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ICSCCW-2026

**13th International Conference on Theory and
Application of Soft Computing, Computing with Words,
Perception and Artificial Intelligence**

<https://icsccw2026.az/>

25-26 August 2026, Tbilisi, Georgia

13th International Conference on Theory and Application of Soft Computing, Computing with Words, Perception and Artificial Intelligence



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

PROGRAMME

Organized by:

Association of “Zadeh’s Legacy and Artificial Intelligence” (Baku, Azerbaijan)
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SCHEDULE-AT-A-GLANCE

Time	Tuesday, August 25, 2026
08:00 – 09:00	Breakfast
09:00 – 09:40	Registration
09:40 – 10:00	Opening Ceremony
10:00 – 10:40	Keynote Speech Chair: R. A. Aliev, Azerbaijan J. Kacprzyk: Z-Numbers in Multistage Fuzzy Decision Making and Control: A Higher Expressive Power but at a Price
10:40 – 11:20	Keynote Speech Chair: W. Pedrycz, Canada R. A. Aliev: Toward Type-2 Z-Numbers
11:20 – 11:40	Tea/Coffee
11:40 – 13:00 Room 1	Session A Theory and Application of Soft Computing Chairman: K. Alieva
11:40 – 13:00 Room 2	Session B Decision Theory with Imperfect Information Chairman: A. Nuriyev
13:00 – 14:00	Lunch
14:10 – 14:50	Keynote Speech Chair: J. Kacprzyk, Poland W. Pedrycz: Informed Machine Learning: Emerging Opportunities
14:50 – 15:30	Keynote Speech Chair: G. Sirbiladze, Georgia T. Allahviranloo: A Mathematical Framework for Artificial Intelligence under Reliability-Aware Uncertainty
15:30 – 15:50	Tea/Coffee
15:50 – 16:30	Keynote Speech Chair: N. Muzaffarli, Azerbaijan G. Sirbiladze: A New Direction of Temporal Fuzzy Modeling in Emergency Logistics Planning for Disaster Region

16:30 – 17:50 Room 1	<i>Session C</i> Decision Theory with Imperfect Information Chairman: I. Khutsishvili
16:30 – 18:00 Room 2	<i>Session D</i> Fuzzy Logic and Neuro-Fuzzy Technology Chairman: I. Kachiashvili
09:00 – 19:00	Flexible Session Chairman: G. Huseynzada
19:00	Social Event

Time	Wednesday, August 26, 2026
08:30 – 09:30	Breakfast
09:30 – 10:10	<i>Keynote Speech</i> Chair: R. B. Eke, Turkey A. Mohammadzadeh: Advancement in Type-3 Fuzzy Systems and Control
10:10 – 10:50	<i>Keynote Speech</i> Chair: A. Averkin, Russia N. Muzaffarli: Methodological Foundations of Bipolar Measurement in Comparative Economic Research
10:50 – 11:10	Tea/Coffee
11:10 – 11:50	<i>Keynote Speech</i> Chair: J. Mammadov, Azerbaijan R. B. Eke: Logical Line in Data Granulation
11:50 – 12:30	<i>Keynote Speech</i> Chair: L. Gardashova, Azerbaijan R. Abiyev: Type-3 Fuzzy Inference Using Similarity Measure
12:30 – 13:30	Lunch
13:45 – 14:25	<i>Keynote Speech</i> Chair: T. Allahviranloo, Turkey Z. Selcuk: Z-Number-Based Fuzzy Approach to Measure Student Performance
14:25 – 16:25 Room 1	<i>Session E</i> Machine Learning, Deep Learning Chairman: K. Jabbarova

14:25 – 16:25 Room 2	<i>Session F</i> Artificial Intelligence Tools Chairman: E. Ismayilov
16:30 – 18:00	<i>Session G</i> Soft Computing and AI in Engineering, Material Science, Earth Sciences, Aerospace, Business, Economics, Finance, Social Sciences, Medicine, Chemical-Technological Processes and Pharmaceutical Sciences Chairman: L. Zeinalova
09:00 – 18:00	Flexible Session Chairman: G. Huseynzada
18:00 – 18:40	Round Table
18:40 – 19:00	Closing Ceremony

Welcome

I would like to convey my greetings to all the participants of ICSCCW-2026. As you know, this is a long-life conference. The first conference was held in 2001. The father of fuzzy logic, the Honorary Chair of ICSCCW Prof. L.A. Zadeh participated in almost all the conferences held in different countries of the world. Unfortunately, about nine years ago, in the beginning of September 2017, we 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 Logic and Soft Computing 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 thirteenth 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 ICSCCW-2026

Prof. R.A. Aliev

Plenary Session Papers Abstracts

Toward Type-2 Z-Numbers

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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 Academy. 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 deep bimodal information environment, we face with fuzzy and probabilistic uncertainties. Fuzzy-probabilistic framework is important to process both expert-driven and data-driven information. To solve real-life problems in this situation, Z-number construct was proposed by prof. L. Zadeh as a novel form of a granule. Existing classical Z-number theory is based on Type-1 fuzzy sets for

describing a both a value of variable of interest and restriction on probability measure of this value. However, type-1 fuzzy sets-based description may not be adequate for real-world uncertainty.

