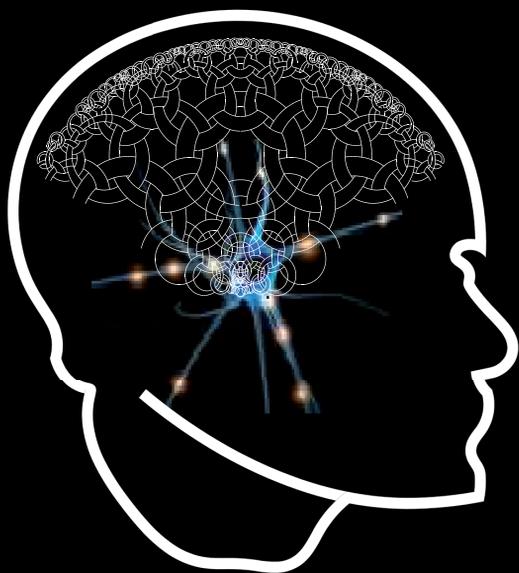


PISA AS OD 9A

International Conference on Intelligent Systems Design and Applications



9th International Conference on Intelligent Systems Design and Applications

Palazzo dei Congressi
Pisa, Italy

30 November - 2 December 2009

Final Program

Book of Abstracts

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International Conference on Intelligent Systems Design and Applications



9th International Conference on Intelligent Systems Design and Applications

Proceedings edited by

Ajith Abraham
Jose' Manuel Benitez
Francisco Herrera
Vincenzo Loia
Francesco Marcelloni
Sabrina Senatore

Booklet edited by

Michela Antonelli
Francesco Marcelloni

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Local Organizing Secretariat

G.E.C.O. Eventi
Via San Martino, 77
Pisa, Italy

Phone + 39 050 2201353
Mobile + 39 333 1668633
Fax + 39 050 2209734
e-mail: isda2009@gecoeventi.it
www.gecoeventi.it

P.I.C. Emanuela Ferro

Contents

Preface.....	2
Conference venue.....	3
Committees.....	8
Special sessions.....	13
Workshops.....	14
Plenary Talks.....	15
Program at-a-glance.....	25
Conference Area.....	28
Tecnical program.....	29
Abstracts.....	46

Preface

Welcome to the 9th International Conference on Intelligent Systems Design and Applications (ISDA'09) held in Pisa (Italy), which is famous in the world for the Square of Miracles, where you can admire the Leaning Tower, the Cathedral and the Baptistery. ISDA'09 is hosted by the University of Pisa, one of the oldest and prestigious universities in Italy, financially sponsored by the Machine Intelligence Research Labs (MIR Labs) and technically sponsored by IEEE Systems, Man and Cybernetics Society, International Fuzzy Systems Association, European Neural Network Society, European Society for Fuzzy Logic and Technology, and The World Federation on Soft Computing.

ISDA'09 brings together researchers, engineers, developers and practitioners from academia and industry working in all interdisciplinary areas of computational intelligence and system engineering to share their experience, and to exchange and cross-fertilize their ideas. The aim of ISDA'09 is to serve as a forum for the dissemination of state-of-the-art research, development and implementations of intelligent systems, intelligent technologies and useful applications in these two fields.

We received a total of 413 submissions from 46 countries. Each paper was reviewed by at least two reviewers and most papers had three or more reviews. Papers submitted to the special sessions and workshops were peer-reviewed with the same criteria used for regular papers. Based on the outcome of the review process, 274 papers were accepted for inclusion in the conference proceedings. We are sure that the diversity of the topics dealt with in these papers and the quality of their contents, and the international stature of the five keynote speakers, Piero Bonissone, Carlos A. Coello Coello, Hani Hagaras, Hisao Ishibuchi and Witold Pedrycz, make for an exciting conference. Finally, as proof of the quality of the program, we would like to point out that seven well-known international journals, namely Applied Soft Computing, Soft Computing, Evolutionary Intelligence, International Journal of Hybrid Intelligent Systems, International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems, International Journal of Computational Intelligence and Applications, and Neural Network World, have accepted to consider extended versions of significant conference contributions for possible inclusion in special issues.

We would like to express our sincere gratitude to the workshop and special session organizers, the advisory board, the program committee and the numerous referees who helped us evaluate the papers and make ISDA'09 a very successful scientific event.

We hope that you will enjoy the program.

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Conference venue

The conference will be held in Pisa, Italy at Palazzo dei Congressi.

The venue for the conference will be Palazzo dei Congressi, located in the centre of the city, at a walking distance from the heart of Pisa.

It stands in one of the most attractive parts of the city and, as it is only two kilometres far from the airport (Pisa airport is very close to downtown), the railway station and the exit on the Firenze - Pisa highway, it is easy to reach by all forms of transport.

A walk of the same distance along the River Arno and through the fascinating Medieval town centre takes you to the Leaning Tower in the Piazza dei Miracoli.

Equipment in the building is technologically of the first order and can satisfy every congress need.

About Pisa

Pisa, located in western Tuscany, is known throughout the world for its famous Leaning Tower, but there is so much more to Pisa than just this striking landmark.

Pisa is a university city with a population of nearly 100,000 (and with 40,000 students). It is situated in Tuscany, close to the coast just 80 km from Florence, 15 km from Lucca and 150 km from Siena. The historic centre of Pisa is roughly in the shape of a quadrilateral surrounded by 12th-century walls, with sides measuring 1.5 km.

The Arno river crosses the city from east to west, cutting it into two parts named Tramontana (north) and Mezzogiorno (south).

History of Pisa

The ecclesiastical city of Pisa began life as a seaside settlement around 3,000 years ago and was first laid out in the mid-eleventh century. An important naval base in Roman times and a flourishing maritime republic until the 13th century, Pisa is now a town renowned for its art and architectural treasures.

Pisa is crammed full of wonderful, historical monuments and buildings dating back many hundreds of years and much of Pisa has retained its medieval appearance.

In the north-west of Pisa there is an immense green lawn on which four impressive buildings stand in gleaming white marble. These imposing structures are the enormous, breathtaking Duomo (cathedral) - built almost 1,000 years ago, the cathedral's bell tower - better known as the Leaning Tower of Pisa, the circular Battistero (Baptistery) - the largest of its kind in the whole of Italy, and the Camposanto - also known as the Holy Field, without doubt one of the most beautiful cemeteries in the world. This area of Pisa is known as the Campo dei Miracoli or the Piazza dei Miracoli (Field of Miracles) and these remarkable Pisan buildings combine Moorish, Gothic and Romanesque architectural features.

The world-famous leaning tower, the cathedral and baptistery make it one of Italy's favourite tourist destinations. The Leaning Tower of Pisa is undoubtedly one of the most famous and beloved monuments in the world. From 1173 (when its construction started) up to the present, the Tower has been the object of very special attention, both because of its dramatic lean, and its beauty. In 1990, the structure was deemed to be leaning too far for tourists to climb safely and it was

closed to the public. Happily, Italy's legendary Leaning Tower of Pisa re-opened to the public on December 15th, 2004, and is now standing just a little straighter. Besides the tower, Pisa has other significant sights. Highlights are the Duomo, the Cathedral of Pisa, which is famed for its Romanesque panels depicting the life of Christ, the Museo of Palazzo Reale and the Museo Nazionale di San Matteo that contains many other dramatic examples of Romanesque and Gothic art.

University of Pisa

Pisa is also known as Galileo Galilei birthplace and for its prestigious university, which has become one of Italy's top schools.

The University of Pisa was officially established in 1343, although a number of scholars claim its origin dates back to the 11th century.

The papal bull 'In supremae dignitatis', granted by Pope Clement VI on 3 September 1343, recognized the 'Studium' of Pisa as a 'Studium Generale'; an institution of further education founded or confirmed by a universal authority, the Papacy or Empire. Pisa was one of the first European universities that could boast this papal attestation, which guaranteed the universal, legal value of its educational qualifications.

With the birth of the Kingdom of Italy, the University of Pisa became one of the new state's most prestigious cultural institutions. Between the second half of the nineteenth and first half of the twentieth century the following prestigious lecturers taught at Pisa: the lawyers Francesco Carrara and Francesco Buonamici, philologists Domenico Comparetti and Giovanni D'Ancona, historians Pasquale Villari, Gioacchino Volpe and Luigi Russo, philosopher Giovanni Gentile, economist Giuseppe Toniolo and mathematicians Ulisse Dini and Antonio Pacinotti. The first European institute of Historical Linguistics was founded in Pisa in 1890.

After the second world war the University of Pisa returned to the avant-garde in many fields of knowledge. To the faculties of Engineering and Pharmacy, established pre-war, were added Economics, Foreign Languages and Literature and Politics. In 1967 the 'Scuola Superiore di Studi Universitari e Perfezionamento S. Anna' was founded which, together with 'La Scuola Normale', formed a highly prestigious learning and teaching centre.

Today the University of Pisa boasts eleven faculties and fifty-seven departments, with high level research centres in the sectors of agriculture, astrophysics, computer science, engineering, medicine and veterinary medicine. Furthermore the University has close relations with the Pisan Institutes of the National Board of Research, with many cultural institutions of national and international importance, and with industry, especially that of information technology, which went through a phase of rapid expansion in Pisa during the nineteen sixties and seventies.

The Scuola Normale Superiore and the SSSUP S. Anna play the role of honours colleges and provide master and doctoral programs.

The University of Pisa now enrolls about 40,000 students.

Pisa is also home to a very large and recently built facility of the Italian National Research Council (CNR), which covers a broad spectrum of research activities, from physiology to quantum chemistry, from computer science to language analysis.

Traditions and cultural events

Pisa is a community proud and involved. Rich traditions and cultural events are organized in the city.

Each June Pisa honours its patron saint – San Ranieri – with a great regatta and a night-time "luminaria" along both banks of the River Arno. Historic buildings are lit with candles or burning torches – some 50,000 in all – creating a most evocative mood, reflecting softly in the placid waters. The regatta takes place on the evening of 16 June and the illuminations are enhanced by a parade of antique boats with costumed crews. A historical river race takes place on the following day, contested by teams from the four quarters of the city. The luminaria are repeated in the evening, to commemorate the 1688 moving of the ashes of the Saint, the first occasion on which the city was bathed in lights.

Tourism

The main tourist office is just outside Porta Santa Maria on the west side of Piazza dei Miracoli in Via C. Cammeo 2 (tel. +39-050-560464 or +39-050-830-253; open daily May-Oct 9am-7:30pm, until 5:30pm Nov-Apr). It provides the latest information about Pisa tourist attractions, museums, events, Pisa festivals, Pisa travel, Pisa sightseeing and general Pisa tourism and tourist information.

A small office is also located outside the train station.

How to reach Pisa

By Plane

Pisa has an international airport with daily flights to major European and Italian cities. The timetable of incoming and outgoing flights is available at the Galilei airport web site. The airport is on the outskirts of the town, approximately 2 km from the center. A train shuttle is available from/to Florence railway station (Santa Maria Novella). The most convenient way to reach the center is probably by taxi. Taxis are located near the "Arrivals" exit of the air terminal. For non-stop radio taxi service call +39 050 541600. Alternatively, take the the city bus "LAM Rossa" www.cpt.pisa.it/orari.htm to get to "Piazza della Stazione" (Railway Station square). A list of the Airlines available to flight on Pisa are available at [/www.pisa-airport.com](http://www.pisa-airport.com)

By Train

Pisa Centrale railway station has direct connections to Rome, Florence, Genoa and Milan.

Up to date timetable is available at the Italian railways web site www.ferroviedellostato.it.

Recall that in Italy, before getting on the train, you must validate your ticket by using those small yellow machines available within the station.

By Car

Pisa is near the intersection of two highways: A12 north-south (Sestri Levante – Livorno) and A11 east-west (Pisa – Florence). Exit at "Pisa centro" and follow the indications towards the center of the town. Please note that Pisa is a small town with

several pedestrian areas. Most of parking areas are with pay-meters which can be purchased at newspaper kiosks or bars.

Concert venue

The organ concert will be held at the Duomo, the medieval cathedral, entitled to Santa Maria Assunta (St. Mary of the Assumption), with the magnificent organ Mascioni, built in 1980, with four keyboards. Duomo is a five-naved cathedral with a three-naved transept. The church is known also as the Primatial, being the archbishop of Pisa a Primate since 1092.

This grandiose masterpiece of Romanesque - Pisa Style was started in the year 1063 by the great architect Buschetto. It is therefore, the first work undertaken in the area that became later the "Piazza dei Miracoli". It was possible because of the enormous wealth amassed by the powerful Sea Republic which at that time Pisa was, particularly after a successful excursion on Palermo. The Cathedral was consecrated in the year 1118, even though still incomplete, by Pope Gelasio II. It was terminated in the 13th century, with the erection of the façade, unchanged up to today, by Rainaldo.

The Cathedral, designed in Latin-Cruciform, basically has a romanesque architectural style, but at the same time interprets and absorbs elements of various styles, forming thus a unique style which has something of sublime. The Cathedral was adorned through the years with numerous works of art. Giovanni Pisano is certainly the artist who excels in these works, especially because he has given us the famous, extremely rich and ingenious Pergamo (Pulpit).

The impressive mosaic, in the apse, of Christ in Majesty, flanked by the Blessed Virgin and St. John the Evangelist, survived the fire however. It evokes the mosaics in the church of Monreale, Sicily. Although it is said that the mosaic was done by Cimabue, only the head of St. John was done by the artist in 1302 and was his last work, since he died in Pisa in the same year. The cupola, at the intersection of the nave and the transept, was decorated by Riminaldi showing the ascension of the Blessed Virgin. Galileo is believed to have formulated his theory about the movement of a pendulum by watching the swinging of the incense lamp (not the present one) hanging from the ceiling of the nave. That lamp, smaller and simpler than the present one, it is now kept in the Camposanto, in the Aulla chapel. The notable granite Corinthian columns between the nave and the aisle came originally from the mosque of Palermo, captured by the Pisans in 1063. The building, as have several in Pisa, has tilted slightly since its construction.

Gala dinner venue

The gala dinner will take place at Villa Rossi, Lucca, a national monument surrounded by a vast park with old trees and vineyards. The Renaissance villa is entirely covered with frescoes with a huge library, a portrait-saloon and a gallery.

The Villa Rossi Gattaiola was built by Nicola Civitali in the early sixteenth century for Francesco Burlamacchi, a generous and visionary gentleman of Lucca, who, in order to counteract the excessive power of Florence and fight the corruption of religious

hierarchies, organized a conspiracy aimed to involve two small towns of Tuscany in a league in Lucca and to introduce the Protestant Reformation.

Betrayed by some of his closest collaborators, Burlamacchi was arrested, tried, convicted and beheaded. Villa, confiscated, was auctioned and from there went from family to family. At the end of the seventeenth century, the walls and the ceilings at the first floor were entirely decorated. The decoration lasted about one hundred years. Among the many artists who took part in the course of time you can remember Bartholomew de Santi and Antonio Cecchi.

In the late nineteenth century villa with all its attachments was purchased by Count Emilien de Nieuwerkerk, Netherlands, childhood friend of Napoleon III, superintendent of museums in France during the Second Empire, painter, sculptor and lover of Princess Mathilde, cousin of the Emperor.

The Museum of Compiègne has recently dedicated a major exhibition in Nieuwerkerk, mainly focused on the memories of the Villa. The four large paintings in the exhibition of the portraits depict, respectively, Napoleon III, Empress Eugenie (painted by Winterhalter), Nieuwerkerk and Princess Olga. The two marble busts depicting Olga and Prince are the work of Altieri Nieuwerkerk same. The woman's hand which is calculated at the library is the Princess Mathilde's one.

In 1940, the villa was bought at auction by Paolo Rossi, well known anti-fascist, author of two books seized and burned during the regime, the personality of the first owner was a great incentive to buy the property.

Currently the owner of the Villa is Paolo Rossi's daughter, the writer Francesca Duranti.

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Special sessions

	Session Title	Organizers
S1	Representation and Approximation of Fuzzy Numbers and Applications	L. Stefanini, P. Grzegorzewski
S2	From Business Intelligence to Business Artificial Intelligence: New Challenges for Intelligent Systems	A. Bugarín, M. Lama
S3	Evolutionary Multiobjective Optimization—Design and Applications (EMODA)	C. Grosan, A. Abraham
S4	Designing Comprehensible Intelligent Systems	C. Castiello, F. Marcelloni, C. Mencar
S5	Computational Intelligence for Personalization in Web Content and Service Delivery	D. Aloini, M.G.C.A. Cimino, R. Dulmin, B. Lazzerini, V. Mininno
S6	Hybrid Metaheuristics and Their Applications	P. Isasi
S7	Education and Learning Models, Applications and Solutions	S. Bortoleto, K. Bortoleto
S8	Intelligent E-Learning Systems	N. Yusof, N.B. Hj. Ahmad, A. Abraham
S9	Intelligent Systems for Industrial Processes	L. Reyneri, V. Colla
S10	Intelligent Systems and Data Mining Techniques for Bioinformatics	A. Troncoso, R. Giráldez, R. Ruiz
S11	Bioinspired and Evolutionary Computation Based Data Mining Techniques	M.J. del Jesus, J. A. Gámez, J.M. Puerta

Workshops

	Workshop Title	Organizers
W1	Soft Computing in Intelligent Agents and Web Technologies	E. Herrera-Viedma, V. Loia
W2	Genetic Fuzzy Systems: Design and Applications	R. Alcalá, P. Ducange, Y. Nojima
W3	Intelligent Image Processing and Artificial Vision	S. Damas, A. Sánchez, J. Santamaría, G. Schaefer
W4	Hybrid Learning for Artificial Neural Networks: Architectures and Applications	C. Hervás, J.C. Fernandez, P.A. Gutiérrez
W5	Tags and Recommendations in Web 2.0	A. Dattolo, C. Tasso
W6	Intelligent Systems Design and Applications in the Health Domain	O. Salvetti, I. Tollis, F. Chiarugi
W7	Intelligent Systems for Data Reduction	S. García López, J.M. Benítez Sánchez
W8	Intelligent Signal and Image Analysis in Remote Sensing	G. Corsini, M. Diani
W9	Human Monitoring and Machine Learning Strategies	A. Landi, G. Ploggia
W10	Consensus and Decision Making	E. Herrera-Viedma, J.L. García-Lapresta
W11	Provisioning of Smart Services in Ontology-Based Systems	M. Gaeta, A. Micarelli
W12	Computational Intelligence for Personalization in Web Content and Service Delivery	G. Castellano, M.A. Torsello, M.G.C.A. Cimino
W13	Evolutionary Algorithms and Other Metaheuristics for Continuous Optimization Problems --- A Scalability Test	F. Herrera, M. Lozano
W14	Educational Data Mining	M. Pechenizkiy, S. Ventura, C. Romero
W15	Data Mining and Ontologies Models, Applications and Solutions	S. Bortoleto, N. Ebecken, M. Woźniak
W16	Neural Networks and Neuro-Fuzzy Systems	L.J. Herrera, H. Pomares Cintas, I. Rojas Ruiz
W17	Soft Computing and Image Processing	H. Bustince, M. Pagola, E.Barrenechea, P. Melo-Pinto, P. Couto

Plenary Talks

Computational Intelligence in Prognostics and Health Management (PHM)

Piero Bonissone

Computing and Decision Sciences Global Technology Office

Monday, November, 30TH 8:50 -9:40, Auditorium

Abstract

Prognostics and Health Management (PHM) is a multi-discipline field, as it includes facets of Electrical Engineering (reliability, design, service), Computer Science and Decision Sciences (Computational Intelligence, Artificial Intelligence, Soft Computing, Machine Learning, Statistics, OR), Mechanical Engineering (geometric models for fault propagation), Material Sciences, etc.

Within this talk we will focus on the role that Computational Intelligence (CI) plays in PHM for assets such as locomotives, medical scanners, aircraft engines, etc. functionalities. The main goal of PHM is to maintain these assets' operational performance over time, improving their utilization while minimizing their maintenance cost. This tradeoff is typical of long-term service agreements offered by OEM's to their valued customers. The main goal of PHM for assets such as locomotives, medical scanners, and aircraft engines is to maintain these assets' operational performance over time, improving their utilization while minimizing their maintenance cost. This tradeoff is critical for the proper execution of Contractual Service Agreements (CSA) offered by OEM's to their valued customers.

When addressing real-world PHM problems, we usually deal with systems that are difficult to model and possess large solution spaces. So we augment available physics-based models, which are usually more precise but difficult to construct, customize, and adapt, with approximate solutions derived from Computational Intelligence methodologies. In this process we leverage two types of resources: problem domain knowledge of the process (or product) and field data that characterize the system's behavior. The relevant available domain knowledge is typically a combination of first principles and empirical knowledge. This knowledge is often incomplete and sometimes erroneous. The available data are typically a collection of input-output measurements, representing instances of the system's behavior, and are generally incomplete and noisy. Computational Intelligence is a flexible framework in which we can find a broad spectrum of design choices to perform the integration of knowledge and data in the construction of approximate models.

To better understand PHM requirements, we introduce a decision-making framework in which we analyze PHM decisional tasks. This framework is the cross product of the decision's time horizon and the domain knowledge used by CI models. Within such a framework, we analyze the progression from simple to annotated lexicon, morphology, syntax, semantics, and pragmatics. We use this metaphor to monitor the leverage of domain knowledge in CI to perform anomaly detection, anomaly identification, failure mode analysis (diagnostics), estimation of remaining useful life (prognostics), on-board control, and off board logistics actions. This is shown in the following figure.

	One Shoot	Tactical	Operational	Strategic	Lifecycle	Time Horizon
Lexicon		Anomaly Detection				
Morphology		Anomaly Detection				
Marked-up Lexicon		Anomaly Identification				
Syntax		Anomaly Id. Diagnostics	Scheduling			
Semantics	Transactional Decision	Anomaly Id. Diagnostics Prognostics Control	Scheduling Planning Readiness Assessment Asset Allocation Optimization DM	Long-Term Planning Contingency Planning Asset Management MOO, Tradeoffs, MCMD	Model Update & Maintenance	
Pragmatics						

Domain Knowledge

We will illustrate this concept with a case study in anomaly detection, which is solved by the construction and fusion of an ensemble of diverse detectors, each of which is based on different CI technologies.



PIERO BONISSONE received a Ph.D. degree in electrical engineering and computer science from the University of California at Berkeley in 1979. A Chief Scientist at GE Global Research, Dr. Bonissone has been a pioneer in the field of fuzzy logic, AI, soft computing, and approximate reasoning systems applications since 1979. During the eighties, he conceived and developed the Diesel Electric Locomotive Troubleshooting Aid (DELTA), one of the first fielded expert systems that helped maintenance technicians in troubleshooting diesel-electric locomotives. He has been the Principal Investigator in many DARPA programs, from Strategic Computing Initiative, to Pilot's Associate, Submarine Operational Automation System, and Planning Initiative. He is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), of the Association for the Advancement of Artificial Intelligence (AAAI), of the International Fuzzy Systems Association (IFSA), and a Coolidge Fellow at GE Global Research. He served as Editor

in Chief of the International Journal of Approximate Reasoning for thirteen years. He is on the editorial board of five technical journals and is Editor-at-Large of the IEEE Computational Intelligence Magazine. He has co-edited six books and has over 150 publications in refereed journals, book chapters, and conference proceedings, with an H-Index of 21. He received thirty-nine patents issued from the US Patent Office (plus forty-one pending patents). Since 1982, he has been an Adjunct Professor at Rensselaer Polytechnic Institute, in Troy N, where he has supervised five Ph.D. theses and thirty-two Master theses. In 2002 he was also President of the IEEE Neural Networks Society. He has co-chaired nine scientific conferences focused on Multi-Criteria Decision-Making, Fuzzy sets, Diagnostics, Prognostics, and Uncertainty Management.

Multiobjective Genetic Fuzzy Systems - Accurate and Interpretable Fuzzy Rule-Based Classifier Design -

Hisao Ishibuchi

*Department of Computer Science and Intelligent Systems, Osaka Prefecture University,
Sakai, Osaka, Japan*

Monday, November, 30TH 14:00 -14:50, Auditorium

Abstract

Fuzzy rule-based systems are universal approximators of non-linear functions [1] as multilayer feedforward neural networks [2]. That is, they have a high approximation ability of non-linear functions. A large number of neural and genetic learning methods have been proposed since the early 1990s [3, 4] in order to fully utilize their approximation ability. Traditionally, fuzzy rule-based systems have been mainly applied to control problems with a few input variables. Recently, they have also been applied to approximation and classification problems with many input variables.

The main advantage of fuzzy rule-based systems over black-box non-linear models such as neural networks is their linguistic interpretability. Fuzzy rules are often written in the if-then form with linguistic terms such as "If x_1 is small and x_2 is small then y is large" and "If x_1 is large and x_2 is large then Class 1". In this case, it is easy for human users to understand fuzzy rule-based systems since each fuzzy rule is linguistically interpretable.

As we have already explained, fuzzy rule-based systems have two advantages: high approximation ability and high interpretability. These advantages, however, often conflict with each other as shown in Fig. 1. For example, accuracy maximization (i.e., error minimization in Fig. 1) often leads to accurate but complicated fuzzy rule-based systems with low interpretability. On the other hand, interpretability maximization (i.e., complexity minimization in Fig. 1) often leads to interpretable but inaccurate fuzzy rule-based systems.

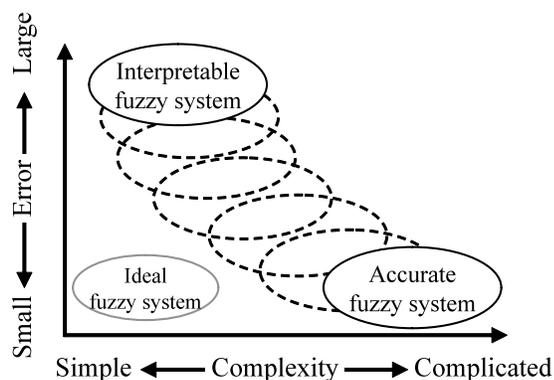


Fig. 1. Tradeoff between accuracy and complexity.

These discussions mean that we usually do not have an ideal fuzzy rule-based system with high accuracy and high interpretability. Thus the design of fuzzy rule-based systems can be viewed as finding a good compromise (i.e., tradeoff) between accuracy and interpretability [5, 6]. One approach

to this problem is to integrate accuracy and interpretability into a single objective function. Another approach is the use of constraint conditions on fuzzy rule-based systems in order to maintain their interpretability. A large number of genetic algorithm-based techniques have been proposed under the name of genetic fuzzy systems [7] to find a single fuzzy rule-based system on the accuracy-interpretability tradeoff curve.

Recently the design of fuzzy rule-based systems has been handled as multi-objective optimization problems [8] as

$$\text{Maximize Accuracy}(S) \text{ and Interpretability}(S), \quad (1)$$

where Accuracy(S) and Interpretability(S) measure the accuracy and the interpretability of a fuzzy rule-based system S. Multiobjective genetic algorithms are used to search for a large number of non-dominated fuzzy rule-based systems on the accuracy-complexity tradeoff curve of (1).

In this talk, first we explain some fuzzy rule generation methods for classification problems. Next we explain single-objective and multi-objective approaches to the design of accurate and interpretable fuzzy rule-based classifiers. Then we discuss the interpretability of fuzzy rule-based classifiers.

References

- [1] L. X. Wang and J. M. Mendel, Fuzzy basis functions, universal approximation, and orthogonal least-squares learning. *IEEE Trans. on Neural Networks* 3: 807-814 (1992).
- [2] K. Hornik et al., Multilayer feedforward networks are universal approximators. *Neural Networks* 2: 359-366 (1989).
- [3] J. S. R. Jang, ANFIS: Adaptive-network-based fuzzy inference system. *IEEE Trans. on SMC* 23: 665-685 (1993).
- [4] C. L. Karr and E. J. Gentry, Fuzzy control of pH using genetic algorithms. *IEEE Trans. on Fuzzy Systems* 1: 46-53 (1993).
- [5] J. Casillas et al. (eds.), *Accuracy Improvements in Linguistic Fuzzy Modeling*, Springer, Berlin (2003).
- [6] J. Casillas et al. (eds.), *Interpretability Issues in Fuzzy Modeling*, Springer, Berlin (2003).
- [7] F. Herrera, Genetic fuzzy systems: Taxonomy, current research trends and prospects. *Evolutionary Intelligence* 1: 27-46 (2008). See also his GFS Webpage: <http://sci2s.ugr.es/gfs/>
- [8] M. Cococcioni, Evolutionary Multiobjective Optimization of Fuzzy Rule-Based Systems Bibliography Page (EMOFRBSS): <http://www2.ing.unipi.it/~g000502/emofrbss.html>



Professor HISAO ISHIBUCHI received the BS and MS degrees in precision mechanics from Kyoto University, Japan, in 1985 and 1987, respectively. He received the Ph. D. degree from Osaka Prefecture University, Japan, in 1992. Since 1987, he has been with Osaka Prefecture University, Japan, where he was a research associate (1987-1993), an assistant professor (1993), and an associate professor (1994-1999). He is currently a professor since 1999. Since 2006, he is also the Head of Computational Intelligence Research Center, Osaka Prefecture University. His current research interests include evolutionary multiobjective optimization, fuzzy rule-based classification systems, and multiobjective genetic fuzzy systems. He have proposed a number of hybrid computational intelligence techniques such as neural network-based fuzzy regression analysis, learning of neural networks form fuzzy if-then rules, neural networks with fuzzy connection weights, genetic algorithm-based fuzzy rule selection,

multiobjective genetic local search, and multiobjective fuzzy genetics-based machine learning. He received GECCO 2004 Best Paper Award, ISIS 2005 Outstanding Paper Award, EFS 2006 Best Runner-Up Paper Award, HIS-NCEI 2006 Best Paper Award, GECCO 2007 Competition First Prize, 2007 JSPS PRIZE from the Japan Society for the Promotion of Science, and GEFS 2008 Best Paper Finalist Award. He is the IEEE CIS Fuzzy Systems TC Chair (2008-) and a Vice-President of SOFT in Japan (2007-2009). He is an associate editor of *Mathware & Soft Computing* (2001-), *IEEE Trans. on SMC: Part B* (2002-), *IEEE Trans. on Fuzzy Systems* (2004-), *IEEE CI Magazine* (2005-), *International Journal of Computational Intelligence Research* (2005-), *Advances in Fuzzy Systems* (2007-), *International Journal of Metaheuristics* (2007-), and *IEEE Trans. on Evolutionary Computation* (2007-). He is also an area editor of *Soft Computing* (2007-). He was an Area Chair of IJCNN 1997 and FUZZ-IEEE 1998, a Technical Co-Chair of FUZZ-IEEE 2006, a Program Co-Chair of EMO 2007, an Area Chair of IFSA 2009 and FUZZ-IEEE 2009, and will work as the Program Chair for CEC 2010

Algorithmic Facets of Human Centricity in Computing with Fuzzy Sets

Witold Pedrycz

*Department of Electrical & Computer Engineering University of Alberta, Edmonton Canada
and Systems Research Institute, Polish Academy of Sciences Warsaw, Poland*

Tuesday, December, 1ST 8:50 -9:40, Auditorium

Abstract

In information processing we are faced with new challenges and opportunities that can lead to the enhancements of the ways in which the technology of fuzzy sets becomes utilized. More often than before we encounter systems that are distributed and hierarchical in their nature in which there is a significant level of knowledge generation and knowledge sharing. As a matter of fact, knowledge generation is inherently associated with the mechanisms of collaboration and knowledge sharing being realized between participating systems. The aspects of distributed intelligence and agent systems stress the facet of human centricity and human-centric computing (HC2). In numerous ways of forming efficient conceptual and algorithmic vehicles of human-system interaction fuzzy sets, and Granular Computing, in general, have been playing an important role in the HC2 domain. We show how this feature gives rise to the paradigm shift.

The intent of this talk to bring into attention several ideas being of interest in the context of the challenges identified above. The feature of human centricity of fuzzy set-based constructs is the underlying leitmotiv of our considerations.

New directions of knowledge elicitation and knowledge quantification realized in the setting of fuzzy sets In the past there have been a number of ways of designing fuzzy sets. The two main directions, that is (a) expert – based, and (b) data – based elicitation of membership functions have formed quite distinct avenues that are visible in the theory and practice of fuzzy sets. We must note here that fuzzy sets- information granules as being reflective of domain knowledge underpinning the essence of abstraction, dwell on numeric, data-oriented experimental evidence as well as perception of the humans who use such information granules. This stresses a hybrid nature of fuzzy sets, which has to be reflected in the foundations fuzzy sets are to be dwelled upon. We elaborate on an idea of knowledge-based clustering, which aims at the seamless realization of the data-expertise design of information granules. We emphasize the need for this unified treatment in the context of knowledge sharing where fuzzy sets are developed not only on the basis of numeric evidence available locally but in their construction we also actively engage the domain knowledge being shared by others. It is also emphasized that collaboration and reconciliation of locally available knowledge give rise to the concept of higher type fuzzy sets along with the principle of justifiable granularity supporting their construction. This principle helps capture the diversity of numeric entities and encapsulate them in the form of information granules where the level of granularity is adjusted to quantify the level of existing diversity. Likewise when dealing with a diversity of information granules of type-1, the concept of justifiable granularity supports a realization of information granules of type-2.

Non-numeric quantification of fuzzy sets and their processing To enhance human centricity of computing with fuzzy sets, it becomes beneficial to establish a conceptual and algorithmic setup in which the predominantly numeric values of membership functions could be interpreted at the

qualitative level of membership characterization such as high, medium or low membership, low relationship between concepts, etc. We discuss a suite of algorithms facilitating such qualitative assessment of fuzzy sets, formulate a series of optimization tasks guided by well-formulated performance indexes and discuss the essence of the resulting solutions. It will be demonstrated that type-2 fuzzy sets emerge in this setting as a viable conceptual entity with sound algorithmic underpinnings. The concepts of three-valued logic quantification of membership functions are also elaborated in the context of the linguistic quantification of fuzzy sets. Proceeding with fuzzy models, we show how to endow fuzzy modeling with an additional interpretation layer of type-2 fuzzy sets, which enhances the functionality of the existing fuzzy models and their human-centricity. It will allow us to view fuzzy models in a broader context of system modeling and introduce a concept of linguistic equivalence, linguistic stability and other descriptors. We also revisit a plethora of logic operators available in the theory of fuzzy sets vis-à-vis their qualitative interpretation.



WITOLD PEDRYCZ (M'88-SM'90-F'99) received the M.Sc., and Ph.D., D.Sci. all from the Silesian University of Technology, Gliwice, Poland. He is a Professor and Canada Research Chair (CRC) in Computational Intelligence in the Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Canada. He is also with the Polish Academy of Sciences, Systems Research Institute, Warsaw, Poland. His research interests encompass Computational Intelligence, fuzzy modeling, knowledge discovery and data mining, fuzzy control including fuzzy controllers, pattern recognition, knowledge-based neural networks, granular and relational computing, and Software Engineering. He has published numerous papers in these areas. He is also an author of 12 research monographs. Witold Pedrycz has been a member of numerous program committees of IEEE conferences in the area of fuzzy sets and neurocomputing. He serves as Editor-in-Chief of IEEE Transactions on Systems Man and Cybernetics-part A and Associate Editor of IEEE Transactions on Fuzzy Systems. He is also an Editor-in-Chief of Information Sciences. Dr. Pedrycz is a recipient of the prestigious Norbert Wiener award from the IEEE Society of Systems, Man, and Cybernetics and an IEEE Canada Silver Medal in Computer Engineering.

From Interval to General Type-2 Fuzzy Logic Controllers- Towards FLCs that can Better Handle Uncertainties in Real World Applications

Hani Hagrass

The Computational Intelligence Centre School of Computer Science and Electronic Engineering, University of Essex, United Kingdom

Tuesday, December, 1ST 14:00 -14:50, Auditorium

Abstract

Most real world applications face high levels of uncertainties that can affect the operations of such applications. Hence, there is a need to develop different approaches that can handle the available uncertainties and reduce their effects on the given application. To date, Type-1 Fuzzy Logic Controllers (FLCs) have been applied with great success to many different real world applications. The traditional type-1 FLC which uses crisp type-1 fuzzy sets cannot handle high levels of uncertainties appropriately. Nevertheless it has been shown that higher order Fuzzy Logic Controllers (FLCs) such as interval type-2 FLCs using interval type-2 fuzzy sets can handle such uncertainties better and thus produce a better performance. Through the review of the various interval type-2 FLC applications, it has been shown that as the level of imprecision and uncertainty increases, the interval type-2 FLC will provide a powerful paradigm to handle the high level of uncertainties present in real-world environments. It has been also shown in various applications that the interval type-2 FLCs have given very good and smooth responses that have outperformed their type-1 counterparts. Thus, using interval type-2 FLC in real-world applications can be a better choice since the amount of uncertainty in real systems most of the time is difficult to estimate.

General type-2 FLCs are expected to further extend the interval type-2 FLC capability. However, the immense computational complexities associated with general type-2 FLCs have until recently prevented their application to real world control problems.

This speech will explain the concepts of interval and general type-2 FLCs and will present a new framework to design general type-2 FLC based on the theory of interval type-2 FLC. The proposed approach will lead to a significant reduction in both the complexity and the computational requirements for general type-2 FLCs while offering the capability of representing complex general type-2 fuzzy sets. This speech will explain how the proposed approach can present a way forward for fuzzy systems in real world environments and applications that face high levels of uncertainties. The talk will present different ways to design interval and general type-2 FLCs. The talk will also present the successful application of type-2 FLCs to many real world settings including industrial environments, mobile robots, ambient intelligent environments video congestion control and intelligent decision support systems. The talk will conclude with an overview on the future directions of type-2 FLCs.



