

**North American Fuzzy Information
Processing Society
Annual Conference**

NAFIPS 2010

**12-14 July 2010
Ryerson University
Toronto, Canada**



Celebrating 125 Years
of Engineering the Future



RYERSON UNIVERSITY



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Welcome from the Conference Organizers

On behalf of the Program and the Organizing Committees of the 2010 Annual North American Fuzzy Information Processing Society's Conference, it is our great pleasure to welcome you to Toronto, Southern Ontario and to the Conference. This conference has attracted over 120 participants, and we anticipate a very exciting and inspiring event on July 12-14, 2010 at Ryerson University located in Toronto, Ontario, Canada.

This conference brings, under the theme *Soft Computing: past, present, and future applications*, the researchers and practitioners in the area of soft computing to Southern Ontario – Canada's manufacturing capital and the home to several of the world's leading industries headquarters. We believe that this year's conference will provide an exceptional setting for sharing and exchanging new ideas, methods, and systems that are directly targeted to industrial applications in automation, control, pattern recognition, imaging, knowledge-based engineering, system modeling, and many other real world soft computing applications.

The conference features 88 high-quality papers selected from 100 papers submitted to the conference after peer-review. They focus on all main aspects of soft computing. One special focus is on type II fuzzy theory and applications. The technical program includes 3 tutorial sessions, three plenary presentations, 7 oral presentation sessions, including 3 invited special sessions, and a banquet at the Atlantis restaurant overlooking Lake Ontario. We expect that this intensive but exciting program will introduce the Toronto area to you as a unique place where innovation, research, development, and education merge with industry and business.

This year marks 45 years of the publication of the seminal paper "Fuzzy Sets" by Lotfi Zadeh and the birth of the fuzzy theory as a foundation of the soft computing. Fuzzy logic and soft computing are already a part of the main engineering technologies. The numbers of soft computing-based publications, patents, products, technologies, and applications are rapidly increasing. This conference is a continuation of the tremendous success of the field and its impact on our day-to-day lives.

NAFIPS'2010 conference would not be possible without the excellent teamwork of all the people involved in its organization. We want to express our sincere thanks to all members of the Program and Organizing Committees and to the student volunteers from Ryerson University for their dedication and hard work. Our special thanks go to all the conference sponsors, the Institute of Electrical and Electronic Engineers (IEEE), Expert Systems of Rome, Italy, Ryerson University, in particular Dr. Anastasios Venetsanopoulos, Vice President Research and Innovations, and Dr. Mohamed Lachemi, Dean of Engineering, Architecture and Science.



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General Co-Chair



William Tastle
General Co-Chair

William Melek

Hao Ying

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Conference Organizing Committee

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University of California,

Executive Chairs

Michael Berthold
University of Konstanz

Burhan Turksen
TOBB-Economics and Technology University, Turkey
University of Toronto

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Mark Wierman
Creighton University

Local Arrangements Chair

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Ryerson University

Meeting Rooms / Presentation Information

Directions to Meeting Rooms

The conference is to be held at the Ryerson University, Department of Computer Science, George Vari Engineering and Computing Centre 245 Church Street, Toronto, Ontario Canada M5B 2K3.

Meeting Rooms:

ENG105 is located on the ground floor.

ENG-LG12 is located on the lower ground floor.

ENG-LG13 is located on the lower ground floor.

Instructions for the Presenting Authors

A computer and LCD projector will be available in each room. Authors must copy their presentation files on a USB key. Authors **must use the computer provided in the Session rooms**, and their presentations must be loaded onto these computers. Adobe Reader and Microsoft PowerPoint will be available on the session computers; however, to ensure compatibility of your presentation with the available software, it is strongly recommended that your presentation is in PDF format, rather than PowerPoint.

Important Note – Duration of Presentation

The total time allocated to any presentation is 30 minutes. Allowing 5 minutes for preparation and introduction at the beginning and 5 minutes for questions, your planned presentation must be limited to 20 minutes.

Student Paper Awards

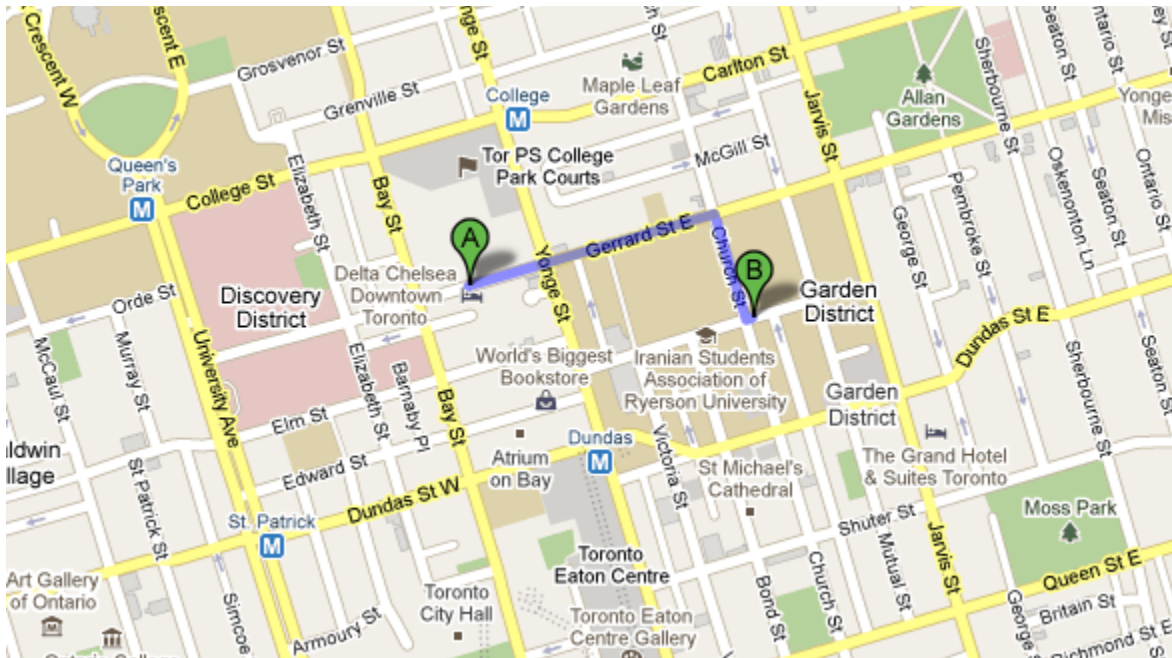
Student Paper Award winners will receive a certificate from the conference. Please follow the notices.

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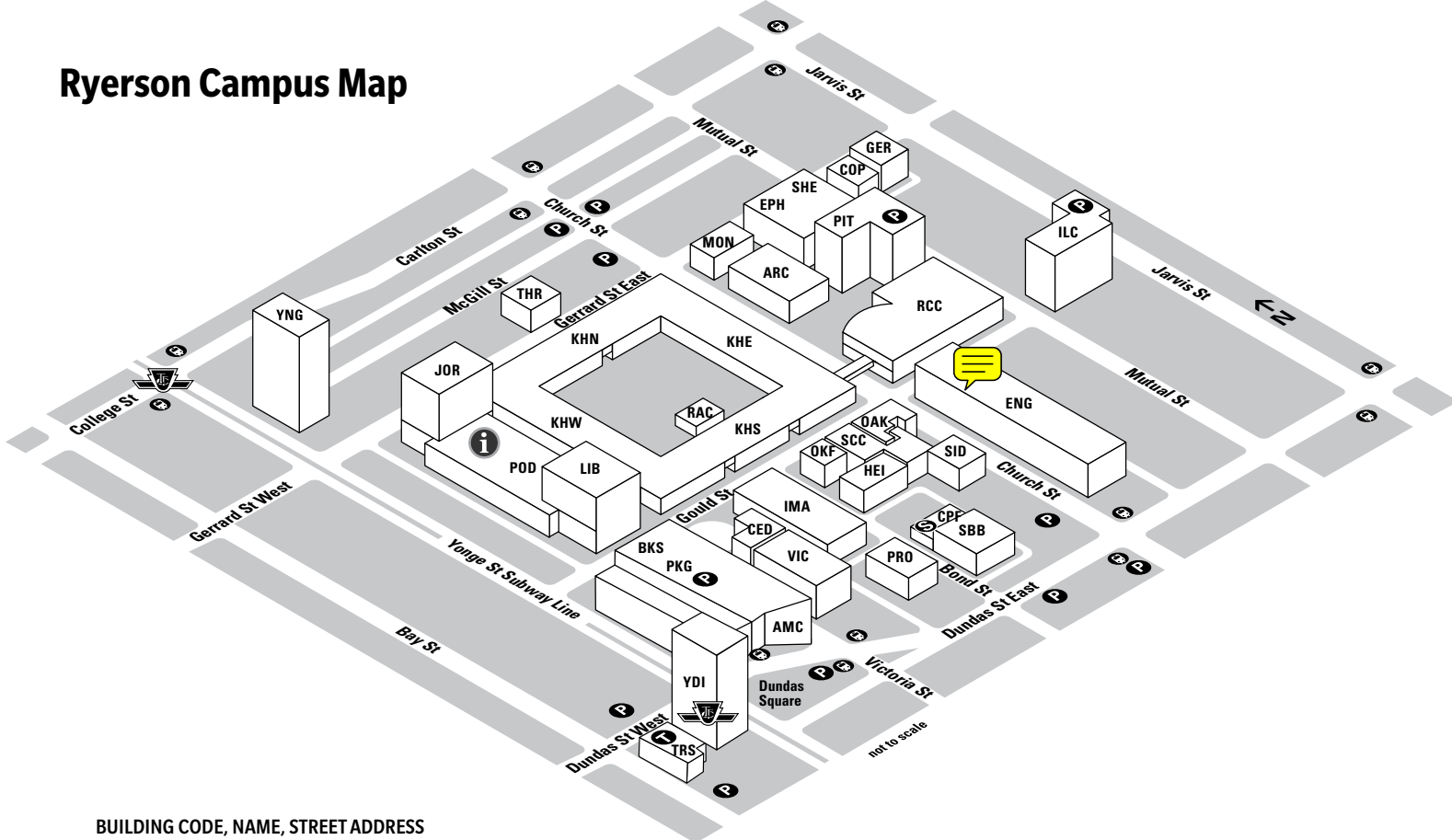
George Vari Engineering and Computing Centre is located at the corner of Church street and Gould street (that is one block north of Yonge & Dundas subway station in case you are walking). In the following map, you may find the direction from *Delta Chelsea Hotel*, to the conference building.