That is, due to political, economic and ecological instability factors, one may find difficulties to precisiate existing internet uncertainty linguistic evaluation by using type-1 fuzzy numbers, that is, to use precise degrees of membership. In contrast, type-2 fuzzy numbers are more adequate to reflect imprecision of membership functions of both A and B parts due to instability factors. To handle more adequately deep uncertainty in bimodal information situation we need to provide this framework by additional layer of uncertainty which includes both type-2 fuzzy sets.

In this study, for first time we suggest Type-2 Z-number conception to extend the capabilities of existing Z-number framework. We formulate a definition of type-2 Z-number where a possible probability distribution is assigned a degree of possibility in form of type-1 fuzzy number. Indeed, precise degree of possibility can hardly be assigned under high uncertainty of perceptions related to actual probability distribution. For this representation, a framework of basic arithmetic operations over type-2 Z-numbers is developed.

Z-Numbers in Multistage Fuzzy Decision Making and Control: A Higher Expressive Power but at a Price

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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

We assume as the point of departure the classic Bellman and Zadeh's [2] problem of multistage decision making and control under fuzzy constraints on inputs (decisions or controls) and fuzzy goals on the outputs (states, for simplicity), in a more comprehensive form presented in Kacprzyk [10]. As opposed to the basic case of a fixed and specified termination time (planning horizon), for instance

"10 years" in the case of economic planning, we assume a fuzzy termination time exemplified, for instance, by "more or less 10 years", "much more than 5 years", "much less than 15 years", etc. Such a fuzzy termination time is quite often what is really perceived by the human stakeholders, for instance, decision makers, in real life even if, for formal reasons, a fixed and specified termination time, here "10 years" is set. The fuzzy termination time, introduced by Kacprzyk [3,4,5] is assumed to be a fuzzy set in the set of control (decision making) stages which is assumed to be finite. We assume, first, that the system under control is deterministic and its dynamics (stage transitions) is given as state transition matrix, both the same at all control stages and also time varying, that is, different for different control stages.

To extend the expressive power of the formulation, and to account for a partial reliability, the fuzzy constraints and fuzzy goals are represented by the Z-numbers defined in finite sets of states and controls, and then, we also mention an extended formulation with the system under control represented by a Z-relation. We assume in the first shot that the fuzzy termination time is defined just as a fuzzy number defined in the set of control stages.

First, we recall the source Z-number based basic approach to the problem of multistage fuzzy control with a fixed and specified termination time by Aliev, Pedrycz, Guirimov, Huseynov and Aliyev (2024) in which the termination time is assumed to be fixed and specified, exemplified by "10 years" as in our example.

Then, we consider the 3 basic approaches to the formulation and solution of the multistage fuzzy control (decision making) problem with a fuzzy termination time proposed by Kacprzyk [3, 4, 5, 10]: dynamic programming, branch-and-bound, evolutionary computation (mostly genetic algorithms).

We start with the presentation of a Z-number extension of Kacprzyk's [3, 4, 5] basic fuzzy dynamic programming model of the multistage fuzzy control (decision making) problem with a fuzzy termination time combined with some Z-number related solutions employed for the fuzzy dynamic programming by Aliev, Pedrycz, Guirimov, Huseynov and Aliyev [1]. This new approach proposed involves an additional degree of membership of a particular control stage in the fuzzy termination time.

Next, we show first a Z-number based extension of the branch-and-bound approach (cf. Kacprzyk [6]) to the formulation and solution of the problem of multistage fuzzy control (decision making) with a fuzzy termination time which can be a good alternative to dynamic programming for larger problems because it makes it possible to alleviate the infamous curse of dimensionality of dynamic programming, including clearly fuzzy dynamic programming and the Z-number based dynamic programming alike. We show mainly how to implement the partitioning of a problem into smaller problems, and to devise and implement a bounding function in the case of the Z-numbers.

Then, we show a Z-number based extension of a conceptually simple genetic algorithm approach by Kacprzyk [11].

Finally, we briefly indicate possible further extensions related to the use of the Z-numbers for the formulation and solution of multistage fuzzy control (decision making) with a fuzzy termination

time in the case of the stochastic and fuzzy systems under control, and also a very interesting case of a fuzzy termination time specified as a Z-number. We mention a possible Z-number based extension of a neural network approach to the solution of the multistage fuzzy control (decision making) problem, an extension of Francelin, Kacprzyk and Gomide [12, 13], as well as the use of belief qualification introduced by Kacprzyk and Yager [14]. We also mention some applications, notably in inventory control.

