cost function is defined as the sum of balance/revenue due to electricity trade between microgrid and the main grid, which includes the power provided to local load and distribution losses. Five different scenarios are considered for local load and microgrid assembly operation. Measures of balance/revenue will be extracted to represent benefits of using fuzzy logic for energy management in microgrids with air pollution reduction policy.

Mo M. Jamshidi (Fellow IEEE, Fellow ASME, A. Fellow-AIAA, Fellow AAAS, Fellow TWAS, and Fellow NYAS) is the Lutcher Brown Endowed Chaired Professor and Leader of Sustainable Energy Research Group at the University of Texas, San Antonio, TX, USA. He has served US Government (NASA, USAF and USDOE) as an advisor or scientist for 27 years. He has worked for IBM, GM and Siemens for a total of 4 years. In summer 1999, he was a NATO Distinguished Professor in Portugal conducting lectures on intelligent systems and control. He has over 650 technical publications including 64 books (11 text books), research volumes, and edited volumes. His most recent 2 edited and 1 text books are on system of systems engineering. He is the Editor-in-Chief of *IEEE Systems Journal*. Dr. Jamshidi is a Fellow or member of 8 societies and academies. He is the recipient of the IEEE Centennial Medal and IEEE Control Systems Society Distinguished Member Award and the IEEE CSS Millennium Award, and NASA National Service Award in 2005. He was on the Board of Governors of the IEEE Society on Systems, Man and Cybernetics and is currently on the board of the IEEE Systems Council. He is an Honorary Professor at three Chinese Universities, Deakin University in Australia and the University of Birmingham (UK, 2012-2017) and Obuda University (Budapest, Hungary). In October 2005 he was awarded the IEEE's Norbert Weiner Research Achievement Award. He was a UK Royal Academy of Engineering distinguished fellow at Cardiff University, Wales, UK during 2009-2010. He holds honorary doctorate degrees from Odlar Yourdu University, Baku, Azerbaijan, 1999, University of Waterloo, Canada, 2004 and Technical University of Crete, Greece, 2004. He received the Presidential Award on Advancing Globalization at the University of Texas, San Antonio.

Computing with words: past, present and future challenges

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Abstract: The purpose of this talk is to present Zadeh's seminal idea of computing with words (CWW) as a general paradigm of tackling problems when broadly perceived computing is needed or expedient but the setting and information available may preclude the use of traditional computation architectures, tools and techniques that are number based. We start with the roots of CWW which can well be traced to Zadeh's revolutionary ideas from the mid-1970s of a linguistic variable, fuzzy conditional statements and the compositional rule of inference, emphasize they role for virtually all more traditional applications of fuzzy logic, and refocus them in the perspective of level 1 CWW, or CWW-1, for short. Then, we present some more sophisticated types of linguistic statements and information, notably those including modalities of natural language exemplified by: probability, possibility or certainty (the likelihood of something happening or being the case), usuality (how frequently something occurs), obligation or necessity (how necessary it is for things to be done or to happen in a certain way), ability (the ability of someone or something, to do something), inclination (the inclination or willingness of someone to do something), to name a few. We then present the recent Zadeh's idea of level 2 CWW, or CWW-2, for short, that can handle more sophisticated statements, notably including some modalities. To be more specific, we first show the inclusion of the basic modality of probability, possibility and certainty and show how they can be handled in the setting of fuzzy logic and possibility theory. Then, we present a crucial case the usuality modality, show its crucial role, notably is data summarization that is usually a necessary task in real world applications, and is taken as a pivotal aspect of CWW-2. Finally, we touch upon the other modalities, like the obligation, ability or inclination and show difficulties of CWW with handling them.

Then, while emphasizing that broadly perceived Natural Language Processing or Computational Linguistics concern in fact different problem classes and have different agendas than CWW, we advocate their use to amplify the sheer expressive and computational power of CWW. Notably, we mention the role of natural language generation (NLG) and Systemic Functional Linguistics (SFL) to help derive linguistic data summaries that are at the heart of CWW-2.

