The 8ᵗʰ World Conference on Soft Computing

dedicated to the 100ᵗʰ Birthday anniversary and research heritage of

professor Lotfi A. Zadeh

Supported by

National Academy of Sciences of Azerbaijan

Ministry of Education of Azerbaijan

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PROGRAM

February 03-05, 2022

Baku, Azerbaijan

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Vilem Novak (Czech Republic)
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Vladik Kreinovich (USA)

Schedule at Glance

Thursday,

February 03, 2022

09:00 am 10:00 am	**Welcome Opening** **Ali M. Abbasov (moderator),** Director General institute of Control System, NAS of Azerbaijan, **Rasim Alquliyev,** Vice President of NAS of Azerbaijan, **Firudin Qurbanov**, deputy minister of Education of Azerbaijan, **Rovshan Rustamov,** Deputy Minister of Ministry of Digital Development and Transport of Azerbaijan Republic, **Masoud Nikravesh**, University of California, Berkeley, CA, USA, **Janusz Kacprzyk**, Academician of Polish Academy of Sciences, Poland, **Adalet Muradov,** Rector of Azerbaijan State Economic University-UNEC, Azerbaijan, **Vladik Kreinovich,** professor University of Texas at El Paso, USA, **Ildar Batyrshin,** Regular Member of Mexican Academy of Sciences, Mexico, **Asaf Hajiyev,** President of Lotfi Zadeh's International Academy of Sciences. https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
10:00 am 11:00 am	**Lotfi A. Zadeh's life and his scientific legacy** **Prof. Shahnaz N. Shahbazova** *Chair: Prof. Janusz Kacprzyk* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
11:00 am 11:45 am	**Group decisions under fuzzy preferences and fuzzy majority:** **beyond the consensus perspective** **Prof. Janusz Kacprzyk** *Chair: Prof Vladik Kreinovich* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746

11:45 am 12:30 pm	**Different Concepts, Similar Computational Complexity:** **Nguyen's Results about Fuzzy and Interval Computations 35 Years Later** **Prof. Vladik Kreinovich** *Chair: Prof. Shahnaz N.Shahbazova* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
12:30 pm 13:15 pm	**Towards a Cyber Secure Global Village** **Prof. Praveen K. Khosla** *Chair: Prof. Valentina E. Balas* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
13:15 pm 14:00 pm	**Solid Development Teams Search Approach** **Prof. Nadezhda Yarushkina** *Chair: Prof. Vadim Stefanyuk* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746

14:00 pm 15:40 pm	**Fuzzy Logic applications** https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746	**Fuzzy model and Z-information** https://zoom.us/j/8166188149?pwd=U2JEbnk0SDZaSE9WU3JsUVp0WEh5UT09 Conference ID: 816 618 8149 Access code: X9fDK9
15:40 pm 17:00 pm	**Neural Networks** https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746	**Artificial Intelligence** https://zoom.us/j/8166188149?pwd=U2JEbnk0SDZaSE9WU3JsUVp0WEh5UT09 Conference ID: 816 618 8149 Access code: X9fDK9

09:00 am 10:00 am	Panel chair: Vladik Kreinovich **Lotfi Zadeh's legacy: inspirations for mathematics, systems theory, decision, control** ***Janusz Kacprzyk, Oscar Castillo, Ildar Batyrshin,** Nadezhda Yarushkina, Valentina E.Balas, Vadim Stefanuk, Jozo Dujmovic, Shahnaz N.Shahbazova* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746	
10:00 am 11:20 am	**Soft Computing Logic Aggregation** https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746	**Intelligent methods and Fuzzy approach** https://zoom.us/j/8166188149?pwd=U2JEbnk0SDZaSE9WU3JsUVp0WEh5UT09 Conference ID: 816 618 8149 Access code: X9fDK9
11:20 am 13:00 am	**Probabilistic Uncertainty** https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746	**Fuzzy control Systems** https://zoom.us/j/8166188149?pwd=U2JEbnk0SDZaSE9WU3JsUVp0WEh5UT09 Conference ID: 816 618 8149 Access code: X9fDK9
13:00 am 13:45 am	**Explainable Similarity Correlation of Categorical Data and Bar Charts** **Prof. Imre Rudas and Prof. Ildar Batyrshin** *Chair: Prof. Takahiro Yamanoi* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746	

13:45 am 14:30 am	**Functional-Algebraic Models in Analysis of Relationships in Data:** **Similarity, Dissimilarity and Correlations Function on Involutive Sets** **Prof. Ildar Batyrshin** *Chair: Prof. Praveen K. Khosla* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
14:30 am 15:15 pm	**Spatiotemporal Activities in Brain on Recognizing Ambiguous Figures** **Prof. Takahiro Yamanoi** *Chair: Prof. Nishchal Kumar Verma* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
15:15 pm 16:00 pm	**Mathematical Modeling of Distributed Memory** **Prof. Vadim Stefanyuk** *Chai: Prof. Valentina E. Balas* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
16.00 pm 16:45 pm	**Ideas of Lotfi A. Zadeh on Explainable Artificial Intelligence** **Prof. Alexey Averkin** *Chair: Prof. Vadim Stefanyuk* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
16:45 pm 17:30 pm	**Kolmogorov Stories** **Academician Asaf Hajiyev** *Chair: Prof. Alexey Averkin* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746

09:00 am 10:00 am	*Panel chair: Prof. Janusz Kacprzyk* **Fuzzy Logic and Soft Computing, Computational Intelligence and Intelligent Technologies** *Ali A.Abbasov, Vladik Kreinovich, Takahiro Yamanoi, Asaf Hajiyev, Praveen K. Khosla, Averkin Alexey, Ildar Batyrshin, Marius Balas, Nishchal Kumar Verma, Shahnaz N. Shahbazova* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
10:00 am 10:45 pm	**Optimization of Type-2 Fuzzy Systems: Theory and Applications** **Prof. Oscar Castillo** *Chair: Prof. Shahnaz N.Shahbazova* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
10:45 pm 11:30 pm	**Intangible Benefit Identification and Realization –** **Issues and Challenges in Project Program and Portfolio Management** **Prof. Elizabeth Chang** *Chair: Prof. Oscar Castillo* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
11:30 pm 12:15 pm	**Advanced Aspects in Multidisciplinary Soft Computing and Applications** **Prof. Valentina E. Balas** *Chair: Prof. Nadezhda Yarushkina* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746

12:15 pm 13:00 pm	**State-space based designing of control systems** **Prof. Marius Balas** *Chair: Asaf Hajiyev* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746
13:00 pm 13:45 pm	**AI, Deep Learning and Deep Fuzzy Network** **Prof. Nishchal Kumar Verma** *Chair: Prof. Shahnaz N. Shahbazova* https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746

13.45 pm 15:25 pm	**Fuzzy Logic and Sets** https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746	**Fuzzy simulation** https://zoom.us/j/8166188149?pwd=U2JEbnk0SDZaSE9WU3JsUVp0WEh5UT09 Conference ID: 816 618 8149 Access code: X9fDK9
15:30 pm 17:10 pm	**Fuzzy Logic and applications** https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746	**Fuzzy recognizing** https://zoom.us/j/8166188149?pwd=U2JEbnk0SDZaSE9WU3JsUVp0WEh5UT09 Conference ID: 816 618 8149 Access code: X9fDK9

17:10 pm 18:10 pm	**Closing Event** **Ali M. Abbasov, Janusz Kacprzyk, Takahiro Yamanoi, Asaf Hajiyev, Praveen K. Khosla, Alexey Averkin, Nishchal Kumar Verma, Valentina E. Balas, Nadezhda Yarushkina, Marius Balas, Vadim Stefanyuk, Shahnaz N. Shahbazova** https://us02web.zoom.us/j/3207853453?pwd=YTREM0xyN0VDcEl0WG1hYUxUOFhTQT09 Conference ID: 320 785 3453 Access code: 350746

Thursday

February 3th, 2022

Time : 09:00 am – 10:00 am

Welcome Opening

Ali M. Abbasov (moderator), Director General institute of Control System, NAS of Azerbaijan, **Rasim Alquliyev,** Vice President of NAS of Azerbaijan, **Firudin Qurbanov**, deputy minister of Education of Azerbaijan, **Rovshan Rustamov,** Deputy Minister of Ministry of Digital Development and Transport of Azerbaijan Republic, **Masoud Nikravesh**, University of California, Berkeley, CA, USA, **Janusz Kacprzyk**, Academician of Polish Academy of Sciences, Poland, **Adalet Muradov,** Rector of Azerbaijan State Economic University-UNEC, Azerbaijan, **Vladik Kreinovich,** prof. University of Texas at El Paso, USA, **Ildar Batyrshin,** Regular Member of Mexican Academy of Sciences, Mexico, **Asaf Hajiyev,** President of Lotfi Zadeh's International Academy of Sciences.