Prof. HANI HAGRAS is a Professor in the School of Computer Science and Electronic Engineering, Director of the Computational Intelligence Centre and the Head of the Fuzzy Systems Research Group in the University of Essex, UK. His major research interests are in computational intelligence, notably type-2 fuzzy systems, fuzzy logic, neural networks, genetic algorithms, and evolutionary computation. His research interests also include ambient

intelligence, pervasive computing and intelligent buildings. He is also interested in embedded agents, robotics and intelligent control. He has authored more than 150 papers in international journals, conferences and books. His work has received funding that totalled to about £2.5 Million in the last five years from the European Union, the UK Department of Trade and Industry (DTI), the UK Engineering and Physical Sciences Research Council (EPSRC), the UK Economic and Social Sciences Research Council (ESRC), the Korea- UK S&T fund as well as several industrial companies. He has also two industrial patents in the field of Computational intelligence and intelligent control. He is a Fellow of the Institution of Engineering and Technology (IET (IEE)) and a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE). He is the Chair of IEEE Computational Intelligence Society (CIS) Senior Members Sub-Committee. He is also the chair of the IEEE CIS Task Force on Intelligent Agents and Chair of the IEEE CIS Task Force on Extensions to Type-1 Fuzzy Sets. His research has won numerous prestigious international awards where most recently he was awarded by the IEEE Computational Intelligence Society (CIS), the Outstanding Paper Award in the IEEE Transactions on Fuzzy Systems. In addition, he was awarded the IET Knowledge Networks Award. He is an Associate Editor of the IEEE Transactions on Fuzzy Systems. He is also an Associate Editor of the International Journal of Robotics and Automation, the Journal of Cognitive Computation, the Journal of Applied Computational Intelligence and Soft Computing and the Journal of Ambient Computing and Intelligence. He served also as a guest editor in the Journal of Information Sciences and the Journal of Ubiquitous Computing and Intelligence. He is a member of the IEEE Computational Intelligence Society (CIS) Fuzzy Systems Technical Committee. He is also a member of the IEEE Industrial Electronics Society (IES) Technical Committee of the Building Automation, Control and Management. In addition he is member of the Executive Committee of the IET Robotics and Mechatronics Technical and Professional Network. Prof. Hagrais chaired several international conferences where most recently he served as the General Co-Chair of the 2007 IEEE International Conference on Fuzzy systems London, July 2007 and he also served as Programme Chair for the 2008 IET International Conference on Intelligent Environments, Seattle, USA and he is currently serving as the Programme Chair of 2009 IEEE Symposium on Intelligent Agents, Nashville, USA, April 2009 and he is also a Programme Area Chair (control) for the 2009 IEEE International Conference on Fuzzy Systems, Jeju Island, Korea, August 2009. He served as a member of the international programme committees of numerous international conferences.

Evolutionary Multi-Objective Optimization: Current and Future Research Trends

Carlos A. Coello Coello
CINVESTAV-IPN, Depto. Computación, México

Wednesday, December, 2ND 9:30 -10:30, Auditorium

Abstract

During the last few years, there has been an increasing interest in using heuristic search algorithms based on natural selection (the so-called "evolutionary algorithms") for solving a wide variety of problems. As in any other discipline, research on evolutionary algorithms has become more specialized over the years, giving rise to a number of sub-disciplines. This talk deals with one of these emerging sub-disciplines that has become very popular due to its wide applicability: evolutionary multi-objective optimization (EMOO).

EMOO refers to the use of evolutionary algorithms (or even other biologically-inspired metaheuristics) to solve problems with two or more (often conflicting) objectives. Unlike traditional (single-objective) problems, multi-objective optimization problems normally have more than one possible solution (the so-called Pareto optimal set, whose vectors are called nondominated and whose image is called the Pareto front). Even the notion of optimum is different in this case, since the main aim is not to find one globally optimum solution, but the best possible trade-offs or compromise solutions (i.e., solutions in which it is not possible to improve one objective without worsening another one). This is called Pareto optimality, which is the most popular definition of optimum currently adopted in multi-objective optimization. Thus, traditional evolutionary algorithms (e.g., genetic algorithms or evolution strategies) need to be modified in order to deal with such problems, since in their original form they will tend to converge to a single solution (i.e., the fittest in the population) after a sufficiently large number of iterations. The main change required involves modifying the selection process, which must be blocked such that several solutions can be retained in the population during a run. This has as its goal to be able to generate, after a single run, several elements of the Pareto optimal set, rather than only one.

This talk will provide a general overview of the EMOO field, from a historical view, focused, mainly, around the major algorithmic achievements in the field. Thus, at the beginning, the first generation multi-objective evolutionary algorithms (MOEAs) will be discussed. Such algorithms were relatively simple, normally not too efficient, were non-elitist and remained in use during about 10 years. Elitism refers to retaining the best solutions found in one iteration into the next population. Such a concept is more complicated in EMOO, since all the nondominated solutions are equally good and, in theory, all of them must be retained. In practice, however, elitist mechanisms are normally bounded, limiting the number of nondominated solutions that are maintained, and giving rise to the another key mechanism of modern MOEAs: diversity estimators. A diversity estimator tries to promote the search towards little explored regions of the search space, by penalizing solutions that are in very crowded regions, and rewarding those lying in isolated regions. The use of elitism is important, since it has been proved that such mechanism is required in order to guarantee convergence of a MOEA. Nowadays, elitism is

normally implemented through the use of an external archive that stores the (globally) nondominated solutions generated by a MOEA. However, other elitist mechanisms are also possible.

Towards the end of the 1990s, elitist MOEAs started to become popular, and new, more elaborate, efficient and effective MOEAs were developed. The most representative approaches from these two groups (non-elitist and elitist MOEAs) will be briefly described in this talk, emphasizing their key components.

In the final part of the talk, some of the current applications of MOEAs will be mentioned. Then, the main current challenges faced by EMOO researchers will be briefly discussed (e.g., problems having many objectives, mechanisms to deal with very expensive objective functions, etc.), aiming to motivate practitioners, researchers and students to get interested in this exciting field that has already attracted the interest of a wide number of people from diverse disciplines around the world.



Carlos Artemio Coello Coello received a PhD in Computer Science in 1996. He is currently full professor at CINVSTAV-IPN in Mexico City, Mexico. He has published over 200 papers in international peer-reviewed journals and conferences. He has also co-authored the book "Evolutionary Algorithms for Solving Multi-Objective Problems" (Second Edition, Springer, 2007) and has co-edited the book "Applications of Multi-Objective Evolutionary Algorithms" (World Scientific, 2004). He has delivered invited talks, keynote speeches and tutorials at international conferences held in Spain, USA, Canada, Switzerland, UK, Chile, Colombia, Brazil, Argentina, Uruguay, India, China, and Mexico. Dr. Coello currently serves as associate editor of the "IEEE Transactions on Evolutionary Computation", "Evolutionary Computation", "Journal of Heuristics", "Pattern Analysis and Applications", and "Computational Optimization and Applications", and as a member of the editorial boards of the journals "Soft Computing",

the "International Journal of Computational Intelligence Research", "Engineering Optimization" and "International Journal of Intelligent Computing and Cybernetics". He is member of the Mexican Academy of Science, Senior Member of the IEEE, and member of Sigma Xi, The Scientific Research Society. He received the 2007 National Research Award granted by the Mexican Academy of Science, in the area of exact sciences. His current research interests are: multiobjective optimization using meta-heuristics, constraint-handling techniques for evolutionary algorithms and evolvable hardware.

Program at-a-glance

MONDAY, NOVEMBER 30TH

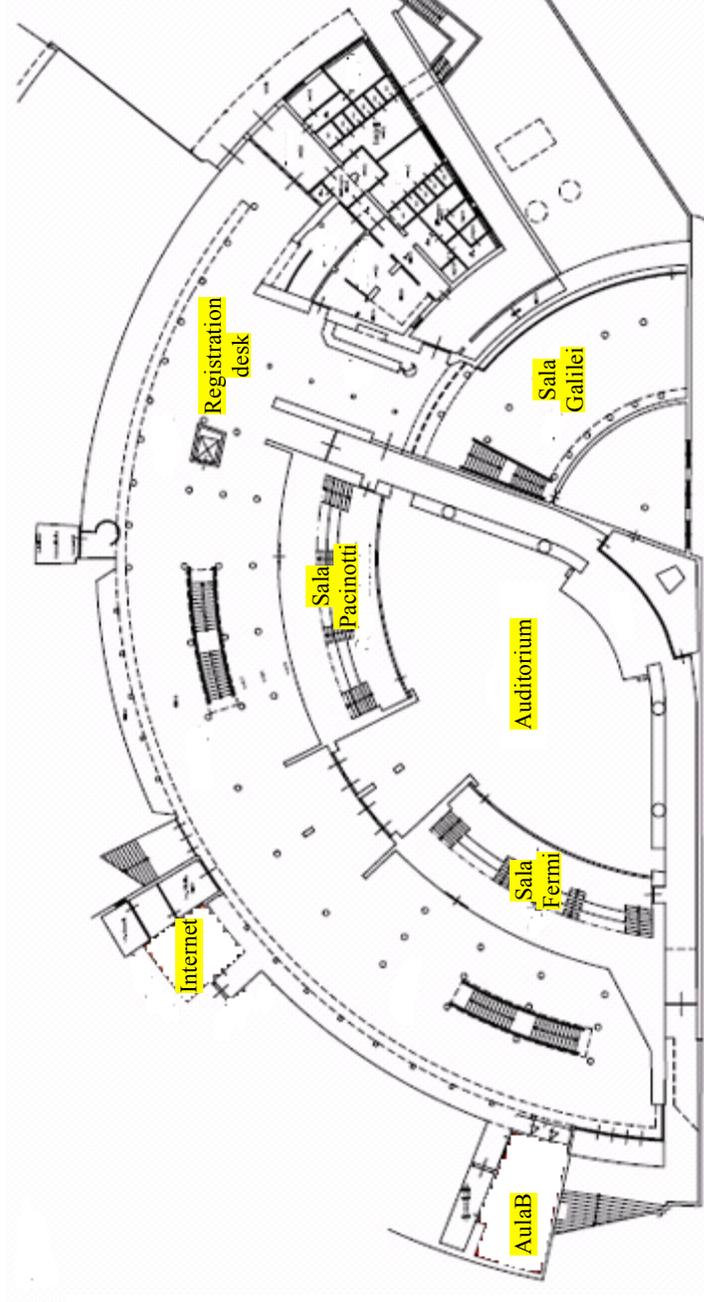
	Auditorium	Sala Fermi	Sala Pacinotti	Sala Galilei	AulaB
8:00 – 8:30			Registration		
8:30 – 8:50			Opening		
8:50 – 9:40	Plenary Talk (Auditorium) Invited Speaker: Piero Bonissone				
9:40 – 10:00			Coffee Break		
10:00 – 11:20	Evolutionary algorithms	W1: Soft Computing in Intelligent Agents and Web Technologies	W2: Genetic Fuzzy Systems: Design and Applications	W3: Intelligent Image Processing and Artificial Vision	W4: Hybrid Learning for Artificial Neural Networks: Architectures and Applications
11:30 – 12:50	Evolutionary algorithms	W1: Soft Computing in Intelligent Agents and Web Technologies	W2: Genetic Fuzzy Systems: Design and Applications	W3: Intelligent Image Processing and Artificial Vision	W4: Hybrid Learning for Artificial Neural Networks: Architectures and Applications
12:50 – 14:00	Lunch				
14:00 – 14:50	Plenary Talk (Auditorium) Invited Speaker: Hisao Ishibuchi				
15:00 – 16:20	Swarm Intelligence	W5: Tags and Recommendations in Web 2.0	S1: Representation and Approximation of Fuzzy Numbers and Applications	W6: Intelligent Systems Design and Applications in the Health Domain	S2: From Business Intelligence to Business Artificial Intelligence: New Challenges for Intelligent Systems
16:20 – 16:40			Coffee Break		
16:40 – 18:20	S3: Evolutionary Multiobjective Optimization-Design and Applications (EMODA)	W5: Tags and Recommendations in Web 2.0	S4: Designing Comprehensible Intelligent Systems	W6: Intelligent Systems Design and Applications in the Health Domain	S5: Computational Intelligence in Business Management and Risk Analysis
19:00 – 21:00	Welcome Cocktail				
21:30 – 23:00	Concert				

TUESDAY, DECEMBER 1ST

	Auditorium	Sala Fermi	Sala Pacinotti	Sala Galilei	AulaB
8:50 – 9:40	Plenary Talk (Auditorium) Invited Speaker: Witold Pedrycz				
9:40 – 10:00	Coffee Break				
10:00 – 11:20	S6: Hybrid Metaheuristics and Their Applications	W7: Intelligent Systems for Data Reduction	W8: Intelligent Signal and Image Analysis in Remote Sensing	W9: Human Monitoring and Machine Learning Strategies	Innovative Networking and Communication Techniques
11:30 – 12:50	Intelligent Control and Automation	W7: Intelligent Systems for Data Reduction	W8: Intelligent Signal and Image Analysis in Remote Sensing	W9: Human Monitoring and Machine Learning Strategies	Intelligent Internet Modeling
12:50 – 14:00	Lunch				
14:00 – 14:50	Plenary Talk (Auditorium) Invited Speaker: Hani Hagrass				
15:00 – 16:20	Intelligent Control and Automation	W10: Consensus and Decision Making	S7: Education and Learning Models, Applications and Solutions	W9: Human Monitoring and Machine Learning Strategies	W11: Provisioning of Smart Services in Ontology-Based Systems
16:20 – 16:40	Coffee Break				
16:40 – 18:20	Intelligent Control and Automation	W10: Consensus and Decision Making	S8: Intelligent E-Learning Systems	S9: Intelligent Systems for Industrial Processes	W11: Provisioning of Smart Services in Ontology-Based Systems
20:00 – 23:00	Gala Dinner				

	Auditorium	Sala Fermi	Sala Pacinotti	Sala Galilei	AulaB
9:10 – 9:30	The Machine Intelligence Research (MIR) Lab: A scientific Network for Innovation and Research Excellence Speaker: Ajith Abraham (Auditorium)				
9:30 – 10:20	Plenary Talk (Auditorium) Invited Speaker: Carlos Artemio Coello Coello				
10:20 – 10:40	Coffee Break				
10:40 – 12:40	Intelligent Data Mining	W12: Computational Intelligence for Personalization in Web Content and Service Delivery	W13: Evolutionary Algorithms and other Metaheuristics for Continuous Optimization Problems - A Scalability Test	W14: Educational Data Mining	W15: Data Mining and Ontologies Models, Applications and Solutions
12:40 – 13:50	Lunch				
13:50 – 15:30	Intelligent Knowledge Management	S10: Intelligent Systems and Data Mining Techniques for Bioinformatics	W16: Neural Networks and Neuro-Fuzzy Systems	W17: Soft Computing and Image Processing	W15: Data Mining and Ontologies Models, Applications and Solutions
15:30 – 15:50	Coffee Break				
15:50 – 17:50	Hybrid Systems	Intelligent Image and Signal Processing	W16: Neural Networks and Neuro-Fuzzy Systems	W17: Soft Computing and Image Processing	S11: Bioinspired and Evolutionary Computation based Data Mining Techniques
18:00	Closure of the Conference				

Conference Area



Technical program

EVOLUTIONARY ALGORITHMS – PART 1

47

Monday, November 30TH, 10:00 – 11:20 Auditorium

Chair: Carlos A. Coello Coello

Valley-Adaptive Clearing Scheme for Multimodal Optimization Evolutionary Search

Mostafa M.H. Ellabaan and Yew Soon Ong

Handling Box, Linear and Quadratic-Convex Constraints for Boundary Optimization with Differential Evolution Algorithms

Massimo Spadoni and Luciano Stefanini

Scaling Genetic Algorithms using MapReduce

Abhishek Verma, Xavier Llorà, David E. Goldberg and Roy H. Campbell

Efficiency Enhancement of ECGA Through Population Size Management

Vinícius V. de Melo, Thyago S.P.C. Duque and Alexandre C.B. Delbem

W1: SOFT COMPUTING IN INTELLIGENT AGENTS AND WEB TECHNOLOGIES PART 1

47

Monday, November 30TH, 10:00 – 11:20 Sala Fermi

Chair: Enrique Herrera-Viedma

RSS-generated Contents through Personalizing e-Learning Agents

Carmen De Maio, Giuseppe Fenza, Matteo Gaeta, Vincenzo Loia, Francesco Orciuoli and Sabrina Senatore

Combining Agents and Ontologies to Support Task-Centred Interoperability in Ambient Intelligent Environments

Gaëtan Pruvost, Achilles Kameas, Tobias Heinroth, Lambrini Seremeti and Wolfgang Minker

A Web-based Fuzzy Linguistic Tool to Filter Information in a Biomedical Domain

José Manuel Morales-del-Castillo, Eduardo Peis and Enrique Herrera-Viedma

Agent-based Web Content Engagement Time (WCET) Analyzer on e-Publication System

Raymond S.T. Lee, James N.K. Liu, Karo S.Y. Yeung, Alan H.L. Sin and Dennis T.F. Shum

W2: GENETIC FUZZY SYSTEMS: DESIGN AND APPLICATIONS – PART 1

48

Monday, November 30TH, 10:00 – 11:20 Sala Pacinotti

Chair: Rafael Alcalá

Effects of Data Reduction on the Generalization Ability of Parallel Distributed Genetic Fuzzy Rule Selection

Yusuke Nojima and Hisao Ishibuchi

Obtaining a Linguistically Understandable Random Sets-based Classifier from Interval-Valued Data with Genetic Algorithms

Luciano Sánchez and Inés Couso

Handling High-Dimensional Regression Problems by Means of an Efficient Multi-Objective Evolutionary Algorithm

Maria José Gacto, Rafael Alcalá and Francisco Herrera

Exploiting a New Interpretability Index in the Multi-Objective Evolutionary Learning of Mamdani Fuzzy Rule-based Systems

Michela Antonelli, Pietro Ducange, Beatrice Lazzerini and Francesco Marcelloni

W3: INTELLIGENT IMAGE PROCESSING AND ARTIFICIAL VISION – PART 1

49

Monday, November 30TH, 10:00 – 11:20 Sala Galilei

Chair: Ángel Sánchez

Natural Scene Image Recognition by Fusing Weighted Colour Moments with Bag of Visual Patches on Spatial Pyramid Layout

Yousef Alqasrawi, Daniel Neagu and Peter Cowling

A Fuzzy System for Impact Analysis of Advertisement Billboards in Soccer Telecast

Suprio Das, Shamik Sural and Arun K. Majumdar

GPU-Based Road Sign Detection using Particle Swarm Optimization

Luca Mussi, Stefano Cagnoni and Fabio Daolio

Improved Fuzzy Snakes Applied to Biometric Verification Problems

Jose Vélez, Angel Sánchez and Felipe Fernández

W4: HYBRID LEARNING FOR ARTIFICIAL NEURAL NETWORKS: ARCHITECTURES AND APPLICATIONS – PART 1

50

Monday, November 30TH, 10:00 – 11:20 AulaB

Chair: César Hervás

A Sensitivity Clustering Method for Memetic Training of Radial Basis Function Neural Networks

Francisco Fernández-Navarro, Pedro Antonio Gutiérrez and César Hervás-Martínez

Hyperbolic Tangent Basis Function Neural Networks Training by Hybrid Evolutionary Programming for Accurate Short-Term Wind Speed Prediction

César Hervás-Martínez, Pedro Antonio Gutiérrez, Juan Carlos Fernández, Sancho Salcedo-Sanz, Antonio Portilla-Figueras, Ángel Pérez-Bellido and Luis Prieto

Hybridizing Ensemble Classifiers with Individual Classifiers

Gonzalo Ramos-Jiménez, José del Campo-Ávila and Rafael Morales-Bueno

Classification by Evolutionary Generalized Radial Basis Functions

Adiel Castaño, César Hervás-Martínez, Pedro Antonio Gutiérrez, Francisco Fernández-Navarro and M. M. García

EVOLUTIONARY ALGORITHMS – PART 2

50

Monday, November 30TH, 11:30 – 12:50, Auditorium

Chair: Manuel Lozano Márquez

Solving Permutation Problems with Differential Evolution: An Application to the Jobshop Scheduling Problem

Antonin Ponsich, Ma. Guadalupe Castillo Tapia and Carlos A. Coello Coello

Speeding up the Genetic Algorithm Convergence Using Sequential Mutation and Circular Gene Methods

Mehdi Baradaran Nia and Yousef Alipouri

Performance Analysis of MADO Dynamic Optimization Algorithm

Julien Lepagnot, Amir Nakib, Hamouche Oulhadj and Patrick Siarry

Encoding Structures and Operators used in Facility Layout Problems with Genetic Algorithms

Laura Garcia-Hernandez, Antonio Arauzo-Azofra, Henri Pierreval and Lorenzo Salas-Morera

W1: SOFT COMPUTING IN INTELLIGENT AGENTS AND WEB TECHNOLOGIES PART 2

51

Monday, November 30TH, 11:30 – 12:50 Sala Fermi

Chair: Enrique Herrera-Viedma

CASTALIA: Architecture of a Fuzzy Metasearch Engine for Question Answering Systems

Jesus Serrano-Guerrero, Jose Angel Olivas, Jesus A. Gallego, Francisco P. Romero and Andres Soto

An Experiment about Using Copulative and Comparative Sentences as Constraining Relations
Andrés Soto, José Angel Olivas, Francisco P. Romero and Jesús Serrano-Guerrero

An Automat for the Semantic Processing of Structured Information
Amed Leiva Mederos, Jose A. Senso, Sandor Dominguez-Velasco and Pedro Hípola

Using Incomplete Fuzzy Linguistic Preference Relations to Characterize User Profiles in Recommender Systems
Enrique Herrera-Viedma and Carlos Porcel

W2: GENETIC FUZZY SYSTEMS: DESIGN AND APPLICATIONS – PART 2

52

Monday, November 30TH, 11:30 – 12:30 Sala Pacinotti

Chair: Rafael Alcalá

On the Combination of Accuracy and Diversity Measures for Genetic Selection of Bagging Fuzzy Rule-based Multiclassification Systems

Krzysztof Trawiński, Arnaud Quirin and Oscar Cordón

Linguistic Modifiers to Improve the Accuracy-Interpretability Trade-off in Multi-Objective Genetic Design of Fuzzy Rule Based Classifier Systems

Alessandro G. Di Nuovo and Vincenzo Catania

Parallel Distributed Two-Level Evolutionary Multiobjective Methodology for Granularity Learning and Membership Functions Tuning in Linguistic Fuzzy Systems

Miguel Angel De Vega, Juan Manuel Bardallo, Francisco Alfredo Márquez and Antonio Peregrin

W3: INTELLIGENT IMAGE PROCESSING AND ARTIFICIAL VISION – PART 1

52

Monday, November 30TH, 11:30 – 12:50 Sala Galilei

Chair: José Santamaría

Multiple Neural Networks System for Dynamic Environments

Aldo Franco Dragoni, Paola Baldassarri, Germano Vallesi and Mauro Mazzieri

A Comparative Study of Clustering Methods for Urban Areas Segmentation from High Resolution Remote Sensing Image

Safaa M. Bedawi and Mohamed S. Kamel

A New Scheme for Vision Based Flying Vehicle Detection Using Motion Flow Vectors Classification

Ali Taimori, Alireza Behrad and Samira Sabouri

Image Contrast Control based on Łukasiewicz's Operators and Fuzzy Logic

Nashaat M. Hussein Hassan and Angel Barriga

W4: HYBRID LEARNING FOR ARTIFICIAL NEURAL NETWORKS: ARCHITECTURES AND APPLICATIONS – PART 2

53

Monday, November 30TH, 11:30 – 12:50 AulaB

Chair: Pedro Antonio Gutiérrez

Optimization of Neural Networks Weights and Architecture: A Multimodal Methodology

Antonio Miguel F. Zarth and Teresa B. Ludermir

Modeling Environmental Noise using Artificial Neural Networks

Natalia Genaro, Antonio Jose Torija, Angel Ramos, Ignacio Requena, Diego Pablo Ruiz and Montserrat Zamorano

Combining Uncertainty Sampling Methods for Active Meta-Learning

Ricardo B.C. Prudêncio and Teresa B. Ludermir

Echo State Network for Abrupt Change Detections in Non-stationary Signals

Qingsong Song, Zuren Feng, Liangjun Ke and Min Li

SWARM INTELLIGENCE

54

Monday, November 30TH, 15:00 – 16:20 Auditorium

Chair: Ajith Abraham

Heuristic Factors in Ant System Algorithm for Course Timetabling Problem

Djasli Djamarus and Ku Ruhana Ku-Mahamud

A Multiple Objective Particle Swarm Optimization Approach using Crowding Distance and Roulette Wheel

Robson A. Santana, Murilo R. Pontes and Carmelo J. A. Bastos-Filho

Hardware Architecture for Particle Swarm Optimization using Floating-point Arithmetic

Daniel M. Muñoz, Carlos H. Llanos, Leandro dos S. Coelho and Mauricio Ayala-Rincón

Dynamic Clan Particle Swarm Optimization

Carmelo J. A. Bastos-Filho, Danilo F. Carvalho, Elliackin M. N. Figueiredo and Pérciles B. C. de Miranda

W5: TAGS AND RECOMMENDATIONS IN WEB 2.0 PART 1

55

Monday, November 30TH, 15:00 – 16:20 Sala Fermi

Chair: Antonina Dattolo

Content-based Filtering with Tags: the FIRSt System

Pasquale Lops, Marco de Gemmis, Giovanni Semeraro, Paolo Gissi, Cataldo Musto and Fedelucio Narducci

Item Recommendation with Veristic and Possibilistic Metadata: a Preliminary Approach

Danilo Dell'Agnello, Corrado Mencar and Anna Maria Fanelli

Neighbor Selection and Recommendations in Social Bookmarking Tools

Antonina Dattolo, Felice Ferrara and Carlo Tasso

Using Tag Co-occurrence for Recommendation

Christian Wartena, Rogier Brussee and Martin Wibbels

S1: REPRESENTATION AND APPROXIMATION OF FUZZY NUMBERS AND APPLICATIONS

55

Monday, November 30TH, 15:00 – 16:20 Sala Pacinotti

Chairs: Luciano Stefanini, Przemyslaw Grzegorzewski

Fuzzy Option Value with Stochastic Volatility Models

Gianna Figà-Talamanca and Maria Letizia Guerra

Some Parametric Forms for LR Fuzzy Numbers and LR fuzzy Arithmetic

Laerte Sorini and Luciano Stefanini

Bi-symmetrically Weighted Trapezoidal Approximations of Fuzzy Numbers

Przemyslaw Grzegorzewski and Karolina Pasternak-Winiarska

Value Function Computation in Fuzzy Real Options by Differential Evolution

Maria Letizia Guerra, Laerte Sorini and Luciano Stefanini

W6: INTELLIGENT SYSTEMS DESIGN AND APPLICATIONS IN THE HEALTH DOMAIN - PART 1

56

Monday, November 30TH, 15:00 – 16:20 Sala Galilei

Chairs: Ovidio Salvetti, Ioannis Tollis

The Virtual Physiological Human NoE and Functional Brain Networks (Project: VPH NoE)

Ioannis Tollis (invited talk) "

CHRONIOUS: An intelligent system for chronic diseases management" (Project: CHRONIOUS)

Roberto Rosso (invited talk)

Toward Multi-Organs Simulations of Immune-Pathogen Interactions

Filippo Castiglione and Francesco Pappalardo

An Efficient Combinatorial Approach for Solving the DNA Motif Finding Problem

Filippo Geraci, Marco Pellegrini and M. Elena Renda

Using Machine Learning Techniques to Improve the Behaviour of a Medical Decision Support System for Prostate Diseases

Constantinos Koutsojannis, Eman Nabil, Maria Tsimara and Ioannis Hatzilygeroudis

S2: FROM BUSINESS INTELLIGENCE TO BUSINESS ARTIFICIAL INTELLIGENCE: NEW CHALLENGES FOR INTELLIGENT SYSTEMS

57

Monday, November 30TH, 15:00 – 16:20 AulaB

Chair: Alberto Bugarín

A Genetic Programming-based Algorithm for Composing Web Services

Manuel Mucientes, Manuel Lama and Miguel I. Couto

Linguistic Summaries of Time Series using a Degree of Appropriateness as a Measure of Interestingness

Janusz Kacprzyk and Anna Wilbik

Evaluating an Intelligent Business System with a Fuzzy Multi-Criteria Approach

Sinan Apak and Ózalp Vayvay

Support Vector Machines for Insolvency Prediction of Irish Companies

Anatoli Nachev

S3: EVOLUTIONARY MULTIOBJECTIVE OPTIMIZATION—DESIGN AND APPLICATIONS (EMODA)

58

Monday, November 30TH, 16:40 – 18:20 Auditorium

Chair: Ajith Abraham

A Multi-objective Evolutionary Approach to Data Compression in Wireless Sensor Networks

Francesco Marcelloni and Massimo Vecchio

Design of Artificial Neural Networks using a Memetic Pareto Evolutionary Algorithm using as Objectives Entropy versus Variation Coefficient

Juan Carlos Fernández, César Hervás, Francisco José Martínez and Manuel Cruz

Wavelength Converter Allocation in Optical Networks: An Evolutionary Multi-Objective Optimization Approach

Diego Pinto Roa, Benjamín Barán and Carlos A. Brizuela

Solving Multi-Objective Reinforcement Learning Problems by EDA-RL – Acquisition of Various Strategies

Hisashi Handa

W5: TAGS AND RECOMMENDATIONS IN WEB 2.0 PART 2

58

Monday, November 30TH, 16:40 – 18:20 Sala Fermi

Chair: Antonina Dattolo

A Parametric Architecture for Tags Clustering in Folksonomic Search Engines

Nicola Raffaele Di Matteo, Silvio Peroni, Fabio Tamburini and Fabio Vitali

Evaluation Measures for Ordinal Regression

Stefano Baccianella, Andrea Esuli and Fabrizio Sebastiani

Improved Search in Tag-Based Systems

Ruba Awawdeh and Terry Anderson

Social and Behavioral Aspects of a Tag-based Recommender System

Frederico Durao and Peter Dolog

A JADE-based ART-inspired Ontology and Protocols for Handling Trust and Reputation

Javier Carbo and Jose M. Molina

S4: DESIGNING COMPREHENSIBLE INTELLIGENT SYSTEMS

59

Monday, November 30TH, 16:40 – 18:20 Sala Pacinotti

Chair: *Ciro Castiello*

An Interpretability-guided Modeling Process for Learning Comprehensible Fuzzy Rule-based Classifiers
José M. Alonso and Luis Magdalena

A Study on Interpretability Conditions for Fuzzy Rule-Based Classifiers
Raffaele Cannone, Ciro Castiello, Corrado Mencar and Anna Maria Fanelli

Qualitative and Task Analytic Methods to Support Comprehensible Intelligent System Design
Melanie C. Wright, Noa Segall, Jonathan B. Mark and Jeffrey M. Taekman

Comprehensible Model of a Quasi-Periodic Signal
Alberto Alvarez and Gracián Triviño

The Impact of Pruning BayesFuzzy Rule Set
I-Hsien Yin, Estevam R. Hruschka Jr and Heloisa de A. Camargo

W6: INTELLIGENT SYSTEMS DESIGN AND APPLICATIONS IN THE HEALTH DOMAIN - PART 2

60

Monday, November 30TH, 16:40 – 18:20 Sala Galilei

Chairs: *Ovidio Salvetti, Franco Chiarugi*

Translating Cancer Research into Clinical Practice: A Framework for Analyzing and Modeling Cancer from Imaging Data

Vangelis Sakkalis, Konstantinos Marias, Alexandros Roniotis and Emmanouil Skounakis

A Decision Support System for Aiding Heart Failure Management

Sara Colantonio, Massimo Martinelli, Davide Moroni, Ovidio Salvetti, Franco Chiarugi and Dimitra Emmanouilidou

Knowledge Discovery Approaches for Early Detection of Decompensation Conditions in Heart Failure Patients

Antonio Candelieri, Domenico Conforti, Angela Sciacqua and Francesco Perticone

On Intelligent Procedures in Medication for Patient Safety: The PSIP Approach

Vassilis Koutkias, Katerina Lazou, Vassilis Kilintzis, Régis Beuscart and Nicos Maglaveras

A Semantic Infrastructure for the Integration of Bioinformatics Services

Giorgos Zacharioudakis, Lefteris Koumakis, Stelios Sfakianakis and Manolis Tsiknakis

Accuracy Improvement of SOM-based Data Classification for Hematopoietic Tumor Patients

Naotake Kamiura, Ayumu Saitoh, Teijiro Isokawa and Nobuyuki Matsui

S5: COMPUTATIONAL INTELLIGENCE IN BUSINESS MANAGEMENT AND RISK ANALYSIS

61

Monday, November 30TH, 16:40 – 18:20 AulaB

Chair: *Beatrice Lazzerini*

A Hybrid Fuzzy-Promethee Method for Logistic Service Selection: Design of a Decision Support Tool
Davide Aloini, Riccardo Dulmin and Valeria Mininno

Optimizing Allocation in Floor Storage Systems for the Shoe Industry by Constraint Logic Programming

Antonella Meneghetti

Dynamic Representation of a Situation: a Step of a Decision Support Process

Fahem Kebair and Frédéric Serin

Method to Select Effective Risk Mitigation Controls Using Fuzzy Outranking

Kiyoshi Nagata, Michio Amagasa, Yutaka Kigawa and Dongmei Cui

The Fuzzy Probabilistic Weighted Averaging Operator and its Application in Decision Making

José M. Merigó

S6: HYBRID METAHEURISTICS AND THEIR APPLICATIONS

62

Tuesday, December 1ST, 10:00 – 11:20 Auditorium

Chair: Pedro Isasi

Improved Accuracy Rates of a Prototype Based Classifier Using Evolutionary Computation

Gustavo Recio, Yago Saez and Pedro Isasi

Hybrid and Evolutionary Agent-Based Social Simulations Using the PAX Framework

Fernando B. de Lima Neto, Marcelo Pita and Hugo Serrano B. Filho

Implementing Metaheuristic Optimization Algorithms with JEColi

Pedro Evangelista, Paulo Maia and Miguel Rocha

Hybrid Evolutionary Algorithms for Sensor Placement on a 3D Terrain

Haluk Rahmi Topcuoglu, Murat Ermis and Mesut Sifyan

W7: INTELLIGENT SYSTEMS FOR DATA REDUCTION PART 1

63

Tuesday, December 1ST, 10:00 – 11:20 Sala Fermi

Chair: José M. Benítez

A First Approach to Nearest Hyperrectangle Selection by Evolutionary Algorithms

Salvador García, Joaquín Derrac, Julián Luengo and Francisco Herrera

Addressing Data-Complexity for Imbalanced Data-sets: A Preliminary Study on the Use of Preprocessing for C4.5

Julián Luengo, Alberto Fernández, Salvador García and Francisco Herrera

Context-based Adaptive Filtering of Interest Points in Image Retrieval

Giang P. Nguyen and Hans Jørgen Andersen

Clustering-based Feature Selection in Semi-supervised Problems

Ianisse Quinzàn Suarez, José Martínez Sotoca and Filiberto Pla

W8: INTELLIGENT SIGNAL AND IMAGE ANALYSIS IN REMOTE SENSING PART 1

63

Tuesday, December 1ST, 10:00 – 11:20 Sala Pacinotti

Chair: Marco Diani

Semi-Supervised Kernel Target Detection in Hyperspectral Images

Luca Capobianco, Andrea Garzelli and Gustavo Camps-Valls

A Contextual Multiscale Unsupervised Method for Change Detection with Multitemporal Remote-Sensing Images

Gabriele Moser, Elena Angiati and Sebastiano B. Serpico

Texture-based Segmentation of Very High Resolution Remote-Sensing Images

Raffaele Gaetano, Giuseppe Scarpa and Giovanni Poggi

Towards Interpretable General Type-2 Fuzzy Classifiers

Luís A. Lucas, Tania M. Centeno and Myriam R. Delgado

W9: HUMAN MONITORING AND MACHINE LEARNING STRATEGIES PART 1

64

Tuesday, December 1ST, 10:00 – 11:20 Sala Galilei

Chair: Giovanni Pioggia

Applications of Soft Computing to Medical Problems

Ahmet Yardimci

An Ontology-driven Multisensorial Platform to Enable Unobtrusive Human Monitoring and Independent Living

Giovanni Pioggia, Giulia Ricci, Silvio Bonfiglio, Angelos Bekiaris, Gabriele Siciliano and Danilo De Rossi

Improved Learning of Bayesian Networks in Biomedicine

Antonella Meloni, Andrea Ripoli, Vincenzo Positano and Luigi Landini

Extraction and Synchronization of BOLD Spontaneous Oscillations using Singular Spectrum Analysis
Danilo Menicucci, Angelo Gemignani, Andrea Piarulli, Remo Bedini, Claudio Gentili, Giacomo Handjaras, Sabrina Danti, Mario Guazzelli, Marco Laurino, Paolo Piaggi and Alberto Landi

