Guest editorial

Soft Computing in Economics and Business

Introduction

Soft Computing in Economics and Business is becoming very popular in the literature because it offers practical techniques to deal with the complex information of our world (Gil-Aluja, 1999; Gil-Lafuente and Merigó, 2010; Merigó *et al.*, 2015a). Soft Computing includes a wide range of methods and techniques, including fuzzy sets and systems, neural networks, evolutionary algorithms, probabilistic reasoning and other related tools (Yager *et al.*, 2013; Zadeh, 1965). 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 "Soft Computing in Economics and Business", and it presents extended versions of selected papers presented at the International Conference of the International Association for Fuzzy-Set Management and Economy (SIGEF 2015) held in Girona (Spain) between July 6 and 8, 2015. The conference was sponsored by the Faculty of Economics and Business and the Department of Business Administration of the University of Girona. About 100 people from 20 different countries participated at the conference.

Focusing on *Kybernetes*, we see that it has grown a lot throughout time. Now, the journal is close to become 50 years old and is a well-established and recognized journal in the international scientific community. Currently, it has an impact factor of 0.637 in the latest edition of the Journal Citation Reports of the Web of Science (WoS). According to WoS Core Collection, *Kybernetes* has 3,110 articles. By using some bibliometric indicators (Merigó *et al.*, 2015b), we see that the total number of citations received is 6,982, the *h*-index (Hirsch, 2005) is 27 and the average citation per item is 2.25. Table I presents the ten most cited papers in *Kybernetes* of all-time according to WoS Core Collection.

After a careful review process, 13 papers have been selected for publication in this special issue of *Kybernetes* titled "Soft Computing in Economics and Business".

First of all, the special issue begins with a preface from the honorary president of SIGEF, Jaime Gil Aluja, that introduces a general overview of ideas about fuzzy logic and economic science. This time, his focus is on the importance that these tools may have on the European economy. Note that this preface appears at the end of this guest editorial in the Appendix.

The first paper, by Laura Lanzarini, Augusto Villa-Monte, Aurelio Fernández-Bariviera and Patricia Jimbo-Santana, presents some credit scoring rules using modern algorithms based on learning vector quantization and particle swarm optimization. This approach represents a new contribution in the analysis of credit risk management, which is a key issue in financial corporations. The study focuses on developing classification rules that can deal with nominal attributes.

The second article, by Jaime Gil-Aluja, analyzes the basis for establishing one or more Europes. For doing so, he uses a wide range of algorithms for dealing with the complex information, including the method for establishing the maximum similarity subrelations, the Pichat algorithm and the theory of affinities. Several tools are used in this analysis, including the Hamming distance, the Euclidean distance and Galois lattices.

In the third paper, Montserrat Yepes-Baldó, Sefa Boria-Reverter, Marina Romeo and Luis Torres develop a comparative analysis between expertons and uncertain averaging operators and correlational approaches. This comparison is carried out with a case study in corporate social responsibility and effectiveness systems. The authors use several modern aggregation operators, including the uncertain weighted average, the uncertain ordered weighted average (UOWA) and the uncertain probabilistic weighted average. To assess the

Kybernetes
Vol. 46 No. 1, 2017
pp. 2-7

0368-492X
DOI 10.1108/K-12-2016-0341

R	TC	Title	Author/s	Year
1	312	Convergence of Adomian method	Y Cherruault	1989
2	93	On choosing between fuzzy subsets	RR Yager	1980
3	88	Fuzzy pattern matching	M Cayrol; H Farreny; H Prade	1982
4	84	Theory of grey systems	Y Lin; MY Chen; SF Liu	2004
5	78	Representation theorems for fuzzy concepts	CV Negoita; DA Ralescu	1975
6	76	A new definition of the Adomian polynomials	RC Rach	2008
7	72	A theory of concepts and their combination – II	D Aerts; L Gabora	2005
8	63	New numerical study of Adomian method applied to a diffusion model	N Ngarhasta; B Some; K Abbaoui; et al.	2002
9	57	A theory of concepts and their combinations – I	D Aerts; L Gabora	2005
10	56	Information, prediction and structural whole	Y Lin	2001

Notes: Abbreviations: *R* = rank; TC = E

Table I.
10 Most cited papers of all-time in *Kybernetes*

imprecise information of the environment, the authors use interval numbers that can represent the information considering an upper and lower bound.

The fourth paper, by Victor Alfaro-García, Anna M. Gil-Lafuente and Gerardo Alfaro-Calderón, considers a fuzzy methodology for innovation management measurement. They use several methods and techniques especially focused on the theory of forgotten effects and fuzzy relations to build the innovation model.