While in our discussion we mainly deal with meaning representation, statements and inference schemes, that can be viewed to be of a symbolic computation type, we also mention some attempts to use ideas stemming from CWW in some modeling tools from the numerical computation based areas, notably related to linguistic terms in the structural and dynamic models exemplified by differential equations.

We conclude with general remarks on the future of CWW, notably related to a more explicit use of results from theories of perceptions, inclusion of further modalities, and its integration within a more general and human consistent set of tools and techniques for an effective and efficient natural language handling.

Janusz Kacprzyk graduated from the Department of Electronic, Warsaw University of Technology in Warsaw, Poland with M.Sc. in automatic control, his Ph.D. in systems analysis and D.Sc. ("habilitation") in computer science from the Polish Academy of Sciences. He is Professor of Computer Science at the Systems Research Institute, Polish Academy of Sciences, Professor of Computerized Management Systems at WIT – Warsaw School of Information Technology, and Professor of Automatic Control at PIAP – Industrial Institute of Automation and Measurements, in Warsaw, Poland, and Department of Electrical and Computer Engineering, Cracow University of Technology, in Cracow, Poland. He is Honorary Foreign

Professor at the Department of Mathematics, Yli Normal University, Xinjiang, China, and Visiting Scientist at the RIKEN Brain Research Institute in Tokyo, Japan. He is Full Member of the Polish Academy of Sciences and Foreign Member of the Spanish Royal Academy of Economic and Financial Sciences (RACEF). He is Fellow of IEEE and of IFSA.

He was a frequent visiting professor in the USA, Italy, UK, Mexico and China. His main research interests include the use of computational intelligence, notably fuzzy logic, in decisions, optimization, control, data analysis and data mining, with applications in databases, ICT, mobile robotics, etc.

He is the author of 5 books, (co)editor of 60 volumes, (co)author of ca. 400 papers. He is the editor in chief of 5 book series at Springer, and of 2 journals, and a member of editorial boards of more than 40 journals. He is a member of Award Committee of IEEE CIS, a member of Adcom (Administrative Committee) of IEEE CIS, and a Distinguished Lecturer of IEEE CIS.

He received many awards, notably: The 2006 IEEE CIS Pioneer Award in Fuzzy Systems, The 2006 Sixth Kaufmann Prize and Gold Medal for pioneering works on soft computing in economics and management, and The 2007 Pioneer Award of the Silicon Valley Section of IEEE CIS for contribution in granular computing and computing in words, and Award of the 2010 Polish Neural Network Society for exceptional contributions to the Polish computational intelligence community. Currently he is President of the Polish Society for Operational and Systems Research and Past President of IFSA (International Fuzzy Systems Association).

Need for Expert Knowledge (and Soft Computing) in Geosciences

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Abstract: Civilization greatly depends on the things we extract from the Earth: oil, gas, water, etc. The need is growing, so we must find new resources. The problem is that most easy-to-access mineral resources have been discovered. For example, new oil fields are at large depths, under water, in remote areas – so drilling is very expensive. It is therefore necessary to predict resources before we invest in drilling. How can we do that? We know what structures are promising. For example, oil and gas concentrate near the top of (natural) underground domal structures. So, to find mineral resources, we must determine the structure at different depths and locations.

In other words, we need to reconstruct the values of the quantities of interest -- such as density at different depths and different locations -- from the measurement results. From the mathematical viewpoint, the corresponding problems are often "ill-posed", meaning that usually, several drastically different density distributions are consistent with the same observations. Out of all these distributions, we need to select the physically meaningful one(s) -- and this is where expert knowledge is needed, to describe what "physically meaningful" means. On the example of the above geophysical problem, we show how this expert knowledge can be taken into account.

Somewhat surprisingly, the need for such expert knowledge emerges even in situations when we simply want to "fuse" data from different sources. In such situations, seemingly natural statistical approaches (such as Maximum Likelihood methods), sometimes lead to physically meaningless results. To get physically meaningful results, we must supplement the data itself (and the corresponding statistical information) with expert knowledge describing which fusion results are physically meaningful and which are not. In the talk, we show how this expert knowledge can help.