INNOVATIVE NETWORKING AND COMMUNICATION TECHNIQUES

65

Tuesday, December 1ST, 10:00 – 11:20 AulaB

Chair: Ajith Abraham

Efficient Scheduling Algorithms on Bandwidth Reservation Service of Internet using Metaheuristics
Tomoyuki Hiroyasu, Kozo Kawasaki, Michihiro Koibuchi, Shigeo Urushidani, Mitsunori Miki and Masato Yoshimi

Solving a Realistic Location Area Problem Using SUMATRA Networks with the Scatter Search Algorithm

Sónia M. Almeida-Luz, Miguel A. Vega-Rodríguez, Juan A. Gómez-Pulido and Juan M. Sánchez-Pérez

Danger Theory and Multi-agents Applied for Addressing the Deny of Service Detection Problem in IEEE 802.11 Networks

Moisés Danziger, Marcelo Lacerda and Fernando B. de Lima Neto

Design and Implementation of Distributed Intelligent Firewall based on IPv6

Qian Ma, Yingxu Lai and Guangzhi Jiang

INTELLIGENT CONTROL AND AUTOMATION PART 1

66

Tuesday, December 1ST, 11:30 – 12:50 Auditorium

Chair: Leonardo M. Reyneri

Agent-oriented Intelligent Control Strategies for the Nano-Satellite Autonomous Thermal System
Liu Jia, Li Yunze, Wang Yuying and Wang Jun

Intelligent Lighting Control User Interface through Design of Illuminance Distribution

Tomoyuki Hiroyasu, Akiyuki Nakamura, Sho Shinohara, Masato Yoshimi, Mitsunori Miki and Hisatake Yokouchi

Adaptive Paralleled DMC-PID Controller Design on System with Uncertainties

Ruihua Wei and Lihong Xu

An Efficient Solver for Scheduling Problems on a Class of Discrete Event Systems Using CELL/B.E. Processor

Hiroyuki Goto and Atsushi Kawaminami

W7: INTELLIGENT SYSTEMS FOR DATA REDUCTION PART 2

66

Tuesday, December 1ST, 11:30 – 12:50 Sala Fermi

Chair: José Salvador García

Empirical Study of Individual Feature Evaluators and Cutting Criteria for Feature Selection in Classification

Antonio Arauzo-Azofra, José L. Aznarte M. and José M. Benítez

Agglomeration and Elimination of Terms for Dimensionality Reduction

Patrick Marques Ciarelli and Elias Oliveira

Automatically Generated Linguistic Summaries of Energy Consumption Data

Albert van der Heide and Gracián Triviño

Measures for Unsupervised Fuzzy-Rough Feature Selection

Neil Mac Parthaláin and Richard Jensen

W8: INTELLIGENT SIGNAL AND IMAGE ANALYSIS IN REMOTE SENSING PART 2

67

Tuesday, December 1ST, 11:30 – 12:50 Sala Pacinotti

Chair: Giovanni Corsini

On the Effects of Synthetic-Aperture Length on SAS Seabed Segmentation

David P. Williams and Johannes Groen

Fully Unsupervised Learning of Gaussian Mixtures for Anomaly Detection in Hyperspectral Imagery

Tiziana Veracini, Stefania Matteoli, Marco Diani and Giovanni Corsini

Performance Assessment of a Mathematical Morphology Ship Detection Algorithm for SAR Images through Comparison with AIS Data

Raffaele Grasso, Sergio Mirra, Alberto Baldacci, Jochen Horstmann, Matthew Coffin, Melanie Jarvi

Intelligent Cooperative Tracking in Multi-Camera Systems

Yan Lu and Shahram Payandeh

W9: HUMAN MONITORING AND MACHINE LEARNING STRATEGIES PART 2

68

Tuesday, December 1ST, 11:30 – 12:50 Sala Galilei

Chair: Alberto Landi

Backpropagation-Based Non Linear PCA for Biomedical Applications

Alberto Landi, Paolo Piaggi and Giovanni Pioggia

Cluster Analytic Detection of Disgust-Arousal

Masood Mehmood Khan

Automatic Detection of Arrhythmias Using Wavelets and Self-Organized Artificial Neural Networks

Sérgio R. Rogal Jr, Alfredo Beckert Neto, Marcus Vinícius Mazega Figueredo, Emerson Cabrera Paraiso and Celso A. Alves Kaestner

ENMET: Endothelial Cell Metabolism Mathematical Model

Gianni Orsi, Carmelo De Maria, Federico Vozzi, Mariangela Guzzardi, Arti Ahluwalia and Giovanni Vozzi

INTELLIGENT INTERNET MODELING

68

Tuesday, December 1ST, 11:30 – 12:50 AulaB

Chair: Umberto Straccia

Extending Datatype Restrictions in Fuzzy Description Logics

Fernando Bobillo and Umberto Straccia

A Combined Query Expansion Technique for Retrieving Opinions from Blogs

Saeedeh Momtazi, Stefan Kazalski and Dietrich Klakow

Novel IPCA-Based Classifiers and Their Application to Spam Filtering

Alessandro Rozza, Gabriele Lombardi and Elena Casiraghi

A Fuzzy Decision System Using Shoppers' Preferences for Recommendations in E-Commerce Applications

Zhengping Wu and Hao Wu

Evolutionary Shallow Parsing

John Atkinson and Juan Matamala

INTELLIGENT CONTROL AND AUTOMATION PART 2

69

Tuesday, December 1ST, 15:00 – 16:20 Auditorium

Chair: Antonio Peregrin Rubio

Design Based on a Shared Lookup-Table for an Obstacle Avoidance Fuzzy Controller for Mobile Robots

Jinwook Kim, Young-Gu Kim, Young-Duk Kim, Won-Seok Kang and Jinung An

Acquisition of Image Feature on Collision for Robot Motion Generation

Taichi Okamoto, Yuichi Kobayashi and Masaki Onishi

Using Fuzzy Techniques for Bounding the Tolerance of GPS-based Speed and Distance Measurements in Taximeter Verification

Adolfo Otero, José Otero and Luciano Sánchez

Identification of Petri Net Models based on an Asymptotic Approach

Maria Elena Meda Campaña, Francisco Javier Lopez-Lopez, Cuauhtemoc Lopez-Martin and Arturo Chavoya

W10: CONSENSUS AND DECISION MAKING PART 1

70

Tuesday, December 1ST, 15:00 – 16:20 Sala Fermi

Chair: Enrique Herrera-Viedma

Consensus with Linguistic Preferences in Web 2.0 Communities

Sergio Alonso, Ignacio J. Pérez, Enrique Herrera-Viedma and Francisco Javier Cabrerizo

Optimizing the Method for Building an Extended Linguistic Hierarchy

Macarena Espinilla, Rosa M Rodríguez, Luis Martínez, F. Mata and Jun Liu

A Preliminary Study of the Effects of Different Aggregation Operators on Consensus Processes

Francisco Mata, Luis Martínez and Juan Carlos Martínez

Action Rules in Consensus Reaching Process Support

Janusz Kacprzyk, Sławomir Zadrozny and Zbigniew W. Raś

S7: EDUCATION AND LEARNING MODELS, APPLICATIONS AND SOLUTIONS

71

Tuesday, December 1ST, 15:00 – 16:20 Sala Pacinotti

Chairs: Silvio Bortoleto, Katia Bortoleto

Cognition and Affectivity: its Influences in Teacher-Student Relation and in the Teaching-Learning Process

Ana Letícia Galastri

Intelligent Reporting System with e-Training Capabilities

Maria Murri, Marco Lupinelli and Luca Onofri

Analyzing Online Asynchronous Discussion Using Content and Social Network Analysis

Erlin, Norazah Yusof and Azizah Abdul Rahman

Improving Academic Performance Prediction by Dealing with Class Imbalance

Nguyen Thai-Nghe, Andre Busche and Lars Schmidt-Thieme

W9: HUMAN MONITORING AND MACHINE LEARNING STRATEGIES PART 3

71

Tuesday, December 1ST, 15:00 – 16:20 Sala Galilei

Chair: Giovanni Pioggia

An FPGA based Arrhythmia Recognition System for Wearable Applications

Antonino Armato, Elena Nardini, Antonio Lanatà, Gaetano Valenza, Carlo Mancuso, Enzo Pasquale Scilingo and Danilo De Rossi

Postponed Updates for Temporal-Difference Reinforcement Learning

Harm van Seijen and Shimon Whiteson

Sensor Fusion-oriented Fall Detection for Assistive Technologies Applications

Stefano Cagnoni, Guido Matrella, Monica Mordonini, Federico Sassi, and Luca Ascari

Event Related Biometrics: Towards an Unobtrusive Sensing Seat System for Continuous Human Authentication

Marcello Ferro, Giovanni Pioggia, Alessandro Tognetti, Gabriele Dalle Mura and Danilo De Rossi

W11: PROVISIONING OF SMART SERVICES IN ONTOLOGY-BASED SYSTEMS PART

72

Tuesday, December 1ST, 15:00 – 16:20 AulaB

Chair: Pierluigi Ritrovato

Using Ontologies to Achieve Semantic Interoperability in the Web: an Approach based on the Semantic Triangle Model

Angelo Chianese, Annarita Fasolino, Vincenzo Moscato and Porfirio Tramontana

Ontology-based System for Enterprise 2.0

Giuseppina Rita Mangione, Sergio Miranda, Stefano Paolozzi, Anna Pierri, Pierluigi Ritrovato and Saverio Salerno

A Business Intelligence Process to Support Information Retrieval in an Ontology-Based Environment

Filippo Sciarrone, Paolo Starace and Tommaso Federici

Combining DHTs and SONs for Semantic-Based Service Discovery

Giuseppe Pirrò, Paolo Missier, Paolo Trunfio, Domenico Talia, Gabriele Falace and Carole Goble

INTELLIGENT CONTROL AND AUTOMATION PART 3

73

Tuesday, December 1ST, 16:40 – 18:20 Auditorium

Chair: Alberto Landi

Transferring the Progress Control Policy for a Class of Discrete Event Systems

Hiroyuki Goto and Takakazu Tsubokawa

AAFES: An Intelligent Fuzzy Expert System for Realization of Adaptive Autonomy Concept

Alireza Fereidunian, Mohammad-Ali Zamani, Caro Lucas, Hamid Lesani and Matti Lehtonen

The Bi-objective Problem of Distribution of Oil Products by Pipeline Networks Approached by a Particle Swarm Optimization Algorithm

Thatiana C. N. Souza, Elizabeth F. G. Goldberg and Marco C. Goldberg

Detection of Similarity of Trajectory of Center of Gravity in Operating Unicycle Uses Motion Capture System

Takahiro Kawasaki, Teruyosho Sadahiro, Masami Iwase and Shoshiro Hatakeyama

Observer Design using T-S Fuzzy Systems for Pressure Estimation in Hydrostatic Transmissions

Horst Schulte and Patrick Gerland

W10: CONSENSUS AND DECISION MAKING PART 2

74

Tuesday, December 1ST, 16:40 – 18:20 Sala Fermi

Chair: José Luis García-Lapresta

On the Use of the Uncertain Induced OWA Operator and the Uncertain Weighted Average and its Application in Tourism Management

José M. Merigo, Anna M. Gil-Lafuente and Onofre Martorell

Measuring Social Welfare through Location and Consensus Measures

José Luis García-Lapresta and Ricardo Alberto Marques Pereira

Connection among Some Characterizations of Complete Fuzzy Preorders

Susana Díaz, Davide Martinetti, Ignacio Montes and Susana Montes

Definition of a Consensual Drug Selection Process in Hospital Universitario Virgen de la Victoria

Jesus M. Doña, Isabel Moya and Jesus López

Strategic Assessment of Business

Jesus M. Doña, Jose I. Peláez and Luis G. Vargas

S8: INTELLIGENT E-LEARNING SYSTEMS

74

Tuesday, December 1ST, 16:40 – 18:20 Sala Pacinotti

Chairs: Ajith Abraham, Norazah Yusof

Developing Student Model using Kohonen Network in Adaptive Hypermedia Learning System

Bariah Yusob, Siti Mariyam Hj Shamsuddin and Nor Bahiah Ahmad
 OCEAN Project. A Prototype of AIWBES based on Fuzzy Ontology
Francesco Colleoni, Silvia Calegari, Davide Ciucci and Matteo Dominoni
 LS-LAB: a Framework for Comparing Curriculum Sequencing Algorithms
Carla Limongelli, Filippo Sciarrone and Giulia Vaste
 Concept-based Classification for Adaptive Course Sequencing Using Artificial Neural Network
Norsham Idris, Norazah Yusof and Puteh Saad
 A Metrics Suite for Measuring Reusability of Learning Objects
Siti Fadzilah Mat Noor, Norazah Yusof and Siti Zaiton Mohd Hashim

S9: INTELLIGENT SYSTEMS FOR INDUSTRIAL PROCESSES

75

Tuesday, December 1ST, 16:40 – 18:20 Sala Galilei

Chairs: Leonardo Maria Reyneri, Valentina Colla

Tutorial: About Industrial Acceptance of Intelligent Systems

Leonardo M. Reyneri

Automatic Diagnosis of Defects of Rolling Element Bearings based on Computational Intelligence Techniques

Marco Cococcioni, Beatrice Lazzerini and Sara Lioba Volpi

GA-Based Solutions Comparison for Storage Strategies Optimization for an Automated Warehouse

Valentina Colla, Gianluca Nastasi, Nicola Matarese and Leonardo M. Reyneri

Profit Forecasting Using Support Vector Regression for Consulting Engineering Firms

Victor Yepes, Eugenio Pellicer and Francesc J. Ferri

On-Line Neural Network Stator Resistance Estimation in Direct Torque Controlled Induction Motor Drive

Yassine Sayouti, Ahmed Abbou, Mohammed Akherraz and Hassane Mahmoudi

W11: PROVISIONING OF SMART SERVICES IN ONTOLOGY-BASED SYSTEMS PART 2

76

Tuesday, December 1ST, 16:40 – 18:20 AulaB

Chair: Filippo Sciarrone

Product Configurator: an Ontological Approach

Francesco Colace, Massimo De Santo and Paolo Napoletano

WikiArt: an Ontology-based Information Retrieval System for Arts

Roberto Pirrone, Vincenzo Cannella, Orazio Gambino, Arianna Pipitone and Giuseppe Russo

An Ontology-based Method for Integrating Heterogeneous Itembanks

Chun-Wei Tsai, Shih-Pang Tseng, Yu-Sheng Yang, Ming-Chao Chiang and Chu-Sing Yang⁷⁷

Higher Education in the Twenty-first Century. The Chance of Adaptive Learning Environments

Antonella Poce

A Probabilistic Method for Text Analysis

Fabio Clarizia, Massimo De Santo and Paolo Napoletano

Ontology Merging and Database Schema Integration: An Approach to Identify Semantic Similarity and Resolve Schematic Heterogeneity in Interoperable GIS Application

Nanna Suryana, Shahrin Sahib, Ridwan Habibi, Norayu Abdul Ghani, Zahriah Othman and Ahmad Tajuddin Samsudin

INTELLIGENT DATA MINING

77

Wednesday, December 2ND, 10:40 – 12:40 Auditorium

Chair: Teresa B. Ludermir

An Experimental Study on Unsupervised Clustering-based Feature Selection Methods

Thiago Ferreira Covões and Eduardo Raul Hruschka

A Penalty Function for Computing Orthogonal Non-Negative Matrix Factorizations

Nicoletta Del Buono

Comparison Among Methods for k Estimation in k-means

Murilo C. Naldi, André Fontana and Ricardo J.G.B. Campello

A Possibilistic Approach for Building Statistical Language Models

Saeedeh Momtazi and Hossein Sameti

A Robust Prediction Method for Interval Symbolic Data

Roberta A.A. Fagundes, Renata M.C.R. de Souza and Francisco José A. Cysneiros

Optimizing Linear and Quadratic Transformations for Classification Tasks

José M. Valls and Ricardo Aler

W12: COMPUTATIONAL INTELLIGENCE FOR PERSONALIZATION IN WEB CONTENT AND SERVICE DELIVERY

78

Wednesday, December 2ND, 10:40 – 12:40 Sala Fermi

Chairs: Giovanna Castellano, Maria Alessandra Torsello

Modeling User Preferences through Adaptive Fuzzy Profiles

Corrado Mencar, Maria Alessandra Torsello, Danilo Dell'Agnello, Giovanna Castellano and Ciro Castiello

Situation-aware Mobile Service Recommendation with Fuzzy Logic and Semantic Web

Alessandro Ciaramella, Mario Giovanni C. A. Cimino, Beatrice Lazzerini and Francesco Marcellon

An Heuristic Approach to Page Recommendation in Web Usage Mining

Antonio Maratea and Alfredo Petrosino

Recommendations toward Serendipitous Diversions

Leo Iaquina, Marco de Gemmis, Pasquale Lops and Giovanni Semeraro

A Preliminary Experience in Optimizing the Layout of Web Pages by Genetic Algorithms to Fit Mobile Devices

Luigi Troiano, Gennaro Cirillo, Roberto Armenise and Cosimo Birtolo

A Recommendation Technique for Cultural Heritage Hypermedial Objects

Pierpaolo Di Bitonto, Teresa Roselli and Veronica Rossano

W13: EVOLUTIONARY ALGORITHMS AND OTHER METAHEURISTICS FOR CONTINUOUS OPTIMIZATION PROBLEMS - A SCALABILITY TEST

79

Wednesday, December 2ND, 10:40 – 12:40 Sala Pacinotti

Chairs: Francisco Herrera, Manuel Lozano

Memetic Algorithm with Local Search Chaining for Continuous Optimization Problems: A Scalability Test

Daniel Molina, Manuel Lozano and Francisco Herrera

Continuous Variable Neighbourhood Search Algorithm Based on Evolutionary Metaheuristic Components: A Scalability Test

Carlos García-Martínez and Manuel Lozano

A Memetic Differential Evolution Algorithm for Continuous Optimization

Santiago Muelas, Antonio LaTorre and José María Peña

An Adaptive Memory Procedure for Continuous Optimization

Abraham Duarte, Rafael Marti and Fred Glover

A Scalability Test for Accelerated DE Using Generalized Opposition-based Learning

Hui Wang, Zhijian Wu, Shahryar Rahnamayan and Lishan Kang

Unidimensional Search for Solving Continuous High-dimensional Optimization Problems

Vincent Gardeux, Rachid Chelouah, Patrick Siarry and Fred Glover

W14: EDUCATIONAL DATA MINING

80

Wednesday, December 2ND, 10:40 – 12:40 Sala Galilei

Chair: Sebastián Ventura

Mining Models for Failing Behaviors

Cláudia Antunes

Checking the Reliability of GeSES: Method for Detecting Symptoms of Low Performance

Javier Bravo, Estefania Martin, Alvaro Ortigosa and Rosa M. Carro

From Local Patterns to Global Models: Towards Domain Driven Educational Process Mining

Nikola Trčka and Mykola Pechenizkiy

Predicting Academic Achievement Using Multiple Instance Genetic Programming

Amelia Zafra, Cristóbal Romero and Sebastián Ventura

Discovering Learning Objects Usability Characteristics

Alfredo Zapata, Victor H. Menendez and Manuel E. Prieto

Time Analysis of Forum Evolution as Support Tool for E-Moderating

Carlo Alberto Bentivoglio

W15: DATA MINING AND ONTOLOGIES MODELS, APPLICATIONS AND SOLUTIONS PART 1

81

Wednesday, December 2ND, 10:40 – 12:40 AulaB

Chair: Silvio Bortoleto

MAHATMA: A Genetic Programming-Based Tool for Protein Classification

Denise F. Tsunoda, Alex A. Freitas and Heitor S. Lopes

A Strategy for Biodiversity Knowledge Acquisition based on Domain Ontology

Andréa Corrêa Flôres Albuquerque, José Laurindo Campos dos Santos and José Francisco de Magalhães Netto

A Fast Algorithm for Mining Rare Itemsets

Luigi Troiano, Giacomo Scibelli and Cosimo Birtolo

Developing an Implementation through a Modeling of the Database for Cardiovascular Monitoring

Hugo Bulegon, Silvio Bortoleto and Angelmar Constantino Roman

An FCD Information Processing Model under Traffic Signal Control

Weifeng Lv, Leishi Xu, Tongyu Zhu, Dongdong Wu and Bowen Du

Designing a Conceptual Model for Herbal Research Domain using Ontology Technique

Azlida Mamat and Azizah Abdul Rahman

INTELLIGENT KNOWLEDGE MANAGEMENT

82

Wednesday, December 2ND, 13:50 – 15:30 Auditorium

Chair: Vincenzo Loia

Some Basic Results of Fuzzy Research in the ISI Web of Knowledge

José María Merigó and Ana M. Gil-Lafuente

On the Role of Dialogue and Argumentation in Collaborative Problem Solving

Nadim Obeid and Asma Moubaidin

Inductive Query Answering and Concept Retrieval Exploiting Local Models

Claudia d'Amato, Nicola Fanizzi, Floriana Esposito and Thomas Lukasiewicz

Order Independent Incremental Evolving Fuzzy Grammar Fragment Learner

Nurfadhlina Mohd Sharef, Trevor Martin and Yun Shen

Automatic Labeling Of Topics

Davide Magatti, Silvia Calegari, Davide Ciucci and Fabio Stella

S10: INTELLIGENT SYSTEMS AND DATA MINING TECHNIQUES FOR BIOINFORMATICS

83

Wednesday, December 2ND, 13:50 – 15:30 Sala Fermi

Chair: Raúl Giráldez

Optimization of Multi-classifiers for Computational Biology: Application to the Gene Finding Problem

Rocio Romero-Zaliz, Coral del Val and Igor Zwir

An Overlapping Control-Biclustering Algorithm from Gene Expression Data

Juan A. Nepomuceno, Alicia Troncoso and Jesús S. Aguilar-Ruiz

Similarity Analysis of Protein Binding Sites: A Generalization of the Maximum Common Subgraph Measure Based on Quasi-Clique Detection

Imen Boukhris, Zied Elouedi, Thomas Fober, Marco Mernberger and Eyke Hüllermeier

Efficient Construction of Multiple Geometrical Alignments for the Comparison of Protein Binding Sites

Thomas Fober, Gerhard Klebe and Eyke Huellermeier

Optimizing Multiple Sequence Alignment by Improving Mutation Operators of a Genetic Algorithm

Fernando José Mateus da Silva, Juan Manuel Sánchez Pérez, Juan Antonio Gómez Pulido and Miguel A. Vega Rodríguez.

W16: NEURAL NETWORKS AND NEURO-FUZZY SYSTEMS PART 1

84

Wednesday, December 2ND, 13:50 – 15:30 Sala Pacinotti

Chair: Luis Javier Herrera

Risk Factor Identification and Classification of Macrosomic Newborns by Neural Networks

Alberto Guillen, Andrea Martinez-Trujillo, Gines Rubio, Ignacio Rojas, Hector Pomares and Luis Javier Herrera

A Data Mining Approach Based on a Local-Global Fuzzy Modelling for Prediction of Color Change after Tooth Bleaching using Vita Classical Shades

Luis J. Herrera, María del Mar Pérez, Janiley Santana, Rosa Pulgar, Jesús González, Héctor Pomares and Ignacio Rojas

Trajectory Tracking of Complex Dynamical Network for Recurrent Neural Network Via Control V-Stability

José P. Pérez, Joel Pérez, Jorge A. González

General Purpose Input Variables Extraction: A Genetic Algorithm based Procedure GIVE A GAP

Silvia Cateni, Valentina Colla and Marco Vannucci

A Fuzzy Wavelet Neural Network Model for System Identification

Sevcan Yilmaz and Yusuf Oysal

WORKSHOP W17: SOFT COMPUTING AND IMAGE PROCESSING PART 1

85

Wednesday, December 2ND, 13:50 – 15:30 Sala Galilei

Chair: Humberto Bustince

Assessment of Asymmetry in Pyramidal Tract by Using Fiber Tracking

Fatima Tensaouti, Jean Albert Lotterie, Perrine Clarisse and Isabelle Berry

A A-IFSs Based Image Segmentation Methodology for Gait Analysis

Pedro Couto, Vitor Filipe, Pedro Melo-Pinto, Humberto Bustince and Edurne Barrenechea

A 3D Lifting Based Method Augmented by Motion Compensation for Video Coding

Sedat Telceken, Sukru Gorgulu and Omer N. Gerek

A Structural Approach to Image Segmentation

Daniel Gómez, Javier Montero and Javier Yáñez

Noisy Image Edge Detection Using an Uninorm Fuzzy Morphological Gradient

Manuel González-Hidalgo, Arnau Mir Torres and Joan Torrens Sastre

W15: DATA MINING AND ONTOLOGIES MODELS, APPLICATIONS AND SOLUTIONS PART 2

86

Wednesday, December 2ND, 13:50 – 15:30 AulaB

Chair: Katia Bortoleto

Potential Data Mining Classification Techniques for Academic Talent Forecasting

Hamidah Jantan, Abdul Razak Hamdan and Zulaiha Ali Othman

Equalizing the Structures of Web Communities in Ontology Development Tools

Francesca Arcelli Fontana, Raffaele Ferrante Formato and Remo Pareschi

Searching Common Pattern in Agents Behaviors with Usage of FCA

Petr Gajdoš and Michal Radecký

Vertical Mining of Frequent Patterns Using Diffset Groups

Laila A. Abd El-Megid, Mohamed E. El-Sharkawi, Laila M. El-Fangary and Yehia K. Helmy

HYBRID SYSTEMS

86

Wednesday, December 2ND, 15:50 – 17:50 Auditorium

Chair: Eduardo Raul Hruschka

Integration of Graphical Modeling with Fuzzy Clustering for Casual Relationship of Electric Load Forecasting

Hiroyuki Mori and Wenjun Jiang

Testing for Serial Independence of the Residuals in the Framework of Fuzzy Rule-based Time Series Modeling

José Luis Aznarte M., Antonio Arauzo-Azofra and José M. Benítez-Sánchez

Efficient Computation Methods for the Kleene Star in Max-Plus Linear Systems

Hiroyuki Goto and Munenori Kasahara

Using Smart Sampling to Discover Promising Regions and Increase the Efficiency of Differential Evolution

Vinícius Veloso de Melo and Alexandre C.B. Delbem

EACImpute: An Evolutionary Algorithm for Clustering-Based Imputation

Jonathan de Andrade Silva and Eduardo Hruschka

INTELLIGENT IMAGE AND SIGNAL PROCESSING

87

Wednesday, December 2ND, 15:50 – 17:50 Sala Fermi

Chair: Beatrice Lazzerini

Intracellular Volume Registration

Shin Yoshizawa, Satoko Takemoto, Miwa Takahashi, Makoto Muroi, Sayaka Kazami, Hiromi Miyoshi and Hideo Yokota

Algorithm Selection for Intracellular Image Segmentation based on Region Similarity

Satoko Takemoto and Hideo Yokota

Effective Feature Selection for Mars McMurdo Terrain Image Classification

Changjing Shang, Dave Barnes and Qiang Shen

View-Independent Face Recognition with Biological Features based on Mixture of Experts

Alireza Hajiany, Nina Taheri Makhsoos and Reza Ebrahimpour

Study on Mapping of Basic Elements in the Chinese Character Intelligent Formation without Character Library System

Mingyou Liu, Wenzhi Liao and Youguo Pi

W16: NEURAL NETWORKS AND NEURO-FUZZY SYSTEMS PART 2

88

Wednesday, December 2ND, 15:50 – 17:50 Sala Pacinotti

Chair: Ignacio Rojas

FPGA-Based Recurrent Wavelet Neural Network Control System for Linear Ultrasonic Motor

Ying-Chih Hung and Faa-Jeng Lin

Fitting Multiple Alpha Peaks using Neural Network Techniques

Javier Miranda, Antonio Baeza, Javier Guillén and Rosa M. Pérez Utrero

Computer Vision-Based Eyelid Closure Detection: a Comparison of MLP and SVM classifiers

David González-Ortega, Francisco Javier Díaz-Pernas, Míriam Antón-Rodríguez, Mario Martínez-Zarzuela, José Fernando Díez-Higuera and Daniel Boto-Giralda

A Method to Point Out Anomalous Input-Output Patterns in a Database for Training Neuro-Fuzzy System with a Supervised Learning Rule

Valentina Colla, Nicola Matarese and Leonardo M. Reyneri

Acquisition of Body and Object Representation Based on Motion Learning and Planning Framework

Takahiro Asamizu and Yuichi Kobayashi

WORKSHOP W17: SOFT COMPUTING AND IMAGE PROCESSING PART 2

89

Wednesday, December 2ND, 15:50 – 17:50 Sala Galilei

Chair: Pedro Melo-Pinto

On the Use of t-Conorms in the Gravity-based Approach to Edge Detection

Carlos Lopez-Molina, Humberto Bustince, Mikel Galar, Javier Fernandez and Bernard De Baets

Ignorance-based fuzzy clustering algorithm

Aranzazu Jurio, Miguel Pagola, Daniel Paternain, Edurne Barrenechea, Jose Antonio Sanz and Humberto Bustince

THRECOND: An Automated and Unsupervised Three Colour Fuzzy-Based Algorithm for Detecting Nuclei in Cervical Pap Smear Images

Fabio Vaschetto, Eduard Montseny, Pilar Sobrerilla and Enrique Lerma

Fusion of IKONOS Remote Sensing Filtered Images using Shadow Information to Improve the Rate of Building Extraction in Urban Images

Mohammad Jalal Rastegar Fatemi, Seyed Mostafa Mirhassani and Bardia Yousefi

Introducing Type-2 Fuzzy Sets for Image Texture Modelling

Jesus Chamorro-Martínez, Pedro Martínez-Jiménez and Daniel Sánchez

S11: BIOINSPIRED AND EVOLUTIONARY COMPUTATION BASED DATA MINING TECHNIQUES

90

Wednesday, December 2ND, 15:50 – 17:50 AulaB

Chair: José M. Puerta

Structural Learning of Bayesian Networks by using Variable Neighbourhood Search based on the Space of Orderings

Juan Ignacio Alonso-Barba, Luis delaOssa and Jose M. Puerta

Binary Representation in Gene Expression Programming: Towards a Better Scalability

Jose G. Moreno-Torres, Xavier Llorà and David E. Goldberg

E-tsRBF: Preliminary Results on the Simultaneous Determination of Time-lags and Parameters of Radial Basis Function Neural Networks for Time Series Forecasting

Elisabet Parras-Gutierrez, Victor Rivas and Maria José del Jesus

Grammatical Concept Representation for Randomised Optimisation Algorithms in Relational Learning

Petr Buryan, Jiří Kubalik and Katsumi Inoue

Fast Evolutionary Algorithms for Relational Clustering

Danilo Horta and Ricardo J.G.B. Campello

Abstracts

Evolutionary algorithms – Part 1

Monday, November 30TH, 10:00 – 11:20

Auditorium

Chair: Carlos A. Coello Coello

Valley-Adaptive Clearing Scheme for Multimodal Optimization Evolutionary Search

Mostafa M.H. Ellabaan and Yew Soon Ong

Recent studies [13, 18] have shown that clearing schemes are efficient multi-modal optimization methods. They efficiently reduce genetic drift which is the direct reason for premature convergence in genetic algorithms. However, clearing schemes assumed a landscape containing equal-spaced basins when using a fixed niche radius. Further, most clearing methods employ policies that favor elitists, thus affecting the explorative capabilities of the search. In this paper, we present a valley adaptive clearing scheme, aiming at adapting to non-uniform width of the valleys in the problem landscape. The framework of the algorithm involves hill-valley initialization, valley-adaptive clearing and archiving. Experimental results on benchmark functions are presented to demonstrate that the proposed scheme uncovers more local optima solutions and displays excellent robustness to varying niche radius than other clearing schemes.

Handling Box, Linear and Quadratic-Convex Constraints for Boundary Optimization with Differential Evolution Algorithms

Massimo Spadoni and Luciano Stefanini

We propose and test the performance of an implicit strategy to handle box, linear and quadratic convex constraints, based on changing the search space from points to directions, suitable to be easily implemented in combination with differential evolution (DE) algorithms for the boundary optimization of a generic continuous function. In particular, we see that DE can be efficiently implemented to find solutions on the boundary of box constraints, linear inequality constraints and quadratic convex constraints, for which the feasible set is convex and bounded. The computational results are performed on different classes of minimization problems.

Scaling Genetic Algorithms using MapReduce

Abhishek Verma, Xavier Llorà, David E. Goldberg and Roy H. Campbell

Genetic algorithms (GAs) are increasingly being applied to large scale problems. The traditional MPI-based parallel GAs require detailed knowledge about machine architecture. On the other hand, MapReduce is a powerful abstraction proposed by Google for making scalable and fault tolerant applications. In this paper, we show how genetic algorithms can be modeled into the MapReduce model. We describe the algorithm design and implementation of GAs on Hadoop, an open source implementation of MapReduce. Our experiments demonstrate the convergence and scalability up to 10⁵ variable problems. Adding more resources would enable us to solve even larger problems without any changes in the

algorithms and implementation since we do not introduce any performance bottlenecks.

Efficiency Enhancement of ECGA Through Population Size Management

Vinícius V. de Melo, Thyago S.P.C. Duque and Alexandre C.B. Delbem

This paper describes and analyzes population size management, which can be used to enhance the efficiency of the extended compact genetic algorithm (ECGA). The ECGA is a selectorecombinative algorithm that requires an adequate sampling to generate a high-quality model of the problem. Population size management decreases the overall running time of the optimization process by splitting the algorithm into two phases: first, it builds a high-quality model of the problem using a large population; second, it generates a smaller population, sampled using the high-quality model, and performs the remaining of the optimization with a reduced population size. The paper shows that for decomposable optimization problems, population size management leads to a significant optimization speedup that decreases the number of evaluations for convergence in ECGA by a factor of 30% to 70% keeping the same accuracy and reliability. Furthermore, the ECGA using PSM presents the same scalability model as the ECGA.

W1: Soft Computing in Intelligent Agents and Web Technologies – Part 1

Monday, November 30TH, 10:00 – 11:20

Sala Fermi

Chair: Enrique Herrera-Viedma

RSS-generated Contents through Personalizing e-Learning Agents

Carmen De Maio, Giuseppe Fenza, Matteo Gaeta, Vincenzo Loia, Francesco Orciuoli and Sabrina Senatore

Nowadays, the emphasis on Web 2.0 is specially focused on user generated content, data sharing and collaboration activities. Protocols like RSS (Really Simple Syndication) allow users to get structured web information in a simple way, display changes in summary form and stay updated about news headlines of interest. In the e-Learning domain, RSS feeds meet demand for didactic activities from learners and teachers viewpoints, enabling them to become aware of new blog posts in educational blogging scenarios, to keep track of new shared media, etc. This paper presents an approach to enrich personalized e-learning experiences with user-generated content, through the RSS-feeds fruition. The synergic exploitation of Knowledge Modeling and Formal Concept Analysis techniques enables the definition and design of a system for supporting learners in the didactic activities. An agent-based layer supervises the extraction and filtering of RSS feeds whose topics are specific of a given educational domain. Then, during the execution of a specific learning path,

the agents suggest the most appropriate feeds with respect to the subjects in which the students are currently engaged in.

Combining Agents and Ontologies to Support Task-Centred Interoperability in Ambient Intelligent Environments

Gaëtan Pruvost, Achilles Kameas, Tobias Heinroth, Lambrini Seremeti and Wolfgang Minker

This article describes our approach towards the specification and realization of interoperability within Next Generation Ambient Intelligent Environments (NGAIE). These are populated with numerous devices and multiple occupants or users exhibit increasingly intelligent behaviour, provide optimized resource usage and support consistent functionality and human-centric operation. In NGAIEs users will interact with their environments using the devices therein complemented with adaptive multimodal dialogue. This requires the definition of the local and global information which is relevant to the interaction and mechanisms to share this knowledge among entities. In our approach, knowledge is represented as a set of heterogeneous ontologies which have to be aligned in order to provide a uniform and consistent knowledge representation. The combination of heterogeneous ontologies and ontology matching algorithms allows for semantically rich information exchange. Based on a combination of agent-based and service-oriented architectures, the proposed approach adopts a task-based model to maximize the use of available heterogeneous resources.

A Web-based Fuzzy Linguistic Tool to Filter Information in a Biomedical Domain

José Manuel Morales-del-Castillo, Eduardo Peis and Enrique Herrera-Viedma

In Biomedical Sciences is necessary the development of new services capable of satisfying specific information needs. In this paper we present a filtering system that applies Semantic Web technologies and Fuzzy Linguistic Modeling techniques in order to provide users valuable information about resources that fit their interests. The main features and elements of the system are enumerated in this paper, and an operational example (which illustrates the overall system performance) is presented. Furthermore, the outcomes of a simple system evaluation are shown

Agent-based Web Content Engagement Time (WCET) Analyzer on e-Publication System

Raymond S.T. Lee, James N.K. Liu, Karo S.Y. Yeung, Alan H.L. Sin and Dennis T.F. Shum

This paper focuses on the adoption of Agent Technology to calculate and evaluate the Web Content Engagement Time (WCET). Traditional Web traffic analysis metrics such as pageviews, unique browser, visitor loyalty, etc have been used to analyze the web traffic behaviour for a long time since the birth of World Wide Web, but the emersion of software robots and web crawlers trigger a huge impact on the integrity and correctness of these traditional Web statistics. For advertisers, these statistics are not enough for them to evaluate the actual

return-on-investment (ROI). For instance, large amount of pageviews but extremely short session duration will not have much impact for the advertisers to promote their products and brands. Web Content Engagement Time (WCET) for the reading on interactive Web content such as e-magazines and e-publications, which focuses on the page duration between each "page-flipping", will give advertisers much more information and confidence on whether such eye-balls (i.e. attention) are actually focused on the Web content (and hence the eAds) or not, especially during the browsing of e-magazines and e-publications. But such indicator involves significant amount of calculation within the Web server, especially when over thousands of users are reading a popular e-publication at the same time. To tackle with this problem, a multi-agent based Web Content Engagement Time (WCET) Analyzer is proposed on e-publication system. From the experimental perspective, popular Chinese e-magazine "MingPaoWeekly", with over 0.5 million readership in Hong Kong and oversea Chinese communities are tested over the IAToLife.com Web Channel platform, promising Web Content Engagement Time (WCET) are recorded, which provides not only integrity and confidence for the publishers and advertisers, but also shines a new light for the future agent-based target marketing and e-reader profile and reading behavior analysis.

