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News and calls

EUSFLAT

EUROPEAN SOCIETY
FOR FUZZY LOGIC
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Mathware & Soft Computing

The magazine of the European Society for Fuzzy Logic and Technology

Hot Topics

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Message from the Editor-in-Chief (April 2021)

HUMBERTO BUSTINCE

We are living strange and complicate times. The COVID pandemics has completely changed our world and our life in a way which was impossible to imagine just a few months ago. So let me first give my full support to all those who have suffered or are suffering the disease, in their own lives or in their beloved people.

The COVID pandemics has also affected our Mathware & Soft Computing magazine. But, in any case, I am deeply sorry for this huge delay in the appearance of the new issue. Restrictions and complications in our everyday life and in the university have not allowed us to complete it in time. But finally, it is here. Thanks a lot to Prof.Bedregal and Dimuro, for their hard work on the history of fuzzy theory in Brazil; to Prof.Kovalerchuk for his memorial on Prof.Resconi; to all of you who have submitted news and announcements. Thanks

to all this work, I am sure you will enjoy your magazine once again.

But, in any case, in this different times this is a different message. Rather than just commenting the contents of the journal, I want to play an optimistic note. Because, from the point of view of our scientific community, one positive aspect has arose from all this trouble: that of the relevance of science. Nowadays it is clear that only science can help to go out from this nightmare. And it is science who has done almost miracles, from creating a vaccine from scratch in just a few months to helping to arranging in a proper way the available resources and creating the possibility of keeping the communications among all of us. And I am sure that, as a community, we have made our best efforts to help with our scientific work, each of us in our own fields. And I am also sure that society as a whole has understood this point. Now, the society is absolutely aware of science as a possibility and a necessity, and we must work so that this new link is not broken, to keep and improve this new image of science, in general, and of the work of our community, in particular.

I expect that Mathware & Soft Computing can be a vehicle for this. As usual, that will depend on your contributions, because, as you know, it is you, all of us, who make this magazine.

Enjoy this new issue!

Humberto Bustince
Editor-in-chief

Message from the President (January 2021)

MARTIN ŠTĚPNIČKA

Dear EUSFLAT members,

let me welcome you in 2021 and let me wish youhealth, safety, happiness, and a successful journey back to your scientific as well as personal lives you had before the COVID-19 pandemic struck. We are, indeed, facing obstacles we had not been used to face. I know, that we are all tired by online teaching, we are all tired by working from home and by lacking real collaboration with personal interaction. However, I also know that our love to science is unbeatable, our eagerness for knowledge is infinite, our will to go on is unstoppable. This year, 2021, will not be an easy year. But it will be the comeback year.

We need to support our way back. We need to support the conference organizers.We need to support journals.We need to be a role model for our students. We need to be brave enough to risk a bit. If we wait, it will be hard to find organizers for future events. If we wait, our journals will go down. If we wait, our students will lose one more year. If we wait, we will make this year easy but the future will be difficult. If we do not wait, this year will be difficult but it will be a successful year. And I do not doubt about it.

Looking forward to meeting you in Luxembourg. Looking forward to meeting you in Bratislava. Looking forward to meeting you at any place where you wish to be and give a talk. Looking forward ... heads up.

Martin Štěpnička
President of EUSFLAT

Some historical accounts about the history of Fuzzy Logic in Brazil: an interview with Benjamin Bedregal by Graçaliz P. Dimuro

Benjamin Bedregal and Graçaliz P. Dimuro: a long-term friendship and research partnership.

Fernando Gomide and Ricardo Tanscheit: pioneers, togheter with Armando Rocha of Fuzzy Logic in Brazil.

Armando Rocha (Right): first paper in FSS; Joge M. Barreto (Left): first conference paper.

Prof. Dr. Benjamin Bedregal and Prof. Dr. Graçaliz P. Dimuro are both researchers on Fuzzy Logic and Systems, the first at the Federal University of Rio Grande do Norte (Natal, Brazil) and the latter at the Federal University of Rio Grande (Rio Grande, Brazil), two Brazilian universities located at the northeast and southern of the country, respectively, separated by around 3.500 km, considering a straight line. Despite the large physical distance between them, these two professors developed a great research partnership, in addition to a great friendship, with numerous joint articles, works in conferences and research projects. They constitute part of the second generation of researchers in fuzzy logic in Brazil. Actually, both researchers are mentioned in the ranking of the most influential researchers in the world in 2019, a study by Stanford University considering the 100,000 best researchers in all fields and also the 2% most influential in their research subfields [6].

The **Mathware & Soft Computing** magazine provides here a space for these researchers to talk about the evolution of fuzzy logic in Brazil, based on data and materials provided by important names who introduced the area in such country, such as Prof. Dr. Fernando Gomide (University of Campinas, São Paulo, Brazil) and Prof. Dr. Ricardo Tanscheit (Pontifical Catholic University of Rio de Janeiro, Brazil).

Raúl Pérez-Fernández: Let us start from the beginning. You are really interested in languages and, in particular, in the etymology of words, so did you – as a little boy from the outskirts of Ghent (Belgium) – always know you wanted to pursue a career in science, or was it a choice that was shaping itself as university was nearing?

Graçaliz P. Dimuro: Prof. Bedregal, tell us a little about the beginnings of fuzzy logic in Brazil.

Benjamin Bedregal.: The first reports I found on this subject in Brazil date back to 1969, and are related with the two-week visit of Prof. Lotfi Zadeh to COPPE (Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering) at Federal University of Rio de Janeiro. At that time, Prof. Zadeh also gave a lecture at USP (Univerisity of São Paulo) to a large audience. As a result of his visit to COPPE, several ideas and suggestions were given by Prof. Zadeh. The most important was the suggestion of creating the Systems Engineering and Computing Graduate Program at COPPE. In fact, it was created in 1970 and nowadays it is considered one of the most highly regarded graduate programs in computing of Brazil.

There is an anecdote of this visit to COPPE, which happened when he arrived at Galeão airport in Rio de Janeiro.

He was received with great enthusiasm by several young people. Prof. Zadeh thanked them for the kind reception, but asked very politely by the most senior professors. The young people answered him: "There is no senior professor!". In fact, the oldest of them was just over 25 years old at that time.

G. P. D.: What books have been published in the area with an author working in Brazil?

B. B.: Curiously, the production of books by publishers outside Brazil far exceeds those published in Brazil. The first one has as author Prof. Armando Rocha and was published in 1992, by Springer in the LNAI series (c.f. [13]).

L. Barros, G. P. Dimuro and B. Bedregal: the first is one of the authors of very popular books (bottom) [1, 2] on fuzzy logic among Brazilian students.

