

Editorial

For this volume, the editorial board of the journal has carefully selected some of the most important works in several areas, ranging from robotics to classification, parameter estimation, control for nonlinear systems, to laws and development of IT projects. Let me briefly introduce to our valuable readers the contents of the works included in this current issue.

“A KKT Simplex Method to Efficiently Solve Linear Programs for Grasp Analysis Based on the Identification of Nonbinding Constraints” by A. Mosso-Vázquez, D. Juárez-Romero, M. A. Cruz-Chávez, L. Enrique Sucar (Mexico) presents a one-phase efficient method called KKT Simplex to solve linear programming problems for grasp analysis of robotic hands. KKT is the acronym for Karush-Kuhn-Tucker, and the method they propose processes free variables directly, while choosing the entering and leaving variables, which converts it in a one-phase method that is able to start at any point of the set of feasible solutions. Their method lowers the number of simplex steps by the angular pricing strategy to choose the entering variable and reduces the size of the linear programming problem by the identification of nonbinding constraints. Several linear programming problems of grasp analysis are solved for testing the efficiency and the one-phase nature of the proposed method.

Jonás Velasco, Mario A. Saucedo-Espinosa, Hugo Jair Escalante, Karlo Mendoza, César Emilio Villarreal-Rodríguez, Óscar L. Chacón-Mondragón, and Arturo Berrones (Mexico) work with adaptive random searches and describe their results in “An Adaptive Random Search for Unconstrained Global Optimization”. Beginning from the Adaptive Gibbs Sampling Algorithm, a heuristic for unconstrained global optimization, which is a population-based method that uses a random search strategy to generate a set of new potential solutions, they propose to adaptively control the noise level according to the landscape, while combining the random search of the one-dimensional Metropolis-Hastings algorithm and the

multidimensional Gibbs sampler. This allows them to obtain a good balance between exploration and exploitation over the search space. Velasco *et al.* perform experiments on three well-known test problems in a range of dimensions with a resulting test bed of 33 instances. They compare the Adaptive Gibbs Sampling Algorithm against two deterministic methods and three stochastic methods and finally find that the Adaptive Gibbs Sampling Algorithm is robust in problems that involve central aspects that mainly determine the difficulty of global optimization problems, such as high-dimensionality, multi-modality and non-smoothness.

In “Two-Degrees-of-Freedom Robust PID Controllers Tuning via a Multiobjective Genetic Algorithm”, R. Lagunas-Jiménez, V. Moo-Yam, and B. Ortiz-Moctezuma (Mexico) present a design methodology for a proportional integral derivative (PID) control design by means of the statement of a multiobjective optimization problem. They use a controller with two degrees of freedom. The objective functions are deployed considering a set point response, load disturbances, and robustness, to model uncertainty as its components. The time constant of measurement noise filter is a component of the vector of decision variables and the optimization problem is solved by means of a genetic algorithm.

“Feature Selection for Microarray Gene Expression Data using Simulated Annealing guided by the Multivariate Joint Entropy”, presented by Félix Fernando González-Navarro and Lluís A. Belanche-Muñoz (Mexico, Spain), consists in using the discretized multivariate joint entropy as the basis for a fast evaluation of gene relevance in a Microarray Gene Expression context. Microarray classification poses many challenges for data analysis, given that a gene expression data set may consist of dozens of observations with thousands or even tens of thousands of genes. In this context, feature subset selection techniques can be very useful to reduce the representation space to one that is

manageable by classification techniques. The algorithm of González-Navarro and Belanche-Muñoz combines a simulated annealing schedule specially designed for feature subset selection with the incrementally computed joint entropy, reusing previous values to compute current feature subset relevance. They conclude that this combination turns out to be a powerful tool, when applied to the maximization of gene subset relevance. Particularly, their method delivers interpretable solutions that are more accurate than similar methods.

A work devoted to supervised classification is “Attributes and Cases Selection for NN Classifier through Rough Sets and Naturally Inspired Algorithms”, by Yenny Villuendas-Rey and Maria Matilde Garcia-Lorenzo (Cuba). They focus in improving the performance of the Nearest Neighbor classifier, which is one of the simplest but consistently accurate classifier in supervised classification. They observe that the training set preprocessing is essential for obtaining high quality classification results. In their work, they present an algorithm for attributes and cases selection, using a hybrid Rough Set Theory and a naturally inspired approach. Their algorithm deals with mixed and incomplete, as well as imbalanced datasets. Finally they test the performance of their algorithm over repository databases, having high classification accuracy, while keeping few cases and attributes.

“Efficiently Finding the Optimum Number of Clusters in a Dataset with a New Hybrid Cellular Evolutionary Algorithm”, is a new work which results from the collaboration of Javier Arellano-Verdejo, Adolfo Guzmán-Arenas, Salvador Godoy-Calderón, and Ricardo Barrón Fernández (Mexico). They address the important problem of covering the search space as broadly as possible by applying multiple local searches in promising areas. Particularly, they employ hybrid methods that seek to balance global and local search procedures. The authors explore the integration of different learning and adaptation techniques to overcome individual limitations and archive synergetic effects through hybridization or fusion of several techniques. They learned from the experience of clustering algorithms that are unable to determine the optimal number of clusters to be found in a particular dataset, and they present a

novel cellular evolutionary algorithm. Extensive experimentation and results with different datasets and indexes are discussed.