Finally, expert knowledge is needed to estimate how accurate are the results of geophysical data processing.

Vladik Kreinovich received his M.Sc. in Mathematics and Computer Science from St. Petersburg University, Russia, in 1974, and Ph.D. from the Institute of Mathematics, Soviet Academy of Sciences, Novosibirsk, in 1979. In 1975-80, he worked with the Soviet Academy of Sciences, in particular, in 1978-80, with the Special Astrophysical Observatory (representation and processing of uncertainty in radioastronomy). In 1982-89, he worked on error estimation and intelligent information processing for the National Institute for Electrical Measuring Instruments, Russia. In 1989, he was a Visiting Scholar at Stanford University. Since 1990, he is with the Department of Computer Science, University of Texas at El Paso. Also, served as an invited professor in Paris (University of Paris VI), Hong Kong, St. Petersburg, Russia, and Brazil.

Main interests: representation and processing of uncertainty, especially interval computations and intelligent control. Published 3 books, 6 edited books, and more than 800 papers. Member of the editorial board of the international journal "Reliable Computing" (formerly, "Interval Computations"), and several other journals. Co-maintainer of the international website on interval computations http://www.cs.utep.edu/interval-comp

Honors: President, North American Fuzzy Information Processing Society; Foreign Member of the Russian Academy of Metrological Sciences; recipient of the 2003 El Paso Energy Foundation Faculty Achievement Award for Research awarded by the University of Texas at El Paso, and a co-recipient of the 2005 Star Award from the University of Texas System.

On fuzziness and the interpretability-accuracy trade-off

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Abstract: One of the significant topics in fuzzy systems design is that of the interpretability-accuracy trade-off. We can consider that the presence of this question as a key aspect of fuzziness is quite new, as a matter of fact, only at the beginning of this century, the question has been formalized and analyzed. However, interpretability has always been acknowledged as the main advantage of Fuzzy Systems against other systems based on black-box models such as conventional Neural Networks. In earlier research on Fuzzy Systems, the main goal was achieving models with high interpretability, mainly working with expert knowledge and a few simple linguistic rules. However, later researchers realized that expert knowledge was not enough to deal with complex problems, and the use of techniques to induce knowledge from data became a hot topic. As a result, during the last decade of past century, the main effort was made regarding the accuracy of the final model, building complex models with high accuracy, but often disregarding the model interpretability. Finally, with the new century the target shifted to the design of Fuzzy Systems that acquire accurate, robust and interpretable knowledge from data, looking for a good interpretability-accuracy trade-off. Moreover, at present, fuzzy systems design moves towards a more human-centric perspective, where users understand and rely on the knowledge embodied in such systems. But the main problem to achieve this interpretability-accuracy trade-off is that while accuracy is, in most cases, a clearly defined and well established concept, interpretability is a subjective and somehow fuzzy one. The talk will offer a wide view of the concept of interpretability in fuzzy systems design, as well as different approaches to focus on the interpretability-accuracy trade-off problem.