Note that, despite being a text on neural nets, it strongly addresses for the approximate reasoning and theory of fuzzy sets. Now, the first book completely in the area of fuzzy logic is the one written by professors Witold Pedrycz and Fernando Gomide (c.f. [10]). Since then, several books have been published in international publishers, among them [2, 3, 4, 8, 9, 11, 14]. Unfortunately, for books published in Brazil, we only have [1, 15, 17, 18], although the book by Laécio Barros and Rodney Bassanezi [1] can be considered the first reading for any undergraduate and even graduate students interested in fuzzy systems.

In my opinion a greater diversity of bibliographic material would contribute a lot in the training of people interested in the subject, which not always have facilities to read an English text.

G. P. D.: And what about the training of masters and doctors in Brazil?

B. B.: The first two Master thesis that I found are by Profa. Maria Irma Hadler, advised by Prof. Armando Freitas da Rocha, at UNICAMP, and by Prof. Ricardo Tanscheit, supervised by Prof. Jorge Muniz Barreto, at the Military Engineering Institute - IME, Rio de Janeiro, both in 1978. The oldest doctoral thesis in fuzzy systems was by a Chilean student, Prof. Heriberto E. Roman Flores, in 1989, who was advised by prof. Rodney Bassanezi, at UNICAMP.

Basically, at the beginning, the research on fuzzy logic and systems it was limited to large research centers in the states of São Paulo and Rio de Janeiro. However, nowadays there are researchers who publish in the area in practically all states in the country. It is clear that this greater number of people researching in fuzzy logic or adopting fuzzy techniques in their areas, together with a significant increase of graduate programs in Brazilian universities, leads to an increase in students carrying out their theses and dissertations on related topics to fuzzy systems. But not only the quantity had increased, also the quality of those developments is getting better and better, at least that is what I perceive in my participation in Master and Doctorate boards in Brazil. Concrete evidence of this is in the awards obtained by Brazilian students at events like NAFIPS and events in Brazil like CNMAC (National Conference on Applied and computational Mathematics) and BRACIS (Brazilian Conference on Intelligent Systems).

Laécio Barros flanked by Javier Montero and Marek Reformat.

Laécio Barros students Nilmara Pinto, Vinícius Wasques and Beatriz Laiate: Best Student Paper Awards at IFSA/NAFIPS 2019, by the hands of Javier Montero and Marek Reformat.

The students also won the Best Paper Awards at NAFIPS 2018. Vinicius was also awarded with the Best PhD Thesis at NAFIPS 2020.

Laécio Barros and his students Francielle Pedro and Luciana Gomes (with Estevão Esmin on the right): Outstanding Student Paper at IFSA 2015.

G. P. D.: Can you mention some of these and other awards obtained by Brazilian students?

B. B.: Just to mention a few in the past 3 years (the students' names are underlined):

1. NAFIPS 2020, Redmond, USA – Best PhD Thesis Awards:

- First Place: Fuzzy Differential Equations via Interactive Arithmetic: Applications to Biomathematics by <u>Vinícius Francisco Wasques</u> (adviser: Laécio C. de Barros).

- Second Place: Granular Feedback Linearization - An Approach using Participatory Learning by <u>Lucas Silva Oliveira</u> (adviser: Fernando Gomide and Valter Leite)

2. IFSA/NAFIPS 2019, Lafayette, USA - Best Student Paper Awards:

- Least square method with quasi linearly interactive fuzzy data: Fitting an HIV dataset by <u>Nilmara J. Biscaia Pinto</u>, Estevao Esmi, <u>Vinícius Wasques</u>, and Laécio C. Barros

- Choquet Calculus in the study of the dynamics of HIV transference by <u>Beatriz Laiate</u>, Rosana M. Jafelice, Estevão L. Esmi, and Laécio C. Barros

Camila Dias and awards received at international conferences: NAFIPS 2018 – Best Paper 2nd Place (on the top) and IFSA/NAFIPS 2019 – Outstanding Student Paper (on the bottom, received by her advisor, Graçaliz P. Dimuro, and Humberto Bustince, in whose group she spent the Master research mobility).

3. IFSA/NAFIPS 2019, Lafayette, USA – Outstanding Student Paper Award:

- Simulating the behaviour of Choquet-like (pre) aggregation functions for image resizing in the pooling layer of Deep Learning Networks by Camila A. Dias, Jessica C. S. Bueno, Eduardo N. Borges, Giancarlo Lucca, Helida Santos, Graçaliz P. Dimuro, Humberto Bustince, Paulo L. J. Drews Jr, Silvia S. C. Botelho, and Eduardo Palmeira.

4. NAFIPS 2018, Fortaleza, Brazil – Best Paper Awards:

- First Place: Numerical Solutions for Bidimensional Initial Value Problem with Interactive Fuzzy Numbers by Nilmara J. B. Pinto, Vinícius F. Wasques, Estevão L. Esmi, Laécio C. Barros:

- Second Place: Using the Choquet Integral in the Pooling Layer in Deep Learning Networks by Camila Alves Dias, Jéssica C. S. Bueno, Eduardo N. Borges, Silvia S. C. Botelho, Graçaliz P. Dimuro, Giancarlo Lucca, Javier Fernandez, Humberto Bustince, Paulo Drews Jr.

G. P. D.: Besides the 1969 visit by Prof. Zadeh to Brazil, do you know if he was in Brazil other times?

B. B.: Yes, indeed Zadeh came to Brazil in July 1995 to participate in the Sixth International Fuzzy Systems Association World Congress (IFSA 1995) held at the PUC-SP, São Paulo. In that conference, 600 articles were presented, tutorials in Portuguese and English, authors from different continents, and Prof. Armando Rocha (Unicamp) was the General Chair.

Brazilian researchers (Peter Sussner, Fernando Gomide, Marley Vellasco, Guilherme de Souza and Graçaliz Dimuro) at FUZZ-IEEE 2018, New Orleans, USA

B. B.: It is important to point out that the Brazilian researchers have organized several special sessions in international conferences outside Brazil, with numerous papers presented all over the world.

Additionally, Brazilians have a large cooperation with international research groups, which can be testified by the numerous joint papers that have been published year by year. Now, answering to your question, Brazil hosted another 3 international conferences:

1. 11th International FLINS Conference on Decision Making and Soft Computing (FLINS2014), August 17-20, 2014, João Pessoa, Brazil. Chair: Ronei Moraes (Brazil).

2. 37th Conference of the North American Fuzzy Information Processing Society, NAFIPS, July 4-6, 2018, Fortaleza, Brazil Chairs: Guilherme Barreto, Ricardo Coelho.

3. 2018 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2018), July 8-13, Rio de Janeiro. Chairs: Marley Vellasco (WCCI), Fernando Gomide (FUZZ-IEEE).

Prof. L. Zadeh at IFSA 1995 held in São Paulo, Brazil.

