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Advances in Computational Intelligence

15th International Work-Conference
on Artificial Neural Networks, IWANN 2019
Gran Canaria, Spain, June 12–14, 2019
Proceedings, Part I

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Preface

We are proud to present the set of final accepted papers for the 13th edition of the IWANN conference—the International Work-Conference on Artificial Neural Networks—held in Gran Canaria, (Spain) during June 12–14, 2019.

IWANN is a biennial conference that seeks to provide a discussion forum for scientists, engineers, educators, and students about the latest ideas and realizations in the foundations, theory, models, and applications of hybrid systems inspired by nature (neural networks, fuzzy logic and evolutionary systems) as well as in emerging areas related to these topics. As in previous editions of IWANN, it also aims to create a friendly environment that could lead to the establishment of scientific collaborations and exchanges among attendees. The proceedings will include all the communications presented at the conference. A publication of an extended version of selected papers in a special issue of several specialized journals (such as *Neural Computing and Applications*, *PLOS One*, and *Neural Processing Letters*) is also foreseen.

Since the first edition in Granada (LNCS 540, 1991), the conference has evolved and matured. The list of topics in the successive Call for Papers has also evolved, resulting in the following list for the present edition:

1. **Mathematical and theoretical methods in computational intelligence.** Mathematics for neural networks. RBF structures. Self-organizing networks and methods. Support vector machines and kernel methods. Fuzzy logic. Evolutionary and genetic algorithms.
2. **Neurocomputational formulations.** Single-neuron modeling. Perceptual modeling. System-level neural modeling. Spiking neurons. Models of biological learning.
3. **Learning and adaptation.** Adaptive systems. Imitation learning. Reconfigurable systems. Supervised, non-supervised, reinforcement, and statistical algorithms.
4. **Emulation of cognitive functions.** Decision-making. Multi-agent systems. Sensor mesh. Natural language. Pattern recognition. Perceptual and motor functions (visual, auditory, tactile, virtual reality, etc.). Robotics. Planning motor control.
5. **Bio-inspired systems and neuro-engineering.** Embedded intelligent systems. Evolvable computing. Evolving hardware. Microelectronics for neural, fuzzy and bioinspired systems. Neural prostheses. Retinomorph systems. Brain–computer interfaces (BCI) Nanosystems. Nanocognitive systems.
6. **Advanced topics in computational intelligence.** Intelligent networks. Knowledge-intensive problem-solving techniques. Multi-sensor data fusion using computational intelligence. Search and meta-heuristics. Soft computing. Neuro-fuzzy systems. Neuro-evolutionary systems. Neuro-swarm. Hybridization with novel computing paradigms.
7. **Applications.** Expert systems. Image and signal processing. Ambient intelligence. Biomimetic applications. System identification, process control, and manufacturing. Computational biology and bioinformatics. Parallel and distributed computing. Human-computer interaction, Internet modeling, communication and networking.

Intelligent systems in education. Human–robot interaction. Multi-agent systems. Time series analysis and prediction. Data mining and knowledge discovery.

At the end of the submission process, and after a careful peer review and evaluation process (each submission was reviewed by at least 2, and on average 2.9, Program Committee members or additional reviewers), 150 papers were accepted for oral or poster presentation, according to the reviewers’ recommendations and the authors’ preferences.

In this edition of IWANN 2019, a workshop entitled “Artificial Intelligence in Nanophotonics” was presented, organized by Dr. Nikolay Zheludev, University of Southampton, UK, and NTU Singapore and Dr. Cesare Soci, NTU, Singapore.

During IWANN 2019, several special sessions were held. Special sessions are a very useful tool for complementing the regular program with new and emerging topics of particular interest for the participating community. Special sessions that emphasize multi-disciplinary and transversal aspects, as well as cutting-edge topics, are especially encouraged and welcome, and in this edition of IWANN 2019 comprised the following:

- **SS01: Artificial Neural Network for Biomedical Image Processing**
Organized by: Dr. Yu-Dong Zhan
- **SS02: Deep Learning Models in Health Care and Biomedicine**
Organized by: Dr. Leonardo Franco, Dr. Ruxandra Stoean and Dr. Francisco Veredas
- **SS03: Deep Learning Beyond Convolution**
Organized by: Dr. Miguel Atencia
- **SS04: Machine Learning in Vision and Robotics**
Organized by: Dr. José García-Rodríguez, Dr. Enrique Domínguez and Dr. Ramón Moreno
- **SS05: Data-Driven Intelligent Transportation Systems**
Organized by: Dr. Ignacio J. Turías Domínguez, Dr. David Elizondo and Dr. Francisco Ortega Zamorano
- **SS06: Software Testing and Intelligent Systems**
Organized by: Dr. Juan Boubeta, Dr. Pablo C. Cañizares and Dr. Gregorio Díaz
- **SS07: Deep Learning and Natural Language Processing**
Organized by: Dr. Leonor Becerra-Bonache, Dr. M. Dolores Jiménez-López and Dr. Benoît Favre
- **SS08: Random-Weights Neural Networks**
Organized by: Dr. Claudio Gallicchio
- **SS09: New and Future Tendencies in Brain–Computer Interface Systems**
Organized by: Dr. Ricardo Ron and Dr. Ivan Volosyak
- **SS10: Human Activity Recognition**
Organized by: Dr.-Ing. habil. Matthias Pätzold
- **SS11: Computational Intelligence Methods for Time Series**
Organized by: Dr. Héctor Pomares
- **SS12: Advanced Methods for Personalized/Precision Medicine**
Organized by: Dr. Luis Javier Herrera and Dr. Fernando Rojas