Time : 10:00 am – 11:00 am

Lotfi A.Zadeh's life and his scientific legacy

Prof. Shahnaz N. Shahbazova

Chair: *Prof. Janusz Kacprzyk*

Time : 11:00 am – 11:45 am

*Group decisions under fuzzy preferences and fuzzy majority:
beyond the consensus perspective*

Prof. Janusz Kacprzyk

Chair: *Prof Vladik Kreinovich*

Time : 11:45 am – 12:30 pm

Different Concepts, Similar Computational Complexity:
Nguyen's Results about Fuzzy and Interval Computations 35 Years Later

Prof. Vladik Kreinovich

Chair: Prof. Shahnaz N. Shahbazova

Time : 12:30 pm – 13:15 pm

Towards a Cyber Secure Global Village

Prof. Praveen K. Khosla

Chair: Prof. Valentina E.Balas

Time : 13:15 pm – 14:00 pm

Solid Development Teams Search Approach

Prof. Nadezhda Yarushkina

Chair: Prof. Shahnaz N. Shahbazova

Time : 14:00 pm – 15:40 pm

Fuzzy Logic applications
Chair: Prof. Vadim Stefanyuk

Creating a database of estimates of noise characteristics for monitoring the technical condition of industrial facilities
T.A.Aliyev, Prof. N.Musayeva

On the Errors of the Theory of Safety of Environmentally Hazardous Facilities
Aminaga Sadigov

Decision Making in a Distributed Intelligent Personnel Health Management System on Offshore Oil Platform
M. Mammadova, Z. Jabrayilova

Intuitionistic fuzzy tools in evaluation of macroeconomic stability

G. J. Imanov, A.Z. Aliyev

The use of cognitive modeling in solving problems of ecological sustainability of the region
A.B. Hasanov

Fuzzy model and Z-information

Chair: Prof. Averkin Alexey

Clustering of the state of plant species in the urban environment under Z-information
O. Poleshchuk, E. Komarov

Multi-criteria analysis of the objects state under Z- information
O. Poleshchuk

On one boundary-value problem in a non-classical treatment for the Generalized mangeron equation
Sh. N. Shahbazova, I. G.Mamedov

Graphical Modeling of Information Coming from a Numerous of Different Types of Sensors
A.A. Akhundov, E.M. Akhundova

Digital Transformation in Chemical Industry: Case of Azerbaijan

A.A. Guliyeva, A.A.Abdulova, U.Sh. Rzayeva

Time : 15:40 pm - 17:00 pm

Neural Networks

Chair: Prof. Nadezhda Yarushkina

Quality Estimation of Wine Data Using Improved Crow Search Alghoritm Based Fuzzy Neural Networks Classifier
Z. N. Ali, I.N. Askerzade, M.S. Güzel

AI-based Network Security Anomaly Prediction and Detection in Future Network
G. Abdiyeva-Aliyeva, M.Hematyar

Dow Jones Index Time Series Forecasting Using Feedforward Neural Network Model
R.R.Rzayev, P.E.Alizada

The Regularity Of Solutions Degenerate Nonlinear Elliptic Equations

T.Gadjiev, Y.Rustamov, T.Maharramova

Artificial Intelligence

Chair: Prof. Valentina E. Balas

Inverter fault diagnosis with AI at edge
Aditya Anand, Priya G Das, Saneep K.

Parallelization of Array Method with Hybrid Programming: OpenMP and MPI
Apolinar Velarde Mart´ınez

Risk Management in Bank: Fuzzy Inference Based Process Model
R.R. Rzayev, J.H. Aghajanov

Analysis of the methods for constructing membership functions using expert data
K.R. Aida-Zade, P.S. Guliyeva, R.E. Ismibayli

Friday

February 4th, 2022

Time : 09:00 am - 10:00 am

Panel chair: Prof. Vladik Kreinovich

Lotfi Zadeh's legacy:
inspirations for mathematics, systems theory, decision, control

Ali M. Abbasov, Janusz Kacprzyk, Oscar Castillo, Ildar Batyrshin, Nadezhda Yarushkina*, Valentina E.Balas, Vadim Stefanuk, Jozo Dujmovic, Shahnaz N. Shahbazova*

Time : 10:00 am - 11:20 am

Soft Computing Logic Aggregation

Chair: Prof. V.Kreinovich

LSPeval – an Educational Decision Support Tool Based on Soft Computing Logic Aggregation
Jozo Dujmovic, K.Kapre

Mental Illness Classification on Social Media Texts using Deep Learning and Transfer Learning
Ameer I., Arif M., Sidorov G., Gómez-Adorno H.M.

Job Offers Classifier using Neural Networks and Oversampling Methods
Ortiz G., Bel-Enguix G., Ameer I., Gómez-Adorno H., Sidorov G.

Analysis of Fake News Detection Methods
Amjad M., Vitman O., Sidorov G., Zhila A., Gelbukh A

Inteliggent metods and Fuzzy approach

Chair: Prof. I. Batyrshin

Transformer-based predictive factors for Sentiment Detection
O. E. Ojo, T. H. Ta, A.r Gelbukh, H. Calvo, O. O.Adebanji and G.Sidorov

Automatic Humor Classification: Analysis between embeddings and models
V. M. Palma, A. Gelbukh and G. Sidorov

Medical Diagnosis Enhancement through DNN-based Binary Classification
Maldonado-Sifuentes, G. Sidorov and L. Chanona-Hernandez

Analysis of Fake News Detection Methods
Amjad M., Vitman O., Sidorov G., Zhila A., Gelbukh A

On Similarity Correlation of Probability Distributions
Maria Elena Ensastegui-Ortega, Ildar Batyrshin and Alexander Gelbukh

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Time : 11:20 am - 13:00 am

Probabilistic Uncertainty

Chair: Prof. V.Kreinovich

Shall we Be Foxes or Hedgehogs: What Is the Best Balance for Research?
Miroslav Svitek, Olga Kosheleva, Shahnaz Shahbazova, and Vladik Kreinovich

How to Gauge Students' Ability to Collaborate?
Christian Servin, Olga Kosheleva, Shahnaz Shahbazova, and Vladik Kreinovich

Ethical Dilemma of Self-Driving Cars:Conservative Solution
Christian Servin, Vladik Kreinovich, and Shahnaz Shahbazova

Need to Combine Interval and Probabilistic Uncertainty: What Needs to Be Computed, What Can Be Computed, What Can Be Feasibly Computed, and How Physics Can Help
Julio Urenda, Olga Kosheleva and Vladik Kreinovich

Why Moving Fast and Breaking Things Makes Sense?
Francisco Zapata, Eric Smith, and Vladik Kreinovich

Fuzzy control Systems

Chair: Prof. Shahnaz N. Shahbazova

Tuning of Fuzzy Control Systems by Artificial Bee Colony with Dynamic Parameter Values Algorithm for Traction Power System
Sh. N. Shahbazova, D. Ekmekci

Balance-based fuzzy approach for the classification of liver diseases due to hepatitis c virus
D. Ekmekci and Sh. N.Shahbazova

A Survey of Empathetic Generative Chatbots
Carolina Martin del Campo Rodriguez, Grigori Sidorov and Ildar Batyrshin

Comparative Analysis of Parametric Optimization Techniques: Fuzzy DSS for Medical Diagnostics
Oleksiy Kozlov, Yuriy Kondratenko and Oleksandr Skakodub

Imitation modeling and research of the flexible manufacture module by means of the petri net
M.A. Akhmedov, S.M.Akhmedova

Time : 13:00 am - 13:45 am

Explainable Similarity Correlation of Categorical Data and Bar Chart

Prof. Imre Rudas and Prof. Ildar Batyrshin

Chair: Prof. Takahiro Yamanoi

Time : 13:45 am - 14:30 am

Functional-Algebraic Models in Analysis of Relationships in Data: Similarity,

Dissimilarity and Correlations Functions on Involutive Sets

Prof. Ildar Batirshin

Chair: Prof. Praveen K.Khosla

Time : 14:30 pm - 15:15 pm

Spatiotemporal Activities in Brain on Recognizing Ambiguous Figures

Prof. Takahiro Yamanoi

Chair: Prof. Ali M. Abbasov

Time : 15:15 pm - 16:00 pm

Mathematical Modelling of Distributed Memory

Prof. Vadim Stefanyuk

Chair: Prof. Valentina E.Balas

Time : 16:00 pm - 16:45pm

Ideas of Lotfi Zadeh on Explainable Artificial Intelligence

Prof. Alexey Averkin

Chair: Prof. Vadim Stefanyuk

Time : 16:45 pm - 17:30pm

Kolmogorov Stories
Asaf Hajiyev

Chair: Prof. Alexey Averkin

Saturday
February 5th, 2022

Time : 09:00 am – 10:00 am

Panel Chair: *Prof.* *Janusz Kacprzyk*

Fuzzy Logic and Soft Computing, Computational Intelligence and Intelligent Technologies

Ali M. Abbasov, Vladik Kreinovich, Oscar Castillo, Takahiro Yamanoi, Asaf Hajiyev, Praveen K. Khosla, Averkin Alexey, Ildar Batyrshin, Marius Balas, Nishchal Kumar Verma, Shahnaz N. Shahbazova

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Time : 10:00 am – 10:45 am

Optimization of Type-2 Fuzzy Systems: Theory and Applications
Prof. Oscar Castillo

Chair: Prof. Shahnaz N. Shahbazova

Time : 10:45 am – 11:30 am

Intangible Benefit Identification and Realisation – Issues and Challenges in Project Program and Portfolio Management
Prof. Elizabeth Chang

Chair: Prof. Oscar Castillo

Time : **11:30 am – 12:15 pm**

Advanced Aspects in Multidisciplinary Soft Computing and Applications
Prof. VALENTINA E. BALAS

Chair: Prof. Ali M. Abbasov

State-space based designing of control systems

Prof. Marius Balas

Chair: Asaf Hajiyev

Time : 13:00 pm − 13:45 pm

AI, Deep Learning and Deep Fuzzy Network

Prof. Nishchal Kumar Verma

Chair: Prof. Shahnaz N. Shahbazova

Time : 13:45 pm − 15:25 pm

Fuzzy Logic and sets

Chair: Prof. Nishchal Kumar Verma

Fuzzy model of defence of the defensive line by a group of dynamic objects
A.A.Bayramov, A.B.Pashayev, E.N.Sabziev

