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Emilio Corchado Manuel Graña Romay  
Alexandre Manhaes Savio (Eds.)

# Hybrid Artificial Intelligence Systems

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## Table of Contents – Part II

SIFT-SS: An Advanced Steady-State Multi-Objective Genetic Fuzzy System .....	1
<i>Michel González, Jorge Casillas, and Carlos Morell</i>	
Evolving Multi-label Classification Rules with Gene Expression Programming: A Preliminary Study .....	9
<i>José Luis Ávila-Jiménez, Eva Gibaja, and Sebastián Ventura</i>	
Solving Classification Problems Using Genetic Programming Algorithms on GPUs .....	17
<i>Alberto Cano, Amelia Zafra, and Sebastián Ventura</i>	
Analysis of the Effectiveness of G3PARM Algorithm.....	27
<i>J.M. Luna, J.R. Romero, and S. Ventura</i>	
Reducing Dimensionality in Multiple Instance Learning with a Filter Method .....	35
<i>Amelia Zafra, Mykola Pechenizkiy, and Sebastián Ventura</i>	
Graphical Exploratory Analysis of Educational Knowledge Surveys with Missing and Conflictive Answers Using Evolutionary Techniques...	45
<i>Luciano Sánchez, Inés Couso, and José Otero</i>	
Data Mining for Grammatical Inference with Bioinformatics Criteria ...	53
<i>Vivian F. López, Ramiro Aguilar, Luis Alonso, María N. Moreno, and Juan M. Corchado</i>	
Hybrid Multiagent System for Automatic Object Learning Classification .....	61
<i>Ana Gil, Fernando de la Prieta, and Vivian F. López</i>	
On the Use of a Hybrid Approach to Contrast Endmember Induction Algorithms .....	69
<i>Miguel A. Veganzones and Carmen Hernández</i>	
Self-emergence of Lexicon Consensus in a Population of Autonomous Agents by Means of Evolutionary Strategies .....	77
<i>Darío Maravall, Javier de Lope, and Raúl Domínguez</i>	
Enhanced Self Organized Dynamic Tree Neural Network .....	85
<i>Juan F. De Paz, Sara Rodríguez, Ana Gil, Juan M. Corchado, and Pastora Vega</i>	

Agents and Computer Vision for Processing Stereoscopic Images . . . . .	93
<i>Sara Rodríguez, Fernando de la Prieta, Dante I. Tapia, and Juan M. Corchado</i>	
Incorporating Temporal Constraints in the Planning Task of a Hybrid Intelligent IDS . . . . .	101
<i>Álvaro Herrero, Martí Navarro, Vicente Julián, and Emilio Corchado</i>	
HERA: A New Platform for Embedding Agents in Heterogeneous Wireless Sensor Networks . . . . .	111
<i>Ricardo S. Alonso, Juan F. De Paz, Óscar García, Óscar Gil, and Angélica González</i>	
A Genetic Algorithm for Solving the Generalized Vehicle Routing Problem . . . . .	119
<i>P.C. Pop, O. Matei, C. Pop Sitar, and C. Chira</i>	
Using Cultural Algorithms to Improve Intelligent Logistics . . . . .	127
<i>Alberto Ochoa, Yazmani García, Javier Yañez, and Yaddik Teymanoglu</i>	
A Cultural Algorithm for the Urban Public Transportation . . . . .	135
<i>Laura Cruz Reyes, Carlos Alberto Ochoa Ortíz Zezzatti, Claudia Gómez Santillán, Paula Hernández Hernández, and Mercedes Villa Fuerte</i>	
Scalability of a Methodology for Generating Technical Trading Rules with GAPs Based on Risk-Return Adjustment and Incremental Training . . . . .	143
<i>E.A. de la Cal, E.M. Fernández, R. Quiroga, J.R. Villar, and J. Sedano</i>	
Hybrid Approach for the Public Transportation Time Dependent Orienteering Problem with Time Windows . . . . .	151
<i>Ander Garcia, Olatz Arbelaitz, Pieter Vansteenwegen, Wouter Souffriau, and Maria Teresa Linaza</i>	
A Functional Taxonomy for Artifacts . . . . .	159
<i>Sergio Esparcia and Estefanía Argente</i>	
A Case-Based Reasoning Approach for Norm Adaptation . . . . .	168
<i>Jordi Campos, Maite López-Sánchez, and Marc Esteva</i>	
An Abstract Argumentation Framework for Supporting Agreements in Agent Societies . . . . .	177
<i>Stella Heras, Vicente Botti, and Vicente Julián</i>	
Reaching a Common Agreement Discourse Universe on Multi-Agent Planning . . . . .	185
<i>Alejandro Torreño, Eva Onaindia, and Oscar Sapena</i>	