Luis Magdalena received the M.S. and Ph.D. degrees in Telecommunication Engineering, both from the Universidad Politécnica de Madrid, Spain, in 1988 and 1994, respectively.
He has been an Associate Professor in Computer Science at the Department of Applied Mathematics of the Universidad Politécnica de Madrid since 1995, where he was previously Assistant Professor since 1990. In 1998 he Co-founded the Company Daedalus: Data, Decisions and Language (spin-off of UPM). From 2003 to 2005 he was Deputy Director (and promoter) of the Centro de Domótica Integral (Smart House Research Center), at Universidad Politécnica de Madrid. In 2006 he joined the Foundation for the Advancement of Soft Computing/European Center for Soft Computing as Director General. His research interests include Soft Computing and its application, particularly in the field of robotics and automation. He has been actively involved in research projects funded by National and European programs, as well as by private companies, being project leader in more than fifteen of those projects.
He is co-author of the book "Genetic Fuzzy Systems: Evolutionary Tuning and Learning of Fuzzy Knowledge Bases" (World Scientific, 2001). He is co-editor of the books "Technologies for Constructing Intelligent Systems" (two volumes, Phisica Verlag, 2002), "Interpretability Issues in Fuzzy Modeling" (Springer, Studies in Fuzziness and Soft Computing, 2003), "Accuracy Improvements in Linguistic Fuzzy Modeling" (Springer, Studies in Fuzziness and Soft Computing, 2003), and "Foundations of Reasoning under Uncertainty" (Springer, Studies in Fuzziness, 2010). Hi has also authored over two hundred papers in books, journals and conferences.
From 2001 to 2005 he has been the President of the "European Society for Fuzzy Logic and Technologies", and Vice-president of IFSA from 2007 to 2011. He is Senior member of IEEE, and member of the AdCom of the IEEE Computational Intelligence Society. Since 2009 he is a member of the Scientific Advisory Committee of the Spanish Research Council (Consejo Superior de Investigaciones Científicas, CSIC).

Data and Variable Compression with Fuzzy Extended Logic in Statistical Modeling

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Abstract: Prospects for both fuzzy spherical and non-spherical clustering methods are considered in the context of analysis of covariance, regression modeling and dimensionality reduction. This approach stems from Lotfi Zadeh's novel fuzzy extended logic. In this manner we may construct both nonparametric and nonlinear models conveniently with our statistical data set.

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Fuzzy Modeling: A Retrospective View and Future Directions

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Abstract: Fuzzy modeling and fuzzy models have been around for several decades with their emergence coinciding with the inception of the fundamental notions of fuzzy sets. Fuzzy modeling and its constructs evolved over this time. The plethora of methodological accomplishments, algorithmic developments and application-oriented studies in fuzzy modeling is stunning.
In this talk, we offer a general view at the area of fuzzy modeling. We identify the key tendencies as they became visible in the past and highlight the main phases of evolution of fuzzy modeling being witnessed in the area. We also identify main quests as they were posed in the past as well as look at the ongoing challenges in the realm of fuzzy modeling.
As the diversity of fuzzy models is truly remarkable leading to a diversified landscape of fuzzy modeling, we propose certain taxonomy of fuzzy models established along several carefully selected criteria and stressing the issues of (a) architectural (structural) character, (b) development strategies, and (c) transparency (interpretability).
Along with this retrospective holistic view at the area, we also venture into the future pursuits. With this regard, we advocate a general direction focused on the design of *granular* fuzzy models by dwelling upon essential abstraction capabilities delivered by Granular Computing. To further delve into granular modeling, several key algorithmic developments are discussed in the context of fuzzy rule-based models, pattern classifiers, and models of group decision-making.

Witold Pedrycz is Professor and Canada Research Chair (CRC) in Computational Intelligence in the Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Canada. He is also with the Systems Research Institute of the Polish Academy of Sciences, Warsaw, Poland. In 2009 Dr. Pedrycz was elected a foreign member of the Polish Academy of Sciences. He is a Fellow of the Royal Society of Canada and a Fellow of the IEEE, IFSA, International Society of Management Engineers, Engineers Canada, and Engineering Institute of Canada.
He main research directions involve Computational Intelligence, fuzzy modeling and Granular Computing, knowledge discovery and data mining, fuzzy control, pattern recognition, knowledge-based neural networks, relational computing, and Software Engineering. He has published numerous papers in this area. He is also an author of 15 research monographs covering various aspects of Computational Intelligence and Software Engineering. Witold Pedrycz has been a member of numerous program committees of IEEE conferences in the area of fuzzy sets and neurocomputing.