A- Delta Chelsea Hotel, 33 Gerrard Street West, Toronto, Ontario M5G 1Z4







B- George Vari Engineering and Computing Centre, 245 Church Street, Toronto, Ontario Canada M5B 2K3



Ryerson Campus Map



BUILDING CODE, NAME, STREET ADDRESS

- | | |
|---|---|
| AMC Toronto Life Square, 10 Dundas Street East | POD Podium, 350 Victoria Street (area connecting Jorgenson Hall to the Library Building) |
| ARC Architecture Building, 325 Church Street | PRO Projects Office, 112 Bond Street |
| BKS Bookstore, 17 Gould Street | RAC Recreation and Athletics Centre, entrance through archway at 40 and 50 Gould Street |
| CED Heaslip House, The G. Raymond Chang School of Continuing Education, 297 Victoria Street | RCC Rogers Communications Centre, 80 Gould Street |
| COP Co-operative Education and Internship, 101 Gerrard Street East | SBB South Bond Building, 105 Bond Street |
| CPF Campus Planning and Facilities, 111 Bond Street | SCC Student Campus Centre, 55 Gould Street |
| ENG George Vari Engineering and Computing Centre, 245 Church Street | SHE Sally Horsfall Eaton Centre for Studies in Community Health, 99 Gerrard Street East |
| EPH Eric Palin Hall, 87 Gerrard Street East | SID School of Interior Design, 302 Church Street |
| GER Research/Graduate Studies, 111 Gerrard Street East | THR Theatre School, 44/46 Gerrard Street East |
| HEI HEIDELBERG Centre – School of Graphic Communications Management, 125 Bond Street | TRS Ted Rogers School of Management – 575 Bay Street (entrance at 55 Dundas Street West) |
| ILC International Living/Learning Centre, entrances at 133 Mutual Street and 240 Jarvis Street | VIC Victoria Building, 285 Victoria Street (temporary home of the School of Image Arts) |
| IMA School of Image Arts, 122 Bond Street (building closed for renovations; see VIC) | YDI Yonge-Dundas I, 1 Dundas Street West |
| JOR Jorgenson Hall, 380 Victoria Street | YNG 415 Yonge Street |
| KHE Kerr Hall East, 340 Church Street/60 Gould Street | |
| KHN Kerr Hall North, 31/43 Gerrard Street East |  TTC Streetcar stop |
| KHS Kerr Hall South, 40/50 Gould Street |  TTC Subway stop |
| KHW Kerr Hall West, 379 Victoria Street |  Parking |
| LIB Library Building, 350 Victoria Street |  Security |
| MON Civil Engineering Building, 341 Church Street |  Undergraduate Admissions and Recruitment Welcome and Student Information Centre |
| OAK Oakham House, 63 Gould Street |  Direct underground access from the Ted Rogers School of Management to the Dundas Subway |
| OKF O'Keefe House, 137 Bond Street | |
| PIT Pitman Hall, 160 Mutual Street | |
| PKG Parking Garage, 300 Victoria Street | |

General Information

Registration Desk

The Conference Registration Desk will be set up at the ground floor for authors and attendees to register and pick up their conference packages.

Hours of operation are:

Sunday, 11 July, 13:00 PM to 17:00 PM

Monday, 12 July, 08:00 AM to 17:00 PM

Tuesday, 13 July, 08:00 AM to 17:00 PM

Welcome Reception

All participants are invited to the Welcome Reception on Monday, 12 July from 18:00PM to 20:00PM in the *Atrium*, located in the third floor.

Breakfast

For conference attendees, breakfast will be served at the George Vari Engineering and Computing Centre 245 Church Street, lower ground.

Monday, 12 July, 8:00 AM to 9:00 AM.

Tuesday, 13 July, 8:00 AM to 9:00 AM.

Wednesday 14 July, 8:00 AM to 9:00 AM.

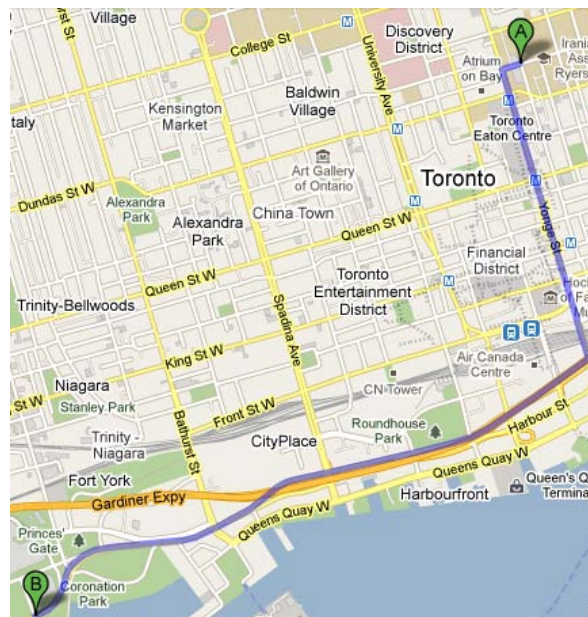
Banquet

Note: Admission to this event is upon the presentation of your Banquet ticket, which may be found in the registration package. No exceptions will be made, so please bring your ticket with you.

- Tuesday 13 July, evening Banquet (*Atlantis Pavilions*, 19:30 to 22:00 PM)

Extra tickets for the Banquet (\$50.00) will be available from the Registration Desk on Ground Floor.

Atlantis Pavilions, is located at Ontario Place, 955 Lakeshore Boulevard West, Toronto, ON M6K 3B9. Transportation from Ryerson to the *Atlantis* will be provided at 6:45 PM. Participants will board a bus from the conference building and will be returned to the conference building after the event.



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Lunches

Some good restaurants/fast foods nearby you can try:

Pickle Barrel, Spring Roll, Red Lobster, Milestones, Elephant & Castle, Food Court in Delta Chelsea, the food court in AMC.

Conference Proceedings USB key

Your registration fee includes the Conference Proceedings (on USB key). Extra USBs are available for \$15. After the conference, Proceedings will be available from the IEEE Publications.

Internet Access

- Wireless Internet Access is available for the conference attendees. You have to connect to the "RYERSON" wireless signal, when prompted enter the key "EGGY1". Once connected, open a browser and you will be redirected to Ryerson login page. Use one of the following credentials to log in.
 - Username: *nafips2010*, Password: *dam59GRC*
 - Username: *nafipsguest*, Password: *ph165BTT*
- Machines in the lab ENG206 – second floor- as well as the cables to hook up laptops are also available. Use the following credentials to access the facilities in the lab.
 - Username: *nafips2010*, Password: *dam59GRC*
- There are Internet cafés nearby,
 - 324 Yonge St., Toronto
 - 509 Yonge St., Toronto

Keynote Speakers

	<p>Witold Pedrycz</p> <p>Collaborative Knowledge Development and Management in Fuzzy Modeling</p> <p>Department of Electrical & Computer Engineering University of Alberta, Edmonton, AB T6R 2V4, Canada and Research Systems Institute, Polish Academy of Sciences Warsaw, Poland pedrycz@ee.ualberta.ca</p>
	<p>Burhan Turksen</p> <p>A Historical Development of Fuzzy System Models</p> <p>Professor Emeritus of Industrial Engineering, University of Toronto, Fellow of IFSA and IEEE turksen@mie.utoronto.ca</p>
	<p>Rafik Aliev</p> <p>Theory of Decision Making with Imperfect Information</p> <p>Department of Computer-Aided Control Systems, Azerbaijan State Oil Academy, 20 Azadlig Ave., AZ1010 Baku, Azerbaijan raliev@asoa.edu.az</p>

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Conference Program at a glance

Sunday - July 11	13:00-19:00	Registration
	13:00-19:00	Tutorials
Monday - July 12	8:00-17:00	Registration
	08:00-09:00	Breakfast
	09:00-09:15	General Announcements
	09:15-09:50	Keynote Speech
	09:50-10:10	Refreshment
	10:10-12:10	Parallel Sessions
	12:10-13:30	Lunch Break
	13:30-15:30	Parallel Sessions
	15:30-15:50	Refreshment
	15:50:17:50	Parallel Sessions
Tuesday - July 13	8:00-17:00	Registration
	08:00-09:00	Breakfast
	09:00-09:15	General Announcements
	09:15-09:50	Keynote Speech
	09:50-10:10	Refreshment
	10:10-12:10	Parallel Sessions
	12:10-13:30	Lunch Break
	13:30-15:30	Parallel Sessions
	15:30-15:50	Refreshment
	15:50:17:50	Parallel Sessions
Wednesday - July 14	08:00-09:00	Breakfast
	09:00-09:50	Keynote Speech
	09:50-10:10	Refreshment
	10:10-12:10	Parallel Sessions

Detailed Schedule of Activities

Sunday - 11 July 2010

Sun.
11-Jul

13:00-19:00

Registration

13:00-19:00

Tutorials

Tutorial 1 : An Introduction to the Mathematics of Fuzzy Sets.

Organizer: Mark Wierman

Room: ENG105 - 13:00-14:00

Abstract For many years, Pluto was a planet and then in 2006, it was not. Pluto had not changed. What had changed was its classification. The discovery of many distant objects in the solar system, some larger than Pluto, had caused astronomers to question the classification of Pluto. On August 24, 2006, the International Astronomical Union defined the term "planet" for the first time! It is also very important to notice that up until 2006 it would seem that the scientific term planet was vague! Was it that scientists did not know what they were talking about? That is not the case. The lack of a precise definition of planet in no way affected its use or usefulness. However for computers to process vague and ill defined information a new approach was needed. Fuzzy set theory takes a different approach. The classification of "planet" would not have a distinct boundary. Instead, some objects might have characteristics that allow for partial inclusion in the category. Fuzzy set theory would place Pluto in the set of planets but not to the same degree as the eight inner planets. This special session is designed for the non-mathematician and non-fuzzy researcher who wishes to learn about this important discipline. You will learn the basics of fuzzy set theory, without the theorems and proofs of a traditional class. The pace will be quick, and you will be encouraged to raise questions and solve a continuing set of problems as your level of understanding moves forward.

Tutorial 2: Type-2 fuzzy sets, operations and membership function elicitation

Organizers: Alireza Sadeghian-Hooman Tahayori

Room: ENG105 - 14:30-15:30

Abstract Fuzzy set, as a class with a continuum of grades of membership, was introduced to be a reasonable framework to enable manipulating problems in which the lack of precisely defined criteria for class membership is the source of imprecision. However, in about a decade, through observing the association between the concept of a linguistic truth with truth-values on one hand, and fuzzy sets with linguistic grades of membership instead of crisp numbers on the other hand, Zadeh was motivated to consider fuzzy sets with fuzzy membership functions which resulted in the introduction of type-2 fuzzy sets as an extension of type-1 fuzzy sets. Two main obstacles that have to be overcome to be able to take more advantages of type-2 fuzzy sets in real-world applications are related to the elicitation of their membership functions and the computational complexity of the operations on them. In performing type-2 fuzzy set operations, Zadeh's extension principle has the pivotal role, that generally is neither simple nor efficient. On the other hand, contrary to the different existing methods for membership function elicitation of type-1 fuzzy sets, few methods are proposed for type-2 fuzzy sets. In this tutorial we will discuss different efficient algorithms for performing operations on type-2 fuzzy sets and will demonstrate some methods on type-2 membership function elicitation by illustrative examples.

Tutorial 3: On the Robustness of Fuzzy Logic Systems

Organizers: William Melek - Mohammad Biglarbegian

Room: ENG105 - 16:00-17:00

Abstract Fuzzy logic systems (FLSs) have been successfully used in modeling and control of a large class of systems. More importantly, we have witnessed an increasing interest in using type-1 as well as interval type-2 FLSs (IT2 FLSs) in numerous applications. However, robustness is not usually considered in the design process of such systems, and hence there is a need for an in-depth investigation that will ultimately pave the road for the design of robust FLSs. Specifically, when a system is subjected to small deviations around the sampling points (operating points) for which the FLS is designed, it is of great interest to find the maximum tolerance of the system for handling those deviations, which we refer to as the system's robustness. In this tutorial, we present a methodology for the robustness analysis of FLSs. An algorithm for the design of robust FLSs is then proposed. Several examples are introduced to describe the implementation and assess the effectiveness of the proposed robustness analysis techniques.

Tutorial 4 : Fuzzy LP and applications to Power Systems

Organizer: Bala Venkatesh

Room: ENG105 - 17:30-18:30

Abstract Linear Programming (LP) is a very important tool in large scale optimization applications such as those found in power systems. In certain practical situations as faced in power systems, it is useful to have LP allow relaxing constraint enforcement or optimize multiple objectives. While relaxed constraint enforcement or multiple objective optimizations is not possible in a regular LP, it is possible in fuzzy LP. This tutorial will introduce fuzzy sets and fuzzy LP. It will be followed by an illustrative example describing its application to a Power System problem.

Monday - 12 July 2010

Mon. 08:00-17:00

Registration

12-Jul 08:00-09:00

Breakfast

09:00-09:15

General Announcements - Room: ENG105

09:15-09:50

Keynote Speech

Chair: Dr Alireza Sadeghian

Burhan Turksen : A Historical Development of Fuzzy System Models

Room: ENG105

Abstract

We first review the development of Fuzzy System Models from Fuzzy Rule bases proposed by Zadeh (1965, 1975) and applied by Mamdani, et al. (1981) to "Fuzzy Functions" proposed by Turksen (2007-2008) and further developed by Celikyilmaz and Turksen (2007-2009) in a variety of versions. Next, we also review a complementary development of "Fuzzy C-Regression Model", (FCRM) proposed by Hathaway and Bezdek, (1993) as well as a Combined FCM, and FCRM algorithms proposed by Höppner and Klawonn (2003). As well we show applied case studies to show the significant results obtained by various met.

