Second International Workshop on Advanced Computational Intelligence

FINAL PROGRAM

Sponsored by:

Center for Research and Advanced Studies of
the National Polytechnic Institute
(CINVESTAV-IPN)

Consejo Nacional de Ciencia
y Tecnología
(CONACyT)

Academia Mexicana
de Ciencias
(AMC)

October 8-10, 2009

CINVESTAV-IPN, Mexico City, Mexico

Greeting from the General Chair

I am extremely pleased to welcome all of you, world-wide researchers who are interested in computational intelligence, to attend the second International Workshop on Advanced Computational Intelligence (IWACI2009) in Mexico City, the capital of Mexico, and the economic, industrial, and cultural center in the country. I believe that you will enjoy this workshop both from the perspective of computational intelligence research and the perspective of the Mexican culture.

Over the past decades, computational intelligence community has witnessed tremendous efforts and developments in all aspects of theoretical foundations, architectures and network organizations, modelling and simulation, empirical study, as well as a wide range of applications across different domains. IWACI2009 provided a great platform for the community to share their latest research results, discuss critical future research directions, stimulate innovative research ideas, as well as facilitate international multidisciplinary collaborations.

IWACI2009 received 146 submissions from about 373 authors in 26 countries and regions across six continents. Based on the rigorous peer reviews by the Program Committee members, 52 high-quality papers were selected for publication in this book, with an acceptance rate of 36.3%. These papers cover major topics of the theoretical research, empirical study, and applications of computational intelligence.

In addition to the contributed papers, the IWACI2009 technical program included four plenary speeches by Hojjat Adeli, Reza Langari, Jun Wang, and Jacek M. Zurada. As organizer of IWACI2009, I would like to express my sincere thanks to the Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (CINVESTAV-IPN), Consejo Nacional de Ciencia y Tecnología (CONACyT), and Academia Mexicana de Ciencias (AMC). I would also like to sincerely thank the Advisory Committee Chairs for their guidance in every aspect of the entire conference, and Organizing Committee Chairs for overall organization of the workshop. I want to take this opportunity to express our deepest gratitude to the members of the International Program Committee for their professional review of the papers.

I sincerely hope that all IWACI2009 participants will enjoy attending conference sessions and activities, meeting research partners, setting up new research collaborations and having a pleasant stay in Mexico City.

Wen Yu
General Chair of IWACI 2009
CINVESTAV-IPN

Conference Committees

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Publications Chair
Xiaoou Li, CINVESTAV-IPN, Mexico

Registration Chair
Gary G. Feng, City University of Hong Kong, Hong Kong

Workshop Information

Venue

Sala de usos múltiples
Departamento de Control Automático
CINVESTAV-IPN
Mexico City
Mexico

Registration

Registarion for the workshop will be open at the following times

Thursday, October 8 …….. 9:00 - 14:00
Friday, October 9 ……..... 9:00 - 14:00

Social Events

Lunch (12:30 - 14:30, Thursday, October 8, 2009)
Banquet (19:30 - 22:00, Thursday, October 8, 2009)
Lunch (12:30 - 14:30, Friday, October 9, 2009)
Closing Reception (19:30 -22:00, Friday, October 9, 2009)

Hotel Reservation

Information about the workshop hotel, Quality Inn, is available at
http://www.qualityinnlindavista.com/ or calling the hotel directly at +52-55-57474520

Local Tour

- 13:30 - 17:30, Thursday, October 8, 2009, Anthropological Museum
- 13:30 - 17:30, Friday, October 9, 2009, Chapultepec Castle
- Saturday October 10, 2009
    - 10:00-13:00 Pyramids of Teotihuacán
    - 13:00-15:00 Lunch
    - 15:00-18:00 Centro Histórico
    - 18:00-19:00 Dinner

Plenary Talks

Plenary Talk I:

Fuzzy Control of Large Civil Structures Subjected to Natural Hazards

Reza Langari
Mechanical Engineering, Texas A&M University

Abstract: In this talk, a new semiactive nonlinear fuzzy control (SNFC) system design framework is proposed through integration of a set of Lyapunov-based state feedback controllers and Kalman filters. A nonlinear multi-input multi-output (MIMO) autoregressive exogenous (ARX) Takagi-Sugeno (T-S) fuzzy model is constructed out of a set of linear dynamic models. Subsequently, multiple Lyapunov-based state feedback controllers are formulated in terms of linear matrix inequalities (LMIs) such that the resulting system is globally asymptotically stable. The resulting state feedback controllers are integrated with Kalman filters and a converting algorithm using a T-S fuzzy interpolation method to construct a semiactive output feedback controller. To demonstrate the effectiveness of the proposed design framework, the resulting scheme is applied to a three- and a twenty-story building employing nonlinear hysteretic control devices. It is demonstrated from numerical simulations that the proposed approach is effective in controlling the responses of seismically excited large civil structures equipped with magnetorheological (MR) dampers: both displacement and acceleration responses of both three- and twenty-story buildings subjected to the 1940 El-Centro earthquake disturbance are dramatically reduced when the proposed control approach is applied.

Biography

Reza Langari received the B.Sc., M.Sc., and Ph.D. degrees in mechanical engineering from the University of California, Berkeley, in 1980, 1983, and 1991, respectively. Currently, he is a professor with the Department of Mechanical Engineering, Texas A&M University, College Station, and Assistant Director of the Aerospace Vehicle Systems Institute (AVSI). His expertise is in the area of fuzzy information processing and control, nonlinear and adaptive control systems, and computing architecture for real-time control. He is the coauthor of the textbook *Fuzzy Logic: Intelligence, Control and Information*, (Englewood Cliffs: Prentice-Hall, 1999) and coeditor of *Fuzzy Control: Synthesis and Analysis* (New York: Wiley, 2000). Dr. Langari serves as Associate Editor of IEEE TRANSACTIONS ON FUZZY SYSTEMS, as well as the *ASME Journal of Dynamic Systems* and *Measurement and Control*.

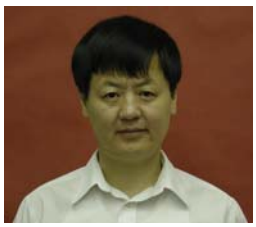
Plenary Talk II:

Neurodynamic Optimization with Its Applications for Model Predictive Control

Jun Wang
Mechanical and Automation Engineering, The Chinese University of Hong Kong

Abstract: Optimization problems arise in a wide variety of scientific and engineering applications. It is computationally challenging when optimization procedures have to be performed in real time to optimize the performance of dynamical systems. For such applications, classical optimization techniques may not be competent due to the problem dimensionality and stringent requirement on computational time. One very promising approach to dynamic optimization is to apply artificial neural networks. Because of the inherent nature of parallel and distributed information processing in neural networks, the convergence rate of the solution process is not decreasing as the size of the problem increases. Neural networks can be implemented physically in designated hardware such as ASICs where optimization is carried out in a truly parallel and distributed manner. This feature is particularly desirable for dynamic optimization in decentralized decisionmaking situations arising frequently in control and robotics. In this talk, I will present the historic review and the state of the art of neurodynamic optimization models and selected applications in robotics and control. Specifically, starting from the motivation of neurodynamic optimization, we will review various recurrent neural network models for optimization. Theoretical results about the stability and optimality of the neurodynamic optimization models will be given along with illustrative examples and simulation results. It will be shown that many problems in control systems, such model predictive control, can be readily solved by using the neurodynamic optimization models. Specifically, linear and nonlinear model predictive control based on neurodynamic optimization will be delineated.