Dr. Pedrycz is intensively involved in editorial activities. He is an Editor-in-Chief of ***Information Sciences*** and Editor-in-Chief of ***IEEE Transactions on Systems, Man, and Cybernetics - part A***. He currently serves as an Associate Editor of ***IEEE Transactions on Fuzzy Systems*** and a number of other international journals. In 2007 he received a prestigious Norbert Wiener award from the IEEE Systems, Man, and Cybernetics Council. He is a recipient of the IEEE Canada Computer Engineering Medal. In 2009 he has received a Cajastur Prize for Soft Computing from the European Centre for Soft Computing for "*pioneering and multifaceted contributions to Granular Computing*".

Mathematical model of the applicability of expert systems based on neural networks technology and hybrid systems for decision-making

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Abstract: This talk deals with the theoretical and practical bases for the construction of the expert system implemented in a distributed environment. The solutions to most of the key issues related to the design of high-quality mathematical elements of the expert system for educational purposes considered and offered.

Were validated mathematical model of expert systems, implemented in an intranet environment of the university, and its uses in the classroom. Address and offer solutions to most of the key issues related to the design of the university Intranet, and expert system for educational purposes.

By modeling key aspects of the main components of the complex was obtained the possibility of integration of the expert system elements in the learning process, the possibility of accumulation and database development, and building a knowledge base built on powerful and flexible rules.

Besides, we proposed methods to simulate ANN optimal complexity, which will improve the efficiency of decision-making power without having to re-design and mathematical modeling to fine-tune the system.

Mathematical formulations are the number of problems of neural networks and expert systems in hybrid subsystem decision making and evaluation of knowledge.

Shahnaz N. Shahbazova received her Candidate of Technical Sciences degree in 1995 and she is Associate Professor since 1996. She serves more than 30 years at "Information Technology and Programming" Department of Azerbaijan Technical University. She is Doctor of Philosophy in Engineering Science and International Personnel Academy UNESCO (2000). She is an academician of the Azerbaijan Modern National Academy named by L. Zadeh, 2002. Her research interests include Artificial Intelligence, Soft Computing, Intelligent system, Mmachine Learning Techniques to Decision Making and Fuzzy Neural Network. She was awarded research Grants in following countries: India (1998), Germany-DAAD (1999), Germany-DAAD (2003), USA UC-Berkeley Fulbright Visiting Scholar (2006/2007), Germany-DAAD (2010). She is a member of Berkeley Initiative in Soft Computing (BISC) group, New York Academy of Sciences and a Fellow of IEEE. Shahbazova was invited to serve as a Program Committee member for over 30 international conferences and as reviewer for nearly 40 international journals. She is co-editor of the book "Soft Computing: State of the Art Theory and Novel Applications", (Springer, Series Title: Studies in Fuzziness and Soft Computing, 2011). She was an elected board director of the North American Fuzzy Information Processing Society (NAFIPS) and served as Program Chair of Organizing committee for the NAFIPS Conferences. Also, she is an international expert UNESCO of implementation ICT in educational environment in Azerbaijan.

Shahnaz N. Shahbazova is a member of following projects: "Application ICT in education environment" (USA, Indiana, 2001), Information-communication technologies and higher education-priorities of modern society development" (Saint Petersburg, 2009), "Establishment of Educational Network System of Azerbaijan Technical University"(Korea, KOICA, 2011).

Why can we think?

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Abstract: We perceive and think with language. No doubt thinking belongs to higher-order consciousness. Human higher-order consciousness is characterized by language. A point is that human infants do not become automatically able to think; first they must learn how to mean through language and then learn how to think with language.
This talk is a first attempt to explore a theory of thinking. We first characterize human activity 'thinking' by referring to linguistics and then investigate how infants learn to mean and to think with proto-language along the development of primary consciousness.
We shall see some essential moments with which infants begin to think. The emergence of grammar plays an essential role in human thinking. The system of language with higher-order consciousness provides rich resources enabling us to think. In particular, 'Natural Logic' for thinking evolved in language over millions of years from which propositional logic arose.