The Introduction of a Fuzzy Parameter to Predict the Devaluation of the Local currency Caused by the Fall in World Oil Prices
R.Y. Shikhlinskaya

Comparison of Artificial and Convolutional Neural Networks in recognition of handwritten letters of Azerbaijani alphabet
R. Azimov

Research and Analysis Criterion Quality of Service and Experience Multifractal Traffic Using Fuzzy Logic
B. G. Ibrahimov, S. R. Ismaylova, A.H. Hasanov, Y.S. Isayev

Fuzzy set theory in the context of probability theory
A. H. Rzayev, R.Sh. Asadova

Fuzzy simulation

Chair: Prof. Praveen K. Khosla

Evaluation of the use of the software package, taking into account the psychophysiological characteristics of the user
N.B. Agayev, E.N. Agazade

Improving intersection traffic management solutions by means of simulation: case study
F. Dashdamirov, A. Aliyev, T. Verdiyev and U. Javadli

Applications of Autoregressive Models for Forecasting of some Stock Indexes
H.A. Jafarova, R.T. Aliyev

Necessary Optimality Condition in Linear Fuzzy Optimal Control Problem with Delay
R. O. Mastaliyev and K. B. Mansimov

Modeling the movement of mudflows in river basins
A.B. Hasanov, S. Yu. Guliyeva

Time : 15:30 pm – 17:10 pm

Fuzzy recognition
Chair: Prof. Sh.N. Shahbazova

Difficulties in recognizing flat shapes based on Fuzzy logic
Sh.N. Shahbazova and A.M. Abbasov

The problem of parsing and recognizing individual objects of information on base of fuzzy Logic
Z. Huseynova

Call Center and Robot Call Center How to Reduce the Cost
O. Fatullayev, R. Fatullayev and A. Fatullayev

An intelligent method for optimizing calculations in the recognition of sound information
Z. Huseynova and Sh. N. Shahbazova

Fuzzy Logic and applications

Chair: Prof. Ali M. Abbasov

Advanced Trainings in the System of Teachers' Professional Development: the Empirical Study
T.A. Aliyeva, U.Sh. Rzayeva

Development of a Combined Test Algorithm to Increase the Intelligence of Measurement Systems
M. Isayev, L.Mahmudbeyli, N.Khasayeva

Development the system of intelligent fusion information by using the paradigm method calculated by words
Sh. N.Shahbazova and I.Khydyrov

Simulation of statistical and spectral characteristics of surficial sea-ways in reservoirs
R. Gasanov and A. Gasanov

The main directions of the use of innovations in industrial production in Azerbaijan
A. A. Aliyeva

Time : 17:10 pm – 18:10 pm

CLOSING EVENT

Ali M. Abbasov, Janusz Kacprzyk, Vadim Stefanyuk, Takahiro Yamanoi, Asaf Hajiyev, Praveen K. Khosla, Alexey Averkin, Nishchal Kumar Verma, Valentina E.Balas, Shahnaz N. Shahbazova

Plenary Talks

LOTFI A. ZADEH

Department of Electrical Engineering
& Computer Sciences
College of Engineering
University of California, Berkeley, USA

Lotfi A. Zadeh joined the Department of Electrical Engineering at the University of California, Berkeley, in 1959, and served as its chair 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. He held a number of visiting appointments, including a visiting professorship in Electrical Engineering at MIT in 1962 and 1968; visiting scientist at IBM Research Laboratory, San Jose, CA, in 1968, 1973, and 1977; 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.He was a Professor in the UC Berkeley Graduate School and served as the Director of BISC (Berkeley Initiative in Soft Computing).

Until 1965, Dr. Zadeh's work 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. In 1965, his research interests shifted to the theory of fuzzy sets and its applications to artificial intelligence, linguistics, logic, decision analysis, control theory, expert systems and neural networks. His later research 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 was 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.

He received the IEEE Education Medal in 1973 and 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.

Dr. Zadeh was accorded the following honors:

1992

- IEEE Richard W. Hamming Medal "For seminal contributions to information science and systems, including the conceptualization of fuzzy sets."
- Foreign Member of the Russian Academy of Natural Sciences (Computer Sciences and Cybernetics Section)
- Certificate of Commendation for AI Special Contributions Award from the International Foundation for Artificial Intelligence
- Kampe de Feriet Prize
- Honorary Member of the Austrian Society of Cybernetic Studies

1993

- 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."
- Grigore Moisil Prize for Fundamental Researches
- Premier Best Paper Award by the Second International Conference on Fuzzy Theory and Technology

1995

- IEEE Medal of Honor "For pioneering development of fuzzy logic and its many diverse applications."

1996

- Okawa Prize "For outstanding contribution to information science through the development of fuzzy logic and its applications."

1997

- B. Bolzano Medal by the Academy of Sciences of the Czech Republic "For outstanding achievements in fuzzy mathematics."

- J.P. Wohl Career Achievement Award of the IEEE Systems, Science and Cybernetics Society
- 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.

1998
- Edward Feigenbaum Medal by the International Society for Intelligent Systems
- Richard E. Bellman Control Heritage Award by the American Council on Automatic Control. the Information Science Award from the Association for Intelligent Machinery
- SOFT Scientific Contribution Memorial Award from the Society for Fuzzy Theory in Japan

1999
- Elected to membership in Berkeley Fellows
- Certificate of Merit from IFSA (International Fuzzy Systems Association)

2000
- IEEE Millennium Medal
- IEEE Pioneer Award in Fuzzy Systems
- ASPIH 2000 Lifetime Distinguished Achievement Award
- ACIDCA 2000 Award for the paper, "From Computing with Numbers to Computing with Words—From Manipulation of Measurements to Manipulation of Perceptions."
- Chaos Award from the Center of Hyper incursion 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

2001
- ACM 2000 Allen Newell Award for seminal contributions to AI through his development of fuzzy logic
- 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

2003
- Elected as a foreign member of the Finnish Academy of Sciences
- 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."

2004

- Civitate Honoris Causa by Budapest Tech (BT) Polytechnical Institution, Budapest, Hungary
- V. Kaufmann Prize by the International Association for Fuzzy-Set Management and Economy (SIGEF)

2005

- Elected as a foreign member of the Polish Academy of Sciences, Korea Academy of Science & Technology and Bulgarian Academy of Sciences
- Nicolaus Copernicus Medal of the Polish Academy of Sciences
- J. Keith Brimacombe IPMM Award

2006

- Elected as a foreign member of the National Academy of Sciences of Azerbaijan
- Pioneer Award for Outstanding Contributions to Soft Computing, Georgia State University, Atlanta, Georgia
- Silicon Valley Engineering Hall of Fame

2007

- Egleston Medal, Columbia University, New York
- Member of the International Academy of Systems Studies (IASS)

2009

- Franklin Institute Medal, Philadelphia

2011

- Medal of the Foundation by the Trust of the Foundation for the Advancement of Soft Computing, Spain
- High State Award 'Friendship Order', from the President of the Republic of Azerbaijan
- Trans disciplinary Award and Medal of the Society for Design and Process Sciences, Korea.

Dr. Zadeh was a recipient of twenty-four honorary doctorates from the following Universities:

- Paul-Sabatier University, Toulouse, France
- State University of New York, Binghamton

- 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
- Silesian Technical University, Gliwice, Poland
- University of Toronto, Toronto, Canada
- University of Ostrava, the Czech Republic
- University of Central Florida, Orlando, FL
- University of Hamburg, Hamburg, Germany
- University of Paris(6), Paris, France
- Jahannes Kepler University, Linz, Austria
- University of Waterloo, Canada
- University of Aurel Vlaicu, Arad, Romania
- Lappeenranta University of Technology, Finland
- Muroran Institute of Technology, Japan
- Hong Kong Baptist University, China
- Indian Statistical Institute, Kolkata, India
- University of Saskatchewan, Canada;
- Polytechnic University of Madrid, Spain
- Ryerson University, Canada

Lotfi A. Zadeh's life and his scientific legacy

Professor Shahnaz N. Shahbazova, Ph.D., D.Sc.

Department of Computer Technology and Cybersecurity, Azerbaijan Technical University, Baku, Azerbaijan
Institute of Control System National Academy of Sciences, Azerbaijan
shahbazova@aztu.edu.az, shahbazova@isi.az

Abstract: This paper describes Professor Lotfi A. Zadeh's life and his scientific legacy. The work begins with his birth where he was born in Baku in Azerbaijan, as well as the period of residence in Baku from birth to 10 years. After 10 years, he moves to Iran, where he lives from 10 to 23 years. After 23 years, he moves to the States for the purpose of getting an education.

The paper also describes Studying and working in the States (Doctoral studies) and some information about his Family.

Zadeh's articles and the first results of scientific work, as well as Scientific discoveries (how the theory was born, the history of this theory and features) are described in detail in this work too.

His collaboration with other scientists (his teacher Norbert Wiener, Rudolf Kalman, Charles A.Desoer and others is written in detail in this article.

The work describes scientific life by years to the last stage of life.

The very important conferences and symposiums that he participated in and he make presentation as a keynote speaker are described in detail in this work.

The paper also describes in detail his visit to his native country, where he was born, which he visited Azerbaijan International Exhibition Telecommunications and Information Technologies - BakuTel2008 and reception of the President of the home country and his close ties with Azerbaijan, scientific friends from Azerbaijan.