– **SS13: Exploring Document Information to Improve Neural Summarization Models**

Organized by: Dr. Luigi Di Caro

– **SS15: Machine Learning in Weather Observation and Forecasting**

Organized by: Dr. Juan Luis Navarro-Mesa, Dr. Antonio Ravelo-García and Dr. Carmen Paz Suárez Araujo

In this edition of IWANN, we were honored to have the presence of the following invited speakers:

1. Dr. Nuria Oliver, Director of Research in Data Science, Vodafone Chief Data Scientist, Data-Pop Alliance
2. Dr. Aureli Soria-Frisch, Director of Neuroscience, Starlab Consulting Division
3. Dr. Jose C. Principe, Distinguished Professor ECE, Eckis Professor of ECE, Director Computational NeuroEngineering Lab, University of Florida
4. Dr. Marin Soljacic, Professor of Physics at MIT

It is important to note that for the sake of consistency and readability of the book the presented papers are not organized as they were presented in the IWANN 2019 sessions, but classified under 22 chapters. The papers are organized in two volumes arranged basically following the topics list included in the call for papers. The first volume (LNCS 11506), entitled *Advances in Computational Intelligence. IWANN 2019. Part I*, is divided into ten main parts and includes contributions on:

1. Machine learning in weather observation and forecasting
2. Computational intelligence methods for time series
3. Human activity recognition
4. New and future tendencies in brain–computer interface systems
5. Random-weights neural networks
6. Pattern recognition
7. Deep learning and natural language processing
8. Software testing and intelligent systems
9. Data-driven intelligent transportation systems
10. Deep learning models in health care and biomedicine

In the second volume (LNCS 11507), entitled *Advances in Computational Intelligence. IWANN 2019. Part II*, is divided into 12 main parts and includes contributions on:

1. Deep learning beyond convolution
2. Artificial neural network for biomedical image processing
3. Machine learning in vision and robotics
4. System identification, process control, and manufacturing
5. Image and signal processing
6. Soft computing
7. Mathematics for neural networks
8. Internet modeling, communication, and networking
9. Expert systems

10. Evolutionary and genetic algorithms
11. Advances in computational intelligence
12. Computational biology and bioinformatics

The 14th edition of the IWANN conference was organized by the University of Granada, University of Malaga, and Polytechnical University of Catalonia. We wish to thank to the University of Gran Canaria for their support and grants.

We would also like to express our gratitude to the members of the different committees for their support, collaboration, and good work. We especially thank our honorary chairs (Prof. Joan Cabestany, Prof. Alberto Prieto and Prof. Francisco Sandoval), the technical program chairs (Prof. Miguel Atencia, Prof. Francisco García-Lagos, Prof. Luis Javier Herrera and Prof. Fernando Rojas), the local Organizing Committee (Prof. Domingo J. Benítez Díaz, Prof. Carmen Paz Suárez Araujo and Prof. Juan Luis Navarro Mesa), the Program Committee, the reviewers, invited speaker, and special session organizers. Finally, we want to thank Springer and especially Alfred Hofmann and Anna Kramer for their continuous support and cooperation.

June 2019

Ignacio Rojas
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Contents – Part I

Machine Learning in Weather Observation and Forecasting

A Deeper Look into ‘Deep Learning of Aftershock Patterns Following Large Earthquakes’: Illustrating First Principles in Neural Network Physical Interpretability	3
<i>Arnaud Mignan and Marco Broccardo</i>	
Boosting Wavelet Neural Networks Using Evolutionary Algorithms for Short-Term Wind Speed Time Series Forecasting.	15
<i>Hua-Liang Wei</i>	
An Approach to Rain Detection Using Sobel Image Pre-processing and Convolutional Neuronal Networks.	27
<i>José A. Godoy-Rosario, Antonio G. Ravelo-García, Pedro J. Quintana-Morales, and Juan L. Navarro-Mesa</i>	
On the Application of a Recurrent Neural Network for Rainfall Quantification Based on the Received Signal from Microwave Links.	39
<i>Ivan Guerra-Moreno, Juan L. Navarro-Mesa, Antonio G. Ravelo-García, and Carmen Paz Suarez-Araujo</i>	
Ambient Temperature Estimation Using WSN Links and Gaussian Process Regression	52
<i>Sofia I. Inácio and Joaquim A. R. Azevedo</i>	

Computational Intelligence Methods for Time Series

Voice Command Recognition Using Statistical Signal Processing and SVM.	65
<i>Aleksandra Osowska and Stanislaw Osowski</i>	
Enterprise System Response Time Prediction Using Non-stationary Function Approximations	74
<i>K. Ravikumar, Kriti Kumar, Naveen Thokala, and M. Girish Chandra</i>	
Using Artificial Neural Networks for Recovering the Value-of-Travel-Time Distribution	88
<i>Sander van Cranenburgh and Marco Kouwenhoven</i>	
Sparse, Interpretable and Transparent Predictive Model Identification for Healthcare Data Analysis	103
<i>Hua-Liang Wei</i>	

