Programme

ICAFS 2025

17th International Conference on Theory and Application of Fuzzy Systems, Soft Computing and AI tools - ICAFS

https://icafs2025.az/

25-26 August, Iaşi, Romania

17th International Conference on Theory and Application of Fuzzy Systems, Soft Computing and AI tools

Dedicated to the memory of
Prof. L.A. Zadeh

PROGRAMME

Organized by:

Azerbaijan Association of "Zadeh's Legacy and Artificial Intelligence"
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SCHEDULE-AT-A-GLANCE

Time	Monday, August 25, 2025
08:00 – 08:40	**Breakfast**
08:40 – 09:20	**Registration**
09:20 – 09:50	**Opening Ceremony**
09:50 – 10:25	*Keynote Speech* **Chair: R. A. Aliev, Azerbaijan** **J. Kacprzyk:** Multistage Fuzzy Decision Making and Control with an Implicitly Specified Termination Time: New Perspectives and Challenges for the use of Z-Numbers
10:25 – 11:00	*Keynote Speech* **Chair: W. Pedrycz, Canada** **R. A. Aliev:** Approximate Reasoning under Bimodal Z-Information
11:00 – 11:20	**Tea/Coffee**
11:20 – 12:40 Room 1	*Session A* **Theory and Application of Soft Computing** **Chairman: L. A. Gardashova**
11:20 – 12:40 Room 2	*Session B* **Fuzzy Logic, Neuro-Fuzzy Technologies and Artificial Intelligence in Engineering** **Chairman: H. - N. L. Teodorescu**
12:40 – 14:00 Room 1	*Session C* **Decision theory with imperfect information** **Chairman: V. E. Balas**
12:40 – 14:00 Room 2	*Session D* **Fuzzy Logic, Neuro-Fuzzy Technologies and Artificial Intelligence in Social Sciences** **Chairman: V. Askarov**
14:00 – 15:00	**Lunch**
15:00 – 15:30	*Keynote Speech* **Chair: J. Kacprzyk, Poland** **W. Pedrycz:** Data – Knowledge Environment and Knowledge Landmarks in Machine Learning

15:30 – 16:00	*Keynote Speech* **Chair: R. Azizov, Azerbaijan** **Horia-Nicolai L. Teodorescu**: Approximation and Interpolation Theorems for Fuzzy Systems: Consequences and Applications
16:00 – 16:30	*Keynote Speech* **Chair: R. B. Eke, Turkey** **K. Abdulla:** Fuzzy Logic in Linguistics
16:30 – 16:40	**Tea/Coffee**
16:40 – 18:00 **Room 1**	*Session E* **Machine Learning, Deep Learning** **Chairman: J. Mammadov**
16:40 – 18:00 **Room 2**	*Session F* **Fuzzy Logic, Neuro-Fuzzy Technologies and Artificial Intelligence in Business, Economics, Finance** **Chairman: F. Adilov**
09:00-18:00	**Flexible Session**
18:00	**Welcome reception**
Time	**Tuesday, August 26, 2025**
08:00 – 09:30	**Breakfast**
09:30 – 10:10	*Keynote Speech* **Chair: L.-G. Maha, Romania** **R. A. Aliev, R. Abiyev:** Type-3 Fuzzy Systems and Their Applications
10:10-10:50	*Keynote Speech* **Chair: A. Iftene, Romania** **R. B. Eke:** System, Language, Fuzzy Logic
10:50 – 11:10	**Tea/Coffee**
11:10 - 13:00	*Session G* **Theory and application of Soft Computing** **Chairman: A. Nuriyev**
13:00 – 14:00	**Lunch**
14:00-14:40	*Keynote Speech* **Chair: G. Imanov, Azerbaijan** **T. Allahviranloo:** Uncertain Dynamic Systems: A Look at Multiple Sclerosis

14:40-15:20	*Keynote Speech* **Chair: R. Abiyev, North Cyprus** **A. Mohammadzadeh:** Application of AI in Automation and Control Systems: Fourier-Based Type-2 Fuzzy Neural Networks
15:20 - 16:30	*Session H* **Artificial intelligence methods** **Chairman: N. Adilova**
16:30 – 17:00	**Round Table**
17:30	**Closing Ceremony**
09:00 – 18:00	**Flexible Session**

Welcome

I would like to convey my greetings to all the participants of ICAFS-2025. As you know, this is a long-life conference. The first conference was held in 1994. The father of fuzzy logic, the Honorary Chair of ICAFS, Prof. L.A. Zadeh participated in almost all the conferences held in different countries of the world. Unfortunately, about 8 years ago, in the beginning of September 2017, we have lost a genius scientist, Prof. L.A. Zadeh. Let us rise and observe a minute of silence in memory of Prof. L.A. Zadeh.

Currently, the significant increase can be noticed in number of consumer products, industrial systems, multimedia systems etc. with high level of MIQ based on Fuzzy Logic. Fuzzy Logic is widely used in practice with hybrid intelligent systems. Recently, Fuzzy Set and Fuzzy Logic theory and technology are extensively used in the realm of decision analysis. We are proud to have the honor of presenting this conference for the 17th time. As a result, we hope to be able to promote further research in the above-mentioned fields. Furthermore, this conference is to give students the opportunity to become familiar with these subject matters.

We would like to thank everybody who participated in the preparation and presentation of this conference. I hope that this conference will be fruitful and will give chance and opportunities for exchange of experience.