G. P. D.: What were the related international conferences besides IFSA 1995 that were organized in Brazil?

Brazilian researchers with Prof. Zadeh at NAFIPS 2012, USA

It is important to remark that we do have a Brazilian Congress of Fuzzy Systems (CBSF), which started in 2010, with the great support of SBMAC (Brazilian Society of Applied and Computational Mathematics), where we have a

Thematic Committee on Fuzzy Systems. Nevertheless, the Symposium on Fuzzy Logic Applications (SALF) occurred in 2006 and in 2008, as regional event that is considered the precursor of the national conference. We can say that CBSF is the only conference in South America dedicated to this subject. Before the organization of the CBSF, the researchers on fuzzy logic had to present their work at conferences on related areas, such as, the National Congress on Applied and Computational Mathematics (CNMAC), the Brazilian Symposium on Artificial Intelligence (actually the Brazilian Conference on Artificial and Computational Intelligence) and the Brazilian Congress on Automation.

G. P. D.: Tell us a little more about the history of the CBSF.

B. B.: In 2008, I contacted you to hear your opinion on the idea of proposing a mini-symposium on "Fundamentals and Applications of Fuzzy Logic" at CNMAC 2009 in Cuiabá, Mato Grosso.

And you Graçaliz gave me all the support and encouragement. I also suggested to the CNMAC organizers to invite Professor Fernando Gomide as a key-note speaker, and it worked. As the main region where fuzzy research is carried out was, and continues to be, the state of São Paulo, I contacted Laécio C. de Barros, professor at UNICAMP, who agreed to help organize this event and, among us three, we ran the project. By e-mail I asked Laécio about the possibility of holding a national event exclusively dedicated to the fuzzy area.

From the left, Graçaliz Dimuro and Benjamin Bedregal, organizers (together with Laécio Barros) of the mini-symposium on "Fundamentals and Applications of Fuzzy Logic" at CNMAC 2009, and Regivan Santiago, organizer of the e-mailing list of Brazilian researcher on fuzzy logic at that conference.

He told me that they had organized the Symposium on Applications of Fuzzy Logic (SALF) in Sorocaba, in 2006 and 2008, and, despite of their regional character, the last one had the participation of people from other states of Brazil, so they were already thinking about the possibility of extending the scope of SALF. At the end of our Mini-symposium, full auditorium, I presented data showing that the academic curriculum platform in Brazil, Lattes, contained, at that time, over 2,000 curricula (today there are more than 11,000) with some occurrence of the word fuzzy and that this showed the potential of having a national conference in the area. In the sequence, the people from Sorocaba manifested their support to this initiative, but suggested, since SALF had already gone beyond the regional scope, that this new event should be considered an evolution of SALF. He also suggested to adopt the same SALF's logo for the new national conference.

Audience of CBSF 2016 at Campinas, with Bernard De Baets as a key-note speakers. In the foreground, José Arnaldo F. Roveda, organizer of SALF at Sorocaba and the creator of the SALF/CBSF logo.

After several other supports to the new conference, unanimously it was decided to create the bi-annual event with the name Brazilian Congress of Fuzzy Systems (CBSF), to use a logo based on that of SALF, and that the first CBSF would be in Sorocaba, in the place of the third SALF.

Then, Prof. Regivan Santiago, asked everyone in attendance to write his name by email, as he would create an email list to disseminate information about the event. This list currently has 250 members. A thematic committee in Fuzzy Systems was also created within the SBMAC (Brazilian Society of Applied and Computational Mathematics). This mini-Symposium was a milestone to the consolidation of fuzzy systems as an independent research area in Brazil.

As early mentioned, the first CBSF was in Sorocaba, the second in Natal, the third in João Pessoa (in conjunction with FLINS), the fourth in Campinas and the last in Fortaleza (joint with NAFIPS). The 2020 edition was suspended because of the pandemic, and postponed to 2021 in a online format, on November 3-5, organized by UNESP university at São José do Rio Preto.

CBSF 2012, in the paradisiac city of Natal: audience with the key-note speakers Humberto Bustince (UPNA, Spain) and Vladik Kreinovich (UTEP, USA).

This conference is important for bringing together researchers from all over the country with interest or affinity with fuzzy logic and to publicize and encourage the area within Brazil, bringing internationally renowned researchers in the area, such as prof. Humberto Bustince, Bernard de Baets, Vladik Kreinovich, Didier Dubois, among others, as invited speakers and strengthen the exchange between researchers from different regions of the country.

G. P. D.: To close, talk about the perspectives and challenges for the area in Brazil.

B. B.: At the academy, the purpose and potential of fuzzy logic and techniques is increasingly known, and this is evidenced by the more than 6,000 Ph.D. (in the most diverse areas of knowledge) who included the word fuzzy in their curriculum Lattes. This has been reflected in the greater number of publications in events and indexed magazines from Brazilian researchers. In my viewpoint, the area is well consolidated at a national level, but even so we must strengthen our CBSF and cooperation between the various groups in the fuzzy area in Brazil, as well as incentive the interaction with other areas of knowledge. In the international scenario, we are still far from the level of other countries, but the presence of Brazilian researchers in events and cooperation with researchers from other countries is increasing. So I believe that we are on the right direction.

Another point that deserves attention is that we do not have an association, society or simply an official group in the area, who plays the role of spokesperson and representative, in various spheres. At now, we are being represented by SBA and SBMAC, in fact a coalition of both is associated with IFSA. Thus, I believe that it is not yet necessary to have such an entity, however its creation may be important in the future.

G. P. D.: Finally, I suggest to listen this interesting interview given by Prof. Gomide during WCCI 2018 at Rio de Janeiro:

https://drive.google.com/file/d/192EFWPwNx9BIYnq9s
9JdyYtzTOfzkuUD/view?ts=6009a10a

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Germano Resconi (1942-2020) and research on uncertainty modeling

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Germano Resconiwas born on September 26, 1942 and passed away on September17, 2020. His work heavily influenced the work of many scientists. He worked at the Catholic University in Italy and was very active in the community in different capacities, actively participating in the World Conferences on Computation Intelligence, and many others. He was heavily involved in research and discussion on foundations of fuzzy systems, and relations with other uncertainty theories, including probability theory and quantum physics. A deep analysis of Germano's contribution to the field is a topic of future studies. These notes are rather limited personal recollections of influenceof his work that I witnessed,and I expect willinfluence future research. I hope that these notes will demonstrate that, while physically Germano is not with us anymore, his work continues to influence us, and givesimpulses to new research.

For me, his death was very personal sad news.We collaborated, and published 11 papers together, on foundations of uncertainty modeling listed below [1-11]. We first met at the 11th European Meeting on Cybernetics and Systems in beautiful Vienna in spring 1992. Both of us worked on foundations of logic of uncertainty [12-15], and wanted to talk to George Klir, on this topic at that conference.George Klir (1932-2016) was a very influential figure in this area. His work heavily influenced both of us. Thus, these notes are inevitably in memory of both Gernano and George.

