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Abstracts

Fuzzy Logic and Philosophy: From *De Interpretatione* to some recent papers

Alejandro Sobrino and *Martin Pereira-Fariña*
Faculty of Philosophy, University of Santiago de Compostela
Praza de Mazarelos, s.n., 15782 Santiago de Compostela, Spain
Email: alejandro.sobrino@usc.es, martin.pereira@usc.es

Fruitful relations between two disciplines demand not only to watch towards the future, but also to know their trajectory in the past. Based on this conviction, our intention is to deal with both researcher directions in order to pose some insights about the relations between fuzzy logic and philosophy. To cope with this, we will refer our talk to that interaction in the past and present and we will suggest some possible areas of reciprocal cooperation for the future.

In the past, Aristotle spoke about the Principle of Bivalence and the problems that future contingents throw on it. However, only with analytic philosophers, vagueness get a central position in the philosophical arena, appearing articles entirely devoted to that topic. In the consolidation of vagueness as a habitual topic in the philosophical literature had a crucial paper theoretical and applied success of the multiple-valued logic.

The publication of the Zadeh's 1975 paper “Fuzzy logic and approximate reasoning” in the philosophy Journal Synthese represented, in our opinion, a turning point for a new kind of connections between both disciplines and it opens the present time. After Zadeh’s paper, philosophers as Susan Haak wrote works exploring critically some philosophical foundations of fuzzy logic. Today, ‘vagueness’ and ‘fuzzy logic’ are frequently displayed as titles of articles, books, readings or encyclopaedia entries, but unlike in the early analytic philosophers' papers or in Haack’s books, both labels do not appear mixed, but usually separated. In the current analytic philosophy, vagueness does not consider fuzzy logic and fuzzy logic do not refer to philosophical vagueness analysis.

Our purpose is to finish the talk suggesting some possible areas of interaction for the future that contribute to solve this autistic position. Several directions will be addressed, as to revise some classical philosophical concepts (conjecture, hypothesis,…) from modern fuzzy logic; to explore the role of fuzzy logic like a tool to pose rationality in some modern social problems (sustainability or cultural diversity) and, finally, to explore some fuzzy borders of fuzzy logic (metatheory), questioning, f. ex., if there are vague objects or a genuine fuzzy computation.

Alejandro Sobrino Cerdeiriña is Ph. D. in Philosophy from the University of Santiago de Compostela, Spain. Currently is Associated Professor at the Dpt. of Logic and Moral Philosophy at the same university, where he teaches 'Formal Grammars' and 'Logic Programming'. His areas of interest are: vagueness, fuzzy logic and (vague) natural language processing.

Martín Pereira Fariña_has a degree in Philosophy for the University of Santiago de Compostela (2007). At present, he has been awarded with a FPU grant from Spanish Ministry of Science and Innovation for his Phd studies on Information Technologies in the University of Santiago de Compostela.
His research is focused on the relationships between Philosophy and Soft Computing, as well as the study of a catalogue of rules of fuzzy inferences like models of different types of approximate reasoning. He participated in some conferences and he will publish a paper in a scientific journal.

"Explicandum" versus "Explicatum" and Soft Computing

Settimo Termini
Dipartimento di Matematica, Università di Palermo and
Istituto di Cibernetica "Eduardo Caianiello" del CNR, Napoli, Italy
Email: s.termini@cib.na.cnr.it

The aim of this workshop is very important in my mind since the relationship of soft computing with the so called soft sciences IS crucial for a complete understanding of the ways in which different activities of human mind interact. In this context a central role is played by the question asked by Lotfi Zadeh on the apparently strange fact that in these past decades the interaction with soft sciences has not been as strong as one could have imagined.
The thesis I present here is that at a theoretical level the interaction is a very profound one, independently from what the existing relationships shows. It impinges, in fact, on basic, foundational problems of these disciplines, and asks also for a revisitation of classical problems as the one of "the two cultures".
Starting from Carnap's distinction between explicandum and explicatum of a concept, I shall briefly look at such problems as: a) fuzziness vs vagueness; b) ways of measuring fuzziness: c) the role of aristotelian principles in fuzzy logic; d) revisability vs approximation; e) discrete vs continuum and SC.
A by product of these epistemological considerations, in my view, will be the emergence of a sort of Information dynamics, modelled along the lines outlined by John von Neumann.

Settimo Termini is Professor of Computer Science at the University of Palermo and Director of the Istituto di Cibernetica "Eduardo Caianiello" of CNR (National Research Council). Among his scientific interests, we mention: the introduction (starting from the early 70s) and formal development of the theory of (entropy) measures of fuzziness; an analysis in innovative terms of the notion of vague predicate as it appears and is used in Information Sciences, Cybernetics and AI; the attempt to introduce a new point of view on revisable reasoning based on the notion of 'incompatibility' between statements. Recently he has been interested also on the connections between scientific research and economic development.
He is Fellow of the International Fuzzy System Association and of the Accademia Nazionale di Scienze, Lettere ed Arti of Palermo.
Main books: Aspects of Vagueness, Reidel (1984), edited with E. Trillas and H.J. Skala; Imagination and Rigor, Springer (2006); Contro il declino, Codice edizioni (2007), coauthored with Pietro Greco

Conjectural Reasoning

Itziar García
European Centre for Soft Computing (ECSC), Mieres (Asturias), Spain.
Email: itziar.garcia@softcomputing.es

Reasoning is a human capability that may be the fundamental one that allows the evolution of humankind. It can be considered that any reasoning is a conjecture, finding a conjecture is to get some information from some known information, mathematically, it will be considered that a conjecture is something non-contradictory with the information known. So, it is essential to have some information, without information, everything could be non-contradictory with the empty set and every thing can be conjectured what becomes the fact of conjecture in a no relevant fact.
They can be distinguished three general types of reasoning: deductive, abductive, and inductive reasoning. CHC (Conjectures, Hypotheses and Consequences) models, will try to concrete each kind of reasoning in three well defined sets: consequences set, hypotheses and speculation one. And all elements in these sets will be considered conjectures.
In order to define these sets, it will be taken the definition of operator of consequences in the sense of Tarski, the set of consequences will be formed by all elements deduced from the information known by means of the consequences' operator. Conjectures will be defined as the elements whose negation can not be deduced from the information known. Then, hypotheses are defined as those conjectures that allow deducing all information known. And finally, speculation will be all conjectures that are neither consequences nor hypotheses.
Each consequence operator provides different consequences, depending how it treated the information known, it is common to compare all elements with the infimum of this information, but the elements can be compared with each unit of information, or premise, getting another consequences' operator.
So, it will be introduced CHC models, as a mathematical formalization of human reasoning.