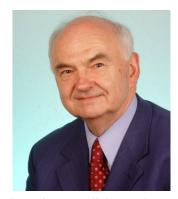*The Chairman of ICAFS-2025*
Prof. R.A. Aliev

Plenary Session Papers Abstracts

Multistage Fuzzy Decision Making and Control with an Implicitly Specified Termination Time: New Perspectives and Challenges for the use of Z-Numbers

Janusz Kacprzyk

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Janusz Kacprzyk is a 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.

Abstract
The classic Bellman and Zadeh's (1970) problem of multistage decision making and control under fuzzy constraints on inputs (decisions or controls) and fuzzy goals on the outputs (states, for simplicity) is considered (cf. Kacprzyk, 1997, for a full account of all problems and approaches). The termination time is assumed to be finite and implicitly specified by the moment when the state enters for the first time a specified set of termination states. The system under control is deterministic, for simplicity. To account for a partial reliability, the fuzzy constraints and goals are represented by Z- number defined in finite states, and the system under control is represented by a Z-relation. We show how the Z-number based basic approach with a fixed and specified termination time by Aliev, Pedrycz, Guirimov, Huseynov and Aliyev (2024) can be extended to the impicit termination time. We briefly consider the main approaches to solving the problem: the classic, functional equation based approach by Bellman and Zadeh, the graph theoretic approach by Komolov et al., and the branch-and- bound approach by Kacprzyk - cf. Kacprzyk (1997) for details. We comment upon main challenges and difficulties implied by the use of the Z-numbers in these different approaches which are mainly related to difficulties in the formulation and solution of respective functional equations. Some examples are mentioned.

Approximate Reasoning under Bimodal Z-Information

Rafik Aliev

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Rafik A. Aliev received the Ph.D. and Doctorate degrees from the Institute of Control Problems, Moscow, Russia, in 1967 and 1975, respectively. His major fields of study are decision theory with imperfect information, fuzzy logic, soft computing and control theory. He is a Professor and the Head of the Department of the joint MBA Program between the Georgia State University (Atlanta, GA, USA) and the Azerbaijan State Oil and Industry University. His current research is focused on generalized theory of stability, recurrent fuzzy neural networks, fuzzy type-2 systems, evolutionary computation, decision theory with imperfect information, calculus with Z-numbers, and fuzzy economics. He has over 350 scientific publications including 55 books, 15 editor volumes and more than 280 research papers. Dr. Aliev is a regular Chairman of the International Conferences on Applications of Fuzzy Systems and Soft Computing and International Conferences on Soft Computing and Computing with Words. He is an Editor of the Journal of Advanced Computational Intelligence and Intelligent Informatics (Japan), associate editor of the Information Sciences journal, a member of Editorial Boards of International Journal of Information Technology and Decision Making, International Journal of Web-based Communities (The Netherlands), Iranian Journal of Fuzzy Systems (Iran), International Journal of Advances in Fuzzy Mathematics (Italy), and International Journal "Intelligent Automation and Soft Computing." He is series editor of "Advances in Uncertain Computation", "World Scientific". He was awarded USSR State Prize in field of science (1983), USA Fulbright Award (1997), and Lifetime Achievement Award in Science (2014). He was a supervisor of more than 150 PhD Students and over 30 Doctorates.

Abstract

In decision analysis, control systems, prediction problems and other related areas the great attention is paid to the development of approximate reasoning using fuzzy conditional inference rules. It is related with logical inference in which the preconditions and conclusions contain fuzzy concepts. Unfortunately, these approaches did not take into account reliability of existing information. As a formal construct to deal with bimodal information, a Z-number concept was introduced by Zadeh. To the best of our knowledge there is no study on Z-number valued conditional inference rules. In this study we formulate some inference rules in which the logical preconditions and consequences are conditional propositions including fuzzy Z-extension concepts. To do this it is needed to formulate Z- valued implications here we suggest different types of fuzzy Z-implications.

The following Z-conditional inference is considered:

Proposition 1: IF x is $Z_1(A_1, B_1)$ THEN y is $Z_2(A_2, B_2)$

Proposition 2: x is $Z_1'(A_1', B_1')$

Conclusion is $Z_2'(A_2, B_2')$. Here Z_1, Z_1' and Z_2, Z_2' are fuzzy Z-concepts, represented as Z-sets. The logical consequence Z_2' is derived by using different type of Z-set composition operators. The obtained theoretical results are tested using control system for chemical reactor described by Z-number valued IF-THEN rules.

Data – Knowledge Environment and Knowledge Landmarks in Machine Learning

Witold Pedrycz

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Witold Pedrycz is a 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. He also holds an appointment of special professorship in the School of Computer Science, University of Nottingham, UK. In 2009 Dr. Pedrycz was elected a foreign member of the Polish Academy of Sciences. In 2012 he was elected a Fellow of the Royal Society of Canada. Witold Pedrycz has been a member of numerous program committees of IEEE conferences in the area of fuzzy sets and neurocomputing. 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 2008. 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". In 2013 has was awarded a Killam Prize. In the same year he received a Fuzzy Pioneer Award 2013 from the IEEE Computational Intelligence Society. His 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, data mining, and Software Engineering. Dr. Pedrycz is intensively involved in editorial activities. He is an Editor-in-Chief of Information Sciences and Editor-in-Chief of WIREs Data Mining and Knowledge Discovery (Wiley). He currently serves as an Associate Editor of IEEE Transactions on Fuzzy Systems and is a member of a number of editorial boards of other international journals