Integrating Information Extraction Agents into a Tourism Recommender System . . . . .	193
<i>Sergio Esparcia, Víctor Sánchez-Anguix, Estefanía Argente, Ana García-Fornes, and Vicente Julián</i>	
Adaptive Hybrid Immune Detector Maturation Algorithm . . . . .	201
<i>Jungan Chen, Wenxin Chen, and Feng Liang</i>	
Interactive Visualization Applets for Modular Exponentiation Using Addition Chains . . . . .	209
<i>Hatem M. Bahig and Yasser Kotb</i>	
Multimedia Elements in a Hybrid Multi-Agent System for the Analysis of Web Usability . . . . .	217
<i>E. Mosqueira-Rey, B. Baldonado del Río, D. Alonso-Ríos, E. Rodríguez-Poch, and D. Prado-Gesto</i>	
An Approach for an AVC to SVC Transcoder with Temporal Scalability . . . . .	225
<i>Rosario Garrido-Cantos, José Luis Martínez, Pedro Cuenca, and Antonio Garrido</i>	
A GPU-Based DVC to H.264/AVC Transcoder . . . . .	233
<i>Alberto Corrales-García, Rafael Rodríguez-Sánchez, José Luis Martínez, Gerardo Fernández-Escribano, José M. Claver, and José Luis Sánchez</i>	
Hybrid Color Space Transformation to Visualize Color Constancy . . . . .	241
<i>Ramón Moreno, José Manuel López-Guede, and Alicia d’Anjou</i>	
A Novel Hybrid Approach to Improve Performance of Frequency Division Duplex Systems with Linear Precoding . . . . .	248
<i>Paula M. Castro, José A. García-Naya, Daniel Iglesia, and Adriana Dapena</i>	
Low Bit-Rate Video Coding with 3D Lower Trees (3D-LTW) . . . . .	256
<i>Otoniel López, Miguel Martínez-Rach, Pablo Piñol, Manuel P. Malumbres, and José Oliver</i>	
Color Video Segmentation by Dissimilarity Based on Edges . . . . .	264
<i>Lucía Ramos, Jorge Novo, José Rouco, Antonio Mosquera, and Manuel G. Penedo</i>	
Label Dependent Evolutionary Feature Weighting for Remote Sensing Data . . . . .	272
<i>Daniel Mateos-García, Jorge García-Gutiérrez, and José C. Riquelme-Santos</i>	

Evolutionary $q$ -Gaussian Radial Basis Functions for Binary-Classification .....	280
<i>F. Fernández-Navarro, C. Hervás-Martínez, P.A. Gutiérrez, M. Cruz-Ramírez, and M. Carbonero-Ruz</i>	
Evolutionary Learning Using a Sensitivity-Accuracy Approach for Classification .....	288
<i>Javier Sánchez-Monedero, C. Hervás-Martínez, F.J. Martínez-Estudillo, Mariano Carbonero Ruz, M.C. Ramírez Moreno, and M. Cruz-Ramírez</i>	
An Hybrid System for Continuous Learning .....	296
<i>Aldo Franco Dragoni, Germano Vallesi, Paola Baldassarri, and Mauro Mazzieri</i>	
Support Vector Regression Algorithms in the Forecasting of Daily Maximums of Tropospheric Ozone Concentration in Madrid .....	304
<i>E.G. Ortiz-García, S. Salcedo-Sanz, A.M. Pérez-Bellido, J. Gascón-Moreno, and A. Portilla-Figueras</i>	
Neuronal Implementation of Predictive Controllers .....	312
<i>José Manuel López-Guede, Ekaitz Zulueta, and Borja Fernández-Gauna</i>	
$\alpha$ -Satisfiability and $\alpha$ -Lock Resolution for a Lattice-Valued Logic LP(X) .....	320
<i>Xingxing He, Yang Xu, Yingfang Li, Jun Liu, Luis Martinez, and Da Ruan</i>	
On Compactness and Consistency in Finite Lattice-Valued Propositional Logic .....	328
<i>Xiaodong Pan, Yang Xu, Luis Martinez, Da Ruan, and Jun Liu</i>	
Lattice Independent Component Analysis for Mobile Robot Localization .....	335
<i>Ivan Villaverde, Borja Fernandez-Gauna, and Ekaitz Zulueta</i>	
An Introduction to the Kosko Subsethood FAM .....	343
<i>Peter Sussner and Estevão Esmi</i>	
An Increasing Hybrid Morphological-Linear Perceptron with Evolutionary Learning and Phase Correction for Financial Time Series Forecasting .....	351
<i>Ricardo de A. Araújo and Peter Sussner</i>	
Lattice Associative Memories for Segmenting Color Images in Different Color Spaces .....	359
<i>Gonzalo Urcid, Juan Carlos Valdiviezo-N., and Gerhard X. Ritter</i>	