Biography



Jun Wang is a Professor and the Director of Computational Intelligence Laboratory in the Department of Mechanical and Automation Engineering at the Chinese University of Hong Kong. Prior to this position, he held various academic positions at Dalian University of Technology, Case Western Reserve University, and University of North Dakota. Besides, he also holds a Cheung Kong Chair Professorship in computer science and engineering at Shanghai Jiao Tong University on a part-time basis since 2008. He received a B.S. degree in electrical engineering and an M.S. degree in systems engineering from Dalian University of Technology, Dalian, China. He received his Ph.D. degree in systems engineering from Case Western Reserve University, Cleveland, Ohio, USA. His current research interests include neural networks and their applications. He published over 140 journal papers, 11 book chapters, 8 edited books, and numerous conference papers in the areas. He is an Associate Editor of the IEEE Transactions on Neural Networks since 1999 and IEEE Transactions on Systems, Man, and Cybernetics – Part B since 2003, a member of the Editorial Advisory Board of the International Journal of Neural System since 2006. He also served as an Associate Editor of the IEEE Transactions on Systems, Man, and Cybernetics – Part C (2002-2005), a guest editor/co-editor of the special issue of European Journal of Operational Research (1996), International Journal of Neural Systems (2007), and Neurocomputing (2008), He was an organizer of several international conferences such as the General Chair of the 13th International Conference on Neural Information Processing (2006) and the 2008 IEEE World Congress on Computational Intelligence. He served as the President of Asia Pacific Neural Network Assembly in 2006 and as a member of several IEEE technical committees over the years. He is an IEEE Fellow.

Plenary Talk III:

Computational Intelligence and Machine Learning Virtual Infrastructure Network

Jacek M. Zurada
Electrical and Computer Engineering, University of Louisville

Abstract: The Computational Intelligence and Machine Learning Virtual Infrastructure Network (CIMLVIN) focuses on fostering collaborative efforts in the field of computational intelligence and machine learning (CI-ML). The network will support involvement and collaboration in the CI-ML community and enhance the existing engineering virtual organization (EVO) infrastructure by promoting the creation and sharing of resources and software tools. The CIMLVIN is intended to facilitate interaction between CI-ML researchers and cooperation with bioinformaticians, computational physicists, chemists, biologists, earth science researchers, and others. The CIMLVIN will facilitate a virtual community for researchers, software developers, educators, and end-users for the sharing of computational and educational resources relevant to CI-ML. Members will contribute data for sharing, data utilization and analysis software, and other computational tools. Educational benefits of the network include bridging research and education, access to well-documented CI-ML tools along with their theory, insight into working applications, access to practical models, and the opportunity for students and practitioners to add their own contributions. The network will feature access to prerecorded multimedia lectures, as well as to virtual laboratories and educational demonstrations.

Biography

Jacek M. Zurada is the S.T. Fife Alumni Professor of Electrical and Computer Engineering, University of Louisville, Louisville, KY. He is the coeditor of *Knowledge-Based Neurocomputing* (Cambridge, MA: MIT Press, 2000), *Computational Intelligence: Imitating Life* (Piscataway, NJ: IEEE Press, 1994), and the author of *Introduction to Artificial Neural Systems* (Boston, MA: PWS-Kent, 1992). He is the author or co-author of more than 200 journal and conference papers in the area of neural networks and VLSI circuits. Dr. Zurada has been the Editor-in-Chief of IEEE TRANSACTIONS ON NEURAL NETWORKS since 1998. Hewas the recipient of the 2001 University of Louisville President's Distinguished Service Award for Service to the Profession. He is currently the President of IEEE Neural Networks Society in 2004–2005. In March 2003, he was conferred the Title of the Professor by the President of Poland, A. Kwasniewski.

Plenary Talk IV:

The Third Generation Neural Network: Spiking Neural Network

Hojjat Adeli
Civil & Environmental Engineering & Geodetic Science, The Ohio State University

Abstract: Artificial Neural Networks (ANNs) are based on highly simplified brain dynamics and have been used as powerful computational tools to solve complex pattern recognition, function estimation, and classification problems. Throughout their development, ANNs have been evolving towards more powerful and more biologically realistic models. In the last decade, the third generation Spiking Neural Networks (SNNs) have been developed which comprise of spiking neurons. Information transfer in these neurons models the information transfer in biological neurons, i.e., via the precise timing of spikes or a sequence of spikes. Addition of the temporal dimension for information encoding in SNNs yields new insight into the dynamics of the human brain and has the potential to result in compact representations of large neural networks. As such, SNNs have great potential for solving complicated time-dependent pattern recognition problems defined by time series because of their inherent dynamic representation. This article presents an overview of the development of spiking neurons and SNNs within the context of feedforward networks, and provides insight into their potential for becoming the next generation neural networks.