Dr. Shahnaz N. Shahbazova received the academic degree of hD in 1995, the academic title of associate professor in 1996, the academic degree of Doctor of Sciences in Engineering 2015. Since 2002, she has been an academician, and since 2014, Vice-President of the Lotfi A. Zadeh International Academy of Sciences. Since 2011, she has held the position of General Chairman and organizer of the World Conference on Soft Computing (WConSC), dedicated to the preservation and development of the scientific heritage of Professor Lotfi A. Zadeh. She is an honorary professor at the University of Obuda in Hungary and the Aurel Vlaicu University of Arad in Romania, an Honorary Doctor of Philosophy of Technical Sciences of the UNESCO International Personnel Academy.

She is a member of the Board of Directors of the North American Society for Fuzzy Information Processing (NAFIPS); moderator of the Berkeley Soft Computing Initiative (BISC) group; member of the council 3338.01 "System Analysis, Management and Information Processing" for the defense of PhD and doctoral dissertations, as well as chairman of the seminar of the same council at the Azerbaijan Technical University.

Dr. Shahbazova participated in many international conferences as Organizer, Honorary Chair, Session Chair, member in Steering, Advisory or International Program Committees and Keynote Speaker. She is a president of Fuzzy System Association in Baku.

She's awards: India - 3 months (1998), Germany (DAAD) - 3 months (1999, 2003, 2010), USA, California, Berkeley University (Fulbright) - (2007-2008, 2012, 2015, 2016, 2017). She is the author of more than 176 scientific articles, 8 methodological manuals, 9 textbooks, 2 monographs and 7 Springer publications. Her research interests include Artificial Intelligence, Soft Computing, Intelligent Systems, Machine Learning Methods for Decision Making and Fuzzy Neural Network.

Group decisions under fuzzy preferences and fuzzy majority: beyond the consensus perspective

Janusz Kacprzyk

Intelligent Systems Laboratory
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Newelska 6, 01-447 Warsaw, Poland
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Abstract: The problem of the broadly perceived group (collective) decision making is considered in which a finite and relatively small set of agents (individuals) is meant to find a best option (or a course of action) from a finite set of possible options (courses of action). A preference based model is assumed in which the preferences between options are given by individual fuzzy preference relations that specify the preferences as real numbers from [0,1]. The majority is assumed to be fuzzy exemplified by "most agents", and handled by fuzzy logic with linguistic quantifiers. The best option (course of action) to be determined is generally what is best preferred as the group of agents as a whole which is given as a social fuzzy preference relation. As a point of departure the popular approach is first assumed in that a consensus reaching process is first performed to find the preferences of the individual agents and the group at consensus, that is the best what can be attained at the time. The consensus reaching process is gauged by Kacprzyk and Fedrizzi's degree of consensus.

Though the consensus based group decision making is very popular and effective and efficient, there are many reports and results of investigation – by researchers and scholars from many fields like decision sciences, management sciences, psychology, cognitive sciences, etc., but also in the media – that "consensus is the best way to kill innovation" because, as they argue, by forcing agents to reach consensus less emphasis is on innovative solutions that are usually characterized by proposals that go beyond what is agreed upon by the group.

New approaches and models are therefore needed to involve a lack of consensus, or a low degree thereof. Some new classes of fuzzy preference and fuzzy majority based models are shown, based on Kacprzyk and Zadrożny's concept of consensory and dissensory agents, that propose new classes of group decision models and solutions in such a setting that does not follow the usual consensus based decision process, and admits different testimonies of the some agents that are not in line with what the majority thinks. New decision protocols under such conditions are proposed. Examples of applications are presented.

Janusz Kacprzyk Janusz Kacprzyk is Professor of Computer Science at the Systems Research Institute, Polish Academy of Sciences, WIT – Warsaw School of Information Technology, and Chongqing Three Gorges University, Wanzhou, Chongqing, China, and Professor of Automatic Control at PIAP – Industrial Institute of Automation and Measurements in Warsaw, Poland. He is Honorary Foreign Professor at the Department of Mathematics, Yli Normal University, Xinjiang, China. He is Full Member of the Polish Academy of Sciences, Member of Academia Europaea, European Academy of Sciences and Arts, European Academy of Sciences, Foreign Member of the: Bulgarian Academy of Sciences, Spanish Royal Academy of Economic and Financial Sciences (RACEF), Finnish Society of Sciences and Letters, Flemish Royal Academy of Belgium of Sciences and the Arts (KVAB), National Academy of Sciences of Ukraine and Lithuanian Academy of Sciences. He was awarded with 6 honorary doctorates. He is Fellow of IEEE, IET, IFSA, EurAI, IFIP, AAIA, I2CICC, and SMIA.

His main research interests include the use of modern computation computational and artificial intelligence tools, notably fuzzy logic, in systems science, decision making, optimization, control, data analysis and data mining, with applications in mobile robotics, systems modeling, ICT etc.

He authored 7 books, (co)edited more than 150 volumes, (co)authored more than 650 papers, including ca. 150 in journals indexed by the WoS. He is listed in 2020 and 2021 "World's 2% Top Scientists" by Stanford University, Elsevier (Scopus) and ScieTech Strategies and published in PLOS Biology Journal.

He is the editor in chief of 8 book series at Springer, and of 2 journals, and is on the editorial boards of ca. 40 journals.. He is President of the Polish Operational and Systems Research Society and Past President of International Fuzzy Systems Association.

Different Concepts, Similar Computational Complexity: Nguyen's Results about Fuzzy and Interval Computations 35 Years Later

Vladik Kreinovich

University of Texas at El Paso, USA

Abstract. When we know for sure which values are possible and which are not, we have crisp uncertainty -- of which interval uncertainty is a usual case. In practice, we are often not 100\% sure about our knowledge, i.e., we have fuzzy uncertainty -- i.e., we have fuzzy knowledge, of which crisp is a particular case. Usually, general problems are more difficult to solve that most of their particular cases. It was therefore expected that processing fuzzy data is, in general, more computationally difficult than processing interval data -- and indeed, Zadeh's extension principle -- a natural formula for fuzzy computations -- looks very complicated. Unexpectedly, Zadeh-motivated 1978 paper by Hung T. Nguyen showed that fuzzy computations can be reduced to a few interval ones -- and in this sense, fuzzy and interval computations have, in effect, the same computational complexity. In this paper, we remind the readers about the motivations for (and proof of) this result, and show how and why in the last 35 years, this result was generalized in various directions.

Vladik Kreinovich received his MS in Mathematics and Computer Science from St. Petersburg University, Russia, in 1974, and PhD from the Institute of Mathematics, Soviet Academy of Sciences, Novosibirsk, in 1979. From 1975 to 1980, he worked with the Soviet Academy of Sciences; during this time, he worked with the Special Astrophysical Observatory (focusing on the representation and processing of uncertainty in radioastronomy). For most of the 1980s, 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 has worked in the Department of Computer Science at the University of Texas at El Paso. In addition, he has served as an invited professor in Paris (University of Paris VI),France; Hannover, Germany; Hong Kong; St. Petersburg and Kazan, Russia; and Brazil.

His main interests are the representation and processing of uncertainty, especially interval computations and intelligent control. He has published 12 books, 39 edited books, and more than 1,800 papers. Vladik is a member of the editorial board of the international journal "Reliable Computing" (formerly "Interval Computations") and several other journals. In addition, he is the co-maintainer of the international Web site on interval computations http://www.cs.utep.edu/interval-comp.

Vladik is Vice President of the International Fuzzy Systems Association (IFSA), Vice President of the European Society for Fuzzy Logic and Technology (EUSFLAT), Fellow of International Fuzzy Systems Association (IFSA), Fellow of Mexican Society for Artificial Intelligence (SMIA), Fellow of the Russian Association for Fuzzy Systems and Soft Computing, Treasurer of the IEEE Systems, Man, and Cybernetics Society; he served as Vice President for Publications of IEEE Systems, Man, and Cybernetics Society 2015-18, and as President of the North American Fuzzy Information Processing Society 2012-14; is a foreign member of the Russian Academy of Metrological Sciences; was the recipient of the 2003 El Paso Energy Foundation Faculty Achievement Award for Research awarded by the University of Texas at El Paso; and was a co-recipient of the 2005 Star Award from the University of Texas System.

Optimization of Type-2 Fuzzy Systems: Theory and Applications

Prof. Oscar Castillo, Ph.D., D.Sc.

Tijuana, Institute of Technology

Tijuana, Mexico

Abstract: Type-2 fuzzy systems are powerful intelligent models based on the theory of fuzzy sets, originally proposed by Prof. Zadeh. Most real-world applications up to now are based on type-1 fuzzy systems, which are built based on the original (type-1) fuzzy sets that extend the concept of classical sets. Type-2 fuzzy sets extend type-1 fuzzy sets by allowing the membership to be fuzzy, in this way allowing a higher level of uncertainty management. Even with the current successful applications of type-1 fuzzy systems, now several papers have shown that type-2 is able to outperform type-1 in control, pattern recognition, manufacturing and other areas. The key challenge in dealing with type-2 fuzzy models is that their design has a higher level of complexity, and in this regard the use of bio-inspired optimization techniques is of great help in finding the optimal structure and parameters of the type-2 fuzzy systems for particular applications, like in control, robotics, manufacturing and others. Methodologies for designing type-2 fuzzy systems using bio-inspired optimization in different areas of application are presented as illustration. In particular, we will cover Bee Colony Optimization, Particle Swarm Optimization, Gravitational Search and similar approaches to the optimization of fuzzy systems in control applications, robotics and pattern recognition. We will also consider using fuzzy logic for enhancing the performance of metaheuristics, where also good results have been achieved. Finally, the prospects for the future applications of type-3 fuzzy logic will be discussed.

