Mathware & Soft Computing

The magazine of the European Society for Fuzzy Logic and Technology

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Message from the Editor-in-Chief (June 2018)

HUMBERTO BUSTINCE

Once again, the year is finishing, and with the last days of 2018, the new issue of the Mathware&Soft Computing online magazine arrives to all of you. I hope that the many different topics in this new issue will be of interest for you, but let me start remembering some people who have left us.

The pages of the issue include obituaries for two such giants of the fuzzy theory as Prof. De Luca and Porf. Riečan. The authors of these obituaries have expressed much better than I am able to the great loss these passings mean, but let me just for a minute think about those giants that are supporting our work. In the past of the fuzzy theory there have been many, many personalities whose influence goes beyond our community. We should never forget to thank all of them, all of these precursors, since it is their hard work which has made possible our recent successes. But, of course, we should also look for new successes. We must show in our work the validity and usefulness of fuzzy theory. Specially in these days in which Artificial Intelligence is in the focus of the society. Because we have a lot to say in Artificial Intelligence, and we should fight so that our words are heard.

Of course, I know all of us are fighting for that. And I also know that it is not an easy battle. But our community is strong and able, and I have no doubt at all that we can be there, in the core of the new trends. And I hope that in order to do so, this magazine can become a humble help in order to link all of us to each other, in such a way that we can boost collaborations, projects and lines of works. Because, at the end, the Mathware&Soft Computing online magazine intends to do exactly that, bring to all of us any aspect that can be of interest, and we will do it as long as you help us.

For this reason, I also want to thank of all of you who have made this new issue possible. And I hope all of us enjoy its pages, its contents, feeling them as a part of our EUSFLAT community life.

Happy New Year 2019 to all.

Humberto Bustince
Editor-in-chief

Message from the President (June 2018)

MARTIN ŠTĚPNIČKA

Dear EUSFLAT members,

I am sure that right at these days, apart from many work duties related to distinct yearly (grant) reports and preparing your excellent scientific results into a publishable form in order to meet conference deadline scheduled for the first months of 2019, your main focus is concentrated on Christmas and on your family circle. I do not want to disturb this beautiful atmosphere too much by a frontal attack of information stream related to the EUSFLAT Society and thus, let me only look shortly back and also forward into the future on related "Christmas gifts". The first and very early Christmas gifts we all got, were two main summer events of the Society âĂŞ **IPMU 2018** and the European Summer School **SFLA 2018**. Looking back always gets me feeling very pleasant, it was an amazing job and time we spent in Cádiz and Bari and opening photo galleries from these times is like opening a Christmas gift under the tree - thank you Jesús Medina, thank you Corrado Mencar, deep gratitude to your teams. And this was not all of course, the other gifts in the form of EUSFLAT endorsed were coming later on, for example **FLINS 2018** in Belfast, **AAIA 2018** in Poznan, **SMPS/BELIEF** 2018 in Compiegne, **IJCCI 2018** in Seville, or **LFA 2018** in Arras, just to name some of them. It was a great conference season and sitting by a fireplace with a Christmas punch leads many of us to recall the great moments we had there.

Other presents that our members were unpacking in the period form the last issue of the Mathware magazine, were, as usually, personal awards and recognitions. It made me very happy to again learn about successes of our members such as: **Enrique Herrera-Viedma** was elected IEEE SMC Vice President, **Vladik Kreinovich** was appointed doctor honoris causa of the University of Ostrava, and finally, **Vilem Novak** and **Irina Perfilieva** got jointly the Rector's Award for Excellent Long-Term Research, Artistic or Civil Society Activity for Academic and Scientific Staff of the University of Ostrava. Congratulations!

However, as promised above, let me look to the future. The upcoming year 2019 will be open with paper submission deadlines to our crucial endorsed events, namely, in the time order, with FUZZ-IEEE in New Orleans, IFSA/NAFIPS in Lafayette, and our major event âĂŞ EUSFLAT in Prague. I am very keen on participating on all of them and it will be my pleasure to meet you there. Undoubtedly, these dominant events of the year will create a perfect forum for exchanging ideas as well as many other EUSFLAT endorsed events. I am very to inform you, that the list of benefits contains 50 USD discount on the registration fee to FUZZ-IEEE and this benefits is valid also for students! Many thanks **Bernadette Bouchon-Meunier**. The EUSFLAT Conference fee offers 100 EUR discount for regular members and 50EUR discount for student members! And this is by far not all, the discount is also offered by IJCCI, by MDPI journals Axioms and Algorithms on their article processing fees, and our main journal IJCIS offers first 20 papers authored by EUSFLAT members. And we should not forget about PhD Thesis awards, Best Student Paper at EUSFLAT 2019 Conference Awards, rich Student Travel Grant programme and many non-financial yet equally important benefits.

Finally, let me wish to all of you Merry Christmas and strong health, and lots of joy and successes in 2019.

Martin Štěpnička
President of EUSFLAT

EUSFLAT Membership Benefits 2019

Financial benefits

- **100EUR discount** on EUSFLAT 2019 Conference fee
- **50EUR discount** on EUSFLAT 2019 Conference student fee
- **50USD discount** on FUZZ-IEEE 2019 Conference fee
- **Discount** (to be determined) on IJCCI registration fee
- **850EUR discount** (exemption from processing fee) in the International Journal of Computational Intelligence Systems (IJCIS) for first 20 submissions of members in the year.
- **15% discount** on article processing fees in the MDPI journals Axioms and Algorithms.
- **87% discount** on the Journal of Advanced Computational Intelligence and Intelligent Informatics JACIII subscription (**131EUR** for print and e-journal, **105EUR** for e-journal instead of ca **923EUR** for the regular subscription).
- **Special discounts on membership fees of other societies (currently ACIA, SBA, HFA, SIGEF, IRSS, NAFIPS, NSAIS, and RAFSSoftCom).**

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- Participation in **EUSFLAT Assemblies** (once a year).
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INTERVIEW

Dialogue with Anca Ralescu

Irene Díaz

I'm pleased to have the opportunity to interview professor Ralescu as she is a key researcher in fuzzy logic, obtaining important achievements in this area. University of Oviedo in general, and UNIMODE research group in particular are proud to collaborating with her. I hope we will know her better at the end of this interview.

Let's start from the beginning, which is your scientific background?

ANCA RALESCU: I studied Mathematics at the University of Bucharest, Romania, and then obtained my PhD at Indiana University, Bloomington, Indiana, USA.

What research topics you were first interested in?

A.R.: My concentration, both at the undergraduate and graduate level, was in the theory of probability. More specifically, during graduate school I studied empirical processes. My dissertation was on the subject of rates of decay for weighted empirical processes.

When did you find "fuzzy logic" for the first time?

A.R.: I heard of fuzzy logic for the first time in 1972, when I was in my 5th year at university (at that time the 1st degree in Romanian universities was obtained after five years). Dan Ralescu, my fiancé was recommended by one of the professors in the Mathematics Department to evaluate a draft on fuzzy sets, submitted for publication. Eventually, he became very interested and ended up co-authoring the first book on fuzzy systems, published in Romanian in 1974, with an English translation in 1976.

I recall that we talked a lot about this new concept of uncertainty/imprecision, and that we were very excited about it. I was very interested in any theory of uncertainty. I recall reading papers such as Professor Zadeh's initial paper, Fuzzy Sets, and, among others, Ruspini's paper on the butterfly clustering.

Why were you interested to fuzzy mathematics?

A.R.: As I previously mentioned, I was very interested in any theory of uncertainty. Even though my work and studies were in classical approaches, it seemed natural to me to look at various forms of uncertainty.

Once arrived in the USA, where I started the PhD studies, I devoted most of my time to pure probability theory. At the same time, due to some requirements of the Mathematics Department and the Graduate School I took several courses in the Computer Science Department. In the last two years of the PhD studies I taught in the Quantitative Business Analysis Department of the School of Business at Indiana University. So, in addition to the theoretical probability studies I started to look at other theories again.

Since my initial introduction to fuzzy systems, I developed and maintained a close professional relationship with Professor Zadeh. He became a mentor of sorts and was instrumental in my orientation when I arrived at Indiana University. He advised me on a nearly weekly basis, and suggested problems to look at (for example the treatment of imprecise quantifiers using fuzzy sets), and other approaches to uncertainty such as Glen Shafer's Mathematical Theory of Evidence. On the whole, I found fuzzy sets/ fuzzy logic, Bayesian approaches, Mathematical Theory of Evidence very interesting and felt that they may be useful in practical problems, but I was not ready to leave my field of probability.