Lattice Neural Networks with Spike Trains . . . . .	367
<i>Gerhard X. Ritter and Gonzalo Urcid</i>	
Detecting Features from Confusion Matrices Using Generalized Formal Concept Analysis . . . . .	375
<i>Carmen Peláez-Moreno and Francisco J. Valverde-Albacete</i>	
Reconciling Knowledge in Social Tagging Web Services . . . . .	383
<i>Gonzalo A. Aranda-Corral and Joaquín Borrego-Díaz</i>	
2-D Shape Representation and Recognition by Lattice Computing Techniques . . . . .	391
<i>V.G. Kaburlasos, A. Amanatiadis, and S.E. Papadakis</i>	
Order Metrics for Semantic Knowledge Systems . . . . .	399
<i>Cliff Joslyn and Emilie Hogan</i>	
Granular Fuzzy Inference System (FIS) Design by Lattice Computing . . . . .	410
<i>Vassilis G. Kaburlasos</i>	
Median Hetero-Associative Memories Applied to the Categorization of True-Color Patterns . . . . .	418
<i>Roberto A. Vázquez and Humberto Sossa</i>	
A Comparison of VBM Results by SPM, ICA and LICA . . . . .	429
<i>Darya Chyzyk, Maite Termenon, and Alexandre Savio</i>	
Fusion of Single View Soft k-NN Classifiers for Multicamera Human Action Recognition . . . . .	436
<i>Rodrigo Cilla, Miguel A. Patricio, Antonio Berlanga, and Jose M. Molina</i>	
Self-adaptive Coordination for Organizations of Agents in Information Fusion Environments . . . . .	444
<i>Sara Rodríguez, Belén Pérez-Lancho, Javier Bajo, Carolina Zato, and Juan M. Corchado</i>	
Sensor Management: A New Paradigm for Automatic Video Surveillance . . . . .	452
<i>Lauro Snidaro, Ingrid Visentini, and Gian Luca Foresti</i>	
A Simulation Framework for UAV Sensor Fusion . . . . .	460
<i>Enrique Martí, Jesús García, and Jose Manuel Molina</i>	
An Embeddable Fusion Framework to Manage Context Information in Mobile Devices . . . . .	468
<i>Ana M. Bernardos, Eva Madrazo, and José R. Casar</i>	

Embodied Moving-Target Seeking with Prediction and Planning . . . . .	478
<i>Noelia Oses, Matej Hoffmann, and Randal A. Koene</i>	
Using Self-Organizing Maps for Intelligent Camera-Based User Interfaces . . . . .	486
<i>Zorana Banković, Elena Romero, Javier Blesa, José M. Moya, David Fraga, Juan Carlos Vallejo, Álvaro Araujo, Pedro Malagón, Juan-Mariano de Goyeneche, Daniel Villanueva, and Octavio Nieto-Taladriz</i>	
A SVM and k-NN Restricted Stacking to Improve Land Use and Land Cover Classification . . . . .	493
<i>Jorge Garcia-Gutierrez, Daniel Mateos-Garcia, and Jose C. Riquelme-Santos</i>	
A Bio-inspired Fusion Method for Data Visualization . . . . .	501
<i>Bruno Baruque and Emilio Corchado</i>	
CBRid4SQL: A CBR Intrusion Detector for SQL Injection Attacks . . . . .	510
<i>Cristian Pinzón, Álvaro Herrero, Juan F. De Paz, Emilio Corchado, and Javier Bajo</i>	
<b>Author Index . . . . .</b>	<b>521</b>