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Oscar Castillo holds the Doctor in Science degree (Doctor Habilitatus) in Computer Science from the Polish Academy of Sciences (with the Dissertation "Soft Computing and Fractal Theory for Intelligent and Manufacturing"). He is a Professor of Computer Science in the Graduate Division, Tijuana Institute of Technology, Tijuana, Mexico. In addition, he is serving as Research Director of Computer Science and head of the research group on Hybrid Fuzzy Intelligent Systems. Currently, he is President of HAFSA (Hispanic American Fuzzy Systems Association) and Past President of IFSA (International Fuzzy Systems Association). Prof. Castillo is also Chair of the Mexican Chapter of the Computational Intelligence Society (IEEE). He also belongs to the Technical Committee on Fuzzy Systems of IEEE and to the Task Force on "Extensions to Type-1 Fuzzy Systems". He is also a member of NAFIPS, IFSA and IEEE. He belongs to the Mexican Research System (SNI Level 3). His research interests are in Type-2 Fuzzy Logic, Fuzzy Control, Neuro-Fuzzy and Genetic-Fuzzy hybrid approaches. He has published over 300 journal papers, 10 authored books, 50 edited books, 300 papers in conference proceedings, and more than 300 chapters in edited books, in total more than 1000 publications (according to Scopus) with h index of 82 and more than 23000 citations according to Google Scholar. He has been Guest Editor of several successful Special Issues in the past, like in the following journals: Applied Soft Computing, Intelligent Systems, Information Sciences, Soft Computing, Non-Linear Studies, Fuzzy Sets and Systems, JAMRIS and Engineering Letters. He is currently Associate Editor of the Information Sciences Journal, Journal of Engineering Applications on Artificial Intelligence, International Journal of Fuzzy Systems, Journal of Complex Intelligent Systems, Granular Computing Journal and Intelligent Systems Journal (Wiley). He was Associate Editor of Journal of Applied Soft Computing and IEEE Transactions on Fuzzy Systems. He has been elected IFSA Fellow in 2015 and MICAI Fellow in 2016. Finally, he recently received the Recognition as Highly Cited Researcher in 2017 and 2018 by Clarivate Analytics and Web of Science.

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ResearchGate: http://www.researchgate.net/profile/Oscar_Castillo2/publications

Functional-Algebraic Models in Analysis of Relationships in Data: Similarity, Dissimilarity and Correlations Functions on Involutive Sets

Ildar Batyrshin

Instituto Politecnico Nacional,
Centro de Investigacion en Computacion,
Mexico

Abstract. We present a new, *Functional-Algebraic,* approach to the analysis of relationships in data. This approach contains the following main features:

- It considers different types of data sets as *involutive sets* with an involutive unary operation defined on the set. Such a set with an involutive operation defines an *involutive algebra*.
- It considers different similarity measures, distances, correlation, association coefficients, and relations as *relationship functions* with arguments from an involutive set satisfying some given properties.

A *Functional-Algebraic Model* (*FAM*) contains one or more involutive operations defined on the same set together with several relationship functions.

Such a general approach gives a unified look at different relationship measures defined for various types of data in Data Science and Data Mining, Statistics, Fuzzy Set Theory, Pattern Recognition, and Machine Learning. Considering different types of data sets as underlying sets of involutive algebras allows us to study together data types formerly studied separately in Boolean Algebra, in Linear Algebra, etc. Considering different types of relationship measures as functions satisfying some properties gives the possibility to establish connections between them and propose new general methods of constructing these measures. As a result, one can apply these methods to build new relationship measures for specific data sets.

In this talk, we consider examples of the definition of involutive operations and algebras for different data types. Correlation function (association measure) is defined as a function with two arguments from an involutive set satisfying several properties. We show that many classical correlation and association coefficients considered in statistics during more than one hundred years satisfy these properties. We discuss several methods of constructing correlation functions from fuzzy relations and establish a one-to-one correspondence between correlation functions and bipolar fuzzy relations. Finally, the methods of building correlation functions using co-symmetric fuzzy relations and pseudo-difference operations associated with t-conorms are considered.

Ildar Batyrshin Ildar Batyrshin graduated from the Moscow Physical-Technical Institute. He received Ph.D. from the Moscow Power Engineering Institute and Dr. Sc. from the Higher Attestation Committee of the Russian Federation. He occupied professor and research positions in Applied Mathematics and Computer Science at the National Research Technological University, Kazan, Russia, the Institute of Problems of Informatics of Academy of Sciences of the Republic of Tatarstan, Russia, and Mexican Petroleum Institute (IMP). Since 2014 he with the Center for Computing Research (CIC) of National Polytechnic Institute (IPN), Mexico, as a Titular Professor C.

He is the President of the Mexican Society for Artificial Intelligence (SMIA), Past-President of the Russian Association for Fuzzy Systems and Soft Computing (RAFSSoftCom), a member of the NAFIPS Board of Directors, a member of BoG of IEEE SMCS, and Senior Member of IEEE.

His awards: Fellow of IFSA, SMIA and RAFSSoftCom; Regular Member of the Mexican Academy of Sciences; Level 3 (highest) Researcher of the National System of Researchers of Mexico; Honorary Professor of Obuda University, Budapest, Hungary; Honorary Researcher of the Republic of Tatarstan, Russia; 1st Prize for the Best Research of IMP for the Development of Expert System in Diagnostics of Water Production (SMART-Agua) in 2007; State Research Fellowship of the Presidium of Russian Academy of Sciences for Distinguished Researchers (1997-2003).

He is an associate editor of several scientific journals. He is a co-author and co-editor of more than 20 books and special volumes of journals.

He served as a Co-Chair of Program or Organizing Committees of more than 10 International Conferences on Soft Computing, Artificial Intelligence, Computational Intelligence, and Data Mining.

Advanced Aspects in Multidisciplinary Soft Computing and Applications

Prof. Valentina Emilia Balas

Aurel Vlaicu University of Arad, Romania

Abstract: This presentation is aimed to highlight the soft computing paradigms for designing intelligent systems. Nowadays soft computing techniques are considered a good approach to solve many problems in a wide range of applications.

We are focused on the conception, development and implementation of soft computing techniques in multidisciplinary design problems. In particular, these soft computing techniques offers the advantages of the linguistic based representation of knowledge as well as a remarkable easiness of the implementations.

The presented case studies proved to be useful in a wide field of applications, especially in designing complex systems.

Valentina E. Balas is currently Full Professor in the Department of Automatics and Applied Software at the Faculty of Engineering, "Aurel Vlaicu" University of Arad, Romania.

She holds a Ph.D. Cum Laude, in Applied Electronics and Telecommunications from Polytechnic University of Timisoara. Dr. Balas is author of more than 350 research papers in refereed journals and International Conferences. Her research interests are in Intelligent Systems, Fuzzy Control, Soft Computing, Smart Sensors, Information Fusion, Modeling and Simulation.

She is the Editor-in Chief to *International Journal of Advanced Intelligence Paradigms* (*IJAIP*) *and to International Journal of Computational Systems Engineering (IJCSysE),* member in Editorial Board member of several national and international journals and is evaluator expert for national, international projects and PhD Thesis.

Dr. Balas is the director of Intelligent Systems Research Centre in Aurel Vlaicu University of Arad and Director of the Department of International Relations, Programs and Projects in the same university.

She served as General Chair of the International Workshop Soft Computing and Applications (SOFA) in nine editions organized in the interval 2005-2020 and held in Romania and Hungary.

Dr. Balas participated in many international conferences as Organizer, Honorary Chair, Session Chair, member in Steering, Advisory or International Program Committees and Keynote Speaker.

Recently she was working in a national project with EU funding support: BioCell-NanoART = Novel Bio-inspired Cellular Nano-Architectures - For Digital Integrated Circuits, 3M Euro from National Authority for Scientific Research and Innovation.

She is a member of European Society for Fuzzy Logic and Technology (EUSFLAT), member of Society for Industrial and Applied Mathematics (SIAM) and a Senior Member IEEE, member in Technical Committee – Fuzzy Systems (IEEE Computational Intelligence Society), chair of the Task Force 14 in Technical Committee – Emergent Technologies (IEEE CIS), member in Technical Committee – Soft Computing (IEEE SMCS).

Dr. Balas was past Vice-president (responsible with Awards) of IFSA - International Fuzzy Systems Association Council (2013-2015), is a Joint Secretary of the Governing Council of Forum for Interdisciplinary Mathematics (FIM), - A Multidisciplinary Academic Body, India and recipient of the "Tudor Tanasescu" Prize from the Romanian Academy for contributions in the field of soft computing methods (2019).

MATHEMATICAL MODELING OF DISTRIBUTED MEMORY

Vadim L. Stefanuk

Institute for Information Transmission Problems RAS

Peoples' Friendship University of Russia

Abstract. Several mathematical models are considered with the purpose to make a comparison of the memory models used in artificial systems and in alive creatures. The first model was proposed by M. Tsetlin, who called it "Pile of Books Model" in his publication in 1961. He described some valuable properties of his memory model.

This model was rediscovered by Hendriks in 1972. In 1973 Burville and Kingman obtained strict mathematical results concerning the depth of the memory that later found reasonable use in the Internet search machines.

The main attention in the present paper is paid to our "Distributed Memory Model", which contains additional parameters: the numbers of copies of the same elements.

Our model demonstrated some additional useful applications for Internet. Also some similarity was found with the results mentioned by A.Levi and S.Sikevits on some unusual functions observed in biological cells applied for storage of enzymes. Our model provides an explanation for the phenomenan.