09:50-10:10

Refreshment

10:10-12:10

Parallel Sessions

Regular Session-M01: Classification, Clustering and Segmentation

Chair: Amit Banerjee

Room: ENG-LG12

M01-1 *Nicolas Labroche.*

New Incremental Fuzzy C Medoids Clustering Algorithms

Abstract—This paper proposes two new incremental fuzzy c medoids clustering algorithms for very large datasets. These algorithms are tailored to work with continuous data streams, where all the data is not necessarily available at once or cannot fit in main memory. Some fuzzy algorithms already propose solutions to manage large datasets in a similar way but are generally limited to spatial datasets to avoid the complexity of medoids computation. Our methods keep the advantages of the fuzzy approaches and add the capability to handle large relational datasets by considering the continuous input stream of data as a set of data chunks that are processed sequentially. Two distinct models are proposed to aggregate the information discovered from each data chunk and produce the final partition of the dataset. Our new algorithms are compared to state-of-the-art fuzzy clustering algorithms on artificial and real datasets. Experiments show that our new approaches perform closely if not better than existing algorithms while adding the capability to handle relational data to better match the needs of real world applications.

M01-2 *Rogério R. De Vargas and Benjamín R. C. Bedregal.*

A Comparative Study Between Fuzzy c-means and ckMeans Algorithms

Abstract—Clustering is a useful approach in data mining, image segmentation, and other problems of pattern recognition. Fuzzy clustering process can be quite slow when there are many objects or pattern to be clustered. This article discusses about an algorithm, ckMeans, which is able to reduce the number of distinct patterns which must be clustered without adversely affecting partition quality. The reduction is done by calculating a new mathematical equation to obtaining center cluster. To validate the proposed methodology we compared the original fuzzy c-means algorithm with that proposed in this paper.

M01-3 *Nick Pizzi, Aleksander Demko and Witold Pedrycz.*

Classification Using An Adaptive Fuzzy Network

Abstract—The analysis of feature variance is a common approach used for data interpretation. In the case of pattern classification, however, the transformation of correlated features into a new set of uncorrelated variables must be used with caution, as there is no necessary causal connection between discriminatory power and variance. To compensate for this potential shortcoming, we present a classification method that blends variance analysis with an adaptive fuzzy logic network that identifies the most discriminatory set of uncorrelated variables. We empirically evaluate the effectiveness of this method using a suite of biomedical datasets and comparing its performance against two benchmark classifiers.

M01-4 *Amit Banerjee.*

An Improved Genetic Algorithm for Robust Fuzzy Clustering with Unknown Number of Clusters

Abstract—In this paper the problem of partitioning noisy data when the number of clusters c is not known *a priori* is revisited. The methodology proposed is a population-based search in the partition space using a genetic algorithm. Potential solutions are represented using a two-part representation scheme, where the first part of the chromosome represents the classification of the data into true (retained) and outlier (trimmed) sets, and the second part is the result of a partition on the true set for a particular value of c , which is simultaneously optimized by the process. A two-tier fitness function is also proposed in this paper, one which first assesses potential solutions on the basis of a test of clustering tendency on the retained set, and later on the efficacy of the partition for a given value of c . A mating pool is created out of highly successful individuals from the test of clustering tendency and allowed to crossover and produce offspring solutions which inherit the better partition from either of its parents. The proposed methodology is an improvement over a multi-objective genetic algorithm-based clustering technique, which previously was shown to be superior (or at least comparable) to robust clustering methods that assume a known value of c .

Mon. 12-Jul	10:10-12:10	Regular Session-M02: Database and Ontology Chair: Patrick Bosc Room: ENG-LG13
	M02-1	<i>Patrick Bosc and Olivier Pivert</i> Queries Mixing Positive and Negative Associations and their Weakening <i>Abstract</i> —This paper deals with queries involving two components: one describing desired associations, another specifying forbidden associations. In addition, those preferences are cited in the context of a hierarchy expressing some strength about what is wanted and rejected. So doing an ordinal ordering over the answers is made available in order to distinguish among the elements of the answer. The situation where no answer is returned is also tackled and it is proposed to soften the initial query in order to get a non-empty answer. It is shown that this can be achieved still using an ordinal framework which is an extension of the initial one.
	M02-2	<i>Patrick Bosc and Olivier Pivert</i> On the Division of Bipolar Fuzzy Relations <i>Abstract</i> —In this paper, we deal with the relational division operation and extend it so that it can handle bipolar fuzzy relations, i.e., relations where each tuple t is attached a pair of grades in the unit interval expressing the extent to which t satisfies a flexible constraint and a flexible wish tied by a consistency condition. The framework considered is that of an extended relational algebra. It is shown that the result of a division of bipolar relations can be characterized as a twofold quotient. The question of the (non-) primitivity of the operator is also tackled.
	M02-3	<i>Julia Taylor and Victor Raskin.</i> Fuzzy Ontology for Natural Language <i>Abstract</i> —The paper outlines a framework for a full incorporation of fuzziness into a comprehensive system of natural language meaning processing with the help of ontological semantic technology. It goes far beyond the traditional examples of fuzziness for natural language modifiers, claiming that fuzziness is pervasive throughout natural language and cannot be avoided without a considerable penalty on accuracy.
	M02-4	<i>Hanene Ghorbel, Afef Bahri and Rafik Bouaziz.</i> Fuzzy Ontologies Building Method: Fuzzy OntoMethodology <i>Abstract</i> — Building ontologies is very important for diverse domains and especially for semantic Web. We find in the literature many methods and tools for this building. However, the fuzzy aspect is not enough studied in these methods and tools, whereas information systems can include uncertainties and imperfections. The goal of the definition of fuzzy ontologies is to integrate these characteristics. So, we must be able to modulate uncertainties, on the one hand, and to product representations accessible and understandable by machines, on the other hand. If we find actually many building methods and editors for classic ontologies (i.e., crisp or exact), we do not find such methods for fuzzy ontologies. Then, this paper defines our work for fuzzy ontologies building. It presents our fuzzy ontologies building method “Fuzzy OntoMethodology”.
	Special Session-M03: Special Session: Type-2 fuzzy logic systems and control Chair: William Melek Room: ENG105	
	M03-1	<i>Leonardo Leottau and Miguel Melgarejo.</i> A Simple Approach for Designing a Type-2 Fuzzy Controller for a Mobile Robot application <i>Abstract</i> — This paper presents an approach for designing an interval type-2 fuzzy logic controller (IT2-FLC) for a mobile robot application and describes how it can be developed involving the use of type-1 and type 2 fuzzy sets. Some tests are carried out in order to compare its performance variability under different levels of noise and different defuzzifier methods. In addition, designed IT2-FLC is implemented and tested onto a digital signal controller embedded hardware. Simulated and emulated results evidence that IT2-FLC is robust to defuzzifier changes and exhibits better performance than a T1-FLC when noise is added to inputs and outputs.
	M03-2	<i>Mohammad Biglarbegan, William Melek and Jerry Mendel.</i> Robustness of Interval Type-2 Fuzzy Logic Systems <i>Abstract</i> —Fuzzy logic systems (FLSs) have been successfully used in various modeling and control applications. More importantly, we are witnessing an increasing interest in using interval type-2 FLSs (IT2 FLSs) for numerous applications. However, robustness, defined as the tolerance of an FLS to handle a maximum desired output deviation, is not usually considered in the design process of FLSs, and hence there is a need for an in-depth investigation. In this paper, we present a methodology for the robustness analysis of IT2 FLSs. Our approach is general and can be used to analyze the robustness of T1 FLSs as well. To demonstrate the effectiveness of the proposed methodologies, two examples are presented, and it is concluded that T1 and IT2 FLSs exhibit robust behaviors. Moreover, IT2 FLSs due to their flexible structures, revealed reduced output errors and in some cases showed enhanced robust performance than T1. In general, the superiority in terms of the robust performance of T1 over IT2 (or IT2 over T1) is problem-dependent. The approach presented in this paper can be exploited in the design of robust FLSs for modeling applications.
	M03-3	<i>Luis Felipe Albarracin Sanchez and Miguel Alberto Melgarejo Rey.</i> An Approach for Channel Equalization Using Quasi Type-2 Fuzzy Systems <i>Abstract</i> —This article presents a simple approach for the equalization of a nonlinear time varying communication channel using a quasi type-2 fuzzy system. Basically, the Quasi-type 2 fuzzy equalizer is tuned by clustering the output of the channel as it is proposed in previous reported works for other fuzzy equalizers. The main difference is that the quasi type-2 fuzzy perspective permits to derive more design parameters from clustering. The proposed equalizer is compared with type one and interval type-2 equalizers. Although, simulation results show that the quasi type-2 fuzzy adaptive filter exhibits better performance for particular levels of uncertainty, it behaves similarly to the other equalizers in general terms.
	M03-4	<i>Qun Ren, Luc Baron, Marek. Balazinski and Krzysztof Jemielniak.</i> Acoustic Emission Signal Feature Analysis Using Type-2 Fuzzy logic System <i>Abstract</i> – In this paper, type-2 fuzzy logic system is applied to analyse acoustic emission signal feature for tool condition monitoring in a tool micromilling process. To make the comparison and evaluation of AE signal features easier and more transparent, Type-2 fuzzy analysis is used as not only a powerful tool to model AE SFs, but also a great estimator for the ambiguities and uncertainties associated with them. Depend on the estimation of root-mean-square error (RMSE) and variations in modeling results of all signal features, reliable ones are selected and integrated into tool wear evaluation. A discussion and comparison of results is given.

12:10-13:30 Lunch Break

Mon. 13:30-15:30
12-Jul

Paralell Sessions

Regular Session-M11: Modeling

Chair: Thomas Whalen

Room: ENG-LG12

M11-1 *Nael abu-halaweh and Robert W. Harrison.*

FDT 1.0: An Improved Fuzzy Decision Tree Induction Tool

Abstract — FDT is a scalable supervised-classification freeware software tool implementing fuzzy decision trees. It is based on an improved version of the fuzzy ID3 (FID3) algorithm. It implements four different variations of FID3, the first utilizes fuzzy information gain, the second utilizes classification ambiguity, the third utilizes a fuzzy version of Gini-index and the fourth integrates fuzzy information gain and classification ambiguity to select a test (branching) feature. FDT also implements our previously published rule-set reduction method. The tool supports two inference methods: sum-of-products (X- X- +) and max-min. In this paper we introduce FDT and review its' major features and functionalities. In addition, we show that integrating our previously published rule-set reduction approach can improve the classification accuracy and can reduce the number of rules produced of all FID3 versions.

M11-2 *Shih-Chuan Cheng and Premchand Nair.*

Knowledge Presentation According to the Linkage Intensity

Abstract - The objective of this paper is to study methods of knowledge representation, such as frame approaches, production systems, semantic network, and symbolic logic, can be found in literatures. In this paper, we study the notions of similar relation of sets and linkage sets that can be used in not only the characterization of the relation, but also the knowledge representation system and pattern recognition.

M11-3 *Thomas Whalen*

Assessing Probability and Possibility of Catastrophic Failure in Managed Systems Using Sparse Fuzzy Data

Abstract : Comparing risks of rare, high consequence events poses serious challenges to social decision making as well as deep methodological and epistemological problems. It is necessary to assess the merits of countermeasures that are only useful in extremely unlikely circumstances. The value of a conventional conditional probability $P(A|B)$ becomes too uncertain to be useful $P(A \square B) P(B)$ when $P(B)$ is not well measurably different from zero. Possibility theory offers a solution to this dilemma. This paper presents a mathematical model of possibilistic uncertainty in the context of "adventitious" events for which the uncertainty surrounding the best estimate of the rate of occurrence is larger than that best estimate itself.

