

Guest Editorial

Fuzzy systems in management and information science

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1. Introduction

Logic is a formal science that studies the principles of valid argumentation [1], and objects essential to making an argument are declarative sentences. In the classical system of logic any meaningful declarative sentence must either be true or false. Aristotle [2] postulated that the declarative sentence “There will be a sea battle tomorrow” could not be considered true or false. His reasoning can be summarized as follows: if the sentence is true at the moment of being pronounced, nothing can prevent a sea battle from taking place tomorrow. If it is false, the same will be the case, that is, there will be no way to start a sea battle tomorrow. Therefore, to accept that the sentence is either true or false at the moment it is issued would mean that our future is already determined and will be forever, and, according to Aristotle, this does not make sense since, in general, future events have the possibility of taking place or not. These types of simple declarative sentences about events that may or may not occur in the future are known as “future contingent propositions”. Łukasiewicz [3], reflecting on Aristotelian future contingents, came to the conclusion that this type of proposition should be considered “not yet determined”, creating a third possibility that differs from the “true” and “false” options. Łukasiewicz formalized this thinking in mathematical terms, giving formal origin to “three-valued logic”. Soon afterwards, Łukasiewicz himself created a formulation

for other logics that allows sentences to be classified into further possibilities than that allowed by three-valued logic. Max Black [4], accepting that it is possible for an object to fulfil a property to a certain degree of truth and falsehood within the continuous interval [0,1], laid the foundations for the creation of an infinitely multi-valued system of logic. Three decades later, Zadeh [5] elaborated a linguistic context around the word “fuzzy” to designate the logical paradigm that allows each proposition to be assigned a value of truth within a continuous infinite of options. With this, Zadeh opened the doors to the new techniques used in multiple industrial applications today, such as, for example, control systems for focusing video cameras or vehicle braking [6–8]. Zadeh’s theory spilled over into fields as diverse as medicine, geology or business management [9–12]. Indeed, scientific works related to this theory can currently be counted in the tens of thousands [13, 14].

This special issue aims to present some of the newest advancements in this direction including contributions in economics, finance and management. The title of the special issue is “Fuzzy Systems in Management and Information Science” and presents extended versions of selected papers presented at the International Conference on Modelling and Simulation in Engineering, Economics and Management (AMSE) held in Girona (Spain) between 28 and 29 June, 2018. The conference was sponsored by the Faculty of Economics and Business of the University of Girona. About 80 people from 17 universities around the world participated at the conference.

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After a careful review process, nine papers of fuzzy logic have been selected for publication in this special issue of *Journal of Intelligent & Fuzzy Systems* titled “Fuzzy Systems in Management and Information Science”.

The first paper, by Javier Reig-Mullor, Jose M. Brotons-Martinez, and Manuel E. Sansalvador-Selles proposes a novel approach to the bank ranking process based on the possibilistic theory. The main objective of their paper is to simplify processes, increase efficiency and improve the sensitivity of results in the bank ranking process.

The second article, by Joan Carles Ferrer-Comalat, Dolors Corominas-Coll and Salvador Linares-Mustarós, analyzes a simplified model for determining national income in which it is assumed that, for the sake of equilibrium, said value is composed of consumption and investment. The aim of this paper is to show a way of incorporating uncertainty into the analysis of the income behavior model and demonstrate how the prediction process is affected when behavior is studied globally for all the possible values of the uncertain parameters that are taken into account, each with their own degree of possibility.

In the third paper, Antonio Socias Salvá, Carolina Nicolas, Patricia Horrach Rosselló and Carles Mulet-Fortezza apply the theory of the forgotten effects to develop a comparative analysis between expertons and shows that the non-foreseen causes, at least in the first instance, affect remarkably to the generation of value in non-profit organizations. This study aims to derive responses to the following questions: What are the most important actions that hybrid business management models can take to generate specific value-creation actions? What are the most important actions that hybrid business management models can take to generate generic value-creation actions? And finally, what are the actions that have more hidden effects on creating value?

The fourth paper, by Victor G. Alfaro-García, José M. Merigó, Gerardo G. Alfaro Calderón, Leobardo Plata-Pérez, Anna M. Gil-Lafuente and Enrique Herrera-Viedma, presents the results of a citation analysis focusing on the universities and countries represented by publications in 22 highly oriented fuzzy research journals using bibliometric techniques. The aim is to advance knowledge of the trends that connect the selected journals by focusing on the most cited universities and countries that shape the broad fuzzy research scope, and with that visualize the trends that link academics and regions.