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Informed Machine Learning: Emerging Opportunities

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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 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

Machine Learning (ML) and Artificial Intelligence (AI) have enjoyed a lot of interest and led to numerous success stories including those in areas of high criticality. With the passage of time, some limitations of ML technology have become visible and raised concerns about the deployment of the ML constructs (including LLMs) and their exclusive reliance on data. Indeed, data are a lifeblood of design methodologies and drive current commonly encountered development practices. At the center

of the ML methodology lies a default assumption that the data fully represent the problem to be solved (e.g., classification or prediction). We look at the problem and produce a solution through the lens of data; in many cases, this may lead to the data blinding effect. We advocate that a holistic knowledge-data development perspective is urgently needed.

An Informed ML (IML) has emerged as a new direction of research addressing these needs. In brief, IML is sought as a methodology in which data and knowledge are used in unison to design ML systems. From the design perspective encountered in the ML learning environment, data and knowledge are radically different. Data are numeric and precise. Knowledge is general and usually expressed at the higher level of abstraction (generality). Knowledge and data emerge at different levels of information granularity.

In this talk, we deliver a comprehensive taxonomy of main pursuits of IML and link them with keyways the knowledge is represented. A historical perspective is offered by studying the symbolic and sub-symbolic processing encountered in successive decades of AI.

The two general categories of physics-oriented and neuro-symbolic constructs are associated with the ways in which knowledge and data are explored together. We elaborate on the design process being guided by a prudently augmented additive loss function whose corresponding parts minimize distances between the developed ML model and numeric target values and deliver adherence of the model to information granules reflecting available knowledge. A general taxonomy of neuro-symbolic systems involving learning-for-reasoning, reasoning-for-learning, reasoning-learning-learning-learning is discussed.

Z-Number-Based Fuzzy Approach to Measure Student Performance

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Abstract

The problem of educational assessment has a challenge for better understanding and improving student performance. The traditional methods cannot address this challenge, because they rely on numerical grading and quantitative metrics, consequently, cannot effectively capture real nature of student success. The paper aims to present a novel approach to measure student performance based on use of fuzzy logic, namely of its Z-number valued extension, to accommodate uncertainty and vagueness in educational environments. The use of Z-number extension of fuzzy sets provides ability to involve multiple qualitative and quantitative measures of student performance, taking into consideration their inherent imprecision and vagueness, and reliability of information. The results demonstrate validity of fuzzy Z-number-valued student performance estimation model through a case study using diverse student information from a higher education school.

A Mathematical Framework for Artificial Intelligence under Reliability-Aware Uncertainty

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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* (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

Classical Artificial Intelligence models primarily rely on probabilistic frameworks to represent uncertainty. However, many real-world systems involve not only randomness but also imprecision, linguistic ambiguity, and varying levels of information reliability. Traditional AI methodologies do not adequately capture these structured forms of uncertainty.

This talk introduces Z-AI, a mathematical framework for Artificial Intelligence based on Z-information theory, where each piece of information is modeled as a pair consisting of a restriction component and a reliability component. By embedding credibility directly into the learning and inference process, Z-AI enables intelligent systems to distinguish between uncertain data and unreliable data.

The presentation outlines the theoretical foundations of Z-numbers, their linguistic extensions, and their integration into machine learning and optimization models. Applications in decision support and healthcare systems are discussed to illustrate how reliability-aware uncertainty modeling can enhance robustness, interpretability, and trust in AI systems.

Z-AI represents a step toward mathematically rigorous, reliability-conscious intelligent systems capable of operating in complex, uncertainty-rich environments.

A New Direction of Temporal Fuzzy Modeling in Emergency Logistics Planning for Disaster Region

Gia Sirbiladze

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Professor Gia Sirbiladze is a leading expert in the field of intelligent simulation modeling, fuzzy decision-making problems in uncertain environments, systems research and engineering and others. He is an author and editor of more than 250 papers and two monographs in expert knowledge engineering and decision-making problems in uncertain environments. His research interest in Computer Science also includes systems science in engineering; fuzzy technologies in decision-making support systems; extreme dynamic systems, control, optimal control, filtration, identification and prediction; fuzzy discrete optimization problems in management, emergency management problems for the disaster-stricken regions. He has more than 40 years of experience in teaching and research at the Iv. Javakhishvili Tbilisi State University, Georgia. He is a professor of applied informatics at the Department of Computer Sciences of Iv. Javakhishvili Tbilisi State University. He is a member of several international societies of computer sciences and engineering: IEEE, IFSR, MCDM and others. He also is a member of an editorial board of various international journals in computer sciences.

