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Ostuni, Italy

CIMSA 2007 Technical Program Tracks and Sessions

Wednesday, June 27

4:00 PM - 5:30 PM

Neural and fuzzy technologies for prediction: Elite Room

Session Chair: Ning Chang (Cisco Systems, USA)

Dynamic Possibilistic Networks : Representation and Exact Inference **1**

Abdelkader Heni (IPEIM University Of Monastir TUNISIA, Tunisia)
Nahla Ben Amor (LARODEC, Tunisia)
Salem Benferhat (CRIL, France)
Adel Alimi (University of Sfax, National Engineering School of Sfax Tunisia, Tunisia)

Abstract—In this paper, we present two versions of an exact algorithm for propagation in dynamic possibilistic networks (DPNs). These two versions are adapted from the standard Interface algorithm well defined for inference in dynamic Bayesian networks. The main contribution of this paper is the use of possibilistic logic as a framework for representation of temporal networks which gives an alternative framework for dynamic probabilistic networks. We especially, present how junction trees can be used to make online inference namely filtering problem in product-based DPNs and min-based DPNs and we will discuss how this technique can be extended to make prediction.
Abdelkader HENI is a PHD student in Information system Engineering at the National School of Engineers Tunisia the main topic research are : - Knowledge representation - Inference in possibilistic graphical models - Reasoning under uncertainty

Estimating Uncertainty of Measurement Process **9**

Ning Chang (Cisco Systems, USA)
Jim Lambert (Cisco Systems, USA)

Abstract—Estimating measurement is a challenge where uncertainty and variation have the greatest impact. Specially, there is not enough information at estimation time. Here, EUMP (Estimating Uncertainty of Measurement Process) is introduced. EUMP is a recursively process which is using both multi regression and Monte Carlo simulation. It can be systematically obtained through EUMP process for all distribution functions of both dependent and independent variables. Moreover, dependent variable can be estimated. Finally, predicable system has been described. It is proved that the error of estimated dependent variable is going to zero when time t goes to infinity.

Prediction of Polymer Optical Fiber Properties Using Artificial Neural Networks **14**
Xi Chen (Philadelphia University, USA)
Les Sztandera (Philadelphia University, USA)
Hugh Cartwright (Oxford University, Oxford U.K.)

Abstract—Polymer fibers are finding increasing applications in commercial optical communication systems. Polymer optical fibers, with specified desirable consumer characteristics, can be computationally designed. Through the use of an extensive structure - property correlation database, properties of polymers can be predicted by a Neural Network, and the structure of novel polymers with desired properties can be optimized by a Genetic Algorithm. In this paper we are focusing on one of the parameters, glass transition temperature that influences a desired outcome in polymer optical fibers. Performance of such fibers can be optimized by engineering a polymer to exhibit a lower refractive index and Tg. This paper compares and discusses a neural network model and a linear model that have been developed to correlate glass transition temperature (Tg) and repeating units of polymers. A set of descriptors, chosen based on previous studies of the relations between Tg and polymer structure, was used to describe the structure of repeating units, individual bond energies and intermolecular forces, especially hydrogen bonding, which is the strongest intermolecular force and exerts the greatest influence on Tg comparing with other intermolecular interactions. A comprehensive neural network model with 28 descriptors was developed to predict Tg values of 6 randomly selected polymers from a database containing 71 polymers. The network was trained with the remaining 65 polymers and had a typical training RMSE of 17K (R2 = 0.95) and prediction average error of 17 K (R2 =0.85). A linear regression model developed for comparison had an average error of 32 K (R2 = 0.81).

Sensor Calibration Using the Neural Extended Kalman Filter in a Control Loop **19**
Kathleen Kramer (University of San Diego, USA)
Stephen Stubberud (Rockwell Collins, USA)
J. Antonio Geremia (Entropic Communications, USA)

Abstract – Sensor errors can adversely affect the behavior of a control system. When multiple sensors are used, a broken sensor can have its effects minimized by artificially inflating its error covariance. In this paper, a different approach to compensating for sensor errors in a multiple-sensor control system is introduced. The technique, referred to as a neural extended Kalman filter (NEKF), is developed for closed-loop control systems. The NEKF learns online from the same residual information used in the state estimator. The improvement in the sensor report is made by the neural network being added to the measurement model. In this work, the NEKF is applied to vehicle trajectory control problem with a position sensor and a velocity sensor.