M11-4 *Ayman Mansour, Hao Ying, Peter Dews, Yanqing Ji, Margo S. Farber, John Yen, Richard E. Miller, R. Michael Massanari*

A Multi-Agent System for Detecting Adverse Drug Reactions

Abstract — Discovering unknown adverse drug reactions (ADRs) as early as possible is highly desirable. Current methods largely rely on passive spontaneous reports, which suffer from serious underreporting, latency, and inconsistent reporting. They are not ideal for early identification of ADRs [5]. In this paper, we propose a multi-agent system approach for ADR detection. A multi-agent system is formed by a community of agents that exchange information and proactively help one another to achieve the goals set by the system designer. We show how agents, equipped with decision rules developed by the physicians on the team, can collaborate to detect signal pairs of potential ADRs. Using the popular agent language JADE [8, 10] and clinical information on 1,000 patients treated at the Detroit Veterans Affairs Medical Center, we have constructed a small group of agents and generated preliminary simulated detection results.

Regular Session-M12: Mathematics

Chair: Valerie Cross

Room: ENG-LG13

M12-1 *Dionís Boixader and J. Recasens*

Introducing Strong T-transitivity in Approximate Fuzzy Preorders and Equivalences.

Abstract — Any fuzzy preorder or equivalence is or is not a fuzzy preorder or equivalence. Through these pages we present two ways of regarding any arbitrary fuzzy relation as a fuzzy preorder or equivalence, at least to some extent. The two ways are the *axiomatic approach*, which deals with relaxed versions of reflexivity, symmetry and T-transitivity, and the *similarity based approach*, which looks into the proximity between a given arbitrary relation and a prototype – a fuzzy preorder or equivalence in the standard fuzzy sense. The relationship between the two views on the problem is studied. As a result, *strong-T-transitivity* is introduced and shown to be a more suitable choice than standard T-transitivity.

M12-2 *Afef Bahri, Rafik Bouaziz and faiez gargouri.*

A Generalized Fuzzy Extension of EL++

Abstract — Fuzzy extensions of Description Logics are generally based on precise membership functions which assign a particular real number to an element or a subset of the universe. In some cases where we may only be able to identify approximately appropriate membership degrees the use of precise membership functions become unsuitable. In this paper we propose a generalized fuzzy extension of the description logic *EL++*, named *Gf-EL++*, based on interval-valued fuzzy sets. We present the syntax and the semantics of *Gf-EL++* which uses an extension of concept subsumption with "intervalvalued fuzzy subsumption". We equally propose a tractable subsumption algorithm for *Gf-EL++*.

M12-3 *Claudi Alsina, Enric Trillas and Itziar García-Honrado.*

On the coincidence of conditional functions

Abstract — This paper deals with a problem in fuzzy logic that can be traced back to classical logic: the reduction of one conditional to another. In particular, the reduction of Rimplications to S-implications and to Q-operators is considered, although the more complex case is the reduction of a Q-operator to an S-implication, equivalent to find the complete solution of a functional equation involving strong negations, continuous t-conorms, and continuous t-norms. Necessary and sufficient conditions for the validity of such equation are presented in several cases, but other cases remain open and deserve to be studied.

M12-4 *Valerie Cross, Meenakshi Kandasamy and Wenting Yi.*

Fuzzy Concept Lattices: Examples using the Gene Ontology

Abstract – Much research in the use of concept lattices for knowledge discovery and data mining has occurred in the past several years. Various approaches have also been proposed to create fuzzy formal contexts and to transform these into fuzzy concept lattices. This paper first briefly reviews concept lattices and then presents several approaches to creating fuzzy concept lattices. One of these approaches is demonstrated with bioinformatics data, specifically using gene annotation data files. The evidence code specified with an annotation is translated into a numeric value in (0, 1] and is interpreted as the degree of association between the gene or gene product and the annotating Gene Ontology term. These degrees of association are used to create the fuzzy formal context which can then be used to create a fuzzy concept lattice.

Mon. 12-Jul	13:30-15:30	Special Session-M13: Inter-relation between interval and fuzzy techniques -Part I Chair: Vladik Kreinovich Room: ENG105
	M13-1	<i>Tanja Magoc and Vladik Kreinovich.</i> How to Relate Fuzzy and OWA Estimates <i>Abstract</i> —In many practical situations, we have several estimates x_1, \dots, x_n of the same quantity x , i.e., estimates for which $x_1 \leq x, x_2 \leq x, \dots, x_n \leq x$. It is desirable to combine (fuse) these estimates into a single estimate for x . From the fuzzy viewpoint, a natural way to combine these estimates is: (1) to describe, for each x and for each i , the degree $\mu_i(x)$ to which x is close to x_i , (2) to use a t-norm (“and”-operation) to combine these degrees into a degree to which x is consistent with all n estimates, and then (3) find the estimate x for which this degree is the largest. Alternatively, we can use computationally simpler OWA (Ordered Weighted Average) to combine the estimates x_i . To get better fusion, we must appropriately select the membership function $\mu_i(x)$, the t-norm (in the fuzzy case) and the weights (in the OWA case). Since both approaches – when applied properly – lead to reasonable data fusion, it is desirable to be able to relate the corresponding selections. For example, once we have found the appropriate $\mu_i(x)$ and t-norm, we should be able to deduce the appropriate weights – and vice versa. In this paper, we describe such a relation. It is worth mentioning that while from the application viewpoint, both fuzzy and OWA estimates are not statistical, our mathematical justification of the relation between them uses results that have been previously applied to mathematical statistics.
	M13-2	<i>Gang Xiang and Vladik Kreinovich.</i> Extending Maximum Entropy Techniques to Entropy Constraints <i>Abstract</i> —In many practical situations, we have only partial information about the probabilities. In some cases, we have <i>crisp</i> (interval) bounds on the probabilities and/or on the related statistical characteristics. In other situations, we have <i>fuzzy</i> bounds, i.e., different interval bounds with different degrees of certainty. In a situation with uncertainty, we do not know the exact value of the desired characteristic. In such situations, it is desirable to find its worst possible value, its best possible value, and its “typical” value – corresponding to the “most probable” probability distribution. Usually, as such a “typical” distribution, we select the one with the largest value of the entropy. This works perfectly well in usual cases when the information about the distribution consists of the values of moments and other characteristics. For example, if we only know the first and the second moments, then the distribution with the largest entropy is the normal (Gaussian) one. However, in some situations, we know the entropy (= amount of information) of the distribution. In this case, the maximum entropy approach does not work, since all the distributions which are consistent with our knowledge have the exact same entropy value. In this paper, we show how the main ideas of the maximum entropy approach can be extended to this case.
	M13-3	<i>John Harding, Carol Walker and Elbert Walker.</i> Type-2 Fuzzy Sets and Bichains <i>Abstract</i> —This paper is a continuation of the study of the variety generated by the truth value algebra of type-2 fuzzy sets. That variety and some of its reducts were shown to be generated by finite algebras, and in particular to be locally finite. A basic question remaining is whether or not these algebras have finite equational bases, and that is our principal concern in this paper. The variety generated by the truth value algebra of type-2 fuzzy sets with only its two semilattice operations in its type is generated by a four element algebra that is a bichain. Our initial goal is to understand the equational properties of this particular bichain, and in particular whether or not it has a finite equational basis.
	M13-4	<i>Yurilev Chalco-Cano, Weldon Lodwick</i> On difference of intervals and differentiability of interval-valued functions <i>Abstract</i> —In this article we present different approaches to the difference of two intervals and its application to differentiability of interval-valued functions. Also, we show the relationship between some definitions of derivative for interval-valued functions.

15:30-15:50 Refreshment

15:50:17:50 **Parallel Sessions**

Regular Session-M21: Generalization and Summarization
Chair: William Tastle
Room: ENG-LG12

M21-1	<i>Mark Wierman.</i> Cloud Sets as a measure theoretic basis for fuzzy set theory <i>Abstract</i> —The theory of Cloud sets is presented and standard techniques of set theory allow for the development of a rich algebra of cloud sets. When measures are added we can introduce the Cloud complement and show that Cloud Sets are isomorphic to fuzzy sets. However, the fundamental manipulations, techniques, and definitions are simpler and more amenable to analysis. For example, the extension principle is easy to define.
M21-2	<i>Anca Ralescu, Sofia Visa and Stefana Popovici.</i> FuzzyProbSim: Fuzzy Probability as Similarity Measure <i>Abstract</i> —This study investigates a unified robust measures of similarity applicable in many domains and across many dimensions of data. Given a distance or discrepancy measure on a domain, the similarity of two values in this domain is defined as the probability that any pair of values from that domain are more different (at a larger distance) than these two values are. Fuzzy sets are introduced to make this definition more sensitive to quantitative difference. Combination across domains is also discussed.
M21-3	<i>H. Rom’an-Flores, A. Flores-Franulic and Hamzeh Agahi</i> Extended Chebyshev type inequality for Sugeno integral <i>Abstract</i> —An extended Chebyshev type inequality for the Sugeno integral on abstract spaces is studied. More precisely, necessary and sufficient conditions under which the inequality or its reverse hold for an arbitrary fuzzy measure-based type Sugeno integral μ and a binary operation and a nonnegative function are given.
M21-4	<i>Mark Wierman and William Tastle</i> Measurement theory and subsethood <i>Abstract</i> —The connection between logical implication and the subsethood relationship is apparent when bivalent logic and crisp set theory are examined. When fuzzy logic and fuzzy set theory are examined, however the connection is not always clear. Ragin Ragin (1987) introduced fuzzy subsethood into the social sciences as a tool for detecting necessary and sufficient conditions. Unfortunately, Ragin’s efforts were dismissed by social scientists because of the problem of scale. This paper examines the use of fuzzy subsethood as tools for detecting causality.

Mon. 15:50:17:50
12-Jul

Regular Session-M22:Image Processing

Chair: Lawrence Mazlack

Room: ENG-LG13

M22-1 *Naoki Motohashi, Kousuke Yamauchi and Tomohiro Takagi.*

Improvement of Bag of Visual Words using Iconclass

Abstract— Recently, bag-of-visual-words has been paid attention to as an image retrieval approach that uses the defining features of images. However, k-means clustering generally used in bag-of-visual-words has a drawback such that its result is affected by setting up initial points and their number. Additionally, the more keypoints increase, the more expensive processing becomes. We resolve the problem of bag-of-visual-words by using a quantizing method that we have developed. In addition, we have developed a theme comprehending system that uses ontology.

M22-2 *Hoon Kang, Seung Hwan Lee, and Jayong Lee*

Image Segmentation Based On Fuzzy Flood Fill Mean Shift Algorithm

Abstract—In this paper, the fuzzy flood fill mean shift algorithm is introduced. This algorithm is developed for the methodology of robust segmentation by improving the mean shift algorithm through the fuzzy kernels and the flood fill technique, instead of those based on the spatial bandwidth. Due to this exchange, the flood fill mean shift involves only one parameter, the range bandwidth, which is less sensitive and is able to acquire the global characteristics. If the image parts affected by the illumination changes are sufficiently small and their boundaries are not clear, the illumination effects do not have an influence on the mode seeking procedure of the proposed fuzzy flood fill mean shift. To prove the usefulness and the validity of our algorithm, we present several experiments and analysis of the results.

M22-3 *Amar Khoukhi and Syed Feraz Ahmed.*

Fuzzy LDA for Face Recognition with GA Based Optimization

Abstract— The paper addresses the face recognition problem by modifying the Fuzzy Fisherface classification method. In conventional methods, the relationship of each face to a class is assumed to be crisp. The Fuzzy Fisherface method introduces a gradual level of assignment of each face pattern to a class, using a membership grading based upon the K-Nearest Neighbor (KNN) algorithm. This method was further modified by incorporating the membership grade of each face pattern into the calculation of the between-class and within class scatter matrices, termed as Complete Fuzzy LDA (CFLDA). Both Fuzzy Fisherface and CFLDA methods utilize the Fuzzy-KNN algorithm. The present work aims at improving the assignment of class membership by improving the parameters of the membership functions. A genetic algorithm is employed to optimize these parameters by searching the parameter space. Furthermore, the genetic algorithm is used to find the optimal number of nearest neighbors to be considered during the training phase. The experiments were performed on the ORL (Olivetti Research Laboratory) face image database and the results show consistent improvement in the recognition rate when compared to the results from other techniques applied on the same database and reported in literature.