W2: Genetic Fuzzy Systems: Design and Applications – Part 1

Monday, November 30TH, 10:00 – 11:20

Sala Pacinotti

Chair: Rafael Alcalá

Effects of Data Reduction on the Generalization Ability of Parallel Distributed Genetic Fuzzy Rule Selection

Yusuke Nojima and Hisao Ishibuchi

Genetic fuzzy rule selection has been successfully used to design accurate and interpretable fuzzy classifiers from numerical data. In our former study, we proposed its parallel distributed implementation which can drastically decrease the computational time by dividing both a population and a training data set into sub-groups. In this paper, we examine the effect of data reduction on the generalization ability of fuzzy rule-based classifiers designed by our parallel distributed approach. Through computational experiments, we show that data reduction can be realized without severe deterioration in the generalization ability of the designed fuzzy classifiers.

Obtaining a Linguistically Understandable Random Sets-based Classifier from Interval-Valued Data with Genetic Algorithms

Luciano Sánchez and Inés Couso

Combining descent algorithms and a coevolutionary scheme, we have defined a new procedure that is able to obtain rule-based models from datasets with censored or interval-valued

data, and can also identify the conflictive instances in the training set: those that contribute the most to the indetermination in the likelihood of the model.

Handling High-Dimensional Regression Problems by Means of an Efficient Multi-Objective Evolutionary Algorithm

Maria José Gacto, Rafael Alcalà and Francisco Herrera

Linguistic fuzzy modeling in high dimensional regression problems is a challenging topic since conventional linguistic fuzzy rule-based systems suffer from exponential rule explosion when the number of variables and/or data examples becomes high. A good way to face this problem is by searching for a good and simple global structure within the same process, in order to consider the relationships among the different components defining the final linguistic model. In this contribution, we propose an effective multi-objective evolutionary algorithm that based on the data base learning a priori (involved variables, granularities and slight uniform displacements of the fuzzy partitions) allows a fast derivation of simple and quite accurate linguistic models, making use of some effective mechanisms in order to ensure a fast convergence. The good results obtained in several large-scale regression problems demonstrate the effectiveness of the proposed approach.

Exploiting a New Interpretability Index in the Multi-Objective Evolutionary Learning of Mamdani Fuzzy Rule-based Systems

Michela Antonelli, Pietro Ducange, Beatrice Lazzerini and Francesco Marcelloni

In this paper, we introduce a new index for evaluating the interpretability of Mamdani fuzzy rule-based systems (MFRBSs). The index takes both the rule base complexity and the data base integrity into account. We discuss the use of this index in the multi-objective evolutionary generation of MFRBSs with different trade-offs between accuracy and interpretability. The rule base and the membership function parameters of the MFRBSs are learnt concurrently by exploiting an appropriate chromosome coding and purposely-defined genetic operators. Results on a real-world regression problem are shown and discussed.

W3: Intelligent Image Processing and Artificial Vision – Part 1

Monday, November 30TH, 10:00 – 11:20

Sala Galilei

Chair: Ángel Sánchez

Natural Scene Image Recognition by Fusing Weighted Colour Moments with Bag of Visual Patches on Spatial Pyramid Layout

Yousef Alqasrawi, Daniel Neagu and Peter Cowling

The problem of object/scene image classification has gained increasing attention from many researchers in computer vision. In this paper we investigate a number of early fusion methods using a novel approach to combine image colour information and the bag of visual patches (BOP) for recognizing natural scene image categories. We propose keypoints density-based weighting method (KDW) for merging colour moments and the BOP on a spatial pyramid layout. We found that the density of keypoints located in each image sub-region at specific granularity has noticeable impacts on deciding the importance of colour moments on that image sub-region. We demonstrate the validity of our approach on a six categories dataset of natural scene images. Experimental results have proved the effectiveness of our proposed approach.

A Fuzzy System for Impact Analysis of Advertisement Billboards in Soccer Telecast

Suprio Das, Shamik Sural and Arun K. Majumdar

Advertisement billboards placed along the periphery of a soccer field in popular tournaments are used to promote specific products or the brand image of a company. In this paper, we introduce a fuzzy logic based approach for estimating the visual impact of such billboards when broadcasted through the television medium. The present system estimates the persistence effect of a billboard on human mind by using a two stage fuzzy rule based system. In the first phase, a shot level analysis is carried out, which is followed by an inter shot analysis to estimate the overall impact. In both the stages, parameters of the fuzzy set membership functions are tuned using the Particle Swarm Optimization algorithm. The system works on top of a billboard detection system and the results have been compared against a user survey.

GPU-Based Road Sign Detection using Particle Swarm Optimization

Luca Mussi, Stefano Cagnoni and Fabio Daolio

Road Sign Detection is a major goal of Advanced Driving Assistance Systems (ADAS). Since the dawn of this discipline, much work based on different techniques has been published which shows that traffic signs can be first detected and then classified in video sequences in real time. While detection is usually performed using classical computer vision techniques based on color and/or shape matching, most often

classification is performed by neural networks. In this work we present a novel approach based on both sign shape and color which uses Particle Swarm Optimization (PSO) for detection. Remarkably, a single fitness function can be used both to detect a sign belonging to a certain category and, at the same time, to estimate its actual position with respect to the camera reference frame. To speed up execution times, the algorithm exploits the parallelism offered by modern graphics cards and, in particular, the CUDA™ architecture by nVIDIA. The effectiveness of the approach has been assessed on a synthetic video sequence, which has been successfully processed in real time at full frame rate.

Improved Fuzzy Snakes Applied to Biometric Verification Problems

Jose Vélez, Angel Sánchez and Felipe Fernández

Some types of biometric patterns can be represented as a collection of variable-length interconnected lines. This is the case of handwriting signature strokes, palmprint lines or infrared hand vein data. Typical variations in size, shape and orientation of these patterns for the same person make difficult to develop reliable biometric verification systems for them. Fuzzy snakes have been successfully applied to the off-line signature verification problem where the corresponding energy function is described by a set of fuzzy rules. In this paper, we extend the fuzzy shape-memory snake model by introducing a new external energy term: the difference between the angle of the tangent to the snake in a control point and the angle of the tangent to a specific stroke point (for all the strokes of the test pattern). Experimental results for both off-line signature and palmprint verifications have shown that the new fuzzy approach outperforms other snake models.

W4: Hybrid Learning for Artificial Neural Networks: Architectures and Applications – Part 1

Monday, November 30TH, 10:00 – 11:20
AulaB

Chair: César Hervás

A Sensitivity Clustering Method for Memetic Training of Radial Basis Function Neural Networks

Francisco Fernández-Navarro, Pedro Antonio Gutiérrez and César Hervás-Martínez

In this paper, we propose a Memetic Algorithm (MA) for classifier optimization based on a clustering method that applies the k-means algorithm over a specific derived space. In this space, each classifier or individual is represented by the set of the accuracies of the classifier for each class of the problem. The proposed sensitivity clustering is able to obtain groups of individuals that perform similarly for the different classes. Then, a representative of each group is selected and it is improved by a local search procedure. This method is applied in specific stages of the evolutionary process. The sensitivity clustering process is compared to a clustering

process applied over the n-dimensional space that represent the behaviour of the classifier over each training pattern, where n is the number of patterns. This second method clearly results in a higher computational cost. The comparison is performed in ten imbalanced datasets, including the minimum sensitivity results (i.e. the accuracy for the worst classified class). The results indicate that, although in general the differences are not significant, the sensitivity clustering obtains the best performance for almost all datasets both in accuracy and minimum sensitivity, involving a lower computational demand.

Hyperbolic Tangent Basis Function Neural Networks Training by Hybrid Evolutionary Programming for Accurate Short-Term Wind Speed Prediction

César Hervás-Martínez, Pedro Antonio Gutiérrez, Juan Carlos Fernández, Sancho Salcedo-Sanz, Antonio Portilla-Figueras, Ángel Pérez-Bellido and Luis Prieto

This paper proposes a neural network model for wind speed prediction, a very important task in wind parks management. Currently, several physical-statistical and artificial intelligence (AI) wind speed prediction models are used to this end. A recently proposed hybrid model is based on hybridizations of global and mesoscale forecasting systems, with a final downscaling step using a multilayer perceptron (MLP). In this paper, we test an alternative neural model for this final step of downscaling, in which projection hyperbolic tangent units (HTUs) are used within feed forward neural networks. The architecture, weights and node typology of the HTU-based network are learnt using a hybrid evolutionary programming algorithm. This new methodology is tested over a real problem of wind speed forecasting, in which we show that our method is able to improve the performance of previous MLPs, obtaining an interpretable model of final regression for each turbine in the wind park.

Hybridizing Ensemble Classifiers with Individual Classifiers

Gonzalo Ramos-Jiménez, José del Campo-Ávila and Rafael Morales-Bueno

Two extensive research areas in Machine Learning are classification and prediction. Many approaches have been focused in the induction of ensemble to increase learning accuracy of individual classifiers. Recently, new approaches, different to those that look for accurate and diverse base classifiers, are emerging. In this paper we present a system made up of two layers: in the first layer, one ensemble classifier process every example and tries to classify them; in the second layer, one individual classifier is induced using the examples that are not unanimously classified by the ensemble. In addition, the examples that reach to the second layer incorporate new information added in the ensemble. Thus, we can achieve some improvement in the accuracy level, because the second layer can do more informed classifications. In the experimental section we present some results that suggest that our proposal can actually improve the accuracy of the system.

Classification by Evolutionary Generalized Radial Basis Functions

Adiel Castaño, César Hervás-Martínez, Pedro Antonio Gutiérrez, Francisco Fernández-Navarro and M. M. García

This paper proposes a novelty neural network model by using generalized kernel functions for the hidden layer of a feed forward network (Generalized Radial Basis Functions, GRBF), where the architecture, weights and node typology are learned through an evolutionary programming algorithm. This new kind of model is compared with the corresponding models with standard hidden nodes: Product Unit Neural Networks (PUNN), Multilayer Perceptrons (MLP) and the RBF neural networks. The methodology proposed is tested using six benchmark classification datasets from well-known machine learning problems. Generalized basis functions are found to present a better performance than the other standard basis functions for the task of classification.

Evolutionary algorithms – Part 2

Monday, November 30TH, 11:30 – 12:50,
Auditorium

Chair: Manuel Lozano Márquez

Solving Permutation Problems with Differential Evolution: An Application to the Jobshop Scheduling Problem

Antonin Ponsich, Ma. Guadalupe Castillo Tapia and Carlos A. Coello Coello

This study addresses the solution of Jobshop Scheduling Problems using Differential Evolution (DE). The issue of representing permutations through real numbers constitutes the key issue for developing an efficient implementation. Several techniques are empirically validated on problem instances traditionally adopted in the specialized literature. We also present a simple hybridization of DE with tabu search, which produces significant performance gains.

Speeding up the Genetic Algorithm Convergence Using Sequential Mutation and Circular Gene Methods

Mehdi Baradaran Nia and Yousef Alipouri

Genetic Algorithms (GAs) are intelligent computational tools which their simplicity, accuracy and adaptable topology cause them to be used in globally minimum or maximum finding problems. Developing the GAs to increase their speed in finding the global minimum or maximum of a cost function has been a big challenge until now and many variants of GA has been evolved to accomplish this goal. This paper presents two new Sequential Mutation Method and Circular Gene Method to increase the speed of the GA. These methods attain a better final answer accompanied by lesser use of cost function evaluations in comparison with the original GA and some other known complementary methods. In addition, it

speeds up reaching the minimum or maximum point regarding the number of generations. A number of common test functions with known minimum values and points are tested and the results are compared with some other algorithms such as original GA, Bacterial Evolutionary Algorithm, Jumping Gene and PSO. Simulation results show that the presented methods in this paper can reach the global minimum point through lesser generations and evaluations of the cost function in comparison with the traditional methods.

Performance Analysis of MADO Dynamic Optimization Algorithm

Julien Lepagnot, Amir Nakib, Hamouche Oulhadj and Patrick Siarry

Many real-world problems are dynamic and require an optimization algorithm that is able to continuously track a changing optimum over time. In this paper, a new multiagent algorithm for solving dynamic problems is studied. This algorithm, called MADO, is analyzed using the Moving Peaks Benchmark, and its performances are compared to those of competing dynamic optimization algorithms on several instances of this benchmark. The obtained results show the efficiency of MADO, even in multimodal environments.

Encoding Structures and Operators used in Facility Layout Problems with Genetic Algorithms

Laura Garcia-Hernandez, Antonio Arauzo-Azofra, Henri Pierreval and Lorenzo Salas-Morera

The allocation of facilities in a plant layout is a complex problem. For solving it, many authors have used Genetic Algorithms (GAs) with the objective of reaching an efficient plant layout design. To represent the plant layout design as a data structure, GAs require a defined encoding scheme. Such a structure defines the types of solutions that can be obtained, and influences the GA's ability to find good solutions. There are a few surveys on facility layout problems, but they have not addressed evolutionary issues in depth. This work presents a review that focuses on encoding schemes and related operators used in GAs, and suggests a method of classifying the different encoding structures described in the bibliography. We also studied their main characteristics and objectives; and successfully identified the crossover and mutation operators that could be utilized depending on the type of encoding scheme.

W1: Soft Computing in Intelligent Agents and Web Technologies – Part 2

Monday, November 30TH, 11:30 – 12:50
Sala Fermi
Chair: Enrique Herrera-Viedma

CASTALIA: Architecture of a Fuzzy Metasearch Engine for Question Answering Systems

Jesús Serrano-Guerrero, José Ángel Olivás, Jesús A. Gallego, Francisco P. Romero and Andrés Soto

The goal of this paper is to present the architecture of a metasearch engine called Castalia, still under development, which includes several underlying Q&A systems. Usually metasearch engines manage typical search engines like Google or Yahoo, but in this case the encapsulation of Q&A systems proposes new challenges that can be modeled by fuzzy logic apart from the other existing challenges such as the fuzzy modeling of temporal or causal questions.

An Experiment about Using Copulative and Comparative Sentences as Constraining Relations

Andrés Soto, José Ángel Olivás, Francisco P. Romero and Jesús Serrano-Guerrero

Existing search engines and question-answering (QA) systems have made possible processing large volumes of textual information. Current work on QA has mainly focused on answering two basic types of questions: factoid and definition questions. However, the capability to synthesize an answer to a query by drawing on bodies of information which reside in various parts of the knowledge base is not among the capabilities of those systems. In this paper, a system oriented to infer query answers from a collection of propositions expressed in natural language is introduced. By means of a specific example, it is outlined how the system proceeds to face those situations. This approach is based on the use of formal constraining relations modeling copulative and comparative sentences. Combining those propositions with others contained in different knowledge bases and applying deduction rules, the desired answer could be obtained.

An Automat for the Semantic Processing of Structured Information

Amed Leiva Mederos, José A. Senso, Sandor Domínguez-Velasco and Pedro Hípola

Using the database of the PuertoTerm project, an indexing system based on the cognitive model of Brigitte Enders was built. By analyzing the cognitive strategies of three abstractors, we built an automat that serves to simulate human indexing processes. The automat allows the texts integrated in the system to be assessed, evaluated and grouped by means of the Bipartite Spectral Graph Partitioning algorithm, which also permits visualization of the terms and the documents. The system features an ontology and a database to enhance its operativity. As a result of the application, we achieved better

rates of exhaustivity in the indexing of documents, as well as greater precision and retrieval of information, with high levels of efficiency.

Using Incomplete Fuzzy Linguistic Preference Relations to Characterize User Profiles in Recommender Systems

Enrique Herrera-Viedma and Carlos Porcel

In [12] we presented a fuzzy linguistic recommender system to advise research resources in university digital libraries. The problem of this system is that the user profiles are provided directly by the own users and the process for acquiring user preferences is quite difficult because it requires too much user effort. In this paper we present a new fuzzy linguistic recommender system that facilitates the acquisition of the user preferences to characterize the user profiles. We allow users to provide their preferences by means of an incomplete fuzzy linguistic preference relation. We include tools to manage incomplete information when the users express their preferences, and, in such a way, we show that the acquisition of the user profiles is improved.

W2: Genetic Fuzzy Systems: Design and Applications – Part 2

Monday, November 30TH, 11:30 – 12:30
Sala Pacinotti
Chair: Rafael Alcalá

On the Combination of Accuracy and Diversity Measures for Genetic Selection of Bagging Fuzzy Rule-based Multiclassification Systems

Krzysztof Trawiński, Arnaud Quirin and Oscar Cerdón

A preliminary study combining two diversity measures with an accuracy measure in two bicriteria fitness functions to genetically select fuzzy rule-based multiclassification systems is conducted in this paper. The fuzzy rule-based classification system ensembles are generated by means of bagging and mutual information-based feature selection. Several experiments were developed using four popular UCI datasets with different dimensionality in order to analyze the accuracy-complexity trade-off obtained by a genetic algorithm considering the two fitness functions. Comparison are made with the initial fuzzy ensemble and a single fuzzy classifier.

Linguistic Modifiers to Improve the Accuracy-Interpretability Trade-off in Multi-Objective Genetic Design of Fuzzy Rule Based Classifier Systems

Alessandro G. Di Nuovo and Vincenzo Catania

In the last few years a number of studies have focused on the design of fuzzy rule-based systems which are interpretable (i.e. simple and easy to read), while maintaining quite a high level of accuracy. Therefore, a new tendency in the fuzzy modeling that looks for a good balance between

interpretability and accuracy is increasing in importance. In fact, recently multi-objective evolutionary algorithms have been applied to improve the difficult trade-off between interpretability and accuracy. In this paper, we focus both on rule learning and fuzzy memberships tuning proposing a technique based on a multi-objective genetic algorithm (MOGA) to design deep-tuned Fuzzy Rule Based Classifier Systems (FRBCSs) from examples. Our technique generates a FRBCS which includes certain operators (known as linguistic hedges or modifiers) able to improve accuracy without losses in interpretability. In our proposal the MOGA is used to learn the FRBCS and to set the operators in order to optimize both model accuracy and metrics of interpretability, compactness and transparency in a single algorithm. The resulting Multi-Objective Genetic Fuzzy System (MOGFS) is evaluated through comparative examples based on well-known data sets in the pattern classification field.

Parallel Distributed Two-Level Evolutionary Multiobjective Methodology for Granularity Learning and Membership Functions Tuning in Linguistic Fuzzy Systems

Miguel Angel De Vega, Juan Manuel Bardallo,
Francisco Alfredo Márquez and Antonio Peregrin

This paper deals with the learning of the membership functions for Mamdani Fuzzy Systems – the number of labels of the variables and the tuning of them – in order to obtain a set of Linguistic Fuzzy Systems with different trade-offs between accuracy and complexity, through the use of a two-level evolutionary multi-objective algorithm. The presented methodology employs a high level main evolutionary multi-objective heuristic searching the number of labels, and some distributed low level ones, also evolutionary, tuning the membership functions of the candidate variable partitions.

W3: Intelligent Image Processing and Artificial Vision – Part 1

Monday, November 30TH, 11:30 – 12:50
Sala Galilei
Chair: José Santamaría

Multiple Neural Networks System for Dynamic Environments

Aldo Franco Dragoni, Paola Baldassarri, Germano Vallesi and Mauro Mazzieri

We propose a “Multiple Neural Networks” system for dynamic environments, where one or more neural nets may no longer be able to properly operate, due to sensible partial changes in the characteristics of the individuals. We assume that each expert network has a reliability factor that can be dynamically re-evaluated on the ground of the global recognition operated by the overall group. Since the net’s “degree of reliability” is defined as “the probability that the net is giving the desired output”, in case of conflicts between the outputs of the various nets the re-evaluation of their “degrees of reliability” can be simply performed on the basis

of the Bayes Rule. The new vector of reliability will be used for making the final choice, by applying the “Inclusion based” algorithm over all the maximally consistent subsets of the global outcome. Finally, the nets recognized as responsible for the conflicts will be automatically forced to learn about the changes in the individuals’ characteristics and avoid to make the same error in the immediate future.

A Comparative Study of Clustering Methods for Urban Areas Segmentation from High Resolution Remote Sensing Image

Safaa M. Bedawi and Mohamed S. Kamel

This paper focuses on evaluating and comparing a number of clustering methods used in color image segmentation of high resolution remote sensing images. Despite the enormous progress in the analysis of remote sensing imagery over the past three decades, there is a lack of guidance on how to select an image segmentation method suitable for the image type and size. Clustering has been widely used as a segmentation approach therefore, choosing an appropriate clustering method is very critical to achieve better results. In this paper we compare five clustering methods that have been suggested for segmentation of images. We focus on segmentation of urban areas in high resolution remote sensing images. Effective clustering extracts regions which correspond to land uses in urban areas. Ground truth images are used to evaluate the performance of clustering methods. The comparison shows that the average accuracy of road extraction is above 75%. The results show the potential of clustering high resolution aerial images starting from the three RGB bands only. The comparison gives some guidance and tradeoffs involved in using each.

A New Scheme for Vision Based Flying Vehicle Detection Using Motion Flow Vectors Classification

Ali Taimori, Alireza Behrad and Samira Sabouri

This paper presents a vision based scheme for detecting flying vehicle using a new feature extraction and correspondence algorithm as well as a motion flow vectors classifier. The base of detection is to classify the motion flow vectors of object and scene at two video sequences from a mobile monocular CCD camera. For this purpose, we introduce a method to extract robust features from fuzzified edges at first frame. Then, correspondence features are approximated at second video frame by a multi resolution feature matching processing based on edge Gaussian pyramids. In next stage, the estimated motion flow vectors classify into two object and scene classes using a supervised machine learning method based on MLPs neural network. In final step, the flying vehicle localize by approximating the contour of object based on a convex hull algorithm. Experimental results demonstrate that the proposed method has proper stability and reliability especially for the detection of aerial vehicle in applications with mobile camera.

Image Contrast Control based on Łukasiewicz's Operators and Fuzzy Logic

Nashaat M. Hussein Hassan and Angel Barriga

This paper describes a technique to control the contrast in images based on the application of Łukasiewicz algebra operators. In particular, the technique is based on the bounded-sum and the bounded-product. An interesting feature when applying these operators is that it allows low cost hardware realizations (in terms of resources) and high processing speed. The selection of the control parameters is performed by a fuzzy system.

W4: Hybrid Learning for Artificial Neural Networks: Architectures and Applications – Part 2

Monday, November 30TH, 11:30 – 12:50

AulaB

Chair: Pedro Antonio Gutiérrez

Optimization of Neural Networks Weights and Architecture: A Multimodal Methodology

Antonio Miguel F. Zarth and Teresa B. Ludermir

This paper describes a multimodal methodology for evolutionary optimization of neural networks. In this approach, we use Differential Evolution with parallel subpopulations to simultaneously train a neural network and find an efficient architecture. The results in three classification problems have shown that the neural network resulting from this method has low complexity and high capability of generalization when compared with other methods found in literature. Furthermore, two regularization techniques, weight decay and weight elimination, are investigated and results are presented.

Modeling Environmental Noise using Artificial Neural Networks

Natalia Genaro, Antonio Jose Torija, Angel Ramos, Ignacio Requena, Diego Pablo Ruiz and Montserrat Zamorano

Since 1972, when the World Health Organization (WHO) classified noise as a pollutant, most industrialized countries have enacted laws or local regulations that regulate noise levels. Many scientists have tried to model urban noise, but the results have not been as good as expected because of the reduced number of variables. This paper describes artificial neural networks (ANN) to model urban noise. This model was applied to data collected at different street locations in Granada, Spain. The results were compared to those obtained with mathematical models. It was found that the ANN system was able to predict noise with greater accuracy, and therefore it was an improvement on these models. Furthermore, this paper reviews literature describing other research studies that also used soft computing techniques to model urban noise.

Combining Uncertainty Sampling Methods for Active Meta-Learning

Ricardo B.C. Prudêncio and Teresa B. Ludermir

Meta-Learning has been applied to acquire useful knowledge to predict learning performance. Each training example in Meta-Learning (i.e. each meta-example) is related to a learning problem and stores features of the problem plus the performance obtained by a set of candidate algorithms when evaluated on the problem. Based on a set of such meta-examples, a meta-learner will be used to predict algorithm performance for new problems. The generation of a set of meta-examples can be expensive, since for each problem it is necessary to perform an empirical evaluation of the candidate algorithms. In a previous work, we proposed the Active Meta-Learning, in which Active Learning was used to reduce the set of meta-examples by selecting only the most relevant problems for meta-example generation. In the current work, we proposed the combination of different Uncertainty Sampling methods for Active Meta-Learning, considering that each individual method will provide useful information that can be combined in order to have a better assessment of problem relevance for meta-example generation. In our experiments, we observed a gain in Meta-Learning performance when the proposed method was compared to the individual active methods being combined.

Echo State Network for Abrupt Change Detections in Non-stationary Signals

Qingsong Song, Zuren Feng, Liangjun Ke and Min Li

The issue of abrupt change detection (ACD) in non-stationary time series signal is considered as a signal classification problem in this paper. A novel reservoir-computing based neural network model (RCNN) is proposed. The main component of RCNN is a large size, sparsely and randomly interconnected dynamical reservoir (DR), which is followed by a single layer perceptron (SLP). The signal containing abrupt changes is firstly projected into the high dimensional state space of DR, and then is linearly classified by the SLP. The SLP is trained by the delta learning rule. The classification brought out by the SLP is the ACD result. Two synthetic non-stationary time series signals, one is non-chaotic, another one is chaotic, are verified on the RCNN respectively. The simulation experiment results show that the ACD performance of the proposed RCNN is comparable with that of the segment function embedded in MATLAB for the non-chaotic signal, and even outperforms for another chaotic signal. It is concluded that RCNN is a more efficient ACD technique.

Swarm Intelligence

Monday, November 30TH, 15:00 – 16:20
Auditorium
Chair: Ajith Abraham

Heuristic Factors in Ant System Algorithm for Course Timetabling Problem

Djasli Djamarus and Ku Ruhana Ku-Mahamud

This paper presents an algorithm that is based on ant system to solve the course timetabling problem. The problem is modeled using the bipartite graph. Four heuristic factors are derived from the graph characteristic, are used to direct ants as the agent in finding course timetable elements. The concept of negative pheromone was also applied to ensure that paths leading to dead ends are not chosen. The performance of this proposed algorithm is promising when comparison of performance was made with the original ant system algorithm.

A Multiple Objective Particle Swarm Optimization Approach using Crowding Distance and Roulette Wheel

Robson A. Santana, Murilo R. Pontes and Carmelo J. A. Bastos-Filho

This paper presents a multiobjective optimization algorithm based on Particle Swarm Optimization (MOPSO-CDR) that uses a diversity mechanism called crowding distance to select the social leaders and the cognitive leader. We also use the same mechanism to delete solutions of the external archive. The performance of our proposal was evaluated in five well known benchmark functions using four metrics previously presented in the literature. Our proposal was compared to other four multi objective optimization algorithms based on Particle Swarm Optimization, called m-DNPSO, CSS-MOPSO, MOPSO and MOPSO-CDLS. The results showed that the proposed approach is competitive when compared to the other approaches and outperforms the other algorithms in many cases.

Hardware Architecture for Particle Swarm Optimization using Floating-point Arithmetic

Daniel M. Muñoz, Carlos H. Llanos, Leandro dos S. Coelho and Mauricio Ayala-Rincón

High computational cost for solving large engineering optimization problems point out the design of parallel optimization algorithms. Population based optimization algorithms provide parallel capabilities that can be explored by their implementations done directly in hardware. This paper presents a hardware implementation of Particle Swarm Optimization algorithms using an efficient floating-point arithmetic which performs the computations with high precision. All the architectures are parameterizable by bit-width, allowing the designer to choose the suitable format according to the requirements of the optimization problem. Synthesis and simulation results demonstrate that the

proposed architecture achieves satisfactory results obtaining a better performance in terms of elapsed time than conventional software implementations.

Dynamic Clan Particle Swarm Optimization

Carmelo J. A. Bastos-Filho, Danilo F. Carvalho, Elliackin M. N. Figueiredo and Péricles B. C. de Miranda

Particle Swarm Optimization (PSO) has been widely used to solve many different real world optimization problems. Many novel PSO approaches have been proposed to improve the PSO performance. Recently, a communication topology based on Clans was proposed. In this paper, we propose the Dynamic Clan PSO topology. In this approach, a novel ability is included in the Clan Topology, named migration process. The goal is to improve the PSO degree of convergence focusing on the distribution of the particles in the search space. A comparison with the Original Clan topology and other well known topologies was performed and our results in five benchmark functions have shown that the changes can provide better results, except for the Rastrigin function.

W5: Tags and Recommendations in Web 2.0 Part 1

Monday, November 30TH, 15:00 – 16:20
Sala Fermi
Chair: Antonina Dattolo

Content-based Filtering with Tags: the FIRSt System

Pasquale Lops, Marco de Gemmis, Giovanni Semeraro, Paolo Gissi, Cataldo Musto and Fedelucio Narducci

Basic content personalization consists in matching up the attributes of a user profile, in which preferences and interests are stored, against the attributes of a content object. This paper describes a content-based recommender system, called FIRSt, that integrates user generated content (UGC) with semantic analysis of content. The main contribution of FIRSt is an integrated strategy that enables a content-based recommender to infer user interests by applying machine learning techniques, both on official item descriptions provided by a publisher and on freely keywords which users adopt to annotate relevant items. Static content and dynamic content are preventively analyzed by advanced linguistic techniques in order to capture the semantics of the user interests, often hidden behind keywords. The proposed approach has been evaluated in the domain of cultural heritage personalization.

Item Recommendation with Veristic and Possibilistic Metadata: a Preliminary Approach

Danilo Dell'Agnello, Corrado Mencar and Anna Maria Fanelli

Item recommendation depends on metadata describing items as well as users through their profiles. Most currently used

technologies use precise metadata because of the efficiency of the recommendation process. Nonetheless fuzzy metadata can be useful because of their ability to deal with imprecision and gradedness, two features pervading real-world applications. Fuzzy metadata can have both possibilistic and veristic interpretations, which are complementary and can simultaneously occur in a recommendation context. In this paper we describe a preliminary approach to deal with this double interpretation proposing an extension of the theory of veristic variables, that is specifically suited for item recommendation. Fuzzy metadata are used to calculate the interestingness of an item for a user computing possibility and necessity measures, which enable the ranking of items. As described in the illustrative examples, this approach effectively provides for semantically significant results that are useful for item recommendation with fuzzy metadata.

Neighbor Selection and Recommendations in Social Bookmarking Tools

Antonina Dattolo, Felice Ferrara and Carlo Tasso

Web 2.0 applications innovate traditional informative services providing Web users with a set of tools for publishing and sharing information. Social bookmarking systems are an interesting example of this trend where users generate new contents. Unfortunately, the growing amount of available resources makes hard the task of accessing to relevant information in these environments. Recommender systems face this problem filtering relevant resources connected to users' interests and preferences. In particular, collaborative filtering recommender systems produce suggestions using the opinions of similar users, called the neighbors. The task of finding neighbors is difficult in environment such as social bookmarking systems, since bookmarked resources belong to different domains. In this paper we propose a methodology for partitioning users, tags and resources into domains of interest. Filtering tags and resources in accordance to the specific domains we can select a different set of neighbors for each domain, improving the accuracy of recommendations.

Using Tag Co-occurrence for Recommendation

Christian Wartena, Rogier Brussee and Martin Wibbels

Tagging with free form tags is becoming an increasingly important indexing mechanism. However, free form tags have characteristics that require special treatment when used for searching or recommendation because they show much more variation than controlled keywords. In this paper we present a method that puts this large variation to good use. We introduce second order co-occurrence and a related distance measure for tag similarities that is robust against the variation in tags. From this distance measure it is straightforward to derive methods to analyze user interest and compute recommendations. We evaluate the use of tag based recommendation on the Movielens dataset and a dataset of tagged books

S1: Representation and Approximation of Fuzzy Numbers and Applications

Monday, November 30TH, 15:00 – 16:20

Sala Pacinotti

Chairs: Luciano Stefanini, Przemyslaw Grzegorzewski

Fuzzy Option Value with Stochastic Volatility Models

Gianna Figà-Talamanca and Maria Letizia Guerra

Uncertainty and vagueness play a central role in financial models and fuzzy numbers can be a profitable way to manage them. In this paper we generalize the Black and Scholes option valuation model (with constant volatility) to the framework of a volatility supposed to vary in a stochastic way. The models we take under consideration belongs to the main classes of stochastic volatility models: the endogenous and the exogenous source of risk. Fuzzy calculus for financial applications requires massive computations and when a good parametric representation for fuzzy numbers is adopted, then the arithmetic operations and fuzzy calculus can be efficiently managed. Good in this context means that the shape of the resulting fuzzy numbers can be observed and studied in order to state fundamental properties of the model.

Some Parametric Forms for LR Fuzzy Numbers and LR fuzzy Arithmetic

Laerte Sorini and Luciano Stefanini

In this paper we show that the models for parametric representation of fuzzy numbers in the level-cuts setting can be used to model LR fuzzy numbers and LR fuzzy arithmetic. This extends the family of LR fuzzy numbers to a sequence of finite-dimensional subspaces, approximating the space of fuzzy numbers with increasing goodness. The basic arithmetic with parametric LR fuzzy numbers is illustrated in an algorithmic framework.

Bi-symmetrically Weighted Trapezoidal Approximations of Fuzzy Numbers

Przemyslaw Grzegorzewski and Karolina Pasternak-Winiarska

Trapezoidal approximation of fuzzy numbers preserving the expected interval is considered. A general problem of the trapezoidal approximation of fuzzy numbers with respect to the distance based on bi-symmetrical weighted functions is solved. A practical algorithm for constructing approximation operator is given.

Value Function Computation in Fuzzy Real Options by Differential Evolution

Maria Letizia Guerra, Laerte Sorini and Luciano Stefanini

Real options are a typical framework in economics that involves uncertainty. The definition of the value function of real options can take advantage of a model of uncertainty that includes stochastic processes and fuzzy numbers; to perform the complete analysis with american type real options, we need to compute the fuzzy extension of the value function for A special version of the multiple population differential evolution algorithm is designed to compute the level-cuts of the fuzzy extension of the multidimensional real valued function of fuzzy numbers in the resulting optimization problems. We perform some computational experiments connected with the option to defer investment, that is an American call option on the present value of the completed expected cash flows with the exercise price equal to the required outlay.

W6: Intelligent Systems Design and Applications in the Health Domain Part 1

Monday, November 30TH, 15:00 – 16:20
Sala Galilei
Chairs: Ovidio Salvetti, Ioannis Tollis

The Virtual Physiological Human NoE and Functional Brain Networks (Project: VPH NoE)

Ioannis Tollis (invited talk) "

CHRONIOUS: An intelligent system for chronic diseases management" (Project: CHRONIOUS)

Roberto Rosso (invited talk)

Toward Multi-Organs Simulations of Immune-Pathogen Interactions

Filippo Castiglione and Francesco Pappalardo

Computer simulations play an increasingly important role in bio-medical research by allowing cheap verification of conjectures and exploration of ideas. The IMMUNOGRID project, among other things, has contributed to the development of computer models for the simulation of different human pathologies by adopting the agent-based modeling paradigm. In pursuing the main goal of the project, that is to construct a virtual immune system, we have unwrapped challenges and opportunities. In this article we discuss one of them, that is, how to envisage a multi-scale, multi-organ three dimensional simulator of the immune response that can be a useful tool in medical bioinformatics with the special requirement of being user friendly to non specialists.

An Efficient Combinatorial Approach for Solving the DNA Motif Finding Problem

Filippo Geraci, Marco Pellegrini and M. Elena Renda

The detection of an over-represented sub-sequence in a set of (carefully chosen) DNA sequences is often the main clue leading to the investigation of a possible functional role for such a subsequence. Over-represented substrings (with possibly local mutations) in a biological string are termed motifs. A typical functional unit that can be modeled by a motif is a Transcription Factor Binding Site (TFBS), a portion of the DNA sequence apt to the binding of a protein that participates in complex transcriptomic biochemical reactions. In the literature it has been proposed a simplified combinatorial problem called the planted (l-d)-motif problem (known also as the (l-d) Challenge Problem) that captures the essential combinatorial nature of the motif finding problem. In this paper we propose a novel graph-based algorithm for solving a refinement of the (l-d) Challenge Problem. Experimental results show that instances of the (l-d) Challenge Problem considered difficult for competing state of the art methods in literature can be solved efficiently in our framework.