Itziar García-Honrado has a degree in Mathematics for the University of Oviedo (2007) and she is carrying out her PhD in the University of León under the program "Intelligent Systems in Engineering" and working as research assistant at the European Centre for Soft Computing in the unit of "Fundamentals of Soft Computing". Her reaserch is focused in the meaning of logic connectives and the analysis of Conjectures, Hypotheses and Consequences (CHC) models in Fuzzy Logic context.

About the perception of probability

Gracián Trivino
European Centre for Soft Computing (ECSC), Mieres (Asturias), Spain.
Email: gracian.trivino@softcomputing.es

To perceive consist of interpreting the elements in the environment in the light of our personal experience.
The meaning of a perception is the use that the agent does of the received information, in a specific context, for some purpose, e.g., to construct experience.
The granularity of perceptions allows us to explain the second-order perceptions using as a base first-order perceptions.
Metaphors are not only a way of rhetorically using the language, but a way of creating concepts. Rather than an exception, the use of metaphors is a normal rule when making new concepts. There is an interesting type of second order perceptions constructed using metaphors.
The perception of probability belongs to a set of basic perceptions like: size, weight, colour etc.
August De Morgan said: "I consider the word probability as meaning the state of mind respect to an assertion, coming event, or any other matter on which absolute knowledge does not exist".
In this presentation I show the perception of balance between two areas as a metaphor of the perception of probability.
Finally, using this metaphor, I present the solution to several problems of fuzzy probabilities proposed by Lotfi Zadeh.

Gracián Triviño 1982 M.S. Electrical Engineering, 2000. Ph.D. Polytechnic University of Madrid (Spain). From 1982 to 1999 he occupied several positions managing R&D projects in the industry. Areas covered during this professional activity include: Industrial Control, Nuclear Power Plants Control, Telecommunications, Avionics, and Software Engineering.
From 1999 to 2006 he occupied the position of Associated Professor at the Computer Science School of the Polytechnic University of Madrid. Since January 2007 he occupies the position of a Principal researcher of the Research Unit titled "Cognitive Computing. Computing with Perceptions" at the European Centre for Soft Computing in Asturias (Spain).

"Sciences and Complexity" revisited

Rudolf Seising
European Centre for Soft Computing (ECSC), Mieres (Asturias), Spain
Email: Rudolf.Seising@softcomputing.es

61 years ago Warren Weaver's article "Science and Complexity" appeared in the *American Scientist*. The mathematician Weaver was a very important science administrator during and after World War II. As the director of natural science of the Rockefeller Foundation he was significantly involved in changing the leading sciences from physics to life sciences. In his 1949 article "Science and Complexity" Weaver associates this change with the location of a "great middle region" of scientific problems between the "problems of simplicity" that physical sciences are concerned with and the "problems of disorganized complexity" that can be solved by probability theory and statistics. This "middle region" covers the "problems of organized complexity"! He wrote: "These problems—and a wide range of similar problems in the biological, medical, psychological, economic, and political sciences—are just too complicated to yield to the old nineteenth-century techniques …" and "these new problems, moreover, cannot be handled with the statistical techniques so effective in describing average behaviour in problems of disorganized complexity." Weaver stated: "These new problems – and the future of the world depends of many of them, requires science to make a third great advance, an advantage that must be even greater than the nineteenth-century conquest of problems of simplicity or the twentieth-century victory over problems of disorganized complexity. Science must, over the next 50 years, learn to deal with these problems of organized complexity" and that "something more is needed than the mathematics of averages." To solve such problems he pinned his hope on the power of digital computers and on interdisciplinary collaborating "mixed teams".

These quotations sound very similar to statements of Lotfi A. Zadeh's, e. g. in his 1962 paper "From Circuit Theory to System Theory" when he described "the fundamental inadequacy of the conventional mathematics – the mathematics of precisely-defined points, functions, sets, probability measures, etc. - for coping with the analysis of biological systems, and that to deal effectively with such systems, which are generally orders of magnitude more complex than man-made systems, we need a radically different kind of mathematics, the mathematics of fuzzy or cloudy quantities which are not describable in terms of probability distributions." Without knowing how the new kind of mathematics will look – he founded his theory of "Fuzzy sets" three years later –, he said, that "the need for such mathematics is becoming increasingly apparent even in the realm of inanimate systems, for in most practical cases the a priori data as well as the criteria

by which the performance of a man-made system is judged are far from being precisely specified or having accurately-known probability distributions."
Of course when Zadeh called for this "fuzzy mathematics" in 1962 he could not know what fuzzy sets would be when he would create this theory more than two years later, but in 1965 he published his theory of Fuzzy Sets and in 1990 he began to formulate a new scientific concept when he wrote that "what might be referred to as *soft computing* – and, in particular, fuzzy logic – to mimic the ability of the human mind to effectively employ modes of reasoning that are approximate rather than exact. In traditional – hard – computing, the prime desiderata are precision, certainty, and rigor. By contrast, the point of departure in soft computing is the thesis that precision and certainty carry a cost and that computation, reasoning, and decision making should exploit – wherever possible – the tolerance for imprecision and uncertainty.
In this talk we consider the theory of Fuzzy Sets and the research field of soft computing as an approach to solve Weaver's "problems of organized complexity".

Rudolf Seising received the MS degree in mathematics from the Ruhr-University of Bochum 1986 and the Ph.D. degree in philosophy of science from the Ludwig-Maximilians-University (LMU) of Munich in 1995, and the habilitation degree (PD) of history of science from the LMU of Munich in 2004 for his thesis on the history of the theory of fuzzy sets (The Fuzzification of Systems)
He was scientific assistant for computer sciences at the University of the Armed Forces in Munich (1988 - 1995) and scientific assistant for history of sciences at the same university (1995-2002). He was scientific assistant for medical expert and knowledge-based systems at the University of Vienna Medical School resp. of the Medical University of Vienna (2002-2008). In 2008 he was acting as a professor for the history of sciences at the Friedrich-Schiller-University in Jena. Since January 2009 he is Visiting Researcher at the ECSC.