Alexander Gelbukh (Mexico) in “Unsupervised Learning for Syntactic Disambiguation” addresses the problem of syntactic ambiguity: in a sentence “John sees a cat with a telescope,” English grammar allows the interpretation of “a cat with a telescope” as what John sees; however, the interpretation of “seeing with a telescope” is much more plausible. The paper presents an unsupervised learning method to automatically choose the most plausible interpretation for such ambiguous sentences. The suggested method differs from grammar induction in that it takes advantage of an existing grammar and thus requires relatively few training examples.

Flavio Reyes Díaz, Gabriel Hernández Sierra, and José Calvo de Lara (Cuba) present “A Gaussian Selection Method for Speaker Verification with Short Utterances”. In order to remove the model redundancy, they propose a Gaussian mixture model only with more representative Gaussian components. Results of speaker verification experiments applying their proposal show a similar performance to the baseline; however the authors report that the used models have a reduction of 80% with regard to the baseline. The application of the method Reyes Díaz *et al.* in real or embedded speaker verification systems is expected to be very useful for reducing computational and memory cost.

The problem of design and development of training and educational systems that enable effective personalized learning is tackled in “Enrichment of Learner Profile with Ubiquitous User Model Interoperability”, by María de Lourdes Martínez-Villaseñor, Miguel González-Mendoza, Ignacio Danvila Del Valle (Mexico, Spain). The computational effort to create a user model that represents user’s knowledge, characteristics, interests, goals, background and preferences is repeatedly done by many systems and applications in several domains, but each system ends up with a partial view of the user. Researchers in user modeling foresee the need of sharing and reusing user model information in order to obtain a better understanding of the user and be able to provide personalized and proactive

services. Martínez-Villaseñor *et al.* present an application scenario of sharing and reusing information scattered in several commonly used applications to enhance learner profiles.

Samuel Sepúlveda Cuevas and Ania Cravero Leal (Chile) present a proposal to help standardize processes associated with the development of IT projects belonging to a service company, based on the use of standards and best practices in the software industry, in "Standardization of the Processes Associated to Computer Projects: a Case Study". Their proposal analyzes, classifies and discriminates by project types, requirements and resources needed for the kind of projects that a company may face. Their results show positive effects on product quality and satisfaction of internal customers.

José de Jesús Medel and María Teresa Zagaceta Álvarez (Mexico) present their latest results in digital filter theory in "Black-box System Parameters Estimation". In digital filter theory, the identification process describes internal dynamic states based on a reference system, commonly known as a black-box. Unfortunately in the black-box concept, the exponential transition function considers the unknown internal parameters; this means that the identification process does not operate correctly because its transition function has no access to internal dynamic gains. An approximation to solve this difficulty is used and is considered as an estimator. The authors present an estimator for a single output with stationary properties.

In the field of adaptive neural networks, Joel Pérez, Jose P. Perez, Francisco Rodríguez and Angel Flores (Mexico), present "Trajectory Tracking for Chaos Synchronization Via PI Control Law between Roosler-Chen", in which an application of adaptive neural networks is shown. Their work is based on applying a dynamic neural network to trajectory tracking of unknown nonlinear plants. The main methodology on which the approach is based is recurrent neural networks, Lyapunov functions, and Proportional-Integral (PI) control for nonlinear systems. The proposed controller structure is composed of a neural identifier and a control law defined by using the PI approach. The new control scheme is applied via simulations to Chaos Synchronization. The authors show the usefulness of the proposed

approach for Chaos Production. To verify the analytical results, they simulate an example of a dynamical network and propose a theorem to ensure the tracking of the nonlinear system.

Ricardo Carreño, Miguel Patiño and Julián Patiño (Mexico) explore dynamical models of aircrafts in "Sliding Modes Control Applied to a Mini Aircraft Pitch Position Model". Particularly, they evaluate and compare real aircrafts performance results with respect to the pitch control law based on reference trajectory in the presence of external disturbances (blasts) or changes in the aircraft controller model. Normally, mini aircrafts must be able to perform tasks such as aerial photography, aerial surveillance, remote fire and pollution sensing, disaster areas recognition, road traffic and security monitoring, among other applications without stability problems in the presence of many bounded perturbations. Particularly, the dynamic model is affected by blast perturbations. The presented model has non-linear properties, but soft perturbations through the aircraft trajectory allow a linear description without losing its essential properties.

Finally, the repercussions of the Federal Copyright Law, the Federal Law of Industrial Property and the Federal Criminal Code of Mexico on the creation and distribution of computer programs are discussed in "Laws governing in Mexico for computer programs, databases and documentation", by María del Consuelo Argüelles Arellano and Claudia Ávila Méndez, (Mexico). A developer of computer programs, databases and information has many challenges to overcome, being one of them to act ethically and respecting the law. This work is based on the belief that it is fundamental to know the federal laws related to computer programs in order to professionally carry on their endeavors.

We are pleased to release all of these works to our esteemed readers with the certainty that they will find many of them useful and representative of the current state of the art.

Hiram Calvo
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