The fifth article, written by Klender Cortez-Alejandro and Martha del Pilar Rodríguez-García, uses a multi-criteria approach under uncertainty to assess sustainable portfolios of the organization for economic cooperation and development. The work uses portfolio theory and genetic algorithms. Several techniques are considered, including Jensen's alpha, Sharpe ratio and nonlinear programming. The case study uses a sample of almost 1,000 firms from Europe, Asia, America and Oceania.

In the sixth paper, M. Teresa Sorrosal-Forradellas, Lisana Martínez and Antonio Terceño analyze if the European sovereign bonds are in concordance with the general macroeconomic variables evolution. The sample considers European countries between 1999 and 2013. The methodology is carried out by using self-organizing maps. The analysis is able to identify significant connections in the Eurozone, especially during the last financial crisis.

The seventh work, by Xavier Piulachs, Ramón Alemany and Montserrat Guillen, compares emergency care usage and longevity and identifies that they have opposite effects on health insurance rates. The authors develop a longitudinal analysis and obtain dynamic estimations of event probabilities. They develop joint models for personalized survival curve adjustment. The sample focuses on individuals aged 65 years or more who are covered by a private insurance policy.

The eighth paper, by Valeria Scherger, Antonio Terceño and Hernán Vigier, study several aggregation operators and distance measures based on the ordered weighted average (OWA) distance. Particularly, they analyze the goodness index and verify the superiority of the minimum t-norm over other decision rules. This approach is very useful to classify the causes or diseases that affect business failure.

In the ninth article, by Jyrki Savolainen, Mikael Collan and Pasi Luukka, develops a cycle reverting price process in modeling metal mining project profitability. They suggest the inclusion of managerial estimates of long-term market price trends. The model is based on a net present value-based simulation and stochastic differentia

equations. The objective is to include expert information about price cycles in the metal mining investment analysis.

The tenth paper, by Vasile Georgescu, presents genetic algorithms to evolve interval Type-2 fuzzy logic systems to predict bankruptcy. The main advantage of this approach is that it provides a deeper representation of the information that Type-1 fuzzy logic systems can do. The authors present a wide range of issues related to Type-2 fuzzy systems, including Type-2 membership functions, fuzzy rules and enhanced Karnik-Mendel algorithms. The authors develop several simulations for studying the performance in predicting bankruptcy.

The 11th article, written by José M. Brotons and Manuel E. Sansalvador, presents a new approach for dealing with uncertain environments where the information is assessed with fuzzy numbers that represent the minimum and maximum value that can occur and the possibility that the internal values will occur. The focus is on the valuation of quality management systems with fuzzy information. For doing so, they introduce a new type of OWA operator: the basic defuzzification distribution – fuzzy induced OWA (BADD-FIOWA) operator. This operator uses fuzzy information and induced aggregation operators together with BADD distributions.

In the 12th work, Eric Alfredo Rincón-García, Miguel Ángel Gutiérrez-Andrade, Sergio Gerardo de los Cobos-Silva, Roman Anselmo Mora-Gutiérrez, Antonin Ponsich, and Pedro Lara-Vazquez, develops a comparative study of methods based on algorithms for analyzing the population in situations of districting problem. For doing so, the authors use techniques from particle swarm optimization and artificial bee colony.

Finally, in the last paper, Dolors Corominas, Joan Carles Ferrer-Comalat, Salvador Linares-Musarós, and Xavier Bertran study the strong Allee effect with fuzzy information and analyze applications in economic problems. Note that the Allee effect analyzes the evolution of specific population groups characterized by low density levels that can bring survival problems.

José M. Merigó
Department of Management Control and Information Systems, University of Chile, Chile, and
Salvador Linares-Mustarós and **Joan Carles Ferrer-Comalat**
Department of Business Administration, University of Girona, Girona, Spain

References

Gil-Aluja, J. (1999), *Elements for a Theory of Decision Under Uncertainty*, Kluwer Academic Publishers, Dordrecht.

Gil-Lafuente, A.M. and Merigó, J.M. (2010), *Computational Intelligence in Business and Economics*, World Scientific.

Hirsch, J.E. (2005), "An index to quantify an individual's scientific research output", *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 102, pp. 16569-16572.

Merigó, J.M., Engemann, K.J. and Gil-Lafuente, A.M. (2015a), "Intelligent systems in business and economics", *Cybernetics and Systems*, Vol. 46 Nos 3/4, pp. 145-149.