After graduating from the Department of Physics, The University of Tokyo, Michio Sugeno worked at Mitsubishi Atomic Power Industry. Then, he served the Tokyo Institute of Technology as Research Associate, Associate Professor and Professor from 1965 to 2000. After retiring from the Tokyo Institute of Technology, he worked as Laboratory Head at the Brain Science Institute, RIKEN from 2000 to 2005, and then, as Distinguished Visiting Professor at Doshisha University from 2005 to 2010. He is currently Emeritus Professor at the Tokyo Institute of Technology, Japan, and Emeritus Researcher at the European Centre for Soft Computing, Spain.
He was President of the Japan Society for Fuzzy Theory and Systems from 1991 to 1993, and also President of the International Fuzzy Systems Association from 1997 to 1999. He is the first recipient of the IEEE Pioneer Award in Fuzzy Systems with Zadeh in 2000. He also received the 2010 IEEE Frank Rosenblatt Award and very recently Kampét de Feriét Award in 2012.

Type 1, ..., Full Type N Fuzzy System Models

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Abstract: We first brief review the essential Type 1 Fuzzy System models. Next we state the well known FCM algorithm which lets one to extract Type 1 membership values from a given data set for the development of Type 1 fuzzy system models as a foundation for the develop Full Type 2 to Full Type N fuzzy system models. For this purpose, we describe how one can generate Full Type 2 to Full Type N fuzzy system models and their membership value distributrions for a development of second and nth order fuzzy system models with our proposed data anaysis algorithm. That is we propose how a new recursive statement of Full Type 2 to Full Type N algorithm that would cause the generation such system models.
We present our results grafically for TD_Stockprice data with respect to three validity indeces: 1) Xie-Beni's, 2) Çelikyılmaz-Türksen's and 3) Bezdek's

I.B. Türksen received the B.S. and M.S. degrees in Industrial Engineering and the Ph.D. degree in Systems Management and Operations Research all from the University of Pittsburgh, PA. He joined the Faculty of Applied Science and Engineering at the University of Toronto and became Full Professor in 1983. In 1984-1985 academic year, he was a Visiting Professor at the Middle East Technical University and Osaka Prefecture University. Since 1987, he has been Director of the Knowledge / Intelligence Systems Laboratory. During the 1991-1992 academic year, he was a Visiting Research Professor at LIFE, Laboratory for International Fuzzy Engineering, and the Chair of Fuzzy Theory at Tokyo Institute of Technology. During 1996 academic year, he was Visiting Research Professor at the University of South Florida,USA, and Bilkent University, Ankara, Turkey. Since December 2005, he is appointed as the Head of Department of Industrial Engineering at TOBB Economics and Technology University.
He was and/or is a member of the Editorial Boards of the following publications: Fuzzy Sets and Systems, Approximate Reasoning, Decision Support Systems, Information Sciences, Fuzzy Economic Review, Expert Systems and its Applications, Journal of Advanced Computational Intelligence, Information Technology Management, Transactions on Operational Research, Fuzzy Logic Reports and Letters, Encyclopedia of Computer Science and Technology, Failures and Lessons Learned in Information Technology, Applied Soft Computing. He is the co-editor of NATO-ASI Proceedings on Soft Computing and Computational Intelligence, and Editor of NATO-ASI Proceedings on Computer Integrated Manufacturing as well co-editor of two special issues of Robotics and Autonomus Systems.
He is a Fellow of IFSA and IEEE, and a member of IIE, CSIE, CORS, IFSA, NAFIPS, APEO, APET, TORS, ACM, etc.
He is the founding President of CSIE. He was Vice-President of IIE, General Conference Chairman for IIE International Conference, and for NAFIPS in 1990. He served as Co-Chairman of IFES'91 and Regional Chairman of World Congress on Expert Systems, WCES'91, WCES'94, WCES'96 and WCES'98, Director of NATO-ASI'87 on Computer Integrated Manufacturing and Co-Director of NATO-ASI'96 on Soft Computing and Computational Intelligence. He was General Conference Chairman for Intelligent Manufacturing

Systems, IMS '1998, IMS '2001, IMS`2003. He was the President of IFSA during 1997- 2001 and Past President of IFSA, International Fuzzy Systems Association during 2001-2003. Currently, he is the President, CEO and CSO, of IIC, Information Intelligence Corporation.