Some Doubts on Coupling the Words 'Fuzzy' and 'Probability'

Enric Trillas, Claudio Moraga, and Sergio Guadarrama
European Centre for Soft Computing (ECSC), Mieres (Asturias), Spain
Email: enric.trillas@softcomputing.es

The currently intriguing problem of establishing a new theory of probability for 'fuzzy events', still remains an open one, and mainly for the case in which the probability's measure should be itself fuzzy, that is, a fuzzy number.
In the authors view, the scientifically prestigious term 'measure of probability', as axiomatized in 1933 by A. N. Kolmogorov, deserves to be carefully used in fuzzy logic. That is, only used when showing the basic treats of a classical measure of probability, although some requirements for the classical crisp case could be shortened or changed.
This communication deals with that kind of questions.

Enric Trillas got his Ph.D on Sciences from the University of Barcelona and became Professor at the Technical University of Catalonia in 1974. In 1989 moved to the Technical University of Madrid, where he was Professor at the Department of Artificial Intelligence until September 2006.
Formerly, and among other positions, he has been Vice-Rector of the Technical University of Catalonia, President of the National Council for Scientific Research (CSIC), Director General of the National Institute for Aerospace Technology (INTA) and General Secretary of the National Plan for Scientific and Technological Research.
Other than several distinctions and medals, he is Fellow of the International Fuzzy Systems Association (IFSA), got the Fuzzy Pioneers Award of the European Society for Fuzzy Logic, an the Fuzzy Systems Pioneer Award of the IEEE Computational Intelligence Society.
His current research interests are Fundamentals of Fuzzy Set Theories, and Fuzzy Logic's Methods of reasoning.

Perceptions: a psychobiological approach

Clara Barroso Jerez
Profesora Titular de Universidad
Dto. Historia y Filosofía de la Ciencia, Educación y Lenguaje
Universidad de La Laguna, Spain
Email: cbarroso@ull.es

Many studies justify defining perception as a psychobiological capacity of humans. From an organic point of view, perception is defined as the neuronal capacity to fire electrochemical impulses in response to stimuli sent to the brain from sensory organs; in psychological terms, perception is the ability to decipher these stimuli by attributing meanings to them. These meanings are constituted through the subject's experiences of the world.

The experience that a subject acquires as she develops within a certain context is what allows her to not only "feel" the stimuli but also to comprehend them and assign them values in terms of meaningful information to act upon. The opportunity to experience events or incidents provides individuals with a catalogue of stimuli that conform how they understand the world that surrounds them and, as a consequence, their grasp of meanings (learning). Two elements determine perception in psychological terms: individual experience and the collective experience of the group to which they belong.

Finally, human subjects are fluent in a collection of shared meanings whose associations with certain stimuli are not defined by precise logical inferences. During the learning process humans develop the ability to assign different meanings to specific stimuli, but also different levels of association between them; how context is perceived plays a significant role in this process. This will make up the knowledge that individuals possess at any given moment and that continues to develop throughout their lifetimes.

Clara Barroso has a Ph.D. in Philosophy and Education Science from the University of La Laguna, Spain where is Associated Professor at the Dpt. of Logic and Moral Philosophy at the same university.

She has made research stays at the Institute of Philosophy of CSIC, the Centre d'Estudis Avançats of Blanes, the Institut de Investigació en Intelligencia Artificial of CSIC and University of Edinburgh

Her areas of interest are in general related to the field of Science, Technology and Society and, in particular, to the application of information technologies to teaching and learning processes and knowledge representation.

Rough Logic in Analyzing Medical Diseases by Knowledge Based Systems?[1]

Gianpiero Cattaneo
Dipartimento Di Informatica, Sistemistica e Comunicazione
Università di Milano - Bicocca, Viale Sarca 336 - U14, I-20126 Milano, Italy
Email: gianpiero.cattaneo@unimib.it

In the analysis of a medical disease in which some symptoms are involved, one has to do with statements of the natural language of the form \the high value of this symptoms is a *necessary* condition in order to have the disease" or \to have headache is a *possible* condition for the same disease" in which some typical terms of modal logic such as \necessary"' or \possible" are involved.
We want to formalize this kind of language by the *rough logical approach* based, according to Pawlak ([Paw81, Paw82, Paw91]), on *information systems*, also called *knowledge representation system* by Vakarelov ([Vak91]). In particular we explore the following investigations.

1. The notion of approximation space as the abstract environment in which the concrete realization of information systems can be formalized.
2. The corresponding modal logic of rough theories with the involved algebraic (lattice) semantic.
3. Some quantitative measure of roughness linked to information Shannon entropy and Boltzmann thermodynamics entropy. These measures are very important in analyzing two possible scenarios:

   The first is the one in which, for some research reasons of the specific medical field, the number of symptoms must be increased and so the patient partition is modified and all the disease conclusion might change.
   The second one in which it is the number of patients which must be increased in order to have a better information.

References

[Paw81] Z. Pawlak, Information systems - theoretical foundations, *Information Systems* 6 (1981), 205-218.
[Paw82] Z. Pawlak, Rough sets, *Int. J. of Computer and Information Sciences* 11 (1982), 341-356.

[1] This work has been supported by MIUR*n*PRIN project “Mathematical aspects and forthcoming applications of automata and formal languages”.

[Paw91] Z. Pawlak, *Rough sets - theoretical aspects of reasoning about data*, Kluwer, Academic Publishers, Dordrecht, 1991.

[Vak91] D. Vakarelov, A modal logic for similarity relations in Pawlak knowledge representation systems, *Fundamenta Informaticae* XV (1991), 61-79.

Gianpiero Cattaneo is Full Professor in "Dynamical System Theory" at the Università di Milano – Bicocca, Department of Computer Science. Previously he was Associate Professor in "Mathematical Methods of Physics" (from 1974 to 1984) and Researcher of "Theoretical Physics" (from 1968 to 1974).
He was Visiting Professor at the Department of Philosophy of Science of Cambridge for the argument of "Mathematical and Logical Foundations of Quantum Mechanics" (1992-1994), at the London School of Economics (Department of Logic and Scientific Methods) (1994-1997), where, since 1998, he has a position of Research Associate at ``The Centre for the Philosopy of Natural and Social Science" , he was Maitre de Conferences de 1ere class at the Nancy-Metz Academy, Institut Universitaire de Technologie (IUT)-Informatique (1997-1999), Maitre de Conferences de 1ere class at "la Ecole Normale Superieure (ENS)" - Lyon: Laboratoire de l'Informatique du Parallèlisme (1999-2001) and in 2007 he was Visiting Professor at the University of Regina (Canada), Dept. of Computer Science.
His research activity, with results published on international journals in more than 210 papers, is centered on the following topics: "Topological Chaos, Cellular Automata and Related Languages", "Algebraic Approach to Fuzzy Logic and Rough Sets", "Axiomatic Foundations of Quantum Mechanics", "Realization of reversible gates by quantum computing techniques".