Using Machine Learning Techniques to Improve the Behaviour of a Medical Decision Support System for Prostate Diseases

Constantinos Koutsojannis, Eman Nabil, Maria Tsimara and Ioannis Hatzilygeroudis

Prostate gland diseases, including cancer, are estimated to be of the leading causes of male deaths worldwide and their management are based on clinical practice guidelines regarding diagnosis and continuing care. HIROFILOS-II is a prototype hybrid intelligent system for diagnosis and treatment of all prostate diseases based on symptoms and test results from patient health records. It is in contrast to existing efforts that deal with only prostate cancer. The main part of HIROFILOS-II is constructed by extracting rules from patient records via machine learning techniques and then manually transforming them into fuzzy rules. The system comprises crisp as well as fuzzy rules organized in modules. Experimental results show more than satisfactory performance of the system. The machine learning component of the system, which operates off-line, can be periodically used for rule updating, given that enough new patient records have been added to the database.

S2: From Business Intelligence to Business Artificial Intelligence: new challenges for Intelligent Systems

Monday, November 30TH, 15:00 – 16:20

AulaB

Chair: Alberto Bugarín

A Genetic Programming-based Algorithm for Composing Web Services

Manuel Mucientes, Manuel Lama and Miguel I. Couto

Web Services are interfaces that describe a collection of operations that are network-accessible through standardized web protocols. When a required operation is not found, several services can be compounded to get a composite service that performs the desired task. To find this composite service, a search process over a huge search space must be performed. The algorithm that composes the services must select the adequate atomic processes and, also, must choose the correct way to combine them using the different available control structures. In this paper a genetic programming algorithm for web services composition is presented. The algorithm has a context-free grammar to generate the valid structures of the composite services. Moreover, it includes a method to update the attributes of each node. A full experimental validation with a repository of 1,000 web services has been done, showing a great performance as the algorithm finds a valid solution in all the tests.

Linguistic Summaries of Time Series using a Degree of Appropriateness as a Measure of Interestingness

Janusz Kacprzyk and Anna Wilbik

We further extend our approach to the linguistic summarization of time series (cf. Kacprzyk, Wilbik and Zadrozny [9, 10, 11, 12]) in which an approach based on a calculus of linguistically quantified propositions is employed, and the essence of the problem is equated with a linguistic quantifier driven aggregation of partial scores (trends). In addition to the basic criterion of a degree of truth (validity), we also use as a degree of appropriateness as an additional quality criterion. However, for simplicity and tractability, we use in the first shot the degrees of truth (validity) and focus, which usually reduce the space of possible linguistic summaries to a considerable extent, and then – for a usually much smaller set of linguistic summaries obtained – we use the degree of appropriateness to make a final choice as it gives us an additional quality of being able to detect how surprising, i.e. valuable, a linguistic summary obtained is. We also mention relations to natural language generation (NLG) as pointed out recently by Kacprzyk and Zadrozny [19]. We show an application to the absolute performance type analysis of daily quotations of an investment fund, and the numerical results are promising. The linguistic summaries obtained using this additional quality criterion of a degree of appropriateness seem to better reflect human intents and interest.

Evaluating an Intelligent Business System with a Fuzzy Multi-Criteria Approach

Sinan Apak and Özalp Vayvay

In this ever changing business structure, Intelligent Business System (IBS) is one of the survivals of a company, and the functions of information technology (IT) are becoming increasingly important. Evaluating the appropriate IBS for required conditions is the critical strategic decisions in formulating a business strategy. Although a number of factors were found to be influential in the choice of IBS. IBS evaluation is an inherently uncertain activity. To deal with the uncertainty in decision making, a fuzzy multi criteria decision making (FMCDM) method is adopted. This study presents an empirical approach of BIS evaluation and a real life evaluation process is presented to illustrate the effectiveness of the approach.

Support Vector Machines for Insolvency Prediction of Irish Companies

Anatoli Nachev

This study explores experimentally the potential of linear and non-linear support vector machines with three kernels to predict insolvency of Irish firms. The dataset used contains selected financial features based on information collected from 88 companies for a period of six years. Experiments show that non-linear support vector machines (SVM) with polynomial kernel gives highest prediction accuracy and outperforms all other techniques used so far with the same dataset. SVM performance is estimated by various metrics, receiver operating characteristics analysis, and results are validated by the leave-one-out cross-validation technique.

S3: Evolutionary Multiobjective Optimization—Design and Applications (EMODA)

Monday, November 30TH, 16:40 – 18:20

Auditorium

Chair: Ajith Abraham

A Multi-objective Evolutionary Approach to Data Compression in Wireless Sensor Networks

Francesco Marcelloni and Massimo Vecchio

Energy is a primary constraint in the design and deployment of wireless sensor networks (WSNs) since sensor nodes are typically powered by batteries with a limited capacity. Since radio communication is, in general, the most energy hungry operation in a sensor node, most of the techniques proposed to extend the lifetime of a WSN have focused on limiting transmission/reception of data, for instance, through data compression. Since sensor nodes are equipped with limited computational and storage resources, enabling compression requires specifically designed algorithms. In this paper, we propose a lossy compressor based on a differential pulse code modulation scheme with quantization of the differences

between consecutive samples. The quantization parameters, which allow achieving the desired trade-off between compression performance and information loss, are determined by a multi-objective evolutionary algorithm. Experiments carried out on three datasets collected by real WSN deployments show that our approach can achieve significant compression ratios despite negligible reconstruction errors.

Design of Artificial Neural Networks using a Memetic Pareto Evolutionary Algorithm using as Objectives Entropy versus Variation Coefficient

Juan Carlos Fernández, César Hervás, Francisco José Martínez and Manuel Cruz

This paper proposes a multi-classification pattern algorithm using multilayer perceptron neural network models which try to boost two conflicting main objectives of a classifier, a high correct classification rate and a high classification rate for each class. To solve this machine learning problem, we consider a Memetic Pareto Evolutionary approach based on the NSGA2 algorithm (MPENSGA2), where we defined two objectives for determining the goodness of a classifier: the cross-entropy error function and the variation coefficient of its sensitivities, because both measures are continuous functions, making the convergence more robust. Once the Pareto front is built, we use an automatic selection methodology of individuals: the best model in accuracy (upper extreme in the Pareto front). This methodology is applied to solve six benchmark classification problems, obtaining promising results and achieving a high classification rate in the generalization set with an acceptable level of accuracy for each class.

Wavelength Converter Allocation in Optical Networks: An Evolutionary Multi-Objective Optimization Approach

Diego Pinto Roa, Benjamín Barán and Carlos A. Brizuela

The huge bandwidth of optical fibres is exploited through wavelength division multiplexing technology, which introduces new complexities in the routing problem. In this context, the wavelength converter allocation problem has become a key factor to minimize blocking. The wavelength converter allocation problem has been treated as a mono-objective problem minimizing the number of wavelength converters or minimizing blocking; however, both criteria are in conflict with each other. Therefore, the wavelength converter allocation problem is studied here in a pure multi-objective optimization context for more appropriate decision making. This work proposes a multi-objective optimization approach based on an evolutionary algorithm which simultaneously minimizes blocking and the number of wavelength converters. Extensive simulations on three real optical networks show promising results in the sense that our algorithm generates the trade-off curve between blocking and the number of converters needed, and outperforms a recently proposed approach.

Solving Multi-Objective Reinforcement Learning Problems by EDA-RL - Acquisition of Various Strategies

Hisashi Handa

EDA-RL, Estimation of Distribution Algorithms for Reinforcement Learning Problems, have been proposed by us recently. The EDA-RL can improve policies by EDA scheme: First, select better episodes. Secondly, estimate probabilistic models, i.e., policies, and finally, interact with the environment for generating new episodes. In this paper, the EDA-RL is extended for Multi-Objective Reinforcement Learning Problems, where reward is given by several criteria. By incorporating the notions in Evolutionary Multi-Objective Optimization, the proposed method is enable to acquire various strategies by a single run.

W5: Tags and Recommendations in Web 2.0 Part 2

Monday, November 30TH, 16:40 – 18:20
Sala Fermi
Chair: Antonina Dattolo

A Parametric Architecture for Tags Clustering in Folksonomic Search Engines

Nicola Raffaele Di Matteo, Silvio Peroni, Fabio Tamburini and Fabio Vitali

Semantic search engines rely on the existence of a rich set of semantic connections between the concepts associated to documents and those used for the queries. With folksonomies, this is not always guaranteed. Creating clusters of folksonomic tags around terms of controlled ontological vocabularies is a potentially sophisticated approach, but algorithms abound for this clustering and no clear cut winner exists. In this paper we introduce FolksEngine, a parametric search engine for folksonomies allowing to specify any clustering algorithm as a three step process: the user's query is expanded according to semantic rules associated to the terms of the query, the new query is then executed on the plain folksonomy search engine, and the results are ranked according to semantic rules associated to the folksonomic tags actually used for the documents.

Evaluation Measures for Ordinal Regression

Stefano Baccianella, Andrea Esuli and Fabrizio Sebastiani

Ordinal regression (OR -- also known as ordinal classification) has received increasing attention in recent times, due to its importance in IR applications such as learning to rank and product review rating. However, research has not paid attention to the fact that typical applications of OR often involve datasets that are highly imbalanced. An imbalanced dataset has the consequence that, when testing a system with an evaluation measure conceived for balanced datasets, a trivial system assigning all items to a single class (typically,

the majority class) may even outperform genuinely engineered systems. Moreover, if this evaluation measure is used for parameter optimization, a parameter choice may result that makes the system behave very much like a trivial system. In order to avoid this, evaluation measures that can handle imbalance must be used. We propose a simple way to turn standard measures for OR into ones robust to imbalance. We also show that, once used on balanced datasets, the two versions of each measure coincide, and therefore argue that our measures should become the standard choice for OR.

Improved Search in Tag-Based Systems

Ruba Awawdeh and Terry Anderson

Social bookmarking systems are used by millions of web users to tag, save and share items. User-defined tags, however, are so variable in quality that searching on these tags alone is ineffective. One way to improve search in bookmarking systems is by adding more metadata to the user-defined tags to enhance tag quality. Such an approach would add value by incorporating information about the content of the resource while retaining the original user-defined tag. Tags automatically extracted from the resource could be the main source for tag enhancement. This paper describes how users' tags can be enhanced with metadata in the form of additional tags automatically extracted from the original document. An evaluation study shows how the enhanced tag set improved user searching in comparison to using only user-defined tags.

Social and Behavioral Aspects of a Tag-based Recommender System

Frederico Duraó and Peter Dolog

Collaborative tagging has emerged as a useful means to organize and share resources on the Web. Recommender systems have been utilized for identifying similar resources and generate personalized recommendations. In this paper, we analyze social and behavioral aspects of a tag-based recommender system which suggests similar Web pages based on the similarity of their tags. Tagging behavior and language anomalies in tagging activities are some aspects examined from an experiment involving 38 people from 12 countries.

A JADE-based ART-inspired Ontology and Protocols for Handling Trust and Reputation

Javier Carbo and Jose M. Molina

Trust and Reputation management play an important role in agent-based Recommender Systems. Although several protocols and ontologies of agents using trust and reputation has been proposed, none of them has been so extensively used and implicitly accepted by research community as those from Agent Reputation and Trust (ART in advance) testbed. The motivation of this adaptation is to facilitate the use of ART principles in real distributed applications instead of a centralized testbed for experimentation. This paper presents an adaptation of the protocols proposed by ART testbed to a codification for the most popular Agent platform: JADE. This implementation follows a coherent API with the FIPA protocols included in JADE distribution for an easy use. We also complement the behaviours of corresponding initiators

and responders of the protocols with an ontology formed by a collection of concepts, predicates and agent actions that may represent as the ART application domain as any other service-oriented domain. The proposal has been designed to be applied in domains where multi-agent e-commerce solutions are needed. Future work includes the integration of this ontology and protocols in context-aware scenarios such as an airport.

S4: Designing Comprehensible Intelligent Systems

Monday, November 30TH, 16:40 – 18:20

Sala Pacinotti

Chair: Ciro Castiello

An Interpretability-guided Modeling Process for Learning Comprehensible Fuzzy Rule-based Classifiers

José M. Alonso and Luis Magdalena

This work presents a new process for building comprehensible fuzzy systems for classification problems. Firstly, a feature selection procedure based on crisp decision trees is carried out. Secondly, strong fuzzy partitions are generated for all the selected inputs. Thirdly, a set of linguistic rules are defined combining the previously generated linguistic variables. Then, a linguistic simplification procedure guided by a novel interpretability index is applied to get a more compact and general set of rules without losing accuracy. Finally, an efficient and simple local search strategy increases the system accuracy while preserving the high interpretability. Results obtained in several benchmark classification problems are encouraging because they show the ability of the new methodology for generating highly interpretable fuzzy rule-based classifiers while yielding accuracy comparable to that achieved by other methods like neural networks and C4.5.

A Study on Interpretability Conditions for Fuzzy Rule-Based Classifiers

Raffaele Cannone, Ciro Castiello, Corrado Mencar and Anna Maria Fanelli

Interpretability represents the most important driving force behind the implementation of fuzzy logic-based systems. It can be directly related to the system's knowledge base, with reference to the human user's easiness experienced while reading and understanding the embedded pieces of information. In this paper, we present a preliminary study on interpretability conditions for fuzzy rule-based classifiers on the basis of an innovative approach that relies on the concept of semantic cohesiveness. The approach adopted in this study consists in analysing the components of a fuzzy classifiers so that inference is carried out with the respect of logical properties. As a result, we derive some sufficient conditions and basic requirements to be verified by a fuzzy classifier in order to be tagged as interpretable in the semantic sense.

Qualitative and Task Analytic Methods to Support Comprehensible Intelligent System Design

Melanie C. Wright, Noa Segall, Jonathan B. Mark and Jeffrey M. Taekman

We argue that a critical component of designing comprehensible intelligent systems is finding the right applications for intelligence and designing intelligent solutions toward those applications. While we do not refute the value of good attention to later stages of human-centered design such as the application of human interface design principles and usability testing as methods for improving comprehensibility, there must also be significant attention to understanding problems in the context of use and how intelligence systems can best address those problems. In light of supporting naturalistic decision-making, we present a review of task analytic and qualitative research techniques that may be useful for better understanding problems in context that will support the design of more comprehensible intelligent systems.

Comprehensible Model of a Quasi-Periodic Signal

Alberto Alvarez and Gracián Triviño

In this paper we present a new method to analyze quasi-periodic signals. This method consists of modeling these signals using a Fuzzy Finite State Machine as a particular case of a Linguistic Fuzzy Model of a dynamical system. This model defines states and transitions using a priori knowledge of the signal we want to analyze. The model is represented using fuzzy rules that make it easily comprehensible. We include a practical example analyzing quasi-periodic signals of acceleration measured during the human gait cycle where good results were achieved.

The Impact of Pruning BayesFuzzy Rule Set

I-Hsien Yin, Estevam R. Hruschka Jr and Heloisa de A. Camargo

The use of Bayesian Network Classifiers (BCs) combined with the Fuzzy rule model to explain the learned BCs have been previously presented as the BayesFuzzy approach. This paper follows along BayesFuzzy lines of investigation aiming at improving the comprehensibility of a BC model and enhancing BayesFuzzy results by combining new pruning methods. In order to improve BayesFuzzy performance, in addition to the Markov Blanket-based pruning idea used by BayesFuzzy, two other pruning methods are proposed, implemented and empirically evaluated. The first pruning method is based on the conditional probability estimates given by the BC and the second one is the well-known post-rule pruning approach, usually used to prune rules extracted from decision trees. Also, three different Bayesian Networks induction algorithms, namely IC, K2 and Naïve-Bayes, as well as, the C4.5 Decision Tree induction algorithms are employed in the empirical comparative analysis performed in the experiments. The obtained results reveal that BayesFuzzy combined with the new pruning methods can bring comprehensibility enhancements.

W6: Intelligent Systems Design and Applications in the Health Domain Part 2

Monday, November 30TH, 16:40 – 18:20
Sala Galilei
Chairs: Ovidio Salvetti, Franco Chiarugi

Translating Cancer Research into Clinical Practice: A Framework for Analyzing and Modeling Cancer from Imaging Data

Vangelis Sakkalis, Konstantinos Marias, Alexandros Roniotis and Emmanouil Skounakis

This paper presents the work of our group concerning cancer image analysis and modeling. The adopted strategy aims to build a complete system for analysis and visualization of DICOM tomographic data, offering a variety of annotation or automatic segmentation tools as well as tools for tumor growth simulation and visualization.

A Decision Support System for Aiding Heart Failure Management

Sara Colantonio, Massimo Martinelli, Davide Moroni, Ovidio Salvetti, Franco Chiarugi and Dimitra Emmanouilidou

The purpose of this paper is to present an effective way to achieve a high-level integration of a Clinical Decision Support System in the general process of Heart Failure care and to discuss the advantages of such an approach. In particular, the relevant and significant medical knowledge and experts' know-how have been modelled according to an ontological formalism extended with a base of rules for inferential reasoning. These have been also combined with advanced analytical tools for data processing. In particular, methods for the segmentation of echocardiographic image sequences and algorithms for ECG processing have been implemented and integrated into the system.

Knowledge Discovery Approaches for Early Detection of Decompensation Conditions in Heart Failure Patients

Antonio Candelieri, Domenico Conforti, Angela Sciacqua and Francesco Perticone

A crucial mid-long term goal for the clinical management of chronic heart failure (CHF) patients is to detect in advance new decompensation events, for improving quality of outcomes while reducing costs on the healthcare system. Within the relevant clinical protocols and guidelines, a general consensus has not been reached on how further decompensations could be predicted, even though many different evidence-based indications are known. In this paper we present the Knowledge Discovery (KD) task which has been implemented and developed into the EU FP6 Project HEARTFAID (www.heartfaid.org), proposing an innovative knowledge based platform of services for effective and

efficient clinical management of heart failure within elderly population. KD approaches have represented a practical and effective tool for analyzing data about 49 CHF patients who have been recurrently visited by cardiologist, measuring clinical parameters taken from clinical guidelines and evidence-based knowledge and that are also easy to be acquired at home setting. Several KD algorithms have been applied on collected data, obtaining different binary classifiers performing a plausible early detection of new decompensations, showing high accuracy on internal validation and independent test.

On Intelligent Procedures in Medication for Patient Safety: The PSIP Approach

Vassilis Koutkias, Katerina Lazou, Vassilis Kilintzis, Régis Beuscart and Nicos Maglaveras

Adverse Drug Events (ADEs) are currently considered as a major public health issue, resulting in endangering patients' safety and significant healthcare costs. The EU-funded project PSIP (Patient Safety through Intelligent Procedures in Medication) aims to develop intelligent mechanisms towards preventing ADEs, aiming to improve the entire Prescription - Dispensation - Administration - Compliance (PDAC) medication chain. In this regard, PSIP employs data mining and human factor analysis techniques applied on unified patient records and diverse clinical settings respectively, so as to identify the origin of preventable ADEs. This new knowledge combined with existing evidence, in terms of drug interactions and already identified ADE signals reported in the literature, will constitute the basis for constructing contextualized CDSS (Clinical Decision Support System) modules for ADE prevention. In this paper, we briefly present the overall rationale of PSIP and focus on the knowledge engineering approach employed towards the construction of a Knowledge-based System (KBS) regarded as the core part of the PSIP CDSS modules.

A Semantic Infrastructure for the Integration of Bioinformatics Services

Giorgos Zacharioudakis, Lefteris Koumakis, Stelios Sfakianakis and Manolis Tsiknakis

Web services integration has been a vigorous research area for the last years. With the introduction of the Semantic Web the publication of expressive metadata in a shared knowledge framework enables the deployment of services that can intelligently use web resources. Syntactic and semantic interoperability of services is crucial for services integration and complex scientific workflows creation. In this paper we propose a semantic based infrastructure for bioinformatics services integration that is designed and implemented in the context of the ACGT European project. This infrastructure features the integration of many different service registries in unified "meta-repository" and provides a knowledge based querying facility.

Accuracy Improvement of SOM-based Data Classification for Hematopoietic Tumor Patients

Naotake Kamiura, Ayumu Saitoh, Tejiro Isokawa and Nobuyuki Matsui

This paper presents map-based data classification for hematopoietic tumor patients. A set of squarely arranged neurons in the map is defined as a block, and previously proposed block-matching-based learning constructs the map used for data classification. This paper incorporates pseudo-learning processes, which employ block reference vectors as quasi-training data, in the above training processes. Pseudo-learning improves the accuracy of classification. Experimental results establish that the percentage of missing the screening data of the tumor patients is very low.

S5: Computational Intelligence in Business Management and Risk Analysis

Monday, November 30TH, 16:40 – 18:20
AulaB
Chair: Beatrice Lazzarini

A Hybrid Fuzzy-Promethee Method for Logistic Service Selection: Design of a Decision Support Tool

Davide Aloini, Riccardo Dulmin and Valeria Mininno

This paper presents a hybrid multi-criteria/fuzzy method for the selection of the carrier among a number of pre-selected logistic service providers. The method was developed and applied to the case of a multinational company in the Power-electronic market. Finally, an automated system supporting the decisional process was designed to support users.

Optimizing Allocation in Floor Storage Systems for the Shoe Industry by Constraint Logic Programming

Antonella Meneghetti

Floor storage systems are used in the shoe industry to store fashion products of seasonal collections with low quantity and high variety. Since space is precious and order picking must be sped up, stacking of shoe boxes should be optimized. The problem is modeled by assigning an integer code to each box basing on shoe characteristics (model, material, color, and size) and trying to force similar boxes into near locations to improve pickers' ability of fast order retrieval. The model is encoded in Constraint Logic Programming and solved comparing different strategies, also using Large Neighborhood Search.

Dynamic Representation of a Situation: a Step of a Decision Support Process

Fahem Kebair and Frédéric Serin

A multiagent approach to build a decision support system is proposed in this paper. We think the system may be used in different applications types and is appropriate for complex problems as the risk management thanks to a mechanism of perception, representation, characterization and assessment. We focus here on a first level of this approach that intends to reflect the dynamic evolution of the current situation. The RoboCupRescue is used as a test bed. Experimentations and results are provided and discussed.

Method to Select Effective Risk Mitigation Controls Using Fuzzy Outranking

Kiyoshi Nagata, Michio Amagasa, Yutaka Kigawa and Dongmei Cui

In an information-oriented society, the security of information related assets in organizations is one of chief concerns and the importance of security evaluation system to grasp their security level is increasing. We also consider that the magnitude of risk to information assets is highly dependent on the scales, forms, treat etc. of the organization, and should be evaluated by reflecting these characteristics. Standing on this concept, we adopted OCTAVESM as the basic information system and already proposed two fuzzy-based methods integrated in it. One is to determine the set of critical assets using fuzzy decision making methodology by multi-participants. The other is to calculate the degree of risks along with the given threat path as a crisp value using fuzzy inference mechanism and so on. In this paper, we propose a system for selecting some mitigation controls considered to be more effective than others as an application of fuzzy outranking.

The Fuzzy Probabilistic Weighted Averaging Operator and its Application in Decision Making

José M. Merigó

We present a new aggregation operator that uses the probability and the weighted average in the same formulation. Moreover, we consider a situation where the information is uncertain and can be represented with fuzzy numbers. We call this new aggregation operator the fuzzy probabilistic weighted average (FPWA) operator. We study some of its main properties. We also study its applicability and we focus on a business decision making problem about the selection of monetary policies.

S6: Hybrid Metaheuristics and Their Applications

Tuesday, December 1ST, 10:00 – 11:20

Auditorium

Chair: Pedro Isasi

Improved Accuracy Rates of a Prototype Based Classifier Using Evolutionary Computation

Gustavo Recio, Yago Saez and Pedro Isasi

Prototype based classifiers allow to determine the class of a new example based on a reduced set of prototypes instead of using a large set of known samples. By doing this, the computational time gets substantially decreased as the initial set is replaced by a reduced one and hence the classification requires less computations to estimate nearest neighbours. In most simple classification problems the samples associated to each class are in general gathered in a particular region of the euclidean space defined by their characteristic features. In these particular problems prototype classifiers reach their best performance. Unfortunately, not all classification problems have their samples distributed in this way and therefore improvements are needed in order to reach acceptable classification accuracy rates. This work proposes a nearest prototype classifier that uses evolutionary computation techniques to increase the classification accuracy. A genetic algorithm was used to evolve the spatial location of each prototype resulting in a better distribution of prototypes which are able to obtain larger classification accuracy rates.

Hybrid and Evolutionary Agent-Based Social Simulations Using the PAX Framework

Fernando B. de Lima Neto, Marcelo Pita and Hugo Serrano B. Filho

This paper investigates a new hybrid evolutionary agent model for agent-based social simulations (ABSS), which incorporates two decision components: (i) sub-symbolic (genetic) and (ii) symbolic (cultural). These components are coherently combined to produce a more plausible agent model. Experiments were carried out using the Plausible Agents Matrix (PAX) framework, and modeled a real dengue fever spreading scenario. They aim to analyze the qualitative and quantitative predictive power of the model. Previous work has explored the impact of structuring elements on agents' behaviors and the impacts of communication mechanisms on agents' behaviors using PAX. In this paper we investigated three types of agent models regarding to the combination of decision components: (1) agents only with genetic component; (2) agents only with cultural component; and (3) agents with both genetic and cultural components. Results show the importance of each component in the model and their synergic effects when combined.

Implementing Metaheuristic Optimization Algorithms with JEColi

Pedro Evangelista, Paulo Maia and Miguel Rocha

This work proposes JEColi - a novel Java-based library for the implementation of metaheuristic optimization algorithms with a focus on Genetic and Evolutionary Computation based methods. The library was developed based on the principles of flexibility, usability, adaptability, modularity, extensibility, transparency, scalability, robustness and computational efficiency. The project is open-source, so JEColi is made available under the GPL license, together with extensive documentation and examples, all included in a community Wiki-based web site (<http://darwin.di.uminho.pt/jecoli>). JEColi has been/is being used in several research projects that helped to shape its evolution, ranging application fields from Bioinformatics, to Data Mining and Computer Network optimization.

Hybrid Evolutionary Algorithms for Sensor Placement on a 3D Terrain

Haluk Rahmi Topcuoglu, Murat Ermis and Mesut Sifyan

In this paper, we propose a framework for deploying and configuring a set of given sensors in a synthetically generated 3-D terrain with multiple objectives on conflicting attributes: maximizing the visibility of the given terrain, maximizing the stealth of the sensors and minimizing the cost of the sensors used. Because of their utility-independent nature, these complementary and conflicting objectives are represented by a multiplicative total utility function model, based on multi-attribute utility theory. In addition to theoretic foundations, this paper also present a hybrid evolutionary algorithm based technique to solve the sensor placement problem. It includes specialized operators for hybridization, which are problem-specific heuristics for initial population generation, intelligent variation operators which comprise problem specific knowledge, and a local search phase. The experimental study validates finding the optimal balance among the visibility, the stealth and the cost related objectives.

W7: Intelligent Systems for Data Reduction Part 1

Tuesday, December 1ST, 10:00 – 11:20

Sala Fermi

Chair: José M. Benítez

A First Approach to Nearest Hyperrectangle Selection by Evolutionary Algorithms

Salvador García, Joaquín Derrac, Julián Luengo and Francisco Herrera

The nested generalized exemplar theory accomplishes learning by storing objects in Euclidean n-space, as hyperrectangles. Classification of new data is performed by computing their distance to the nearest “generalized

exemplar” or hyperrectangle. This learning method permits to combine the distance-based classification with the axis-parallel rectangle representation employed in most of the rule-learning systems. This contribution proposes the use of evolutionary algorithms to select the most influential hyperrectangles to obtain accurate and simple models in classification tasks. The proposal is compared with the most representative nearest hyperrectangle learning approaches and the results obtained show that the evolutionary proposal outperforms them in accuracy and requires storing a lower number of hyperrectangles.

Addressing Data-Complexity for Imbalanced Data-sets: A Preliminary Study on the Use of Preprocessing for C4.5

Julián Luengo, Alberto Fernández, Salvador García and Francisco Herrera

In this work we analyse the behaviour of the C4.5 classification method with respect to a bunch of imbalanced data-sets. We consider the use of two metrics of data complexity known as “maximum Fishers discriminant ratio” and “nonlinearity of 1NN classifier”, to analyse the effect of preprocessing (oversampling in this case) in order to deal with the imbalance problem. In order to do that, we analyse C4.5 over a wide range of imbalanced data-sets built from real data, and try to extract behaviour patterns from the results. We obtain rules that describe both good or bad behaviours of C4.5 in the case of using the original data-sets (absence of preprocessing) and when applying preprocessing. These rules allow us to determine the effect of the use of preprocessing and to predict the response of C4.5 to preprocessing from the data-set’s complexity metrics prior to its application, and then establish when the preprocessing would be useful to.

Context-based Adaptive Filtering of Interest Points in Image Retrieval

Giang P. Nguyen and Hans Jørgen Andersen

Interest points have been used as local features with success in many computer vision applications such as image/video retrieval and object recognition. However, a major issue when using this approach is a large number of interest points detected from each image and created a dense feature space. This influences the processing speed in any runtime application. Selecting the most important features to reduce the size of the feature space will solve this problem. Thereby this raises a question of what makes a feature more important than the others? In this paper, we present a new technique to choose a subset of features. Our approach differs from others in a fact that selected feature is based on the context of the given image. Our experimental results show a significant reduction rate of features while preserving the retrieval performance.

Clustering-based Feature Selection in Semi-supervised Problems

Ianisse Quinzàn Suarez, José Martínez Sotoca and Filiberto Pla

In this contribution a feature selection method in semi-supervised problems is proposed. This method selects variables using a feature clustering strategy, using a combination of supervised and unsupervised feature distance measure, which is based on Conditional Mutual Information and Conditional Entropy. Real databases were analyzed with different ratios between labelled and unlabelled samples in the training set, showing the satisfactory behaviour of the proposed approach.

W8: Intelligent Signal and Image Analysis in Remote Sensing Part 1

Tuesday, December 1ST, 10:00 – 11:20
Sala Pacinotti
Chair: Marco Diani

Semi-Supervised Kernel Target Detection in Hyperspectral Images

Luca Capobianco, Andrea Garzelli and Gustavo Camps-Valls

A semi-supervised graph-based approach to target detection is presented. The proposed method improves the Kernel Orthogonal Subspace Projection (KOSP) by deforming the kernel through the approximation of the marginal distribution using the unlabeled samples. The good performance of the proposed method is illustrated in a hyperspectral image target detection application for thermal hot spot detection. An improvement is observed with respect to the linear and the non-linear kernel-based OSP, demonstrating good generalization capabilities when low number of labeled samples are available, which is usually the case in target detection problems.

A Contextual Multiscale Unsupervised Method for Change Detection with Multitemporal Remote-Sensing Images

Gabriele Moser, Elena Angiati and Sebastiano B. Serpico

Change-detection represents a powerful tool for monitoring the evolution of the Earth's surface by multitemporal remote-sensing imagery. Here, a multiscale approach is proposed, in which observations at coarser and finer scales are jointly exploited, and a multiscale contextual unsupervised change-detection method is developed for optical images. Discrete wavelet transforms are applied to extract multiscale features that discriminate changed and unchanged areas and Markovian data fusion is used to integrate both these features and the spatial contextual information in the change-detection process. Unsupervised statistical learning methods (expectation-maximization and Besag's algorithms) are used to

estimate the model parameters. Experiments on burnt-forest area detection in multitemporal Landsat TM images are presented.

Texture-based Segmentation of Very High Resolution Remote-Sensing Images

Raffaele Gaetano, Giuseppe Scarpa and Giovanni Poggi

Segmentation of very high resolution remote-sensing images cannot rely only on spectral information, quite limited here for technological reasons, but must take into account also the rich textural information available. To this end, we proposed recently the Texture Fragmentation and Reconstruction (TFR) algorithm, based on a split-and-merge paradigm, which provides a sequence of nested segmentation maps, at various scales of observation. Early experiments on several high-resolution test images confirm the potential of TFR, but there is room for further improvements under various points of view. In this paper we describe the TFR algorithm and, starting from the analysis of some critical results propose two new version that address and solve some of its weak points.

Towards Interpretable General Type-2 Fuzzy Classifiers

Luís A. Lucas, Tania M. Centeno and Myriam R. Delgado

This paper presents two versions of a general type-2 fuzzy classifier. The focus is on interpretability since the rules are meaningful and the rule base is comprised of few rules, which is a direct consequence of the hierarchical reclassification process being proposed. The approaches are evaluated on a land cover classification problem by using data from a remote sensing platform. The classifiers' performance are compared with the reference ones' (maximum likelihood classifier and ordinary fuzzy classifier). The results show that the general type-2 fuzzy modeling is able to produce accurate classifiers while maintaining the model interpretability.

W9: Human Monitoring and Machine Learning Strategies Part 1

Tuesday, December 1ST, 10:00 – 11:20
Sala Galilei
Chair: Giovanni Pioggia

Applications of Soft Computing to Medical Problems

Ahmet Yardimci

The medical industry requires new engineering technologies, to assess information objectively. While recent developments in medical engineering have been achieved by state-of-the-art of intelligent computing techniques including computer-aided diagnosis, computer-aided radiography, developments in computational techniques including soft computing (SC), information processing and data mining hold new premises in this field. SC methods are becoming indispensable for to sport

modern medical practice. SC combines Fuzzy Logic (FL), Neural Networks (NN), and Genetic Algorithms (GAs) methodologies. The aim of this paper is to introduce briefly the various SC methodologies and to present various applications in medicine between the years 2000 and 2008. The recent published knowledge about use of SC in medicine is researched in MEDLINE. According to MEDLINE database searches, the rates of preference of SC methodologies in medicine were found as 68% of FL-NN, 27% of NN-GA and 5% of FL-GA.

An Ontology-driven Multisensorial Platform to Enable Unobtrusive Human Monitoring and Independent Living

Giovanni Pioggia, Giulia Ricci, Silvio Bonfiglio, Angelos Bekiaris, Gabriele Siciliano and Danilo De Rossi

The profound, pervasive and enduring consequences of ageing population present enormous challenges as well as enormous opportunities for Information and Communication Technology. The EU funded OASIS project, a Large Scale Integrated Project, is aimed to develop an open and innovative reference architecture, based upon ontologies and semantic services, that will allow plug and play and cost-effective interconnection of existing and new services in all domains required for the independent and autonomous living of the elderly and their enhanced quality of life. Among other technological advances, in OASIS we are developing a smart multisensorial platform for monitoring the lower limbs movements, as well as the muscular activations. We are using unobtrusive integrated sensors to transduce posture and kinematic variables and to acquire surface Electromyography (sEMG). The platform is able to analyze and merge the sEMG signals and kinematics variables to provide a single coherent dynamic information of the acquired movements. A Predictive Dynamic Model (PDM) based on machine learning techniques assesses the physiological muscular recruitments as well as muscular fatigue and physiological conditions.

Improved Learning of Bayesian Networks in Biomedicine

Antonella Meloni, Andrea Ripoli, Vincenzo Positano and Luigi Landini

Bayesian Networks represent one of the most successful tools for medical diagnosis and therapies follow-up. We present an algorithm for Bayesian network structure learning, that is a variation of the standard search-and-score approach. The proposed approach overcomes the creation of redundant network structures that may include non significant connections between variables. In particular, the algorithm finds which relationships between the variables must be prevented, by exploiting the binarization of a square matrix containing the mutual information (MI) among all pairs of variables. Four different binarization methods are implemented. The MI binary matrix is exploited as a preconditioning step for the subsequent greedy search procedure that optimizes the network score, reducing the number of possible search paths in the greedy search. Our approach has been tested on two different medical datasets

and compared against the standard search-and-score algorithm as implemented in the DEAL package.

Extraction and Synchronization of BOLD Spontaneous Oscillations using Singular Spectrum Analysis

Danilo Menicucci, Angelo Gemignani, Andrea Piarulli, Remo Bedini, Claudio Gentili, Giacomo Handjaras, Sabrina Danti, Mario Guazzelli, Marco Laurino, Paolo Piaggi and Alberto Landi

Spontaneous cerebral blood oxygenation level-dependent (BOLD) fluctuations are gaining interest in the neurophysiology community. These oscillations are prominent in the low-frequency range with spatiotemporal correlations. From a healthy individual, a basal resting state BOLD fMRI acquisition has been performed by collecting 4 slices. Voxel signals from seven selected regions have been considered. We assumed a composite null-hypothesis of oscillations embedded in "red noise". To extract oscillations from BOLD signals we applied the Monte Carlo Singular Spectrum Analysis (SSA). Phase-synchronization of the oscillatory components, in the low-frequency range 0.085-0.13Hz, have been also achieved. As results, region-dependent distributions were apparent both for the noise parameters and for the number of connections between voxels. Although further studies on population samples should confirm the result consistency, the SSA technique combined with a phase-synchronization analysis seems a feasible method to extract low frequency BOLD spontaneous oscillations and to find functional connections among cerebral areas.