Use of Complex Networks for the Automatic Detection and the Diagnosis of Alzheimer’s Disease	115
<i>Aruane Mello Pineda, Fernando M. Ramos, Luiz Eduardo Betting, and Andriana S. L. O. Campanharo</i>	
The Generalized Sleep Spindles Detector: A Generative Model Approach on Single-Channel EEGs	127
<i>Carlos A. Loza and Jose C. Principe</i>	
DeepTrace: A Generic Framework for Time Series Forecasting.	139
<i>Nithish B. Moudhgalya, Siddharth Divi, V. Adithya Ganesan, S. Sharan Sundar, and Vineeth Vijayaraghavan</i>	
Automatic Identification of Interictal Epileptiform Discharges with the Use of Complex Networks.	152
<i>Gustavo H. Tomanik, Luiz E. Betting, and Andriana S. L. O. Campanharo</i>	
Anomaly Detection for Bivariate Signals	162
<i>Marie Cottrell, Cynthia Faure, Jérôme Lacaille, and Madalina Olteanu</i>	
A Scalable Long-Horizon Forecasting of Building Electricity Consumption.	174
<i>Naveen Kumar Thokala, S. Spoorthy, and M. Girish Chandra</i>	
Long-Term Forecasting of Heterogenous Variables with Automatic Algorithm Selection.	186
<i>Naveen Kumar Thokala, Kriti Kumar, M. Girish Chandra, and Karumanchi Ravikumar</i>	
Automatic Time Series Forecasting with GRNN: A Comparison with Other Models.	198
<i>Francisco Martínez, Francisco Charte, Antonio J. Rivera, and Maria P. Frías</i>	
Improving Online Handwriting Text/Non-text Classification Accuracy Under Condition of Stroke Context Absence	210
<i>Serhii Polotskyi, Ivan Deriuga, Tetiana Ignatova, Volodymyr Melnyk, and Hennadii Azarov</i>	
Improving Classification of Ultra-High Energy Cosmic Rays Using Spacial Locality by Means of a Convolutional DNN.	222
<i>Francisco Carrillo-Perez, Luis Javier Herrera, Juan Miguel Carceller, and Alberto Guillén</i>	

Model and Feature Aggregation Based Federated Learning for Multi-sensor Time Series Trend Following	233
<i>Yao Hu, Xiaoyan Sun, Yang Chen, and Zishuai Lu</i>	
Robust Echo State Network for Recursive System Identification	247
<i>Renan Bessa and Guilherme A. Barreto</i>	
Random Hyper-parameter Search-Based Deep Neural Network for Power Consumption Forecasting	259
<i>J. F. Torres, D. Gutiérrez-Avilés, A. Troncoso, and F. Martínez-Álvarez</i>	
A First Approximation to the Effects of Classical Time Series Preprocessing Methods on LSTM Accuracy	270
<i>Daniel Trujillo Viedma, Antonio Jesús Rivera Rivas, Francisco Charte Ojeda, and María José del Jesus Díaz</i>	
Human Activity Recognition	
Detecting Driver Drowsiness in Real Time Through Deep Learning Based Object Detection	283
<i>Muhammad Faique Shakeel, Nabit A. Bajwa, Ahmad Muhammad Anwaar, Anabia Sohail, Asifullah Khan, and Haroon-ur-Rashid</i>	
The Influence of Human Walking Activities on the Doppler Characteristics of Non-stationary Indoor Channel Models	297
<i>Muhammad Muaaz, Ahmed Abdelgawwad, and Matthias Pätzold</i>	
A Neural Network for Stance Phase Detection in Smart Cane Users	310
<i>Juan Rafael Caro-Romero, Joaquín Ballesteros, Francisco García-Lagos, Cristina Urdiales, and Francisco Sandoval</i>	
Closed-Eye Gaze Gestures: Detection and Recognition of Closed-Eye Movements with Cameras in Smart Glasses	322
<i>Rainhard Dieter Findling, Le Ngu Nguyen, and Stephan Sigg</i>	
RF-Based Human Activity Recognition: A Non-stationary Channel Model Incorporating the Impact of Phase Distortions	335
<i>Alireza Borhani and Matthias Pätzold</i>	
Workout Type Recognition and Repetition Counting with CNNs from 3D Acceleration Sensed on the Chest	347
<i>Kacper Skawinski, Ferran Montraveta Roca, Rainhard Dieter Findling, and Stephan Sigg</i>	

Improving Wearable Activity Recognition via Fusion of Multiple Equally-Sized Data Subwindows	360
<i>Oresti Banos, Juan-Manuel Galvez, Miguel Damas, Alberto Guillen, Luis-Javier Herrera, Hector Pomares, Ignacio Rojas, and Claudia Villalonga</i>	