Detecting possible terrorist groups via social network

Ana Alvarez, Daniel Gomez, Javier Montero, Javier Yáñez
Faculty of Mathematics, Complutense University, Madrid, Spain
Email: anahpunto@gmail.com, monty@mat.ucm.es

Developing security procedures to prevent terrorist attacks has become a major issue for the governments of most countries in the world. Terrorism is no longer a local problem but a global threat, and international collaboration based upon new communication technologies offer the possibility of detecting the existence of more or less closed groups by means of the connections their members establish, in such a way that additional available information can point them as a potential risk, even if they are isolated from the main terrorist organization.
In this paper we use some colouring tools taken from graph theory in order to analyze social networks, in such a way that the structure of the group and the similitude between individuals, together with other characteristics, can help to identify potential threats.

Ana Álvarez has a degree in Mathematics of the University of Oviedo (2006). Since August 2006 she is analytic consultacy at Neo Metrics Analytics. She works with different statistical softwares (SAS, SPPS, R, Matlab, etc.). She is employed at projects of detection of frauds, analysis of social networks, optimization of advertising, forecasting... In May 2007 she has collaborated in Methods of reasoning with Enric Trillas in the European Centre for Soft Computing. They published two works in this period. Since October 2007 she is working with Javier Montero and Daniel Gómez in Complutense University of Madrid. Her research interests are Social networks.

Javier Montero is Associate Professor at the Department of Statistics and Operational Research, Faculty of Mathematics, Complutense University of Madrid (Spain). He holds a Ph.D. in Mathematics from Complutense University since 1982. He is author of more than 60 research papers in refereed journals such as Approximate Reasoning, European Journal of Operational Research, Fuzzy Sets and Systems and a lot more, plus more than 60 refereed papers as book chapters.
His research interests are in Aggregation Opertators, Preference Representation, Multicriteria Decision Making, Group Decision Making, System Reliability Theory and Classification problems, mainly viewed as application of Fuzzy Sets Theory.

Alternatives to Preference Ranking in the Theory of Choice

Hannu Nurmi
Public Choice Research Centre and
Department of Political Science, University of Turku, Finland
Email: hnurmi@utu.fi

Since its re-birth in the 1950's the theory voting has been based on the assumption that the voters are endowed with complete and transitive preference relations – rankings – over the alternatives being voted upon. This assumption can be defended e.g. by the essential incomparability of individual utility values and the ease of manipulation of utility based aggregation systems. Yet, given the abundance of negative results stemming from the ranking assumption, it makes sense to ask if at least some of these results could be avoided by assuming something more or something less than a preference ranking. In this presentation I shall deal with a few alternative assumptions and assess their advantages and disadvantages. The alternatives looked at are individual choice functions, individual preference tournaments as well as assumptions akin to utility functions. The individual choice functions are rules mapping each subset of alternatives into the set of subsets of that set (the best alternatives). The individual preference tournaments, in turn, are complete and asymmetric relations over alternatives. If these are the starting point, the individual is assumed to be able to single out the better one of any pair of alternatives. Some results on the individual choice functions already exist, but the individual preference tournaments remain largely unexplored. Aggregation of individual utility functions has been studied in economic theory (e.g. the Bergson-Samuelsson social welfare function), but our interest is in general in systems that assume that the individuals signal something more detailed or nuanced than their preference rankings. E.g. they may give a grade from A to F to each candidate in elections. A system called majoritarian judgement has been designed in this manner. It turns out to be a version of the range voting which allows the individuals to give each alternative a score – say from -1 to +1 – and the alternative with the largest sum of assigned scores is declared the winner. The majoritarian judgment differs from the range voting in singling out as the winner the alternative with the highest median score. The fuzzy counterparts of the alternative assumptions are also dealt with. Thus, we deal with various choice desiderata involving fuzzy individual choice sets and individual fuzzy preference relations.

Hannu Nurmi received his academic training in University of Turku, Finland, where he obtained his PhD in political science in 1974. For twenty years he was an associate professor of methodology of social sciences before assuming his present position of the professor of political science. In 1990's he served as the Dean of Faculty of Social Sciences of University of Turku. From 2003 till 2008 Nurmi was an Academy Professor of Academy of Finland. From the beginning of 2008 he has been the Director of Public Choice Research Centre in Turku. He is currently also the head of the Department of Political Science at University of Turku. He has been a Senior Fulbright Scholar at Johns Hopkins University (Baltimore. MD, USA), a British Academy Wolfson Fellow at University of Essex (UK) and a visiting professor at University of Minnesota (USA). Nurmi is the author of some 170 scholarly articles and ten books, the most recent ones being *Voting Procedures under Uncertainty* (Springer-Verlag 2002) and *Models of Political Economy* (Routledge 2006). Nurmi's works range from nonexperimental causal analysis techniques to electoral system design, applied game theory and social choice.

Voting on how to vote

José Luis García-Lapresta
PRESAD Research Group, University of Valladolid, Spain,
e-mail: lapresta@eco.uva.es
and
Ashley Piggins
J. E. Cairnes School of Business and Economics,
National University of Ireland, Galway, Ireland,
e-mail: ashley.piggins@nuigalway.ie

There exists a large number of voting systems that can be used in different situations, depending on the issue and the number of alternatives.
When voters have a choice over only two alternatives or candidates, each voter chooses their preferred alternative and the voting system decides the winner (sometimes ties appear). Simple, absolute, special and qualified majorities, and majorities based on the difference of votes may be used in those cases.
Although generally a voting system is fixed before voters reveal their preferences, in this paper we consider that, in a first stage, voters are asked about what is the most suitable voting system for the specific situation over which they have to choose. Once the voting system is selected, in a second stage it is applied to individual preferences and the outcome is obtained.
Some recent papers advocate self-stability for choosing a voting system taking into account individual opinions, in the sense that it should defeat the other voting systems by applying that rule. In this paper we analyze this possibility for a wide class of crisp and fuzzy majorities.