Vadim L. Stefanuk
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PhD and Dr. Sc.
Leading researcher in the Institute for Information Transmission Problems RAS,
Professor of Russian University for People's Friendship,
Vice-President of Russian Association for Artificial Intelligence,
Member of ECCAI (Eur_AI)

Some Problems Formulations and Results by V. L. Stefanuk

Collective behavior of learning automata.
Wireless mobile communication.
Axiomatic approach towards Fuzzy Evidence.
Theory of Category methods in AI.
Dynamic Expert Systems.
Conditioning in Natural Language.
Automata behavior in Fuzzy Environment.
Intelligent Transactions in Tutoring.
Semiotic Introspection.
Axiomatics of Markov-Stefanuk chains.
Creative problems and methods in AI.
Measuring of Fuzzy values.

Under 300 publications, including 4 books.

Intangible Benefit Identification and Realisation – Issues and Challenges in Project Program and Portfolio Management

E. Chang, Ru Perera

Australian Defence, UNSW@ADFA and
Defence University Sri Lanka
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Abstract. In recent years there is an upsurge in the adoption of Benefit approach to project, program, and portfolio (PPP) management in the Government sector particularly in the area of procurement, commercial grade contracts, IT governance, innovation investment space and there is an emergence of new worldwide consulting business based on Benefit approach to PPP by mega consulting enterprises, however, customers such as large portfolio of government departments are not aware of the quantifiability of the benefit that has been identified or presented in PPP by the benefit team, or various of benefit offices or consulting companies. Our recent field studies and practical PPP evaluation of benefit approaches in PPP showed that although tangible benefits such as cost saving, Return on Investment, etc can be identified and measured in PPP management, 70-80% of benefits identified in those PPP management are Intangible benefits, such as Capability, efficiency etc and no measurement or technics provided on how to measure those benefits in PPP, as ""what gets measured get delivered".

The intangible benefits are largely identified in the context of strategic intent, social economic drivers or futuristics. Due to the vagueness and imprecision of benefit concepts, particularly intangible benefits, there is no solid measurement techniques and tools available to help customers or largely government organizations to realise the benefit resulting in repeated high cost in procurement, contracts, IT and investment. In this research, we present our research on applying bivalent logic and probability theory to build the framework of tangible and intangible benefit concepts for PPP and to formulate fuzzy concept within the framework of bivalent logic and probability theory, the use Fuzzy logic via Computing with Words and Evidence Theory to model vagueness, fuzziness, and imprecision of benefit and intangible benefits. We also present an analytical framework of belief/perceptions and the concept of stratification(CST) to help define the inputs and fuzzy rules for project benefits leading to benefit realization in PPP.
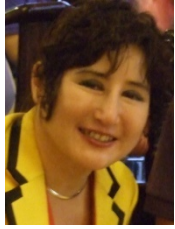
Professor Elizabeth Chang
PhD, MSc, BSc, FIEEE

Professor of Logistics and IT
University of New South Wales at Australian Defence Force Academy (UNSW@ADFA).

Professor Elizabeth Chang has been a Professor of Logistics and IT at the UNSW at Australian Defence Force Academy since 2013 and has led the Defence *Logistics Innovation and Information Dominance Research* Group for the last 8 years. Prof. Chang completed her BSc, MSc and PhD in Computer Science and Software Engineering in the 1990s. Her key R&D strengths are in big data, complex system development including key elements of human-system engineering, trust, security, and risk management. Recent work includes Enterprise Blockchain and AI which are funded by the Department of Defence (DoD). In the 2012 edition of MIS Quarterly vol. 36(4) Special Issue on Business Research, Professor Chang was listed fifth in the world for researchers in Business Intelligence.

She has obtained 30+ Competitive Research Grants including 10 Defence Research Contract and 12 Australian Research Council (ARC) grants worth over $20 million. Recently, she led the team that obtained #1 place in Defence Innovation Competition Award organized by the Department of Defence. Prof. Chang has supervised to completion 54 PhD students. She received the 2020 Research Supervisor Award at UNSW. She has delivered 60+ Keynote/Plenary speeches largely at major Conferences both within Australia and internationally. She has published 8 authored books, 600+ international journal papers and refereed conference papers with an H-Index of 58 (Google Scholar) and over 17,000 citations.

New Approach to Analysis of Categorical Data in Social Sciences and Business Analytics: Explainable Similarity Correlation of Categorical Data and Bar Charts

Imre Rudas and Ildar Batyrshin

Abstract. Social and behavioral sciences, business analytics, computational linguistics, machine learning, and pattern recognition widely use categorical data. Such data are often characterized by distributions of counts or frequencies of appearance of variable measurements in different categories or classes. An analysis of possible relationships between such categorical data distributions is essential for many applications. For example, one can compare the distributions of votes for several political parties in two states or regions, the distributions of gender preferences for social or professional activity, distributions of preferences for two types of customers, distributions of sales of car models in two countries, etc. Usually, such distributions are presented by contingency tables or bar charts. Descriptive statistics uses bar charts for visual comparison and analysis of distributions. Statistics has several measures for analyzing the possible association between categorical variables. In our work, we propose the method of calculating the correlation between categorical data and bar charts. The proposed approach is based on recently developed methods of construction of correlation functions from fuzzy similarity and dissimilarity functions. We propose a new approach to the presentation of bar charts visually explaining the detected correlation between them. We hope that the proposed methods of analysis of relationships between categorical data will find wide applications in business analytics and other areas where categorical data appear.

Imre J. Rudas graduated in Budapest in 1971 in Mechanical Engineering, received the Master Degree in Mathematics from the Eötvös Loránd University, Budapest, the Ph.D. in Robotics from the Hungarian Academy of Sciences in 1987, while the Doctor of Science degree from the Hungarian Academy of Sciences in 2004.

He is Rudolf Kalman Distinguished Professor, Rector Emeritus and Professor Emeritus of Óbuda University.

He is a Life Fellow of IEEE and the President of the IEEE Systems, Man, and Cybernetics Society 2020-2021. He is the Senior Past Chair of IEEE Hungary Section. He serves as an editor of some scientific journals, and runs several annual IEEE conferences.

He received many awards, among others the Denes Gábor award in 2006, John von Neumann Award in 2006, Hungarian Order of Merit in 2009 and Pro Óbuda award in 2014. He received Doctor Honoris Causa degree from the Technical University of Košice, Slovakia, from "Polytechnica" University of Timisoara, Romania, from Óbuda University, and from Slovak University of Technology in Bratislava. He was awarded by the Honorary Professor title in 2013 and Ambassador Title by Wroclaw University of Science and Technology.

His present areas of research activities are Computational Cybernetics, Fuzzy Control and Fuzzy Sets, Robotics, Cyber Physical Systems of Systems. He has edited and/or published 22 three books, published more than 850 papers in international scientific journal, conference proceedings and book chapters, and received more than 6000 citations

IDEAS OF LOTFI A. ZADE IN EXPLAINABLE ARTIFICIAL INTELLIGENCE

ALEXEY AVERKIN

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Abstract. This year marks the 100th anniversary of the birth of the great scientist of our time, the founder of several major scientific trends in applied mathematics, automatic control theory, computer science and artificial intelligence, Professor Lotfi Zadeh. He belonged to the cohort of very few pioneering scientists who generate new, original scientific ideas and form the basic scientific paradigms that change our world. Professor L. Zadeh was the founder of the theory of fuzzy sets and linguistic variables, the "father" of fuzzy logic and approximate reasoning, the author of the theory of possibility and general theory of uncertainty, the creator of Z-numbers theory and generalized restrictions, the ancestor of granular and soft computing. His ideas and theories not only opened a new epoch in the development of scientific thought, free from the limitations of narrow scientific directions and contributing to their synergy. They made a significant contribution to the development of new information and cognitive technologies, led to the creation of effective industrial technologies, such as fuzzy computers and processors, fuzzy regulators, fuzzy clustering and recognition systems, and many others. Professor L. Zadeh has been deservedly included in the IEEE Computer Society's gallery of fame scientists who have made pioneering contributions to the field of artificial intelligence and intelligent systems.

Soviet scientists were among the first to support the new direction. Speaking at the ICSCCW-2001 conference in June 2001, L. Zadeh stressed that his first paper on fuzzy sets took place in 1965 at a conference on cybernetics held in the USSR aboard the liner «Admiral Nakhimov».

The role of L. Zadeh in AI is also hard to overestimate, and I would especially like to focus on the concept of soft computing, originally combining hybrid models based on fuzzy sets, neural

networks, and soft computing. The emergent properties of these models were one of the foundations of the current hype in artificial intelligence and machine learning.

The study of fuzzy logic culminated in the late 20th century and has since begun to slow down a bit. This slowdown may be due in part to the temporary absence of fuzzy math results in machine learning. Current research will pave the way for fuzzy logic researchers to develop AI applications and solve complex problems that are also of interest to the machine learning community. Experience and expertise in fuzzy logic is well suited to model ambiguities in big data, model uncertainty in knowledge representation, and provide transfer learning with noninductive inference.

This talk will examine fuzzy models to improve the effectiveness of XAI systems in explaining their decisions and actions to the user, through fuzzy models. and to establish a concrete and fundamental connection between two important fields in artificial intelligence i.e., symbolic systems and connectionist systems, more specifically, between deep learning and fuzzy logic. Several authors show how deep learning could benefit from the comparative research by re-examining many heuristics in the lens of fuzzy logic.

Very effective is also, the use of fuzzy layers in deep learning networks. The most interesting from the point of view of this research is the extraction of rules using neuro-fuzzy models. Systems based on fuzzy rules, developed using fuzzy logic, have become a field of active research in the last few years. These algorithms have proven their strengths in tasks such as managing complex systems, creating fuzzy controls. The relationship between production rules and neural networks of both worlds has been thoroughly studied and shown to be equivalent. This means that we can translate the knowledge embedded in the neural network into a more cognitively acceptable language - fuzzy rules. In other words, we get a semantic interpretation of neural networks.