Upon finishing my PhD, I had to look for a job, when the difficulties started. Then, unlike today, when universities have come with initiatives to hire husband and wife as faculty members, the situation of a couple where both spouses wanted and were qualified to work in the academia, was dubbed as "the two body problem". Eventually, I obtained a position in the Department of Mathematical Sciences at University of Cincinnati, but...for their Computer Science minor. I was happy to have a job, but not so happy to be in the CS track. However, relatively soon, within the first year, I saw that my training in probability, the reading I had done at Lotfi's advice was going to be very useful in the area of management of uncertainty in intelligent systems. And this is how I actually moved into the field of fuzzy sets and applications.

What were your first contributions to fuzzy set theory?

A.R.: I am not sure that I can really call my work contributions, but anyway, here are some of the topics I worked on. My first study was, as I have already mentioned, suggested by Lotfi, on the treatment of imprecise quantifiers, such as "most", "a few", "approximately N", etc. using fuzzy sets.

I was delighted with the formula I obtained for evaluating statements of the kind "Q of A1,..., An" where Q is a quantifier and A1,..., An are fuzzy sets. I worked on that problem during 1984 and I published the result in 1986 in Information Sciences, in article titled "A Note of Rule Representation in Expert Systems". I tried to be modest, this is why I chose that title. Today, I would not advise anybody especially at the start of their careers to title their papers as "Notes".

The formula for quantifier evaluation which I found seems to me, even today, very beautiful. It is simple, and at the same time very powerful. It can be interpreted in terms of the cardinality of a fuzzy set, and through that it can be linked to the treatment of imprecise quantifiers given by Bairwise and Cook, which, of course, do not use any quantitative component (e.g., probabilistic, not say fuzzy). I revisit this topic from time to time because I like it very much.

At some point in the late 1980's I became very interested in approaches to knowledge representation, such as Sowa's conceptual structures, and to combine these with learning (concept learning from examples and counter examples) and applications to image understanding. Image understanding was always something that interested me. There are so many ways and so many levels at which it can be defined. As one progresses from the original image data to other levels, there is some sort of summarization that takes place, which lumps together tokens at a level to tokens at the next level. The process stops at the level most useful for a specific application. For example, when communicating the contents of the image natural language is desired. For a robot, natural language may not be necessary, the process of going from one level of image description to another may stop before natural language, unless it needs to collaborate with a human user.

In 1990 I went to Japan for a sabbatical leave. You see, I wanted to learn fuzzy control. I come now to what was to become one of the most interesting periods in my academic life. The previous year, in 1989, the initiative led by Professor Sugeno of Tokyo Institute of Technology (TIT, now Titech) resulted in the six-year national project on fuzzy research known under the name of Laboratory for International Fuzzy Engineering Research (LIFE). This initiative also led to the creating the LIFE Endowed Chair in Fuzzy Theory at TIT. This provided for inviting four foreign professors each for the period of one year. The first year coincided with my looking to spend my sabbatical in Japan, and so I was appointed on this position. At the end of the academic year, I moved to LIFE, in charge of the Image Understanding (IU) Team, and then from April 1992 to the end of the project in March 1995 also as Assistant Director of the laboratory for international relations.

I have found memories of my experience there. First and foremost, I would like to pay homage to the late Professor Toshiro Terano, from whom I learned a lot. His imagination had no bounds, and many of the things he said then, which seemed very far fetched such as Brain Computer Interface came to become main research themes these days. The IU team consisted of several talented and very creative researchers. With the exception of one foreign researcher, all other foreign visiting researchers were in the IU team. So, at different times, we had researchers from China, France, Ireland, and Spain.

We defined image understanding as the verbal description of the image contents (today we call this image annotation). Another hypothesis we made, was that fuzziness is a natural language phenomenon, which enables it to capture the similarities and variability between instances of a concept. So, we worked on hierarchical models for object recognition, description of spatial relations in an image, of facial expressions, perceptual organization for image understanding, image retrieval from verbal descriptions, all based using fuzzy sets.

Today my graduate students marvel at the performance of deep networks in various image and language processing and think that the applications they read about are all very new. They are very surprised when I tell them what we were working on 25-28 years ago.

At LIFE, the facial expression work was carried out with Riad Hartani from University of Paris, graduate student advised by Bernadette Bouchon, who visited LIFE on two occasions supported by a fellowship from the French government. Some of that work was also done with Hiroshi Iwamoto from Kao corporation. I was part of Riad's PhD committee. Today Dr. Hartani is a very successful entrepreneur based in Vancouver, Canada. The work on perceptual organization was carried out with James Shanahan an Irish researcher who joined IU team in 1994. He went on to obtain a PhD from University of Bristol. Today Dr. Shanahan is a very successful machine learning expert based in San Francisco. Spatial organization research was carried out with Koji Miyajima then from NTT Data, who went on to obtain a PhD from Sofia University Tokyo. Today, Dr. Miyajima is executive vice president of Strategy for NTT DATA, Inc. and member of the Board of Directors.

Except for a few, most researchers in image understanding, computer vision were not convinced of the usefulness of fuzzy methods in these fields. I heard more than once "fuzzy sets are not necessary", or "my image processing algorithms do not result in fuzzy sets". I think they raised an important issue, namely, "to what extent are fuzzy sets necessary and not merely a matter of choice". I think that understanding, describing spatial relations in an image, or describing facial expressions based on face photographs, are examples of applications where fuzzy sets are necessary rather than a matter

of choice, or preference. In each case, the actual concept âĂŞ spatial relation, facial expression âĂŞ is conveyed by subtle differences in the features (which need not be fuzzy) that are extracted by the image processing step.

In the aftermath of my work on spatial relations in 1995 I went to visit Professor Isabelle Bloch at École nationale supérieure des télécommunications(ENST), Image and Signal Processing Department, whose work on spatial relation in an image based on mathematical morphology was very interesting. It turned out that she was just as interested in our work on this subject and since then we became good friends and collaborators.

To prove how good a fuzzy approach is, one has to see how it performs for the application for which it was developed. There is a subtle trade off between precision and the summarization that goes on when the data are collected in a fuzzy set. For instance, in applications requiring retrieval, the result of the retrieval based on verbal descriptions based on fuzzy sets is one way to evaluate the fuzzy model.

How did you start collaborations with other members of this community?

A.R.: This is a very interesting question which I never asked myself. I will try to answer as best as possible. I think that on the main, I have two kinds of collaborations, those which are more or less imposed by the set-up of the research, others which are really a matter of common research interests and personal affinities. In the first category are the collaborations at LIFE with my team members, at the university with my graduate students, and with visitors to my lab. The second category consists of collaborations such as I have with Isabelle Bloch, and more recently with Professor Irene Diaz Rodriguez from University of Oviedo, or with a group led by Professor Amit Konar from Jadavpur University, based on common research interests. I think that collaborations require a great deal of give-and-take and tact in order to work, and in this regard I was very lucky.

What do you consider the most important part of your work?

A.R.: You know, frankly, I am never sure that the work we do is really important. I mean, we are lucky and at the same time unlucky to work in a very exciting field, but one that moves very very fast. It is not like say, pure mathematics, where one proves something and that's it. What we do depends not only of the maturity of the field, that is, what concepts are available to tackle various problems. It also greatly depends on the technology available, which fuels what can be done. I think that a lot of our work is exploratory and experimental in nature, we usually build our lab so to say, and use it to solve a problem. I like all of the problems I worked on, quantifiers, spatial relations, facial expressions, concept learning from examples and counter examples, learning from imbalanced data sets, measures of similarity between heterogeneous data such as the Fuzzy Hamming Distance, combining probability and fuzzy approaches.

How was to be a woman in a world where the researchers were mainly men?

A.R.: You are asking some very hard questions. Frankly, I never had enough time to think much about this issue. As a mathematics student in Romania, I seldom, if ever, thought about that. After all, at that time more than 50% of math students in my class were women.

When I arrived in the USA, I was very surprised to learn that women were not supposed to be "good at math". If I remember correctly, in 1977, at Indiana University, Bloomington, I was one of only four women admitted to graduate studies, the only one married and with a baby. Some professors disapproved of my being there and told me so, which also astonished me a great deal. I could not believe their attitude and often wondered where I had landed. Forward to 1980 when I had to chose an adviser. The pendulum had begun to swing in the opposite direction, and I was asked by more than one professor to do my dissertation with them, even though I was not in their area of research. At University of Cincinnati, I was for a while the only woman in the department.

These days the pendulum has completely gone to the opposite extreme: being a woman almost qualifies one from the start for the position one applies for. Personally, I think that gender should not be an issue, even though I know from experience how difficult it is to balance family responsibilities and work. In my case, the unconditional support of my family, my mother, my husband, and yes, my son even when he was a child, were of essential help.