New and Future Tendencies in Brain-Computer Interface Systems

Preliminary Results Using a P300 Brain-Computer Interface Speller: A Possible Interaction Effect Between Presentation Paradigm and Set of Stimuli	371
<i>Álvaro Fernández-Rodríguez, María Teresa Medina-Juliá, Francisco Velasco-Álvarez, and Ricardo Ron-Angevin</i>	
Custom-Made Monitor for Easy High-Frequency SSVEP Stimulation	382
<i>Mihaly Benda, Felix Gembler, Piotr Stawicki, Sadok Ben-Salem, Zahidul Islam, Arne Vogelsang, and Ivan Volosyak</i>	
A Comparison of cVEP-Based BCI-Performance Between Different Age Groups	394
<i>Felix Gembler, Piotr Stawicki, Aya Rezeika, and Ivan Volosyak</i>	
Remote Steering of a Mobile Robotic Car by Means of VR-Based SSVEP BCI	406
<i>Piotr Stawicki, Felix Gembler, Roland Grichnik, and Ivan Volosyak</i>	
A VR-Based Hybrid BCI Using SSVEP and Gesture Input	418
<i>Roland Grichnik, Mihaly Benda, and Ivan Volosyak</i>	
Word Prediction Support Model for SSVEP-Based BCI Web Speller.	430
<i>Abdul Saboor, Mihaly Benda, Felix Gembler, and Ivan Volosyak</i>	
Is Stress State an Important Factor in the BCI-P300 Speller Performance? . . .	442
<i>Liliana Garcia, Maud Zak, Celestin Grenier, Solene Hanrio, Dorine Henry, Romain Randriamanantena, Catherine Semal, Jean Marc Andre, Veronique Lespinet-Najib, and Ricardo Ron-Angevin</i>	

Random-Weights Neural Networks

Echo State Networks with Artificial Astrocytes and Hebbian Connections . . .	457
<i>Peter Gergel' and Igor Farkaš</i>	
Multiple Linear Regression Based on Coefficients Identification Using Non-iterative SGTm Neural-like Structure	467
<i>Ivan Izonin, Roman Tkachenko, Natalia Kryvinska, Pavlo Tkachenko, and Michal Greguš ml.</i>	

Richness of Deep Echo State Network Dynamics	480
<i>Claudio Gallicchio and Alessio Micheli</i>	
Image Classification and Retrieval with Random Depthwise Signed Convolutional Neural Networks	492
<i>Yunzhe Xue and Usman Roshan</i>	
Exploring Classification, Clustering, and Its Limits in a Compressed Hidden Space of a Single Layer Neural Network with Random Weights	507
<i>Meiyan Xie and Usman Roshan</i>	
Improving Randomized Learning of Feedforward Neural Networks by Appropriate Generation of Random Parameters	517
<i>Grzegorz Dudek</i>	
Pattern Recognition	
Detector of Small Objects with Application to the License Plate Symbols . . .	533
<i>Alexey Alexeev, Yuriy Matveev, Anton Matveev, Georgy Kukharev, and Sattam Almatarneh</i>	
Failure Diagnosis of Wind Turbine Bearing Using Feature Extraction and a Neuro-Fuzzy Inference System (ANFIS)	545
<i>Mojtaba Kordestani, Milad Rezamand, Rupp Carriveau, David S. K. Ting, and Mehrdad Saif</i>	
OnMLM: An Online Formulation for the Minimal Learning Machine	557
<i>Alan L. S. Matias, César L. C. Mattos, Tommi Kärkkäinen, João P. P. Gomes, and Ajalmar R. da Rocha Neto</i>	
Adversarial Examples are a Manifestation of the Fitting-Generalization Trade-off.	569
<i>Oscar Deniz, Noelia Vallez, and Gloria Bueno</i>	
Deep Learning and Natural Language Processing	
Some Insights and Observations on Depth Issues in Deep Learning Networks	583
<i>Arindam Chaudhuri</i>	
Multi-input CNN for Text Classification in Commercial Scenarios	596
<i>Zuzanna Parcheta, Germán Sanchis-Trilles, Francisco Casacuberta, and Robin Redahl</i>	