Merigó, J.M., Gil-Lafuente, A.M. and Yager, R.R. (2015b), "An overview of fuzzy research with bibliometric indicators", *Applied Soft Computing*, Vol. 27, pp. 420-433.

Yager, R.R., Abbasov, A.M., Reformat, M.Z. and Shahbazova, S.N. (2013), *Soft Computing: State of the Art Theory and Novel Applications,* Springer-Verlag, Berlin.

Zadeh, L.A. (1965), "Fuzzy sets", *Information and Control*, Vol. 8 No. 3, pp. 338-353.

Appendix. Fuzzy logic and economic science

Professor Dr Jaime Gil Aluja

Science's spaces

When we relate to the spaces where the scientific activity runs, we usually refer, in an implicit way, to the geographic areas where the research task takes place; that specific research task which gives birth to the new discoveries within the different knowledge areas.

Therefore, we proceed to discuss about Europe and Science and how both of them cross their roots over each other's. Facing this statement, you may expect us to start quoting the pre-Socratics and Democrit, and Aristotle afterwards, then Galilei, Newton, Einstein […].

But we are not going to do it this way, because that would be starting by describing the old continent, whereas we are as young as our ambition for the knowledge is.

Therefore, we invite you all to pursue this ambition together through this reading, as well as discovering that we are also living a passionate moment, hoping to build Europe as a mental space beyond its geography: we hope it to be the center of the human universe.

That is why we are not going to revise the limits of our continent. We are not going to talk about borderlines, rivers, seas or mountain chains.

We are going to focus on a mental space, where the "logos" was born, the reason, the empiricism and the science, which had its geographic origin in Eurasia's occidental end, but is considered Europe nowadays. Currently, it is no longer limited by geographic features. There are no longer physical limits, because this space resides within any point where human beings happen to meet and assume:

- the scientific rationality and subjectivity, which help us to reach the knowledge;
- the technologic innovation, which allows converting the knowledge into solutions for the human requirements; and
- the political democracy, which spreads, or should spread, all the results of our intellect among the whole citizenship.

Those values, and not the territories, borderlines, mountains or rivers, are now Europe.

Since the conviction that democracy transforms the best ones' reason and talent into the welfare of all, we can assert together with Karl Popper, one of the thinkers who has best understood the need of an open and free society to avoid the transformation of the technological progress into a totalitarian nightmare, that there is no progress without freedom.

Therefore, if all of us assume the challenge of changing, but any of us cooperate at distributing the results of the progress, Europe, as an historical mission, the highest that can ever be achieved by the human genius, is convicted to failure and will fall down again to the populisms, demagogies, authoritarianisms, false exits […] Europe needs to progress, and we must contribute with our research to achieve our goals, through the collaboration of us all.

The idea that science lacks sense when not resulting in the collective human welfare has always moved us through the past and present, and so it should in the future. That is the modular element that has led our scientific project since the very beginning.

The fusion of space and time

You will agree that we have a hard time accepting the transformation process of the environment where we live, and that we enjoy settling in our routine, because evolution has turned us into genetically reluctant to changes. All over thousands of generations, the human being has restricted himself to inhabiting long-term transformation places. During a million years, our ancestors could only answer the environment's challenges with genetic adaptations; whether the temperature would increase or decrease, our primate ancestors would develop thicker or thinner fat layers, as well as hair layers, just like any other animal.

But, perhaps thanks to the most mysterious coincidence after the one which lead to the origin of life, we learned to talk, and with the language, we dynamited the biological evolution, turning it into cultural and symbolic. This fact took place through an explosion of sense, which changed the history of our planet.

So now, we find ourselves getting ready for a new takeoff, as we have multiplied the major progress, which allowed us to conquer the Earth, once again: our contents cross our brains through their nets, causing humanity to share one single net, a single brain formed by a vast number of units.

What defines this new era for Europe is its emancipation from the geographic support to change into a convergence of brains. It is precisely now the moment to open our eyes to the change and accept what we see; that we are already surfing the turbulences caused by an updated Schumpeterian takeoff: a creative destruction which will distress us if we only take a look over inequality, dismissals and cutbacks on social benefits; a creative destruction which shows up at short term, but which will fill us up with hope if we are capable to understand that those turbulences are a product of a human, social and scientific renovation, with no precedents.

Indeed, Professor Ana Mª Gil Lafuente pointed out in her research work, published by Springer as "Decision Making and Knowledge Decision Support Systems", that the Medieval age lasted 800 years; renaissance lasted 300 years; industrial revolution needed 200 years to conquer Europe; afterwards, we witnessed how Marconi's radio just needed 50 years to impose itself, and finally, just 25 years for the television to occupy the same role. Internet has barely needed 10 years to be the center of our existences.