At that time, Germano collaborated with George on hierarchical uncertainty metatheory, based upon modal logic [12]. Also, George worked on possibility-probability conversions, and links with Dempster-Shafer belief theory, and wrote an influential paper "Is there more to uncertainty than some probability theorists might have us believe?" [16]. In my paper, on why belief functions are effective [14], it was shown that one of George's examples on Dempster-Shafer belief function, can be done with classical Markov chains, and I wanted to discuss with him, the advantages and disadvantages of using emerging uncertainty modeling theories. When I approached George, he was talking with Germano. This is how I met Germanothe first time. It started our many discussions on relations between the emerging new theories of uncertainty, and the probability theory. Next time I "met" Germano, when he commented on our paperwith George Klir, on the contextual interpretation of fuzzy membership functions with linguistic context spaces, and intersections of probability spaces [22]. At that time, I was at SUNY Binghamton, as a visiting professor, working with George during the 1994-1995 academic year.

Next time I met Germano at the Knowledge-Based and Intelligent Systems (KES) conferences in Italy in 2002, and in UK in 2003, and we started close discussions and collaboration. The results of those discussions, and our publications, are relevant to the current issues of uncertainty modeling theory and practice [24, 25]. Multiple uncertainty theories cover axioms and operations, on numeric values of uncertainties, such as subjective probabilities, fuzzy membership functions' values, belief functions' values, multivalued and modal logics values. However, they covered much less or completely left outside of the theories the ways of how to obtain these uncertainty values, which are critical for justification of the respective uncertainty theories and their practical applications.

To address this challenge Germano initiated with me an Agent-based Uncertainty Theory (AUT)and series of studies on logic of uncertainty with irrational self-conflicting agents [5, 7-11], as well as bridging probability theory and fuzzy

logic with copula [1], and works on neural and quantum uncertainty [2, 3, 4, 6]. The ideas of these papers are summarized below. We presented joint work at several conferences (WCCI, Hong-Kong, 2008; Barcelona, 2010; IJCNN, Atlanta, 2009) and others. It always was my pleasure to talk to Germano, host him at Central Washington University in 2005, and listen to his presentation to our faculty and students. Germano was well prepared to do this work. He published with Lakhmi Jain a book "Intelligent agents" in Springer in 2004 [19]. I tried to help them when they worked on this book, but I was occupied by another book project [23] therefore my involvement was minimal, while it prepared me better to work on agent-based uncertainty theory later with Germano.

In 2007, the community had a large discussion (Klir and others) on Elkan's theorem on the paradoxical success of fuzzy logic [18]. Germano and I responded with a paper âĂIJExplanatory model for the break of logic equivalence by irrational agents in Elkan's paradoxâĂİ at EUROCAST 2007 [10]. The main point of this paper is presented below in the summary of our papers. That discussion did not stop at that time, in 2014, Lotfi Zadeh published at BISC his previous correspondence with George Klir, as an argument in the discussion on foundationswith several people, whichis summarized in [24].

Germano was very a productive scientist. He expanded his work on intelligent systems and published a book "Geometry of knowledge for intelligent systems" in Springer in 2012. Last time we met face to face in Italy in 2016, discussing multiple new ideas and published a paper [1] in 2017. At that meeting in Venice, he talked about his new work on Morphogenetic Computing with colleagues. In 2017, he published with them another book âĂIJIntroduction to Morphogenetic ComputingâĂİ in Springer [21].

In conclusion, a few words about Germano as a person. He always was very respectful to everybody, extremely candid and tactful to the people who disagree with him. He did not hide those disagreements. Our last meeting with Germano and Cornelia was especially personal and enjoyable for me and Natalie when we spend time together in Venice. He left his family of wife Cornelia, daughters Silvia and Elisa and grandkids. May his soul rest in peace!

Short summary of joint papers. Full papers at

http://www.cwu.edu/ borisk/cv/Papers_by_Topics.htm

In [5] the agent-based uncertainty theory (AUT) wasintroduced. Traditionally agent-based systems use probabilistic and other uncertainty models without explicit involvement of agents in these uncertainty models. The advantages of AUT are that it provides a uniform agent-based representation, and an operational empirical interpretation for several uncertainty theories, such asrough set theory, fuzzy sets theory, evidence theory, and probability theory. The paper shows also that the introduction of agents, to intuitionist uncertainty formalisms, can reduce their conceptual complexity. To build such uniformity, the AUT exploits the

fact that agents, as independent entities, can give conflicting evaluations of the same attribute.The AUT is based on complex aggregations of crisp conflicting judgments of agents.

In our paper [1], a copula as a bridge between probability theory and fuzzy logic was established. This work shows how dependence, in many-valued logic and probability theory, can be fused into one concept by using copulas and marginal probabilities. It also shows that the t-norm concept used in fuzzy logic is covered by this approach. This leads to a more general statement that axiomatic probability theory (which is much wider than statistical interpretation of probability) is able to cover the logic structure of fuzzy logic. This paper shows the benefits of using structures, which go beyond simple concepts of classical logic and set theory for the modeling of dependences.

In [2] a quantum and neural uncertainty models are presented using the Agent-based Uncertainty Theory (AUT). The AUT fuses complex crisp conflicting judgments of agentsproviding a uniform representation, and an operational empirical interpretation, for rough set theory, fuzzy sets theory, evidence theory, and probability theory. This agent approach gives a novel definition of the quantum uncertainty and quantum computations for quantum gates, which are realized by unitary transformations of the state. It introduces classical logic into the quantum domain, with the concept of quantum gate, and connects the intrinsic irrationality of the quantum system, and the non-classical quantum logic with the agents. A major argument is that AUT can help to find meaning for quantum superposition of non-consistent states. Next, it shows that the neural fusion at the synapse can be modeled by the AUT in the same fashion by transformingclassical logic expressions into many-valued logic expressions. The motivation for such a neural networkis providing high flexibility and logic adaptation of the brain model.

In [3] the agent-based uncertainty logic network is proposed. Boolean and discrete networks play an important role in many domains such as cellular automata. This work generalizes the concept of Boolean networks for complex situations, with multiple agents acting under uncertainty. It creates a logic network using a concept of the Agent-based Uncertainty Theory (AUT). An AUT network extends the traditional inferential process, by using a set of logic matrices, obtained from AUT logic evaluation samples, connected in a network. This network computes transformations of AUT logic vectors, and gives logic rules for uncertainty situation. The AUT logic network generalizes the Boolean network, whichconsists of a set of Boolean variables, whose states are determined by other variables in the network. An AUT logic network is formed by a set of agents, presented as vector variables, whose states or logic vector evaluations are determined by other variables in the network.