# Table of Contents – Part I

Y-Means: An Autonomous Clustering Algorithm (Invited Paper) . . . . .	1
<i>Ali A. Ghorbani and Iosif-Viorel Onut</i>	
A Survey and Analysis of Frameworks and Framework Issues for Information Fusion Applications (Invited Paper) . . . . .	14
<i>James Llinas</i>	
A Regular Tetrahedron Formation Strategy for Swarm Robots in Three-Dimensional Environment . . . . .	24
<i>M. Fikret Ercan, Xiang Li, and Ximing Liang</i>	
Markovian Ants in a Queuing System . . . . .	32
<i>Ilija Tanackov, Dragan Simić, Siniša Sremac, Jovan Tepić, and Sunčica Kocić-Tanackov</i>	
A Parametric Method Applied to Phase Recovery from a Fringe Pattern Based on a Particle Swarm Optimization . . . . .	40
<i>J.F. Jimenez, F.J. Cuevas, J.H. Sossa, and L.E. Gomez</i>	
Automatic PSO-Based Deformable Structures Markerless Tracking in Laparoscopic Cholecystectomy . . . . .	48
<i>Haroun Djaghloul, Mohammed Batouche, and Jean-Pierre Jessel</i>	
A Framework for Optimization of Genetic Programming Evolved Classifier Expressions Using Particle Swarm Optimization . . . . .	56
<i>Hajira Jabeen and Abdul Rauf Baig</i>	
Developing an Intelligent Parking Management Application Based on Multi-agent Systems and Semantic Web Technologies . . . . .	64
<i>Andrés Muñoz and Juan A. Botía</i>	
Linked Multicomponent Robotic Systems: Basic Assessment of Linking Element Dynamical Effect . . . . .	73
<i>Borja Fernandez-Gauna, Jose Manuel Lopez-Guede, and Ekaitz Zulueta</i>	
Social Simulation for AmI Systems Engineering . . . . .	80
<i>Teresa Garcia-Valverde, Emilio Serrano, and Juan A. Botia</i>	
Automatic Behavior Pattern Classification for Social Robots . . . . .	88
<i>Abraham Prieto, Francisco Bellas, Pilar Caamaño, and Richard J. Duro</i>	
Healthcare Information Fusion Using Context-Aware Agents . . . . .	96
<i>Dante I. Tapia, Juan A. Fraile, Ana de Luis, and Javier Bajo</i>	

Multivariate Discretization for Associative Classification in a Sparse Data Application Domain . . . . .	104
<i>María N. Moreno García, Joel Pinho Lucas, Vivian F. López Batista, and M. José Polo Martín</i>	
Recognition of Turkish Vowels by Probabilistic Neural Networks Using Yule-Walker AR Method . . . . .	112
<i>Erdem Yavuz and Vedat Topuz</i>	
A Dynamic Bayesian Network Based Structural Learning towards Automated Handwritten Digit Recognition . . . . .	120
<i>Olivier Pauplin and Jianmin Jiang</i>	
A Dual Network Adaptive Learning Algorithm for Supervised Neural Network with Contour Preserving Classification for Soft Real Time Applications . . . . .	128
<i>Piyabute Fuangkhan and Thitipong Tanprasert</i>	
The Abnormal vs. Normal ECG Classification Based on Key Features and Statistical Learning . . . . .	136
<i>Jun Dong, Jia-fei Tong, and Xia Liu</i>	
Classification of Wood Pulp Fibre Cross-Sectional Shapes . . . . .	144
<i>Asuka Yamakawa and Gary Chinga-Carrasco</i>	
A Hybrid Cluster-Lift Method for the Analysis of Research Activities . . .	152
<i>Boris Mirkin, Susana Nascimento, Trevor Fenner, and Luís Moniz Pereira</i>	
Protein Fold Recognition with Combined SVM-RDA Classifier . . . . .	162
<i>Wiesław Chmielnicki and Katarzyna Stępor</i>	
Data Processing on Database Management Systems with Fuzzy Query . . . . .	170
<i>İrfan Şimşek and Vedat Topuz</i>	
A Hybrid Approach for Process Mining: Using From-to Chart Arranged by Genetic Algorithms . . . . .	178
<i>Eren Eşgin, Pinar Senkul, and Cem Cimenbicer</i>	
Continuous Pattern Mining Using the FCPGrowth Algorithm in Trajectory Data Warehouses . . . . .	187
<i>Marcin Gorawski and Pawel Jureczek</i>	
Hybrid Approach for Language Identification Oriented to Multilingual Speech Recognition in the Basque Context . . . . .	196
<i>N. Barroso, K. López de Ipiña, A. Ezeiza, O. Barroso, and U. Susperregi</i>	