What have you been doing more recently?

A.R.: I have a number of graduate students who work on various subjects, some on image annotation, semantic similarity between images, activity recognition in images, others on medical images. More recently, I became interested in cyber security, recognition of malware and actions to disable it, especially in critical systems, such as power grid software systems.

Which project you couldn't afford, but you would like to try?

A.R.: I am very interested in BCI (brain computer interface). I have an excellent, but small BCI system which I bought a few years ago from a grant. But to do the research I really would like to do, I would need much more. This is a case where what we can do really depends on the technology used.

Which scientific perspectives you see in this domain for the future?

A.R.: People often tell me that there does not seem to be as much excitement about fuzzy methods as before, say 20 years ago. My reply is to ask if there is any excitement about some well established mathematical concepts (choose any one of calculus, or probability concepts). Some of the current arguments against fuzzy set based approaches are the same as 40 years ago: subjectivity, context dependence, etc. These arguments have been addressed. It remains that this acknowledged by people outside the fuzzy community and in this sense, I think that fuzzy sets based methods have reached a point where there is more acceptance, that they are here to stay, and that their use will actually increase.

RECOGNITION

Aldo, friend and magister

Settimo Termini

Our dear friend Aldo de Luca passed away on last October 16, 2018. The lines which follow will not be a scholarly resumÃl' of his (scientific) life as a true homage to him would have required. Simply, I am unable to do it. For various reasons. I had been tempted to say that his interests have been so ample that one single person could hardly report with competence the deepness of all his scientific achievements. But, although the previous statement is true, I must confess that this is not the point in question here. The fact is that while trying to fix on the paper some points, my mind immediately begins to move around. My efforts to stop it, at best, limit the area of the roaming but no more than that. Others, perhaps, will remember, list and testify the profoundness of his technical results, here one can find only a messy report of some wanderings of my mind, certainly useless for knowing what the "scientist" Aldo has achieved, but - maybe - the simple witnessing of some intricacies of his interests can help for asking (asking, not answering) some questions about Aldo as a person.

To report some data and facts is considered unavoidable but I shall not be reciting his cursus honorum. I limit myself to provide some essential information. Aldo took his degree in Physics in 1964 at the University of Naples discussing a thesis on General Relativity. His encounter with Cybernetics happened very soon when he began what, at the time, was called "Scuola di perfezionamenti in Fisica teorica", a novelty, an invention of the theoretical physicist Eduardo Caianiello, a sort of post graduate School whose Opening Lecture, the first Academic year had been given by Werner Heisenberg. But this unusual thing was also the Trojan horse for entering into new unexpected and unknown fields. Besides this School, Caianiello, in those years, had founded a new Institute of Theoretical Physics and a Cybernetics research group. And around these frontier activities (they were such in those remote years) many other things and scientific activities were happening, among which an important event was the Ravello 1964 Summer School on Automata Theory [1] . "In this occasion", Aldo wrote, "I was lucky enough to meet the greatest scientists in the field" and, in informal discussions, he repeatedly talk about the unexpected discovery (for a young researcher accustomed to the world of the "continuum" techniques of General Relativity) of an equal richness owned by discrete structures unveiling the treasury of recursiveness and the theory of computation. He has remembered these years, their novelty for him (but not only for him) in two published memoirs [2],[3]. Maybe he has written other things which are still unpublished as his manuscript "The Mind as a Mechanism of the Brain" which he mention in his [2], a paper from which the following passage is taken:

> "Our group of Cybernetics at the Institute of Theoretical Physics, directed by Caianiello, was of a real interdisciplinary nature, consisting of Physicists, Chemists, Mathematicians, Logicians, Engineers, and Biologists, including collaborators expert in the humanities such as natural languages. Every week we had a very interesting general meeting where research projects were discussed by all of us, each one giving a contribution on the base of its own experience and competence." (page 668 of the electronic edition)

He stressed also the strong international character of the research of the group (but this, in a sense, is nothing more than witnessing its high scientific level). What was (and is) really a novelty is the possibility of having an open discussion, its informality and the fact that it was about truly interdisciplinary arguments. Something that, unfortunately, can appear unusual also from today perspective. Another quote can help focusing the atmosphere:

> "The researchers gathered every week with Eduardo, when the various problems we dealt with were put on the carpet, and everyone contributed to the discussion based on their skills and experiences. The atmosphere was beautiful and extremely stimulating; I remember the meetings that took place almost every Wednesday at Villa Virgiliana, in Cuma, next to the Antro della Sibilla, where we went around 3 o'clock in the afternoon; there was no one besides us, just a blackboard and a stove because in winter it was very cold; around 5 o'clock you could hear a gong and we found on a table, in the living room, tea served by an elusive waiter. The debate was free and open, on problems ranging from neurological models to problems of very subtle and demanding maths." (page 34 of [3])

This is the atmosphere were the "fuzzy entropy" was conceived. I refer to [4] for details of the way in which we arrived at this idea. Aldo (as also myself) was conscious that to contribute to a very recent research field is something different than to work in classical fields: very challenging and truly demanding. This awareness characterized all our discussions (along the Seventies of last Century) about the possibilities offered by Fuzzy sets approach for affording the presence of uncertainty in systems of different nature. Surprisingly, also starting from different points, we were always able to find an agreement. This was a novelty since, when discussing of interpretative questions regarding analogous questions in the setting of quantum mechanics, our fierce fightings never arrived at a composition. I want to add here that although the active work of Aldo in Fuzzy set theory lasted for no more than fifteen years, his interest for its general questions was present forever and he often remembered the contribution he had done in this very young field. As an example of the way of working of Aldo let me recollect that in his [5] he

started from noticing some mathematical properties and ruminating about them he arrived at the conclusion that these results could be inserted in the general scheme of the measures of fuzziness. So, he did not start from questions posed by the field of investigation but from some mathematical aspects that he picked up as meaningful. This was typical of him in a twofold sense. First, the deepness of his approach to a problem was always the same both in attempting to prove some formal properties and in analyzing a conceptual question. Secondly, and crucial for him, to find out mathematical characterizations was the mark of having really settled a piece of work. A nice mathematical property was a strong indication that a conceptual question could be clarified. The mathematician's conceit, one could say, but, in a while, we shall see that Aldo's thought is more complex and intricate than that. Let us come back to Cybernetics. As he wrote:

> "The great novelty of Cybernetics was the introduction, in the setting of the physical sciences, of a new entity called information of fundamental importance in the communication of human beings and machines. Information and its measurement are, however, intuitive concepts which have a wide 'semantic halo' so that several formalizations are possible." ([2], page 669 , my italics)

It is very likely that neither Aldo nor myself (this is certainly true for myself) would have thought to such a thing like "fuzzy entropy" in a different cultural scientific context and let me stress that it is the simultaneous presence of what I underlined in italics that could have favored the birth of this new idea. From the descriptions offered above Cybernetics could appear as a sort of Garden of Eden, and - perhaps - it was really so for a few years. But, soon, something began changing:

> "Cybernetics was quite vital and developed in Italy up to the middle of the seventies ... However, since the beginning of seventies the term Cybernetics was less and less used and often replaced by the term Computer Science or by the new term Informatics. At the present, practically no one in Italy and only a few in the world uses the term Cybernetics. ... Why this decline of Cybernetics? ... In my opinion the main reason for decline is that the original research project was much too wide and ambitious, and the results obtained on the main problems (understanding high mental functions like intelligence) were very modest and often far from the effective and practical needs of science and technology. In a way, in some respects analog to what occurred to Science after the Renaissance, from Cybernetics several scientific disciplines were originated and, successively, separated." ([2], page 668)

These general considerations held also for the CNR Institute of Cybernetics which had inherited the scientific activities of the original smaller "cybernetic group" at the Institute of Theoretical Physics. In fact,

> "The Institute of Cybernetics was a sort of an incubator that allowed, starting from the initial program of Cybernetics, to create and develop within itself much more specialized research related to the new emerging disciplines. There was in a short time the transition from an interdisciplinary research to a multidisciplinary one ... Subsequently, especially following the presence in the Institute of Marco SchÃijtzenberger for over a year, the scientific interests of some of us were oriented towards theoretical computer science." ([3], pages 35-36)

It is at this point that Aldo became profoundly involved in these challenging new questions that mark the birth of "theoretical informatics" as such, as a separate and distinct scientific activity, something of which Aldo was one of the first and main protagonists in Italy and in Europe. I refer to [4, 5] for a detailed overview of his results and for a more or less complete list of his publications. My point is that more than traces of the original formative cybernetic period remained in Aldo's subsequent scientific life, as a sort of imprinting.