In [4] an agent uncertainty model and a quantum mechanics representation are presented with non-locality modeling. It connects the Agent-based Uncertainty Theory (AUT) with quantum mechanics, where agents are interpreted in terms of the particles. It justifies AUT operations as physically meaningful, and provides a new explanatory mecha-

nism for contradictory issues in quantum mechanics. The AUT is described in agent terms and then is interpreted in quantum mechanics terms. The AUT many-valued logic is a derived from classical logic with local and global evaluations of a proposition. The evaluation by an individual agent is called a local evaluation and evaluation by a set of agents is called a global evaluation of a proposition. Here the local operations AND, OR, NOT are classical logic operations, but global operations differ from them where a set of agents generates the vectors of logic values. In the AUT, local evaluations of a proposition by different agents can be in conflict in contrast with the classical logic. In quantum mechanics, non-locality is related to the superposition of different positions of the particles, and to representation of two particles in different positions, as a single non-local particle with correlation or entanglement.

In [5] an agents' model of uncertainty is explored. Multiagent systems play an increasing role in sensor networks, software engineering, web design, e-commerce, robotics, and many other areas. Uncertainty is a fundamental property of these areas. Agent-based systems use probabilistic and other uncertainty models developed earlier without explicit consideration of agents. This work explores the impact of agents on uncertainty models and theories. It compares two methods of introducing agents to uncertainty theories in a new agent-based uncertainty theory (AUT). The advantages of AUT are that it provides a uniform agent-based representation and an operational empirical interpretation for several uncertainty theories. This work showsthat the introduction of agents to intuitionist uncertainty formalisms can reduce their conceptual complexity. To build such uniformity the AUT exploits the fact that agents as independent entities can give conflicting evaluations of the same attribute. The generality of AUT is derived from the logical classification of types (orders) of conflicts in the agent populations. At the first order of conflict, the two agent populations are disjoint and there is no interference of logic values assigned to any statement p, and its negation by agents. The second order of conflict models superposition (interference) of the logic values for overlapping agent populations, where an agent assigns conflicting logic values (true, false) to the same attribute simultaneously.

In [6] agents in neural uncertainty are studied. It models neural uncertainty using the Agent-based Uncertainty Theory (AUT). This paper shows that the neural fusion at the synapse can be modeled by the AUT. The neuron is modeled as an operator that transforms classical logic expressions into many-valued logic expressions. The new neural network has neurons at two layers. The first-layer agents implement the classical logic operations, but at the second level, neurons or nagents (neuron agents) compute the same logic expression with different results for different agent inputs. The motivation for such neural network is to provide high flexibility and logic adaptation of the neural model.

In [7] fusion in Agent-based Uncertainty Theory (AUT) and neural image of uncertainty are explored. In neural network modeling, the goal often is getting a most specific crisp output (e.g., binary classification ofobjects) from neu-

ron inputs that have multiple possible values. This work changes the viewpoint and assumes that the neuron is an operator, which transforms binary classical logic input to the many valued logic output, e.g., changes crisp sets into fuzzy sets. In this interpretation, the neural network is composed of agents or neurons, which work to implement uncertainty calculus and many valued logics from crisp perceptual input. This idea is closely related to the Dynamic Logic approach and recent cognitive science experimental discoveries. According to this model having crisp perceptual input, brain (1) produces a less certain representation, (2) processes input at this uncertainty level of representation, (3) converts results to the next more certain level of informationrepresentation, (4) processes this information and (5) repeats these steps several times until the acceptable level of certainty is reached. To build such a model we rely not on the binary logic, but on the logic of the uncertainty to obtain the high flexibility and logic adaptation of the described process.

In [8] a hierarchy of logics of irrational and conflicting agents is explored. It proposes a hierarchy of logics of agents relative to levels of their conflicts, self-conflicts and irrationality to provide a base for several studies on foundations of the theories of uncertainties. These studies include the foundation of known uncertainty theories (probability theory, fuzzy logic, and others) as well as new logics and types of uncertainties. Probability theory, fuzzy logic, and other theories of uncertainties provide a calculus for manipulating with probabilities, membership functions, and other types of uncertainty indicators. However, these theories lack a mechanism for getting initial (basic) uncertainties. The proposed hierarchy of conflicting and irrational agents creates a base for generating uncertainty values, logic operations with these values, and for comparing different types of uncertainty for the preference relation. A core concept of this hierarchy is the concept of expansion by superposition that includes fusion and adjustment of contradictory events and statements.

In [9] break of logic symmetry by self-conflicting agents, relative to descriptive and prescriptive rules, is presented. Classical axiomatic uncertainty theories (probability theory and others) model reasoning of rationalagents. These theories are prescriptive, i.e., prescribe how a rational agent should reason about uncertainties. Inparticular, it is prescribed that (1) uncertainty P of any sentence p is evaluated by a single scalar P(p) value, (2) thetruth-value of any tautology (p∨¬p) is true, and (3) the truth-value of any contradiction (p∧¬p) is false for everyproposition p. However, real agents can be quite irrational in many aspects and do not follow rational prescriptions. In this paper, we build a Logic of Irrational and conflicting agents called I-Agent Logic of Uncertainty (IALU) as a vector logic of evaluations of sentences. This logic does not prescribe rules on how an agent should reason rationally but describe rules on how agents reason irrationally. This is a descriptive not prescriptive theory in contrast with the classical logic and the probability theories. This provides anew possibility to better understand and model uncertainties associated with social conflict phenomena. The work shows that the fuzzy logic has a potential to become a scalar version of a descriptive logic of irrational

agents because it satisfies several necessary conditions of IALU.

In [10] explanatory model is presented for the break of logic equivalence by irrational agents in Elkan's paradox. Fuzzy logic breaks logic equivalence of statements such as(A∧B)∨(¬A∧B)∨(A∧¬B) and A∨B. It breaks the symmetry of use of such logically equivalent statements. There is a controversy about this property. It is called a paradox (Elkan's paradox) and viewed as a logical weakness of fuzzy logic. In the opposite view, it is not a paradox, but a fundamental postulate of fuzzy logic, and one of the sources of its success in applications. There is no explanatory model to resolve this controversy. This paper provides such a model using a vector/matrix logic of rational and irrational agents, which covers scalar classical and fuzzy logics. It is shown that the classical logic models rational agents, while fuzzy logic can model irrational agents. Rational agents do not break logic equivalence in contrast with irrational agents. This work resolves the paradox by showing that the classical and fuzzy logics have different domains of rational and irrational agents.