As part of this ideology, the Russian Association of Artificial Intelligence is currently actively developing fuzzy situational management of complex systems based on their composite hybrid modelling, which uses the capabilities of analytical, neural network and fuzzy approaches to construct composite hybrid models.

Alexey Nikolaevich Averkin (born January 9, 1949) - the leading research associate of the A.A. Dorodnitsyn Computer Center of the Federal Research Center "Informatics and Control" of RAS under Academician I.A. Sokolov, associate professor, candidate of physical and mathematical sciences, the head of the Center for Artificial Intelligence of Dubna University, the leading research associate of the Laboratory of Artificial Intelligence, Neural Technologies and Business Analytics of G.V. Plekhanov Russian University of Economics. Since 1992 he is the member of the Council of Russian Association of Artificial Intelligence; from 1996 to 2006 - president of Russian Fuzzy Systems Association; from 2006 - vice-president of Russian Fuzzy Systems and Soft Computing Association; from 1993 - correspondent member of International Academy of Informatization in the department of Artificial Intelligence. Participated in organization of more than 50 Russian and 20 foreign conferences as a program committee member. Member of editorial boards of international journals. Scientific editor of collective and translated monographs.

In 1971, he graduated from the Faculty of Mechanics and Mathematics, Lomonosov Moscow State University. In 1983 he graduated from the University of Moscow Linguistic University, Faculty for Advanced Training of Chartered Specialists. Completed postgraduate studies at the Dorodnitsyn Computer Center of the Russian Academy of Sciences under the guidance of Professor D.A. Pospelov. In 1985 he defended PhD thesis "Fuzzy Relationship Modeling in Artificial Intelligence Systems".

A. N. Averkin developed the basic principles of the new integrated direction of soft measurements, which unites the general questions of theory and practical applications of soft computing and smart measurements under considerable uncertainty of information on the complex man-made and natural systems. He is one of the founders and permanent deputy chairman of the program committee of Soft Computing and Measurement conference, which is held annually since 1998 in St. Petersburg at the Leningrad Electrotechnical Institute.

For 30 years he has been teaching courses and seminars on artificial intelligence, intelligent information systems, decision making, knowledge management, business analytics, data mining, cognitive economics, neural networks, fuzzy sets, soft computing and project management at Moscow State University, Moscow Engineering Physics Institute, Moscow Power Engineering Institute, Moscow State Technical University, Russian Academy of Economics, Moscow Power Engineering Academy and Dubna University. He has supervised 6 Ph. D. theses on Artificial Intelligence and Decision Making Theory and more than 60 master's, thesis and bachelor's theses. From 2006 to 2010 he was the chairman of the SAC at Belgorod State University. He has lectured many times at Russian and international schools on Artificial Intelligence. He has supervised and participated in dozens of research and development projects by request of the Applied Problems Section of the Russian Academy of Sciences, the Ministry of Industry and Energy of Russia, the Ministry of Defense, in Russian projects by grants of the Russian Foundation for Basic Research and the Ministry of Education and Science, as well as in international projects ESPRIT, ERUDIT, EUNITE, ISTC).

TOWARDS A CYBER SECURE GLOBAL VILLAGE

Praveen Kumar Khosla, Prabhjot Kaur, Rishamjit Kaur, Kashish Chachra

Abstract. The Covid 19 pandemic has led to loss of lives, as well as, loss of livelihoods. In this scenario, where the situation demands people to be physically distant, it is the might of IT that has brought people and the world closer. The intervention of IT has allowed us to address and mitigate multiple challenges posed by the pandemic to a large extent, if not completely.

The perils of Cyber Threats have coexisted with the progress of Cyber Space since the very beginning. However, with increasing reliance on the internet, this ever looming threat to Cyber Security has been put into the spotlight. The Global Risks Report 2021 of the World Economic Forum cites Cyber Security as one of the top four domains of concern.

We are all familiar with the adage that the "Internet has converted this world into a Global Village." This notion, although fairly accurate, is fanciful and romantic at the same time. There are many deterrents that come in the way of making this Globe into a robust and secure Digital Community. With close to two hundred countries in the world, being on the same page and formulating a inter-nation policy framework for Cybersecurity becomes a formidable challenge. All the dimensions of Cybersecurity such as Awareness, Policies, **Interoperability**, Technologies for Incident Detection, **Sharing** Threat Intel, Trained Workforce, and Automated Response Technologies need to be addressed.

This paper enumerates the challenges and also the measures that shall be undertaken in order to allay the aforementioned challenges. It discusses and explains, among other things, the need to:

- Ensure that all internet traffic goes through gateways/routers;
- Deploy large scale honeynets;
- Process the colossal amount of logs by leveraging machine learning;
- Introduce Open APIs, Taxi servers and clients as the drivers of interoperability.;
- Share cyber information from disparate sources of threat intelligence for creation of situational awareness framework.

Achieving absolute harmony in these spheres may be a utopian dream but still, all the countries and stakeholders must pursue to formulate a common, basic, and a collective Cybersecurity architecture. The paper goes on to suggest measures which can be taken as a step towards this direction.

Khosla is a topper in M.Tech. of National Institute of Technology, Kurukshetra, Inida and a PhD from Thapar University in domain of Electronics & Communication Engineering.

He started his career as Scientist B in prestigious Defence Research and Development Organisation (DRDO), India. There, he founded the much sought after '*Embedded Systems* division 'in the Terminal Ballistics Research Laboratory, and headed it for 5 ½ years.

The embedded products developed by him and his team have been successfully inducted into on-board systems. His contributions, in the fields of science and technology have been acknowledged widely and thus, he has received several awards of eminence,

- He was bestowed The National Technology Day Award, 2012.
- He received the Coveted Scientist of the year award - 2015 from the Honorable Minister of Defence and the Minister of Finance, Govt of India.
- He is also the recipient of 'Engineer of the year award' – 2017, accorded by the Chandigarh University, India.
- He received 'Digital India Award' – 2020 in the category 'Innovation in Pandemic' from the Honourable President of India.

Up until 2018 he bequeathed his services to DRDO, as Scientist G.

His determined and relentless efforts have enabled scientists to identify the previously unforeseen and latent issues in the defence systems.

On 18th Dec, 2018, he took over the command of Centre for Development of Advanced Computing (C-DAC), Mohali, India as its Executive Director.

Dr Khosla's experience and credentials have held high utility in this organisation. Here he heads multiple teams, working in areas of Cyber Security, Healthcare technologies, eGovernance, Artificial Intelligence, Super computing, AR/VR and Agri-Electronics.

Additionally, he is spearheading the Cybersecurity initiatives of all C-DAC Centres as Chief Information Security Officer (CISO). He led the initiatives to launch the widely acclaimed mass impact eSanjeevani-the National Teleconsultation Service which has carried out over 20 million consultations as of Dec, 2021, Cyber Threat Management System and Emergency Response Support System (Dial 112) and the like. At C-DAC, he also started new M Tech courses in Artificial Intelligence and Cyber Security.

He has authored one book, several book chapters, and numerous national and international papers. Apart from his usual work, he likes to occupy himself by regularly guiding and mentoring PhD and MTech students.

Spatiotemporal Activities in Brain on Recognizing Ambiguous Figures

Takahiro YAMNOI, Tomoko YONEMURA, Hisashi TOYOSHIMA, Mika OTSUKI, Yahachiro TSUKAMOTO, and Michio SUGENO

Abstract: To treat higher order brain dysfunction, it is necessary to identify the location of each function. In Japan, a super aging society is progressing, and many dysfunctions such as cerebral infarction have occurred. The fMRI analysis is not enough to identify the position of dysfunction in detail. The authors had tried to elucidate higher order brain functions. In the paper, the authors have measured electroencephalograms (EEGs) from subjects (MK and RE) who were observing four images of ambiguous monochrome line pictures. The equivalent current dipole source localization (ECDL) method has been applied to those Event Related Potentials (ERPs): averaged EEGs by each figures and trials. The paper reports the comparison results of "Saxophone player and Girl's face." In the case of the Saxophone player, the process was done over a latency from 400ms to 1000ms, however for the Girl's face image, the corresponding process was completed relatively quickly and ended the latency around 800ms. Especially in the case of Girl's face, ECDs were localized to the right and the left angular gyrus (AnG) around 370ms and to the right post central gyrus (PstCG) around 415ms, then by way of language areas, ECDs were localized again to the right and the left AnG around 520ms. It has been clarified in our previous study that activities on the angular gyrus (AnG) are important to discriminate the unusual shape of presented images. This fact is confirmed also in this work.