Innovative Networking and Communication Techniques

Tuesday, December 1ST, 10:00 – 11:20
AulaB
Chair: Ajith Abraham

Efficient Scheduling Algorithms on Bandwidth Reservation Service of Internet using Metaheuristics

Tomoyuki Hiroyasu, Kozo Kawasaki, Michihiro Koibuchi, Shigeo Urushidani, Mitsunori Miki and Masato Yoshimi

Network services that dynamically allocate bandwidth resources, such as QoS and layer-1 bandwidth-on-demand(BoD), are increasingly required to advanced Internet backbones, such as science information networks (SINET) in Japan. In this paper, we propose scheduling algorithms for BoD service which allocate parts of full bandwidth dedicated to specific users according to their requests in advanced Internet backbones. The scheduling algorithms maximize the number of accepted requests, fairness, or the total bandwidth in BoD. Simulation results show that the proposed algorithms achieve high utilization of network resources and user's fairness, compared with a simple random-based algorithm.

Solving a Realistic Location Area Problem Using SUMATRA Networks with the Scatter Search Algorithm

Sónia M. Almeida-Luz, Miguel A. Vega-Rodríguez,
Juan A. Gómez-Pulido and Juan M. Sánchez-Pérez

This paper presents a new approach based on the Scatter Search (SS) algorithm applied to the Location Management problem using the Location Area (LA) scheme. The LA scheme is used to achieve the best configuration of the network partitioning, into groups of cells (location areas), that minimizes the costs involved. In this work we execute five distinct experiments with the aim of setting the best values for the Scatter Search parameters, using test networks generated with realistic data [1]. We also want to compare the results obtained by this new approach with those achieved through classical strategies, other algorithms from our previous work and also by other authors. The simulation results show that this SS based approach is very encouraging.

Danger Theory and Multi-agents Applied for Addressing the Deny of Service Detection Problem in IEEE 802.11 Networks

Moisés Danziger, Marcelo Lacerda and Fernando B. de Lima Neto

Deny of service (DoS) detection problem is a common and annoying network difficulty, but for IEEE 802.11 standards it becomes even more troublesome. Addressing this issue, we introduce a new approach to promptly warn the user. The detection algorithm put forward, combines second generation of Artificial Immune Systems, Danger Theory and Multi-Agent System. For the detection system, we used the dendritic cells algorithm, modified to IEEE 802.11 environments. Experimental results carried out in controlled setups have shown that the model can easily and effectively be applied for detecting DoS in IEEE 802.11 networks.

Design and Implementation of Distributed Intelligent Firewall based on IPv6

Qian Ma, Yingxu Lai and Guangzhi Jiang

IPv6, as the alternative of IPv4, contains numerous features and improvements that make it attractive from a security perspective, but it is by no means the panacea for security. This paper presents the design and implementation of a distributed intelligent firewall system based on IPv6, which is able to secure the network layer and application layer of IPv6 networking. By the system, the typical attacks coexisting in both IPv4 and IPv6, the emerging IPv6 specific ones such as security threats related to ICMPv6, can be blocked by the rule set of network layer, similarly, with the rule set of application layer, any illegal or reactionary Web page content in HTML source codes can be totally prevented from sneaking into the Intranet. The Initiative Drift mechanism ensures the legitimacy and civilization of the Web environment within the whole IPv6 networking. Finally, we conduct the performance evaluation of the system and a decent result is gotten.

Intelligent Control and Automation Part 1

Tuesday, December 1ST, 11:30 – 12:50
Auditorium
Chair: Leonardo M. Reyneri

Agent-oriented Intelligent Control Strategies for the Nano-Satellite Autonomous Thermal System

Liu Jia, Li Yunze, Wang Yuying and Wang Jun

The paper concerns the autonomous thermal control system of Nano-satellite with a study of the combination of MEMS (Micro Electro Mechanical Systems)-based efficient cooling technique and the agent-oriented intelligent control strategies issue, especially with the issue of autonomy. The particular interest and complexity are the development of the thermal control system that has the intelligent autonomous control capability to maintain the Nano-satellite optimal performance. Based on the modeling and analysis the dynamic characteristics of efficient cooling system utilizing MEMSbased micro-channel heat sink and micro louver arrays by the means of lumped parameter method, the hierarchical structure of agent-oriented intelligent control method for Nano-satellite autonomous thermal system is investigated. With the domain expert knowledge and Fuzzy reasoning, the innovative agentoriented intelligent control strategies achieve an autonomous process to regulate several controlled variables according to the expectation of the system situations and variety tendency, the robustness of the thermal control system is accomplished as well.

Intelligent Lighting Control User Interface through Design of Illuminance Distribution

Tomoyuki Hiroyasu, Akiyuki Nakamura, Sho Shinohara, Masato Yoshimi, Mitsunori Miki and Hisatake Yokouchi

Many types of artifacts can be connected and controlled over a network. However, when a lot of artifacts are connected, it is very difficult to control with conventional interface switches. The interface of these systems should be suitable for each individual user and should be designed for ease of operation. In this paper, a new type of user-friendly interface for a networked lighting system that can be controlled over the network is proposed. In the proposed system, the user operates the lighting system by designing the illuminance distribution, and the system learns user's sensory scale to support this design.

Adaptive Paralleled DMC-PID Controller Design on System with Uncertainties

Ruihua Wei and Lihong Xu

This paper presents an adaptive controller design method for a class of system with modeling uncertainties or environment disturbance. The controller has a paralleled structure of Dynamic Matrix Control and PID Control. The weight for each of the controller can be adaptively tuned through iteratively

learning. It can make full use of the model information, meanwhile resisting disturbance and overcoming the unmodeled uncertainties in a certain degree. The simulation and comparison with other control method show that this method has better tracking performance, disturbance resistance, robustness and great feasibility to be implemented in engineering application.

An Efficient Solver for Scheduling Problems on a Class of Discrete Event Systems Using CELL/B.E. Processor

Hiroyuki Goto and Atsushi Kawaminami

This research implements an efficient solver for scheduling problems in a class of repetitive discrete event systems using a CELL/B.E. (CELL Broadband Engine). The essence of this involves efficiently computing the transition matrix of a system whose precedence constraints regarding the execution sequence of jobs can be described by a weighted DAG (Directed Acyclic Graph). This means solving the longest path problem efficiently for all pairs of source and destination nodes. For the first step towards a high-speed computation, we utilize SIMD (Single Instruction Multiple Data) functions.

W7: Intelligent Systems for Data Reduction Part 2

Tuesday, December 1ST, 11:30 – 12:50

Sala Fermi

Chair: José Salvador García

Empirical Study of Individual Feature Evaluators and Cutting Criteria for Feature Selection in Classification

Antonio Arauzo-Azofra, José L. Aznarte M. and José M. Benítez

The use of feature selection can improve accuracy, efficiency, applicability and understandability of a learning process and its resulting model. For this reason, many methods of automatic feature selection have been developed. By using a modularization of feature selection process, this paper evaluates a wide spectrum of these methods. The methods considered are created by combination of different selection criteria and individual feature evaluation modules. These methods are commonly used because of their low running time. After carrying out a thorough empirical study the most interesting methods are identified and some recommendations about which feature selection method should be used under different conditions are provided.

Agglomeration and Elimination of Terms for Dimensionality Reduction

Patrick Marques Ciarelli and Elias Oliveira

The vector space model is the usual representation of texts database for computational treatment. However, in such representation synonyms and/or related terms are treated as

independent. Furthermore, there are some terms that do not add any information at all to the set of text documents, on the contrary they even might harm the performance of the information retrieval techniques. In an attempt to reduce this problem, some techniques have been proposed in the literature. In this work we present a method to tackle this problem. In order to validate our approach, we carried out a serie of experiments on four databases and we compare the achieved results with other well known techniques. The evaluation results is such that our method obtained in all cases a better or equal performance compared to the other literature techniques.

Automatically Generated Linguistic Summaries of Energy Consumption Data

Albert van der Heide and Gracián Triviño

In this paper a method is described to automatically generate linguistic summaries of real world time series data provided by a utility company. The methodology involves the following main steps: partitioning of time series into fuzzy intervals, calculation of statistical indicators for the partitions, generation of summarising sentences and determination of the truth-fullness of these sentences, and finally selection of relevant sentences from the generated set of sentences.

Measures for Unsupervised Fuzzy-Rough Feature Selection

Neil Mac Parthaláin and Richard Jensen

For supervised learning, feature selection algorithms attempt to maximise a given function of predictive accuracy. This function usually considers the ability of feature vectors to reflect decision class labels. It is therefore intuitive to retain only those features that are related to or lead to these decision classes. However, in unsupervised learning, decision class labels are not provided, which poses questions such as; which features should be retained? and, why not use all of the information? The problem is that not all features are important. Some of the features may be redundant, and others may be irrelevant and noisy. In this paper, some new fuzzy-rough set-based approaches to unsupervised feature selection are proposed. These approaches require no thresholding or domain information, and result in a significant reduction in dimensionality whilst retaining the semantics of the data.

W8: Intelligent Signal and Image Analysis in Remote Sensing Part 2

Tuesday, December 1ST, 11:30 – 12:50

Sala Pacinotti

Chair: Giovanni Corsini

On the Effects of Synthetic-Aperture Length on SAS Seabed Segmentation

David P. Williams and Johannes Groen

In this work, we quantify the relationship between synthetic-aperture length (or equivalently, along-track resolution) and seabed segmentation performance experimentally for real synthetic aperture sonar (SAS) imagery. The seabed segmentation algorithm employed uses wavelet-based features, spectral clustering, and a variational Bayesian Gaussian mixture model. It is observed that for this approach, the correct seabed segmentation rate drops approximately ten percentage points for each halving of the along-track resolution between 3 cm and 96 cm. Moreover, changing the along-track resolution has the most significant effect on rocky seabeds.

Fully Unsupervised Learning of Gaussian Mixtures for Anomaly Detection in Hyperspectral Imagery

Tiziana Veracini, Stefania Matteoli, Marco Diani and Giovanni Corsini

This paper proposes a fully unsupervised anomaly detection strategy in hyperspectral imagery based on mixture learning. Anomaly detection is conducted by adopting a Gaussian Mixture Model (GMM) to describe the statistics of the background in hyperspectral data. One of the key tasks in the application of mixture models is the specification in advance of the number of GMM components, the determination of which is essential and strongly affects detection performance. In this work, GMM parameters estimation was performed through a variation of the well-known Expectation Maximization (EM) algorithm that was developed within a Bayesian framework. Specifically, the adopted mixture learning technique incorporates a built-in mechanism for automatically assessing the number of components during the parameter estimation procedure. Then, Generalized Likelihood Ratio Test (GLRT) is considered for detecting anomalies. Real hyperspectral imagery acquired by an airborne sensor is used for experimental evaluation of the proposed anomaly detection strategy.

Performance Assessment of a Mathematical Morphology Ship Detection Algorithm for SAR Images through Comparison with AIS Data

Raffaele Grasso, Sergio Mirra, Alberto Baldacci, Jochen Horstmann, Matthew Coffin, Melanie Jarvis

This paper describes a procedure to evaluate the performance of ship detection algorithms for Synthetic Aperture Radar (SAR) using real SAR images and Automatic Identification System (AIS) data as ground truth. Accurate AIS-SAR data

association is achieved by correcting the AIS data for the SAR induced position errors by exploiting SAR acquisition parameters and vessel state information (speed and course) provided by AIS tracks. The methodology has been tested on a ship detection algorithm based on mathematical morphology which is described in this paper. The evaluation has been carried out on a RADARSAT-2 data set including images at different acquisition modes which was collected in the Mediterranean Sea. Estimates for the detection and the false alarm probability, and the contact position error are provided.

Intelligent Cooperative Tracking in Multi-Camera Systems

Yan Lu and Shahram Payandeh

In this paper, an approach for intelligent integration of indoor visual tracking system for event detection and movement is proposed. This surveillance system is composed of a stationary camera and a pan tilt zoom (PTZ) camera, where the two cameras have been intrinsically and extrinsically calibrated. The stationary camera detects events such as fall and wandering using motion-based visual tracking. In this initial study, the PTZ camera tracks and follows the person who triggered the event using intelligent color-based particle filtering which is defined based on the expected dynamics of the scene. The purpose of tracking in view of the PTZ camera is to continuously keep the person in the full view of the camera which can further be processed for identifying details of the person. Preliminary experimental results for camera calibration, event detection, and human tracking are presented to demonstrate the performance of the proposed cooperative hybrid visual tracking system.

W9: Human Monitoring and Machine Learning Strategies Part 2

Tuesday, December 1ST, 11:30 – 12:50

Sala Galilei

Chair: Alberto Landi

Backpropagation-Based Non Linear PCA for Biomedical Applications

Alberto Landi, Paolo Piaggi and Giovanni Pioggia

Machine learning methodologies such as artificial neural networks (ANN), fuzzy logic or genetic programming, as well as principal component analysis (PCA) and intelligent control have been recently introduced in medicine. ANNs imitate the structure and workings of the human brain by means of mathematical models able to adapt several parameters. ANNs learn the input/output behavior of a system through a supervised or an unsupervised learning algorithm. In this work, we present and demonstrate a new pre-processing algorithm able to improve the performance of an ANN in the processing of biomedical datasets. The algorithm was tested analyzing lung function and fractional exhaled nitric oxide differences in the breath in children with allergic bronchial asthma and in normal population. Classification obtained

using non linear PCA based on the new algorithm shows a better precision in separating asthmatic and control subjects.

Cluster Analytic Detection of Disgust-Arousal

Masood Mehmood Khan

Automated detection of disgust-arousal could have applications in diagnosing and treating obsessive-compulsive disorder and Huntington's disease. For achieving this ability, experimental data was used first to examine the thermal response of "facial muscles of disgust" to other common negative and positive expressions of emotive states. An attempt was then made to detect disgust-arousal through classification of affect-educed thermal variations measured along the facial muscles. Initial results suggest (i) muscles of disgust experience different levels of thermal variations under the influence of various emotive state and (ii) emotion-educed facial thermal patterns can be modeled as stochastically independent clusters to be separated as linear spaces and making automated detection of disgust-arousal possible.

Automatic Detection of Arrhythmias Using Wavelets and Self-Organized Artificial Neural Networks

Sérgio R. Rogal Jr, Alfredo Beckert Neto, Marcus Vinícius Mazega Figueredo, Emerson Cabrera Paraiso and Celso A. Alves Kaestner

The arrhythmias or abnormal rhythms of the heart are common cardiac riots and may cause serious risks to the life of people, being one of the main causes on deaths. These deaths could be avoided if a previous monitoring of these arrhythmias were carried out, using the Electrocardiogram (ECG) exam. The continuous monitoring and the automatic detection of arrhythmias of the heart may help specialists to perform a faster diagnostic. The main contribution of this work is to show that self-organized artificial neural networks (ANNs), as the ART2, can be applied in arrhythmias automatic detection, working with Wavelet transforms for feature extraction. The self-organized ANN allows, at any time, the inclusion of other groups of arrhythmias, without the need of a new complete training phase. The paper presents the results of practical experimentations.

ENMET: Endothelial Cell Metabolism Mathematical Model

Gianni Orsi, Carmelo De Maria, Federico Vozzi, Mariangela Guzzardi, Arti Ahluwalia and Giovanni Vozzi

Endothelial cells have central role in controlling blood vessels homeostasis, secreting vasodilator (Nitric Oxide, NO) and vasoconstrictor (Endothelin-1, ET-1) molecules, in response to various shear-stress levels due to blood flow. ENMET (Endothelial cell METabolism) is mathematical model that mimics completely the principal metabolic pathways in endothelial cell, connecting mechanical-stimuli responses (Et-1 and NO production) to main biochemical reactions. It is based on a set of non-linear differential equations, implemented in Simulink®, based on the cellular energetic state. The validation phase is based on experiments performed in a

dynamic culture chamber where cell culture is exposed to a laminar flow that generates a well controlled shear stress.

Intelligent Internet Modeling

Tuesday, December 1ST, 11:30 – 12:50

AulaB

Chair: Umberto Straccia

Extending Datatype Restrictions in Fuzzy Description Logics

Fernando Bobillo and Umberto Straccia

Fuzzy Description Logics (DLs) are a family of logics which allow the representation of (and the reasoning within) structured knowledge affected by vagueness. Although a relatively important amount of work has been carried out in the last years, little attention has been given to the role of datatypes in fuzzy DLs. This paper presents a fuzzy DL with three kinds of extended datatype restrictions, together with the necessary rules to reason with them.

A Combined Query Expansion Technique for Retrieving Opinions from Blogs

Saeedeh Montazi, Stefan Kazalski and Dietrich Klakow

In this paper, we discuss the the role of the retrieval component in an TREC style opinion question answering system. Since blog retrieval differs from traditional ad-hoc document retrieval, we need to work on dedicated retrieval methods. In particular we focus on a new query expansion technique to retrieve people's opinions from blog posts. We propose a combined approach for expanding queries while considering two aspects: finding more relevant data, and finding more opinionative data. We introduce a method to select opinion bearing terms for query expansion based on a chi-squared test and use this new query expansion to combine it in a liner weighting scheme with the original query terms and relevant feedback terms from web. We report our experiments on the TREC 2006 and TREC 2007 queries from the blog retrieval track. The results show that the methods investigated here enhanced mean average precision of document retrieval from 17.91% to 25.20% on TREC 2006 and from 22.28% to 32.61% on TREC 2007 queries.

Novel IPCA-Based Classifiers and Their Application to Spam Filtering

Alessandro Rozza, Gabriele Lombardi and Elena Casiraghi

This paper proposes a novel two-class classifier, called IPCAC, based on the Isotropic Principal Component Analysis technique; it allows to deal with training data drawn from Mixture of Gaussian distributions, by projecting the data on the Fisher subspace that separates the two classes. The obtained results demonstrate that IPCAC is a promising technique; furthermore, to cope with training datasets being dynamically supplied, and to work with non-linearly

separable classes, two improvements of this classifier are defined: a model merging algorithm, and a kernel version of IPCAC. The effectiveness of the proposed methods is shown by their application to the spam classification problem, and by the comparison of the achieved results with those obtained by Support Vector Machines SVM, and K-Nearest Neighbors KNN.

A Fuzzy Decision System Using Shoppers' Preferences for Recommendations in E-Commerce Applications

Zhengping Wu and Hao Wu

In e-commerce applications, the magnitude of products and the diversity of vendors cause confusion and difficulty for common consumers to choose the right product from a trustworthy vendor. Although people have recognized the importance of feedbacks and reputations for the trustworthiness of individual vendors and products, they still have difficulties when they have to make a shopping decision from a huge number of choices. This paper introduces fuzzy logic into rule definition for preferences of vendors and price for products, and designs a novel agent-based decision system using fuzzy rules and reasoning mechanisms to find the right product from a trustworthy vendor according to users' preferences.

Evolutionary Shallow Parsing

John Atkinson and Juan Matamala

In this work, a new approach to natural-language chunking using an evolutionary model is proposed. This uses previously captured training information to guide the evolution of the model. In addition, a multi-objective optimization strategy is used to produce the best solutions based on the internal and the external quality of chunking. Experiments and the main results obtained using the model and state-of-the-art approaches are discussed.

Intelligent Control and Automation Part 2

Tuesday, December 1ST, 15:00 – 16:20
Auditorium
Chair: Antonio Peregrin Rubio

Design Based on a Shared Lookup-Table for an Obstacle Avoidance Fuzzy Controller for Mobile Robots

Jinwook Kim, Young-Gu Kim, Young-Duk Kim, Won-Seok Kang and Jinung An

Fuzzy algorithms provide intuitive method for robot obstacle avoidance. Fuzzy controllers incorporating a design based on lookup tables (LUT) enable faster obstacle avoidance in environment with multiple obstacles. In an earlier study, we introduced a full LUT-based architecture for an 18-rule

Positive/Negative (P/N) fuzzy controller. In this study, the number of fuzzy rules is expanded to 50. Because of the extra rules, the controller apparently needs more LUT(s) buffers. In other words, the buffer size increases with the complexity of the fuzzy controller. Therefore, we propose a LUT sharing method to reduce the buffer size without significantly degrading the performance of the controller. The final objective of this work is to design a LUT-based fuzzy controller whose buffer size is independent of the complexity of the fuzzy system. The proposed method is evaluated by simulating a 50-rule P/N fuzzy controller using Microsoft Robotics Developer Studio (MSRDS). The simulation results show that in comparison with the method not using LUT(s), full LUT-based method and the LUT sharing method reduce the operational time by nearly 80% and 70%, respectively. Although the LUT sharing method needs 1.5 times more operational time than the full LUT methods, it reduces the buffer size by more than 90%.

Acquisition of Image Feature on Collision for Robot Motion Generation

Taichi Okamoto, Yuichi Kobayashi and Masaki Onishi

It is important for robots that act in human-centered environments to build image processing in a bottom-up manner. This paper proposes a method to autonomously acquire image feature extraction that is suitable for motion generation while moving in unknown environment. The proposed method extracts low level features without specifying image processing for robot body and obstacles. The position of body is acquired in image by clustering of SIFT features with motion information and state transition model is generated. Based on a learning model of adaptive addition of state transition model, collision relevant features are detected. Features that emerge when the robot can not move are acquired as collision relevant features. The proposed framework is evaluated with real images of the manipulator and an obstacle in obstacle avoidance.

Using Fuzzy Techniques for Bounding the Tolerance of GPS-based Speed and Distance Measurements in Taximeter Verification

Adolfo Otero, José Otero and Luciano Sánchez

GPS sensors are a promising technique for verifying taximeters, because they do not require dedicated facilities and are compatible with a wide range of vehicles. The main drawback of this technology is based on legal issues: neither the absolute error of a GPS-based measurement nor the tolerance of the sensor can be known in advance, because they depend on environmental factors. In this paper we propose a technique that computes a dynamical tolerance for each measurement, using the Circular Error Probable at 50% and 95% levels. By combining the interpretation of a fuzzy set as a nested family of confidence intervals and a genetic algorithm-based interpolation, we have built an interval-valued estimation of the tolerance of a GPS-based verification of a taximeter.

Identification of Petri Net Models based on an Asymptotic Approach

Maria Elena Meda Campaña, Francisco Javier Lopez-Lopez, Cuauhtemoc Lopez-Martin and Arturo Chavoya

The identification problem considered in this work, consists in compute an Interpreted Petri Net (IPN) model, in proportion as new output signals of the system are observed. The identification problem becomes complex when the complete state of the system cannot be fully measured. The state information that is not observed is inferred during the identification process allowing the computed model represents the observed system behavior. As the system evolves new information is revealed and the wrong dependencies are eliminated in order to update the computed model. Given this problem, in this paper are presented the needed algorithms to identify a class of Petri Nets (PN) known as state machines.

W10: Consensus and Decision Making Part 1

Tuesday, December 1ST, 15:00 – 16:20
Sala Fermi
Chair: Enrique Herrera-Viedma

Consensus with Linguistic Preferences in Web 2.0 Communities

Sergio Alonso, Ignacio J. Pérez, Enrique Herrera-Viedma and Francisco Javier Cabrerizo

Web 2.0 Communities are a quite recent phenomenon with its own characteristics and particularities (possibility of large amounts of users, real time communication...) and so, there is still a necessity of developing tools to help users to reach decisions with a high level of consensus. In this contribution we present a new consensus reaching model with linguistic preferences designed to minimize the main problems that this kind of organization presents (low and intermittent participation rates, difficulty of establishing trust relations and so on) while incorporating the benefits that a Web 2.0 Community offers (rich and diverse knowledge due to a large number of users, real-time communication).

Optimizing the Method for Building an Extended Linguistic Hierarchy

Macarena Espinilla, Rosa M Rodríguez, Luis Martinez, F. Mata and Jun Liu

In those problems dealing with linguistic information and multiple sources of information may happen that the sources involved have different degree of knowledge about the problem and could be suitable and necessary the use of different linguistic term sets with different granularity defining a multi-granular linguistic context. Different approaches have been presented to deal with this type of context, being the linguistic hierarchies an approach quite

interesting due to its accuracy in computational model but with a strong limitation about the term sets that can be used. We presented an extension of the linguistic hierarchies [2] to deal any linguistic term set in a precise way. This new approach presents initially a drawback, it needs a term set with a very high granularity, implying complexity in computing with words processes. Therefore, we propose an optimization to building an extended linguistic hierarchy in order to decrease the granularity of such a term set

A Preliminary Study of the Effects of Different Aggregation Operators on Consensus Processes

Francisco Mata, Luis Martínez and Juan Carlos Martínez

Searching for consensus in group decision making is a process in which experts change their preferences in order to achieve a minimum agreement before making a decision. Computing the consensus degree among experts and the group collective opinion by aggregating experts' opinions are two main tasks in a consensus reaching process. In this contribution we have studied the effects of different aggregation operators on the consensus processes. In particular, we have analyzed the obtained outcomes by three different aggregation operators: arithmetic mean, OWA with the linguistic quantifier "most" and Dependent OWA. Finally, some preliminary conclusions about the obtained results and the influence of these aggregation operations on consensus processes are drawn

Action Rules in Consensus Reaching Process Support

Janusz Kacprzyk, Slawomir Zadrozny and Zbigniew W. Raś

We discuss a conceptually new extension of our previous works in which we proposed a concept of a consensus reaching support system based on a new, gradual notion of consensus devised in the framework of fuzzy preference relations and a fuzzy majority. Here, first of all, we propose the use of action rules as a tool to generate some advice as to the further running of discussion in the group. Moreover, we propose to employ intuitionistic fuzzy preference relations to better model individual preferences and to obtain data more suitable for the action rules based analysis.

S7: Education and Learning Models, Applications and Solutions

Tuesday, December 1ST, 15:00 – 16:20
Sala Pacinotti
Chairs: Silvio Bortoleto, Katia Bortoleto

Cognition and Affectivity: its Influences in Teacher-Student Relation and in the Teaching-Learning Process

Ana Leticia Galastri

This study sought to investigate as it has a teacher-student relationship in kindergarten and the extent to which teachers are clearly the presence of cognitive and affective aspects in this relationship. The article takes for granted the fact that it is necessary for professional education has made clear the true meaning of affection, and knowing that the cognitive and affective aspects are inseparable, and that this inseparability it comes down to learning. The poll found that the action of teaching approaches proposed by theorists, but apparently is directed more common sense than by knowledge on the subject, among so many aspects observed, one realizes that there is a need to work on comprehensive training of teachers.

Intelligent Reporting System with e-Training Capabilities

Maria Murri, Marco Lupinelli and Luca Onofri

In high technological complexity industrial systems, the operators' role is more and more critical. They need deeper and deeper specialization and a continuous monitoring of both process and plant to achieve high efficiency and proper working. That requires a continuous training and upgrading of the operator knowledge to react promptly and properly to the different plant/process situation to manage. Furthermore the process complexity, like in a steel plant, requires the workers at any level have a global vision of the various factory indicators (technical and economical) for a complete understanding of their role and the relationships with the other factory departments. The paper describes an intelligent web-reporting system with e-training capabilities based on a new information management. The system is able to support workers in daily operational jobs by the availability of an updated knowledge base and to capitalize the Company know-how making it available at different professional levels.

Analyzing Online Asynchronous Discussion Using Content and Social Network Analysis

Erlin, Norazah Yusof and Azizah Abdul Rahman

Asynchronous discussion forum can provide a platform for online learners to communicate with one another easily, without the constraint of place and time. This study explores the analysis process of online asynchronous discussion. We focus upon content analysis and social network analysis, which is the technique often used to measure online discussion in formal educational settings. In addition, Soller's model for content analysis was developed and employed to

qualitatively analyze the online discussion. We also discuss the use of network indicators of social network analysis to assess level participation and communication structure throughout online discussion. Adjacency matrix, graph theory and network analysis techniques were applied to quantitatively define the networks interaction among students. The findings showed that these methods provide more meaningful students' interaction analysis in term of information of communication transcripts and communication structures in online asynchronous discussion.

Improving Academic Performance Prediction by Dealing with Class Imbalance

Nguyen Thai-Nghe, Andre Busche and Lars Schmidt-Thieme

This paper introduces and compares some techniques used to predict the student performance at the university. Recently, researchers have focused on applying machine learning in higher education to support both the students and the instructors getting better in their performances. Some previous papers have introduced this problem but the prediction results were unsatisfactory because of the class imbalance problem, which causes the degradation of the classifiers. The purpose of this paper is to tackle the class imbalance for improving the prediction/classification results by over-sampling techniques as well as using cost-sensitive learning (CSL). The paper shows that the results have been improved when comparing with only using baseline classifiers such as Decision Tree (DT), Bayesian Networks (BN), and Support Vector Machines (SVM) to the original datasets.

W9: Human Monitoring and Machine Learning Strategies Part 3

Tuesday, December 1ST, 15:00 – 16:20
Sala Galilei
Chair: Giovanni Pioggia

An FPGA based Arrhythmia Recognition System for Wearable Applications

Antonino Armato, Elena Nardini, Antonio Lanatà, Gaetano Valenza, Carlo Mancuso, Enzo Pasquale Scilingo and Danilo De Rossi

The aim of this paper is constituted by the feasibility study and development of a system based on Field Programmable Gate Array for the most significant cardiac arrhythmias recognition by means of Kohonen Self-Organizing Map. The feasibility study on an implementation on the XILINX Virtex®-4 FX12 FPGA is proposed, in which the QRS complexes are extracted and classified in real time between normal or pathologic classes. The whole digital implementation is validated to be integrated in wearable cardiac monitoring systems.

Postponed Updates for Temporal-Difference Reinforcement Learning

Harm van Seijen and Shimon Whiteson

This paper presents postponed updates, a new strategy for TD methods that can improve sample efficiency without incurring the computational and space requirements of model-based RL. By recording the agent's last-visit experience, the agent can delay its update until the given state is revisited, thereby improving the quality of the update. Experimental results demonstrate that postponed updates outperforms several competitors, most notably eligibility traces, a traditional way to improve the sample efficiency of TD methods. It achieves this without the need to tune an extra parameter as is needed for eligibility traces.

Sensor Fusion-oriented Fall Detection for Assistive Technologies Applications

Stefano Cagnoni, Guido Matrella, Monica Mordonini, Federico Sassi, and Luca Ascari

A new trend in modern Assistive Technologies implies making extensive use of ICT to develop efficient and reliable "Ambient Intelligence" applications dedicated to disabled, elderly or frail people. In this paper we describe two fall detectors, based on bio-inspired algorithms. Such devices can either operate independently or be part of a modular and easily extensible architecture, able to manage different areas of an intelligent environment. In this case, effective data fusion can be achieved, thanks to the complementary nature of the sensors on which the detectors are based. One device is based on vision and can be implemented on a standard FPGA programmable logic. It relies on a simplified version of the Particle Swarm Optimization algorithm. The other device under consideration is a wearable accelerometer-based fall detector, which relies on a recent soft-computing paradigm called Hierarchical Temporal Memories (HTMs).

Event Related Biometrics: Towards an Unobtrusive Sensing Seat System for Continuous Human Authentication

Marcello Ferro, Giovanni Pioggia, Alessandro Tognetti, Gabriele Dalle Mura and Danilo De Rossi

The present work is focused on the improvement of a Sensing Seat system previously developed by the authors for the initial authentication purpose in office and car scenarios. The goal is to obtain an event-related continuous authentication system, where the human subject should not take care of the system itself so that he is free to perform his normal actions. The system is realized by means of a sensing cover where conductive elastomers are used as strain sensors. The deformation of the cover caused by the body shape while actions are performed by the subject are used to obtain time-dependent relevant features. Such information are then analyzed by suitable classifiers that are able to perform the real-time continuous authentication task. A measurement campaign was carried out using data from 24 human subjects employed in an office scenario while a set of 22 actions were performed. The authentication capabilities of the system are

reported in terms of acceptance and rejection rates, showing a high degree of correct classification.

W11: Provisioning of Smart Services in Ontology-Based Systems Part 1

Tuesday, December 1ST, 15:00 - 16:20
AulaB
Chair: Pierluigi Ritrovato

Using Ontologies to Achieve Semantic Interoperability in the Web: an Approach based on the Semantic Triangle Model

Angelo Chianese, Annarita Fasolino, Vincenzo Moscato and Porfirio Tramontana

In this paper, we propose an architecture that, exploiting the Semantic Web technologies, has the objective of allowing semantic interoperability among software agents in the Web. Such an architecture takes advantage by the Semantic Triangle model in which communication agents share the referents (real world objects) and not the references (mental image of a real object of the sender agent), thus ensuring an effective semantic interoperability in the information exchange process. We have carried a case study in order to assess the appropriateness and the feasibility of the process for the semantic information exchange by realizing and testing an instantiation of the related architecture.

Ontology-based System for Enterprise 2.0

Giuseppina Rita Mangione, Sergio Miranda, Stefano Paolozzi, Anna Pierri, Pierluigi Ritrovato and Saverio Salerno

Enterprise 2.0 is mainly focused on answering to people needs and to stimulate flexibility, adaptability and innovation. Ontologies define a common vocabulary to share domain information and are used to state the meaning of terms used in data produced, shared and consumed within the context of Semantic Web applications. In this paper we propose a conceptual architecture where ontologies are used to support the social, open and adaptive views of Enterprise 2.0. We also show how the main elements of the architecture can be exploit in an organizational e-learning scenario.

A Business Intelligence Process to Support Information Retrieval in an Ontology-Based Environment

Filippo Sciarrone, Paolo Starace and Tommaso Federici

A Business Intelligence Process to support Information Retrieval in an Ontology-Based Environment

Combining DHTs and SONs for Semantic-Based Service Discovery

Giuseppe Pirrò, Paolo Missier, Paolo Trunfio,
Domenico Talia, Gabriele Falace and Carole Goble

The soaring number of available online services calls for distributed architectures to promote scalability, fault-tolerance and semantics; to provide meaningful descriptions of services; and to support their efficient retrieval. Current approaches exploit either Semantic Overlay Networks (SONs) or Distributed Hash Tables (DHTs) sweetened with some "semantic sugar." SONs enable semantic driven query answering but are less scalable than DHTs, which on their turn, feature efficient but semantic-free query answering based on "exact" match. This paper presents the ERGOT system combining DHTs and SONs to enable distributed and semantic-based service discovery. A preliminary evaluation of the system performance shows the suitability of the approach both in terms of recall and number of messages.

Intelligent Control and Automation Part 3

Tuesday, December 1ST, 16:40 – 18:20
Auditorium
Chair: Alberto Landi

Transferring the Progress Control Policy for a Class of Discrete Event Systems

Hiroyuki Goto and Takakazu Tsubokawa

This research develops an intelligent method of transferring progress control policies for a class of repetitive discrete event systems, whose approach is based on Dioid algebra. The commonly used policies include a method that requires precedence constraints regarding processing order relations, and a method where relative processing start and completion times of all facilities need specified. However, in the conventional methods, these frameworks for handling the state equation differ significantly and not been unified yet. Hence, this research proposes a method of transferring the transition matrices, and accomplishes a method of transferring the progress control policy per job.

AAFES: An Intelligent Fuzzy Expert System for Realization of Adaptive Autonomy Concept

Alireza Fereidunian, Mohammad-Ali Zamani, Caro Lucas, Hamid Lesani and Matti Lehtonen

Intelligent control and automation is associated with expert systems; especially, when it needs to human expertise. Earlier we introduced a framework for implementation of adaptive autonomy (AA) in human-automation interaction systems, followed by a data-fusion-equipped expert system to realize that. This paper uses fuzzy sets concept to realize the AA expert system, in a real automation application. The presented adaptive autonomy fuzzy expert system (AAFES) determines the Level of Automation (LOA), adapting it to the changing

Performance Shaping Factors (PSF) of automation system. The paper includes design methodology and implementation results for AAFES, and discussion on results. Results show that AAFES yields proper LOAs, even in the new contingency situations. This is caused by AAFES's higher intelligence than the crisp (binary) one. Moreover, since AAFES deals with fuzzy linguistic PSFs, it more realistically represents the experts' opinion.

The Bi-objective Problem of Distribution of Oil Products by Pipeline Networks Approached by a Particle Swarm Optimization Algorithm

Thatiana C. N. Souza, Elizabeth F. G. Goldbarg and
Marco C. Goldbarg

The distribution of petroleum products through pipeline networks is an important problem that arises in production planning of refineries. It consists in determining what will be done in each production stage given a time horizon, concerning the distribution of products from source nodes to demand nodes, passing through intermediate nodes. Constraints concerning storage limits, delivering time, sources availability, among others, have to be satisfied. This problem can be viewed as a bi-objective problem that aims at minimizing time and the successive transmission of different products in the same pipe. In this paper, a discrete Particle Swarm Optimization algorithm is applied to this problem. The results obtained with the proposed approach are compared with the results obtained by two Genetic Algorithms proposed previously for the problem.

Detection of Similarity of Trajectory of Center of Gravity in Operating Unicycle Uses Motion Capture System

Takahiro Kawasaki, Teruyosho Sadahiro, Masami Iwase and Shoshiro Hatakeyama

Riding a unicycle is good exercise to enhance and keep rider's sense of equilibrium, reflexes and quickness. But a lot of people can not ride a unicycle because its stability. And there are no theoretically to be able to ride a unicycle. A way to do so is that, at first, the model of riding unicycle is simply considered as the cart-pendulum model, then using inputs and outputs obtained by measured data of Motion Capture System(MCS), its controller is able to derived. But a relationship between rider's body manipulations and movements of center of gravity are not unique. because there a lot of way to make same trajectory of center of gravity by different body manipulations. Therefore, in this paper, to understand a way to ride a unicycle by the relationship, a way to decide the similarity of movements of center of gravity is described.