M22-4 *Akimitsu Mori, Mayu Sato, Minoru Hamaguchi and Tomohiro Takagi.*

Interpretation of Metaphor and the Principle of Conceptual Fuzzy Sets

Abstract—The utterance ‘She is a bulldozer’ is not interpreted by a person to refer to a piece of construction equipment but to mean something like ‘She is powerful’. Thus, interpretations of language are affected by contexts. This phenomenon does not only apply to metaphor. According to ‘Metaphors We Live By’ (Lakoff and Johnson[1]), our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature. The subject of research is a typical metaphor ‘A is B’, which is a foundation of interpretations, and we propose the model interpretation of metaphor along with the principle of conceptual fuzzy sets. We used news documents as a corpus, experimented on the appropriateness of a proposed system, and then evaluated it.

Special Session-M23: Inter-relation between interval and fuzzy techniques -Part II

Chair: Vladik Kreinovich

Room: ENG105

M23-1 *Yurilev Chalco-Cano, Heriberto Román Flores and Arturo Flores Franulic.*

A generalization on the approximation of compact fuzzy sets

Abstract—In this paper we present an approximation for a compact fuzzy set by a sequence of Lipschitz fuzzy sets. For this, given a compact fuzzy set, we construct a sequence of Lipschitz fuzzy sets using the sup-min-convolution which converge in Dmetric to the compact fuzzy set original. The results obtained in this paper are a generalization of previous result obtained by the authors.

M23-2 *Paulo Pinheiro da Silva, Aaron Velasco and Olga Kosheleva.*

Degree-Based Ideas and Technique Can Facilitate Inter-Disciplinary Collaboration and Education

Abstract—In many application areas, there is a need for inter-disciplinary collaboration and education. However, such collaboration and education are not easy. On the example of our participation in a cyberinfrastructure project, we show that many obstacles on the path to successful collaboration and education can be overcome if we take into account that each person’s knowledge of a statement is often a matter of *degree* – and that we can therefore use appropriate degree-based ideas and techniques.

M23-3 *Kuo-ping Chiao.*

A Direct Solution for Obtaining a Priority Vector from Interval Pairwise Comparison Matrix

Abstract—A direct solution based on graphical method([9]) for linear programming with two decision variables for finding the interval priority vector in interval Analytic Hierarchy Process (AHP) is introduced in this paper. Instead of performing complicated computations, the graphical approach is developed to find the global optimal solution to the mathematical programming model for priority vector for the interval pairwise comparison matrix. The solution from graphical method is the global extremes rather than the local extremes. As a result the normalized optimal priority vector is referred to as the Global Optimal Interval Priority Vector (GOIPV). To verify GOIPV method, a numerical example from literature is reviewed with GOIPV method.

M23-4 *Fei You, Hao Ying*

Interval Type-2 Boolean Fuzzy Systems Are Universal Approximators

Abstract—Unlike the Mamdani and TS fuzzy systems, a Boolean fuzzy system, type-1 or type-2, employs a fuzzy implication to interpret its rules. There exist three families of type-2 fuzzy implications – R-implication, S-implication and QL-implication. In this paper, using the same technique that we developed previously [22, 23], we constructively prove that all the interval type-2 Boolean fuzzy systems, regardless of the implication they use, are universal approximators in that they are capable of uniformly approximating any real multivariate continuous function on a compact domain to any degree of accuracy.

18:00-20:00

Welcome Reception - Atrium, Third Floor

Tuesday - 13 July 2010

Tue. 08:00-17:00

Registration

13-Jul 08:00-09:00

Breakfast

09:00-09:15

General Announcements - Room: ENG105

09:15-09:50

Keynote Speech

Chair: Hao Ying
Rafik Aliev: Theory of Decision Making with Imperfect Information
Room: ENG105

Abstract

There is an extensive literature on decision making under uncertainty. Unfortunately, up to date there are no completely valid and trustful decision principles for humanistic systems characterized by imperfect information. In these systems decision-relevant probabilities and utilities are not known precisely – instead they are imprecise, uncertain, incomplete, unreliable, vague or partially true and described in NL. In this study the theory of decision making with imperfect information based on both precisiated and unprecisiated reasoning performed by Zadeh’s classical and extended fuzzy logics is suggested. Regarding the precisiated decision theory, we suggest a new fuzzy utility model intended for use in real-life problems with available information described mainly in NL. We suggest a definition of a fuzzy utility function representing human-like linguistic preference relation defined over a set of fuzzy alternatives. We formulate and prove representation theorems for a fuzzy utility function described as a fuzzy number-valued Choquet integral with a fuzzy number-valued fuzzy measure. The direct theorem provides conditions for existence of the suggested fuzzy utility function representing linguistic preference relation defined over a set of fuzzy actions under conditions of imprecise probabilities. The converse theorem provides conditions under which a fuzzy utility function described as a fuzzy number-valued Choquet integral induces the formulated linguistic preference relation. As opposed to the existing utility models the suggested fuzzy utility model is formulated for the case of imprecise information regarding states of nature, probabilities, outcomes and preferences. Human behavior attributes such as trust, reciprocity, altruism, emotion, riskiness etc. have recently been considered essential in decision making. So, in this study for the first time we introduce combined states decision analysis method that considers both, states of nature, and states of decision maker (DM). For this purpose we consider internal participant modeling of human behavior by using fuzzy “if-then” rules involving probabilistic uncertainty. We explain the relation of the present work to the existing literature. We show that some decision theories can be obtained as a special case of the theory presented here. In general, decision making in real world is more complex and full of various uncertainties. Often we are not able to precisiate available imperfect information, e.g. membership functions of probability, outcomes etc. are not specified. For this case we propose the decision-making method using Zadeh’s fuzzy geometry which is a model of reasoning with unprecisiated perceptions. Reasoning in this model is reduced to similarity firing. The suggested method covers two levels. At the first, meta level, DM gives geometrical representation of decision-relevant information, at the second, “classical” level, by using f-transformation a possible rational resolution is generated. We apply the suggested decision theory for evaluation of alternatives in a benchmark and a real-life economic problem.

09:50-10:10

Refreshment

10:10-12:10

Parallel Sessions

Regular Session-T01: Control
Chair: Kudret Demirli
Room: ENG-LG12

T01-1 *Johan Manuel Gantiva Pinilla, José Yeferson Sánchez Peña, José Jairo Soriano Méndez and Miguel Alberto Melgarejo Rey.*

Tuning Discrete PI Controllers by Fuzzy Fitness Based Genetic Algorithms

Abstract —Different methods and schemes have been proposed in literature for tuning continuous and discrete PI (Proportional-Integral) controllers. This paper proposes a scheme in which, this controller structure is explored in a different way, by looking its behavior as a lag compensator and tuning it by genetic algorithms. A difference with conventional approaches is the manner to evaluate every individual generated by the evolutionary algorithm. That evaluation is achieved by a set of measurements which becomes the input of a fuzzy inference system that models the expert’s knowledge. This scheme is simulated and tested over two nonlinear dynamical systems. Results show that a widely variety of discrete PI controllers can be obtained for one dynamical system, based on the same tuning criterion and having high performance levels in comparison with conventional methods.

T01-2 *Khaled Aljanaideh, Kudret Demirli*

Gain Scheduling Fuzzy Logic Controller For a Wall-Following Mobile Robot

Abstract — Tuning membership functions parameters of fuzzy logic controllers (FLC) has proven to be an effective method in improving the performance of this type of controllers. However, simulations usually require a considerable amount of time to optimize the membership functions parameters. In this paper a new methodology is proposed to optimize the performance of the FLC. The FLC in this paper is simply designed. The gain scheduling controller will be used before the FLC to control the error signal by multiplying it by a certain gain. The value of this gain depends on the value of the error. The proposed method is applied to a wall following mobile robot to ensure its capability to improve the performance of the fuzzy logic controller. Computer simulations are carried out to compare between a Knowledge Based Fuzzy Logic Controller (KBFLC), an optimized KBFLC and our proposed model.

T01-3 *Davi Oliveira , Arthur Plinio de Souza Braga and Otacilio Almeida.*

Fuzzy Logic Controller Implementation on a FPGA using VHDL

Abstract — Fuzzy-logic-based control (FLC) systems have emerged as one of the most promising areas for research in Applied Computational Intelligence. These systems operate with knowledge represented in a linguistic form (IF-THEN rules) that describes relations which are not precisely known, but those effects are intuitively understood by humans. This fundamental feature makes FLC a powerful tool for industrial applications, since complex systems can be controlled by easily comprehensive rules. The growth in number of fuzzy logic applications led to the need of finding efficient and economic ways to implement them. The Field Programmable Gate Arrays (FPGAs) devices, with their reconfigurable logic, practicality, portability, low consumption of energy, high operation speedy and large datastorage capacity, are a great choice for FLC embedded systems project development and prototyping. In this paper, the design and implementation of a Mamdani-type Fuzzy controller is demonstrated using VHDL programming language.

T01-4 *Xinyu Du, Hao Ying and Feng Lin.*

Fuzzy Hybrid Systems Modeling

Abstract —A hybrid system is a system containing a mixture of discrete event components and continuous variable components. The existing hybrid system modeling methods are effective to handle crisp cases but difficult to represent deterministic uncertainties and subjectivity inherent in many real-world applications, especially those in biomedicine. We recently extended the framework of discrete event systems to a framework of fuzzy discrete systems [1-2]. In the present paper, we generalize the crisp hybrid system framework to a fuzzy hybrid system framework by using fuzzy set theory. The former contains the latter as a special case. Membership grades of fuzzy sets are utilized to represent vague system’s states and variables. We have also developed a computational algorithm to calculate fuzzy states and state transitions.

Tue. 10:10-12:10
13-Jul

Regular Session-T02: Decision, :Forecasting and Prediction

Chair: Karen Villaverde

Room: ENG-LG13

T02-1 *Ali Mohammad Kimiagari, Hamed Gharahgozli and Rezvan Nikkholgh.*

Genetic algorithms for fuzzy multi-objective approach to portfolio selection

Abstract - This research deals with a model with better efficiency for selection of portfolio making use of cardinal constraints, which are explained in previous sections. Such a method, which is a combination of fuzzy models and MCDM considering the constraints intended by investors, has not been used in previous models. We have considered transactions cost, because they are among factors important for an investor, and their being ignored in a portfolio selection method will result in inefficient portfolio. Sector value constraint is among other constraints considered here. Such a constraint aims to raise investment rate in sectors with higher values. Cardinal constraints (number of shares existing in a portfolio and shares weight constraints), minimum purchase rate (for prevention of very small investments) and maximum purchase rate (for absorption of diversified and sufficient investment rates) are also added to the proposed method, which in turn results in increased model efficiency and its proximity to reality. A genetic algorithm has been suggested for solving the model, the results of which imply increased efficiency of the problem considering transaction cost as well as increased shares in portfolio.