José Luis García Lapresta got a Ph.D. in Mathematics from the University of Barcelona in 1991. He has been Assistant Professor in the Department of Economy of the Universitat Autònoma de Barcelona, in the Department of Applied Mathematics of the Technical University of Catalunya and, since 1986, in the Department of Applied Economy of the University of Valladolid.
He has done many research stays in universities in France, Italy, Austria and Australia and publicized more than book chapters and more than 20 articles in journals such as *Fuzzy Sets and Systems, Information Sciences, International Journal of Intelligent Systems* and *International Journal of Uncertainty, Fuzziness and Knowledge Based Systems and Soft Computing.*
His main research interests are Modelling of preferences, social choice and decision making.

Mathematics and soft computing in Music

Teresa León[1] and Vicente Liern[2]
[1]Dep. Estadística e Investigación Operativa, Universidad de Valencia, Vicente Andrés Estellés, s/n, 46100-Burjassot (Valencia) – Spain,
[2]Dep. Matemáticas para la Economía y la Empresa, Universidad de Valencia, Avda. Tarongers, s/n, 46022,Valencia – Spain
Email: teresa.leon@uv.es, vicente.liern@uv.es

It is widely accepted that nowadays, Mathematics and Computer Science are really necessary in concerts and music shows. Besides, musicians deal with complex mathematical processes that involve uncertainty both in the musical concepts and in the interactions between notes. Musical theory is not very helpful to overcome this difficulty and actually, in many occasions musicians intuitively decide how to play to better fit the composer or the music director's indications.
Focusing on the daily practice of musicians, we give flexibility to the mathematical treatment of musical notes, tuning systems and the relations between them. This allows us to connect the theory and the practice of music. Using fuzzy logic techniques, we describe some musical concepts as fuzzy sets and introduce the -compatibility as a degree of interchangeability between different proposals. In order to illustrate our approach, we make use of some performances of pieces by well-known authors and analyze the compatibility between several musicians and their compatibilities with the theoretical notes. We consider the tuning systems of Pythagoras, Zarlino and Equal Temperament of 12 notes and different instruments for our study.

Teresa León is a mathematician. She is staff members of the University of Valencia. She has been working on fuzzy logic and soft computing since 1998.

Vicente Liern is a mathematician. He is staff member of the University of Valencia. He has been working on fuzzy logic and soft computing since 1998. Besides Vicente Liern is a musician and he is very interested in the
relationship between Music and Mathematics and particularly in tuning systems.

Invariance and variance of motives: Musical logic and/as Fuzzy Logic

Hanns-Werner Heister
Hochschule für Musik und Theater, Hamburg, Germany
Email: hwh@joki.de

Musical motifs, often combined to more expanded themes, form shapes ("Gestalten") with a fairly stable core and diverse and multiple varied elaborations in the course of the art work as process. Necessarily there are blurs not only on the edges of the motifs. Thought patterns and procedures of Fuzzy Logic serve as methodical instrument that expands and enhances conventional thought patterns of music analysis, beginning with the segmentation and emphasis of significant motifs from the score and its flow, but also regarding the concrete definition of "musical logic" (a term of music theory coined by H. Riemann): for fundamental aspects like the interrelations of motives, not only within a single piece of work, the quotation and/or the allusion, the unaware quote, the reminiscence, in general the perception and remembering of motif complexes and more.

I will demonstrate this with some concrete examples. Inversely music (and similarly the fine arts) appear as part and concrete elaboration of the aesthetic and sensual perception, which form their own laws, logics, layers and types of cognition, and therewith nothing less than a paradigm of Fuzzy Logic.

Hanns-Werner Heister was born 1946 in Plochingen/Neckar, Germany. Dr. phil. habil., Professor for Musicology at the Hochschule für Musik und Theater Hamburg. – Publications on methodology of musicology, music aesthetics and sociology, music history, political, popular music and new music, music and musical culture in the Nazi era, in resistance and in exile, aesthetics and history of music theatre, media and institutions of music culture, music anthropology (in particular music and human perception, origins of art), music and other arts.

Among others: Das Konzert. Theorie einer Kulturform [The Concert. Theory of a Cultural Form], 2 volumes (1983), Jazz (1983); Vom allgemeingültigen Neuen. Analysen engagierter Musik: Dessau, Eisler, Ginastera, Hartmann [Of the Universal New. Analyses of engaged Music:…] (2006); (photographies by Ines Gellrich) Un/Endlichkeit. Begegnungen mit György Ligeti [In/Finity. Encountering Görgy Ligeti] (2008); Hintergrund Klangkunst [Background Sound Art] (2008; publ. 2009).

Co-publisher of (among others): Musik und Musikpolitik im faschistischen Deutschland [Music and Music Politics in Fascist Germany] (1984); Komponisten der Gegenwart

[Contemporary Composers] (loose leaf lexicon, since 1992, so far 38 deliveries); Zwischen Aufklärung & Kulturindustrie [Between Enlightenment and Cultural Industry] (3 volumes, 1993); Musik und. Eine Schriftenreihe der Hochschule für Musik und Theater [Music and] Hamburg (since 2000). – Editor of among others: Zwischen/Töne. Musik und andere Künste [Over/tones. Music and other Arts] (series since 1995; Musik/Revolution [Music/Revolution] (3 volumes, 1996/97); „Entartete Musik“ 1938 - Weimar und die Ambivalenz [„Degenerated Music“ 1938 – Weimar and Ambivalence], 2 volumes (2001); Geschichte der Musik im 20. Jahrhundert [History of Music in the 20th Century], Vol. III: 1945-1975 (2005); Zur Ambivalenz der Moderne [On the Ambivalence of Modernity] (series Musik/Gesellschaft/Geschichte), 4 volumes, Vol. 1 2005; Vol. 2-4 2007.

European Centre for Soft Computing

Music and similarity based reasoning

Josep Lluís Arcos
IIIA, Artificial Intelligence Research Institute
CSIC, Spanish National Research Council
Campus UAB, Bellaterra, E-08193, Spain
Email: arcos@iiia.csic.es

Whenever that a musician plays a musical piece, the result is never a literal interpretation of the score. These performance deviations are intentional and constitute the essence of the musical communication. Specifically, they are thought of as conveying expressivity.
Two main purposes of musical expression are generally recognized: the clarification of the the musical structure and the transmission of affective content. The challenge of the compute music field when modeling expressiveness is to grasp the performers "touch", i.e., the musical knowledge applied when performing a score. One possible approach to tackle the problem is to try to make explicit this knowledge using musical experts. An alternative approach, much closer to the human observation-imitation process, is to directly work with the interpretation knowledge implicitly stored in musical recordings. That is, working by similarity.
Case-Based Reasoning (CBR) is an similarity based methodology that exploits prior experiences (called cases) when solving new problems by identifying relevantly similar cases and adapting them to fit new needs. In this talk we will describe how the CBR methodology has been successfully used to design different computer systems for expressive performance. First, we will present the SaxEx system that is able to generate high-quality human-like melody performances of jazz ballads based on examples of human performances. Next, we will present the TempoExpress system that is able to perform expressivity-aware tempo transformations of saxophone jazz recordings. Finally, we will show how a similarity-based approach can be used for identifying professional violin performers in commercial recordings.