The fifth article, written by Mayer R. Cabrera-Flores, Marta Peris-Ortiz and Alicia León-Pozo explores the relationship between knowledge, innovation, and profit-making in the craft beer industry in Baja California, Mexico. At its core, this study draws on the SECI model as a reference to highlight the different ways in which knowledge and learning combine to produce new forms of processes or products or break into new market segments.

In the sixth paper, Carles López, Salvador Linares-Mustarós and Josep Viñas present a decision method that uses the fuzzy logic tool “experton” as a basis. The aim of this research is to create an assessment tool based on expert opinions that determines criteria for local public administrations to decide whether a service should be outsourced in a given period.

The seventh work, by Ferran Herraiz Faixó, Francisco-Javier Arroyo-Cañada, Marí a Pilar López-Jurado and Ana M. Lauroba Pérez, shows a new approach to city urban congestion management by deploying programmable economy applications, which include some disruptive inputs such as the Internet of value, smart contracts, digital assets and the monetization, all of this combined with the human motivation. The objectives of this paper are to highlight the importance of the digital and programmable economy as a tool to manage externalities and to emphasize the need to focus on the treatment of the current and new threats of Smart Cities from a more holistic and inclusive point of view, considering the vital importance that citizens will play in the search for new solutions. Second, to emphasize the need to focus on the treatment of the current and new threats of Smart Cities from a more holistic and inclusive point of view, considering the vital importance those citizens will play in the search for new solutions.

The eighth paper, by Carolina Nicolas, Julio Rojas-Mora and Leslier Valenzuela-Fernández, concludes with evidence that oil price has a direct incidence on investments in mining and economic expectations, and indirectly in average income middle managers, market share of the company in the mining sector, and growth of imports and exports in the mining sector. The aim of this study is to examine the incidence of economic activity on soft innovation in the mining sector using the theory of forgotten effects.

In the ninth article, written by Jaime A. López-Gauque and Anna M. Gil-Lafuente, presents a general overview and a long-term comparison in fuzzy logic research published between 1965 and 2017, obtained via Web of Science. The study has provides support for the decision-making in institutions

or governments and is a complementary tool to comprehensive evaluation of research and researchers.

AMSE congress communications were also related to other fields of great current interest such as Neural Networks, Probabilistic Reasoning or Decision Making. After a careful review process, fifteen papers of other related topics have been selected for publication in this special issue of *Journal of Intelligent & Fuzzy Systems*.

The tenth paper, by Keivan Amirbagheri, José M. Merigó, Laura Guitart-Tarrés and Ana Nuñez-Carballosa, proposes, through weighted averages and ordered weighted averaging operators, a new aggregation system for the investigation of average gases emissions. The purpose of this work is to concentrate on the analysis of the use of the aggregation operators in the calculation of green-house gases emission with the aim of developing better decision-making techniques.

The eleventh article, by Gustavo Zurita, José M. Merigó, Valeria Lobos-Ossadón and Carles Mulet-Forteza, aims to develop an analysis that identifies the most productive and influential organizations in Computer Science research. The specific objectives of this study are to create a ranking of Computer Science organizations according to bibliometric indicators; to create rankings of Computer Science organizations for each category of Computer Science; to identify the most productive and influence institutions in Computer Science research; and to identify the number of research institutions that are universities, companies and research centers.

The twelfth article, written by Otero-González, Ibragimova, and Martorell Cunil, analyses the effectiveness of the Early Warning System for forecasting bank defaults during the recent financial crisis using a sample of European listed banks. This study proposes possible improvements to the Early Warning System which could be useful to identify inputs to incorporate in intelligent models.

The thirteenth article, by Christian A. Cancino, José Guimón, Juan C. Salazar-Elena and Ariel I. La Paz, presents the evolution of academic research in digital business between 1990 and 2015. The aim of this paper is to develop a journal and author analysis, identifying the most influential studies in digital business research considering several bibliometric indicators, and providing an overview of the relations among studies through citations.