Observer Design using T-S Fuzzy Systems for Pressure Estimation in Hydrostatic Transmissions

Horst Schulte and Patrick Gerland

Hydrostatic transmissions, also called hydrostatic gears, have been widely used in mobile working machines and off-road vehicles such as construction and agricultural machines. This

kind of transmission offers important advantages like continuously variable transmission with high power density, maximum tractive force at low speeds and reversing without changing gear. The automatic electronic control of hydrostatic transmissions, which depend on a number of measurable values, has become more common in industrial practice. To ensure the reliability and safety at least a two-channel redundant system for the measuring channels is required. In this paper, a general model-based approach using a Takagi-Sugeno (T-S) fuzzy observer for analytical redundancy of the oil pressure measuring process in hydrostatic transmissions is developed. It has been shown by experimental results that this approach can be used to estimate the pressure values under varying load conditions and different driving situations.

W10: Consensus and Decision Making Part 2

Tuesday, December 1ST, 16:40 – 18:20
Sala Fermi
Chair: José Luis García-Lapresta

On the Use of the Uncertain Induced OWA Operator and the Uncertain Weighted Average and its Application in Tourism Management

José M. Merigo, Anna M. Gil-Lafuente and Onofre Martorell

We develop a new approach for dealing with uncertain information in a decision making problem about tourism management. We use a new aggregation operator that uses the uncertain weighted average and the uncertain induced ordered weighted averaging (UIOWA) operator in the same formulation. We study some of the main advantages and properties of the new aggregation called uncertain induced ordered weighted averaging - weighted averaging (UIOWAWA) operator. We study its applicability in a decision making problem about the selection of holiday trips. We see that depending on the particular type of UIOWAWA operator used, the results may lead to different decisions.

Measuring Social Welfare through Location and Consensus Measures

José Luis García-Lapresta and Ricardo Alberto Marques Pereira

In this paper we introduce a new procedure for comparing and ordering social welfare situations by considering location, dispersion, consensus and welfare measures generated by exponential means. These measures satisfy interesting properties and generalize some measures used in welfare economics.

Connection among Some Characterizations of Complete Fuzzy Preorders

Susana Díaz, Davide Martinetti, Ignacio Montes and Susana Montes

The concept of (classical) complete preorder can be characterized in several ways. In previous works we have studied whether complete fuzzy preorders can be characterized by the same properties as in the crisp case. We have proven that this is not usually the case. We have studied five possible characterizations and we have proven that only one still characterizes a fuzzy preorder. In this work we study those properties for additive fuzzy preference structures without incomparability. Despite they do not characterize complete fuzzy preorders, they can be related among them. In this contribution we show their connection when the preference structure does not admit incomparable alternatives.

Definition of a Consensual Drug Selection Process in Hospital Universitario Virgen de la Victoria

Jesus M. Doña, Isabel Moya and Jesus López

The adequate and rational drugs selection is considered one of the main objectives in Hospital scenarios. The drugs evaluation for their inclusion in the Hospital Pharmacy requires considering multiple evaluation aspects and criteria where different people are involved with different roles, valuations and preferences with the aim of analyzing a great number of factors and characteristics from a huge number of resources with imprecise assessments. This paper presents a consensus decision model combining quantitative information with fuzzy multigranular linguistic information to support the selection of drugs for their inclusion in the Hospital Universitario Virgen de la Victoria from Málaga.

Strategic Assessment of Business

Jesus M. Doña, Jose I. Peláez and Luis G. Vargas

The stock market volatility and the actual stock exchange activity have increased the need of counting with effective methods on the part of financial analysts to achieve a division in relation to the investment actions, being also growing the demand of methodological instruments that reduce and minimize the risks and uncertainty when valuating financial acts and companies. These systems not only must use quantitative information but the inclusion of qualitative information must also bear heavily on them, as an improvement element in the adjustment of these valuating methods, with the aim of throwing a more well-conceived or less mistaken decision. In this work, we present an alternative strategic assessment of business based in quantitative information.

S8: Intelligent E-Learning Systems

Tuesday, December 1ST, 16:40 – 18:20

Sala Pacinotti

Chairs: Ajith Abraham, Norazah Yusof

Developing Student Model using Kohonen Network in Adaptive Hypermedia Learning System

Bariah Yusob, Siti Mariyam Hj Shamsuddin and Nor Bahiah Ahmad

This paper presents a study on method to develop student model by identifying the students' characteristics in an adaptive hypermedia learning system. The study involves the use of student profiling techniques to identify the features that may be useful to help the researchers have a better understanding of the student in an adaptive learning environment. We propose a supervised Kohonen network with hexagonal lattice structure to classify the student into 3 categories: beginner, intermediate and advance to represent their knowledge level while using the learning system. An experiment is conducted to see the proposed Kohonen network's performances compared to the other types of Kohonen networks in term of learning algorithm and map structure. 10-fold cross validation method is used to validate the network performances. Results from the experiment shows that the proposed Kohonen network produces an average percentage of accuracy, 81.3889% in classifying the simulated data and 51.6129% when applied to the real student data.

OCEAN Project. A Prototype of AIWBES based on Fuzzy Ontology

Francesco Colleoni, Silvia Calegari, Davide Ciucci and Matteo Dominoni

Ocean Project is aimed to realize an Adaptive and Intelligent Web-Based Educational System (AIWBES) working with traditional Learning Management Systems (LMS). It is designed as a collection of open-source libraries (the Omega Framework), so resulting easily customizable and adaptable to the current e-learning platforms. In this new system each course is presented in different ways according to the student's learning level, through to a combined use of ontologies and fuzzy logic.

LS-LAB: a Framework for Comparing Curriculum Sequencing Algorithms

Carla Limongelli, Filippo Sciarrone and Giulia Vaste

Curriculum Sequencing is one of the most appealing challenges in Web-based learning environments: the success of a course mainly depends on the system capability to automatically adapt the learning material to the student's educational needs. Here we address the problem of how to compare and to test different Curriculum Sequencing algorithms in order to reason about them in a self-contained and homogeneous environment. We propose LS-LAB, a framework especially designed for comparing and testing different Curriculum Sequencing algorithms. LS-LAB has been

designed to run different algorithms, each of them provided with its own Student Model representation: a Super Student Model is able to incrementally include all of them. In this framework, the Learning Node has to be compliant to the IEEE LOM specifications, while, through a suitable GUI, one can insert new algorithms or run already available ones. We are carrying out the implementation by using a 3-tier Java application technology, in order to make this environment available on the Internet. Finally we show an application example.

Concept-based Classification for Adaptive Course Sequencing Using Artificial Neural Network

Norsham Idris, Norazah Yusof and Puteh Saad

The task of presenting an optimal personalized learning path in an educational hypermedia system requires much effort and cost particularly in defining rules for the adaptation of learning materials. This research focuses on the adaptive course sequencing method that uses soft computing techniques as an alternative to a rule-based adaptation for an adaptive learning system. In this paper we present recent work concerning concept-based classification of learning object using artificial neural network (ANN). Self Organizing Map (SOM) and Back Propagation (BP) algorithm were employed to discover the connection between the domain concepts contained in the learning object and the learner's learning need. The experiment result shows that this approach is assuring in determining a suitable learning object for a particular student in an adaptive and dynamic learning environment.

A Metrics Suite for Measuring Reusability of Learning Objects

Siti Fadzilah Mat Noor, Norazah Yusof and Siti Zaiton Mohd Hashim

Learning Object (LO) is one of the main research topics in the E-Learning community in the recent years, and most researchers pay attention to the issue of Learning Object Reusability. The most obvious motivation is the economic interest of reusing learning material instead of repeatedly authoring it. Reusability requires the LO to be in a fine-grain form because raw media elements are often much easier to reuse than aggregate assemblies. In other words, as the LO size decreases (lower granularity), its potential for reuse increases. Therefore, when designing learning objects, reusability must be considered as a key consideration. This paper shows how we adapted and applied some of the metrics from the software engineering field for the purpose of measuring reusability of learning objects.

S9: Intelligent Systems for Industrial Processes

Tuesday, December 1ST, 16:40 – 18:20
Sala Galilei

Chairs: Leonardo Maria Reyneri, Valentina Colla

Tutorial: About Industrial Acceptance of Intelligent Systems

Leonardo M. Reyneri

This paper analyzes the stage of maturity that neurofuzzy systems (and soft computing in general) have recently reached and tackles the several reasons why they have not yet reached a widespread acceptance in industrial and agronomic applications, despite the good performance they can offer with a reduced design effort.

Automatic Diagnosis of Defects of Rolling Element Bearings based on Computational Intelligence Techniques

Marco Cococcioni, Beatrice Lazzerini and Sara Lioba Volpi

This paper presents a method, based on classification techniques, for automatic detection and diagnosis of defects of rolling element bearings. We used vibration signals recorded by four accelerometers on a mechanical device including rolling element bearings: the signals were collected both with all faultless bearings and after substituting one faultless bearing with an artificially damaged one. We considered four defects and, for one of them, three severity levels. In all the experiments performed on the vibration signals represented in the frequency domain we achieved a classification accuracy higher than 99%, thus proving the high sensitivity of our method to different types of defects and to different degrees of fault severity. We also assessed the degree of robustness of our method to noise by analyzing how the classification performance varies on variation of the signal-to-noise ratio and using statistical classifiers and neural networks. We achieved very good levels of robustness.

GA-Based Solutions Comparison for Storage Strategies Optimization for an Automated Warehouse

Valentina Colla, Gianluca Nastasi, Nicola Matarese and Leonardo M. Reyneri

The paper analyses the issues behind strategies optimization of an existing automated warehouse for the steelmaking industry. Genetic Algorithms are employed to this purpose by deriving a custom chromosome structure as well as ad-hoc crossover and mutation operators. A comparison between three different solutions able to deal with multiobjective optimization are presented: the first approach is based on a common linear weighting function that combines different objectives; in the second, a fuzzy system is used to aggregate objective functions, while in the last the Strength Pareto Genetic Algorithm is applied in order to exploit a real multiobjective optimization. These three approaches are

described and results are presented in order to highlight benefits and pitfalls of each technique.

Profit Forecasting Using Support Vector Regression for Consulting Engineering Firms

Victor Yepes, Eugenio Pellicer and Francesc J. Ferri

This paper introduces Support Vector Machines (SVM) in the particular field of decision support systems for consulting engineering companies and studies the differences and particularities of the corresponding solutions. A detailed analysis has been performed in order to assess the suitability and adaptability of these methods for the particular task taking into account the risk/benefit tradeoff.

On-Line Neural Network Stator Resistance Estimation in Direct Torque Controlled Induction Motor Drive

Yassine Sayouti, Ahmed Abbou, Mohammed Akherraz and Hassane Mahmoudi

This paper presents an on-line estimation for the stator resistances of the induction motor in the direct torque controlled drive, using artificial neural networks. The variation of stator resistance due to changes in temperature or frequency degrades the performance of such control strategy. In order to solve this issue, a backpropagation algorithm is used for training of the neural network. The error between the desired state variable of an induction motor and the actual state variable of a neural model is back propagated to adjust the weights of the neural model, so that the actual state variable tracks the desired value. Simulation results show the good performance of these resistance estimator and torque response of the drive.

W11: Provisioning of Smart Services in Ontology-Based Systems Part 2

Tuesday, December 1ST, 16:40 – 18:20
AulaB

Chair: Filippo Sciarrone

Product Configurator: an Ontological Approach

Francesco Colace, Massimo De Santo and Paolo Napoletano

Mass customization is one of the most interesting and promising approach in the e-business field. In today's competitive global market the understanding of customer needs and desires is becoming the essential preliminary remark for a successful design and implementation of products. Product development based on customer preferences with applications of innovative technologies is an essential key in order to obtain a larger market share and faster sales growth. In this scenario a tool as the product configurator is becoming a real answer to one of most

important question: how to organize product design to satisfy individual customer need without trading off cost-efficiency of mass production? This paper discusses a novel approach for the design of a smart product configurator. At this moment, in fact, the configurator is just a product viewer for the customer and does not implement any reasoning logics or user adaptive approach. So an ontology based approach is presented. In this methodology three ontologies are introduced: the customer needs ontology, the product functionalities ontology and the product configuration ontology. These ontologies represent the requirement and configuration knowledge that needs for a real customization of the product. The customer has to express his product demands by the use of natural language and by the mapping among the introduced ontologies and the use of a Bayesian Network approach the automatic conversion between customer needs and product configuration is achieved.

WikiArt: an Ontology-based Information Retrieval System for Arts

Roberto Pirrone, Vincenzo Cannella, Orazio Gambino, Arianna Pipitone and Giuseppe Russo

The paper presents WikiArt, a new system integrating three distinct types of contents about the art: data, information, and knowledge, to generate automatically thematic paths to consult all its contents. WikiArt is a wiki, allowing to manage cooperatively documents about artists, artworks, artistic movements or techniques, and so on. It is also an expert system, provided with an ontology about arts, with which it is able to plan possible different ways of consulting and browsing its contents. This ability is made possible by a second part of the ontology of the system, describing a collection of criteria regarding how to plan thematic paths, and by a set of rules followed by the expert system to carry out this task. WikiArt is not a semantic wiki, because the ontology has not been employed to tag semantically the documents by the authors. But only their subjects. Our efforts are now devoted to the extension of the system to make it a semantic wiki too.

An Ontology-based Method for Integrating Heterogeneous Itembanks

Chun-Wei Tsai, Shih-Pang Tseng, Yu-Sheng Yang, Ming-Chao Chiang and Chu-Sing Yang

In this paper, we present a simple but efficient algorithm for integrating a collection of heterogeneous itembanks, called Heterogeneous Itembanks Integrator (HIBI). This algorithm is motivated by the desire to integrate itembanks provided by publishers to the users of an e-Learning system, which generally use different content structures. The proposed algorithm starts off with one of the itembanks as a reference itembank. All the items on the other itembanks are integrated into the reference itembank to create the so-called meta-itembank. Moreover, by treating the metaitembank thus created as the reference itembank, it can be easily extended by using exactly the same algorithm. We also use the concept of ontology to share itemsets with other systems. The experimental results showed that the proposed algorithm can provide an extremely high quality result in terms of both the

relevance of items and the computation time in Chinese itemsets.

Higher Education in the Twenty-first Century. The Chance of Adaptive Learning Environments

Antonella Poce

The keyword which describes in the most effective way Twenty-first century Higher education is suggested by Daniel et al. (2009)[1] and it is "expansion". More and more people will invest in their own education and in this process Higher Education is on the front line. The need for education and training, though, cannot be generic, what nowadays society wants cannot be identified in static knowledge. At the end of the learning path students should be able to employ the outcomes of learning in order to generate new learning. That is why new solutions and methods must be acquired and adopted. Being those the conditions, and having at disposal the undeniable chances that the Internet offers, a possible direction to be undertaken could be the one that drives us directly to the potentialities of distance education performed in adaptive environments. The present contribution aims at analyzing Higher Education present needs, offers a general highlight of adaptive and intelligent web based education systems and concentrates on examples which better respond to the needs previously highlighted.

A Probabilistic Method for Text Analysis

Fabio Clarizia, Massimo De Santo and Paolo Napoletano

Textual materials are source of extremely valuable information, for which there must be a reflection on the techniques of analysis to be used to avoid subjective interpretations especially in the content. The Textual Analysis (TA), which makes use of statistical techniques, ensures the systematic exploration of the structure of the text (size, occurrence, etc.) and simultaneously the possibility to return at any time to the original text for the appropriate interpretations. In this work we test a new technique based on a probabilistic model of language known in the literature as "topic model" for analyzing corpora of documents about electromagnetic pollution. The proposed method is able to reveal how the meaning of a document is distributed all along its spectrum (word-frequency) indicating that the real meaning of a document can be inferred following a multilevel analysis. Such analysis is carried out exploiting a new concept of ontology already used in literature and deeply explained here.

Ontology Merging and Database Schema Integration: An Approach to Identify Semantic Similarity and Resolve Schematic Heterogeneity in Interoperable GIS Application

Nanna Suryana, Shahrin Sahib, Ridwan Habibi, Norayu Abdul Ghani, Zahriah Othman and Ahmad Tajuddin Samsudin

Data and information sharing is driven by the need to maintain more accurate and up to date spatial temporal

database and at the same time reduce the data acquisition and maintenance costs. This paper discusses the need of a database schema integration and ontology merging to support interoperability GIS applications. This enable translation query from one database schema into another to support finally the development of XML-GML based document. Research results shows the potential use of the approaches to solve problems associated with seamless GIS based information sharing.

Intelligent Data mining

Wednesday, December 2ND, 10:40 – 12:40

Auditorium

Chair: Teresa B. Ludermir

An Experimental Study on Unsupervised Clustering-based Feature Selection Methods

Thiago Ferreira Covões and Eduardo Raul Hruschka

Feature selection is an essential task in data mining because it makes it possible not only to reduce computational times and storage requirements, but also to favor model improvement and better data understanding. In this work, we analyze three methods for unsupervised feature selection that are based on the clustering of features for redundancy removal. We report experimental results obtained in ten datasets that illustrate practical scenarios of particular interest, in which one method may be preferred over another. In order to provide some reassurance about the validity and non-randomness of the obtained results, we also present the results of statistical tests.

A Penalty Function for Computing Orthogonal Non-Negative Matrix Factorizations

Nicoletta Del Buono

Nonnegative matrix factorization (NMF) is a widely-used method for multivariate analysis of nonnegative data to obtain a reduced representation of data matrix only using a basis matrix and an encoding variable matrix having non-negative elements. A NMF of a data matrix can be obtained by finding a solution of a nonlinear optimization problem over a specified cost function. In this paper we investigate the formulation and then the computational techniques to obtain orthogonal NMF, when the orthogonal constraint on the columns of the basis is added. We propose a penalty objective function to be minimized on the intersection of the set of non-negative matrices and the Stiefel manifold in order to derive a projected gradient flow whose solutions preserve both the orthogonality and the non-negativity.

Comparison Among Methods for k Estimation in k-means

Murilo C. Naldi, André Fontana and Ricardo J.G.B. Campello

One of the most influential algorithms in data mining, k-means, is broadly used in practical tasks for its simplicity,

computational efficiency and effectiveness in high dimensional problems. However, k-means has two major drawbacks, which are the need to choose the number of clusters, k, and the sensibility to the initial prototypes' position. In this work, systematic, evolutionary and order heuristics used to suppress these drawbacks are compared. 27 variants of 4 algorithmic approaches are used to partition 324 synthetic data sets and the obtained results are compared.

A Possibilistic Approach for Building Statistical Language Models

Saeedeh Momtazi and Hossein Sameti

Class-based n-gram language models are those most frequently-used in continuous speech recognition systems, especially for languages for which no richly annotated corpora are available. Various word clustering algorithms have been proposed to build such class-based models. In this work, we discuss the superiority of soft approaches to class construction, whereby each word can be assigned to more than one class. We also propose a new method for possibilistic word clustering. The possibilistic C-mean algorithm is used as our clustering method. Various parameters of this algorithm are investigated; e.g., centroid initialization, distance measure, and words' feature vector. In the experiments reported here, this algorithm is applied to the 20,000 most frequent Persian words, and the language model built with the clusters created in this fashion is evaluated based on its perplexity and the accuracy of a continuous speech recognition system. Our results indicate a 10% reduction in perplexity and a 4% reduction in word error rate.

A Robust Prediction Method for Interval Symbolic Data

Roberta A.A. Fagundes, Renata M.C.R. de Souza and Francisco José A. Cysneiros

This paper introduces a robust prediction method for symbolic interval data based on the simple linear regression methodology. Each example of the data set is described by feature vector, for which each feature is an interval. Two classic robust regression models are fitted, respectively for range and mid-points of the interval values assumed by the variables in the data set. The prediction of the lower and upper bounds of the new intervals is performed from these fits. To validate this model, experiments with a synthetic interval data set and an application with a cardiology interval-valued data set are considered. The fit and prediction qualities are assessed by a pooled root mean square error measure calculated from learning and test data sets, respectively.

Optimizing Linear and Quadratic Transformations for Classification Tasks

José M. Valls and Ricardo Aler

Many classification algorithms use the concept of distance or similarity between patterns. Previous work has shown that it is advantageous to optimize general Euclidean distances (GED). In this paper, we optimize data transformations, which is equivalent to searching for GEDs, but can be applied to any

learning algorithm, even if it does not use distances explicitly. Two optimization techniques have been used: a simple Local Search (LS) and the Covariance Matrix Adaptation Evolution Strategy (CMA-ES). CMA-ES is an advanced evolutionary method for optimization in difficult continuous domains. Both diagonal and complete matrices have been considered. The method has also been extended to a quadratic non-linear transformation. Results show that in general, the transformation methods described here either outperform or match the classifier working on the original data.

W12: Computational Intelligence for Personalization in Web Content and Service Delivery

Wednesday, December 2ND, 10:40 – 12:40
Sala Fermi

Chairs: Giovanna Castellano, Maria Alessandra Torsello

Modeling User Preferences through Adaptive Fuzzy Profiles

Corrado Mencar, Maria Alessandra Torsello, Danilo Dell'Agnello, Giovanna Castellano and Ciro Castiello

Adaptive software systems are systems that tailor their behavior to each user on the basis of a personalization process. The efficacy of this process is strictly connected with the possibility of an automatic detection of preference profiles, through the analysis of the users' behavior during their interactions with the system. The definition of such profiles should take into account imprecision and gradedness, two features that justify the use of fuzzy sets for their representation. This paper proposes a model for representing preference profiles through fuzzy sets. The model's strategy for adapting profiles to user preferences is to record the sequence of accessed resources by each user, and to update preference profiles accordingly so as to suggest similar resources at next user accesses. Profile adaption is performed continuously, but in earlier stages it is more sensitive to updates (plastic phase) while in later stages it is less sensitive (stable phase) to allow resource suggestion. Simulation results are reported to show the effectiveness of the proposed approach.

Situation-aware Mobile Service Recommendation with Fuzzy Logic and Semantic Web

Alessandro Ciaramella, Mario Giovanni C. A. Cimino, Beatrice Lazzarini and Francesco Marcelloni

Today's mobile Internet service portals offer thousands of services and mobile devices can host plenty of applications, documents and web URLs. Hence, for average mobile users there is an increasing cognitive burden in finding the most appropriate service among the many available. On the other hand, methodologies such as bookmarks and resource tagging require a great arranging effort to handle increasing resources. To help mobile users in managing and using this personal information space, new levels of granularity should be

introduced in the organization of services, together with some degree of self-awareness. This paper proposes a situation-aware service recommender that helps locating services proactively. In the recommender, a semantic layer determines one or more user current situations by using domain knowledge expressed in terms of ontology and semantic rules. A fuzzy inference layer manages the vagueness of some contextual condition of these rules and outputs an uncertainty degree for each situation. Based on this degree, the recommender proposes a set of specific resources.

An Heuristic Approach to Page Recommendation in Web Usage Mining

Antonio Maratea and Alfredo Petrosino

Personalized Web page recommendation is strongly limited by the nature of web logs, the intrinsic complexity of the problem and the tight efficiency requirements. When tackled by traditional Web Usage Mining techniques, due to the presence of an huge number of meaningful clusters and profiles for visitors of a typical highly rated website, the model-based or distance-based methods tend to make too strong and simplistic assumptions or, conversely, to become excessively complex and slow. In this paper, a heuristic "majority intelligence" strategy is designed, that easily adapts to changing navigational patterns, without the costly need to explicitly individuate them before navigation. The proposed approach mimics human behavior in an unknown environment in presence of many individuals acting in parallel and is able to predict with good accuracy and in real time the next page category visited by a user. The method has been tested on real data coming from users who visited a popular website of generic content. Average accuracy on test sets is good on a 17 class problem and, most remarkably, it remains stable as the web navigation goes on.

Recommendations toward Serendipitous Diversions

Leo Iaquina, Marco de Gemmis, Pasquale Lops and Giovanni Semeraro

Recommenders systems are used with various purposes, especially dealing with e-commerce and information filtering tools. Content-based ones recommend items similar to those a given user has liked in the past. Indeed, the past behavior is supposed to be a reliable indicator of her future behavior. This assumption, however, causes the overspecialization problem. Our purpose is to mitigate the problem stimulating users and facilitating the serendipitous encounters to happen. This paper presents the design and implementation of a hybrid recommender system that joins a content-based approach and a serendipitous heuristic in order to provide also surprising suggestions. The reference scenario concerns with personalized tours in a museum and serendipitous items are introduced by slight diversions on the context-aware tours.

A Preliminary Experience in Optimizing the Layout of Web Pages by Genetic Algorithms to Fit Mobile Devices

Luigi Troiano, Gennaro Cirillo, Roberto Armenise and Cosimo Birtolo

Getting access to web content by mobile devices is becoming widespread. This poses the need of adapting content that have been designed for desktop application to being delivered on smaller displays. In this paper we investigate the application of a genetic algorithm as means for an automatic adaptation of existent pages to mobile device requirements, reporting preliminary results and outlining problems to be faced and solved in order to make this approach robust.

A Recommendation Technique for Cultural Heritage Hypermedial Objects

Pierpaolo Di Bitonto, Teresa Roselli and Veronica Rossano

The ever more widespread use of the Web for knowledge sharing has led to the creation of a wide spectrum of opportunities for employing shared information resources and, at the same time, a gradual increase in the technologies for making these resources available. In this scenario, it is important to define new methods and techniques that can support users' search activities and selection of the resources corresponding most closely to their needs. The work is situated in the context of research into recommendation methods for defining systems that can suggest to users what hypermedial resource best fits their specific requirements. The paper proposes a recommendation technique that can elicit relations existing within complex domains so as to be able to suggest semantically correlated hypermedial objects to users according to their requests.

W13: Evolutionary Algorithms and other Metaheuristics for Continuous Optimization Problems - A Scalability Test

Wednesday, December 2ND, 10:40 – 12:40
Sala Pacinotti
Chairs: Francisco Herrera, Manuel Lozano

Memetic Algorithm with Local Search Chaining for Continuous Optimization Problems: A Scalability Test

Daniel Molina, Manuel Lozano and Francisco Herrera

Memetic algorithms arise as very effective algorithms to obtain reliable and high accurate solutions for complex continuous optimization problems. Nowadays, higher dimensional optimization problems are an interesting field of research, that introduces new problems for the optimization process, making recommendable to test the scalable capacities of optimization algorithms. In particular, in memetic

algorithms, a higher dimensionality increases the domain space around each solution, requiring that the local search method must be applied with a high intensity. In this work, we present a preliminar study of a memetic algorithm that assigns to each individual a local search intensity that depends on its features, by chaining different local search applications. This algorithm has obtained good results in continuous optimization problems and we study whether, using this intensity adaptation mechanism with the scalable LS method MTS-LS2, the algorithm is scalable enough for being a good algorithm for medium and high-dimensional problems. Experiments are carried out to test the ability of being scalable, and results obtained show that the proposal is scalable in many of the functions, scalable and non-scalable, of the benchmark used.

Continuous Variable Neighbourhood Search Algorithm Based on Evolutionary Metaheuristic Components: A Scalability Test

Carlos García-Martínez and Manuel Lozano

Variable Neighbourhood Search is a metaheuristic combining three components: generation, improvement, and shaking components. In this paper, we describe a continuous Variable Neighbourhood Search algorithm based on three specialised Evolutionary Algorithms, which play the role of each aforementioned component: 1) an EA specialised in generating a good starting point as generation component, 2) an EA specialised in exploiting local information as improvement component, 3) and another EA specialised in providing local diversity as shaking component. We adopt the experimental framework proposed for the Special Session on Evolutionary Algorithms and other Metaheuristics for Continuous Optimization Problems - A Scalability Test, for the ISDA'09 conference, to test the ability of the model of being scalable for high-dimensional problems.

A Memetic Differential Evolution Algorithm for Continuous Optimization

Santiago Muelas, Antonio LaTorre and José María Peña

Continuous optimization is one of the most active research lines in evolutionary and metaheuristic algorithms. Since CEC 2005 and CEC 2008 competitions, many different algorithms have been proposed to solve continuous problems. Despite there exist very good algorithms reporting high quality results for a given dimension, the scalability of the search methods is still an open issue. Finding an algorithm with competitive results in the range of 50 to 500 dimensions is a difficult achievement. This contribution explores the use of a hybrid memetic algorithm based on the differential evolution algorithm, named MDE-DC. The proposed algorithm combines the explorative/exploitative strength of two heuristic search methods, that separately obtain very competitive results in either low or high dimensional problems. This paper uses the benchmark problems and conditions required for the workshop on "evolutionary algorithms and other metaheuristics for Continuous Optimization Problems - A Scalability Test" chaired by Francisco Herrera and Manuel Lozano.

An Adaptive Memory Procedure for Continuous Optimization

Abraham Duarte, Rafael Marti and Fred Glover

In this paper we consider the problem of finding a global optimum of an unconstrained multimodal function within the framework of adaptive memory programming, focusing on an integration of the Scatter Search and Tabu Search methodologies. Computational comparisons are performed on a test-bed of 11 types of problems. For each type, four problems are considered, each one with dimension 50, 100, 200 and 500 respectively; thus totalling 44 instances. Our results show that the Scatter Tabu Search procedure is competitive with the state-of-the-art methods in terms of the average optimality gap achieved.

A Scalability Test for Accelerated DE Using Generalized Opposition-based Learning

Hui Wang, Zhijian Wu, Shahryar Rahnamayan and Lishan Kang

In this paper a scalability test over eleven scalable benchmark functions, provided by the current workshop (Evolutionary Algorithms and other Metaheuristics for Continuous Optimization Problems - A Scalability Test), are conducted for accelerated DE using generalized opposition-based learning (GODE). The average error of the best individual in the population has been reported for dimensions 50, 100, 200, and 500 in order to compare with the results of other algorithms which are participating in this workshop. Current work is based on opposition-based differential evolution (ODE) and our previous work, accelerated PSO by generalized OBL.

Unidimensional Search for Solving Continuous High-dimensional Optimization Problems

Vincent Gardeux, Rachid Chelouah, Patrick Siarry and Fred Glover

This paper presents a performance study of two versions of a unidimensional search algorithm aimed at solving high-dimensional optimization problems. The algorithms were tested on 11 scalable benchmark problems. The aim is to observe how metaheuristics for continuous optimization problems respond with increasing dimension. To this end, we report the algorithms' performance on the 50, 100, 200 and 500-dimension versions of each function. Computational results are given along with convergence graphs to provide comparisons with other algorithms during the conference and afterwards.

W14: Educational Data Mining

Wednesday, December 2ND, 10:40 – 12:40

Sala Galilei

Chair: Sebastián Ventura

Mining Models for Failing Behaviors

Cláudia Antunes

Understanding the causes for failure is one of the bottlenecks in the educational process. Despite failure prediction has been pursued, models behind that prediction, most of the time, do not give a deep insight about failure causes. In this paper, we introduce a new method for mining fault trees automatically, and show that these models are a precious help on identifying direct and indirect causes for failure. An experimental study is presented in order to access the drawbacks of the proposed method.

Checking the Reliability of GeSES: Method for Detecting Symptoms of Low Performance

Javier Bravo, Estefania Martin, Alvaro Ortigosa and Rosa M. Carro

In the last years the development of learning environments, and particularly of Educational Adaptive Hypermedia (EAH) systems has increased significantly. However, it is important to complement this development with evaluation methods in order to improve EAH system performance. In this context, we propose to analyze the data from student interaction with EAH systems utilizing the GeSES method. This method has been specifically designed to work with student logs and is based on C4.5 rules. In particular, the work described in this paper aims to achieve the following two objectives: testing the method with different types of data in order to find out its reliability, and detecting symptoms of low performance in a specific adaptive learning environment, called CoMoLE.

From Local Patterns to Global Models: Towards Domain Driven Educational Process Mining

Nikola Trčka and Mykola Pechenizkiy

Educational process mining (EPM) aims at (i) constructing complete and compact educational process models that are able to reproduce all observed behavior (process model discovery), (ii) checking whether the modeled behavior (either pre-authored or discovered from data) matches the observed behavior (conformance checking), and (iii) projecting information extracted from the logs onto the model, to make the tacit knowledge explicit and facilitate better understanding of the process (process model extension). In this paper we propose a new domain-driven framework for EPM which assumes that a set of pattern templates can be predefined to focus the mining in a desired way and make it more effective and efficient. We illustrate the ideas behind our approach with examples of academic curricular modeling, mining, and conformance checking, using the student database of our department.

Predicting Academic Achievement Using Multiple Instance Genetic Programming

Amelia Zafra, Cristóbal Romero and Sebastián Ventura

The ability to predict a student's performance could be useful in a great number of different ways associated with university-level learning. In this paper, a grammar guided genetic programming algorithm, G3P-MI, has been applied to predict if the student will fail or pass a certain course and identifies activities to promote learning in a positive or negative way from the perspective of MIL. Computational experiments compare our proposal with the most popular techniques of Multiple Instance Learning (MIL). Results show that G3P-MI achieves better performance with more accurate models and a better trade-off between such contradictory metrics as sensitivity and specificity. Moreover, it adds comprehensibility to the knowledge discovered and finds interesting relationships that correlate certain tasks and the time devoted to solving exercises with the final marks obtained in the course.

Discovering Learning Objects Usability Characteristics

Alfredo Zapata, Victor H. Menendez and Manuel E. Prieto

Metadata is the key to describe Learning Objects. Through them, we can search and reuse these resources. However, there are pedagogical and usability characteristics that metadata do not normally contain. Sources of additional information such as activity log registers in repositories can help to specify such attributes. Data mining techniques allow identifying Learning Objects usability characteristics. This paper presents the results of applying a knowledge extraction methodology to Learning Objects through the use of four data sources: metadata, pedagogical quality evaluations, user's profiles, and log files from Learning Objects management systems.

Time Analysis of Forum Evolution as Support Tool for E-Moderating

Carlo Alberto Bentivoglio

The web forum is a key tool in new knowledge building among students in Learning Management Systems. Unfortunately, the huge number of messages makes difficult, for tutors and teachers, to correctly evaluate the evolution of the forum and its efficacy in the learning process. In order to support the tutors in this effort, a solution, based on simple statistical indices inspired by the work in the text analysis and social network analysis field, is proposed. The obtained results show good performance with a minimum computational effort.

W15: Data Mining and Ontologies Models, Applications and Solutions Part 1

Wednesday, December 2ND, 10:40 – 12:40

AulaB

Chair: Silvio Bortoleto

MAHATMA: A Genetic Programming-Based Tool for Protein Classification

Denise F. Tsunoda, Alex A. Freitas and Heitor S. Lopes

Proteins can be grouped into families according to some features such as hydrophobicity, composition or structure, aiming to establish common biological functions. This paper presents a system that was conceived to discover features (particular sequences of amino acids, or motifs) that occur very often in proteins of a given family but rarely occur in proteins of other families. These features can be used for the classification of unknown proteins, that is, to predict their function by analyzing their primary structure. Experiments were done with a set of enzymes extracted from the Protein Data Bank. The heuristic method used was based on Genetic Programming using operators specially tailored for the target problem. The final performance was measured using sensitivity (Se) and specificity (Sp). The best results obtained for the enzyme dataset suggest that the proposed evolutionary computation method is very effective to find predictive features (motifs) for protein classification.

A Strategy for Biodiversity Knowledge Acquisition based on Domain Ontology

Andréa Corrêa Flôres Albuquerque, José Laurindo Campos dos Santos and José Francisco de Magalhães Netto

Convention on Biological Diversity (CBD) recognizes that biodiversity loss must be reduced to promote poverty alleviation and direct benefit of all live on Earth. To achieve that, we must consider robust strategies and action plans based on knowledge and state of art technology. Parallel to that, research is underway in universities and scientific organization aiming to develop semantic web as an additional resource associated to formal ontology and the avoidance of knowledge acquisition problems such as expertise dependence, tacit knowledge, experts' availability and ideal time importance. Ontology can structure knowledge acquisition process for the purpose of comprehensive, portable machine understanding and knowledge extraction on the semantic web environment. These technologies applied to biodiversity domain can be a valuable resource for CBD. The paper presents a strategy for biodiversity knowledge acquisition based on a negotiation protocol which uses domain ontology to extract knowledge from data sources in the semantic web domain.

A Fast Algorithm for Mining Rare Itemsets

Luigi Troiano, Giacomo Scibelli and Cosimo Birtolo

Mining patterns in large databases is a challenging task facing NP-hard problems. Research focused attention on the most occurrent patterns, although less frequent patterns still offer interesting insights. In this paper we propose a new algorithm for discovering infrequent patterns and compare it to other solutions.

Developing an Implementation through a Modeling of the Database for Cardiovascular Monitoring

Hugo Bulegon, Silvio Bortoleto and Angelmar Constantino Roman

The Cardiovascular diseases are the most responsible for the deaths among adults in most of the world. Facilitate the clinical management in primary health care is essential to improve efficiency and to reduce morbidity and mortality. This article describes about a software focused on the management of major cardiovascular risk factors - CRF (diabetes, hypertension, dyslipidemia, smoking and others). After the registration and based in the clinical guidelines, the software can stratified levels of cardiovascular risk. According to the level of risk, provides summary clinical information for management and through the processing of the results of subsequent laboratory tests, monitor the targets for therapies, according to the level of achievement of results, indicates maintenance or intensification of care. There are described and evaluated other systems or outpatient hospital and use of Entity-Relationship Diagrams to subsidized the development of software.