Josep Lluis Arcos is a Research Scientist at the Artificial Intelligence Institute of the Spanish National Research Council (IIIA-CSIC). He received a M.S. on Musical Creation and Sound Technology from Pompeu Fabra University in 1996, and a Ph.D. in Computer Science from the Universitat Politècnica de Catalunya in 1997. He is the co-recipient of several awards at
Case-Based Reasoning Conferences and Computer Music conferences. Presently working on Case-Based Reasoning and Learning, on self-organization and self-adaptation mechanisms, and on Artificial Intelligence applications to Music.

Generating Architectural Objects using Fuzzy Logic: Application to a Gaudi's Design

Amadeo Monreal and *Joan Jacas*
Secció de Matemàtiques i Informàtica,
Departament d'Estructures a l'Arquitectura,
Universitat Politècnica de Catalunya, Spain
Email: amadeo.monreal@upc.edu, joan.jacas@upc.edu

The basic idea of our talk lies in the observation that some geometrical objects and, more precisely, some architectural shapes can be interpreted as generated by the application of Boolean operators to the functions that modelize the various surfaces that form the shape. From this beginning, our task has been to broaden the repertoire of architectural shapes that we are able to modelize, simply generalizing the set of binary operations to apply to the functions.

In a more formal description, we can say that our basic idea lies in the substitution of the main operations on the power set $P(X)$ of a classical set X (union, intersection and complementation) that gives to $P(X)$ the structure of a Boolean algebra, by other operations provided by their extensions to fuzzy logic mainly t-norms t-conorms or other aggregation operations.

As we have anticipated, in our setting, the sets are geometric ones i. e.: sets of points either of $\Re^2$ or of $\Re^3$. Using these sets as starting objects, we generate procedures that include fuzzy sets operations of them and, depending on the type of operation; the generated object has completely different geometric properties having the same underlying procedure.

We present three examples of this idea: the first one, as an introductory example, is a straightforward application to the generation of roofs by mixing the absolute value function with max-min operations. The second is related to the development of a mathematical typology that can generate naves and domes in within a recursive procedure. Finally, the third example takes as starting point the procedure of "the double twist" invented and applied by the genial architect Antoni Gaudí in order to design a sophisticated type of architectural elements, especially columns. We give a mathematical model of this procedure and we propose further variations by changing the aggregation operation used in it.

Amadeo Monreal Pujadas got his Bachelor of Sciences (Mathematics) from the Universitat Autònoma de Barcelona (1989), PhD in Mathematics from the Universitat Politècnica de Catalunya (UPC) (2001), with the thesis: Modelling of curves and surfaces with applications to the Computer Aided Geometric Design and to the Architecture; Current job: Lecturer from the Technical School of Architecture of Barcelona, UPC, where he teaches common mathematics and modelling of curves and surfaces. His research is devoted to developing a mathematical grammar based on mathematical formulations enabling families or types of geometric objects as a basis for computer aided design. Regarding this subject, he has published several articles and participated in several conferences, seminars and conferences.
He collaborates, through an agreement, with the technical office that manages the construction of the Sagrada Família's temple in Barcelona, for the implementation of programs for generating conics and quadrics, and for solving diverse geometric problems that frequently arise in the process of realization of the project.

Joan Jacas has got his Bachelor in Mathematics (University of Barcelona UB 1967), Doctorate in Computer Science (Technical University of Catalonia UPC 1987). and Full professor (retired on February 2009) at the School of Architecture of Barcelona in the Mathematics and Computer Science department of the UPC
Has published more than 50 articles in international journals and has been the director of *Mathware & Soft Computing* till his retirement.
Areas of interest: fuzzy relations, approximate reasoning, fuzzy cluster analysis, geometry and architecture. Current research: Fuzzy equalities, mathematical modelling of curves and surfaces applied to Gaudí's works.

Rule Based Fuzzy Cognitive Maps in Humanities, Social Sciences and Economics

Joao Paulo Carvalho
INESC-ID - Instituto de Engenharia de Sistemas e Computadores
IST – Instituto Superior Tecnico, TULisbon, Lisboa, Portugal
Email: joao.carvalho@inesc-id.pt

Decision makers, whether they are social scientists, politicians or economists, usually face serious difficulties when trying to model significant, real-world dynamic systems. Such systems are composed of a number of dynamic qualitative concepts interrelated in complex ways, usually including feedback links that propagate influences in complicated chains. Axelrod work on Cognitive Maps (CMs) introduced a way to represent real-world qualitative dynamic systems, and several methods and tools have been developed to analyze the structure of CMs.
However, complete, efficient and practical mechanisms to analyze and predict the evolution of data in CMs were not available for years due to several reasons. System Dynamics tools like those developed by J. W. Forrester could have provided the solution, but since in CMs numerical data may be uncertain or hard to come by, and the formulation of a mathematical model may be difficult, costly or even impossible due to their qualitative and uncertain nature, then efforts to introduce knowledge on these systems should rely on natural language arguments in the absence of formal models.
Fuzzy Cognitive Maps (FCM), as introduced by Kosko, were developed as a qualitative alternative approach to system dynamics. However, FCM are Causal Maps (a subset of Cognitive Maps that only allow basic symmetric and monotonic causal relations), and in most applications do not explore usual Fuzzy capabilities. They do not share the properties of other fuzzy systems and the causal maps usually result in quantitative matrixes without any qualitative knowledge.
This talk introduces Rule Based Fuzzy Cognitive Maps (RB-FCM), a new approach to model and simulate real world qualitative dynamic systems (social, economic, political, etc.) while avoiding the limitations of the above alternatives.

Joao Paulo Carvalho has a PhD and MsC degrees from Instituto Superior Técnico, Technical University of Lisbon, Portugal, where he is currently a Professor at the Department of Electrical Engineering and Computation. He has taught courses on Computational Intelligence, Distributed Systems, Computer Architectures and Digital Circuits since 1998. He is also a senior researcher at L2F – Spoken Language Systems Laboratory, INESC-ID Lisboa, where he has been working since 1991. His main research interests involve applying Computational Intelligence techniques to solve problems in non-computing related areas.