Abstract

The unpreceded progress in Machine Learning (ML) can be attributed to an efficient use of masses of data as being recently exemplified through numerous constructs of LLMs and foundation models. It becomes intriguing, though, that while exhibiting a heavy reliance on data, a role of knowledge in ML has not been clearly considered. In this talk, we advocate an ultimate importance of synthesizing a unified design knowledge-data (KD) of Machine Learning or KD-ML, for brief. As a new paradigm, KD-ML focuses on a prudent and orchestrated engagement of data and knowledge in the design practices in the area. The fundamentals of the KD environment are formulated along with a historical perspective and the key highlights are identified. The issues of origin of problem-oriented knowledge, taxonomy of knowledge and the and its main features are discussed. Data and knowledge arise at very different levels of abstraction with knowledge being formalized and represented at symbolic level. This constitutes a genuine challenge as data are predominantly numeric. We stress that in the development of a cohesive and unified framework of coping with data and knowledge in learning processes, one needs to reconcile highly distinct levels of abstraction (numeric-qualitative) and with this regard information granules play a pivotal role. We offer a taxonomy of knowledge by distinguishing between scientific and common-sense knowledge and elaborate on a spectrum of ensuing knowledge representation scheme. In the sequel, the main categories of knowledge-oriented ML design are discussed including physics-informed ML (with the reliance of scientific knowledge),

an augmentation of data driven models through knowledge-oriented constraints (regularization), a development of granular expansion of the data-driven model and ways of building ML models in the presence of knowledge conveyed by rules. When analyzing the proposed categories, it is also clearly explained how the new ML environment helps avoid a detrimental effect of data blinding. Selected schemes of the KD unified environment and ensuing learning schemes are discussed including a study on LLM-based knowledge acquisition.

Fuzzy Logic in Linguistics

Kamal Abdulla

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Kamal Abdullayev (PhD 1977, Doctor of Sciences 1984) is Rector and Professor at Azerbaijan University of Languages, Baku, Azerbaijan. He is also a full member of Azerbaijan National Academy of Sciences. The study of syntax and text has always been in focus since early years of his academic career as a linguist. Later mythology and epic texts in particular "The Book of Dede Korkut" from the perspectives of linguistics, semiotics and literary theory have become a significant part of his research agenda. His more recent research interests deal with the role of fuzzy logic in humanities, especially in literature and in linguistics. His numerous monographs, textbooks and scholarly articles on various theoretical and applied aspects of these issues have been published in Azerbaijan and abroad including Turkey, Russia and Germany. Kamal Abdulla is also a prominent Azerbaijani writer. He is a Popular Writer of Azerbaijan. Kamal Abdulla`s novels have been published in many languages worldwide.

Abstract

In this study we analyze what do we gain from searching for the manifestation of fuzzy thinking and fuzzy logic in the language-speech level? First of all, we can say that during this search, the relationships and essences hidden in the deep levels (potential) of language-speech activity dazzle with their richness. The rich potential of language-speech activity once again gains the opportunity to be re- examined. New perspectives emerge. The relationships between language-speech units shine in a new light. Additionally, the hidden synergistic relationships within each of these units allow for the discovery of new perspectives. We apply fuzzy logic principles to investigate different levels of language, namely phonology, morphology, lexical and sentence levels.

Approximation and Interpolation Theorems for Fuzzy Systems: Consequences and Applications

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Dept. ETTI, Technical University "Gheorghe Asachi" of Iasi, Iasi, Romania, Dept. Computer Science, "Al.I. Cuza" University of Iasi, Romania, and Romanian Academy. His publications cover topics in artificial intelligence, applied mathematics, stochastic processes, nonlinear dynamics, communications, control, electronics and applied physics, including fuzzy and neuro-fuzzy systems, cellular automata, speech technology, artificial intelligence applications, circuit performance, communication nodes, control loop, dielectric constant, electromagnetic interference, form of equation, internet of things applications, stochastic partial differential equations, access control, acoustic waves, actuators, sensors, communication paths, communication protocol, control applications, critical applications, data packets, electromagnetic compatibility, electromagnetic field, electronic circuits, emotional prosody, and medical applications. Horia-Nicolai L. Teodorescu has served as a Vice-Rector (International) of "Gheorghe Asachi" Technical University of Iasi, and as Director of the Institute of Computer Science of the Romanian Academy, Iasi. He has been an invited Professor at Kyushu Institute of Technology in Japan, the Swiss Federal Institute of Technology in Lausanne, and Leon University in Spain and, for four years, a Visiting Professor at the University of South Florida, Tampa. He has (co)authored or (co)edited more than 20 books published by Springer, CRC Press, Kluwer, and other publishers, as well as more than 300 journal and conference papers. He is an inventor or co-inventor for about 30 patents in the U.S., European Union, Japan, and Romania. He has served as an invited/guest (co)editor to several journal special issues. Dr. Teodorescu is a full member (fellow) of the Romanian Academy and held the honorary position of Vice-Chair of the Science for Peace and Security–Information Technology (SPS-IT) North Atlantic Treaty Organization panel. He has served as the Chairman of several international conference committees and as a member of scientific committees for more than 40 international conferences, several of them organized or supported by IEEE. He served as the Co-chair of several IEEE Symposia and conferences organized in Romania. He has served as an invited speaker at about 20 international conferences and symposia. He received two honorary doctorates (honoris causa).