Thursday, June 28

8:30 AM - 10:00 AM

Applications of intelligent measurement systems: Elite Room

Session Chair: Fernando Lopez Peña (Universidade da Coruña, Spain)

Parallelization of Fuzzy-Classical Filters For Image Noise Reduction **25**

Hamed Vahdat-Nejad (Ferdowsi University of Mashhad, Iran)
Hosneyeh Zolfaghari (Islamic Azad University, Birjand, IRAN)
Reza Monsefi (Ferdowsi University of Mashhad, Iran)

Abstract—Several fuzzy filters for image noise reduction have already been developed. In general, they are able to preserve images in a more comprehensive means than classical filters, and they have the ability to combine edge-preservation and smoothing. However, the implementation of fuzzy filters is very time-consuming. On the other hand, parallel and grid computing technologies are efficient tools for implementing fuzzy filters. In this paper, we propose a parallel skeleton for some fuzzy weighted mean filters. We have implemented the algorithms using MatlabMPI (a parallel, message passing version of Matlab). Our experiments show the feasibility and efficiency of the algorithms.

Characterization and classification of electrical transients using higher-order statistics and neural networks **29**

Juan Jose Gonzalez de la Rosa (University of Cadiz, Spain)
Antonio Moreno-Muñoz (University of Cordoba, Spain)
Africa Martinez (Degree, Spain)
Carlos Puntonet (University of Granada, Spain)

Abstract—This paper deals with power-quality (PQ) event characterization using higher-order cumulants. Their maxima and minima are the main features, and classification is based in competitive layers. We concentrate on differentiating two types of transients (short duration and long duration). By measuring the fourth-order cumulants' maxima and minima, we build the two- dimensional feature measured vector. Cumulants are calculated over high-pass filtered signals, to avoid the 50-Hz signal. We have observed that the minima and maxima produce clusters in the feature space for 4th-order cumulants; third-order cumulants are not capable of differentiate these two very similar PQs. The experience sets the foundations of an automatic procedure.

ANN Residential Load Classifier for Intelligent DSM System **33**

Marco Calabrese (Polytechnic of Bari, Italy)
Vincenzo Di Lecce (Politecnico di Bari, Italy)
Vincenzo Piuri (University of Milan, Italy)

Abstract—This paper describes an ANN-based residential load classification component to use in the Demand-Side Management (DSM) System described in a previous work. The aim of the DSM is to prevent cut-off from happening and to schedule loads in a prioritised mode. By means of an associative memory, each socket tap is capable of virtually guessing the type of load curve profile of the plugged appliance. The eventual misclassification that may arise during the guessing phase is specifically handled by a new training phase. The time the system spends responding to the wrong classification and reacting to it is generally shorter than the time required by the provider’s meter to detect the exceeding of the power limit.

10:30 AM - 12:00 PM

Image understanding and recognition: Elite Room

Session Chair: Abdulmotaleb El Saddik (University of Ottawa, Canada)

Face Recognition by Observation-Sequence-Based Methods Based on Pseudo 2D HMM and Neural Networks 39

Giuseppe Mastronardi (Polytechnic of Bari, Italy)
Vitoantonio Bevilacqua (Polytechnic of Bari, Italy)
Domenico Daleno (Polytechnic of Bari, Italy)
Lucia Cariello (Polytechnic of Bari, Italy)
Riccardo Attimonelli (Polytechnic of Bari, Italy)
Marcello Castellano (Politecnico di Bari, Italy)

Abstract—Face recognition is an obviously interesting research area, due to its applicability in a biometric system both in commercial both in security fields. In this paper a Pseudo 2-Dimension Hidden Markov Model (P2D-HMM) combined with three different observation-sequence-based methods is introduced for face recognition. The P2D-HMM proposed, is applied to five RoI (Region of Interest) of images, one for each significant facial area in which the input frontal images are sequenced: forehead, eyes, nose mouth and chin. It has been trained by coefficients of an Artificial Neural Network used to compress a bitmap image in order to represent it with a reduced number of significant coefficients manipulated by the three observation-sequence-based methods. The introduced system, applied to the input set consisting of the Olivetti Research Lab. face database integrated with others photos, allows to obtain an high rate of recognition, up to 100% in particular with the P2D-HMM realised by the 'Strip'-like sequencing method.