Some experiences applying fuzzy logic to Economics.

Bárbara Díaz Diez
Departamento de Estadística y Econometría.
Universidad de Málaga, Spain
Email: bdiaz10@gmail.com

Economy becomes a field of special interest for the application of fuzzy logic. Fuzzy inference systems are very useful for Economic Modelling. The use of a rule system defines the underlying economic theory, and allows extracting inferences and predictions. We applied them to modelling and prediction of waged-earning employment in Spain, with Jang´s algorithm (ANFIS) for the period 1977-1998.
As additional experiences in this direction, we have applied the IFN algorithm (Info-Fuzzy-Network) developed by Maimon and Last (2000) to the study of the profit value of the Andalusian agrarian industry (Morillas and Díaz, 2004).
The search for key sectors in n economy has been and still is one of the more recurrent themes in input-output analysis. We proposed a multidimensional approach to classify the productive sectors of the Spanish input-output table (Diaz, Moniche and Morillas 2006). We subsequently analyzed the problems that can arise in key sector analysis and industrial clustering, due to the usual presence of outliers when using multidimensional data (Morillas and Díaz, 2008).
In inter-industry studies, the technical coefficients have been analyzed to recognize those that can be considered to be important for an economy. We have considered “important” is a fuzzy concept which importance membership function can be used as support for a fuzzy graph associated to the I-O matrix. This new procedure is applied to the Spanish 2000 I-O matrix and the results are compared to those reached by classical methods (Submitted for publication).

Barbara Diaz Diez received her BA in Economics from Malaga University, Spain in 1992 and her PhD in Economics from the same University in 2000. She is an Associate Professor at the Statistics and Econometrics Department, University of Malaga. From 1996 to 2000 she had a Research and Educational Personnel scholarship from the Spanish Ministry of Education. She was a visiting scholar at University of Marseille and NEURINFO (Neuro-Informatique et Systèmes Flous) in 1997. She had a postdoctoral scholarship from 2004 to 2006 funded by the Spanish State Secretary of Education and Universities and the European Social Fund to support her stay as a visiting scholar at BISC (Berkeley Initiative in Soft Computing) of the EECS Department, UC Berkeley, where she continued her research until the end of the 2006-2007 school year. Her research topics of interest are Fuzzy logic and approximate reasoning, robust statistics, Input-Output Analysis. She has published papers in Estadística Española (INE), Revista

Asturiana de Economía, Ekonomiaz, Fuzzy Economic Review and Economic Systems Research.

Dichotomic Theories don't work (in Social Sciences)

Veronica Sanz, Spain
Universidad Complutense de Madrid, Spain
Email: veronica.sanz@softcomputing.es

During the last two decades, Science, Technology and Society studies (STS) and Science, Technology and Gender studies (STG) have led an enormous development and proliferation of both empirical and theoretical work. Regarding the second one, it is striking to realize that most relevant authors are, in the core, dealing with the problem of dichotomies, or, specifically, with the inefficacy of traditional philosophical and sociological theories to grasp and account for the phenomena they try to explain. That is the case of Evelyn Fox Keller and the "nature/nurture" debate, Donna Haraway and the "technical/social" distinction, Bruno Latour with the division between "humans/non-humans" or Judith Butler with "sex and gender". Ultimately, all these dichotomic pairs are derivations of first general dichotomy in the Western world: "Nature" (the objective realm) versus "Culture" (the subjective realm), which STS studies are at the core of its criticism.
However in this paper I am going to illustrate the problem of dichotomies with a not-so-known example, one that everybody thinks as an auto-evident dichotomy because it refers to something as close as our own bodies: the distinction between men and women, or, better, between male and female bodies.

Veronica Sanz is a Ph.d candidate at the Department of Logic and Philosophy of Science at the University Complutense of Madrid. She has been for 3 years Assistant Researcher at the Institute of Philosophy of the National Council of Scientific Research (CSIC). During her doctoral years she has been Graduate Student at the University of California at Berkeley, and Fellow Researcher at the Institute of Advances Studies in STS in Graz (Austria). Currently is a Visiting Graduate Student at the European Centre for Soft Computing in Mieres (Asturias).
Her areas of research are Philosophy and Science and Technology Studies of Information Technologies and Artificial Intelligence.

Syntactic Ambiguity Amidst Contextual Clarity – Reproducing Human Indifference to Linguistic Vagueness

Jeremy Bradley
Vienna University of Technology, Austria
Email: jeremy.bradley@gmx.net

Even though human speech is, by default, filled with ambiguity, competent speakers of a natural language generally manage to communicate with each other without having to request clarification after every second sentence. In fact, most linguistic ambiguity is not even noticed by speakers of a language, unless they are made explicitly aware of it or are asked to clarify some particular point, possibly by a less competent speaker of the language in question.

Ambiguity in language can be found on many levels.

- In **lexical ambiguity** a specific word can have different meanings – e.g., a "bank" can be an institution where you can deposit money, the land alongside a river or a lake, or an airplane maneuvre.
- In **syntactic ambiguity** there are multiple ways in which a sentence can be parsed – e.g., the sentence "kissing monkeys can be dangerous" can mean that monkeys absorbed in the act of kissing are dangerous or that it is dangerous to kiss a monkey.
- In **semantic ambiguity** the meaning of a parsed sentence is not clear – e.g., the sentence "quitting smoking now greatly reduces your risk of cancer" can mean that if you quit smoking now, you can increase your odds of avoiding cancer or that now, contrary to what was true in the past, quitting smoking reduces the risk of cancer.

While all three forms of linguistic ambiguity can cause headaches for people in certain situations, none of them make human communication impossible, since context, knowledge of the world, and common sense generally make it clear which interpretation is appropriate. For example, the warning of the US Surgeon General cited above is correctly understood by most readers, including those who choose to ignore it.
Syntactically ambiguous statements will generally be semantically sound, as one possible syntactic interpretation will lead to nonsensical results. Take, for example, the following sentences which, on a superficial level, look very similar:

"The work must be done by a professional." – "The work must be done by Friday."