Applying Sentiment Analysis with Cross-Domain Models to Evaluate User eXperience in Virtual Learning Environments	609
<i>Rosario Sanchis-Font, Maria Jose Castro-Bleda, and José-Ángel González</i>	
Document Model with Attention Bidirectional Recurrent Network for Gender Identification	621
<i>Bassem Bsir and Mounir Zrigui</i>	
Visual Disambiguation of Prepositional Phrase Attachments: Multimodal Machine Learning for Syntactic Analysis Correction	632
<i>Sebastien Delecraz, Leonor Becerra-Bonache, Alexis Nasr, Frederic Bechet, and Benoit Favre</i>	
Meeting Summarization, A Challenge for Deep Learning	644
<i>Francois Jacquenet, Marc Bernard, and Christine Largeron</i>	
Semantic Fake News Detection: A Machine Learning Perspective	656
<i>Adrian M. P. Braşoveanu and Răzvan Andonie</i>	
Unsupervised Inflection Generation Using Neural Language Modelling	668
<i>Octavia-Maria Şulea and Steve Young</i>	
AL4LA: Active Learning for Text Labeling Based on Paragraph Vectors	679
<i>Damián Nimo-Járquez, Margarita Narvaez-Rios, Mario Rivas, Andrés Yáñez, Guillermo Bárcena-González, M. Paz Guerrero-Lebrero, Elisa Guerrero, and Pedro L. Galindo</i>	
On Transfer Learning for Detecting Abusive Language Online	688
<i>Ana-Sabina Uban and Liviu P. Dinu</i>	
Software Testing and Intelligent Systems	
Security Testing for Multi-Agent Systems	703
<i>Damas P. Gruska and M. Carmen Ruiz</i>	
GPTSG: A Genetic Programming Test Suite Generator Using Information Theory Measures.	716
<i>Alfredo Ibias, David Griñán, and Manuel Núñez</i>	
An Intelligent System Integrating CEP and Colored Petri Nets for Helping in Decision Making About Pollution Scenarios	729
<i>Gregorio Díaz, Enrique Brazález, Hermenegilda Macià, Juan Boubeta-Puig, and Valentín Valero</i>	
Using Genetic Algorithms to Generate Test Suites for FSMs	741
<i>Miguel Benito-Parejo, Inmaculada Medina-Bulo, Mercedes G. Merayo, and Manuel Núñez</i>	

Conformance Relations for Fuzzy Automata.	753
<i>Iván Calvo, Mercedes G. Merayo, Manuel Núñez, and Francisco Palomo-Lozano</i>	
Investigating the Effectiveness of Mutation Testing Tools in the Context of Deep Neural Networks.	766
<i>Nour Chetouane, Lorenz Klampfl, and Franz Wotawa</i>	
Data-Driven Intelligent Transportation Systems	
SGD-Based Wiener Polynomial Approximation for Missing Data Recovery in Air Pollution Monitoring Dataset.	781
<i>Ivan Izonin, Michal Greguš ml., Roman Tkachenko, Mykola Logoyda, Oleksandra Mishchuk, and Yurii Kynash</i>	
Heavy Duty Vehicle Fuel Consumption Modelling Based on Exploitation Data by Using Artificial Neural Networks	794
<i>Oskar Wysocki, Lipika Deha, David Elizondo, Jacek Kropiwnicki, and Jacek Czyżewicz</i>	
A Deep Ensemble Neural Network Approach to Improve Predictions of Container Inspection Volume	806
<i>Daniel Urda Muñoz, Juan Jesus Ruiz-Aguilar, Javier González-Enrique, and Ignacio J. Turias Domínguez</i>	
Ro-Ro Freight Forecasting Based on an ANN-SVR Hybrid Approach. Case of the Strait of Gibraltar.	818
<i>José Antonio Moscoso-López, Juan Jesús Ruiz-Aguilar, Daniel Urda, Javier González-Enrique, and Ignacio José Turias</i>	
Infering Air Quality from Traffic Data Using Transferable Neural Network Models	832
<i>Miguel A. Molina-Cabello, Benjamin N. Passow, Enrique Domínguez, David Elizondo, and Jolanta Obszyska</i>	
Deep Learning Based Ship Movement Prediction System Architecture.	844
<i>Alberto Alvarelllos, Andrés Figuero, José Sande, Enrique Peña, and Juan Rabuñal</i>	
A Genetic Algorithm and Neural Network Stacking Ensemble Approach to Improve NO ₂ Level Estimations	856
<i>Javier González-Enrique, Juan Jesús Ruiz-Aguilar, José Antonio Moscoso-López, Steffanie Van Roode, Daniel Urda, and Ignacio J. Turias</i>	

Deep Learning Models in Healthcare and Biomedicine

Convolutional Neural Network Learning Versus Traditional Segmentation for the Approximation of the Degree of Defective Surface in Titanium for Implantable Medical Devices.	871
<i>Ruxandra Stoean, Catalin Stoean, Adriana Samide, and Gonzalo Joya</i>	
Convolutional Neural Networks and Feature Selection for BCI with Multiresolution Analysis.	883
<i>Javier León, Julio Ortega, and Andrés Ortiz</i>	
Attention-Based Recurrent Neural Networks (RNNs) for Short Text Classification: An Application in Public Health Monitoring	895
<i>Oduwa Edo-Osagie, Iain Lake, Obaghe Edeghere, and Beatriz De La Iglesia</i>	
A Transfer-Learning Approach to Feature Extraction from Cancer Transcriptomes with Deep Autoencoders	912
<i>Guillermo López-García, José M. Jerez, Leonardo Franco, and Francisco J. Veredas</i>	
Dementia Detection and Classification from MRI Images Using Deep Neural Networks and Transfer Learning.	925
<i>Amen Bidani, Mohamed Salah Gouider, and Carlos M. Travieso-González</i>	
Author Index	935