Abstract

The consequences of natural disasters have significantly increased the loss of human life and material damage in recent years. Such disasters as earthquakes, tsunamis, tornadoes and others can cause serious and lasting damage to regions and countries. Therefore, it is important to know how the transport fleets are organized and managed in the disaster areas, as it makes a crucial contribution to the efficiency of the relief distribution process. When the suitable places of distribution centers (DCs) are selected, a group of places should be selected from them that in some sense better meet the requirements such as: maximizing the reliability index of the selection of DCs, minimizing costs, maximizing demand coverage etc. Given the issues outlined in this study, we will consider a fuzzy temporal multi-objective emergency location and vehicle routing problem (FTMOELVRP). It is essential to allocate disaster affected areas and vehicles for DCs. It generates routes from DC to disaster-affected areas, taking into account distributed demand-supply. The purposes of the model are: (1) maximizing the total selection reliability index of opened DCs, (2) minimizing the fixed costs to

establish DCs and the vehicle travelling cost, (3) minimizing the maximum travel time of the vehicle routes, and (4) maximizing the minimum possibilistic reliability of the routes for all service vehicles in the process. Objective functions of (1) and (4) are novel and their construction and study issues are one of the important tasks of this work. The input to the mathematical model of the system are objective data, as well as expert evaluations. The outputs of the system will solve the FTMOELVRP for disasters' zones. The Intelligent Support System for the FTMOELVRP in disaster zones will be developed in our future research.

Advancement in Type-3 Fuzzy Systems and Control

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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 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

This keynote, titled "Advancement in Type-3 Fuzzy Systems and Control," surveys the rapid evolution of type-3 (T3) fuzzy systems and their growing adoption across a broad range of scientific and technological domains. In recent years, T3 fuzzy frameworks have attracted significant attention due to their enhanced ability to model deep uncertainty, complex nonlinearities, and highly variable operating environments, capabilities increasingly demanded in modern intelligent systems. The talk first reviews the principal methodological advancements in T3 fuzzy systems, highlighting key developments in representation, learning, inference, and computational implementation that have enabled practical deployment. It then introduces Type-3 Adaptive Neuro-Fuzzy Inference Systems (T3-ANFIS) as a unifying learning-and-inference architecture that extends classical ANFIS to higher-order uncertainty modeling. Finally, the keynote presents and critically discusses a recently developed intelligent control scheme based on T3-ANFIS, emphasizing design rationale, validation results, and a real-world implementation to demonstrate feasibility, robustness, and performance in practical control applications.

Type-3 Fuzzy Inference Using Similarity Measure

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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

Traditional fuzzy reasoning is based on compositional inference. In high-order fuzzy systems, this inference mechanism requires both type-reduction and defuzzification operations. In type-3 fuzzy systems, a three-dimensional membership function is first reduced to a two-dimensional representation, then to a one-dimensional form, and finally converted into a crisp output. As the number of variables and rules increases, compositional inference becomes computationally expensive. This research investigates the use of similarity in approximate reasoning. Similarity-based fuzzy reasoning is an alternative inference approach in which conclusions are drawn by measuring how closely a new input resembles previously defined fuzzy rule antecedents, rather than relying solely on strict rule matching. This approach is particularly effective when rule structures are complex (high-order) and inputs do not clearly match existing rules. It compares observed input patterns with stored fuzzy rule antecedents and determines outputs according to their degree of similarity. The proposed mechanism more closely reflects human reasoning, is robust to uncertainty and incomplete knowledge, demonstrates strong generalization capability, and effectively handles nonlinear, high-order interactions. Compared with compositional inference, similarity-based reasoning offers stronger interpolation capability and is more robust to sparse rule bases. In this research, common similarity measures, including set-theoretic and distance-based measures, are investigated to design an inference mechanism for type-3 fuzzy systems, and real-time applications of similarity-based reasoning are examined.

Logical Line in Data Granulation

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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 since 1985. 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 Vakfı (The Language and System Foundation).

Abstract

For some time now, we have been focusing on the intersection between linguistics and fuzzy logic in these studies. We began with the study titled "Some Contributions of Fuzzy Logic and Artificial Intelligence Research to Linguistics" and continued with "Metaphors in the Context of Systems, Language, and Fuzzy Logic." We can say that the most important characteristic of a system being a system and distinguishing it from others is the communication and interaction within the system and between the system and the external world, in other words, the flow of data. For example, a machine, especially one equipped with data-processing artificial intelligence, must transform the data it receives from the external world into a format it can process, process that data, and then present the information it generates to the external world in a format compatible with that world. Just like a human. A human also processes information received from the external world through the five senses via a process that begins with perception and progresses through language. We can refer to this process as a granularization process. At each stage, the data changes form, becoming granules suited to the environment. It is precisely in this process, that is, in the flow of data within the system, that we will focus on the importance of the tension between formal logic and fuzzy logic.

Methodological Foundations of Bipolar Measurement in Comparative Economic Research

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Main books

- Economic Sketches, 1996
- Azerbaijan's Ranking (in International Comparative Studies), 2006
- Rehabilitation of Post-Conflict Territories of Azerbaijan, 2010
- Social Orientation of the Economy in Right-Wing and Left-Wing Systems, 2014
- Post-Conflict Territories: Economic Potential and Comparative Advantages, 2023
- Government Regulation of Pricing: Cross-Country Analysis and Outcomes for Azerbaijan, 2024