In [11] the logic of uncertainty with irrational Agents is presented. Modern axiomatic uncertainty theories (fuzzy logic, probability theory, and others) provide a calculus for manipulating with probabilities, membership functions, and degrees of belief, when the initial valuessuch as probabilities of elementary events are already given. These theories do not include a mechanism for getting initial uncertainty values. The value of these theories is in computing uncertainties of complexevents, which follow a structure imposed by axioms of a specific uncertainty theory. The lack of internalmechanism, for getting initial values, often means that the same mechanism is applied for getting initial probability values, fuzzy logic membership functions, and belief functions. This is a source ofmuch confusion – what is the real difference between all these theories. A resolution of this confusion is critical from both theoretical and practical viewpoints. This work argues that adding an internal mechanism of getting uncertainty values means adding irrational, conflicting and interacting agents along with their contexts.

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NEWS

Ph.D. Thesis defended by Katarzyna Miś

University of Silesia in Katowice, Poland

Katarzyna Miś defended her Ph. D. Thesis entitled *Generalized schemas and rules of reasoning in fuzzy logic* on September 23rd, 2020.

Schemas and rules of reasoning are usually used in approximate reasoning. This is an important tool since it allows us to obtain meaningful conclusions from imprecise data. It has many applications in areas like: decision theory, risk analysis, fuzzy control and data mining. In classical logic, one of the most common used scheme is modus ponens which can be seen as:

$$\frac{A \rightarrow B \ \wedge \ A}{\therefore \quad B}$$

Its generalized version can be described as follows:

RULE:	IF x is A,	THEN y is B.
FACT:	x is A'.	
CONCLUSION:		y is B'.

As we can see objects x, y have some properties A, B and A', B' (represented by fuzzy sets). Usually, elements of a pair (A, A') are only slightly different and the same is required form a pair (B, B'). We are able to compute values of such fuzzy sets using some rules of inference - Zadeh's compositional rule of inference (*CRI*) and Bandler-Kohout subproduct (*BKS*). For the scheme of modus ponens, formulas that allow us to compute the conclusion's values are the following:

$$B'(y) := \sup_{x \in X} T(A'(x), I(A(x), B(y))), \quad y \in Y,$$

$$B'(y) := \inf_{x \in X} I(A'(x), T(A(x), B(y))), \quad y \in Y,$$

where T is a t-norm (or any other generalization of a classical conjunction) and I is a fuzzy implication (or a generalization of a classical implication).

One of the basic properties which is required for these rules is a property of interpolativity, which is nothing else but satisfying the classical version of modus ponens:

$$B(y) = \sup_{x \in X} T(A(x), I(A(x), B(y))), \quad y \in Y.$$

Furthermore, we consider all possible values of fuzzy sets - all unit interval and (with interpolativity) obtain the following functional equations:

$$y = \sup_{x \in [0,1]} T(x, I(x, y)), \quad \text{(CRI-GMP)}$$

$$y = \inf_{x \in [0,1]} I(x, T(x, y)), \quad \text{(BK-GMP)}$$

which should be satisfied for every $y \in [0, 1]$.

There are three other schemas of inference examined in the thesis:

(i) hypothetical syllogism,

(ii) modus tollens,

(iii) law of reduction to absurdity.

These schemas of reasonig applied for two rules (CRI and BKS) give the following equations:

$$I(x, y) = \sup_{z \in [0,1]} (T(I(x, z), I(z, y))), \quad x, y \in [0, 1],$$
$$\text{(CRI-GHS)}$$

$$I_2(x, y) = \inf_{z \in [0,1]} I_1(T(x, z), T(z, y)), \quad x, y \in [0, 1],$$
$$\text{(BK-GHS)}$$

$$N(x) = \sup_{y \in [0,1]} T(N(y), I(x, y)), \quad x \in [0, 1], \quad \text{(CRI-GMT)}$$

$$N(x) = \inf_{y \in [0,1]} I(N(y), T(x, y)), \quad x \in [0, 1], \quad \text{(BK-GMT)}$$

$$x = \sup_{y \in [0,1]} T(N(y), I(N(x), y)), \quad x \in [0, 1], \quad \text{(CRI-GRA)}$$

$$x = \inf_{y \in [0,1]} I(N(y), T(N(x), y)), \quad x \in [0, 1], \quad \text{(BK-GRA)}$$

where T is a t-norm, I, I_1, I_2 are fuzzy implications and N is a fuzzy negation. Moreover, we investigate functional inequalities which can be obtained from lattice operations in Boolean algebra and then extented to some fuzzy connectives:

$$T(x, I(x, y)) \leq y, \quad x, y \in [0, 1] \quad \text{(MP)}$$

$$T(I(x, z), I(z, y)) \leq I(x, y), \quad x, y, z \in [0, 1] \quad \text{(HS)}$$

$$T(N(y), I(x, y)) \leq N(x), \quad x, y \in [0, 1] \quad \text{(MT)}$$

$$T(N(y), I(N(x), y)) \leq x, \quad x, y \in [0, 1], \quad \text{(RA)}$$

In the first two chapters neccesary fuzzy sets theory and approximate reasoning notions are introduced. In the main part of the thesis we consider functional equations and inequalities mentioned above when one function is given - usually a t-norm T (or a semicopula or any other generalization of a classical conjunction). Therefore, some solutions for chosen families of fuzzy implications are shown. Each next chapter contains solutions for different reasoning scheme.

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Two last chapters shortly provide information about other possible functional equations that might be received when combining rules of inference and different fuzzy relations. We also mention there about other notions regarding approximate reasoning like similarity based reasoning or FITA and FATI strategies.

Some of the results presented in the thesis have been already published in referred papers in proceedings [2, 4] which were obtained in collaboration with M. Baczyński and P. Helbin and [1, 3] - prepared with M. Baczyński.
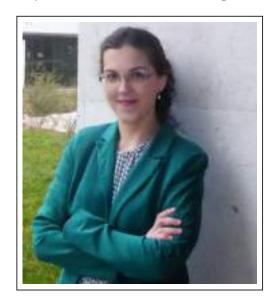
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Ph.D. Thesis defended by Raquel González del Pozo

University of Valladolid, Valladolid, Spain

Raquel González del Pozo defended her PhD Thesis, entitled "Ordinal treatment of ordered qualitative scales: analysis, methods and applications". Her supervisor is José Luis García-Lapresta from the University of Valladolid. The thesis was defended on November 27, 2020 at University of Valladolid, Spain, with the following jury:

- Núria Agell Jané, Universitat Ramon Llull, Spain.

- José Rui Figueira, Instituto Superior Técnico. Universidade de Lisboa, Portugal.

- Daniel Gómez González, Universidad Complutense de Madrid, Spain.

The dissertation focuses on the analysis of non-uniform qualitative scales, that is, qualitative scales where individuals can perceive different psychological proximities between consecutive linguistic terms of the scales.