But before doing that let's recall other steps of his career. In 1971 he obtained the "libera docenza in Cibernetica e Teoria dell'informazione" (the old "venia docenti"), just before the abolition of this old and venerable institution of which he was also one of the youngest recipients. After a period of about fifteen years spent as a researcher in CNR, he moved to the University as a full professor of Algebra at the University of Naples Federico II in 1980 and, later, of Informatica teorica first at the University of Rome "La Sapienza" (from 1985 to 2003) and, again, in Naples from 2003 to 2010 when he retired becoming "professor emeritus" the subsequent year. Let me also remember an important Seminar he gave at the Accademia dei Lincei on the "General Theory of Codes", on 12 February 1982, as well as a three years sabbatical leave at the Centro linceo interdisciplinare "Beniamino Segre" of the same Academy.

The few points I shall discuss now are a following of what I have written above in underlining the variety of Aldo's interests. Not for stressing his erudition, something he did not appreciate, but for throwing some light on the origin of his peculiar way of facing problems, in a word, of his creativity. Aldo was truly a mathematician, but his scientific history associated with his peculiar experience made him a mathematician with unusual features. Caianiello was right in fearing that "Aldo could escape along the mathematical tangent". A phrase often repeated to complain the fact that starting from a specific problem, Aldo - without neglecting it - could anyway become more attracted by unexpected mathematical promising new avenues which were not strictly connected to the starting point. Notwithstanding this, he always preserved his original mental attitude of a physicist in asking the "deep motivation" of a new afforded question. Something that was at the root of the efficacy of his way of presenting and discussing any topic (old, new, in fieri, along its development). Motivation and perspectives were the place where to ground any discussion, not the technicalities. These were important only as a tool. I have directly witnessed this way of doing in our private discussions, especially in the Seventies, a period in which we interacted almost daily, but anyone can tes-

tify that this was a feature of his talks and seminars. What struck me, however, was the discovery - through the testimony of some of his students - that this was a feature also of his routine lessons of the standard courses. One of them explicitly told me, with great admiration, that not only no technical argument was presented without some (non technical) motivation but also some grounding of the problems was indicated, helpful for fixing them in a more general framework; moreover, each lecture could, in a sense, be followed autonomously (as a sort of mini seminar) since at the beginning he cared to provide the basic elements necessary to follow the new presented items. This was associated to a sort of friendly attitude towards the students, tuning the tone and style of his presentation to the audience; a sincere but distant friendship, we should specify, without too much familiarity, something that would have destroyed the correct relationship "teacher-student".

This is one of the reasons why Aldo must be remembered as a "magister" not only for his great capacity and ability as a mathematician, as an innovative researcher and as a wonderful teacher but above all for his ability to capture and absorb all the new present in the things, persons, atmospheres, concepts which he had occasion to cross, molding in such a way his peculiar scientific and human style. The subsequent transmission of these novelties to other people, happening silently, tacitly, through a way of doing that we could define embodied, without any form of detached and ex-cathedra teachings or, even less, boring moral preaching. This must be connected, I am sure, to his declaring himself "anarco-individualist", not in a ideological sense, but - on the contrary - for stressing, exactly, a strong anti-ideological choice. A meditated attitude, more complex and articulated than it appeared and than he would have explicitly admitted in a discussion.

When I went to Naples for a last farewell to Aldo, I took the plane. Usually I prefer the aisle seat but this time, strangely, having been assigned the window seat, I did not ask to change. By chance, then, I noticed that - unusually - the airplane was approaching the airport from the sea and not from the interior air corridor. By surveying, then, Posillipo, the Phlegraean Fields and the bay of Pozzuoli I saw from the window the road that for a few years, following 1969, we had daily traveled to join the Institute of Cybernetics. In the first months after my arrival, thanks to his friendship and courtesy, with his car, an old Fiat Seicento if I remember well. I wish to interpret this unfrequent rout as a sort of tribute that also the airplane wanted to pay to Aldo.

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This Obituary will contemporary appear in "The Archive for the Philosophy and History of Soft Computing" http://aphsc.org/index.php/aphsc

RECOGNITION

Prof. Beloslav Riečan passed away

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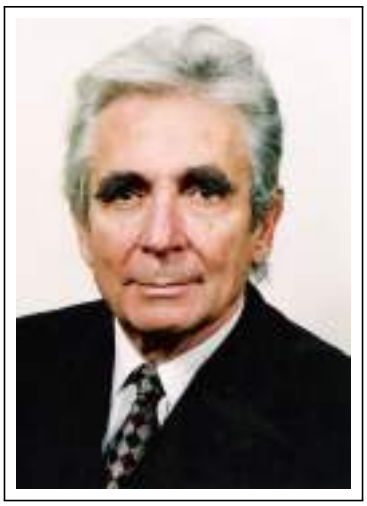

A sad news has announced: *Prof. RNDr. Beloslav Riečan, DrSc., Dr.h.c. passed away on Aug. 13, 2018.*

Who was Prof. B. Riečan, Belo as he was called by his friends and colleagues?

Prof. B. Riecan was born on November 10, 1936, in Žilina, Northern Slovakia. The Fates gave him many gifts but also many stickers: being four and half his beloved mother passed away, being six his eight-year brother Horislav died, too, and in autumn 1994, his firstborn daughter Hanka, a very gifted mathematician, died in the result of a car accident at one Austria highway. Fortunately, other Fates gave him also very scarce gifts: Love to Maths, love to music, and the most important gift — love to people, which helped him very deeply during his whole life — and such Belo is known by the most among us, his students, colleagues and friends. We note that his son Juraj is also a mathematician and his second daughter is doing PhD in Maths.

After the mother death the family moved to Banská Bystrica, central Slovakia, where he attended the primary school, and a very famous high school. Young Riečan absorbed through all his pores a unique atmosphere of Banská Bystrica. As a student, Belo won an All-Slovakian competition for young pianists which caused him a big head ache: It was necessary to decide between a career of a pianist or of a mathematician. He preferred mathematics which have had a great influence for Slovak Maths.

In 1953, Belo is going to Bratislava, where he attended the Faculty of Natural Sciences of the Comenius University. Here he had excellent teachers who belong to the first generation of the Slovak Mathematicians: Acad. Jur Hronec, Profs O. Boruvka, M. Kolibiar and others. His school-class was one of the best in the history.

During his studies he wired to scientific activity under the guidance of Prof. M. Kolibiar and immediately his first paper *On axiomatic of modular lattices*, Acta Fac. Rer. Nat. Univ. Comenianae, Math. **2** (1957), 257–262 (in Slovak), was a top hit. This paper was quoted in monographs of G. Birkhoff, L.A. Skornjakov and G. Grätzer. Every specialist of lattice theory knows very well how a great distinction for any author are such quotations in these three fundamental books. Today, when takes one's stand on CC-publications and SCI-quotations it is surprising, how these mathematical giants could quote this paper, although it was written in Slovak and in a non-current journal.

After finishing his studies in 1958, he started to work at the Department of Mathematics of the Slovak Technical University, Bratislava. In 1962-64 he was a PhD-student of Prof. Š. Schwarz, another giant of the Slovak mathematics. In 1966 he became the Associated Prof., and he started to give lectures also at the Faculty of Natural Sciences of the Comenius University. In 1985 he started to work in Liptovský Mikuláš, at the Department of Mathematics of the Military Academy to come back in 1989 to the Faculty of Mathematics and Physics, Bratislava, as the first willingly elected Dean. Since 1992 he was the Director of the Institute of Mathematics of the Slovak Academy of Sciences, and since 1998 he is back in the city of his youth, Banská Bystrica, at the Faculty of Natural Sciences of the University of Matej Bel.

Prof. Riečan belonged to the most significant mathematicians of Slovakia. He was the author or coauthor of 10 monographs (the last one [M6] appeared in 2017) + 2 chapters in books, around 300 papers published in scientific journals, over 80 technical papers, 4 university textbooks, 30 high-school textbooks and text tools, 8 scripts + 3 in electronic form, 8 books on mathematics (one book on probability had 6 editions), 8 tv-scripts, over 500 publicists articles.

He was a PhD-supervisor of more than 30 PhD-students, which is a Slovak unicum and he was a supervisor of over 50 diploma-theses. Many of his former students are nowadays leading personalities of our universities and of the Slovak Academy of Sciences. His professional activity was probability theory, measure theory and integration, fuzzy sets, and quantum structures. His activities were very large and reach even besides of Maths. He was a member of 6 international scientific societies.