Sessions

Time	Tuesday, August 25, 2026
08:00 – 09:00	Breakfast
09:00 – 09:40	Registration
09:40 – 10:00	Opening Ceremony
10:00 – 10:40	Keynote Speech Chair: R. A. Aliev, Azerbaijan J. Kacprzyk: Z-Numbers in Multistage Fuzzy Decision Making and Control: A Higher Expressive Power but at a Price
10:40 – 11:20	Keynote Speech Chair: W. Pedrycz, Canada R. A. Aliev: Toward Type-2 Z-Numbers
11:20 – 11:40	Tea/Coffee
11:40 – 13:00 Room 1	Session A Theory and Application of Soft Computing Chairman: K. Alieva
Investment Project Selection Problem based on Picture Fuzzy TOPSIS Approach I. Khutsishvili, G. Sirbiladze	
Sustainable Oil Refinery Facility Location Assessment Using Fuzzy Dynamic Group Decision Making with Z-Number Information K. Aliyeva	
Z-Information-Based Multi-Criteria Decision Making for Enterprise AI Platform Selection G. Huseynzada	
Output Quality Diagnostics for Possibility-Based Fuzzy Inference with an Application to SME Creditworthiness Assessment L. Gardashova, A. Huseynov, R. Shirinov	
EBNPO: Enhanced Binary Nomadic People Optimizer with Lévy Flight and Opposition Based Learning for Feature Selection A. Alwhelat, R. H. Abiyev	
11:40 – 13:00 Room 2	Session B Decision Theory with Imperfect Information Chairman: A. Nuriyev
A Multi-Criteria Teaching Quality Assessment Model Using Z Numbers L. K. Hajiyeva	
Z-Information-Based Decision Making Framework for Supplier Selection with Dependent Criteria K. I. Jabbarova	

P,Q,R-Fractional Fuzzy Linguistic MADM in Multi-Objective Temporary Logistics Hubs' Location-Selection Problem G. Sirbiladze, J. Kacprzyk, B. Ghvaberidze, B. Midodashvili, I. Khutsishvili	
Selection of Political Party Members Using AHP Method R. Abiyev, I. Gunsel, M. Tuzunkan	
Advanced Evaluation of Multisensor Systems Based on Type-2 Fuzzy Ideal Solution Theory K. Aliyeva, Sh. Mehdi	
13:00 – 14:00	Lunch
14:10 – 14:50	<i>Keynote Speech</i> Chair: J. Kacprzyk, Poland W. Pedrycz: Informed Machine Learning: Emerging Opportunities
14:50 – 15:30	<i>Keynote Speech</i> Chair: G. Sirbiladze, Georgia T. Allahviranloo: A Mathematical Framework for Artificial Intelligence under Reliability-Aware Uncertainty
15:30 – 15:50	Tea/Coffee
15:50 – 16:30	<i>Keynote Speech</i> Chair: N. Muzaffarli, Azerbaijan G. Sirbiladze: A New Direction of Temporal Fuzzy Modeling in Emergency Logistics Planning for Disaster Region
16:30 – 17:50 Room 1	<i>Session C</i> Decision Theory with Imperfect Information Chairman: I. Khutsishvili
Type-3 Fuzzy System for Measuring Food Security Using a Similarity-based Inference Mechanism R. Aliev, R. Abiyev, R. Aliyev, S. Abizada	
Decision-Making Framework for Food Service Selection Using Aspect-Based Sentiment Analysis and Fuzzy TOPSIS A. Mirzayev	
Z-number-based Multi-Criteria Decision-Making Approach for Company Performance Evaluation N. Ismayilova	
Z-Number-Based Multi-Criteria Evaluation of Adaptive E-Learning Content under Bimodal Information I. Mammadov	
Multicriteria Analysis of Polymer Composites using Triangular Fuzzy Numbers and TOPSIS Method M. T. Tarım, E. Yılmaz, Y. Uzunoglu, M. Doğan, L. Atabek Savaş	
16:30 – 18:00 Room 2	<i>Session D</i> Fuzzy Logic and Neuro-Fuzzy Technology Chairman: I. Kachiashvili
Neuro-Fuzzy Ordinal TSK Tiering for Interpretable Forecast Confidence I. Koberidze, M. Tsintsadze, M. Khachidze, M. Elizbarashvili, I. Gugunashvili	
Application of Syntactically Independent Linguistic Variables in the Fuzzy TOPSIS Method A. Bozhenyuk, I. Dubchak, O. Kosenko	

Development of an AI-driven Adaptive Voltage Management Framework for Smart Grid Distribution Networks in the High-Mountain Smart City of Shusha, Azerbaijan N. Yusifbayli, H. Guliyev, J. Mammadov, F. Ibrahimov, K. Hajiyeve	
Type-3 Fuzzy Neural Network for Stock Price Prediction R. Abiyev, R. Abizada	
Multi-Objective Optimization of Electric Vehicle Charging-Station Placement in Azerbaijan Using Evolutionary Algorithms A. Nuriyev, R. Talibzada, P. Kosov, G. Aghajanova	
Inverse Identification of Layered Soil Thermal Characteristics and Soil-State Class Using Neural Networks E. Gardashov	
09:00 – 19:00	Flexible Session Chairman: G. Huseynzada
19:00	Social Event