Biography

Hojjat Adeli received the Ph.D. degree from Stanford University, Stanford, CA, in 1976. He is Professor of Civil and Environmental Engineering and Geodetic Science, Aerospace Engineering, Biomedical Engineering, Biomedical Informatics, Electrical and Computer Engineering, and Neuroscience, The Ohio State University, Columbus. He is also the holder of Lichtenstein Professorship. He has authored over 400 research and scientific publications in various fields of computer science, engineering, and applied mathematics since 1976. His research has been published in 72 different journals. He has authored 11 books including *Machine Learning – Neural Networks*, *Genetic Algorithms*, and *Fuzzy Systems* (Wiley, 1995); *Wavelets in Intelligent Transportation Systems* (Wiley, 2005). He has also edited 12 books. He is the Founder and Editor-in-Chief of the international research journals *Computer-Aided Civil and Infrastructure Engineering* and *Integrated Computer-Aided Engineering*. He is also the Editor-in-Chief of the *International Journal of Neural Systems*. In 1998, Dr. Adeli received the Distinguished Scholar Award from The Ohio State University "*in recognition of extraordinary accomplishment in research and scholarship*." In 2005, he was elected Honorary Member of American Society of Civil Engineers "*for wide-ranging, exceptional, and pioneering contributions to computing in many civil engineering disciplines and extraordinary leadership in advancing the use of computing and information technologies in civil engineering throughout the world*."

Technical Program

Program at a Glance

Thursday October 8, 2009

9:50 -10:00	Opening Ceremony
10:00 -11:00	Plenary Talk I: Fuzzy Control of Large Civil Structures Subjected to Natural Hazards, Reza Langari
11:00 -11:15	Coffee Break
11:15 -12:15	Plenary Talk II: Neurodynamic Optimization with Its Applications for Model Predictive Control, Jun Wang
12:30 -14:30	Lunch
14:30 -16:50	Oral Session - Th
19:30 -22:00	Banquet

Friday October 9, 2009

10:00 -11:00	Plenary Talk III: Building Virtual Community in Computational Intelligence and Machine Learning Jacek M. Zurada
11:00-11:15	Coffee Break
11:15 -12:15	Plenary Talk IV: The Third Generation Neural Network: Spiking Neural Network, Hojjat Adeli
12:30 -14:30	Lunch
14:30 -16:50	Oral Session - Fr
19:30 -22:00	Closing Reception

Oral Session

Thursday October 8, 2009

Th		Sala de usos múltiples
Chair: Yu Tang		Co-Chair: José de Jesús Rubio Avila
14:30 -16:50		
14:30 -14:50	17: Modeling of the relative humidity via functional networks and control of the temperature via classic controllers for a bird incubator	José de Jesús Rubio Avila, Martín Salazar and Jaime Pacheco
14:50-15:10	51 Discrete-time Reduced Order Neural Observers	Alma Y Alanis and Edgar N Sanchez
15:10-15:30	75: A Novel Multi-threshold Segmentation Approach Based on Artificial Immune System Optimization	Erik Cuevas-Jimenez, Valentín Osuna-Enciso, Daniel Zaldivar-Navarro and Marco A Perez-Cisneros
15:30-15:50	79: Closed-Loop Identification of a Nonlinear Servomechanism: Theory and Experiments	Rubén Alejandro Garrido Moctezuma and Roger Miranda Colorado
15:50-16:10	83: A Continuous-Time Recurrent Neurofuzzy Network for Black-Box Modeling of Insulin Dynamics in Diabetic Type-1 Patients	Marcos Angel Gonzalez Olvera, Ana Gabriela Gallardo Hernandez, Yu Tang, Maria Cristina Revilla-Monsalve and Sergio Islas Andrade
16:10-16:30	89: Learning Method for Life of Artificial Pet	Rodolfo Romero Herrera, Francisco Gallegos Funes and Antonio Gustavo Juárez Gracia
16:30-16:50	92: Stabilization on a Physical Pendulum With Moving Mass	Oscar Octavio Gutiérrez-Frías, Juan Carlos Martínez-García and Ruben Garrido-Moctezuma