Among his most important mathematical contributions we can surely insert establishing unifying theory of measure and integration in ordered spaces. He extended the notion of entropy of dynamical systems. He initiated study of quantum

[1]The author thanks for the support the Slovak Research and Development Agency under contract APVV-16-0073 and the grant VEGA No. 2/0069/16 SAV

structures and fuzzy sets in Slovakia. He developed probability theory of fuzzy sets in Slovakia. That has a very important connection to probability theory on MV-algebras. He was very often invited to address his talks on many conferences in home as well as in abroad.

He was a tireless organizer of many scientific events; many of traditional scientific conferences in Slovakia or seminars have arose due to his direct personal stimulus. Thanks to him, in Liptovský Ján Valley an important mathematical congress centrum has appeared which is already very well entered in awareness of foreign colleagues; as a rule, a concert of conference participants is regularly organized which is always highly welcome. He was a long-standing president of the Union of Slovak Mathematicians and Physicists, he was the Head of the Slovak Association of Rome Club. As an outstanding musician and musical expert, since 1984 together with an important Slovak musician Prof. Roman Berger were guiding the Seminar Mathematics and Music.

On pages of daily press, on TV-screen and radio he was trying on uplift of the education in Slovakia, he was voicing to momentous questions of education, science, culture and clergy in our society, and to acute questions of collaboration between universities and Slovak Academy of Sciences. His scientific, pedagogical, organizing activity was many time awarded on many important national and international platforms. I mention only the latest ones: the Honorary Medal of Bernard Bolzano of the Academy of Sciences of the Czech republic (1998), the Silver Medal of University of Milano (2000), and Medal of the Slovak Academy of Sciences (SAS) for support for science (2001), Order of Ľ. Štúr of the First Grade (2002) (the highest estimation in Slovakia for scholars awarded by the state president), member of the Learning Society of the Slovak Academy of Sciences 2005, Dr.h.c. of the Military Academy, Liptovský Mikuláš, 2006. The Slovak Academy of Sciences honored him by the Golden Medal of SAS in 2012 for his life-work in Mathematics.

All these outstanding scientific degrees which Prof. Riečan achieved are very important and needful, however they don't reflect the main feature of his own. And this was his interest for the man, for the pupil and student, which very often borders on self-sacrificing, and which was very typical for him. Not once I had opportunity to see him how he already as a known professor was near with a young adept of Maths. Thanks for that he induced interest for Maths in many young novices while his sparks were very susceptible. In addition, he had a gift to put people together for the well of matters and he was not shaming to let enlighten himself by younger colleagues. I didn't yet understood where he took so much energy and so much ideas.

Unfortunately, his healthy wasn't perfect in the last years. Few years ago we were very afraid on his health, thank God, everything turned out well. His wife Eva was his guardian angel in his last life years. Even in the last days he was preparing an article to Prague and in the Monday Aug. 13, he was in at the faculty in Banská Bystrica. At home afternoon he was preparing an article. After finishing writing it came bad, and late night on Aug. 13, 2018, he gasp one's last.

Belo was a genuine and one of the last spiritus mathematicus et musicus slovakiensis and thanks for everything!

Dear Belo
Requiescat in pace!

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SCIENTIFIC REPORT

Planning holidays with fuzzy c-means

Jordi Recasens. Universitat Politècnica de Catalunya

Every year my wife and I spend our holidays in Asturias, situated in the north-western part of Green Spain. Last summer we decided to explore the Eastern Territory [1] that comprises 13 boroughs (concejos), some of them in the coast line and some of them in the mountainous Picos de Europa (see the map).

Since the territory was big (1824 km2) and with many boroughs, we decided to establish our headquarters in the capitals of two of them. With that aim, I decided to use the fuzzy c-means algorithm [2] to cluster the boroughs and find the appropriate two locations. Since Asturias is so mountainous, it was not adequate to use their geographic coordinates because the times needed to travel from one place to another do not only depend on distance. For example, the distance between Ribadesella and Ribadedeva is 47.1 km and 44.3 km from Ponga to Piloña, while the time needed is 35 min and 1 h 15 min respectively. For this reason I built the matrix of time-distances (in minutes) between the different boroughs (see at the end of this report).

Then I associated each borough with its corresponding row and applied the fuzzy c-means algorithm with two clusters (c=2) and fuzziness degree m=2 obtaining the following membership degrees to them:

Cluster 1:

$$(0.249, 0.238, 0.123, 0.150, 0.527, 0.514,$$
$$0.227, 0.338, 0.869, 0.773, 0.827, 0.906, 0.920)$$

Cluster 2:

$$(0.751, 0.762, 0.877, 0.850, 0.473, 0.486,$$
$$0.773, 0.662, 0.131, 0.227, 0.173, 0.094, 0.080)$$

Accordingly, from Llanes we visited Caravia, Ribadesella, Peñamellera Alta, Peñamellera Baja and Ribadedeva, and the other boroughs from Cangas de Onís.

This is of course a small divertimento. However the procedure could also be used in Urbanism - more specifically in regional planning- to decide where to locate hospitals, schools, cultural centres or industrial hubs.

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	Piloña	Ponga	Amieva	Parres	Caravia	Ribadesella	Cangas de Onís	Onís	Llanes	Cabrales	Peñamellera Alta	Peñamellera Baja	Ribadedeva
Piloña		75	63	37	57	53	41	57	66	70	97	85	76
Ponga	75		33	53	67	62	30	69	75	66	93	93	85
Amieva	63	33		38	52	48	21	54	61	51	78	78	71
Parres	37	53	38		33	29	17	48	41	46	72	60	51
Caravia	57	67	52	33		18	32	61	28	46	63	46	38
Ribadesella	53	62	48	29	18		27	58	25	43	59	44	35
Cangas de Onís	41	36	21	17	32	27		17	39	30	56	56	49
Onís	57	69	54	48	61	58	17		51	34	60	60	61
Llanes	66	75	61	41	28	25	39	51		36	44	28	20
Cabrales	70	66	51	46	46	43	30	34	36		28	27	46
Peñamellera Alta	97	93	78	72	63	59	56	60	44	28		15	33
Peñamellera Baja	85	93	78	60	46	44	56	60	28	27	15		19
Ribadedeva	76	85	71	51	38	35	49	61	20	45	33	19	

CONFERENCE REPORT

IPMU 2018

The International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems (IPMU) is organized every two years with the aim of bringing together scientists working on methods for the management of uncertainty and aggregation of information in intelligent systems. Since 1986, the IPMU conference has been providing a forum for the exchange of ideas between theoreticians and practitioners working in these areas and related fields. This year IPMU 2018 was held during June 11-15, in Cádiz, Spain.

This IPMU edition held special meaning since one of its co-founders, Lotfi A. Zadeh, passed away on September 6, 2017. To pay him a well-deserved tribute, and in memory of his long relationship with IPMU participants, a special plenary panel was organized to discuss the scientific legacy of his ideas. Renowned researchers and Lotfi's good friends made up the panel: it was chaired by Ronald Yager, while Bernadette Bouchon-Meunier, Didier Dubois, Janusz Kacprzyk, Rudolf Kruse, Rudolf Seising and Luis Magdalena (in substitution of Enric Trillas, who finally could not attend the event) acted as panelists. Besides this, a booklet of pictures with Lotfi Zadeh and friends was compiled and distributed at the conference and it was created the Lotfi A. Zadeh IPMU Best Paper Award, whose recipient was professor Serafin Moral (University of Granada, Spain) on this first occasion because of his work "Divergence Measures and Approximate Algorithms for Valuation Based Systems".

Following the IPMU tradition, the Kampé de Fériet Award for outstanding contributions to the field of uncertainty and management of uncertainty was presented. Past winners of this prestigious award were Lotfi A. Zadeh (1992), Ilya Prigogine (1994), Toshiro Terano (1996), Kenneth Arrow (1998), Richard Jeffrey (2000), Arthur Dempster (2002), Janos Aczel (2004), Daniel Kahneman (2006), Enric Trillas (2008), James Bezdek (2010), Michio Sugeno (2012), Vladimir N. Vapnik (2014), and Joseph Y. Halpern (2016). In this 2018 edition, the award was given to Glenn Shafer (Rutgers University, Newark, USA) for his seminal contributions to the mathematical theory of evidence and belief functions as well as to the field of reasoning under uncertainty. The so-called Dempster-Shafer theory, an alternative to the theory of probability, has been widely applied in engineering and artificial intelligence.