Abstract

Similar to neural networks (NN), fuzzy logic systems (FLSs) with center of gravity (c.o.g.) defuzzifier are universal approximators. Even more, FLSs with a c.o.g. defuzzifier are interpolators for well-behaved functions. These general properties have wide applicability in engineering, decision making, and economics. In many cases, the type of fuzzy logic used in the FLS does not play an important role in the universal approximation or interpolation properties, thus leaving much space for the FLSs optimization. The lecture will review key results about approximation and interpolation with FLSs and will discuss various applications.

Type-3 Fuzzy Systems and Their Applications
Rafik Aliev, Rahib Abiyev

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Rahib H. Abiyev is a Professor in the Department of Computer Engineering, at Near East University, North Cyprus. In 2001, he founded Applied Artificial Intelligence Research Centre and in 2008, he created "Robotics" research group in Near East University. He is currently chair of Applied Artificial Intelligence Institute and chair of Computer Engineering Department. His current research interests include computational intelligence, fuzzy systems, control systems, and signal processing. He has published set of research papers in related subjects. R.H.Abiyev is listed in the "World's 2% Top Scientists" in the field of Artificial Intelligence for 2022, 2023, 2024 and 2025, published by Elsevier BV & Stanford University.

Abstract

In the real world, many complex dynamic processes are characterized by uncertainty. Addressing the complexity of these processes and accurately modeling uncertainties is a major challenge. Traditional type-1 fuzzy systems, which rely on crisp membership functions, are often inadequate for fully capturing the uncertainty involved. To overcome these limitations, type-2 and type-n fuzzy sets were introduced, in which the membership grades themselves are fuzzy, allowing for a more detailed representation of uncertainty. However, even type-2 fuzzy systems may be insufficient for modeling the intricate uncertainties found in many real-world scenarios. This has led to the development of type- 3 fuzzy systems, which future extend the capabilities of fuzzy modeling. Type-3 fuzzy systems are particularly effective in handling scenarios involving linguistic uncertainty, statistical uncertainty, and contextual uncertainty, where both primary and secondary membership functions need to be fuzzy to adequately capture the underlying complexity. One of the most challenging aspects of Type-3 fuzzy systems is the inference process and knowledge acquisition. The inference process requires type- reduction and defuzzification operations. One of efficient approach to automate knowledge acquisition is the use of neural networks, which can learn and adapt fuzzy rules from data. In this context, the design of a type-3 fuzzy neural networks is presented, where the system demonstrates its ability to model deep uncertainty and improve decision-making performance.

System, Language, Fuzzy Logic

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Av.Dr. Rüştü Burak Eke graduated from Istanbul University, Faculty of Law in 1982. He received master's degree (Thesis: "Transfer of Technology through Foreign Investments) and PhD degree (Thesis: Patent Right and License Agreement) at the same university where he worked as a research assistant in the Conflict of Laws Department between 1983-1990 and lecturer at the Faculty of Business Administration between 1990-1995. He was on the board of Başak Insurance Company, an affiliate of state-owned bank Ziraat Bankası between 1995-1996 and thereafter he worked as CEO of Ziraat Leasing, also affiliate of Ziraat Bankası from 1995 to 2003. R. Burak Eke is a member of Istanbul Bar since1985. Currently, he is working as advisor and trainer for numerous companies on the subjects of Communication and Organizational Learning along with his professional activities as an attorney at law. He lectures on contemporary rhetoric at MEF University in Istanbul. He is the founder and trustee of Dil ve Sistem Vakfi (The Language and System Foundation)

Abstract

After focusing on the systems approach in general, I will show how systems and language are indispensable for each other. I will try to identify the theoretical and practical contribution of fuzzy logic in the relationship between systems and language. I will conclude by emphasizing the implications of all this for current and future work in artificial intelligence. In a sense, this is a continuation of the ideas I tried to express last year. That the contribution of fuzzy logic and artificial intelligence studies to contemporary rhetoric can actually be made much more useful by revealing the common ground of the insights gained in these subsystems of the system. It is a view on how the theoretical and practical knowledge we have gained in these fields can move us forward.This is actually an attempt to place fuzzy logic where it should be beyond mathematical discussions.

Uncertain Dynamic Systems: A Look at Multiple Sclerosis

Tofigh Allahviranloo

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Tofigh Allahviranloo is a Professor of Applied Mathematics at Istinye University in Istanbul, Türkiye. An accomplished mathematician and computer scientist, Prof. Allahviranloo is dedicated to multi and interdisciplinary research efforts. His expertise lies primarily in fundamental research in applied fuzzy mathematics, with a special focus on dynamical systems and pioneering applications in applied