Oral Session

Friday October 9, 2009

Fr		Sala de usos múltiples
Chair: Edgar Nelson Sanchez		Co-Chair: Marco A Moreno-Armendariz
14:30 -16:50		
14:30 -14:50	72: Application of MultiLayer Perceptron Type Neural Network to Camera Calibration	Dong-Min Woo and Dong-Chul Park
14:50-15:10	113: Designing a Compact Genetic Algorithm with Minimal FPGA Resources	Alejandro León-Javier, Marco A Moreno-Armendariz and Nareli Cruz-Cortés
15:10-15:30	24: Fuzzy OLAP a Formal Definition	Claudia González, Leonid Tineo and Urrutia Angelica
15:30-15:50	81: Dynamic Classifier Selection with Confidence Intervals	R M Valdovinos and Issachar Ruiz
15:50-16:10	87: Mixture of Experts with Genetic Algorithms Iris Feature Extraction Based on the Complete 2DPCA	Laura Cleofas and Rosa Maria Valdovinos
16:10-16:30	88: Identifcation and Speed Control of a DC Motor Using an Input-Output Recurrent Neurofuzzy Network	Edgar Berrospe, Marcos A. Gonzalez-Olvera, Yu Tang
16:30-16:50	91: Hybrid Intelligent Control Scheme for an Anaerobic Wastewater Treatment Process	Rubén Belmonte, Salvador Carlos and Edgar Nelson Sanchez

DETAILED PROGRAM
Thursday October 8, 2009

14:30 -14:50 *Modeling of the relative humidity and control of the temperature for a bird incubator (#17)*
José de Jesús Rubio Avila, Martín Salazar, Jaime Pacheco

In this paper the mathematical model for the control of temperature in an bird incubator is presented. Two classic laws of control are compared for the control of temperature: the on-off (ON-OFF), and the proportional integral (PI). It is proposed a functional network for the modeling of the relative humidity behavior in the bird incubator. It is gotten that the PI is the best controller.

14:50 -15:10 *Discrete-time Reduced Order Neural Observers (#51)*
Alma Y. Alanis, Edgar N. Sanche

A nonlinear discrete-time reduced order neural observer for the state estimation of a discrete-time unknown nonlinear system, in presence of external and internal uncertainties is presented. The observer is based on a discrete-time ecurrent high order neural network (RHONN) trained with an extended Kalman filter (EKF)-based algorithm. This observer estimates the state of the unknown discrete-time nonlinear system, using a parallel configuration. To illustrate the applicability simulation results are included.

15:10 -15:30 *A Novel Multi-threshold Segmentation Approach Based on Artificial Immune System Optimization (#75)*
Erik Cuevas, Valentín Osuna-Enciso, Daniel Zaldívar and Marco Pérez-Cisneros

Threshold selection is a critical step in computer vision. Immune systems, has inspired optimization algorithms known as Artificial Immune Optimization (AIO). AIO have been successfully applied to solve optimization problems. The Clonal Selection algorithm (CSA) is the most applied AIO method. It generates a response after an antigenic pattern is identified by an antibody. This works presents an image multi-threshold approach based on AIS optimization. The approach considers the segmentation task as an optimization process. The 1-D histogram of the image is approximated by adding several Gaussian functions whose parameters are calculated by the CSA. The mix of Gaussian functions approximates the histogram; each Gaussian function represents a pixel class (threshold point). The proposed approach is computationally efficient and does not require prior assumptions about the image. The algorithm demonstrated ability to perform automatic threshold selection.