The program consisted of the keynote talk "Hypothesis Testing as a Game" by Glenn Shafer, as recipient of the Kampé de Fériet Award, five invited plenary talks, two round tables, and 30 special sessions plus a general track for the presentation of the 190 contributed papers that were authored by researchers from more than 40 different countries. Also, the EUSFLAT General Assembly was held on Tuesday, June 12. The plenary presentations were given by the following distinguished researchers: Gloria Bordogna (Institute for the Electromagnetic Sensing of the Environment of the Italian National Research Council), Lluis Godo (Artificial Intelligence Research Institute of the Spanish National Research Council), Enrique Herrera-Viedma (Department of Computer Science and Artificial Intelligence, University of Granada, Spain), Natalio Krasnogor (School of Computing Science at Newcastle University, United Kingdom) and Yiyu Yao (Department of Computer Science, University of Regina, Canada).

The conference followed a single-blind review process, respecting the usual conflict-of-interest standards. The contributions were reviewed by at least three reviewers. Moreover, the conference chairs further checked the contributions in those cases where conflicting reviews were obtained. Finally, the accepted papers were published in three volumes: Volumes I and II focusing on "Theory and Foundations" while Volume III was devoted to "Applications."

The organization of the IPMU 2018 conference was possible thanks to the assistance, dedication and support of many people and institutions. In particular, this renowned international conference owes its recognition to the great quality of the contributions. In this sense it is worth highlighting the grants offered by EUSFLAT for young students: Cao Thi Hong from Institute for Research and Applications of Fuzzy Modelling, University of Ostrava, Czech Republic. Cédric Marco from Public University of Navarra, Spain. Saransh Dhama from Budapest University of Technology and Economics, Hungary. Samuel Hudec from Matej Bel Universit, Slovakia, and Raquel Fernández from University of the Balearic Islands, Spain.

The closing session on Friday 15th ended the 17th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems. Now all of us are looking forward for next IPMU Conference that will be held in Lisbon, Portugal, on June 15-19, 2020. See you all there!.

CONFERENCE REPORT

IV European Summer School on Fuzzy Logic and Applications (SFLA 2018)

The IV European Summer School on Fuzzy Logic and Applications (SFLA 2018) took place in Bari, Italy, from June 25th to 29th, 2018. SFLA is one of the main activities promoted by the EUropean Society for Fuzzy Logic And Technology (EUSFLAT), which encourages scientific communication and collaboration between its members and the scientific community at large.

Traditionally, all the editions of SFLA offered several courses held by world-famous experts in the field of Fuzzy Logic. Therefore, PhD students and young researchers are the ideal audience for SFLA to be introduced both in the fundamental aspects and in the recent developments of Fuzzy Logic and its applications. The 2018 edition of SFLA (SFLA 2018) is the fourth after those held in Como (Italy), Celadna (Czech Republic) and Santiago de Compostela (Spain).

SFLA 2018 involved the participation of 11 speakers and attracted 21 participants (most of them Ph.D. students, but there were also young researchers) throughout Europe. The program was ideally divided into three parts: (i) theory, (ii) methodology and (iii) applications.

The School started with some retrospective reflections on Fuzzy Logic, with a glance to future directions, through the talk of Prof. Settimo Termini entitled *"Focusing great achievements and big problems in fuzziness"*. Then, two talks given by Prof. Martin Štěpnička introduced some basic concepts of Fuzzy Set Theory (*"Fundamentals of fuzzy set theory and fuzzy modelling"*) with special emphasis on fuzzy relations (*"Fuzzy relational compositions and their applications"*).

The transition from theory to methodology was initiated by Dr. Sebastien Destercke, with his two talks entitled *"Uncertainty modelling and processing with possibility theory"* and *"Elements of statistical learning with possibility theory"*. Prof. Uzay Kaymak focused on one of the core topics of fuzzy logic, namely interpretability, with his two talks entitled *"Learning interpretable fuzzy models"* and *"Fuzzy modeling for clinical decision support"*.

Clustering was the main topic covered by Prof. Francesco Masulli, with two talks entitled *"Introduction to data clustering"* and *"Fuzzy Clustering"*. On the other hand, Prof. Pasi showed a useful application of aggregation operators with her talk entitled *"Aggregation guided by Fuzzy Quantifiers in Information Retrieval and in Social Media Analytics"*.

Fuzzy Logic-based methodology was the key aspect of the subsequent three talks given by, respectively, Prof. Mariagrazia Dotoli on Multicriteria Decision Making (*"Multi criteria decision making techniques: deterministic and fuzzy approaches"*), Prof. Hugues Bersini on recurrent neuro-fuzzy networks (*"Learning Recurrent Neural Networks and Fuzzy Systems"*) and Prof. Pietro Ducange on Big Data Analytics (*"Fuzzy Models for Big Data Mining"*).

School Venue (ex Palazzo delle Poste, Bari)

The School was concluded by two talks, one on the emerging field of eXplainable Artificial Intelligence, given by Dr. José Maria Alonso (*"The Role of Fuzzy Sets and Systems in Explainable Artificial Intelligence Applications"*) and the other on techniques for image processing and understanding given by Prof. Giovanna Castellano (*"Fuzzy logic for Image Processing and Computer Vision"*).

The program of SFLA 2018 was completed by a student session where 13 students presented their current work with short presentations followed by a discussion. Three students were awarded by a jury (prof. Castellano, Dr. Alonso, prof. Štěpnička) with a copy the book *"Computing with Words: Principal Concepts and Ideas"* (Springer), which includes the slides that prof. Zadeh used to present in his keynote speeches on one of the subjects dearest to him. (The books were gently offered by Springer.) Finally, a social event delighted all the participants, with a guided tour in the old town of Bari (so-called Bari Vecchia) and a dinner at a typical local restaurant.

The speakers

The School was in part financially supported by EUSFLAT, with a grant to six students selected by a Committee, and with a grant for sustaining the costs of the School, as well as by the National Institute of High Mathematics "F. Severi", Scientific Computing Group (INDAM-GNCS) with a financial grant.

On the overall, SFLA 2018 delivered 24 hours of lectures (corresponding to 3 ECTS) with an assiduous involvement of the participants. The experience was mainly positive but its success was only possible thanks to the people that actively participated to the organization of the School, including Dr. Ciro Castiello, Prof. Giovanna Castellano and Dr. Gabriella Casalino for the local organization, and the Scientific Committee for the composition of the program. Detailed information about the SFLA 2018 can be found at `sfla2018.di.uniba.it`.

Corrado Mencar
General Chair SFLA 2018

The participants

CONFERENCE REPORT

8th SIPTA School on Imprecise Probabilities and 11th Workshop on Principles and Methods for Statistical Inference with Interval Probability

Between July 24 and 28 it took place in Oviedo (Spain) the 8th SIPTA School on Imprecise Probabilities. The school is held every two years, and it is intended as an introduction to the different models of imprecise probability theory and their applications. In this edition, the school focused on the following topics:

- Introduction to imprecise probability models (Enrique Miranda and Inés Couso).
- Applications in engineering (Scott Ferson).
- Decision making with imprecise probabilities (Matthias Troffaes).
- Imprecise probabilities in machine learning (Cassio de Campos).
- Belief functions (Sébastien Destercke).

The school was organized by Enrique Miranda, Ignacio Montes, Inés Couso, Susana Díaz and Susana Montes, from the UNIMODE and METROLOGY AND MODELS research groups from the University of Oviedo. It was attended by 25 students from Spain, Germany, United States of America, Belgium, Switzerland, France and United Kingdom. Although the school is mainly intended for young researchers (PhD or Postdoc students) that want to become acquainted with the theory, in this edition it was also attended by other experienced researchers in the topic. More information about the school can be found at the website:

`http://bellman.ciencias.uniovi.es/~ssipta18/index.html`

The following week, from July 30 to August 1, it took also place in Oviedo the 11th Workshop on Principles and Methods of Statistical Inference with Interval Probability (WPMSIIP). In this workshop, the most recent advances on imprecise probability models are their applications were discussed, with focus on the topics of computation and applications, reliability, learning making, graphical models, and foundations. In addition to some of the participants of the SIPTA school, other researchers from Belgium and Slovenia presented their latest work during the workshop. Next edition of this workshop, that is held annually, will take place in Durham (UK) in September 2019. More information can be found in the website:

`http://bellman.ciencias.uniovi.es/~ssipta18/WPMSIIP.html`

CONFERENCE REPORT

MDAI 2018

The 15th International Conference on Modeling Decisions for Artificial Intelligence (MDAI 2018) was held at the University of the Balearic Islands in Mallorca, Spain, from October 15th to October 18th, 2018. The organization was carried out by the Soft Computing, Image Processing and Aggregation research group (SCOPIA) jointly with the program co-chairs Dr. Vicenc Torra (National University of Ireland Maynooth) and Dr. Yasuo Narukawa (Tamagawa University).