T02-2 *Saeb Al Ganideh and Ghaleb El Refae*

Socio- psychological Variables as Antecedents to Consumer Ethnocentrism: A Fuzzy Logic Based Analysis Study

Abstract —Despite the growing homogeneity of world markets, ethnocentric tendencies are of the strongest motivations that influence purchasing foreign products. The consequences of consumer ethnocentrism have been well studied in previous research. Yet, the sources of consumer ethnocentrism phenomenon have not been well acknowledged. This study empirically investigates the influence of socio-psychological variables namely, dogmatism, conservatism and world-mindedness on consumer ethnocentrism. All previous studies in the field of consumer ethnocentrism have used traditional statistical techniques to explore the relationships between consumer ethnocentrism and socio- psychological variables; however, this study is the first to apply fuzzy logic on a consumer ethnocentrism research. Such a technique is highly suited to the current research problem. MATLAB® ANFIS has been employed to model the relationships between three inputs (conservatism, dogmatism, and world-mindedness) and one output (ethnocentrism). Consumer ethnocentrism has been expressed as a function of the three variables, conservatism, dogmatism and world-mindedness. The suggested model can help international marketing researchers to predict the degree of ethnocentrism of a certain consumer by knowing his or her conservatism, dogmatism and world-mindedness levels. The results of this research concluded that Sugeno type fuzzy model has the ability to predict precisely consumers ethnocentric tendencies levels based on two socio- psychological variables of the examined three (dogmatism, conservatism and world-mindedness) in a model of three dimensions. Traditional statistics techniques could not deal with such a situation. The results of employing fuzzy logic have proved that high level of dogmatism and high level of conservatism lead to high consumer ethnocentrism. Nevertheless, high level of world-mindedness leads to low consumer ethnocentric tendencies. Overall, fuzzy logic can improve the research of consumer ethnocentrism and can illuminate uncovered sides in the area of consumer ethnocentrism.

T02-3 *Karen Villaverde and Olga Kosheleva.*

Towards a New Justification of the Tastle-Wierman (TW) Dissent and Consensus Measures (and Their Potential Role in Education)

Abstract—To estimate how close the estimates of different experts are, W. J. Tastle and M. J. Wierman proposed numerical measures of dissent and consensus, and showed that these measures indeed capture the intuitive ideas of dissent and consensus. In this paper, we show that the Tastle-Wierman formulas can be naturally derived from the basic formulas of fuzzy logic. We also show that these formulas can be used in education, to describe how different the grades of different students are.

T02-4 *Hsunhsun Chung and Takenobu Takizawa.*

An Application of Fuzzy Number to Educational Evaluation Method

Abstract—It is known that approximate reasoning can be applied to educational evaluation. Especially, evaluation of works in calligraphy and drawing can be obtained more effectively using the approximate reasoning evaluation method than using the weighted mean evaluation method, and the authors use an example to explain why grading by approximate reasoning is more appropriate for grading creative work than grading by weighted mean. In this paper, the authors also propose a method of applying fuzzy numbers to educational evaluation in order to make approximate reasoning more generally applicable and also discuss the properties of the results.

Special Session-T03: Hidden and Fuzzy Information Elicitation with Intelligent Data Mining - Part I

Chair:Massimo Buscema

Room: ENG105

T03-1 *Massimo Buscema, Pier Luigi Sacco*

A Fuzzy Approach to Intensive Data Mining

Abstract— For many spatial processes, there is a natural need to find out the point of origin on the basis of the available scatter of observations; think for instance of finding out the home-base of a criminal given the actual distribution of crime scenes, or the outbreak source of an epidemics. We introduce a new methodology based on the notion of Topological Weighted Centroid (TWC) that allows one to draw powerful inferences also in relatively intractable cases with few observations or a poorly understood underlying data generating process. In this paper we consider reconstruction of global political and economic relationships on the basis of a small-dimensional qualitative dataset.

T03-2 *Massimo Buscema, Pier Luigi Sacco*

Activation and Competition System and Universe Lines Algorithm

Abstract— The Activation and Competition System (ACS), developed by Buscema in 2009 is an original algorithm that can simulate a non linear associative memory, partially inspired by Grossberg’s IAC is presented. The Universe Lines Algorithm (ULA) is an extension of ACS and developed in 2010. ULA is able to transform all the variables of an assigned dataset into a group of connected dynamical systems.

T03-3 *Massimo Buscema, Stefano Terzi,William Tastle*

A New Meta-Classifer

Abstract – A taxonomy for classifying classifiers is presented. A new meta-classifier, with a foundation in both consensus theory and the theory of independent judges, is introduced.

T03-4 *Giulia Massini, Stefano Terzi, Massimo Buscema*

A New Method of Multi Dimensional Scaling

Abstract - This paper presents a new algorithm called “Population” that is an efficient and high speed method of performing Multi Dimensional Scaling based only on the calculation of a local fitness. Population is not bound to a specific Cost Function but is possible to define its in relation to the considered objective. The motivation for its creation was for use in the elaboration of datasets of great dimensions. In performance comparisons between Population and the Sammon method, Population has consistently excelled. Because of the nature of the algorithm, it is not necessary for the data set to be complete at the moment of the elaboration, for new data can be introduced dynamically in the system

12:10-13:30 Lunch Break

Tue. 13:30-15:30
13-Jul**Parallel Sessions****Regular Session-T11: Applications in Business and Social Science****Chair: Nik Pizzi****Room:ENG-LG12**T11-1 *Karima Sedki and Véronique Delcroix.*

A hybrid approach for Multi-Criteria Decision Problems

Abstract—There are several situations where humans express their preferences in order to take good decisions. The major problem is that humans' preferences are more and more complex, the multiple criteria considered are often conflicting and the number of alternatives is too large to be explicitly handled. The objective of Multi-Criteria Decision Making (MCDM) approaches is to efficiently model and solve such complex decision problems. In this paper, we propose a framework allowing on one hand to encode users' preferences about the alternatives regarding the available criteria using a logic-based approach which is a variant of the Qualitative Choice Logic (QCL). On the other hand, the importance of each criterion is considered and computed in terms of probability degrees with respect to what is already known about the person who takes the decision. The available alternatives are then evaluated following two aspects: the first one concerns verifying if a given alternative is satisfied in the preferred models of the users' preferences while the second one is related to the criterion's importance.

T11-2 *Amar Khoukhi and Saeed Alboukhitan.*

A Data-Driven Genetic Neuro-Fuzzy System to PVT Properties Prediction

Abstract— Pressure-Volume-Temperature (PVT) properties are very important in reservoir engineering computations. There are many approaches for predicting various PVT properties based on empirical correlations and statistical regression models. Soft computing techniques and especially artificial neural networks had been utilized in the last decade by researchers to develop more accurate PVT correlations. Unfortunately, the developed neural networks correlations are often limited providing less accurate global correlations are usually. In this paper, a genetic-neuro-fuzzy inference system (GANFIS) is proposed for estimating PVT properties of crude oil systems. Simulation experiments show that the proposed technique outperforms up to date methods.

T11-3 *Takatoshi Sakaguchi, Yuya Akaho and Tomohiro Takagi, Takuya Shintani*

Recommendations In Twitter Using Conceptual Fuzzy Sets

Abstract—Recently, though there are a lot of techniques to rank information there are few studies on how to rank users and thus help to form online communities. We propose the use of a system to recommend the user by analyzing his or her interests, and using Conceptual Fuzzy Sets to expand a query. We show the effectiveness of using Conceptual Fuzzy Sets for recommending users. This can be applied to forming communities.

T11-4 *Christopher Coy and Devinder Kaur*

Improving Evolutionary Training for Sugeno Fuzzy Inference Systems Using a Mutable Rule Base

Abstract—The accurate modeling of a time series using a Sugeno Fuzzy Inference System (FIS) requires an algorithm that can train the FIS to minimize the error of seen and unseen data points. Many researchers have used genetic algorithms to optimize the parameters of the FIS membership functions with a great deal of success. It is presented here that incorporating FIS structure identification into the training process can greatly improve accuracy of predicting future time series data, by using the well-known Mackey-Glass time series as a benchmark. The main structural identification consists of optimizing the number of membership functions per input and total number of rules in the rule base.

Regular Session-T12: GIS and Traffic**Chair: Mehrdad Tirandazian****Room:ENG-LG13**T12-1 *Guy De Tre and Antoon Bronselaer.*

Consistently handling geographical user data: Merging of coreferent POIs

Abstract—In the context of geographic information systems (GIS), points of interest (POIs) are descriptions that denote geographical locations which might be of interest for some user purposes. Examples are nice views, historical buildings, good restaurants, recreation areas, etc. Because information gathering with respect to POIs is usually a resource consuming task, the user community is often involved in this task. In general, POI data that originates from different sources (or users) is vulnerable to imperfections. Different POIs referring to, or describing the same physical geographical location might exist. Such POIs are said to be coreferent POIs. Coreferent POIs must be avoided as they could introduce uncertainty in the data and blemish the database. In this paper, a novel soft computing technique for the (semi-)automatic detection and merging of coreferent POIs is presented. Hereby the focus is on the aspects of the merging technique. Fuzzy set and possibility theory are used to cope with the uncertainties in the data. An illustrative example is provided.

T12-2 *Ari Kassin and Tanja Magoc, Rodrigo Romero*

A Line of Sight Algorithm using Fuzzy Measures

Abstract—A line of sight algorithm is an important tool in determining visibility of target points from an observer point. This method has found applications in real life problems such as urban planning, combat missions, and computer graphics simulations. Even though different line of sight algorithms have been developed for these purposes, they mostly rely only on the elevation of the terrain and are not extendable to consideration of other criteria. In this paper, we develop a new line of sight algorithm that allows numerous criteria to be considered when determining visibility of a point from another point. The novel line of sight algorithm uses fuzzy integration to take into consideration dependencies among numerous criteria considered.

T12-3 *Siamak Barzegar, Maryam Davoudpour, Mohammad Reza Meybodi, Alireza Sadeghian and Mehrdad Tirandazian*

Traffic Signal Control with Adaptive Fuzzy Coloured Petri Net Based on Learning Automata

Abstract— Increasing number of vehicles, as the natural consequence of population growth, has caused a significant bottle-neck in transportation network and consequently major delays at intersections. Hence, in this paper we study a hybrid adaptive model, based on combination of Coloured Petri Nets, Fuzzy Logic and Learning Automata to efficiently control traffic signals. We show that in comparison with the results found in the literature the vehicle delay time is drastically reduced using the proposed method.

T12-4 *Pooia Lalbakhsh, Bahram Zaeri and Mehdi N. Fesharaki.*

Applying Nonlinear Learning Scheme on AntNet Routing Algorithm

Abstract— The paper deals with a conceptual modification on the learning phase of AntNet routing algorithm through nonlinear reinforcement. Since the learning structure of AntNet consists of colonies of learning automata, the proposed approach replaces the previously defined linear learning automata structure with nonlinear learning automata, which modifies the reinforcement process without imposing overhead into the system. In order to select the appropriate nonlinear functions, the convergence rates are mathematically analyzed and the functions with better rates are replaced at the core of the system's learning cycle. To have an appropriate comparison four non-linear AntNet algorithms are considered and simulated on NSFNET topology, which are compared with the standard AntNet. Simulation results show that the vital performance metrics (e.g. packet delay, throughput, and network awareness) are improved using some forms of nonlinear learning functions.

Tue.
13-Jul

13:30-15:30 Special Session-T13: Hidden and Fuzzy Information Elicitation with Intelligent Data Mining - Part II

Chair: Massimo Buscema

Room: ENG105

T13-1 *Enzo Grossi, Massimo Buscema*
Artificial Adaptive Systems and Predictive Medicine

Abstract - An individual patient is not the average representative of the population. Rather he or she is a person with unique characteristics. An intervention may be effective for a population but not necessarily for the individual patient. The recommendation of a guideline may not be right for a particular patient because it is not what he or she wants, and implementing the recommendation will not necessarily mean a favourable outcome. The author describes a reconfiguration of medical thought which originates from non linear dynamics and chaos theory. The coupling of computer science and these new theoretical bases coming from complex systems mathematics allows the creation of "intelligent" agents able to adapt themselves dynamically to problem of high complexity: the Artificial Adaptive Systems, which include Artificial Neural Networks (ANNs) and Evolutionary Algorithms (EA). ANNs and EA are able to reproduce the dynamical interaction of multiple factors simultaneously, allowing the study of complexity; they can also help medical doctors in making decisions under extreme uncertainty and to draw conclusions on individual basis and not as average trends.