An Approach of Bio-inspired Hybrid Model for Financial Markets . . . . .	205
<i>Dragan Simić, Vladeta Gajić, and Svetlana Simić</i>	
Interactive and Stereoscopic Hybrid 3D Viewer of Radar Data with Gesture Recognition . . . . .	213
<i>Jon Goenetxea, Aitor Moreno, Luis Unzueta, Andoni Galdós, and Álvaro Segura</i>	
Recognition of Manual Actions Using Vector Quantization and Dynamic Time Warping . . . . .	221
<i>Marcel Martin, Jonathan Maycock, Florian Paul Schmidt, and Oliver Kramer</i>	
Protecting Web Services against DoS Attacks: A Case-Based Reasoning Approach . . . . .	229
<i>Cristian Pinzón, Juan F. De Paz, Carolina Zato, and Javier Pérez</i>	
Ranked Tag Recommendation Systems Based on Logistic Regression . . .	237
<i>J.R. Quevedo, E. Montañés, J. Ranilla, and I. Díaz</i>	
A Hybrid Robotic Control System Using Neuroblastoma Cultures . . . . .	245
<i>J.M. Ferrández, V. Lorente, J.M. Cuadra, F. delaPaz, José Ramón Álvarez-Sánchez, and E. Fernández</i>	
Image Segmentation with a Hybrid Ensemble of One-Class Support Vector Machines . . . . .	254
<i>Bogusław Cyganek</i>	
Power Prediction in Smart Grids with Evolutionary Local Kernel Regression . . . . .	262
<i>Oliver Kramer, Benjamin Satzger, and Jörg Lässig</i>	
Automatic Quality Inspection of Percussion Cap Mass Production by Means of 3D Machine Vision and Machine Learning Techniques . . . . .	270
<i>A. Tellaache, R. Arana, A. Ibarguren, and J.M. Martínez-Otzeta</i>	
Speaker Verification and Identification Using Principal Component Analysis Based on Global Eigenvector Matrix . . . . .	278
<i>Minkyung Kim, Eunyoung Kim, Changwoo Seo, and Sungchae Jeon</i>	
Hybrid Approach for Automatic Evaluation of Emotion Elicitation Oriented to People with Intellectual Disabilities . . . . .	286
<i>R. Martínez, K. López de Ipiña, E. Irigoyen, and N. Asla</i>	
Fusion of Fuzzy Spatial Relations . . . . .	294
<i>Nadeem Salamat and El-hadi Zahzah</i>	
Reducing Artifacts in TMS-Evoked EEG . . . . .	302
<i>Juan José Fuertes, Carlos M. Travieso, A. Álvarez, M.A. Ferrer, and J.B. Alonso</i>	