biological sciences.Prof. Allahviranloo has made significant scientific contributions, including authoring over 16 international books in English and 10 books in Farsi, as well as approximately 450 publications with renowned publishers such as Elsevier, Springer, Wiley, and Taylor & Francis. He has published more than 250 peer-reviewed journal papers over the past 15 years.He is the lead editor of the book series, Uncertainty, Computational Techniques and Decision Intelligence, published by ELSEVIER. In addition to his extensive writing activities, Prof. Allahviranloo plays an important role in the academic community as Associate Editor and Editorial Board Member of several prestigious journals. These include Information Sciences opens in new tab/window (ELSEVIER), Fuzzy Sets and Systems (ELSEVIER), Journal of Intelligent and Fuzzy Systems (IOS Press), Iranian Journal of Fuzzy Systems, Mathematical Sciences (Springer), Granular Computing (Springer), Journal of Mathematics and Computer Science (ISRP), and Journal of Computational Methods for Differential Equations (University of Tabriz).He is currently Executive Editor-in-Chief of Information Sciences, Editor-in-Chief of Transactions on Fuzzy Sets and Systems, Editor-in-Chief of International Journal of Industrial Mathematics, Chairman of International Conference on Decision Sciences (IDS) and Managing Editor of The Journal of Mathematics and Computer Science (International Scientific Research Publications).In addition, Prof. Allahviranloo is a member of the program committee for the FUZZ-IEEE, NAFIPS Annual Meeting, and IFSA conferences, where he brings his extensive knowledge and experience to these key events in the field of fuzzy systems and applied mathematics.

Abstract

Uncertainty is intrinsic to how real-world systems evolve, especially in complex biological contexts. In modeling dynamic systems—systems that change over time—uncertainty appears not only in initial conditions and parameters but also in the system's structure. This keynote offers a conceptual reflection on uncertain dynamic systems, drawing on the case of Multiple Sclerosis (MS) as a biological phenomenon shaped by unpredictability, variability, and incomplete knowledge. We explore key forms of uncertainty in dynamic modeling:

– Stochastic uncertainty, where randomness drives system variation
– Fuzzy dynamics, where definitions are vague or linguistically expressed
– Interval and incomplete models, where data is partial or bounded
– Epistemic uncertainty, where the trustworthiness of available information is itself in question
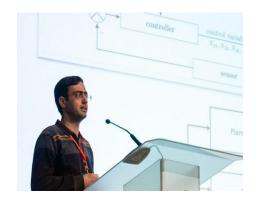
MS, as a progressive neurological disease, illustrates all of these forms. From the unpredictability of immune response to the variability in lesion formation and symptom expression across individuals, modeling MS dynamics requires a framework that accepts and encodes uncertainty rather than eliminating it. The talk reflects on how mathematics—particularly soft and uncertain methods—provides tools not just for prediction but for interpreting uncertainty in evolving systems. Ultimately, this lecture invites a broader dialogue between mathematics, biology, and uncertainty. Through the lens of MS, we examine what it means to model life processes under uncertainty and how dynamic systems thinking can bridge the gap between data, meaning, and decision-making in the face of the unknown.

Application of AI in Automation and Control Systems: Fourier-Based Type-2 Fuzzy Neural Networks.

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Prof. Ardashir Mohammadzadeh is a professor at Sakarya University, Turkey. He also leading a researching team in field of intelligent control systems in China. As reported by Stanford University, in 2021-2024, he was listed among the top 2% of the best researchers in the field of artificial intelligence. He was also listed among the top 1% of highly cited researchers in 2023 based on the ESI database. His research interests include control theory, fuzzy logic systems, machine learning, neural networks, intelligent control systems, electric vehicles, power system control systems, chaotic systems, and medical control systems.

Abstract

One of the key trends in information technology is the rise of artificial intelligence (AI) and machine learning. AI has the potential to revolutionize industries by automating processes, improving decision-making, and enhancing customer experiences. Machine learning algorithms are being used to analyze vast amounts of data and extract valuable insights, enabling organizations to make more informed decisions and drive innovation. On the other hand, intelligent automation and control systems are a trend that has primarily hit the manufacturing and production units and is estimated to only grow more in the coming years. Intelligent automation has also enabled processes to work faster and would allow companies to reach their goals much more efficiently. In this talk, first, the AI systems and majors are defined, the main application and challenges of AI in control systems are summarized, and a new approach of intelligent fuzzy systems is presented as a solution to deal with high dimensional problems. The concept of Fourier-based type-2 fuzzy neural networks is presented and by some examples such as face recognition problem, English handwriting digit recognition, and modeling problem with real-world data its effectiveness is illustrated.

Sessions

Time	Monday, August 25, 2025
08:00 – 08:40	**Breakfast**
08:40 – 09:20	**Registration**
09:20 – 09:50	**Opening Ceremony**
09:50 – 10:25	*Keynote Speech* **Chair: R. A. Aliev, Azerbaijan** **J. Kacprzyk:** Multistage Fuzzy Decision Making and Control with an Implicitly Specified Termination Time: New Perspectives and Challenges for the use of Z-Numbers
10:25 – 11:00	*Keynote Speech* **Chair: W. Pedrycz, Canada** **R. A. Aliev:** Approximate Reasoning under Bimodal Z-Information
11:00 – 11:20	**Tea/Coffee**
11:20 – 12:40 **Room 1**	*Session A* **Theory and Application of Soft Computing** **Chairman: L. A. Gardashova**
Z-MCDM for waste Management Technology Selection in Tourism Regions of Azerbaijan **A. Nuriyev**
	Review of Foxboro FLEX and comparison with Honeywell LEAPTM project execution principles **F. Adilov, M. Astafurov, I. Arsen**
	Z-conditional reasoning in control system **Sh. A. Ahmadov**
	Temperature and Humidity Control in Smart Environments **R. Ismail, F. Al-Turjman**
	Voltage surge classification and fault detection in smart Microgrids using Machine Learning **A. K. Alhamadani, R. H. Abiyev**
11:20 – 12:40 **Room 2**	*Session B* **Fuzzy Logic, Neuro-Fuzzy Technologies and Artificial Intelligence in Engineering** **Chairman: L H.-N. L. Teodorescu**
	Circular Temporal Intuitionistic Fuzzy Expert Model for Evaluating Industrial AI Strategies **V. Traneva, S. Tranev**
	Modeling of Digital Twin for Wind Turbines **O. Rasulzade**
	Comparison of Central Tendency Theorem and Fuzzy AHP-TOPSIS Method in Sensory Evaluation of Turkish Delight **P. Adun, M. Alnalki, M. N. Muhamma, H. I. Kademi, A. Shefik**