15:30-15:50 *Closed-Loop Identification of a Nonlinear Servomechanism: Theory and Experiments (#79)*
Rubén Garrido, Roger Miranda

This paper presents a new methodology for parameter identification of a class of nonlinear servomechanisms. The key element is a closed-loop identification technique where a Proportional Derivative controller stabilizes the servomechanism. Experiments using a laboratory prototype, allows comparing the proposed approach against a standard Least Squares algorithm. It is shown that the disturbances acting on the servomechanism do not significantly affect the parameter estimates obtained using the proposed approach.

15:50-16:10 *A Continuous-Time Recurrent Neurofuzzy Network for Black-Box Modeling of Insulin Dynamics in Diabetic Type-1 Patients (#83)*
Marcos A. González- lvera, Ana G. Gallardo-Hernández, Yu Tang, Maria Cristina Revilla-Monsalve, Sergio Islas-Andrade

Diabetic Type-1 patients have no pancreatic insulin secretion, and an insulin therapy is prescribed for them to regulate glucose absorption. There are several self monitoring devices for glucose, but not for

insulin, which must be known and kept within certain limits to avoid damages to the body. Currently, it is possible to obtain real-time glucose measurements, so control schemes can be designed to control the glucose level using the insulin rate injected to the patient. In this work we present a black-box modeling of the insulin dynamics in different in silico patients using a recurrent neural network that could be used for on-line monitoring of the insulin concentration for a better treatment. The inputs for the identification is the rate of insulin (U/dl/min) applied to the patient, and blood glucose concentration. The output is insulin concentration (U/ml) present in the blood stream. The model is validated through numerical simulations.

16:10 -16:30 *Learning Method for Life of Artificial Pet (#89)*

Rodolfo Romero Herrera1, Francisco Gallegos Funes, Antonio Gustavo Juárez Gracia

The present article shows the implementation of einforcement learning, using the equation of the emotional intensity in a virtual pet for an artificial living environment interacting with the computer user. The pet looks like a very natural because of the learning algorithm proposed, which is based on a neural network. Learning depends on motivation given to the pet by its owner. The equation of emotional intensity gives values which allow to feed the neural network and thus generating learning.

16:30 -16:50 *Stabilization on a physical pendulum with moving mass (#92)*

O. O. Gutiérrez-Frías, J. C. Martínez-García, R. Garrido-Moctezuma

An asymptotic PD controller with gravity compensation to attenuate the oscillation of a poorly damping physical pendulum system is presented. The active vibration-damping element is a mass that moves along the pendulum arm. The stability analysis was carried out using the traditionally Lyapunov method in conjunction with LaSalle's theorem. The closed-loop asymptotic stability performance was tested with some numerical simulations.

14:30 -14:50 *Application of MultiLayer Perceptron Type Neural Network to Camera Calibration (#72)*
Dong-Min Woo, Dong-Chul Park

The objective of camera calibration is to obtain the correlation between camera image coordinate and 3D real world coordinate. In this paper, we propose a new approach which is based on the neural network model instead of the physical camera model including position, orientation, focal length, and optical center. The neural network employed in this paper is MLPNN (MultiLayer Perceptron Type Neural Network), which is primarily used as a mapper between 2D image points and points of a certain space in 3D real world. The neural network model implicitly contains all the physical parameters, some of which are very difficult to be estimated in the conventional calibration methods. In order to show the performance of the proposed method, images from two different cameras with three different camera angles were used for calibrating the cameras. The performance of the proposed neural network approach is compared with the well-known Tsai's two stage method in terms of calibration errors. The results show that the proposed approach gives much more consistent and acceptable calibration error over Tsai's two stage method regardless of the quality of camera and the camera angles.