Everything happens at high speed, and this speed sensitively reveals itself with the same intensity in every corner of our planet. It seems that time and space melt together in a same dimension. This is why nowadays, the expression "here and now" echoes all around the planet right away.

The world obviously accelerates, but it is also evident that during hundreds of thousands of years, the humankind barely progressed, and that slowness is still engraved in our genes. That is why we react stressfully against the acceleration of what may be the major period in the progress of our species.

The moment has arrived, now we must push the Economic science through our work to incorporate under its bosom the intuition besides the reason, the magic compound of subjectivity. We are convinced that the fuzzy theory is playing, and is able to play furthermore beyond in the future, an essential role.

If we do so, we will realize that this is the acceleration of change, where computers double their capacity every two years. It will soon bring us to the confluence between our human intelligence and the artificial one. Only then the formal approaches will have that so-desired effectiveness compound in the decisional field of the states, institutions and businesses.

The question is the following: is the determinism able to go on supporting the economic science just as it has always had thorough the history? The answer is self-evident.

It cannot be forgotten that we are addressing towards a global world where Europe occupies its center, which is no longer a space, but a universal mission of free human beings, guided by the talent and ambition of democratically distributing the products of their efforts among their citizens.

We now take off from Europe towards the future, going across the continents at the speed of sound. Occasionally, the humankind has progressed with a vibrant explosion of knowledge, followed by an economic expansion, such as the current one. Let us remember that this same event took place in the classical Greece (which gave birth to Alexander's Empire and the Roman Empire); during the renaissance (which led to the overcome of the states of the realm's paralysis, petrified, closed-minded, creating the European states) and also during the enlightenment (which planted the seed of reason and caused the industrial revolution and capitalism to sprout). Will we be able to add the subjective compound to the seed of Reason? In our hands resides the unisonous arising of those seeds.

Those periods of the history stand out in first place because of a revolution of the knowledge (led by a few characters). In second place, a cultural revolution followed (led by some cities or nations). Finally, an economic and political revolution sprouted, which affected practically the whole world comprised in that period.

Those were transitional ages of intellectual effervescence, as well as ours; the Europeans were the ones to star in one of the major human epic accomplishments ever dreamt.

The presence of a new renaissance

For a sketched project like ours to make sense, it is necessary to place it in a space and time. Once this action is done, we realize by looking at the present that we find ourselves facing a new renaissance. This affirmation may make you smile shared with lucidity. We are at the verge of a magnificent era.

It can be justified with the considerations we worked out. Why can these moments, the ones we are living, not be expansive moments of the human progress such as in other occasions? Why can those expansions not break the secular barrier to bring us to the new states of progress? Why can new

principles not be imposed on these states of progress? (and, why not the gradual simultaneity principle?). From that point, social, economic and technological paradigms will emerge, unknown up to now.

To make that possible, it is necessary to free the scientific thinking to the use of determinism and be able to apply the powers of the subjective sensation. It may result useful to secure with clarity what is "measurable" and what is "valuable"; the mathematics of the certainty and randomness, the mathematics of uncertainty.

So now we cannot help wondering; which is the characteristic of our age, which the classical Greece, renaissance and enlightenment were lacking? Acceleration, again, it is acceleration. Facing this evidence, we can only conceive a flexible and adaptive scientific knowledge.

Once more, the mathematics of uncertainty pops up to suggest several ways toward the economical science of the future. For the economical science to achieve the acceleration that social life requires, it will be necessary for the scientific development to set forth on the new knowledge, theories and techniques, all required in the new world that awaits us.

Our contribution to that second renaissance, which is sprouting, must strengthen the new globalized education, as well as achieve the required formation in technology and information management, to change the companies into a mecca of the intelligent knowledge (based in innovation), into inclusive (reducing inequalities) and into sustainable (respectful towards the environment and the planet, but also be capable of exploring other worlds within the universe).

Let us suggest a common aim for these final moments: the incorporation of 4,000 million people to this new space of development to achieve the distribution of the global welfare, thanks to a new high quality democracy spread all over the globe.

But that must be carried out by the youth, whose concern pushes them toward the search. They must feel free to assume the whole responsibility in such an important moment of the history. The ones who have already overtaken the old age must let go and allow those overflowing with knowledge and enthusiasm, the ones which will be able to achieve our dream and make it a reality.

Last, dear friends of the new generation, stop thinking in a local and lineal way; start thinking global and exponentially, and let the old ones start enjoying thinking about the future. Welcome to the new Europe.