Contents – Part II

Deep Learning Beyond Convolution

Fuzzy Preprocessing for Semi-supervised Image Classification in Modern Industry	3
<i>Petr Hurtik and Vojtěch Molek</i>	
Interpretability of Recurrent Neural Networks Trained on Regular Languages	14
<i>Christian Oliva and Luis F. Lago-Fernández</i>	
Unsupervised Learning as a Complement to Convolutional Neural Network Classification in the Analysis of Saccadic Eye Movement in Spino-Cerebellar Ataxia Type 2	26
<i>Catalin Stoean, Ruxandra Stoean, Roberto Antonio Becerra-García, Rodolfo García-Bermúdez, Miguel Atencia, Francisco García-Lagos, Luis Velázquez-Pérez, and Gonzalo Joya</i>	
Scale-Space Theory, F-transform Kernels and CNN Realization	38
<i>Vojtech Molek and Irina Perfilieva</i>	
Numerosity Representation in InfoGAN: An Empirical Study	49
<i>Andrea Zanetti, Alberto Testolin, Marco Zorzi, and Pawel Wawrzynski</i>	
Deep Residual Learning for Human Identification Based on Facial Landmarks	61
<i>Abdelgader Abdelwhab Abdelgader and Serestina Viriri</i>	
Dynamic Clustering of Time Series with Echo State Networks	73
<i>Miguel Atencia, Catalin Stoean, Ruxandra Stoean, Roberto Rodríguez-Labrada, and Gonzalo Joya</i>	

Artificial Neural Network for Biomedical Image Processing

Multiple Sclerosis Detection via Wavelet Entropy and Feedforward Neural Network Trained by Adaptive Genetic Algorithm	87
<i>Ji Han and Shou-Ming Hou</i>	
Multi-mother Wavelet Neural Network Training Using Genetic Algorithm-Based Approach to Optimize and Improves the Robustness of Gradient-Descent Algorithms: 3D Mesh Deformation Application	98
<i>Naziha Dhibi and Chokri Ben Amar</i>	

A Clinical Decision Support System to Help the Interpretation of Laboratory Results and to Elaborate a Clinical Diagnosis in Blood Coagulation Domain	109
<i>Francois Lasson, Alban Delamarre, Pascal Redou, and Cedric Buche</i>	
 Machine Learning in Vision and Robotics	
Real-Time Logo Detection in Brand-Related Social Media Images	125
<i>Oscar Orti, Ruben Tous, Mauro Gomez, Jonatan Poveda, Leonel Cruz, and Otto Wust</i>	
A Novel Framework for Fine Grained Action Recognition in Soccer.	137
<i>Yaparla Ganesh, Allaparthi Sri Teja, Sai Krishna Munnangi, and Garimella Rama Murthy</i>	
Towards Automatic Crack Detection by Deep Learning and Active Thermography	151
<i>Ramón Moreno, Eider Gorostegui-Colinas, Pablo López de Uralde, and Ander Muniategui</i>	
Optimization of Convolutional Neural Network Ensemble Classifiers by Genetic Algorithms.	163
<i>Miguel A. Molina-Cabello, Cristian Accino, Ezequiel López-Rubio, and Karl Thurnhofer-Hemsi</i>	
One Dimensional Fourier Transform on Deep Learning for Industrial Welding Quality Control	174
<i>Ander Muniategui, Jon Ander del Barrio, Xabier Angulo Vinuesa, Manuel Masenlle, Aitor García de la Yedra, and Ramón Moreno</i>	
A Serious Game to Build a Database for ErrP Signal Recognition.	186
<i>Adam Pinto, Guilherme Nardari, Marco Mijam, Edgard Morya, and Roseli Romero</i>	
Using Inferred Gestures from sEMG Signal to Teleoperate a Domestic Robot for the Disabled.	198
<i>Nadia Nasri, Francisco Gomez-Donoso, Sergio Orts-Escolano, and Miguel Cazorla</i>	
3D Orientation Estimation of Pharmaceutical Minitablets with Convolutional Neural Network	208
<i>Gregor Podrekar, Domen Kitak, Andraž Mehle, Domen Rački, Rok Dreu, and Dejan Tomažević</i>	

Flatness Defect Detection and Classification in Hot Rolled Steel Strips Using Convolutional Neural Networks	220
<i>Marco Vannocci, Antonio Ritacco, Angelo Castellano, Filippo Galli, Marco Vannucci, Vincenzo Iannino, and Valentina Colla</i>	
Image Completion with Filtered Low-Rank Tensor Train Approximations . . .	235
<i>Rafał Zdunek, Krzysztof Fonał, and Tomasz Sadowski</i>	
Knowledge Construction Through Semantic Interpretation of Visual Information	246
<i>Cristiano Russo, Kurosh Madani, and Antonio Maria Rinaldi</i>	
Ensemble Transfer Learning Framework for Vessel Size Estimation from 2D Images	258
<i>Mario Miličević, Krunoslav Žubrinić, Ivan Grbavac, and Ana Kešelj</i>	
Analyzing Digital Image by Deep Learning for Melanoma Diagnosis	270
<i>Karl Thurnhofer-Hemsi and Enrique Domínguez</i>	
BatchNorm Decomposition for Deep Neural Network Interpretation	280
<i>Lucas Y. W. Hui and Alexander Binder</i>	
Video Categorisation Mimicking Text Mining	292
<i>Cristian Ortega-León, Pedro A. Marín-Reyes, Javier Lorenzo-Navarro, Modesto Castrillón-Santana, and Elena Sánchez-Nielsen</i>	
Trainable Thresholds for Neural Network Quantization	302
<i>Alexander Goncharenko, Andrey Denisov, Sergey Alyamkin, and Evgeny Terentev</i>	
Integration of CNN into a Robotic Architecture to Build Semantic Maps of Indoor Environments	313
<i>D. Chaves, J. R. Ruiz-Sarmiento, N. Petkov, and J. Gonzalez-Jimenez</i>	
Tandem Modelling Based Emotion Recognition in Videos	325
<i>Salma Kasraoui, Zied Lachiri, and Kurosh Madani</i>	
System Identification, Process Control, and Manufacturing	
Computational Intelligence Approach for Liquid-Gas Flow Regime Classification Based on Frequency Domain Analysis of Signals from Scintillation Detectors	339
<i>Robert Hanus, Marcin Zych, and Marek Jaszczur</i>	
Waste Classification System Using Image Processing and Convolutional Neural Networks	350
<i>Janusz Bobulski and Mariusz Kubanek</i>	