The aim of the MDAI conferences is to provide a forum for researchers to discuss 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 and avoid unnecessary disclosure of sensitive information.

Opening Session

The MDAI conference includes tracks on the topics of (i) data science, (ii) data privacy, (iii) aggregation functions, (iv) human decision making and (v) graphs and (social) networks.

In this edition, 43 papers from 15 different countries were accepted, 25 of which as oral presentations. Some of the papers were selected to be published in the Lecture Notes in Artificial Intelligence, Vol. 11144 (by Springer). The conference also included four very interesting plenary talks given by Dr. Aïda Valls (Rovira i Virgili University), Dr. Jordi Nin (University of Barcelona), Dr. Jozo Dujmovic (San Francisco State University) and Dr. Zoe Falomir (UniversitÃd't Bremen).

The conference attendants had a fruitful time to discuss new advances in decision processes. Besides, they enjoyed a great social program with an excursion to the Valldemossa Charterhouse (former royal residence of the King of Mallorca in the XIV century), a beautiful sunset in Serra de Tramuntana and a visit to La Seu, Mallorca's Cathedral. There, Dr. Daniel Ruiz-Aguilera, member of the SCOPIA research group, gave a talk to the attendants on the mathematical aspects of the cathedral.

The conference was supported by the University of the Balearic Islands (UIB), the European Society for Fuzzy Logic and Technology (EUSFLAT), the Catalan Association for Artificial Intelligence (ACIA), the Japan Society for Fuzzy Theory and Intelligent Informatics (SOFT), and the UNESCO Chair in Data Privacy.

Visit to La Seu, Mallorca's Cathedral

CONFERENCE REPORT

11th +FuzzyMAD meeting

December 14, 2018. Faculty of Mathematics, Complutense University, Madrid, Spain

FuzzyMAD meeting series started in 2008 with the declared objective of making it easier, for researchers and professionals interested in fuzzy logic and soft computing, to meet in Madrid at least once per year. But after the great FuzzyMAD 10th edition last year, we decided to change the name from FuzzyMAD to +FuzzyMAD, in order to show that our target is not limited to the theory and applications of fuzzy sets. The CASI-CAM-CM network (with research teams from four Madrid public universities: UC3M, UAM, UPM, UCM), and the IMEIO Ph.D. program (a joint program between UPM and UCM), had joined the organization of FuzzyMAD, traditionally organized by the FORaid research group and the Instituto de MatemÃątica Interdisicplinar at Complutense University of Madrid.

In addition, this year we counted with the support of LODISCO, the main Spanish network of researchers devoted to fuzzy logic and soft computing.

The first part of +FuzzyMAD 2018 was devoted to a course mainly for Ph.D. students, with two hot conferences: *"The art of visualizing data: dimension reduction"* (by Prof. Ángela Fernández, UAM), and *"Geodesic tools for decision support models"* (by Prof. Gonzalo Barderas, UCM).

In the second part of +FuzzyMAD 2018, as usual, we could follow and discus the current status of the research of some of our Ph.D. students.

The third part of +FuzzyMAD 2018 was focused on the traditional poster session, where attendants can explore future joint collaborations around posters from each research group, in a relaxed buffet meeting.

But the highlight of +FuzzyMAD 2018 was the conference of Prof. Enric Trillas, past IFSA Award (the life-time award from the International Fuzzy Systems Association), that has been also acknowledged with the Fuzzy Systems Pioneer Award by the IEEE Computational Intelligence Society, and with the Pioneer Award by the European Society for Fuzzy Logic and Technologies (EUSFLAT), among other acknowledgements and awards. Prof. Enric Trillas is more than a pioneer in Spain, where he played a key role in the introduction and the development of fuzzy sets.

Enric Trillas talk was about *"Thinking and reasoning"*, a wonderful speech about the future of research in computing with words. His talk included also some wise advice about universities and society.

We took this opportunity to prepare a surprise for Prof. Enric Trillas: many friends were able to travel to Madrid to attend his talk, and they all came into the room just when he was about to start his talk. It was an emotive moment, and at the end of his talk we gave him his last book signed by most of his friends.

The presence of Prof. Enric Trillas made of +FuzzyMAD 2018 something to remember.

In this 11th edition of FuzzyMAD, first edition as +FuzzMAD, there were more than 90 attendants. We had a great time, both from a scientific and a personal point of view.

Javier Montero
Complutense University
Madrid, Spain

This event has been sponsored by Project S2013/ICE-2845 of the Government of Madrid (CASI-CAM-CM network); Instituto de Matemática Interdisciplinar (IMI, Complutense University of Madrid); Ph.D. program on Mathematical Engineering, Statistics and Operational Research (IMEIO); Projects TIN2015-66471-P and MTM2015-65803-R of the Government of Spain; Santander-UCM research projects PR26/16-15B-3, PR26/16-21B-2 and PR26/16-21B-3;Project TIN2016-81731-REDT of the Government of Spain (LODISCO network).

NEWS

Ph.D. Thesis defended by M. A. Viraj J. Muthugala

University of Moratuwa, Moratuwa, Sri Lanka

M. A. Viraj J. Muthugala defended his Ph.D. thesis, entitled "Enhancing Interpretation of Uncertain Information in Navigational Commands for Service Robots Using Neuro-Fuzzy Approach", on June 08, 2018. His advisor was Dr. A. G. Buddhika P. Jayasekara, from the University of Moratuwa.

An intelligent service robot is a machine that is able to gather information from the environment and use its knowledge to operate safely in a meaningful and purposive manner. Intelligent service robots are currently being developed to cater to demands in emerging areas of robotic applications such as caretaking and assistance, healthcare and edutainment. These service robots are intended to be operated by non-expert users. Hence, they should have the ability to interact with humans in a human-friendly manner. Humans prefer to use voice instructions, responses, and suggestions in their daily interactions. Such voice instructions and responses often include uncertain information such as "little" and "far" rather than precise quantitative values. The uncertain information such as "little" and "far" have no definitive meanings and depend heavily on factors such as environment, context, user, and experience. Therefore, the ability of robots to understand uncertain information is a crucial factor in the implementation of human-friendly interactive features in robots.

This research has been conducted with the intention of developing effective methodologies for interpreting uncertain notions such as "little", "near" and "far" in navigational user commands in order to enhance human-robot interaction. The natural tendencies of humans have been considered for the development of the methodologies since the ability of the robot in replicating the natural behavior of humans vastly enhances the rapport between the robot and the user. The methodologies have been developed using fuzzy logic and fuzzy neural networks that are capable of adapting the perception of uncertain information according to the environment, experience and user. The robot's perception of distance and direction related uncertain information in navigation commands is adapted according to the environment. The user feedback is used to adapt the perception toward the user while adapting to the environment. Methods have also been proposed to interpret uncertain information in relation to relative references. Furthermore, the information conveyed through the pointing gesture accompanied with the voice instructions is used to further enhance the understanding of the user instructions. The proposed methods have been implemented on an intelligent service robot named as Moratuwa Intelligent Robot (MIRob) which has been developed as a part of the research. The experiments have been carried out in artificially created domestic environments and the experimental results validate the applicability of the proposed methods in improving the interpretation of uncertain information in navigation commands by a service robot.

This thesis work was partially supported by the University of Moratuwa under Senate Research Grants SRC/CAP/14/16 and SRC/CAP/16/03.

NEWS

Ph.D. Thesis defended by Carely Guada

Complutense University of Madrid, Madrid, Spain

Carely Guada defended her Ph.D. Thesis, entitled "Segmentation and edge detection problems in digital images with fuzzy information", on October 5, 2018. Her advisors were Dr. Javier Montero, Dr. Daniel Gómez and Dr. J. Tinguaro Rodríguez, from Complutense University of Madrid. Her thesis has obtained the highest classification unanimously. The court that evaluated the thesis consisted of 5 professors, all from three Spanish public universities: Humberto Bustince and Aránzazu Jurío, from Public University of Navarra, Sebastia Massanet from University of Balearic Islands, Pilar Romero and Javier Yáñez from Complutense University of Madrid.

Image processing is a field of computational intelligence, which consists of imitating human cognition with the purpose of electronically perceiving and understanding a digital image. In this way, when trying to perceive and understand an image replicating the human vision, image processing facilitates or perfects the accomplishment of diverse tasks, mainly in large processes, and that is why, currently, its use in numerous real applications is very extended.