Time	Wednesday, August 26, 2026
08:30 – 09:30	Breakfast
09:30 – 10:10	<i>Keynote Speech</i> Chair: R. B. Eke, Turkey A. Mohammadzadeh: Advancement in Type-3 Fuzzy Systems and Control
10:10 – 10:50	<i>Keynote Speech</i> Chair: A. Averkin, Russia N. Muzaffarli: Methodological Foundations of Bipolar Measurement in Comparative Economic Research
10:50 – 11:10	Tea/Coffee
11:10 – 11:50	<i>Keynote Speech</i> Chair: J. Mammadov, Azerbaijan R. B. Eke: Logical Line in Data Granulation
11:50 – 12:30	<i>Keynote Speech</i> Chair: L. Gardashova, Azerbaijan R. Abiyev: Type-3 Fuzzy Inference Using Similarity Measure
12:30 – 13:30	Lunch
13:45 – 14:25	<i>Keynote Speech</i> Chair: T. Allahviranloo, Turkey Z. Selcuk: Z-Number-Based Fuzzy Approach to Measure Student Performance

14:25 – 16:25 Room 1	Session E Machine Learning, Deep Learning Chairman: K. Jabbarova
Assessing the Cross-Study Generalizability of Machine Learning Models Using DFT QSAR Descriptors for Corrosion Inhibitors V. Abbasov, R. Azizov, E. Aydinsoy, Z. Aghamaliyev, A. Mammadov, N. Dadashova, J. Babayev	
Robot Motion Control Using Z-conditional Reasoning L. Gardashova, B. Mammadova	
Machine Learning–Based Prediction of Critical Buckling Pressure in Steel Cylinders Reinforced with Fiber Reinforced Polymers C. R. Popa, M. Tănase	
Z-Number Interpretation of Uncertainty in Large Language Model Outputs L. M. Zeinalova, J. N. Aliyev	
Development of an Intelligent Architecture for the Automated Management of a Smart City Transportation System J. Mammadov, E. Mehbaliyeva, N. Hajibalayev	
Hybrid AI-driven Decision Support System for Digital Transformation of Drilling Operations Kh. Huseynov	
Machine Learning-Based Dynamic Resource Allocation for Intelligent Cloud Systems Ş. Köşker	
An Assessment of the Features Contributing to Concrete Compressive Strength Prediction with Machine Learning P. Akpınar, H. Güney	
14:25 – 16:25 Room 2	Session F Artificial Intelligence Tools Chairman: E. Ismayilov
Can LLMs Judge Themselves? Assessing Reliability and Bias in LLM-as-Judge Evaluation Pipelines N. Mammadova, E. Ismayilov	
Evaluation of Customer Loyalty in E-Commerce Using a Fuzzy Multi-Criteria Decision-Making Model Sh. Dadashov, R. Alekperov	
Machine Translation: Historical Development and Current Issues A. Mammadov	
Speech to Text Model for Georgian Sensitive Speech Data L. Z. Tabagari, I. K. Kachiashvili	
Where to Sample First? A GIS ML Ranking Tool Without Contaminant Data Yu. V. Trofimov, A. N. Averkin, M. D. Lebedev, A. D. Lebedev	
A Semantic Approach to Explanation Generation for Fuzzy Diagnostic Analysis of Microservices L. Gardashova, A. Mirzazada, P. Kosov	
Constraint-Aware Particle Swarm Optimization for Energy-Flow Scheduling in Residential PV-BESS Systems A. M. Jendeya, I. Babazade	
Wheat Yield Prediction in Shandong Province Using a Residual Cross-Attention Deep Network X. Li, B. Guo, A. Kartanova	

16:30 – 18:00	Session G Soft Computing and AI in Engineering, Material Science, Earth Sciences, Aerospace, Business, Economics, Finance, Social Sciences, Medicine, Chemical-Technological Processes and Pharmaceutical Sciences Chairman: L. Zeinalova
Automatic Identification of Military and Civilian Vehicles R. H. Abiyev, F. Eroglu	
A Soft Computing-Inspired Multi-Agent Framework for Health Misinformation Signal Analysis Using Large-Scale COVID-19 Twitter Data M. Göksu	
An Efficient and Explainable Deepfake Detection Framework for Social Media Images R. Ismayil, R. Abiyev	
A Schema-Guided Prompting Approach to Data Lineage Extraction in Production Banking Systems A. F. Huseynov, N. R. Nabiyev, E. A. Aydinsoy, Z. Aghamaliyev, J. Babayev	
Scalable Text Preprocessing for Extrinsic Plagiarism Detection: A Big Data and Parallel Processing Approach A. Ahmadzade	
AI Based Solution of Optimization Problem for the Efficient Synergetic Usage of Solar and Grid Energy E. Gardashov	
09:00 – 18:00	Flexible Session Chairman: G. Huseynzada
18:00 – 18:40	Round Table
18:40 – 19:00	Closing Ceremony