Model Driven Image Segmentation Using a Genetic Algorithm for Structured Data . . . . .	311
<i>Romain Raveaux and Guillaume Hillairet</i>	
Stamping Line Optimization Using Genetic Algorithms and Virtual 3D Line Simulation . . . . .	319
<i>Javier A. García-Sedano, Jon Alzola Bernardo, Asier González González, Óscar Berasategui Ruiz de Gauna, and Rafael Yuguero González de Mendivil</i>	
Evolutionary Industrial Physical Model Generation . . . . .	327
<i>Alberto Carrascal and Amaia Alberdi</i>	
Evolving Neural Networks with Maximum AUC for Imbalanced Data Classification . . . . .	335
<i>Xiaofen Lu, Ke Tang, and Xin Yao</i>	
A Neuro-genetic Control Scheme Application for Industrial $R^3$ Workspaces . . . . .	343
<i>E. Irigoyen, M. Larrea, J. Valera, V. Gómez, and F. Artaza</i>	
Memetic Feature Selection: Benchmarking Hybridization Schemata . . . . .	351
<i>M.A. Esseghir, Gilles Goncalves, and Yahya Slimani</i>	
A Hybrid Cellular Genetic Algorithm for Multi-objective Crew Scheduling Problem . . . . .	359
<i>Fariborz Jolai and Ghazal Assadipour</i>	
GENNET-Toolbox: An Evolving Genetic Algorithm for Neural Network Training . . . . .	368
<i>Vicente Gómez-Garay, Eloy Irigoyen, and Fernando Artaza</i>	
An Evolutionary Feature-Based Visual Attention Model Applied to Face Recognition . . . . .	376
<i>Roberto A. Vázquez, Humberto Sossa, and Beatriz A. Garro</i>	
Efficient Plant Supervision Strategy Using NN Based Techniques . . . . .	385
<i>Ramon Ferreiro Garcia, Jose Luis Calvo Rolle, and Francisco Javier Perez Castelo</i>	
FDI and Accommodation Using NN Based Techniques . . . . .	395
<i>Ramon Ferreiro Garcia, Alberto De Miguel Catoira, and Beatriz Ferreiro Sanz</i>	
A Hybrid ACO Approach to the Matrix Bandwidth Minimization Problem . . . . .	405
<i>Camelia-M. Pinteá, Gloria-Cerasela Crişan, and Camelia Chira</i>	

Machine-Learning Based Co-adaptive Calibration: A Perspective to Fight BCI Illiteracy . . . . .	413
<i>Carmen Vidaurre, Claudia Sannelli, Klaus-Robert Müller, and Benjamin Blankertz</i>	
Analysing the Low Quality of the Data in Lighting Control Systems . . . . .	421
<i>Jose R. Villar, Enrique de la Cal, Javier Sedano, and Marco García-Tamargo</i>	
Type-1 Non-singleton Type-2 Takagi-Sugeno-Kang Fuzzy Logic Systems Using the Hybrid Mechanism Composed by a Kalman Type Filter and Back Propagation Methods . . . . .	429
<i>Gerardo M. Mendez, Angeles Hernández, Alberto Cavazos, and Marco-Tulio Mata-Jiménez</i>	
An Hybrid Architecture Integrating Forward Rules with Fuzzy Ontological Reasoning . . . . .	438
<i>Stefano Bragaglia, Federico Chesani, Anna Ciampolini, Paola Mello, Marco Montali, and Davide Sottara</i>	
Selecting Regions of Interest in SPECT Images Using Wilcoxon Test for the Diagnosis of Alzheimer’s Disease . . . . .	446
<i>D. Salas-Gonzalez, J.M. Górriz, J. Ramírez, Fermín Segovia, Rosa Chaves, Miriam López, I.A. Illán, and Pablo Padilla</i>	
Effective Diagnosis of Alzheimer’s Disease by Means of Association Rules . . . . .	452
<i>Rosa Chaves, Javier Ramírez, J.M. Górriz, Miriam López, D. Salas-Gonzalez, I.A. Illán, Fermín Segovia, and Pablo Padilla</i>	
Exploratory Matrix Factorization for PET Image Analysis . . . . .	460
<i>A. Kodewitz, I.R. Keck, A.M. Tomé, J.M. Górriz, and Elmar W. Lang</i>	
NMF-Based Analysis of SPECT Brain Images for the Diagnosis of Alzheimer’s Disease . . . . .	468
<i>Pablo Padilla, Juan-Manuel Górriz, Javier Ramírez, Elmar Lang, Rosa Chaves, Fermín Segovia, Ignacio Álvarez, Diego Salas-González, and Miriam López</i>	
Partial Least Squares for Feature Extraction of SPECT Images . . . . .	476
<i>Fermín Segovia, Javier Ramírez, J.M. Górriz, Rosa Chaves, D. Salas-Gonzalez, Miriam López, Ignacio Álvarez, Pablo Padilla, and C.G. Puntonet</i>	
Sensor Fusion Adaptive Filtering for Position Monitoring in Intense Activities . . . . .	484
<i>Alberto Olivares, J.M. Górriz, Javier Ramírez, and Gonzalo Olivares</i>	