He received the outstanding paper award from NAFIPS in 1986, "L.A. Zadeh Best Paper Award" from Fuzzy Theory and Technology in 1995, "Science Award" from Middle East Technical University, and an "Honorary Doctorate" from Sakarya University. He is a Foreign Member, Academy of Modern Sciences.

His current research interests centre on the foundations of fuzzy sets and logics, measurement of membership functions with experts, extraction of membership functions with fuzzy clustering and fuzzy system modeling. His contributions include, in particular, Type 2 fuzzy knowledge representation and reasoning, fuzzy truth tables, fuzzy normal forms, T-formalism which is a modified and restricted Dempster's multi-valued mapping, and system modeling applications for intelligent manufacturing and processes, as well as for management decision support and intelligent control.

He has published near 300 papers in scientific journals and conference proceedings.

Representing and Analyzing the Look-up Table Controllers via Mamdani Fuzzy Control

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Abstract: In this presentation, we focus on a new direction of application of Mamdani controllers that, we believe, has received little, if any, attention. We analytically explore the relationship between one special type of Mamdani fuzzy controllers and the look-up table (LUT) controllers – one of the most widely used practical engineering tools in industry, especially in automotive engineering - and derive conclusions that contribute to the analysis of the LUT-based control systems. LUTs are used in engineering applications as arrays of data that describe relationships between variables. In a broad sense they represent "pseudo-equations to make up for a lack of 'real' equations or perhaps to replace complicated equations with simpler ones." For example, the vehicle control systems employee thousands of LUTs that contain calibration parameters or define control actions under different operating conditions. The most popular LUTs are the two-dimensional tables that define the values of one dependent (output) variable for different combinations of two independent (input) variables and even more single dimensional LUTs. They are used as feedforward controllers or as containers for calibrating or gain scheduling parameters for feedback controllers. The reasons for the popularity of the LUTs in industry are the strong nonlineraity and multimodal behaviors that can be (in many cases) formalized only by experimentally measured data under different operating conditions. In addition, the LUTs are computationally effective, and can be easily interpreted, visualized, and tuned.
Our approach is inspired by the similarity between the fuzzy controllers and LUTs and uses the theory of fuzzy controllers to bring new light to the LUT-based engineering technique that is usually considered a low tech or "black art" type of control tool. We will show how the LUT controllers and one special type of Mamdani fuzzy controllers are analytically related and how to represent the former by the latter. In some sense our approach is just the opposite of the mainstream fuzzy control literature which uses the conventional control theory to explain, analyze, and further develop fuzzy control. It benefits from the great body of works on fuzzy control to derive new knowledge and to provide a new interpretation of the analysis and synthesis of LUT type of controllers. We demonstrate how some of the results derived for Mamdani fuzzy controllers can be applied to obtain practical stability conditions for feedback control systems with LUT controllers.

Dr. Hao Ying is a Professor at the Department of Electrical and Computer Engineering, Wayne State University, Detroit, USA. As sole author, he published the book entitled Fuzzy Control and Modeling: Analytical Foundations and Applications (IEEE Press, 2000), and co-authors the book Type-2 Fuzzy Logic Control: Introduction to Theory and Applications (John Wiley & Sons, Inc., 2013). In addition, he has published more than 90 peer-reviewed journal papers and over 140 conference papers. His work has been widely cited - his h-index of 30 reflecting more than 2,500 citations. He serves as an Associate Editor or a Member of Editorial Board for 9 international journals and is a member of the Fuzzy Systems Technical Committee of the IEEE Computational Intelligence Society. Professor Ying was an elected board member of the North American Fuzzy Information Processing Society (NAFIPS) for two terms and served as Program Chair or Co-Chair for the three NAFIPS Conferences. He was invited to serve as a program committee member for over 50 international conferences and as reviewer for nearly 80 international journals. He is a Fellow of IEEE.

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