Context-Aware Transformer-Based Text Plagiarism Detection (CAT-PD) **A. Ahmadzada, N. Hacibalayev**	
Hybrid Deep Learning for Enhanced Load and Renewable Generation Forecasting in Smart Grids **C. Kavalcioghlu, Ch. Ozkan**	
Design and modeling of intelligent mobile industrial robot in flexible manufacturing system **A. Sadigov, J. Mammadov, N. Guliyeva, I. Aliyev**	

12:40 – 14:00 Room 1	*Session C* **Decision theory with imperfect information** **Chairman: V. E. Balas**

Selection of welding process for grey cast iron in Z-environment **L. A. Gardashova**
Ensembling U-Net-Based Models for Lesion Segmentation Through Genetic Algorithm **F. Cheraghchian, E. Ozbilge**
Modern Trends in Application of Advance Neural Network (ANN) in Biophysics and Bioinformatics **S. U. Abidemi, M. Z. Altabel, M. Darwish, F. Al-Turjman**
Stability of Z-Rule-Based Systems **N. E. Adilova**
Fuzzy Logic-Enhanced Non-Local Means for Adaptive Denoising and Detail Preservation in Medical Imaging **A. K. Alhamadani, K. Dimililer**

12:40 – 14:00 Room 2	*Session D* **Fuzzy Logic, Neuro-Fuzzy Technologies and Artificial Intelligence in Social Sciences** **Chairman: V. Askarov**

Distinctive Characteristics of Hedges in English and French Languages **V. Askerov, F. Huseynova**
Sample-Efficient Reinforcement Learning via Smart Knowledge Transfer **P. Tudor-Constantin, A. Iftene**
MediLITE-QA: A Domain-Specific Transformer for Efficient Medical Question Answering on CPU Edge Devices **O. O. Odewole, S. Basharan**
Artificial Intelligence, Fuzzy Logic and Fiction **J. Dadashov**

14:00 – 15:00	**Lunch**

15:00 – 15:30	*Keynote Speech* **Chair: J. Kacprzyk, Poland** **W. Pedrycz:** Data – Knowledge Environment and Knowledge Landmarks in Machine Learning

15:30 – 16:00	*Keynote Speech* **Chair: R. Azizov, Azerbaijan** **Horia-Nicolai L. Teodorescu**: Approximation and Interpolation Theorems for Fuzzy Systems: Consequences and Applications
16:00 – 16:30	*Keynote Speech* **Chair: R. B. Eke, Turkey** **K. Abdulla:** Fuzzy Logic in Linguistics
16:30 – 16:40	**Tea/Coffee**
16:40 – 18:00 **Room 1**	*Session E* **Machine Learning, Deep Learning** **Chairman: J. Mammadov**

A CNN-Based Approach for Diagnosis of Acute Myeloid Leukemia Diseases **R. J. H. Habeeb, R. H. Abiyev, K. Dimililer**
Modeling and development of field training simulator for complex technological processes and productions **N. Yusupbekov, F.Adilov, A. Bakhadirov, A. Korotaev, D. Adilova, S. Abdurakhmanov**
Distributed deep neural network-based image processing for breast cancer detection **E. Naghizade, N. Ismayilova**
Assessing Distributor Reliability in Strategic Partnerships for Sales Enterprises using Z-numbers **R. Alekperov, V. Salahli, R. Mikayilova**
Optimizing Input Parameters for Predicting the Water Level of Gaborone Dam (Botswana) using Extreme Learning Machine **Y. Kassem, H. Gokchekush, M. T. Adamu**

16:40 – 18:00 **Room 2**	*Session F* **Fuzzy Logic, Neuro-Fuzzy Technologies and Artificial Intelligence in Business, Economics, Finance** **Chairman: F. Adilov**

Fuzzy Algorithm for Simulation EDI level of the country **G. Imanov, A. Aliyev, A. Guluzade**
Predicting Monthly Reference Evapotranspiration in Türkiye using M5 Model Tree in Contrasting Climatic Zones **J. Abdullahi, F. Aslanova, G. Elkiran**
Panel Data Analysis of the Impact of Intellectual Property on Scientific Productivity: Evidence from Uzbekistan, Kyrgyzstan, and Tajikistan **Y. Hasanli, S. Shabanov, E. Ahmadzade, R. Balayev**
Neural Network Architecture Optimization for Stock Market Forecasting: A Convergence of Advanced Digital Networks and Financial Communications **A. ALwhelat, R. Abiyev, K. Dimililer, M. S. AlHakeem**