Time	Flexible Session
09:00 – 19:00 09:00 – 18:00	Session (Flexible) Chairman: G. Huseynzada
Fuzziness of the Lexical Level of Language Kamal Abdulla	
Evolutionary modeling as a method for evaluating the effectiveness of forced fluid withdrawal V. M. Mammadov, H. G. Hajiye, R. M. Mammadov	
The “web of ambiguity” within fuzzy logic and semantics: Kamal Abdulla and Rafik Aliev’s approach L. Bejenaru	
The contribution of the Rafik Aliev and Kamal Abdulla research collaboration to the theory of fuzzy logic L. Bejenaru, A. Barbăneagră	
Agentic AI Fuzzy Framework for Macroeconomic Stability Index Simulation Gorkhmaz Imanov, Asif Aliyev, Aynura Dostaliyeva	

Experimental Investigation and Mathematical Modeling of the Stress–Strain Properties of PVC and PET Polymers N. S. Rzayev, M. M. Bashirov, R. A. Iskanderov, S. A. Baghirov, A. S. Akhiev
3D modeling and visualization of the crystallization surface of solid solutions based on GeTe in the GeTe-Sb ₂ Te ₃ -Te system A. M. Orujlu, E. N. Orujlu, A. N. Mammadov, M. B. Babanly
A Multi-User Digital Training Environment Based on a Centralized Process Simulator and Hybrid 3D-Web Interfaces N. Yusupbekov, F. Adilov, A. Ivanyan, A. Korotaev, D. Alimov, S. Abdurakhmanov
Investigation of the thermodynamic properties of the Daridagh geothermal water of the Nakhchivan Autonomous Republic of Azerbaijan M. M. Bashirov, F. G. Amirov, N. S. Rzayev, A. M. Namazova, N. D. Nabiye
Data-driven green economy assessment of afforestation impacts on microclimate and moisture-related indicators N. Qadimli, U. Mammadov, S. Qenberov
Selection of wells for forced fluid recovery based on application of consequent diagnostic procedure V. M. Mammadov, H. G. Hajiyev, R. M. Mammadov, N. M. Amirli
Few Properties of Type-2 Fuzzy Sets A. Tserkovny
An Expected Utility-Based Decision-Making Approach under Z-Number-Valued Information A. I. Jabbarova, K. I. Jabbarova
Artificial Intelligence-Based Assessment of Students' Educational Needs and Psychological Characteristics for Social Adaptation in Educational Settings U. Verdiyeva, I. Emrahova, N. Ismayilzada
MedScribeAI: An AI-Assisted Clinical Reporting Plat-form for Voice-Based Medical Documentation N. Y. Kian, S. U. Abidemi, M. Z. Altabel, M. Darwish, S. Alturjman, F. Al-Turjman
Exam Scheduler P. Thom, M. Darwish, F. Aryanejad, S. U. Abidemi, M. Z. Altabel, P. N. Dipumba, S. Alturjman, F. Al-Turjman
Explainable Artificial Intelligence M. Shadmanfeat, S. Pirooz, C. P. Mlimwa, S. Alturjman, F. Al-Turjman
The Theory Of Uncertain Computation S. S. Kyauta, S. Salehnezhad, C. P. Mlimwa, S. Alturjman, F. Al-Turjman
Information Granulation J. Rashid, S. U. Abidemi, H. Fallah, C. Altrjman, S. Alturjman, F. Al-Turjman
A Study of Optimal Operating Modes for a Given Size and the Relationship Between the Components of Deep-Well Pumps Using Mathematical Statistics A. A. Quliyev, N. A. Gasanova, A. V. Sharifova
Assessing the Effectiveness of Financial Literacy Training Programs for Men: An Empirical Study F. Gasimov, E. Shafizade
Circular Economy Principles Application: Economic Effect of Entrepreneurship Activity in Balakhani Industrial Park N. Abbasova-Zeynalova, B. Husuyev, V. Mirzayeva
Improving the quality of audit decisions based on the integration of artificial intelligence and digital technologies: a conceptual and empirical approach A. Nadirova, R. Huseynova