T13-2 *Massimo Buscema, Giulia Massini, Francis Newman, Enzo Grossi, William Tastle*
Application of Adaptive Systems Methodology to Radiotherapy

Abstract - Brain volume differences from 58 children are analyzed to determine the degree of volume loss and the effect on IQ after undergoing radiotherapy for tumors in an effort to identify relationships that might yield knowledge in preventing brain volume loss in future treatments. Analysis of the pre- and post-treatment data is performed first using traditional statistics and then with the assistance of a new kind of artificial adaptive systems called the activation and competition system (ACS) and Auto-contractive Map (Auto-CM). While the result of the statistical study suggests that it is not possible to linearly classify the subjects into subsets of higher and lower IQ, the ACS clearly delineates the dataset into two IQ groups. Further, Auto-CM allows us to establish a semantic connection map among different brain segments which indicates a possible interpretation rule in the observed results. The effect of radiation treatment on the nine brain segments is addressed and future research directions are introduced.

T13-3 *Masoomeh Moharrer, Hooman Tahayori and Alireza Sadeghian*
Modeling Linguistic Label Perception in Tourism E-Satisfaction with Type-2 Fuzzy Sets

Abstract — Type-2 fuzzy sets are shown to be able to handle inter and intra uncertainties of group of experts about a concept, however one of their main difficulties is elicitation of their membership functions. This paper discusses a method for type-2 fuzzy membership function elicitation of labels used in a survey on tourism online satisfaction. The method is based on the implementation of factor analysis that ends with different questions to be loaded into five main factors for which effective weights are then calculated using regression analysis.

T13-4 *Lawrence Mazlack.*
Inherently Imprecise Causal Complexes

Abstract—Causal complexes are groupings of smaller causal relations that make up a large grained causal object. Usually, commonsense reasoning is more successful in reasoning about a few large-grained events than many fine-grained events. However, the larger-grained causal objects are necessarily more imprecise as some of their constituent components. Causality is imprecisely granular in many ways. Knowledge of at least some causal effects is inherently imprecise. It is unlikely that all possible factors can be known for many subjects; consequently, causal knowledge is inherently incomplete and therefore imprecise. A satisfying solution might be to develop large-grained solutions and then only go to the finer-grain when the impreciseness of the large-grain is unsatisfactory.

15:30-15:50 Refreshment

15:50:17:50 Parallel Sessions

Regular Session-T21: Systems

Chair: Terrence Fries

Room: ENG-LG12

T21-1 *Terrence Fries*
Evolutionary Optimization of a Fuzzy Rule-Based Network Intrusion Detection System

Abstract —The use of computer networks has increased significantly in recent years. This proliferation, in combination with the interconnection of networks via the Internet, has drastically increased their vulnerability to attack by malicious agents. The wide variety of attack modes has exacerbated the problem in detecting attacks. Many current intrusion detection systems (IDS) are unable to identify unknown or mutated attack modes or are unable to operate in a dynamic environment as is necessary with mobile networks. As a result, it has become increasingly important to find new ways to implement and manage intrusion detection systems. Evolutionary-based systems offer the ability to adapt to dynamic environments and to identify unknown attack methods. Fuzzy-based systems accommodate the imprecision associated with mutated and previously unidentified attack modes. This paper presents an evolutionary-fuzzy approach to intrusion detection that is shown to provide superior performance in comparison to other evolutionary approaches. In addition, the method demonstrates improved robustness in comparison to other evolutionary-based techniques.

T21-2 *Tom Mélange, Mike Nachtegaele and Etienne Kerre.*
A Fuzzy Filter for Random Impulse Noise Removal From Video

Abstract —We present a new filter for image sequences corrupted with random impulse noise. The main goal is to optimally combine noise removal with the preservation of the image details. The filtering strategy is to remove the noise in three different successive filtering steps and a fourth refinement step. In each filtering step, only the pixels that are detected as being noisy are filtered. The noise detection is achieved by fuzzy rules. To exploit the temporal information in image sequences as much as possible, detected pixels are filtered in a motion compensated way. The experimental results show clearly that the proposed method outperforms other state-of-the-art filters both numerically (in terms of the peak-signal-to-noise ratio) and visually.

T21-3 *Xiao-Feng Li, Shi-He Chen, Qing Zhong*
Intelligent Coordinated Control of Circulating Fluidized Bed Boiler-Turbine Unit

Abstract —An intelligent coordinated control strategy has been proposed and successfully applied to 135–300MW circulating fluidized bed (CFB) boiler-turbine units in China. Because the combustion system of the CFB is a complex object characterized by its difficulty to build precise mathematic model and control it with traditional control theory. The paper describes intelligent coordinated control (ICC) system for the circulating fluidized bed (CFB) unit. ICC is based on both fuzzy feedforward control and the fuzzy-PID feedback control. The feedforward control path contains a set of multi-input single-output fuzzy inference systems. The control output is mainly determined by the feedforward path, diminishing the control effort on the PID controllers. The fuzzy-PID controller supplies the complementary control signal component for regulation and disturbance rejection in small neighborhoods about the commanded trajectories. The scheme is implemented based on the Function Code on many typical DCS (INFI-90, XDPS, etc). The industrial application results show that this design scheme works well for the specific range of load variations.

T21-4 *Davi Oliveira, Gustavo Alves de Lima Henn and Otacilio Almeida.*
Design and Implementation of a Mamdani Fuzzy Inference System on an FPGA using VHDL

Abstract — The growth of fuzzy logic applications led to the need of finding efficient ways to implement them. The FPGAs (Field Programmable Gate Arrays) are reconfigurable logic devices that provide mainly practicality and portability, with low consumption of energy, high speed of operation and large capacity of data storage. These characteristics, combined with the ability of synthesizing circuits, make FPGAs powerful tools for project development and prototyping of digital controllers. In this paper, the implementation of a Mamdani Fuzzy Inference System has been demonstrated using VHDL programming language. The accuracy of the model on FPGA was compared with simulation results obtained using MATLAB & Fuzzy Logic Tool Box.

Tue. 15:50:17:50
13-Jul

Regular Session-T22: Neural Networks

Chair: Marcus Vinicius dos Santos

Room: ENG-LG13

T22-1 *Mahmood Amiri, Alireza Sadeghian and Sylvain Chartier.*

One-shot Training Algorithm for Self-Feedback Neural Networks

Abstract - Incorporation of a specific number of stable fixed points (attractors) in a neural network is an important issue in many applications, including image processing and pattern recognition. The vast majority of model requires hundred presentation of the patterns before the learning is converged. This increases the simulation time considerably and thus limit their practical applications. In this paper, a simple and one-shot training algorithm is presented to determine the value of network parameters to control the number of fixed points and simultaneously their stability characteristics in self-feedback neural networks (SFNN). A number of explicit relationships among network parameters such as self-feedback coefficients, input weight matrix and the number of equilibrium points, are obtained. Several simulations are provided to show the effectiveness of the analytical results presented in the paper.

T22-3 *Kayvan Tirdad and Alireza Sadeghian*

Hopfield Neural Networks as Pseudo Random Number Generators

Abstract—Pseudo random number generators (PRNG) play a key role in various security and cryptographic applications where the performance of these applications is directly related to the quality of generated random numbers. The design of such random number generators is a challenging task. In this paper, we propose an application of Hopfield Neural Networks (HNN) as pseudo random number generator. This is done based on a unique property of HNN, i.e., its unpredictable behavior under certain conditions. We compare the main features of ideal random number generators with those of PRNG based on Hopfield Neural Networks. We use a battery of statistical tests developed by National Institute of Standards and Technology (NIST) to measure the performance, and to evaluate the quality of the proposed Hopfield random number generator.

T22-2 *Andre Lemos, Waldir Caminhas and Fernando Gomide.*

New Uninorm-Based Neuron Model and Fuzzy Neural Networks

Abstract—This paper suggests a uninorm-based neuron model and a neural network architecture using unineurons. The unineuron generalizes logical and/or neurons using weighted uninorms. Previous works have addressed fuzzy neurons within the framework of uninorms. This paper introduces a new unineuron model that uses weighted aggregation of the inputs, and computes its output using a conventional neuron. A feedforward fuzzy neural architecture is developed and used to model nonlinear dynamic systems. The resulting fuzzy neural network easily allows fuzzy rule insertion and/or extraction from its topology, process information following a fuzzy inference mechanism, and is an universal function approximator. Experimental results show that the uninorm-based network provides accurate results and performs better than several similar neural and alternative fuzzy function approximators.

T22-4 *Un-Chul Moon, Hoyoun Jang and Marcus Vinicius dos Santos.*

An Application of a Neuro-Fuzzy Inference System For Pattern Classification of HDD Defect Distribution

Abstract—In the production of Hard Disk Drive (HDD), the pattern of HDD defect distribution gives the information about the defective component of HDD. This paper presents a pattern classification method for the HDD defect distribution. Five features of the pattern are developed and an Adaptive Neuro-Fuzzy Inference System (ANFIS) is applied to classify the input pattern. The ANFIS is trained with the sense of supervised learning. The trained ANFIS shows satisfactory results for classification of HDD defect distribution.

Special Sessions-T23: Intelligent Agents and Fuzzy Multi-Agent Systems and Possibility Theory, Credibility Theory and Their Applications

Chair: M. H. Fazel Zarandi

Room: ENG105

T23-1 *M. H. Fazel Zarandi, milad avazbeigi, Mohammad Hassan Anssari, A. Mohaghar and I. B. Turksen.*

A New Intelligent Multi-Agent System for Management of Ordering Policies in A Fuzzy Supply Chain

Abstract—In this paper a new intelligent multi-agent system is proposed for finding the best ordering policy. The best ordering policy is the policy which minimizes the total cost of the supply chain that is the sum of all echelons' costs over all periods. The best ordering policy is obtained by a new window-base genetic algorithm. One limitation of the previous presented GA-based algorithms is the constraint of the fixed ordering rule for each member through the time. To resolve this problem a new concept—window- is introduced that is a parameter of the model. Application of the window basis enables the agents to have different ordering policies through the time. Another limitation of the previous research is the weak management of uncertainty. In this research, supply chain's main parameters such as demand value, ordering amount, lead time and costs are all modeled by fuzzy numbers. The results show that the proposed multiagent system has a lower cost in comparison with similar research in the literature.

T23-2 *Soheil Davari, Mohammad Hossein Fazel Zarandi and I. Burhan Turksen.*

The Fuzzy Reliable Hub Location Problem

Abstract - A Hub Location Problem (HLP) deals with finding the locations of hub facilities and assignment of demand nodes to established facilities. Due to special characteristics of HLP, the overall performance of the network highly depends on proper performance of hubs. Therefore, the design of reliable networks is a critical issue to be considered. In this paper, we design a single-allocation hub-and-spoke network, so that the reliability of the network is maximized. The reliability of each arc is assumed to be a fuzzy variable. An expected value maximization version of the problem is proposed and a simulation-embedded simulated annealing is presented. Finally, a set of test problems are presented and the results are analyzed.

T23-3 *M. H. Fazel Zarandi, Milad Avazbeigi and Mohammad Hassan Anssari.*

Clustering Uncertain Interval Data Using A New Hausdorff-Based Metric

Abstract—This paper presents a new index for measuring interval distances and its related metric. The proposed index and metric are both based on the Hausdorff distance which can be used for clustering uncertain interval data. Then using the new metric, a clustering method is introduced for clustering of intervals. Finally, some experiments are provided to validate the method. Results show that the method can identify appropriate clusters efficiently.

T23-4 *Antoon Bronselaer and Guy De Tre.*

Aspects of object merging

Abstract—Information fusion is a research area that investigates how to combine information provided by independent sources into one piece of information. This topic has been studied for several applications leading to, amongst others, aggregation operators in bounded lattices and merge functions of propositional belief bases. In this paper, information fusion is investigated in the context of coreferent objects, which are objects that refer to the same real world entity. Some important properties of object merge functions are pointed out and object merge functions for both atomic and complex objects are investigated in a possibilistic framework. It is shown how merge functions for complex objects can be composed of merge functions for atomic objects, such that the composite function inherits the properties of the merge functions from which it is composed.