Takahiro Yamanoi is an Invited Professor of Graduated School of Health Sciences of Hokkaido University. He received an Emeritus Professor of Hokkai-Gakuen University in April 2020 after his retirement of Hokkai-Gakuen University. He received his Ph. D. from Hokkaido University. His main works are Biomedical Engineering, i. e. researches on spatiotemporal activities in the human brain and the brain computer interface. After graduated from the doctoral course of Graduate School of Engineering of Hokkaido University, he was a research assistant of the Faculty of Engineering of Hokkaido University from 1979 to 1987. During the period, he was a visiting researcher of Laboratory GRAI (LAP at present), Bordeaux University I, France, in 1984- 1985. Then he became an assistant professor of Faculty of Engineering of Hokkai-Gakuen University from 1988 to 1990, and a professor from 1990 to 2020. During the period, he was a visiting professor, MIF, Faculty of Medicine, Aix-Marseille University II, France, in 1999-2000. He had researched in collaboration with the late Prof. Elie Sanchez there. He was appointed as a director of Admissions Office of Hokkai-Gakuen University in 2002-2006, and the dean ofFaculty of Engineering of Hokkai-Gakuen University in 2009-2012. He is a founder of Department of Electronics and Information Engineering, Graduate School of Engineering, and Department of Life Science and Technology of Hokkai-Gakuen University, Main Awards, 2004- Contribution Award from Japan Society for Fuzzy Theory and Intelligent Informatics, 2016- Contribution Award from Japan Society for Fuzzy Theory and Intelligent Informatics, 2016- Contribution Award from International Symposium on Advanced Intelligent Systems in Korea, 2017- Achievement Award from Japan Society for Fuzzy Theory and Intelligent Informatics.

KOLMOGOROV STORİES

Asaf Hajiyev

Institute of Control Systems,
Azerbaijan National Academy of Sciences

Abstract. A.N.Kolmogorov was the great mathematician who created axioms of theory of probability, has made an important contribution to the theory of turbulency, theory of functions, solved 13-th Hilbert's problem.

The Fuzzy theory created by Loutfi Zadeh can be considered as a continuation of probability theory, because it allows to solve some problems where probability theory does not work.

A.N.Kolmogorov was creater and first head of the department of Theory of Probability, Mathematical Logic, Mathematical Statistics and others. Author has spent more than 15 years (student, PhD student, Postdoc research) in the Interfaculty Laboratory of Statistical Methods created and led by A.N.Kolmogorov in the Lomonosov Moscow State university.

In the talk the interesting stories happened with Kolmogorov and scholars around him will be presented.

Born: 29 May 1951
Political experience
2015 – 2019   Secretary General of the Parliamentary Assembly of the Black Sea Economic Cooperation (PABSEC)
1996 – 2015   Member of Azerbaijani Parliament (Milli Majlis)
2002 – 2015   Head of Delegation of the Milli Majlis to the PABSEC
2006 -2008; 2011 – 2013   Vice-President of the PABSEC
Education and Scientific Degrees
2014   Academician - (full member of Azerbaijan National Academy of Sciences)
2001   Professor
1992   Doctor of Sciences in Mathematics, Bauman Moscow State Technical University
1979   PhD in Mathematics, Lomonosov Moscow State University
1973   BA in Mathematics, Lomonosov Moscow State University
Honorary Titles
Fellow of the World Academy of Sciences (TWAS, Italy)
Honorary Academician of Moldova Academy of Sciences
Honorary Academician of Mongolian National Academy of Sciences
Honorary Professor of Sichuan University in Chengdu (China)
Founder and member of the First International Advisory Board of Sichuan University
Author of more than 150 papers and books, published in world leading scientific journals
Editors of 12 books published by Springer

Visiting Professor
USA - Berkeley University, University of Southern California, Lincoln University, George Washington University
Germany - Humboldt University, Munich University, Free University in Berlin, Fern University in Hagen
Sweden - Royal Institute of Technology, Stockholm University, Chalmers University, Umea University
China - Sichuan University in Chengdu, Hong-Kong City University
Portugal - Lisbon University
Turkey - Bogazici University, Middle East Technical University, Anatolian University
Singapore - National University of Singapore
Foreign Languages:
English, Russian, Turkish - fluently

AI, Deep Learning and Deep Fuzzy Network

Dr. Nishchal Kumar Verma

Abstract: We are living in an era where Artificial Intelligence (AI) has started to scratch the surface of its true potential. Not only does AI create the possibility of disrupting industries and transforming the workplace, but it can also address some of society's biggest challenges. In many contexts, notions of AI, machine learning, and deep learning are used interchangeably, but machine learning and deep learning are a subset of AI. AI is the branch of computer science focused on building machines capable of intelligent behaviour, while machine learning and deep learning are the practice of algorithms, where a machine can learn by experience and make predictions or take autonomous actions without any human involvement. Therefore, instead of programming specific constraints for an algorithm to follow, the algorithm is trained using a large amount of data to give it the ability to learn, reason, and perform a specific task independently. Even with the advances and success of deep learning algorithms in various applications like speech recognition, image classification, handwriting recognition, fraud detection, etc., the deep learning model has still some limitations. As the number of hidden layers and nodes increases, the number of parameters also increases, which in turn increases the computational complexity of the model. Along with that, a large amount of labeled training data is required for training the deep network from scratch. In addition, parameter optimization and hyperparameter tuning greatly affect the performance of deep networks. However, in the era of big data, a large chunk of data available from various sources generates data that can be used to train the deep models easily. Also, to deal with computational complexity, graphical processing units have garnered popularity in the deep learning community for their ability to handle a high degree of parallel operations and efficiently perform matrix multiplications. Machine learning algorithms based on different architectures built using artificial neurons have become state-of-the-art algorithms. Of them, multi-layered feed-forward Artificial Neural Networks (ANN) have been the most successful. Typically, the data used for machine learning algorithms can be categorized in (a) Numerical and (b) Linguistic forms. However, both have certain limitations. Extracting relevant information using only the numerical data is not sufficient because the dataset may have some missing points which may not be able to provide accurate information about the system. On the other hand, relying only on linguistic data, derived from human supervisory operators, is useless for training various algorithms because human experts

aren't always able to describe the complete relevant information of a system. Fuzzy sets and Fuzzy Inference Systems (FIS) prove to be capable of incorporating both the above forms of data in the underlying system. Even in the absence of sufficient learning examples, fuzzy set-based systems can be trained using linguistic data. Both ANNs and FISs are used to mimic a system whose model is unknown since both have the universal function approximation capability. Due to advancements in fuzzy logic and systems in the past decades, handling such complex data has become easy. In effect, the addition of fuzziness into the model of a neuron makes it better to adapt the behaviour of underlying systems that are imprecisely defined through their high degree of complexity. The linguistic and numeric forms of data can be handled together by a Deep Fuzzy Network (DFN). There is a wide scope to develop very effective machine learning architectures based on DFNs with high abstraction quality, high robustness towards uncertainty due to vagueness, ambiguity, and imprecision as well as uncertainty due to randomness and intuitively intelligible to human beings in terms of design and working. DFN allows machines to solve complex problems even when using a dataset that is very diverse, unstructured, and inter-connected. The deeper learning algorithms learn, the better they perform.

Dr. Nishchal K Verma is a Professor in the Department of Electrical Engineering at the Indian Institute of Technology Kanpur, India. He obtained his Ph.D. in Electrical Engineering from the Indian Institute of Technology Delhi, India. He is an awardee of Devendra Shukla Young Faculty Research Fellowship by Indian Institute of Technology Kanpur, India, for 2013-16.

Dr. Verma's research expertise falls under Artificial Intelligence (AI) related theories and its practical applications to many inter-disciplinary domains but not limited to machine learning, deep learning, computer vision, prognosis and health management, bioinformatics, cyber-physical systems, complex and highly non-linear systems modeling, clustering, and classifications, etc. He has published more than 250 research papers and 4 Books (edited/ co-authored) in the field of AI. He has completed 23 projects from various funding agencies such as The BOEING Company, USA, DST, DRDO, JCBCAT, MHRD, SERB, CSIR, IIT Kanpur, MCIT, SFTIG, VTOL, etc. He has 15+ years of experience in the field of AI. He has been serving as Associate Editor/ Editorial Board Member of various reputed journals and conferences, including IEEE Transactions on Artificial Intelligence, IEEE Transactions on Neural Networks and Learning Systems, IEEE Computational Intelligence Magazine, Editor, IEEE Access, and many more. He has also developed several AI-related key technologies for The BOEING Company, USA, and organized AI-related workshops, conferences, seminars, short-term courses, etc.

State-space based designing of control systems

Prof. Marius M. Balas

Aurel Vlaicu University of Arad, Romania

Abstract: Recently published research results show how sculpting the state space by fuzzy rule bases can outperform crisp systems. The presentation proposes a correlation of these results with the fuzzy-interpolative methodology, which is relying on the phase trajectory's analysis of the control error, in the frame of the state-space hypersurfaces. Fuzzy-interpolative controllers and adaptive correctors are designed on behalf of the state-space hypersurfaces' shapes, and their tuning is consisting in the appropriate modification of these surfaces. Case studies and applications are presented.

Dr. Marius M. Balas is currently a Full Professor in the Department of Automatics and Applied Software at the Faculty of Engineering, University "Aurel Vlaicu" Arad (Romania). He holds a Doctorate in Applied Electronics and Telecommunications from the Politehnica University of Timisoara. Dr. Balas is an IEEE Senior Member.

He is the author of 4 books, 12 book chapters, more than 100 papers (33 ISI/BDI papers, 40 papers in journals and conference proceedings, etc.) and 7 invention patents. His research interests are in Electronic Circuits, Modeling and Simulation, Adaptive Control, Intelligent and Fuzzy Systems, Soft Computing and Intelligent Transportation.

The main original concepts introduced by Prof. Marius M. Balas are: the fuzzy-interpolative systems, the passive greenhouse, the constant time to collision optimization of the traffic, the imposed distance braking, the internal model bronze casting, PWM inverter for railway coaches in tropical environments, the rejection of the switching controllers effect by phase trajectory analysis, the Fermat neuron, etc. He has been mentor for many student research teams and challenges, awarded by Microsoft Imagine Cup, GDF Suez, etc.

Prof. Marius M. Balas has participated in many international conferences as organizer, session chair and member in international program committees. He is editor-in chief, member of editorial board or reviewer for several international journals.

Venue