09:00-18:00	*Flexible Session*
18:00	**Welcome reception**

Tuesday, August 26, 2025

08:00 – 09:30	**Breakfast**
09:30 – 10:10	*Keynote Speech* **Chair: L. – G. Maha, Romania** **R. A. Aliev, R. Abiyev:** Type-3 Fuzzy Systems and Their Applications
10:10-10:50	*Keynote Speech* **Chair: A. Iftene, Romania** **R. B. Eke**: System, Language, Fuzzy Logic
10:50 – 11:10	**Tea/Coffee**
11:10 - 13:00	*Session G* **Theory and application of Soft Computing** **Chairman: A. Nuriyev**

Application of fuzzy clustering to analysis of data from sensor streams **A. Jabiyeva, B. Bakhtiyarov, S. Jabiyeva**
Accurate PV Output Forecasting via Principal Component Analysis and Extreme learning machine Support Vector Regression **Y. Kassem, H. Gokchekush, M. T. Adamu**
Leveraging a Fuzzy Semantic Approach for Explainable AI in Interpretable Job Satisfaction Assessment **L. Gardashova, P. Kosov, R. Shirinov**
Fuzzy-convolutional neural networks for kidney disease classification: An interpretable deep learning approach **M. Arslan, M. Z. Altabel, M. Darwish**
The Importance of Considering Hedges in Emotional Sentiment Analysis **F. Huseynova, Kh. Huseynov**

13:00 – 14:00	**Lunch**
14:00-14:40	*Keynote Speech* **Chair: G. Imanov, Azerbaijan** **T. Allahviranloo:** Uncertain Dynamic Systems: A Look at Multiple Sclerosis

14:40-15:20	*Keynote Speech* **Chair: R. Abiyev, North Cyprus** **A. Mohammadzadeh**: Application of AI in Automation and Control Systems: Fourier-Based Type-2 Fuzzy Neural Networks
15:20 - 16:30	*Session H* **Artificial intelligence methods** **Chairman**: N. Adilova

Gender-Specific Language Patterns in Sentiment Analysis **V. Askerov, F. Huseynova**
Extension of Fuzzy implication to Z-implication **Sh. A. Ahmadov**
Evaluating EEG Research Trend: Bibliometric Insights into Neurotechnology and Clinical Applications (2000-2024) **N. Ahmadzadeh N. Azar, M. Karami**
Z-regression of Parkinson disease **N. E. Adilova**
Regression Modeling of Employer Branding in Talent Acquisition and Workforce Development Through a Case Study Approach **S. Imanova, Z. Guliyev**

16:30 – 17:00	**Round Table**
17:30	**Closing Ceremony**
09:00 – 18:00	**Flexible Session**

Development of intelligent control system and automation scheme for the process of microelemented phosphate fertilizer production **R. Azizov, M. Samedov, M. Salmanov, S. Javadova, H. Hashimova**
A note on type-2 Z-numbers as a fusion of type-2 fuzzy sets and second-order probabilities **O. Huseynov, Rafig R. Aliyev**
Formalization of Infocommunication Network Structures based on Associative Interaction of their Components **N. R. Yusupbekov, S. M. Gulyamov, N. B. Usmanova, M. Y. Doshanova**
The Influence of Machine Learning Driven AI on Human Decision Making and Behaviour **E. Imanov, S. I. Raheel, G. Imanova**
A Balanced and Sustainable Approach to the Benefits of Digital Technologies in Modern Education **M.- D. Călın, N. Stoica**
The Impact of Hedges on Meaning Ambiguity in English and French **V. Askerov, F. Huseynova**
Chronic Wound Segmentation using Deep Learning: Development and Validation of a ResNet-34 U-Net Model **Kh. M. A. Adweb, A. Helwan, Kh. Almezghwi, M. Kh. S. Maaitah, A. Radwan**
Diagnostics of flows between layers based on the use of artificial intelligence methods **V. M. Mammadov, H. G. Hajiyev, N. S. Ismayilov**