This doctoral dissertation aims, first to define the fuzzy image segmentation concept based on graph theory opening a new field in the techniques of image processing. To this aim, the concept of crisp segmentation and hierarchical segmentation are formally defined. Furthermore, an algorithm to construct a fuzzy segmentation through hierarchical segmentation was presented. Moreover, a visualization methodology for crisp segmentation, hierarchical segmentation and fuzzy segmentation were proposed. One of the advantages of the fuzzy image segmentation concept is that, produces a sequence of edges with intensity gradation according to the dissimilarity of each object with those around it. These gradations on the edges contribute more information compared to conventional binary outputs. In addition, these gradations of color on the edges are more similar when a human segments an image, where he can highlight more those objects that he sees more clearly in the image.

Secondly, this doctoral dissertation also presented a new classification of problems of image processing based on the output that each of them achieves. This in order to differentiate such problems conceptually because they are frequently confused in the literature.

Thirdly, a new edge detection algorithm called Image Divide and Link (ID&L) is also designed based on hierarchical clustering algorithm. This new algorithm generates an output corresponding to a sequence of hierarchical regions represented through the contour of these regions as a boundary map. The ID&L algorithm has several advantages, one of which is that, when modeling an image as a network, the algorithm is able to work with different types of images. In this doctoral dissertation, the RGB color images that were used for the ID&L algorithm were transformed into the CIELab color space, which has information similar to how humans perceive colors. Additionally, the color images have more information regarding the grayscale images with which other image processing algorithms work. In addition, this doctoral dissertation proposed a new edge evaluation methodology, with the purpose of being able to compare the outputs of the ID&L algorithm with other hierarchical or non-hierarchical edge detection algorithms. The ID&L algorithm is evaluated it with other algorithms that are relevant and widely used in the field of image processing obtaining a good performance.

NEWS

Ph.D. Thesis defended by Pedro Bibiloni

University of the Balearic Islands, Palma, Spain

Pedro Bibiloni defended his PhD Thesis, entitled "Curvilinear Object Detection with Fuzzy Mathematical Morphology for Grayscale and Color Medical Imagery", on October 11th, 2018. The thesis, supervised by Dr. Manuel González-Hidalgo and Dr. Sebastia Massanet, was carried out in the SCOPIA research group (Soft Computing, Image Processing and Aggregation) of the University of the Balearic Islands thanks to the economic support of the Conselleria d'Educació de les Illes Balears. The thesis was awarded the highest qualification by the examining board, composed by Dr. Joan Torrens (University of the Balearic Islands), Dr. Edurne Barrenechea (Public University of Navarre) and Dr. João M. Tavares (Universidade do Porto).

Thanks to the newest technological advances, image processing is getting more and more attention from the scientific community: some tasks, deemed impossible just a few years ago, are suddenly solved. In this PhD thesis, fuzzy mathematical morphology is used to extract information from biomedical imagery with the goal of helping the medical practitioner. In particular, two tasks are faced: the segmentation of vessels from retinal images and the pre-processing of dermoscopic images to remove hair and other artifacts.

Fuzzy mathematical morphology employs fuzzy logic operators to extend the binary morphological operators. In particular, it extends them by being able to process grayscale images, interpreted as fuzzy sets. It is based on two operators, the fuzzy dilation and the fuzzy erosion, that respectively enlarge and shrink objects. They can be sequentially or iteratively combined to provide simple yet powerful image processing algorithms.

In this PhD Thesis, these two operators are generalized to deal with multivariate images by defining the soft color dilation and the soft color erosion. They are designed for generic multivariate color spaces, but also to process natural images consistently with regard to the notions of enlarging and shrinking objects. Besides being able to preserve colors, other theoretical properties are transferred from the fuzzy mathematical morphology.

The soft color dilation and erosion can also be combined, in the same way as the fuzzy erosion and dilation, to provide operators with a complex behaviour. Several combinations of erosions and dilations, both iteratively and sequentially, can now be transferred to color images enabling applications such as noise filtering, contrast enhancing or object segmentation.

In his thesis, Pedro Bibiloni also proposes a definition of curvilinear objects to unify the literature: several image processing problems consider the task of segmenting tubular-shaped objects clearly different to their surrounding background. This state of the art is synthesized by categorizing both the approaches to segment curvilinear objects and the features they consider of interest. Besides, Pedro Bibiloni proposes two algorithms based on morphological operators to segment curvilinear objects. On the one hand, fuzzy mathematical morphology is considered to segment vessels in eye-fundus photographs and on the other hand, soft color morphology is used to detect hair in dermoscopic images.

These two tasks are of crucial interest for practitioners. First, the attributes of the tree-like vessel structure of the retina provide information towards correctly diagnosing illnesses such as retinopathy or glaucoma. Second, it is well-known that dermoscopic images provide useful information towards the diagnosis and classification of skin lesions, such as dysplastic nevi, lentigo maligna or nodular melanomas, among others. However, the presence of bubbles caused by the immersion fluid and skin hair in the images can negatively affect the results of any image processing algorithm. Therefore, a first preprocessing step to reduce noise in these images is highly recommended.

Both proposed methods achieve high performance compared to other published works both from the quantitative and qualitative points of view.

This PhD thesis has several implications: first, it indicates that the soft color morphology is a comprehensible extension of the fuzzy mathematical morphology; second, it is a promising example of the potential of the soft color morphology; and third, it implies that the common denominator of both tasks is extensive enough to face them with similar tools: curvilinear object detectors.

NEWS

New book “The Lyov-Warsaw School. Past and Present”

Ángel Garrido and Urszula Wybraniec-Skardowska

This is a collection of new investigations and discoveries on the history of a great tradition, the Lvov-Warsaw School of logic and mathematics, by the best specialists from all over the world.

The papers range from historical considerations to new philosophical, logical and mathematical developments of this impressive School, including applications to Computer Science, Mathematics, Metalogic, Scientific and Analytic Philosophy, Theory of Models and Linguistics.

https://www.springer.com/us/book/9783319654294

The 11th Conference of the
European Society for Fuzzy Logic and Technology
organized jointly with the IQSA Workshop on Quantum Structures

EUSFLAT2019

Call for papers

Prague, Czech Republic
September 9-13, 2019

The aim of the conference is to bring together theoreticians and practitioners working on fuzzy logic, fuzzy systems, soft computing and related areas. It will provide a platform for the exchange of ideas among scientists, engineers and students.

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 modeling
- Intelligent data analysis and data-mining
- Data aggregation and fusion
- Database management and querying
- Theory and applications of decision-making
- Forecasting and time series modeling
- 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
- Neuro-fuzzy systems
- Stochastic and fuzzy optimization
- Possibility theory and applications
- Rough sets theory
- Semantic web
- Uncertainty modeling

Important dates

Full paper submission:	**February 1, 2019**
Notification of acceptance:	**April 1, 2019**
Early registration:	**April 15, 2019**
Camera ready papers:	**May 1, 2019**

UNIVERSITY OF OSTRAVA
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ISIPTA 2019

3 - 6 July
Ghent, Belgium

The 20-year anniversary edition of the world's main forum on imprecise probabilities

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A wide range of other frameworks, including interval probabilities, sets of probability measures, non-additive set functions, non-linear expectations, and many others, offer powerful robust alternatives and extensions to the probabilistic one. These frameworks are capable of dealing with model uncertainty and indecision, thus allowing for a more faithful representation of real life uncertainty, and are commonly referred to as imprecise probability models. For the past twenty years, their theoretical development and practical application have been the focus of the biennial ISIPTA conferences.

The upcoming 11th edition takes ISIPTA back to its roots: twenty years after its first edition, ISIPTA returns to the medieval city centre of Ghent. What have we learned since then? Which questions still remain open? And what problems should we tackle next? You are hereby warmly invited to join us in shaping the future of imprecise probabilities. Make sure to bring a research state of mind.

Concept: Each accepted contribution is presented *and* discussed, in two separate sessions. Presentations are short and plenary. Detailed explanations and discussions are face-to-face, with the help of a poster or some other visual aid, complemented by a whiteboard, pen and paper, or whichever medium you prefer.

Types of contributions: We accept long papers, short papers and poster abstracts. Papers are published in a volume of PMLR, unless explicitly preferred otherwise by their authors.

Venue: Ghent has been called "Belgium's best kept secret" by The Lonely Planet and a "medieval masterpiece" by The Guardian. The conference itself takes place in an old Augustinian monastery, situated in its historic city centre.

Paper submission deadline: 15 February 2019

More information: *isipta2019.ugent.be*

We hope to welcome you in Ghent next summer!