Ant Colonies for the reconstruction of artificial 3D Objects. 44

Piergiorgio Cerello (Istituto Nazionale di Fisica Nucleare, sez. Torino, Italy, Italy)
Sorin Cheran (Istituto Nazionale di Fisica Nucleare, sez. Torino, Italy, Romania)
Gianfranco Gargano (Università degli Studi di Bari, Italy, Italy)
Roberto Bellotti (Università degli Studi di Bari, Italy, Italy)
Francesco De Carlo (Università degli Studi di Bari, Italy, Italy)
Sonia Tangaro (Istituto Nazionale di Fisica Nucleare, sez. Bari, Italy, Italy)
Cristian Fulcheri (Università degli Studi di Torino, Italy, Italy)
Ernesto Lopez Torres (CEADEN, Havana, Cuba, Cuba)
Eleonora Tommasi (Università degli Studi di Bari, Italy, Italy)

Abstract – Ant Colony Models are artificial simulations of real ant colonies [1], [2]. The way real ants behave in nature inspire cooperation and competition strategies for virtual agent: the emergence of intelligent behavior and swarm-based self-organization can be used to solve difficult problems. In this work an Ant Colony Model for 3D objects reconstruction is presented. The accuracy in reconstructing 3D object is tested on artificial 3D objects and on 10 real Computed Tomography (CT) images of human lungs.

A novel Active Contour Model algorithm for contour detection in complex objects 49

Gianfranco Gargano (Università degli Studi di Bari, Italy, Italy)
Roberto Bellotti (Università degli Studi di Bari, Italy, Italy)
Francesco De Carlo (Università degli Studi di Bari, Italy, Italy)
Sonia Tangaro (Istituto Nazionale di Fisica Nucleare, sez. Bari, Italy, Italy)
Eleonora Tommasi (Università degli Studi di Bari, Italy, Italy)
Marcello Castellano (Politecnico di Bari, Italy)
Piergiorgio Cerello (Istituto Nazionale di Fisica Nucleare, sez. Torino, Italy, Italy)
Sorin Cheran (Istituto Nazionale di Fisica Nucleare, sez. Torino, Italy, Romania)
Cristian Fulcheri (Università degli Studi di Torino, Italy, Italy)

Abstract—Unavailable at time of publication.

2:00 PM - 3:30 PM

Intelligent measurement systems: Elite Room

Session Chair: Vincenzo Piuri (University of Milan, Italy)

A New Fuzzy Algorithm for Global Job Scheduling in Multiclusters and Grids **54**
Hamed Vahdat-Nejad (Ferdowsi University of Mashhad, Iran)
Reza Monsefi (Ferdowsi University of Mashhad, Iran)
Mahmoud Naghibzadeh (Ferdowsi University of Mashhad, Iran)

Abstract—The computational grid provides a promising platform for the efficient execution of parallel applications. In this paper, we propose a fuzzy algorithm for global job scheduling in multiclusters and grids on the basis of layered task scheduling model. We assume that each job is composed of several parallel tasks, which can be executed concurrently. In addition to CPU requirements of tasks, we consider communication requirements of tasks and network load to find a matching degree between available resources and jobs. Simulation results show the effectiveness of the algorithm in terms of jobs completion time.

A Universal Ontology for Sensor Networks Data **59**
Mohamad Eid (University of Ottawa, Canada)
Ramiro Liscano (University of Ontario Institute of Technology, Canada)
Abdulmotaleb El Saddik (University of Ottawa, Canada)

Abstract—In this paper, we present our work towards the development and evaluation of an ontology for searching distributed and heterogeneous sensor networks data. In particular, we propose a two layer prototype ontology that utilizes the IEEE Suggested Upper Merged Ontology (SUMO) as a root definition of general concepts and associations and two sub-ontologies: the sensor data sub-ontology and the sensor hierarchy sub-ontology. The proposed ontology was implemented using Protégé 2000 and eventually evaluated using the RDQL language (RDF Data Query Language). The performance analysis demonstrated the ability of the ontology-based search to improve both the precision and recall rates and enhance the interoperability between different sensor networks domains through the use of the universal SUMO ontology.

Neural Techniques to Improve the Formative Evaluation Procedure in Intelligent Tutoring Systems **63**
Marcello Castellano (Politecnico di Bari, Italy)
Giuseppe Mastronardi (Polytechnic of Bari, Italy)
Gianluca Di Giuseppe (Politecnico di Bari, Italy)
Vito Dicensi (Polytechnic of Bari, Italy)

Abstract—Nowadays a special attention is paid to the quality of teaching valued in terms of efficacy of students' knowledge at the exit of its formative period. This efficacy depends both on the quality of formative iter and on the way formative activities are planned in a single teaching. Not since a lot of time has re-emerged the importance of tutoring as ad hoc regulator in student's learning process. Taking care of a student means design both of diagnostic instruments and of suitable formative interventions. That is the moment in which having the diagnosis to be preceded by a survey of performance indicators becomes important the study of measuring system models to be applied to each student. Intelligent Tutoring Systems (ITS), are any computer system with the ability to adopt pedagogical activities to individual student needs providing customized instruction and feedback. A correct and effective use of such system is obtained through a careful planning of formative deficit diagnostic measuring. In this paper we propose a model of formative evaluation procedure based on the use of neural techniques qualified to improve its accuracy.