Artificial Neural Networks for Bottled Water Demand Forecasting: A Small Business Case Study.	362
<i>Israel D. Herrera-Granda, Joselyn A. Chicaiza-Ipiales, Erick P. Herrera-Granda, Leandro L. Lorente-Leyva, Jorge A. Caraguay-Procel, Iván D. García-Santillán, and Diego H. Peluffo-Ordóñez</i>	
Image and Signal Processing	
Detection of Cancerous Lesions with Neural Networks	377
<i>Hassan El-khatib, Dan Popescu, and Loretta Ichim</i>	
A Deep Learning Approach to Anomaly Detection in the Gaia Space Mission Data	390
<i>Alessandro Druetto, Marco Roberti, Rossella Cancelliere, Davide Cavagnino, and Mario Gai</i>	
On Possibilities of Human Head Detection for Person Flow Monitoring System	402
<i>Petr Dolezel, Dominik Stursa, and Pavel Skrabanek</i>	
Performance of Classifiers on Noisy-Labeled Training Data: An Empirical Study on Handwritten Digit Classification Task	414
<i>Irfan Ahmad</i>	
Combination of Multiple Classification Results Based on K-Class Alpha Integration	426
<i>Gonzalo Safont, Addisson Salazar, and Luis Vergara</i>	
Acceleration of Online Recognition of 2D Sequences Using Deep Bidirectional LSTM and Dynamic Programming	438
<i>Dmytro Zhelezniakov, Viktor Zaytsev, and Olga Radyvonenko</i>	
A New Graph Based Brain Connectivity Measure	450
<i>Addisson Salazar, Gonzalo Safont, and Luis Vergara</i>	
Soft Computing	
Many-Objective Cooperative Co-evolutionary Feature Selection: A Lexicographic Approach.	463
<i>Jesús González, Julio Ortega, Miguel Damas, and Pedro Martín-Smith</i>	
An Online Tool for Unfolding Symbolic Fuzzy Logic Programs	475
<i>Ginés Moreno and José Antonio Ríaza</i>	

Ensemble of Attractor Networks for 2D Gesture Retrieval	488
<i>Carlos Dávila, Mario González, Jorge-Luis Pérez-Medina, David Domínguez, Ángel Sánchez, and Francisco B. Rodríguez</i>	

Sparse Least Squares Support Vector Machines Based on Genetic Algorithms: A Feature Selection Approach.	500
<i>Pedro Hericson Machado Araújo and Ajalmar R. Rocha Neto</i>	

Mathematics for Neural Networks

A Neural Network-Based Approach to Sensor and Actuator Fault-Tolerant Control	515
<i>Marcin Pazera, Marcin Mrugalski, Marcin Witczak, and Mariusz Buciakowski</i>	

Estimating Supervisor Set Using Machine Learning and Optimal Control. . . .	527
<i>Konrad Kosmatka and Andrzej Nowakowski</i>	

Application of Artificial Neural Network Model for Cost Optimization in a Single-Source, Multi-destination System with Non-deterministic Inputs.	539
<i>Modestus O. Okwu, Vitalian U. Chukwu, and Onyewuchi Oguoma</i>	

A New Online Class-Weighting Approach with Deep Neural Networks for Image Segmentation of Highly Unbalanced Glioblastoma Tumors	555
<i>Mostefa Ben Naceur, Rostom Kachouri, Mohamed Akil, and Rachida Saouli</i>	

Classification with Rejection Option Using the Fuzzy ARTMAP Neural Network	568
<i>Francisco Felipe M. Sousa, Alan Lucas Silva Matias, and Ajalmar Rego da Rocha Neto</i>	

About Filter Criteria for Feature Selection in Regression	579
<i>Alexandra Degeest, Michel Verleysen, and Benoît Frénay</i>	

Bistable Sigmoid Networks	591
<i>Stanislav Uschakow, Jörn Fischer, and Thomas Ihme</i>	

Validation of Unimodal Non-Gaussian Clusters.	601
<i>Luis F. Lago-Fernández, Jesús Aragón, and Manuel Sánchez-Montañés</i>	