The syntax of each sentence would allow two interpretations (The person who does the work must be a professional/~~Friday~~; and the work must be done by the deadline of ~~a~~

~~professional~~/Friday), but since we immediately recognize “a professional” as a person and “Friday” as a point in time, the first sentence will not confuse any competent speaker of the English language and the second one will only confuse someone in the process of reading Robinson Crusoe.
As a graduate student in Linguistics and a doctoral candidate in Computer Science, I am currently working on a tool capable of simplifying German texts, optimizing them to meet the needs of people suffering from language disorders, in particular after strokes. In the course of this project, I have encountered many problems of this nature in the German language and have been able to defuse the effects of some of them by making my tool sensitive to context in certain situations.

Jeremy Bradley was born on 6 November 1984 in Vienna, Austria. He is an American by nationality, English is his mother tongue. He graduated from high school in 2004, and started studying medical computer science, at the Vienna University of Technology, the University of Vienna, and the Medical University of Vienna, doing one semester at the University of Helsinki in Vienna. He completed his bachelor of science in 2006, and his master's degree in 2007, and a bachelor in the field of linguistics (Finnish studies) in 2008 at the University of Vienna. He is currently working on his PhD in the field of computer linguistics at the Vienna University of Technology, and on his master's degree in Finno-Ugric studies at the University of Vienna. hel work as a scientific research assistant at the Department of Finno-Ugric languages at the University of Vienna.

Language and Uncertainty in Digitisation

Sven Schlarb
Austrian National Library, Vienna, Austria
Email: sschlarb@yahoo.de

A variety of practical areas are involved in a library digitisation workflow: Scanning the material (newspapers, books, manuscripts, etc.), improving the image quality, applying layout and text recognition (OCR), and supporting the OCR engine or enhancing text recognition output by using language tools. Aspects of uncertainty and fuzziness are inherent to these areas in many facets. On the one hand, in text recognition and image enhancement, fuzziness and uncertainty are a challenge to creating pattern recognition and image processing algorithms. On the other hand, there are approaches which deal with these aspects on the language level. The focus of this abstract is to give an idea where in the IMPACT project[2] uncertainty appears in the latter sense.

Many library collections contain non-digitally born assets representing text, such as newspapers, books, or manuscripts, where no digital version – at least with satisfying quality of the character encoded content – has been created so far. This is especially the case for historical documents from the 16th to the 19th century where many obstacles impede good text recognition results, as there are, historical fonts (e.g. old German gothic fonts), mixed fonts, mixed languages, bad paper quality, bleed through (characters of the other side of the paper are slightly visible), page skew, variable inking, just to name a few. Even if image pre-processing technologies, such as binarisation, deskewing, denoising, etc., can help to overcome these issues to some extend, the accuracy is still far from meeting the expectations of European libraries evaluating the feasibility and added value of large scale digitisation projects. This is exactly where language technologies come into operation. The use of language tools can help being more confident about the correct output of historical variants of a word, or provide lexica especially tailored to the historical context of the material.

As far as the language tools are concerned, there are three main areas in IMPACT where these language tools can improve the output results without human intervention:

- Building (historical) lexica and/or a named entity repository that can be used by the text recognition engine.
- Post-processing the text recognition result by substituting supposed erroneously detected words.

[2] IMPACT is a project funded by the European Commission which aims to significantly improve access to historical text and to take away the barriers that stand in the way of the mass digitisation of the European cultural heritage. See http://www.impact-project.eu.

- Training the recognition engine using ground truth[3] material as a subset of a collection that is going to be digitized.

In this context "uncertainty" refers to the fact that a recognised token, like a single character or word, is always a guess. There is graduation in confidence which highly depends on the methods by which it is determined. In this sense, all of the three areas mentioned above aim at increasing confidence about recognised items.

Sven Schlarb studied Humanities Computing, Philosophy and Spanish Literature at the University of Cologne, and holds a PhD in Humanities Computing focused on the application of fuzzy logic in the Humanities.
Before joining the Austrian National Library in 2008, where he is participating in the EU funded projects IMPACT and PLANETS, he worked as software engineer at Micronet (C++/Java) and SAP support consultant in Madrid.

[3] In the context of text recognition, "ground truth" refers to manually captured (keyed) text document as the ideal result of the digitisation process.

Retrieving conditional and causal sentences in texts

Cristina Puente, Alejandro Sobrino and José A. Olivas, Spain
Email: joseangel.olivas@uclm.es

This paper presents the primary lines of investigation into the automatic retrieval of (crisp and vague) conditional and causal sentences in text documents. The semantic differences between conditional and causal sentences will be analyzed, as well as the most typical lexicographical patterns where they may appear in text documents, classifying them into conditional, biconditional, counterfactual, causal explanations, and causal sentences. It also provides for two different types of tests. The first one will take into account the scope of the documents, such as medical, legal, physics, or aeronautical texts. The second type will introduce an overview of causality in the world of physics, analyzing the popular writings of three different scientists: Stephen Hawking, Isaac Asimov and Carl Sagan.

Cristina Puente Águeda, born in 1978 in Madrid (Spain), received her M.S. degree in Computer Engineering in 2001 (ICAI-Pontificia Comillas University, Madrid, Spain). Phd. student (ICAI-Pontificia Comillas University, Madrid, Spain).
PRINCIPAL EMPLOYMENT AND AFFILIATIONS: From 2005: Associate Professor of the Department of Telecommunications, SEK (IE) University, Segovia, Spain. From 2006: Professor of the Department of Computer Science, ICAI – Pontificia Comillas University, Madrid, Spain. From 2007: Professor of the Department of Mathematics, ICAI –Pontificia Comillas University, Madrid, Spain.

Alejandro Sobrino Cerdeiriña is Ph. D. in Philosophy from the University of Santiago de Compostela, Spain. Currently is Associated Professor at the Dpt. of Logic and Moral Philosophy at the same university, where he teaches 'Formal Grammars' and 'Logic Programming'. His areas of interest are: vagueness, fuzzy logic and (vague) natural language processing.

José A. Olivas, born in 1964 in Lugo (Spain), received his M.S. degree in Philosophy in 1990 (University of Santiago de Compostela, Spain), Master on Knowledge Engineering of the Department of Artificial Intelligence, Polytechnic University of Madrid in 1992, and his Ph.D. in Computer Science in 2000 (University of Castilla–La Mancha, Spain). In 2001 was Postdoc Visiting Scholar at Lotfi A. Zadeh's BISC (Berkeley Initiative in Soft Computing), University of California-Berkeley, USA. His current main research interests are in the field of Soft Computing for Information Retrieval and Knowledge Engineering applications. He received the Environment Research Award 2002 from the Madrid Council (Spain) for his PhD. Thesis.