An FCD Information Processing Model under Traffic Signal Control

Weifeng Lv, Leishi Xu, Tongyu Zhu, Dongdong Wu and Bowen Du

Nowadays Float Car Data (FCD) is playing an important role in real-time traffic information systems. However, traffic signal control in urban road network will cause random delay on float cars, and this kind of delay will result in considerable fluctuation of travel time. Thus, the accuracy of FCD system is seriously affected. In this paper, float car refining models are proposed to calculate the stopped-time delay by means of low-sampling-rate FCD. And then, the classification of controlled delay and non-controlled delay is performed in order to remove traffic signal control's affection, and to obtain the data which can truly reflect the traffic flow characteristics. The contrast experiments indicate that the accuracy of the FCD system has achieved significant improvement after applying the new processing model.

Designing a Conceptual Model for Herbal Research Domain using Ontology Technique

Azlida Mamat and Azizah Abdul Rahman

This paper demonstrates a conceptual model for herbal research domain using ontology technique. Important

information in herbal research domain have been identified through interview sessions conducted on groups of herbs researchers in fields of engineering, medical and botany. The variation of information gathered led to the difficulty of database design. However, we propose a methodology for the development of conceptual model using ontology technique, with adoption of four extended relationship components. It covers relationships of temporal, prerequisite, mutually inclusive and mutually exclusive. In order to ensure the conceptual model is well defined, a set of rules for keyword searching is created to verify preciseness of output produced. The rules created in this paper will be executed on Herbal Research E-Centre prototype.

Intelligent Knowledge Management

Wednesday, December 2ND, 13:50 – 15:30

Auditorium

Chair: Vincenzo Loia

Some Basic Results of Fuzzy Research in the ISI Web of Knowledge

José María Merigó and Ana M. Gil-Lafuente

We present an overview of fuzzy research according to the results found in the ISI Web of Knowledge. Among the different ways and particular results to be used, we have selected the most cited articles, the top authors, the top journals, the evolution by years, and the top countries. Note that the results given in the paper are only a general overview because the rankings can be developed in different ways depending on the variables that we want to take into account.

On the Role of Dialogue and Argumentation in Collaborative Problem Solving

Nadim Obeid and Asma Moubaidin

In this paper, we make a first step towards a formal model of dialogue and argumentation for a multi-agent problem solving. We shall present a multi-agent system for problem solving. We shall the notion of collaborative problem solving and discuss some of the related communication issues. We propose a Partial Information State based framework for dialogue and argumentation. We shall employ a three-valued based nonmonotonic logic for representing and reasoning about partial information. We show via an example that the system can handle collaborative problem-solving tasks.

Inductive Query Answering and Concept Retrieval Exploiting Local Models

Claudia d'Amato, Nicola Fanizzi, Floriana Esposito and Thomas Lukasiewicz

We present a classification method, founded in the instance-based learning and the disjunctive version space approach, for performing approximate retrieval from knowledge bases expressed in Description Logics. It is able to supply answers, even though they are not logically entailed by the knowledge

base (e.g. because of its incompleteness or when there are inconsistent assertions). Moreover, the method may also induce new knowledge that can be employed to make the ontology population task semi-automatic. The method has been experimentally tested showing that it is sound and effective.

Order Independent Incremental Evolving Fuzzy Grammar Fragment Learner

Nurfadhlina Mohd Sharef, Trevor Martin and Yun Shen

It is generally known that most incremental learning systems are order dependent, i.e provide results that depend on the particular order of the data presentation. Our previous work has developed an incremental soft computing algorithm which can be applied to learn text fragment patterns in semi-structured texts. A set of fuzzy grammar fragments is evolved, able to recognize the string set used as examples and any similar strings. Slight modification of the grammar fragments is performed to learn new patterns. This paper investigates the theoretical aspects of order-independence in the algorithm and shows that equivalent grammar fragments are produced irrespective of the order in which illustrative examples are presented.

Automatic Labeling Of Topics

Davide Magatti, Silvia Calegari, Davide Ciucci and Fabio Stella

An algorithm for the automatic labeling of topics accordingly to a hierarchy is presented. Its main ingredients are a set of similarity measures and a set of topic labeling rules. The labeling rules are specifically designed to find the most agreed labels between the given topic and the hierarchy. The hierarchy is obtained from the Google Directory service, extracted via an ad-hoc developed software procedure and expanded through the use of the OpenOffice English Thesaurus. The performance of the proposed algorithm is investigated by using a document corpus consisting of 33,801 documents and a dictionary consisting of 111,795 words. The results are encouraging, while particularly interesting and significant labeling cases emerged

S10: Intelligent Systems and Data Mining Techniques for Bioinformatics

Wednesday, December 2ND, 13:50 – 15:30
Sala Fermi
Chair: Raúl Giráldez

Optimization of Multi-classifiers for Computational Biology: Application to the Gene Finding Problem

Rocio Romero-Zaliz, Coral del Val and Igor Zwir

Genomes of many organisms have been sequenced over the last few years. However, transforming such raw sequence data into knowledge remains a hard task. A great number of prediction programs have been developed to address part of this problem: the location of genes along a genome. We propose a multiobjective methodology to combine algorithms into an aggregation scheme in order to obtain optimal methods' aggregations. Results show a major improvement in specificity and sensitivity when our methodology is compared to the performance of individual methods for gene finding problems. The here proposed methodology is an automatic method generator, and a step forward to exploit all already existing methods, by providing optimal methods' aggregations to answer concrete queries for a certain biological problem with a maximized accuracy of the prediction. As more approaches are integrated for each of the presented problems, de novo accuracy can be expected to improve further.

An Overlapping Control-Biclustering Algorithm from Gene Expression Data

Juan A. Nepomuceno, Alicia Troncoso and Jesús S. Aguilar-Ruiz

In this paper a hybrid metaheuristic for biclustering based on Scatter Search and Genetic Algorithms is presented. A general scheme of Scatter Search has been used to obtain high-quality biclusters, but a way of generating the initial population and a method of combination based on Genetic Algorithms have been chosen. Moreover, in the own algorithm the overlapping among biclusters is controlled adding a penalization term in the fitness function. Experimental results from yeast cell cycle are reported. Finally, the performance of the proposed hybrid algorithm is compared with a genetic algorithm recently published.

Similarity Analysis of Protein Binding Sites: A Generalization of the Maximum Common Subgraph Measure Based on Quasi-Clique Detection

Imen Boukhris, Zied Elouedi, Thomas Fober, Marco Mernberger and Eyke Hüllermeier

Protein binding sites are often represented by means of graphs capturing their most important geometrical and physicochemical properties. Searching for structural similarities and identifying functional relationships between them can thus be reduced to matching their corresponding

graph descriptors. In this paper, we propose a method for the structural analysis of protein binding sites that makes use of such matching techniques to assess the similarity between proteins independently of sequence or fold homology. More specifically, we propose a similarity measure that generalizes the commonly used maximum common subgraph measure in two ways. First, using algorithms for so-called quasi-clique detection, our measure is based on maximum 'approximately' common subgraphs, a relaxation of maximum common subgraphs which is tolerant toward edge mismatches. Second, instead of focusing on equivalence, our measure is a compromise between a generalized equivalence and an inclusion measure. An experimental study is presented to illustrate the effectiveness of the method and to show that both types of relaxation are useful in the context of protein structure analysis.

Efficient Construction of Multiple Geometrical Alignments for the Comparison of Protein Binding Sites

Thomas Fober, Gerhard Klebe and Eyke Huellermeier

We proceed from a method for protein structure comparison in which information about the geometry and physico-chemical properties of such structures are represented in the form of labeled point clouds, that is, a set of labeled points in three-dimensional Euclidean space. Two point clouds are then compared by computing an optimal spatial superposition. This approach has recently been introduced in the literature and was shown to produce very good similarity scores. It does not, however, establish an alignment in the sense of a one-to-one correspondence between the basic units of two or more protein structures. From a biological point of view, alignments of this kind are of great interest, as they offer important information about evolution, heredity, and the mutual correspondence between molecular constituents. In this paper, we therefore developed a method for computing pairwise or multiple alignments of protein structures on the basis of labeled point cloud superpositions.

Optimizing Multiple Sequence Alignment by Improving Mutation Operators of a Genetic Algorithm

Fernando José Mateus da Silva, Juan Manuel Sánchez Pérez, Juan Antonio Gómez Pulido and Miguel A. Vega Rodríguez.

Searching for the best possible alignment for a set of sequences is not an easy task, mainly because of the size and complexity of the search space involved. Genetic algorithms are predisposed for optimizing general combinatorial problems in large and complex search spaces. We have designed a Genetic Algorithm for this purpose, AlineaGA, which introduced new mutation operators with local search optimization. Now we present the contribution that these new operators bring to this field, comparing them with similar versions present in the literature that do not use local search mechanisms. For this purpose, we have tested different configurations of mutation operators in eight BAliBASE alignments, taking conclusions regarding population evolution and quality of the final results. We conclude that the new operators represent an improvement in this area, and that their combined use with

mutation operators that do not use optimization strategies, can help the algorithm to reach quality solutions.

W16: Neural Networks and Neuro-Fuzzy Systems Part 1

Wednesday, December 2ND, 13:50 – 15:30

Sala Pacinotti

Chair: Luis Javier Herrera

Risk Factor Identification and Classification of Macrosomic Newborns by Neural Networks

Alberto Guillen, Andrea Martinez-Trujillo, Gines Rubio, Ignacio Rojas, Hector Pomares and Luis Javier Herrera

This paper presents a first approach to try to determine if a newborn will be macrosomic before the labor, using a set of data taken from the mother. The problem of determining if a newborn is going to be macrosomic is important in order to plan cesarean section and other problems during the labor. The proposed model to classify the weight is a Neural Network whose design is based recent algorithms that will allow the networks to focus on a concrete class. Before proceeding with the design methodology to obtain the models, a previous step of variable selection is performed in order to identify the risk factors and to avoid the curse of dimensionality. Another study is made regarding the missing values in the database since the data were not complete for all the patients. The results will show how useful the addition of the missing values into the original data set can be in order to identify new risk factors.

A Data Mining Approach Based on a Local-Global Fuzzy Modelling for Prediction of Color Change after Tooth Bleaching using Vita Classical Shades

Luis J. Herrera, María del Mar Pérez, Janiley Santana, Rosa Pulgar, Jesús González, Héctor Pomares and Ignacio Rojas

Tooth bleaching is receiving an increasing interest by patients and dentists since it is a relatively non-invasive approach for whitening and lightening teeth. Instrument designed for tooth color measurements and visual assessment with commercial shade guides are nowadays used to evaluate the tooth color. However, the degree of color change after tooth bleaching varied substantially among studies and currently, there are no objective guidelines to predict the effectiveness of a tooth bleaching treatment. Fuzzy Logic is a well known paradigm for data modelling; their main advantage is their ability to provide an interpretable set of rules that can be later used by the scientists. However these models have the problem that the global approximation optimization can lead to a deficient rule local modelling. This work proposes a modified fuzzy model that performs a simultaneous global and local modelling. This property is reached thanks to a special partitioning of the input space in the fuzzy system. The proposed approach is used to approximate a set of color measurements taken after a bleaching treatment using the pre-

bleaching measurements. The system uses as rule antecedents the colorimetric values of the VITA commercial shade guide. The expected post-bleaching colorimetric values are immediately obtained from the local models (rules) of the system thanks to the proposed modified fuzzy model. Additionally, these post-bleaching CIELAB coordinate values have been associated with VITA shades through the evaluation of their respective membership functions, approximating which VITA shades are expected after the treatment for each pre-bleaching VITA shade.

Trajectory Tracking of Complex Dynamical Network for Recurrent Neural Network Via Control V-Stability

José P. Pérez, Joel Pérez, Jorge A. González

In this paper the problem of trajectory tracking is studied. Based on the V-stability and Lyapunov theory, a control law that achieves the global asymptotic stability of the tracking error between a recurrent neural network and the state of each single node of a complex dynamical network is obtained. To illustrate the analytic results we present a tracking simulation of a simple network with four different nodes and five non-uniform links

General Purpose Input Variables Extraction: A Genetic Algorithm based Procedure GIVE A GAP

Silvia Cateni, Valentina Colla and Marco Vannucci

The paper presents an application of genetic algorithms to the problem of input variables selection for the design of neural systems. The basic idea of the proposed method lies in the use of genetic algorithms in order to select the set of variables to be fed to the neural networks. However, the main concept behind this approach is far more general and does not depend on the particular adopted model: it can be used for a wide category of systems, also non-neural, and with a variety of performance indicators. The proposed method has been tested on a simple case study, in order to demonstrate its effectiveness. The results obtained in the processing of experimental data are presented and discussed.

A Fuzzy Wavelet Neural Network Model for System Identification

Sevcan Yilmaz and Yusuf Oysal

In this paper, a fuzzy wavelet neural network model is proposed for system identification problems. The proposed model is obtained from the traditional Takagi-Sugeno-Kang (TSK) fuzzy system by replacing the consequent part of fuzzy rules with wavelet basis functions that have time-frequency localization properties. We use a radial function of Mexican Hat wavelet in the consequent part of each rule. A fast gradient algorithm based on quasi-Newton methods is used to obtain the optimal values for unknown parameters of the model. Simulation results of some benchmark problems in the literature are also given to illustrate the effectiveness of the model.

Workshop W17: Soft Computing and Image Processing Part 1

Wednesday, December 2ND, 13:50 – 15:30

Sala Galilei

Chair: Humberto Bustince

Assessment of Asymmetry in Pyramidal Tract by Using Fiber Tracking

Fatima Tensaouti, Jean Albert Lotterie, Perrine Clarisse and Isabelle Berry

Diffusion Tensor Imaging (DTI) and tractography are able to model fiber architecture within the white matter and become a major component of clinical neuroradiology. The challenge is to answer neuro-anatomic questions by using group studies. In some diseases, the asymmetry between involved tracts is expected to be greater than that in controls. If the quantitative detection of asymmetry is sufficiently sensitive, it will be a good marker of clinically relevant tract-specific abnormalities. In this work, we quantify the range of asymmetry between the right and left pyramidal tract (PT) and explore the side and handedness effects on the microstructure of the PT in healthy subjects by using a probabilistic tractography. The volume and seven DTI parameters (fractional anisotropy (FA), mean, perpendicular and parallel diffusivity, geometric diffusion measures) were determined. The statistical analysis revealed substantial PT asymmetries and an average correlation between FA, mean diffusivity and the laterality quotient.

A A-IFSs Based Image Segmentation Methodology for Gait Analysis

Pedro Couto, Vitor Filipe, Pedro Melo-Pinto, Humberto Bustince and Edurne Barrenechea

In this work, image segmentation is addressed as the starting point within a motion analysis methodology intended for biomechanics behavior characterization. First, we propose a general segmentation framework that uses Atanassov's intuitionistic fuzzy sets (A-IFSs) to determine the optimal image threshold value. Atanassov's intuitionistic fuzzy index values are used for representing the unknowledge/ignorance of an expert on determining whether a pixel belongs to the background or the object of the image. Then, we introduce an extension of this methodology that uses a heuristic based multi-threshold approach to determine the optimal threshold. Experimental results are presented.

A 3D Lifting Based Method Augmented by Motion Compensation for Video Coding

Sedat Telceken, Sukru Gorgulu and Omer N. Gerek

This study introduces a spatio-temporal lifting based algorithm to be used in compression of video signals. The temporal correlation of consecutive frames causes temporal redundancies, which are subject to lifting-like motion predictive compression. Similarly, neighbouring pixels are correlated within each frame. A method that uses both

correlations might be 3D lifting-based decomposition. In this study, block-based motion compensation is added to the classical 3D lifting method. Domain of motion compensation is first selected as free, and then reverse-symmetric. It is observed that reverse-symmetric motion compensation improves the performance of the prediction step in 3D lifting based coding.

A Structural Approach to Image Segmentation

Daniel Gómez, Javier Montero and Javier Yáñez

In this work we propose an efficient and polynomial algorithm for the graph segmentation problem based on the coloring problem for graphs. The work here presented extend the algorithm published in [10] making possible the segmentation to any class of graph (not only fuzzy-valued planar graphs) and also improving the computational complexity of the previous work.

Noisy Image Edge Detection Using an Uninorm Fuzzy Morphological Gradient

Manuel González-Hidalgo, Arnau Mir Torres and Joan Torrens Sastre

Medical images edge detection is one of the most important pre-processing steps in medical image segmentation and 3D reconstruction. In this paper, an edge detection algorithm using an uninorm-based fuzzy morphology is proposed. It is shown that this algorithm is robust when it is applied to different types of noisy images. It improves the results of other well-known algorithms including classical algorithms of edge detection, as well as fuzzy-morphology based ones using the Lukasiewicz t-norm and umbra approach. It detects detailed edge features and thin edges of medical images corrupted by impulse or gaussian noise. Moreover, some different objective measures have been used to evaluate the filtered results obtaining for our approach better values than for other approaches.

W15: Data Mining and Ontologies Models, Applications and Solutions Part 2

Wednesday, December 2ND, 13:50 – 15:30

AulaB

Chair: Katia Bortoletto

Potential Data Mining Classification Techniques for Academic Talent Forecasting

Hamidah Jantan, Abdul Razak Hamdan and Zulaiha Ali Othman

Classification and prediction are among the major techniques in Data mining and widely used in various fields. In this article we present a study on how some talent management problems can be solved using classification and prediction techniques in Data mining. By using this approach, the talent

performance can be predicted by using past experience knowledge discovered from the existing database. In the experimental phase, we have used selected classification and prediction techniques to propose the appropriate techniques from our training dataset. An example is used to demonstrate the feasibility of the suggested classification techniques using academician performance data. Thus, by using the experiments results, we suggest the potential classification techniques for academic talent forecasting.

Equalizing the Structures of Web Communities in Ontology Development Tools

Francesca Arcelli Fontana, Raffaele Ferrante Formato and Remo Pareschi

In this paper we face some relevant issues on the relations between web communities and ontologies. We build an operator that constructs a weak Web Community, according to the definition given in [16], starting from a seed of web sites. The necessity of such an operator is derived from a problem arisen in the model developed in [3], in which some relevant concepts in automotive oriented ontology were not given a corresponding Web community. This fact –if not considered– can bring automatic ontology development ([9,18]) to some non-correct results. In this work we define and analyze a new operator, called Com, with the tools furnished by the method of parametrization ([8,15]) and we find that, given a seed S and the induced graph I(S), the community generated by our operator is monotonic with respect to clustering and is denser than the original graph I(S).

Searching Common Pattern in Agents Behaviors with Usage of FCA

Petr Gajdoš and Michal Radecký

MAS operation brings quite a number of tasks related to behaviors of intelligent agents. More precisely, understanding of agents behaviors and their relationships enables to optimize the whole MAS architecture. The usage of FCA in the area of Multi-agent systems can facilitate solutions of several tasks and/or point to certain data relations, which should be further analyzed in more detail. This paper briefly describes the Triadic Formal Concept Analysis (FCA) which helps us to find some hidden information on MAS and agents interaction. The process of FCA integration within MAS is illustrated on the area of traffic simulation.

Vertical Mining of Frequent Patterns Using Diffset Groups

Laila A. Abd El-Megid, Mohamed E. El-Sharkawi, Laila M. El-Fangary and Yehia K. Helmy

Frequent patterns discovery is a core functionality used in many mining tasks and large broad application. In this paper, we present a new algorithm, VMUDG, for vertical mining of frequent itemsets. The proposed algorithm adapts a new efficient approach that classifies all frequent 2-itemsets into separate groups according to their diffsets. Using these groups, the proposed algorithm offers three new distinct features; First, it allows calculating the support of N itemsets

($N > 0$) using one calculation process rather than N calculation processes. Second, it offers a chance to reduce the time needed for the manipulation of the itemsets diffsets. Third, it minimizes the need for checking the frequency condition for every itemset. A performance study of the proposed algorithm has been conducted. Several experiments show that the algorithm outperforms the well known dEclat algorithm.

Hybrid Systems

Wednesday, December 2ND, 15:50 – 17:50

Auditorium

Chair: Eduardo Raul Hruschka

Integration of Graphical Modeling with Fuzzy Clustering for Casual Relationship of Electric Load Forecasting

Hiroyuki Mori and Wenjun Jiang

This paper proposes a new method for selecting input variables in short-term electric load forecasting models. It is known that input and output variables do not follow the Gaussian distribution in load forecasting. In this paper, a hybrid method of Graphical Modeling (GM) and Deterministic Annealing EM (DAEM) clustering is presented to clarify causal relationship between the explained one-step-ahead electric load and the explanatory variables. GM is effective for estimating the relationship between variables with the Gaussian distribution. The DAEM algorithm is used to decompose non-Gaussian data into clusters of Gaussian data so that GM is applied to Gaussian data in clusters. The proposed method is successfully applied to the real data.

Testing for Serial Independence of the Residuals in the Framework of Fuzzy Rule-based Time Series Modeling

José Luis Aznarte M., Antonio Arauzo-Azofra and José M. Benítez-Sánchez

In this paper, we propose a new diagnostic checking tool for fuzzy rule-based modelling of time series. Through the study of the residuals in the Lagrange Multiplier testing framework we devise a hypothesis test which allows us to determine if there is some left autocorrelation in the error series. This is an important step towards a statistically sound modelling strategy for fuzzy rule-based models.

Efficient Computation Methods for the Kleene Star in Max-Plus Linear Systems

Hiroyuki Goto and Munenori Kasahara

This research proposes efficient calculation methods for the transition matrices in discrete event systems, where the adjacency matrices are represented by directed acyclic graphs. The essence of the research focuses on obtaining the Kleene Star of an adjacency matrix. Previous studies have proposed

methods for calculating the longest paths focusing on destination nodes. However, in these methods the chosen algorithm depends on whether the adjacency matrix is sparse or dense. In contrast, this research calculates the longest paths focusing on source nodes. The proposed methods are more efficient than the previous ones, and are attractive in that the efficiency is not affected by the density of the adjacency matrix.

Using Smart Sampling to Discover Promising Regions and Increase the Efficiency of Differential Evolution

Vinícius Veloso de Melo and Alexandre C.B. Delbem

This paper presents a novel method to discover promising regions in a continuous search space. Using machine learning techniques, the algorithm named Smart Sampling was tested in hard known benchmark functions, and was able to find promising regions with solutions very close to the global optimum, significantly decreasing the number of evaluations needed by a metaheuristic to finally find this global optimum, when heuristically started inside a promising region. Results show favorable agreement with theories which state the importance of an adequate starting population. The results also present significant improvement in the efficiency of the tested metaheuristic, without adding any parameter, operator or strategy. Being a technique which can be used by any populational metaheuristic, the work presented here has profound implications for future studies of global optimization and may help solve considerably difficult optimization problems.

EACImpute: An Evolutionary Algorithm for Clustering-Based Imputation

Jonathan de Andrade Silva and Eduardo Hruschka

We describe an imputation method (EACImpute) that is based on an evolutionary algorithm for clustering. This method relies on the assumption that clusters of (partially unknown) data can provide useful information for imputation purposes. Experimental results obtained in 5 data sets illustrate different scenarios in which EACImpute performs similarly to widely used imputation methods, thus becoming eligible to join a pool of methods to be used in practical applications. In particular, imputation methods have been traditionally only assessed by some measures of their prediction capability. Although this evaluation is useful, we here also discuss the influence of imputed values in the classification task. Finally, our empirical results suggest that better prediction results do not necessarily imply in less classification bias.

Intelligent Image and Signal Processing

Wednesday, December 2ND, 15:50 – 17:50
Sala Fermi
Chair: Beatrice Lazzerini

Intracellular Volume Registration

Shin Yoshizawa, Satoko Takemoto, Miwa Takahashi, Makoto Muroi, Sayaka Kazami, Hiromi Miyoshi and Hideo Yokota

The paper proposes a novel 3D image registration approach to calculating intracellular volumes. The approach extends a standard image registration framework to the curved cell geometry. An intracellular volume is mapped onto another intracellular domain by using two pairs of point set surfaces approximating their nuclear and plasma membranes. The approach is implemented to an interactive volume registration system. We demonstrate that our approach can create models of cells with multiple organelles from data collected from living cells.

Algorithm Selection for Intracellular Image Segmentation based on Region Similarity

Satoko Takemoto and Hideo Yokota

This paper deals with the problem of intracellular image segmentation. Our goal is to propose an algorithm selection framework that has the potential to be general enough to be used for a variety of intracellular image segmentation tasks. With this framework, an optimal algorithm suited to each segmentation task can be selected automatically by our proposed evaluation criteria derived from region similarity of image features and boundary shape. Furthermore, using our framework, we can rank different algorithms, as well as define each algorithm's parameters. We tested our prototype framework on confocal microscope images and showed that application of these criteria gave highly accurate segmentation results without missing any biologically important image characteristics.

Effective Feature Selection for Mars McMurdo Terrain Image Classification

Changjing Shang, Dave Barnes and Qiang Shen

This paper presents a novel study of the classification of large-scale Mars McMurdo panorama image. Three dimensionality reduction techniques, based on fuzzy-rough sets, information gain ranking, and principal component analysis respectively, are each applied to this complicated image data set to support learning effective classifiers. The work allows the induction of low-dimensional feature subsets from feature patterns of a much higher dimensionality. To facilitate comparative investigations, two types of image classifier are employed here, namely multi-layer perceptrons and K-nearest neighbors. Experimental results demonstrate that feature selection helps to increase the classification efficiency by requiring considerably less features, while improving the

classification accuracy by minimizing redundant and noisy features. This is of particular significance for on-board image classification in future Mars rover missions.

View-Independent Face Recognition with Biological Features based on Mixture of Experts

Alireza Hajiany, Nina Taheri Makhsoos and Reza Ebrahimpour

The proposed view-independent face recognition model based on Mixture of Expert, ME, uses feature extraction, C1 Standard Model Feature, C1 SMF, motivated from biology on the CMU PIE dataset. The strength of the proposed model is using fewer training data as well as attaining high recognition rate since C1 Standard Model Feature and the combining method based on ME were jointly used.

Study on Mapping of Basic Elements in the Chinese Character Intelligent Formation without Character Library System

Mingyou Liu, Wenzhi Liao and Youguo Pi

The theory of Chinese character intelligent formation considers that Chinese characters are formed by components according to character structure; all the components are the topological mapping of basic elements in the character structure. The mapping method of basic elements in different character structures is one of the key technologies. This paper carried on a thorough analysis to the transformation of basic elements, proposed the topological mapping method based on affine transformation. 27533 Chinese characters in GB18030-2000 standard were taken as experiment subject, a platform for Chinese character intelligent formation system was developed and all the characters were formed in the platform.

W16: Neural Networks and Neuro-Fuzzy Systems Part 2

Wednesday, December 2ND, 15:50 – 17:50
Sala Pacinotti
Chair: Ignacio Rojas

FPGA-Based Recurrent Wavelet Neural Network Control System for Linear Ultrasonic Motor

Ying-Chih Hung and Faa-Jeng Lin

A field-programmable gate array (FPGA)-based recurrent wavelet neural network (RWNN) control system is proposed to control the mover position of a linear ultrasonic motor (LUSM) in this study. First, the structure and operating principles of the LUSM are introduced. Since the dynamic characteristics and motor parameters of the LUSM are nonlinear and time-varying, an RWNN controller is designed to improve the control performance for the precision tracking of various reference trajectories. The network structure and its on-line learning algorithm using delta adaptation law of the RWNN are described in detail. Moreover, an FPGA chip is

adopted to implement the developed control algorithm for possible low-cost and high-performance industrial applications. Finally, the effectiveness of the proposed control system is verified by some experimental results.

Fitting Multiple Alpha Peaks using Neural Network Techniques

Javier Miranda, Antonio Baeza, Javier Guillén and Rosa M. Pérez Utrero

Despite the sophistication of today's radiochemical separation techniques, it often occurs that the peaks in the spectra of α -emitting radioactive samples partially overlap. We here demonstrate the usefulness of a procedure based on a neural network, a multilayer perceptron with backpropagation training method, trained with isolated alpha peaks of environmental samples in resolving such partially overlapping alpha peaks and in predicting the activities of the α -emitters detected.

Computer Vision-Based Eyelid Closure Detection: a Comparison of MLP and SVM classifiers

David González-Ortega, Francisco Javier Díaz-Pernas, Míriam Antón-Rodríguez, Mario Martínez-Zarzuela, José Fernando Díez-Higuera and Daniel Boto-Giralda

In this paper, a vision-based system to detect the eyelid closure for driver alertness monitoring is presented. Similarity measures with three eye templates (open, nearly close, and close) were calculated from many different features, such as 1-D and 2-D histograms and horizontal and vertical projections, of a big set of rectangular eyes images. Two classifiers, Multi-Layer Perceptron and Support Vector Machine, were intensively studied to select the best with the sequential forward feature selection. The system is based on the selected Multi-Layer Perceptron classifier, which is used to measure PERCLOS (percentage of time eyelids are close). The monitoring system is implemented with a consumer-grade computer and a webcam with passive illumination, runs at 55 fps, and achieved an overall accuracy of 95.75% with videos with different users, environments and illumination. The system can be used to monitor driver alertness robustly in real time.

A Method to Point Out Anomalous Input-Output Patterns in a Database for Training Neuro-Fuzzy System with a Supervised Learning Rule

Valentina Colla, Nicola Matarese and Leonardo M. Reyneri

When designing a neural or fuzzy system, a careful preprocessing of the database is of utmost importance in order to produce a trustable system. In function approximation applications, when a functional relationship between input and output variables is supposed to exist, the presence of data where the similar set of input variables is associated to very different values of the output is not always beneficial for the final system to design. A method is presented which can be used to detect anomalous data, namely non-coherent associations between input and output patterns. This

technique, by mean of a comparison between two distance matrix associated to the input and output patterns, is able to detect elements in a dataset, where similar values of input variables are associated to quite different output values. A numerical example and a more complex application in the pre-processing of data coming from an industrial database were presented.

Acquisition of Body and Object Representation Based on Motion Learning and Planning Framework

Takahiro Asamizu and Yuichi Kobayashi

Vision information processing is important for robots that act in human-interactive environments. In this paper, we propose to acquire visual representation of robot body and object that is suitable for motion learning in a bottom-up manner. An advantage of the proposed framework is that it does not require specific hand-coding depending on the visual properties of objects or the robot. A subtraction technique and SOM are used to compose the state space based on the image with extracted robot body and objects. Motion of the robot is planned based on reachable set. The task of moving an object to a target position is divided into two phases, one to reach a position that is suitable for starting pushing motion and the other to push the object to the target. The proposed method is verified by experiment of pushing manipulation of an object with a robot arm.

Workshop W17: Soft Computing and Image Processing Part 2

Wednesday, December 2ND, 15:50 – 17:50

Sala Galilei

Chair: Pedro Melo-Pinto

On the Use of t-Conorms in the Gravity-based Approach to Edge Detection

Carlos Lopez-Molina, Humberto Bustince, Mikel Galar, Javier Fernandez and Bernard De Baets

This work explores the possibilities of extracting edges using a t-conorm based gravity approach and its relation with the t-norm based one.

Ignorance-based fuzzy clustering algorithm

Aranzazu Jurio, Miguel Pagola, Daniel Paternain, Edurne Barrenechea, Jose Antonio Sanz and Humberto Bustince

In this work an ignorance-based fuzzy clustering algorithm is presented. The algorithm is based on the Entropy-based clustering algorithm proposed by Yao et al. [1]. In our proposal, we calculate the total ignorance instead of using the entropy at each data point to select the data point as the first cluster center. The experimental results show that the ignorance-based clustering improves the data classification made by the EFC in image segmentation.

THREECOND: An Automated and Unsupervised Three Colour Fuzzy-Based Algorithm for Detecting Nuclei in Cervical Pap Smear Images

Fabio Vaschetto, Eduard Montseny, Pilar Sobrerilla and Enrique Lerma

Visual examination and interpretation of microscopic images taken from the cervix are at the core for the detection and prevention of cervical cancer. However these visual processes are tedious and in many cases error-prone. This is why automated screening systems, interacting with the technologist, would be a tremendous improvement for reducing the likelihood of human errors. In this work we propose THREECOND, a three colour-based algorithm that integrates colour information, cyto-pathologists knowledge and fuzzy systems. This algorithm is designed to be integrated into the previously developed system [23], with the aim of improving its accuracy and efficiency for detecting and segmenting the nuclei of Pap smear images.

Fusion of IKONOS Remote Sensing Filtered Images using Shadow Information to Improve the Rate of Building Extraction in Urban Images

Mohammad Jalal Rastegar Fatemi, Seyed Mostafa Mirhassani and Bardia Yousefi

Deficiency of unsharp mask filter in elimination of some regions in IKONOS remote sensing urban image is one of serious difficulties in building extraction from such images. Sometimes, saturation of intensity levels in filtered image makes some regions of image disappear. As a compensation for this issue, in this paper a method for fusion of unsharp mask filtered image and histogram equalized image is presented. In the first step, fusion of filtered images is accomplished. Since shadows give some information about the location of buildings, fusion of filtered images with considering the shadow location can be a satisfactory cure for elimination of image components such as buildings. Afterward, Bayesian classifier is applied to the fused laplacian and edge images to extract the buildings. Experimental results justify application of the proposed method in building extraction for IKONOS remote sensing images.

Introducing Type-2 Fuzzy Sets for Image Texture Modelling

Jesus Chamorro-Martínez, Pedro Martínez-Jiménez and Daniel Sánchez

In this paper, the texture property "coarseness" is modeled by means of type-2 fuzzy sets, relating representative coarseness measures (our reference set) with the human perception of this texture property. The type-2 approach allows to face both the imprecision in the interpretation of the measure value and the uncertainty about the coarseness degree associated to a measure value. In our study, a wide variety of measures is analyzed, and assessments about coarseness perception are collected from pools. This information is used to obtain type-2 fuzzy sets where the secondary fuzzy sets are modelled by means of triangular membership functions fitted to the collected data.

S11: Bioinspired and Evolutionary Computation based Data Mining Techniques

Wednesday, December 2ND, 15:50 – 17:50

AulaB

Chair: José M. Puerta

Structural Learning of Bayesian Networks by using Variable Neighbourhood Search based on the Space of Orderings

Juan Ignacio Alonso-Barba, Luis delaOssa and Jose M. Puerta

Structural Learning of Bayesian networks (BNs) is an NP-hard problem generally addressed by means of heuristic search algorithms. Although these techniques do not guarantee an optimal result, they allow obtaining good solutions with a relatively low computational effort. Many proposals are based on searching the space of Directed Acyclic Graphs. However, there are alternatives consisting of exploring the space of equivalence classes of BNs, which yields more complex and difficult to implement algorithms, or the space of the orderings among variables. In practice, ordering-based methods allow reaching good results, but, they are costly in terms of computation. In this paper, we prove the correctness of the method used to evaluate each permutation when exploring the space of orderings, and we propose two simple and efficient learning algorithms based on this approach. The first one is a Hill climbing method which uses an improved neighbourhood definition, whereas the second algorithm is its natural extension based on the well-known Variable Neighbourhood Search metaheuristic. The algorithms have been tested over a set of different domains in order to study their behaviour in practice.

Binary Representation in Gene Expression Programming: Towards a Better Scalability

Jose G. Moreno-Torres, Xavier Llorà and David E. Goldberg

One of the main problems that arises when using gene expression programming (GEP) conditions in learning classifier systems is the increasing number of symbols present as the problem size grows. When doing model-building LCS, this issue limits the scalability of such a technique, due to the cost required. This paper proposes a binary representation of GEP chromosomes to palliate the computation requirements needed. A theoretical reasoning behind the proposed representation is provided, along with empirical validation.

E-tsRBF: Preliminary Results on the Simultaneous Determination of Time-lags and Parameters of Radial Basis Function Neural Networks for Time Series Forecasting

Elisabet Parras-Gutierrez, Victor Rivas and Maria José del Jesus

Radial basis function neural networks have been successfully applied to time series prediction in literature. Frequently, methods to build and train these networks must be given the past periods or lags to be used in order to create patterns and forecast any time series. This paper introduces E-tsRBF, a meta-evolutionary algorithm that evolves both the neural networks and the set of lags needed to forecast time series at the same time. Up to twenty-one time series are evaluated in this work, showing the behavior of the new method.

Grammatical Concept Representation for Randomised Optimisation Algorithms in Relational Learning

Petr Buryan, Jiří Kubalik and Katsumi Inoue

This paper proposes a novel grammar-based framework of concept representation for randomized search in Relational Learning (RL), namely for Inductive Logic Programming. The utilization of grammars guarantees that the search operations produce syntactically correct concepts and that the

background knowledge encoded in the grammar can be used both for directing the search and for restricting the space of possible concepts to relevant candidate concepts (semantically valid concepts). Not only that it enables handling and incorporating the domain knowledge in a declarative fashion, but grammars also make the new approach transparent, flexible, less problem-specific and allow it to be easily used by almost any randomized algorithm within RL. Initial test results suggest that the grammar-based algorithm has strong potential for RL tasks.

Fast Evolutionary Algorithms for Relational Clustering

Danilo Horta and Ricardo J.G.B. Campello

This paper is concerned with the computational efficiency of clustering algorithms when the data set to be clustered is described by a proximity matrix only (relational data) and the number of clusters must be automatically estimated from such data. Two relational versions of an evolutionary algorithm for clustering are derived and compared against two systematic (repetitive) approaches that can also be used to automatically estimate the number of clusters in relational data. Exhaustive experiments involving six artificial and two real data sets are reported and analyzed.

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