19:30-22:00

Banquet - Atlantis Pavilions

Wednesday - 14 July 2010

Wed. 08:00-09:00
14-Jul

Breakfast

09:00-09:50

Keynote Speech

Chair: Carol Walker

Witold Pedrycz : Collaborative Knowledge Development and Management in Fuzzy Modeling

Room: ENG105

Abstract

With the remarkably diversified plethora of design methodologies and algorithmic pursuits present in fuzzy modeling, we also witness a surprisingly high level of homogeneity, which results from the fact that fuzzy models are predominantly concerned with and built by using a data set generated by a single data source. In this talk, we concentrate on a concept of collaborative knowledge development in fuzzy modeling. In this scenario, a number of separate sources of data and the resulting individual models formed on their basis are encountered. An ultimate objective is to realize modeling at the *global* basis by invoking some mechanisms of knowledge sharing and collaboration. In this way, a fuzzy model is formed not only by relying on a data set that becomes locally available but also is exposed to some general modeling perspective by effectively communicating with other models and sharing and reconciling revealed local sources of knowledge. Several fundamental modes of collaboration (varying with respect to the levels of interaction) are investigated along with the concepts of collaboration mechanisms leading to the effective way of knowledge sharing and reconciling or calibrating the individual modeling points of view. It is also shown that the collaboration and reconciliation of locally available knowledge ultimately give rise to the concept of higher type information granules, especially interval-valued fuzzy sets. With this regard, it is shown that the principle of justifiable granularity offers a constructive way of forming such information granules.

09:50-10:10

Refreshment

10:10-12:10

Parallel Sessions

Regular Session-W01: Theory

Chair: Hooman Tahayori

Room: ENG-LG12

W01-1 *Hongying Zhang, Minggao Dong, Jianjun Qi*

Fuzzy Rough Sets based on Hybrid Monotonic Inclusion Measures and Similarity measures

Abstract—Rough set theory and fuzzy set theory hold the topic of dealing with imperfect knowledge. Recent literature have shown both theories can be combined into a more expressive framework for modeling and processing incomplete information systems. According to the hierarchical characteristic of fuzzy sets, this paper presents the definitions of α -weak fuzzy approximation space and IS_{α} -fuzzy rough set based on a hybrid monotonic inclusion measure and a similarity measure. The properties of the IS_{α} -fuzzy rough set are investigated. The approximate operators of a fuzzy decision concept and the relative decision rules will be derived from the fuzzy rough approximate operators.

W01-2 *Hooman Tahayori, Alireza Sadeghian and Andrea Visconti.*

Operations on Type-2 Fuzzy Sets Based on the Set of Pseudo-Highest Intersection Points of Convex Fuzzy Sets

Abstract— One of the main burdens of using general type-2 fuzzy sets relates to the cost of their basic operations. In this paper we will discuss how the set of pseudo highest intersection points of two convex fuzzy sets can be used to provide algorithms for performing union and intersection operations on convex type-2 fuzzy sets with min and product t-norm and max t-conorm.

W01-3 *Setareh Sharifian, Alireza Chakeri, Farid Sheikholeslam*

Linguistic Representation of Nash Equilibriums in Fuzzy Games

Abstract—Fuzzy preference relation has been a useful tool in decision making situations to choose and compare between alternatives. In this paper we show how fuzzy linguistic preference relation can be used in game theory. A fuzzy IFTTHEN rule set is constructed to derive preferences according to difference between payoffs. Then using a linguistic choice function, priority of each payoff is derived. We interpret the priorities as the linguistic Nash equilibriums. Also for comparing between fuzzy variables, two measures are introduced including possibility and amount of being greater using fuzzy extension principle.

W01-4 *Cathy Helgason, Thomas H. Jobe*

Conscious Percept Formation using Fuzzy Entropy Measures of Neuronal Multiplex Signals

Abstract— One goal of automation is to mimic the smoothness and efficiency of human performance. Fuzzy logic based soft computing and engineering works towards this goal. The obvious difference between machines and humans is that of life. If one could understand the method by which human perception and motor response takes place one might conceive of a means to automate these capabilities. The anatomy and physiology of the living nervous system are notable in this respect. In the mammalian brain, the pyramidal neuron of the cerebral cortex plays a key role in perception. Pyramidal cell axons exhibit clusters of action potentials that form a multiplex code allowing multiple parallel patterns of information to travel in the same time frame along that axon. Selective decoding at different target locations within the central nervous system then takes place. We propose that the anatomy of the cerebral cortex and pyramidal neuron is uniquely suited to distribute a multiplex signal, and that this property then provides the industrial application results show that this design scheme works well for the specific range of load variations. The proposed model can help international marketing researchers to predict the degree of ethnocentrism of a certain consumer by knowing his or her conservatism, dogmatism and world-mindedness levels. The results of this research concluded that Sugeno type fuzzy model has the ability to predict precisely consumers ethnocentric tendencies levels based on two socio- psychological variables of the examined three (dogmatism, conservatism and world-mindedness) in a model of three dimensions. Traditional statistics techniques could not deal with such a situation. The results of employing fuzzy logic have proved that high level of dogmatism and high level of conservatism lead to high consumer ethnocentrism. Nevertheless, high level of world-mindedness leads to low consumer ethnocentric tendencies. Overall, fuzzy logic can improve the research of consumer

Wed. 10:10-12:10
14-Jul

Regular Session-W02:

Chair: Mohammad Biglarbegian

Room: ENG-LG13

W02-1 *Premchand Nair and Shih-Chuan Cheng.*

ALTERNATE WORLD INTERPRETAION OF NEW Ciset OPERATORS

Abstract—In this paper we present a formal model of semantics for newly introduced [8] operators of ciset. The notion of alternate worlds is used to formalize the information content of a ciset. A ciset represents a collection of (regular) sets. Once this collection has been identified, any ciset operator can be applied on the collection of (regular) sets represented by ciset involved. This approach is computationally inefficient and is introduced solely to explain in a formal way, the semantics of newly introduced operators.

W02-2 *Lawrence Mazlack.*

Weaknesses Of DAGs For Imprecise General Causal Representations

Abstract— Causal reasoning occupies a central position in human reasoning. In order to algorithmically consider causal relations, the relations must be placed into a representation that supports manipulation. The most widespread causal representation is directed acyclic graphs (DAGs). However, DAGs are severely limited in what portion of the every day world they can represent. Both possible causal relationships and shifts in grain size are overly limited. Commonsense reasoning recognizes causal granularization. Sometimes, the details underlying an event can be known to a fine level of detail, sometimes not; causal representations must accommodate shifts in grain size. Every day reasoning approaches are used that do not require complete knowledge. An algorithmic way of handling and representing causal imprecision is needed.

W02-3 *Kian Farsandaj, Chen Ding, Alireza Sadeghian*

A New Approach to Improve the Accuracy of Online Clustering Algorithm Based on Scatter/Gather Model

Abstract - In cluster analysis process used in data mining which enables extracting interesting data patterns from datasets, accuracy and efficiency are the factors which play a pivotal role. Scatter/Gather is a cluster-based browsing model, and most of previous works on this model focused on efficiency of the clustering algorithm. In this paper we present an algorithm which could improve the accuracy of the online clustering algorithm while still maintain a reasonable level of efficiency. Our experiment proves that the new algorithm is more accurate than the original algorithm.

W02-4 *Pooia Lalbakhsh, Bahram Zaeri and Mehdi N. Fesharaki*

Nonlinear Ant System for Large Scale Search Spaces

Abstract—In this paper we focus on linearity and nonlinearity of learning schemes applied in ant colony optimization algorithms and discuss about the consequences of the two approaches on the overall algorithm's performance and efficiency. The paper reviews the previously proposed ACO algorithms, talking about the underlying linear philosophy of most of them, and proposes a nonlinear learning scheme by which not only a new flexible view is introduced on ACO, the performance metrics are also considerably improved regarding large scale search spaces. After a theoretical discussion on both linearity and nonlinearity, we applied the nonlinear learning scheme on the travelling salesman problem based on large scale graphs up to 9500 nodes. The simulation is accomplished between the ACS algorithm and the nonlinear method called NLAS on identical randomly generated graphs, to evaluate the performance metrics such as branching factor which implies the algorithm exploration and the generated best tour length which shows the algorithm convergence towards the global optimum. As simulation results show, considerable improvements in the overall convergence and exploration in the nonlinear approach is achieved.

Special Session-W03: Recent Advancements in Fuzzy Type-2 Systems

Chair: Elbert A. Walker

Room: ENG105

W03-1 *Juan Carlos Figueroa García.*

Interval Type-2 Fuzzy Markov Chains: An approach

Abstract—This paper introduces a new proposal to involve uncertainties in Fuzzy Markov Chains by using Interval Type-2 Fuzzy Sets (IT2 FS). A Type-1 Fuzzy Markov chain is an approach which uses Type-1 Fuzzy Sets (T1 FS) to describe the distributional behavior of a Discrete-Time Markov process, while the IT2 FS approach is an extension of its scope that allows to embed several T1 FS inside its *Footprint of Uncertainty*. In this paper, a finite state Fuzzy Markov Chain process is defined by an Interval Type-2 Fuzzy environment, finding their limiting properties and its Type-reduced behavior. To do so, two examples are provided.

W03-2 *Ibrahim Ozkan and Burhan Turksen*

MiniMax ϵ -Stable Cluster Validity Index for Type-2 Fuzziness

Abstract— Uncertainty is a central part of many data analysis methodologies. Although quantifying the uncertainty has long been discussed, the research on it is still in progress. The level of fuzziness in fuzzy system modeling is a source of uncertainty which can be classified as a parameter uncertainty. Upper and lower values of the level of fuzziness for Fuzzy CMean (FCM) clustering methodology have been found as 2.6 and 1.4 respectively in our previous studies. In this paper, we concentrate on the usage of uncertainty associated with the level of fuzziness in determination of the number of clusters in FCM in any data. We propose MiniMax ϵ -stable cluster validity index based on the uncertainty associated with the level of fuzziness within the framework of Interval Valued Type 2 fuzziness. If the data have a clustered structure, the optimum number of clusters may be assumed to have minimum uncertainty under upper and lower levels of fuzziness. Our investigation shows that the half range of upper and lower levels of fuzziness would be enough to determine the optimum number of clusters.

W03-3 *Mohammad Hossein Fazel Zarandi, Ali Molladavoudi and Ahmad Hemmati.*

Fuzzy Time Series Based on defining Interval Length with Imperialist Competitive Algorithm

Abstract - Determining interval length in fuzzy time series has been one of the main concerns of many researchers in this area. Since an interval length has a continuous nature, in this paper, a novel metaheuristic algorithm (ICA), Imperialist Competitive Algorithm, is implemented. ICA can determine accurate interval length and it directly leads to results of fuzzy time series. For checking the validity of proposed model and algorithm, three well known bench mark problems, Daily Temperature in Taipei (Taiwan (1996), TAIFEX series (1996), and Alabama University Enrollment, is used. The results show that the proposed model can reduce both MSE and MAPE in all above mentioned bench mark problems.

W03-4 *Yousef Shafahi, Amir Zarinbal Masouleh and Marzieh Zarinbal Masouleh.*

Type-II Fuzzy Route Choice Modeling

Abstract - Determining interval length in fuzzy time series has been one of the main concerns of many researchers in this area. Since an interval length has a continuous nature, in this paper, a novel metaheuristic algorithm (ICA), Imperialist Competitive Algorithm, is implemented. ICA can determine accurate interval length and it directly leads to results of fuzzy time series. For checking the validity of proposed model and algorithm, three well known bench mark problems, Daily Temperature in Taipei (Taiwan (1996), TAIFEX series (1996), and Alabama University Enrollment, is used. The results show that the proposed model can reduce both MSE and MAPE in all above mentioned bench mark problems.