14:50 -15:10 *Designing a Compact Genetic Algorithm with Minimal FPGA Resources (#113)*
Alejandro León-Javier, Marco A. Moreno-Armendáriz, Nareli Cruz-Cortés

The Compact Genetic Algorithms (cGA) are searching methods used in different engineering applications. These algorithms have interesting features such as their capability to operate with very low memory resources while solving complex optimization problems. In this paper we present a novel design for the implementation of a cGA on a FPGA. This design is modular, so its components would be used for designing other Evolutionary Algorithms.

15:10 -15:30 *Fuzzy OLAP: A Formal Definition (#24)*
Claudia González, Leonid Tine, Angélica Urrutia

Real world is pervaded of imprecision and uncertainty. These characteristics are well represented in computational systems by means of fuzzy logic. Some systems produce vital data that must be stored for its posterior analysis supporting decision making through OLAP. At present time this data may involve imprecision and uncertainty, therefore fuzzy OLAP operators must be provided. We do that in this paper in a formal way, giving a rigorous definition of fuzzy logic extended OLAP operators.

15:30-15:50 *Dynamic Classifier Selection with Confidence Intervals (#81)*
R.M. Valdovinos, M. Sánchez, I.Ruiz

Nowadays, the ensembles are a popular classification method. In order to obtain the final decision the selection and the fusion methods are used. In this paper, the Dynamic Classifier Selection with Confidence Intervals (DCS-CONFI) method is proposed. This method use confidence intervals for identify the true knowledge or the influence of each individual classifier in the final decision, thus, the member with higher confidence interval is chosen for classify the test pattern. The experimental results demonstrated the convenience of to determinate the confidence level when the classifier selection scheme is used.

15:50 -16:10 *Mixture of Experts with Genetic Algorithms (#87)*
L. Cleofas, R.M. Valdovinos, C. Juárez

Mixture of Experts constructing (MxE) is visualized from two slopes: considering diversity in the original training set or diversity in each classifier. Traditionally, the label of the test patterns has been determined by means of an individual

classifier, nevertheless another non-traditional methodology of classification will be presented in this work (Mixture of Experts based in Evolutionary Algorithms), with this methodology is possible to guarantee diversity in each member of the MxE. The rules of apprenticeship considered for the MxE are: the Nearest Neighbor Rule and a Modular Neuronal Network. The experiments were obtained using real data bases form the UCI repository.

16:10 -16:30 *Identifcation and Speed Control of a DC Motor Using an Input-Output Recurrent Neurofuzzy Network (#88)*

Edgar Berrospe, Marcos A. Gonzalez-Olvera, Yu Tang

In this work an input-output recurrent neurofuzzy network is used to identify and control DC motor. The known data are input-output signals obtained directly from measurements of the system. The structure of the network is linear in the consequent parameters and nonlinear in the antecedent ones. The linearization of the antecedent parameters around a suboptimal value is used to get a linear parametrization, and then a Kalman ¯lter is applied. Nonlinear constraints built into the structure are proposed, and a new parameter initialization algorithm is presented. A certainty equivalence control scheme with online adaptation is presented, based on this model.

16:30 -16:50 *Hybrid Intelligent Control Scheme for an Anaerobic Wastewater Treatment Process (#91)*

Rubén Belmonte-Izquierdo, Salvador Carlos-Hernández, Edgar Nelson Sánchez

A control strategy, composed by a neural observer and a fuzzy supervisor, for an anaerobic process is proposed in this paper. A recurrent high order neural observer (RHONO) is developed to estimate variables difficult to measure (biomass and substrate) in a completely stirred tank reactor (CSTR). The recurrent high order neural network (RHONN) structure is trained by an extended Kalman filter. The fuzzy supervisor uses estimations of biomass and methane production to detect biological activity inside the reactor and to apply an L/A (logarithm/anti-logarithm) control action if required in order to avoid washout. The applicability of the proposed scheme is illustrated via simulation.