This doctoral thesis uses the concept of ordinal proximity measure for handling non-uniform ordered qualitative scales in a purely ordinal way. Ordinal proximity measurescollect the information about how individuals perceive the proximities between the terms of scales using sets of ordinal degrees of proximity.

The main objective of this thesis is the analysis, extension and applications of ordinal proximity measures to different contexts. To do that, several procedures for generating and aggregating ordinal proximity measures have been designed, and new multi-criteria decision-making models have been proposed.

The thesis is structured intofour chapters. Each chapter corresponds to an article publishedin a peer-reviewedacademic journal.

The first chapter is devoted to analyze ordinal proximity measures and design new procedures to generate and aggregate ordinal proximity measures. The chapter introduces the notion of metrizable ordinal proximity measure and proposes an aggregation procedure that avoids problems and inconsistencies when metrizable ordinal proximity measures are aggregated.

The second chapter addresses the handling of ordered qualitative scales by different national and international organizations. In particular, this chapter focuses on discussing and analyzing the methodology used by the Spanish Center for Sociological Research (CIS, in Spanish) consisting of grouping together several response categories.

The third chapter presents a multi-criteria decision-making procedure that incorporates the possibility of doubt allowing agents to assess the alternativesthrough one or two consecutive linguistic terms when they are unsure about which linguistic term to use.

Finally, the last chapterproposes a multi-criteria decision-making procedure that manages information from different ordered qualitative scales. This procedure postpones as long as possible the use of numerical values in order to preserve and respect the ordinal information of the scales.

The main results of this thesis, which has been presented as a compendium of published articles, can be found in several high impact international journals such as: Information Sciences, European Journal of Operational Researchand Mathematics.

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Ph.D. Thesis defended by Aleksandar Rakićević

University of Belgrade, Faculty of Organizational Sciences, Belgrade, Serbia

Aleksandar Rakićević defended his PhD Thesis, entitled "Adaptive fuzzy system for algorithmic trading: Interpolative Boolean approach", on November 10, 2020. His advisor was Dr. Bratislav Petrović from the University of Belgrade.
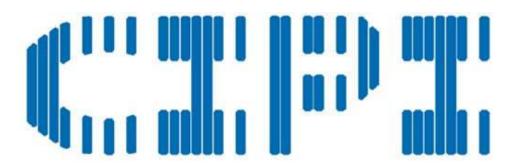
The general aim of the thesis was to introduce Interpolative Boolean Approach to modeling, data analysis and control and its application to financial modeling and algorithmic trading. The proposed approach is based on interpolative Boolean algebra (IBA) and it enables fuzzy modelling and control that preserves all Boolean axioms (laws of contradiction and excluded middle are valid in real-valued case). Using this approach, we've been able to develop novel logic-based models for fuzzy recognition of price patterns in financial markets, identify the logical structure of data that has enabled us to automate the interpretation of financial analysis data and to build an interpolative fuzzy controller to manage algorithmic trading on financial markets.

The proposed Interpolative Boolean Approach was applied to construct an adaptive fuzzy system for algorithmic trading. The proposed system has four components: data analysis component, trading logic component, learning component and reporting component. The proposed system is based on the interpolative fuzzy controller of Tsukamoto type that is used to capture trading logic and genetic algorithm that is able to extract successful trading strategies from historical data and adapt interpolative fuzzy controller in case its trading performance deteriorate over time. The proposed adaptive fuzzy system for algorithmic trading is tested on US stock market data, foreign exchange data and cryptocurrency data. Backtesting results confirms the system is able to sucessfully extract trading model (logic) from historical data, use it for trading and adapt the model if trading performance deteriorate significantly. The obtained results look promising, especially for the cryptocurrency and foreign exchange data.

Thesis is well organized and easy to comprehend. It first provides an overview of the basic theories of financial markets and concepts of algorithmic trading. Then comes an overview of the basic theoretical concepts of fuzzy logic and detailed explanation of interpolative Boolean algebra theory. The Thesis continues with a detailed review of fuzzy systems for algorithmic trading, with the special attention paid to self-learning fuzzy systems. This is followed by the description of data and explanation of the method for dealing with missing data and performance measures. The main contribution of the Thesis is presented in thenext two chapters. The former introduces Interpolative Boolean Apprach to fuzzy modeling, data analysis and control. The latter presents the adaptive fuzzy system for algorithmic trading and its backtesting results obtained on U.S. equity market, foreign exchange market and cryptocurrency market data.

III International Conference on Information Processing
(ICIP 2021)

Convención Científica Internacional UCLV
Universidad Central "Marta Abreu" de Las Villas

Cuba, 15-19 de noviembre del 2021
http://convencion.uclv.cu

Dear colleagues:

The Faculty of Mathematics, Physics and Computation of the Universidad Central "Marta Abreu" de Las Villas (UCLV) is pleased to invite you to the III International Conference on Information Processing (ICIP 2021). The event will be held within the context of the International Convention on Science, Technology and Society, to be held from November 15 to 19, 2021 at the tourist resort located in the north of Villa Clara Province, Cuba. The event will be developed under the general theme: "ICT research for sustainable development of a digital society". It will be a pleasure to welcome you.

Organized By

- Informatic Research Center
- Direction of Information Communications Technology (DICT)
- Direction of Technical and Scientific Information
- Faculty of Mathematics, Physics and Computing

Purpose of the event

The Central University "Marta Abreu" of Las Villas, institution of Excellence in Higher Education in Cuba, is one of the leaders in the use and application of Information and Communication Technologies (ICT).

The rapid development of ICT has led to a change in the formats and ways in which information is sought, retrieved, processed and used.

The objective of CIPI 2021 is to disseminate the main scientific results achieved in the field of information technologies and promote a framework for scientific exchange on these. The event includes tutorial courses, specialized conferences, and keynote presentations.

Main Themes

- Artificial Intelligence: Metaheuristics, Softcomputing (fuzzy sets, rough sets, etc.), Intelligent systems, Data science, Big data, explainable AI.
- Information Systems: Programming technologies and Information systems: Paradigms, programming languages and environments, Web 2.0 and Semantic Web, Methodologies, technologies, and techniques for information management and analysis, Visual Analysis, Database technologies, Software engineering, Geographic information systems.
- Digital Signal and Image Processing (DSPI): Digital Signal Processing, Image Processing, Artificial Vision
- High performance computing: Scientific computing systems, support platforms for HPC and BigData services, supercomputer infrastructure and service orchestration, parallel and distributed computing applications.
- Cyber Physical Systems: Embedded systems, hybrid systems, real-time systems, sensor networks, Internet of Things (IoT), industrial Internet, Industry 4.0, digital twins, intelligent cities, smart anything (environment, agriculture, energy, transportation, buildings, hospitals, houses, appliances, devices), artificial intelligence of things (AIoT).