Reducing Computational Complexity in k-NN based Adaptive Classifiers 68
Cesare Alippi (Politecnico di Milano, Italy)
Manuel Roveri (Politecnico of Milan, Italy)

Abstract—Integrating new information in intelligent measurement systems during their operational life is always profitable from the accuracy point of view but induces an increment in the complexity of the classifier. Adaptive classifiers, which provide adaptive mechanisms to update their knowledge base over time, are able to exploit fresh information to improve accuracy but do not consider complexity issues. In this paper we propose a design solution for adaptive classifiers able to reduce the computational complexity and the memory requirements of the classifier by including condensing editing techniques. Moreover, we propose a novel approach for estimating the innovation content of the fresh information which allows not to include redundant or superfluous information (thus minimizing the knowledge base size). The experimental campaign shows the effectiveness of the proposed approach.

4:00 PM - 5:30 PM

Intelligent monitoring and control systems: Elite Room

Session Chair: Marcello Castellano (Politecnico di Bari, Italy)

Improving WLANs through a Hybrid MAC Access Protocol with a Natural Index 72
Xuejun Tian (Aichi Prefectural University, Japan)
T. Ideguchi (Aichi Prefectural University, Japan)
T. Okuda (Aichi Prefectural University, Japan)

Abstract—Enhancing throughput for limited channel capacity in wireless LANs is an important subject due to limited wireless channel bandwidth. A great deal of research has been carried out and some of proposed schemes are effective. Speci□cally, considerable effort has been devoted to improving the IEEE 802.11 standard which is utilized widely. Previous theoretical analysis gave the upper bound of IEEE 802.11 DCF throughput which is far below the channel capacity and corresponding algorithm was proposed, which can achieve the throughput close to the upper bound. It seems that we cannot expect to enhance the throughput much more in a usual way. In the meantime, besides throughput, there are some other issues for DCF such as fairness and QoS support. However, except for several hybrid protocols, most proposals were either based on contention mode or schedule mode and neither of the two modes has possessed the good characters of the other. In this paper, we propose a new MAC scheme used for DCF (with no control node) that dynamically adapts to traf- □c changes without degradation of delay in the case of low traf□c load and achieves high throughput which is close to transmission capacity in saturated case. The key idea is to divide the virtual frame into two parts, i.e., schedule part and contention part, and to enable each node to reserve a slot in schedule part. Unlike conventional hybrid protocols, every node does not have to intentionally reset any parameter according to the changing traf□c load except its queue length. A distinguishing feature of this scheme is the novel way of allowing WLANs to work with low delay as in the contention-based mode and achieve high throughput as in the schedule-based mode without complicated on-line estimation required in previous schemes. This makes our scheme simpler and more reliable. According to analysis, we show that our scheme can greatly improve the throughput no matter whether the network is in saturated or unsaturated case.

Friday, June 29

8:30 AM - 10:00 AM

Neural, fuzzy and genetic/evolutionary algorithms for optimization/calibration: Elite Room

Session Chair: Vincenzo Di Lecce (Politecnico di Bari, Italy)

Implementation of Genetic Algorithms Optimization Method for the Optimal Design of Parallel Micro Robot 78

Sergiu-Dan Stan (Technical University of Cluj-Napoca, Romania)
Vistrian Maties (Technical University of Cluj-Napoca, Romania)
Radu Balan (Technical University of Cluj-Napoca, Romania)
Ciprian Lapusan (Technical University of Cluj-Napoca, Romania)

Abstract—This paper is aimed at presenting a study on the optimization of the Biglide and Bipod mini parallel robots, which comprises two-degree-of-freedom (DOF) mini parallel robots with constant and variable struts. The robot workspace is characterized and the inverse kinematics equation is obtained. In the paper, design optimization is implemented with Genetic Algorithms (GA) for optimization considering transmission quality index, design space and workspace. Here, intended to show the advantages of using the GA, we applied it to a multicriteria optimization problem of 2 DOF mini parallel robots. Genetic algorithms (GA) are so far generally the best and most robust kind of evolutionary algorithms. A GA has a number of advantages. It can quickly scan a vast solution set. Bad proposals do not affect the end solution negatively as they are simply discarded. The obtained results have shown that the use of GA in such kind of optimization problem enhances the quality of the optimization outcome, providing a better and more realistic support for the decision maker.