Control of acid and base pH neutralization process using fuzzy logic controller **S. U. Abidemi, T. R. Mangai, R. Abiyev, F. Al-Turjman**
Statement of optimization problem for modeling of non-stationary reactor complex **E. A. Melikov, T. M. Magerramova, A. A. Safarova**
Timetabling using Hypercube Optimization Search Algorithm **M. Tuzunkan**
Application of Type-2 fuzzy TOPSIS method for estimating renewable energy sources **K. R. Aliyeva, Sh. Mehdi**
Effectiveness of Financial Literacy Training Programs for Males (in case of Azerbaijan) **F. Gasimov, E. Shafizade, F. Guliyev**
Application of TOPSIS method to Z-information based group decision making problem **K. I. Jabbarova**
Algorithm of Intelligent Positional Contour Control of Objects Moving along a Specified Trajectory **H. Igamberdiev, O. Zaripov, U. Mamirov, D. Sevinova**
An approach to approximate reasoning with Z-number-valued IF-THEN rules **R. A. Aliev, O. Huseynov**
Romanian Itineraries of Lutfi Zade and His "Fuzzy Set" **L. Bejenaru, I. Gogoi-Viziteu, V. Voroneanu**
Job selection problem under fuzzy and probabilistic uncertainty **U. Abbasova**
Fuzzy Logic-Based System for Remote Health Monitoring and Analysis **E. Imanov, B. Ahmed, G. E. Imanova**
Toward the Application of Soft Computing to Construct a Digital Twin for Biological Wastewater Treatment **K. N. Mammadazada**
Optimization of Dielectric Fluid Synthesis Parameters Using Integrated ANFIS and TOPSIS Approach **M. M. Mirjafarova, M. Y. Abdullayeva**
Personal relationships reliability prediction using Fuzzy MADM with interrelated attributes **K. Rizvanova**
Dynamic Plant control using Type-3 Fuzzy Neural Networks **R. Aliyev, S. Abizada**
Inference in Z-rules by using ALI-1 implications **A. V. Alizadeh**
Technological Decision-Making to Improve Oil Recovery Efficiency under Multicriteria Conditions **G. M. Efendiyev, S. V. Abbasova, G. Zh. Moldabayeva, I. A. Piriverdiyev**
Z-Decision Making in pancreatic cancer diagnosis **T. A. Haciyeva, J. I. Ahmadova**
Adaptive Fuzzy Logic Control of Combustion Parameters in Industrial Gas-Fired Furnaces **N. R. Yusupbekov, U. U. Kholmanov, V. Kh. Shamsutdinova**
Construction of a production function for the transport sector under Z-number-based information **V. J. Akhundov**
Ways of intellectual asset financial audit in enterprises and peculiarities of their bookkeeping **D. Baghirov, N. Babayev, E. Baghirov, A. Sadigov**
The Influence of Mental Thinking on the Number of Young Male Teachers in Education: The case of Azerbaijan

A. Huseyn, E. Shafizade,V. Huseynova, A. Alishli, G. Hamidova
Expected value and variance of Z-numbers **A. V. Alizadeh, R. R. Aliyev, E. Zeynalov**
Graph Theory Matrix Approach of Multi-Criteria Decision Analysis for evaluation and ranking of cars **A. Aliyeva, H. Temizkan**
Deep learning-based real-time anomaly detection in cybersecurity: A framework for threat detection in streaming data **Z. Alwaeli**
Assessment of digital literacy in Azerbaijan: Fuzzy modeling for population analysis **M. Kh. Gazanfarli, S. M. Mammadova, N. E. Mammadov**
Robot Motion Planning using Cloud-based Algorithm **Y. Mardanzada, J. Babanli**
Rank reversal-free approach to digital marketing technologies selection **G. E. Imanova, G. Imanova**
The role of artificial intelligence in the financial system: modern challenges and ripe opportunities **D. Baghirov, A. Aghayev**
Estimation the Cycle Length using Z-valued information in traffic problem **B. A. Mahalova**
Evaluating the Impact of ICT on Agricultural Decision-Making **A. Gasimov, A. Alili, B. Ismayilov, K. Mirzammadova, R. Huseynov**
Labeled Road Signs Detection using CNN Model **H. Hajiyev, K. Babanli**
Deep Stacked Structure for Stock Price Forecasting **R. Abizada, M. Tuzunkan**
Type-2 Z-number **Rafig R. Aliyev, A. V. Alizadeh**
Determination of Uncertainty in Thermodynamic Modeling of the Liquidus of Ytterbium (II) Telluride – Antimonu (III) Telluride System **A. N. Mammadov, F. V. Yusubov, M. B. Babanly, D. B. Tagiev**
Dynamic Fuzzy Decision Modeling for Vendor Selection in Industry **K. R. Aliyeva**
Fuzzy Gain Scheduling Control of Mobile Robots **R. H. Abiyev, I. Gunsel, M. Tuzunkan, S. Abizada**
Toward modeling of dependence of competitive industrial performance index on influential factors by using fuzzy rules **Ch. A. Imamalizade, S. A. Isayeva**
Identifying patterns in imprecise data with fuzzy approach **S. I. Yusifov, R. A. Mayilov, I. Y. Bayramov, R.S. Safarov**
University selection for enrollment under deep uncertainty **U. Abbasova**
Application U-number based IF-THEN rules to assessment of student performance **K. I. Jabbarova, A. I. Jabbarova**
Using of Fuzzy Logic in Treatment Process of Sewage in Paint and Varnish Industry **A. A. Hasanov, L. M. Zeinalova**
Econometric evaluation of the financial position of marine transport in the conditions of uncertainty

E. Iskandarov, T. Yadigarov, M. Ramazanov
Digitalization and Artificial Intelligence in Public Administration: Opportunities, Challenges and Strategic Approaches **M. Tuzunkan**
Assessment of Performance Risks in Digital Advertising Platforms using Fuzzy Logic **R. Imamguluyev, V. Aliyev, N. Umarova**
Method of determining the executive dimensions of press-mould elements that produce plastic parts working in oil field equipment **N. A. Gasanova, A. V. Sharifova, Z. S. Huseynli**

General Information

1. Location

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2. Conference Secretariat

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During the conference
During the conference, the secretariat will be in the reception area of the conference room. The secretariat will be opened for registration and distribution of the conference material during the conference times.

3. Conference Fee
€300
Registration fee entitles you to:
- access to the conference sessions;
- get a copy of the final program and the paper copy;
- access to the proceedings of the conference;
- get a list of conference participants;

4. Conference Language
The conference language is English. There is no simultaneous translation available.

5. How to get to Hotel Traian
The Hotel Traian can be reached by bus or taxi from Iasi Airport.