Prediction of Bladder Cancer Recurrences Using Artificial Neural Networks .....	492
<i>Ekaitz Zulueta Guerrero, Naiara Telleria Garay, Jose Manuel Lopez-Guede, Borja Ayerdi Vilches, Eider Egilegor Iragorri, David Lecumberrri Castaños, Ana Belén de la Hoz Rastrollo, and Carlos Pertusa Peña</i>	
Hybrid Decision Support System for Endovascular Aortic Aneurysm Repair Follow-Up .....	500
<i>Jon Haitz Legarreta, Fernando Boto, Iván Macía, Josu Maiora, Guillermo García, Céline Paloc, Manuel Graña, and Mariano de Blas</i>	
On the Design of a CADS for Shoulder Pain Pathology .....	508
<i>K. López de Ipiña, M.C. Hernández, E. Martínez, and C. Vaquero</i>	
Exploring Symmetry to Assist Alzheimer’s Disease Diagnosis .....	516
<i>I.A. Illán, J.M. Górriz, Javier Ramírez, D. Salas-Gonzalez, Miriam López, Pablo Padilla, Rosa Chaves, Fermin Segovia, and C.G. Puntonet</i>	
Thrombus Volume Change Visualization after Endovascular Abdominal Aortic Aneurysm Repair .....	524
<i>Josu Maiora, Guillermo García, Iván Macía, Jon Haitz Legarreta, Fernando Boto, Céline Paloc, Manuel Graña, and Javier Sanchez Abuín</i>	
Randomness and Fuzziness in Bayes Multistage Classifier .....	532
<i>Robert Burduk</i>	
Multiple Classifier System with Radial Basis Weight Function .....	540
<i>Konrad Jackowski</i>	
Mixture of Random Prototype-Based Local Experts .....	548
<i>Giuliano Armano and Nima Hatami</i>	
Graph-Based Model-Selection Framework for Large Ensembles .....	557
<i>Krisztian Buza, Alexandros Nanopoulos, and Lars Schmidt-Thieme</i>	
Rough Set-Based Analysis of Characteristic Features for ANN Classifier .....	565
<i>Urszula Stańczyk</i>	
Boosting Algorithm with Sequence-Loss Cost Function for Structured Prediction .....	573
<i>Tomasz Kajdanowicz, Przemysław Kazienko, and Jan Kraszewski</i>	



Application of Mixture of Experts to Construct Real Estate Appraisal Models .....	581
<i>Magdalena Graczyk, Tadeusz Lasota, Zbigniew Telec, and Bogdan Trawiński</i>	
Designing Fusers on the Basis of Discriminants – Evolutionary and Neural Methods of Training .....	590
<i>Michał Wozniak and Marcin Zmysłony</i>	
<b>Author Index</b> .....	599

# CBRid4SQL: A CBR Intrusion Detector for SQL Injection Attacks

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**Abstract.** One of the most serious security threats to recently deployed databases has been the SQL Injection attack. This paper presents an agent specialised in the detection of SQL injection attacks. The agent incorporates a Case-Based Reasoning engine which is equipped with a learning and adaptation capacity for the classification of malicious codes. The agent also incorporates advanced algorithms in the reasoning cycle stages. The reuse phase uses an innovative classification model based on a mixture of a neuronal network together with a Support Vector Machine in order to classify the received SQL queries in the most reliable way. Finally, a visualisation neural technique is incorporated, which notably eases the revision stage carried out by human experts in the case of suspicious queries. The Classifier Agent was tested in a real-traffic case study and its experimental results, which validate the performance of the proposed approach, are presented here.

**Keywords:** SQL Injection, Intrusion Detection, CBR, SVM, Neural Networks.

## 1 Introduction

Over recent years, one of the most serious security threats around databases has been the SQL Injection attack [1]. In spite of it being a well-known type of attack, the SQL injection remains at the top of the published threat list. The solutions proposed so far [2], [3], [4], [5], [6], [7], [8] seem insufficient to prevent and block this type of attack because these solutions lack the learning and adaptation capabilities for dealing with attacks and their possible variations in the future. In addition, the vast majority of solutions are based on centralized mechanisms with little capacity to work in distributed and dynamic environments.

This study presents the intelligent agent CBRid4SQL (a CBR Intrusion Detector), capable of detecting attacks based on SQL code injection. CBRid4SQL is an agent specially designed following the strategy of an Intrusion Detection System (IDS) and is defined as a Hybrid Artificial Intelligence System (HAIS). This agent is

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