Computational intelligence techniques for reflections identification in iris biometric images 84

Fabio Scotti (University of Milan, Italy)

Abstract—The paper presents a methodology for reflections identification in iris biometric images based on neural networks. Iris biometric systems identify individuals by comparing the characteristics of the iris acquired by the acquisition sensors. When reflections are present in the iris image, the portion of the image covered by reflections must be discarded from any further comparison since it can produce false matches. The method presented in this paper proposes a set of features which can be extracted from the iris image and that can be effectively used to achieve an accurate identification of the reflection position using a neural network. In particular, the paper presents how the radial symmetry operator can be used as a proper feature to identify the reflections in a iris image. The output of the proposed method is an image mask which locates the reflections in the image. The presented method is general and it can be used in any biometric system based on iris images

A Wind Tunnel based CFD Validation Procedure for Sail Design 89

Vicente Díaz Casás (Universidade da Coruña, Spain)
Fernando Lopez Peña (Universidade da Coruña, Spain)
Richard Duro (Universidad de la Coruña, Spain)

Ensuring the identity of a user in time: a multi-modal fuzzy approach 94

Antonia Azzini (Università degli Studi di Milano, Italy)
Ernesto Damiani (University of Milan, Italy)
Stefania Marrara (Università degli Studi di Milano, Italy)

Abstract—The multimodal approach to authentication integrates several different authentication methods within the same system so that the biometric method best suited for identifying a particular individual can be selected. This work proposes a fuzzy multimodal technique capable of guaranteeing the desired level of security while keeping under control the high costs typically associated to some biometric authentication devices. Specifically we describe a fuzzy controller choosing within a palette of authentication techniques to continuously check and confirm its trust in the identity of a user.

10:30 AM - 12:00 PM

Applications of intelligent measurement systems II: Elite Room

Session Chair: Fabio Scotti (University of Milan, Italy)

An Intelligent Wireless Electronic Nose Node for Monitoring Gas Mixtures Using Neuro-Fuzzy Networks Implemented on a Microcontroller 100

YoungWung Kim (Kyungpook National University, Korea)
Jung Hwan Cho (Kyungpook National University, Korea)
Gi Joon Jeon (Kyungpook National University, Korea)

Abstract—This paper presents an intelligent wireless electronic nose node (WENN) that has been designed to classify and quantify binary gas mixtures, NH3 and H2S, the main malodors in various environments. The proposed WENN is based on embedded PC technology and neuro-fuzzy network algorithms. The hardware part of the designed system consists of a microcontroller for processing the measured data set obtained from a micro-gas sensor array, and a Zigbee-ready RF transceiver for transmitting the processed data to a base node. The main program embedded on the designed hardware performs real-time classification and concentration estimation of the binary gas mixtures using the fuzzy ART and ARTMAP neural networks. To verify performance of the designed intelligent WENN, the measured data from the experiments for the binary gas mixtures have been executed using the WENN. The results show the reproducibility of the measured data and the verification of real-time classification and concentration estimation for the target gas.

Linguistic description of human body posture using fuzzy logic and several levels of abstraction 105

Gracian Trivino (European Centre for Soft Computing, Spain)
Gonzalo Bailador (Universidad Politécnica de Madrid, Spain)

Abstract—A remarkable characteristic of the human brain is its capability to create abstract models of the real world. Natural Language is the main tool that we use to manage these abstractions. In this paper we describe a measurement device that represents the data of sensors using concepts defined at different levels of abstraction and produces its output in Natural Language. The ultimate goal of this work is to investigate possibilities of creating instruments capable of communicating their results to human beings using Natural Language. We present an experimental prototype that uses accelerometers to obtain information about the posture of the user. We use two well known objects: the pendulum and the Rubik's cube, to establish a sequence of metaphors that end, at the highest level of abstraction, with a linguistic description of the temporal sequence of the user postures.

Cognitive Models for Adaptive Monitoring System 110

Raffaele Giordano (National Research Council, Italy)
Vito Uricchio (IRSA CNR, Italy)
Michele Vurro (IRSA-CNR, Italy)

Abstract—As is widely acknowledged in literature, decision making in water resources management is largely considered a rational process based on appropriate information and modeling results. Information plays a fundamental role in improving our understanding of the consequences of, and trade-off among, the alternatives in water resources management. Environmental monitoring networks have the potential to provide much information for environmental decision processes. Monitoring is widely used to increase our knowledge both of the state of the environment and of socioeconomical conditions. Environmental monitoring has demonstrated its capacity within resource management to support decision processes providing knowledge of baseline conditions, to detect change, to establish historical status and trends, to promote long-term understanding or prediction, and to establish the need for, or success of, interventions. Incorporating uncertainties about future pressures on river basins into water resources management sets new challenges for environmental resources management. One learning process being developed to address this challenge is Adaptive Management (AM).