Interactive Session

New Neural Observer for an Anaerobic Wastewater Treatment Process (#52)
Rubén Belmonte-Izquierdo, Salvador Carlos-Hernández, Edgar Nelson Sánchez

In this paper, a recurrent high order neural observer (RHONO) for anaerobic processes is proposed. The main objective is to estimate biomass and substrate in a completely stirred tank reactor. The recurrent high order neural network (RHONN) structure is based on hyperbolic tangent as activation function. The learning algorithm is based on an extended Kalman filter. The applicability of the proposed scheme is illustrated via simulation. Thus, this observer can be successfully implemented for control purposes

A transelevator moving inside of an automatic warehouse in virtual reality (#53)
Jose de Jesus Rubio, Enrique Garcia, Jaime Pacheco

In this research, it is simulated the computed movements of a transelevator inside of a warehouse in virtual reality. This transelevator can be used to move some load from the .oor to the deposit, and from the deposit to the .oor, or can be used move the load from one place of the deposit to another one. The virtual reality is simulated using the graphic designer Quest3D. It is presented the simulation of the system.

Hierarchical neural network model for water Quality prediction in wastewater treatment plants (#76)
Qiumei Cong, Wen Yu, Tianyou Chai

Water quality measurement is important for wastewater treatment plants. Up to the present moment, there are not economic on-line sensors for it. In this paper a new soft measurement method is proposed, which uses mechanism model and hierarchical neural networks to resolve a modeling accuracy problem. Since wastewater treatment plants are cascaded processes, hierarchical neural networks can match these structures and predict water quality in inner reactors. By comparing our method with the other soft measurement approaches, we find that based on mechanism model and hierarchical neural networks, the hierarchical model is effective for wastewater treatment plants

Computational Model for Electric Fault Diagnosis in Induction Motors (#78)
Rodrigo Lopez-Cardenas, Luis Pastor Sanchez-Fernandez, and Sergio Suarez-Guerra

This article describes a novel computational model for electric fault diagnostic in induction motors. The essential concept is that a minimum electric fault, like inter-turn short circuit, produces a slight variation that can be identified in current and rotor speed signals. This model uses motor data catalogue to calculate constant parameters that are handled in an original mathematical algorithm that employs varying parameters as function of motor slip. The model performs electric fault simulation and with them, are obtained operation characteristics that build relative and absolute patterns for normal and fault operation. These patterns train a neural network that accomplish the diagnostic in its phase implementation.

An sliding mode control for an elbow arm (#18)
Jose de Jesus Rubio, Jaime Pacheco, Gerardo Villegas

In this paper it is proposed an sliding mode control for an elbow arm. It is proven that the closed loop system of the sliding model control applied to the model of the elbow arm is asymptotic stable. It is given a simulation.

Restricted Growth String for video-type classification (#111)
Pedro L.SÁNCHEZ ORELLANA, José TORRES JIMÉNEZ, Claudio CASTELLANOS SÁNCHEZ

The use of videos to extract information from the environment is one of the most challenging task in the computer vision area. The video sequences are of particular relevance for the recognition of humans in environments; in spite of the large databases existing in the literature, there is a lack of the uniformity among them which causes difficulties at the moment of making comparisons. The main reason is the restrictions on the conditions of the sequences (like illumination). To solve this problem we are proposing a set of 5 characteristics that highly influence the human's gait recognition, also we propose the use of the Restricted Grow Strings to cluster the data bases of characteristics that represent the conditions in the videos.

Bio-inspired architecture for visual recognition of humans walking (#112)
Pedro L. SÁNCHEZ ORELLANA, Claudio CASTELLANOS SÁNCHEZ, Edgar del ANGEL-GUERRERO, Tomás MARTÍNEZ-ARENAS

In this paper we propose a bio-inspired architecture for visual recognition of humans at walking and objects that can be humans but do not describe a gait like humans at walking, based on the behaviour of simples cells in the human primary visual cortex. This architecture was tested with real sequences of images acquired in natural environments. The results show the flexibility of our propose since it helps to distinguish between these two types of moving objects, even in unknown scene conditions (bright, or background motion).