Smart Tourism Destinations Evaluation Using Integrated Fuzzy AHP–TOPSIS Methodology Sh. Mehdi, N. Mehdiyev
Artificial Intelligence and Economic Planning: A Soft Computing Perspective on the Information Coordination Problem T. Hasanqarayev, J. Jafarly, Kh. Aliyev
A Z-number-based Assessment of Corporate AI-washing: Comparing Large Language Model and Human-expert Evaluation R. Huseynova, R. Hajiye
VIKOR Multi-Criteria Decision Making Method for Hotel Ranking A. Aliyeva, H. Temizkan
Integration of Geographic Information Systems (GIS) with Digital Libraries and Electronic Textbooks in the Context of Digitalization S. Safarova, S. Mammadova
Adaptive Soft Attention Fusion for Reliable Tumor Segmentation in Medical Images C. Kavalcioglu, Ç. Özkan, K. Dimililer
Assessment of the Environmental and Economic Conditions in the Oil and Gas Industry and AI-Based Diagnosis of Losses E. Iskandarov, M. Ramazanov, Z. Farzalizade, M. Shukurlu, A. B. Seisembekova
A Comprehensive Approach to Breast Cancer Detection Using Machine Learning Model E. Imanov, K. A. Kareem, G. E. Imanova
A Hybrid Approach to Intrusion Detection Systems: A systematic Review and Experimental Comparison of Anomaly-Based and Signature Based Model E. Imanov, A. C. Awurulor, G. Imanova
Determination of an Efficient Machine Learning Model for Concrete Compressive Strength Prediction H. Güney, P. Akpınar
Artificial Intelligence's Effect on the Humanities: Multidisciplinary Cooperation and Ethical Methods V. Askarov, V. Quliyeva
An Integration of Modified Adaptive Neural Network and Fuzzy Inference System for Intelligent Trend Forecasting of Some Distinguished Stocks Z. Hassanzadeh
A Comparative Evaluation of Machine Learning Techniques for Driving Style Classification O. Safaraliyev, Kh. Mammadova
How Long Does a Forecast Stay Broken? A Recovery-Time Diagnostic for Macroeconomic Models After Structural Shocks Y. Hasanli, U. Mammadzada
An Adaptive-Regularized Algorithm for Parametric Identification of Nonlinear Dynamic Control Objects H. Z. Igamberdiev, A. N. Yusupbekov, U. F. Mamirov, Z. Kh. Khankeldiyeva
Boundary-Fixed Failure-Pocket Repair for Max-Cut: Detector-Guided Validation and Quantum-Classical Repair Benchmarking A. Heidari Rashtabad, H. Altıparmak, Ş. Kaba
Application of Z-Prospect Theory in oil exploration G. Imanova
AI-Driven Analysis of Industrial Development Determinants in Azerbaijan: A LASSO Approach R. I. Hasanov, A. Eminov, N. Namazova
Expandable Big Data Clustering with Apache Spark Structured Streaming A. Jabiyeva, B. Bakhtiyarov

Intelligent Control Systems Based on Artificial Intelligence and Machine Learning for Safe Human-Robot Collaboration in Industry 5.0 F. Karimov, M. Karimova, M. Ahmadova, A. Nadirova
Defuzzification of Z-valued variables A. Alizadeh, R. R. Aliyev
Z-extension of the Zadeh, Aliev and Baczynski fuzzy implications Sh. Ahmadov
Artificial Intelligence in Educational Practice: AI Tools and Their Applications in Education L. Rashidova, G. Aliyeva, Y. Babayeva
Explainable Artificial Intelligence in Banking: The Effects of Explainability on Trust and Regulatory Compliance N. Mammadov, N. Namazova, N. Bakhishova
Digital Green Marketing Technologies Selection Under Z-environment G. Imanova, G. Imanova
Hybrid Use of Artificial Intelligence Methods in Decision Making: Analysis of Shopping Carts in Supermarkets V. Salahli, T. Gasimzade, F. Alasgarova, A. Guliyev
Towards similarity of type-2 Z-numbers R. A. Aliev, O. H. Huseynov, R. R. Aliyev
Estimation of product customer satisfaction under bimodal information S. Z. Eyupoglu, R. R. Aliyev
Using FMCGDM Method in Project Selection S. Akbarova
Analysis of the Chinese transport services market K. N. Shirinzade
Z-Inference and its application in robotics A. Alizadeh, R. Aliyev
Real-Time Biomechanical Posture Analysis Via In-Browser Deep Learning And 3D Visualization M. Arslan, S. Kocyigit, J. Alhajj
Development of Virtual Instruments for Monitoring and Intelligent Control of Technological Processes N. Yusupbekov, Sh. Gulyamov, U. Mukhamedkhanov, V. Shamsutdinova, A. Karaxanova, Z. Zayniddinova, M. Ismailov
Fuzzy Approach to Life Satisfaction Measure K. Rizvanova

General Information

1. Location

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2. Possible Accommodation for Participants

Epigraph Town Hotel

Address: 38a Tabukashvili Street, Tbilisi, Georgia

Web: <https://epigraph.ge/>

Costé Hotel

Address: 45a Merab Kostava Street, Tbilisi, Georgia

Web: <https://hotelcoste.ge/>

3. 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.

4. Important Dates

- last day for paper submission: July 31, 2026;
- last day for notification of acceptance: August 07, 2026;
- last day for conference registration: August 14, 2026;

5. Conference Fee

€300

Registration fee entitles you to:

- access to the conference sessions;
- get the final program and the proceedings;
- get a list of conference participants;
- have coffee during breaks;

6. Bank Account Information

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7. Conference Language

The conference language is English. There is no simultaneous translation available.

8. Abstracting and Indexing

Following the peer review, all the accepted papers will be submitted for publishing in the Springer's Series "[Lecture Notes in Networks and Systems](#)". This series are submitted for indexing by SCOPUS, EI Compendex, INSPEC, WTI Frankfurt eG, zbMATH, SCImago. All books published in the series are submitted for consideration in Web of Science. All are the highly recognized indexing platforms.