Internet Modeling, Communication and Networking

From Iterative Threshold Decoding to a Low-Power High-Speed Analog VLSI Decoder Implementation	615
<i>Werner G. Teich, Heiko Teich, and Giuseppe Oliveri</i>	

Machine Learning as a Means to Adapt Requirement Changes for SDN Deployment Process in SDN Migration	629
<i>Siew Hong Wei, Tan Saw Chin, Jason Ng Binlun, Lee Ching Kwang, Rizaluddin Kapsin, and Zulfadzli Yusoff</i>	

Searching the Shortest Pair of Edge-Disjoint Paths in a Communication Network. A Fuzzy Approach	640
<i>Lisette Valdés, Alfonso Ariza, Sira María Allende, and Gonzalo Joya</i>	

Expert Systems

Toward Robust Mispronunciation Detection via Audio-Visual Speech Recognition	655
<i>Mahdie Karbasi, Steffen Zeiler, Jan Freiwald, and Dorothea Kolossa</i>	

Link Prediction Regression for Weighted Co-authorship Networks	667
<i>Ilya Makarov and Olga Gerasimova</i>	

Red-Black Tree Based NeuroEvolution of Augmenting Topologies	678
<i>William R. Arellano, Paul A. Silva, Maria F. Molina, Saulo Ronquillo, and Francisco Ortega-Zamorano</i>	

A New Classification Method for Predicting the Output of Dye Process in Textile Industry by Using Artificial Neural Networks.	687
<i>Ahsen Noor Subhopoto, Mehmet Akar, and Sencer Sultanoglu</i>	

An Efficient Framework to Detect and Avoid Driver Sleepiness Based on YOLO with Haar Cascades and an Intelligent Agent.	699
<i>Belmekki Ghizlene, Mekakia Zoulikha, and Hector Pomares</i>	

Fingerprint Retrieval Using a Specialized Ensemble of Attractor Networks. . .	709
<i>Mario González, Carlos Dávila, David Dominguez, Ángel Sánchez, and Francisco B. Rodriguez</i>	

Evolutionary and Genetic Algorithms

A Fixed-Size Pruning Approach for Optimum-Path Forest	723
<i>Leonardo da Silva Costa, Gabriel Santos Barbosa, and Ajalmar Régio da Rocha Neto</i>	

Constraint Exploration of Convolutional Network Architectures with Neuroevolution	735
<i>Jonas Dominik Homburg, Michael Adams, Michael Thies, Timo Korthals, Marc Hesse, and Ulrich Rückert</i>	

Impact of Genetic Algorithms Operators on Association Rules Extraction . . .	747
<i>Leila Hamdad, Karima Benatchba, Ahcene Bendjoudi, and Zakaria Ournani</i>	
The Problems of Selecting Problems	760
<i>Alberto de la Encina, Natalia López, Ismael Rodríguez, and Fernando Rubio</i>	
Unsupervised Learning Bee Swarm Optimization Metaheuristic	773
<i>Souhila Sadeg, Leila Hamdad, Mouloud Haouas, Kouider Abderrahmane, Karima Benatchba, and Zineb Habbas</i>	
QBSO-FS: A Reinforcement Learning Based Bee Swarm Optimization Metaheuristic for Feature Selection	785
<i>Souhila Sadeg, Leila Hamdad, Amine Riad Remache, Mehdi Nedjmeddine Karech, Karima Benatchba, and Zineb Habbas</i>	
Advances in Computational Intelligence	
Device-Free Passive Human Counting with Bluetooth Low Energy Beacons	799
<i>Maximilian Münch and Frank-Michael Schleif</i>	
Combining Very Deep Convolutional Neural Networks and Recurrent Neural Networks for Video Classification.	811
<i>Rukiye Savran Kızıltepe, John Q. Gan, and Juan José Escobar</i>	
Towards Applying River Formation Dynamics in Continuous Optimization Problems.	823
<i>Pablo Rabanal, Ismael Rodríguez, and Fernando Rubio</i>	
Go for Parallel Neural Networks.	833
<i>David Turner and Erich Schikuta</i>	
Using Boolean- and Self-Enforcing-Networks for Mathematical E-Tutorial Systems	845
<i>Christina Klüver and Jürgen Klüver</i>	
Digital Implementation of a Biological-Plausible Model for Astrocyte Ca^{2+} Oscillations.	857
<i>Moslem Heidrapur, Arash Ahmadi, and Majid Ahmadi</i>	
Evolving Balancing Controllers for Biped Characters in Games	869
<i>Christopher Schinkel Carlsen and George Palamas</i>	

Computational Biology and Bioinformatics

Feature Selection and Assessment of Lung Cancer Sub-types
by Applying Predictive Models. 883
*Sara González, Daniel Castillo, Juan Manuel Galvez, Ignacio Rojas,
and Luis Javier Herrera*

Energy-Time Analysis of Convolutional Neural Networks Distributed
on Heterogeneous Clusters for EEG Classification. 895
*Juan José Escobar, Julio Ortega, Miguel Damas,
Rukiye Savran Kızıltepe, and John Q. Gan*

The Frequent Complete Subgraphs in the Human Connectome 908
Máté Fellner, Bálint Varga, and Vince Grolmusz

Author Index 921