The fourteenth article, by Pau Vicedo, Hermenegildo Gil and Raúl Oltra-Badenes, conducts bibliometric research into publications during the

period 1999 to early 2018. The aim of this study is to help gain a better understanding of the publications covering CSF and ERP implementations all over the world.

In the fifteenth paper, M. Glòria Barberà-Mariné, Laura Fabregat-Aibar, M. Teresa Sorrosal-Forradellas and Antonio Terceño analyze the survival capacity of mutual funds based on their characteristics. The main purpose of this article is to examine Spanish mutual funds using a methodology based on artificial neural networks, the Self-Organizing Maps developed by Kohonen, to see if they can be clustered into surviving funds and disappeared funds, having defined them using the following variables: age, size, investment flows, performance, volatility, and Morningstar rating.

The sixteenth article, written by Jessica Pesantez-Narvaez and Montserrat Guillen, propose two weighting mechanisms for incorporation in a pseudo-likelihood estimation that improve the predictive capacity of rare binary responses in data collected in complex surveys. The main conclusion is that the methods proposed can improve the predictive performance of logistic regression classifiers in survey data and that this is specially so for most deciles of the predictive distribution.

The seventeenth work, by Martha Flores-Sosa, Ezequiel Avilés-Ochoa and José M. Merigó, presents a new application that uses the simple linear regression and the IOWA operator in the same formulation. The objective of the paper is to obtain a linear model which can be estimated according to a degree of optimism to get different forecast scenarios.

The eighteenth article, by Juan Carlos Salazar-Elena, Asunción López, José Guimón de Ros and Christian A. Cancino, analyses how appropriability regimes are helpful to predict specific patterns of knowledge management strategies in innovative firms, proposing an analytical framework where differences in strategies followed by firms are explained by differences in the environments they face, characterized by disparate levels of threats posed by potential imitators. This work shows that the appearance of diminishing returns from an open innovation strategy is more accelerated in firms immersed in weaker regimes (i.e. firms facing more threats from potential imitators).

The nineteenth paper, written by Gary Reyes-Zambrano, Laura Lanzarini, Waldo Hasperué and Aurelio F. Bariviera, presents a GPS trajectory clustering method that uses angular information to segment the trajectories and a similarity function

guided by a pivot. The improvement in the results obtained in the research is due to the creation of a pivot for the calculation and recalculation of centroids, which improves the selection and obtains more representative groups.

The twentieth article, by Maria Alejandra Pineda-Escobar and José M. Merigó Lindahl, aims to analyze the main contributions in this field, using a bibliometric approach. It considers key bibliometric indicators, such as leading authors, journals, institutions, sources, countries, and the most common keywords. A graphical visualization in bibliometric maps has also been developed, using the VOSviewer software.

In the twenty-first work, Núria Arimany-Serrà and àngels Farreras-Noguer present an economic and financial analysis of the big wine companies in four of the sector's leading territories: Catalonia, La Rioja, Languedoc-Roussillon and Emilia Romagna. The article first characterizes the areas under study and provides a review of the literature before going on to present the empirical study with the appropriate constraints to explain the economic and financial health of these companies representative of the sector and especially their profitability.

The twenty-second paper, by Emilio Mauleón-Méndez, Juanabel Genovart-Balaguer, Onofre Martorell-Cunill and Carles Mulet-Forteza, aims to present a current overview of the main productive and influential countries around the world in the tourism, leisure and hospitality field. The methodology includes a bibliometric analysis in all research journals that are indexed in the Web of Science in the tourism, leisure and hospitality field in 2014 respect to the national contribution that these countries made in these journals.

The twenty-third, written by Augusto Villa-Monte, Laura Lanzarini, Julieta Corvi and Aurelio F. Bariviera presents a technique to extract the most representative sentences of a document taking into account by the user's criteria. These criteria are learned using a neural network, from a minimum set of documents whose sentences have been rated by the user in terms of importance.

Finally, in the last paper, Juan C. Niebla-Zatarain and Francisco J. Pinedo-de-Anda present an overview of entrepreneurship in the family business. The purpose is to understand better the phenomenon of Entrepreneurship, their relationship, and implications related to causes and consequences derived from a family business on the first stage of their life. Scholars with interests in entrepreneurship may find relevant and pertinency information about patterns of research

between universities, authors, countries, keywords, and the co-citations and co-occurrences of them.

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