- Information Sciences: Open Science and Education, Challenges and transformations for the management of information and knowledge in times of pandemic, Digital Governance, Professional Training, Archives, Scientometry-Bibliometrics and Alternative Metrics.

As part of CIPI2021, the "Workshop on the university-company relationship in the computerization of society and the software industry" will be held, with emphasis on the following topics, although not limited to them:

- University-company productive linkages.
- Experiences and good practices in the export of software.

This space will aim to promote synergies that enhance the export of software through the exchange between professionals from universities, companies and entities in the ICT sector.

The forum will be aimed at national and foreign companies, chambers of commerce and ICT industries, national and foreign ICT professionals, national and foreign universities, the Cuban Information Technology Union.

Steering Committee

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Event coordinator: Msc. Frank Reyes

Conference publications

All accepted papers will be included in the conference proceedings and will be made available at the date of the conference. The proceedings will have an ISBN and will be produced by UCLV's publishing house "Samuel Feijó".

Moreover, extended versions of selected papers will be published in special issues of scientific journals (Cuban journal of Informatics Sciences, Cuban journal of digital transformation, Publicando journal and other to be announced soon).

At least one of the authors must complete the conference registration by the early registration deadline; otherwise, the paper will not be included in the conference proceedings.

Pre-event courses

CIPI 2021 includes the delivery of pre-event courses taught by specialists of recognized prestige. The courses will take place at the UCLV days prior to the conference. Those interested in attending these courses should contact the organizers to inform them of their interest, as there are limited places.

Official languages

The official languages of CIPI 2021 are Spanish and English.

The works must be written in any of these languages, but according to the postproceeding that are later defined, possibly only one of them will be established so that a paper can be selected for publication in it. Authors must adhere to the Convention's guidelines for authors using Microsoft Word or LaTeX templates. The works must have a maximum of twelve (12) pages.

Dates of interest:

- Reception of abstracts and papers: June 23, 2021

- Notification to authors about the results of the review of the papers: August 23, 2021

- Delivery of the final version of the accepted works: September 23, 2021

- Submission of papers may be made from May 15, 202

- The registration fees are published in the Convention website.

Virtual event

CIPI2021 will also hold a virtual session where the text in pdf, a presentation in pdf format and a 10-minute video with the oral presentation will be available for each accepted article. Participants will be able to make comments or questions to the authors and speakers.

Relevant news   6-9 July, Granada, Spain

Deadline for long abstract extended until May 15th.

ISIPTA 2021 will be basically a virtual conference. However, if Covid-19 conditions allow it, there will be a possibility of in person attendance in Granada. For more details see the conference venue information.

Info about ISIPTA 2021

ISIPTA is the primary international forum about theories and applications of imprecise probability. The symposium is open to contributions on all aspects of imprecise probability, which is a generic term for the many mathematical and statistical models and methods that allow us to measure chance or uncertainty without the restriction of sharp probabilities. This includes (but is not limited to) sets of probability measures, partial preference orderings, game-theoretic probability, choice functions, interval probabilities, belief functions, and possibility theory.

The biennial ISIPTA conferences (organized by the **The Society for Imprecise Probability: Theories and Applications**) are being organized since 1999, and are devoted to presenting and discussing recent advances in this field. The idea of imprecision in probability goes back to Boole in the middle of the nineteenth century. Previously to this conference, it was developed in a scattered way in different fields, including economics, decision making, statistical inference, artificial intelligence, reliability, psychology, and medicine. ISIPTA has served as a forum in which differences and similarities between alternative approaches have been better understood, allowing a more unified development of the theory.

In this edition, we encourage the submission of methodological tools, including software allowing the automation of the process of modelling and reasoning, contributions showing the added value of imprecision in fields where traditionally uncertainty is modelled by probability, as well as applications solving real world problems.

The conference enforces an open environment where interaction and confrontation of ideas are the primary objectives. To achieve this, there will be no parallel sessions, and each accepted paper will be presented both in a plenary session (brief introduction to the main ideas) and in a poster session (for detailed discussion). There will also be the option of presenting ongoing research, preliminary results, or recently published journal papers in a poster, accompanied by a 1-page abstract.

The local organisation can be contacted at **isipta@decsai.ugr.es**.

We look forward to seeing you in Granada next year!

The 18th International Conference on Modeling Decisions for Artificial Intelligence, Sep 27-30, 2021

In MDAI (Modeling Decisions for Artificial Intelligence) we are particularly interested in the different facets of decision processes in a broad sense. This includes model building and all kind of mathematical tools for data aggregation, information fusion, and decision making; tools to help decision in data science problems (including e.g., statistical and machine learning algorithms as well as data visualization tools); and algorithms for data privacy and transparency-aware methods so that data processing processes and decisions made from them are fair, transparent, explainable and avoid unnecessary disclosure of sensitive information.

The MDAI conference includes tracks on the topics of (i) data science, (ii) machine learning, (iii) data privacy, (iv) aggregation funcions, (v) human decision making, and (vi) graphs and (social) networks. The conference has been since 2004 a forum for researchers to discuss last results into these areas of research. MDAI 2021 is the 18th MDAI conference.

Time : **September 27-30, 2021**

Place: **On-line** (+, if possible, hybrid Umeå, Sweden)

Source, call for papers and more information: http://www.mdai.cat/mdai2021/

Submission deadline (for LNAI proceedings): **April 5th, 2021**

Submission deadline (for USB-only proceedings): **May 31th, 2021**

The 19th World Congress of the International Fuzzy Systems Association
and
the 12th Conference of the European Society for Fuzzy Logic and Technology

IFSA-EUSFLAT2021

organized jointly with

AGOP 2021 - International Summer School on Aggregation Operators
IJCRS 2021 - International Joint Conference on Rough Sets
FQAS 2021 - International Conference on Flexible Query Answering Systems

Bratislava, Slovakia
September 19-24, 2021

The topics addressed by the Conference cover all aspects of fuzzy logic and soft computing, namely (but not limited to):

Approximate reasoning
Clustering and classification
Cognitive modelling
Intelligent data analysis and data-mining
Data aggregation and fusion
Database management and querying
Theory and applications of decision-making
Forecasting and time series modelling
Fuzzy control
Theoretical foundations of fuzzy logic and fuzzy set theory
Imprecise probabilities and fuzzy methods in statistics
Image processing and computer vision
Information retrieval
Knowledge representation and knowledge engineering
Linguistic modelling
Machine learning
Natural language processing, generation and understanding
Neuro-fuzzy systems
Stochastic and fuzzy optimization
Possibility theory and applications
Rough sets theory
Semantic web
Uncertainty modelling

Important dates

Special session proposal deadline
October 31, 2020

Paper submission
March 10, 2021

Abstract submission
April 12, 2021

Notification of acceptance
May 5, 2021

Early registration
June 7, 2021

Camera-ready paper submission
May 25, 2021

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