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Editorial

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This special issue of Fuzzy Sets and Systems is in honour of Francesc Esteva on the occasion of his 70th Birthday, to celebrate a life dedicated to scientific research. Francesc was born in the Mediterranean village of Begur (Catalonia, Spain) in 1943. He got a PhD in Mathematics from the University of Barcelona in 1974 with a dissertation on negations compatible with lattice structures. Since then, he has been actively working in the fields of algebraic and mathematical fuzzy logic as well as in approximate reasoning. Francesc has made important contributions to these fields, like the standard completeness of Hájek's BL logic, the axiomatization of all subvarieties of BL given by standard chains, the introduction of the logic MTL of left-continuous t-norms, the logic ŁΠ combining Łukasiewicz and Product fuzzy logics, similarity-based graded logical systems, etc.

Besides his scientific contributions, Francesc has also played a leading role in research management positions, e.g. as director of the Artificial Intelligence Research Institute (IIIA-CSIC) for more than 20 years, and in promoting science, e.g. in the creation of the Spanish and European societies for fuzzy logic and technology, ESTYLF and EUSFLAT respectively, being elected also president of both societies in the late 90's.

Francesc's research career on fuzzy logic has given him the opportunity of collaborating with excellent scientists, and to settle close relationships with them. Among them, let us first of all mention Enric Trillas. It was with Enric that Francesc, and many other Spanish colleagues, got in touch with Fuzzy Set Theory for the first time in the early 80's. Since then he has shared with Enric many personal and scientific projects and aims. In this sense it is very welcome the contribution by Enric to this special issue.

Second, we have to mention Petr Hájek, with whom Francesc, together with Lluís Godo, has had a long-lasting relationship from the very beginning of the flourishing period (in the early 90's) of what nowadays is called mathematical fuzzy logic. Petr Hájek has been a respected logician since the beginning of his career in the 70's, and his enrollment into mathematical fuzzy logic research has greatly influenced and promoted among many mathematical logicians, including Francesc, the interest for fuzzy logic from the formal point of view, close to what Lotfi Zadeh used to call fuzzy logic in narrow sense. It is really a pity that Petr has not been able to contribute to this issue as a consequence of the health issues that forced him a few years ago to retire from active research.

On the other hand, it was Petr Hájek who introduced Franco Montagna to Francesc, a great logician and even a better person, with whom he maintained a close and fruitful relationship for many years. Very sadly and unexpectedly, Franco passed away on February 2015, but we have been very lucky because he still managed to be one of contributors to this special issue. During the 90's and 2000's Francesc also met and worked together with another exceptional mathematician, Roberto Cignoli, with whom there was (and still is) a long collaboration and friendship. In this period he also had very productive and close collaborations with his French colleagues Bernadette Bouchon-Meunier, Didier Dubois and Henri Prade.

Also, we would like to mention other colleagues and friends close to his generation Francesc has always enjoyed meeting them many times in conferences and workshops, discussing and working together, and who all of them have been very kind to contribute to this special issue; among them Arnon Avron, Miguel Delgado, José Luis García-Lapresta, María Ángeles Gil, Siegfried Gottwald, that suddenly and unexpectedly passed away very recently, Claudio Moraga, Daniele Mundici, Mirko Navara, Vilém Novák, Ewa Orłowska, Irina Perfilieva, Antonia Salas, Sandra Sandri, Michio Sugeno, Settimo Termini, Esko Turunen and Amparo Vila. But actually, the long list of authors that have made possible this special issue encompasses many researchers from younger generations as well, and the editors

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want to sincerely thank all and each one of them for their contributions. All these contributions have undergone a usual peer reviewing process, as the protocol for special issues in FSS requires. In this respect, we are also warmly indebted to all the reviewers that have helped us in this difficult task.

This issue has gathered twenty-six very interesting contributions in a variety of topics, all related in some way or another to Francesc's research interests:

- The paper by Aguzzoli and Bianchi [1] deals with extensions of MTL, first they show that the nilpotent minimum logic can be axiomatized relatively to IMTL with an axiom with only one variable, and then the authors perform an algebraic study of the non-involutive extension of MTL obtained by the same axiom.
- The paper by Ansótegui, Bofill, Manyà and Villaret [2] presents a novel method to build automated theorem provers for many-valued logics, by reducing the semantics of the logic and the formula under consideration into a Satisfiability Modulo Theory instance and subsequently solving the instance using a SMT solver.
- In the paper by Armengol, Dellunde and García-Cerdaña [3] the authors study how to use the formalism of fuzzy description logic to study (local and global) similarity relations.
- In [4], Avron studies two paraconsistent logical systems, extension of the logic **T** of Anderson and Belnap, semantically defined by taking the whole domain but the bottom element as the set of designated values, and important properties of both logical systems, such as completeness and decidability, are proved.
- Bělohlávek and Vychodil present in [5] an algorithm for the factorization of matrices with entries that are grades to which objects represented by rows satisfy attributes represented by columns.
- In [6] Bobillo and Straccia discuss an algorithm for concept inclusion absorption in Fuzzy Description Logics, whose preprocessing of the inclusion axioms allows a smarter application of the tableau rules that results in a speeding up the overall running time of the consistency checking procedure.
- The paper by Bongini, Ciabattoni and Montagna [7] provides a generalization of the framework of sequent calculi, with invertible rules, for a wide family of first-order many-valued logics, called *hyperprojective logics*, that include some important logics, among them Łukasiewicz and Product infinite-valued logics.
- The paper by Busaniche, Cabrer and Mundici [8] provides several characterizations of polyhedral MV-algebras. Polyhedral MV-algebras are isomorphic to the MV-algebra of all continuous $[0, 1]$-valued piecewise linear functions with integer coefficients, defined on some polyhedron in $\mathbb{R}^n$.
- In [9] Cintula offers a systematic study of logics extending MTL with rational truth-constants for which it is possible to ensure Pavelka-style completeness when adding suitable infinitary deduction rules.
- Delgado, Marín, Pérez and Vila investigate in [10] an approach to bipolar queries in the context of flexible querying in fuzzy object databases. By means of the use of a generalized inclusion concept, the authors deal with bipolar conditions on both fuzzy univalued and multivalued attributes.
- In his paper [11], Dubois and Prade explore different multiple-valued extensions of logical expressions of analogical proportions that are equivalent in the Boolean case, discussing the motivations and properties in each of the considered possible extensions.
- Düntsch, Orłowska and van Alten develop in their paper [12] discrete dualities for n-potent MTL algebras, defining classes of frames which provide a relational semantics for the corresponding logics extensions of MTL.
- In the framework of first-order fuzzy logics, Dyba, El-Zekey and Novák study in [13] first-order systems based on non-commutative EQ-algebras, which instead of implication have a fuzzy equality as primitive connective.
- In the paper [14], Esmi, Sussner and Sandri introduce a new class of fuzzy associative memories (FAMs) called *tunable equivalence* FAMs, characterized by the application of parametrized equivalence measures in the hidden nodes, and describe their advantages over other models of FMAs.
- In the context of decision-making problems where agents rate alternatives by means of linguistic terms, García-Lapresta and Pérez-Román propose in [15] an agglomerative hierarchical clustering process where the clusters of agents are generated by using a distance-based consensus measure.
- The paper by Gispert [16] is a contribution to the algebraic study of finitary extensions of Łukasiewicz logic, by describing a specific kind of quasivarieties of MV-algebras that correspond to structural complete extensions of Łukasiewicz logic.
- Gottwald focuses in [17] on the property of local finiteness for t-norm bimonoids for continuous t-norms determined by ordinal sums of Łukasiewicz summands.

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