

Founding Editors

Gerhard Goos

Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis

Cornell University, Ithaca, NY, USA

Editorial Board Members

Elisa Bertino

Purdue University, West Lafayette, IN, USA

Wen Gao

Peking University, Beijing, China

Bernhard Steffen

TU Dortmund University, Dortmund, Germany

Gerhard Woeginger 

RWTH Aachen, Aachen, Germany

Moti Yung

Columbia University, New York, NY, USA

More information about this series at <http://www.springer.com/series/7412>

Ingela Nyström · Yanio Hernández Heredia ·
Vladimir Milián Núñez (Eds.)

Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications

24th Iberoamerican Congress, CIARP 2019
Havana, Cuba, October 28–31, 2019
Proceedings

Editors

Ingela Nyström
Uppsala University
Uppsala, Sweden

Yanio Hernández Heredia 
University of Information Science
Havana, Cuba

Vladimir Milián Núñez 
University of Information Science
Havana, Cuba

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-33903-6 ISBN 978-3-030-33904-3 (eBook)
<https://doi.org/10.1007/978-3-030-33904-3>

LNCS Sublibrary: SL6 – Image Processing, Computer Vision, Pattern Recognition, and Graphics

© Springer Nature Switzerland AG 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The Iberoamerican Congress on Pattern Recognition (CIARP), is an annual international conference that publishes original, high-quality papers related to Pattern Recognition, Artificial Intelligence, and related fields, welcoming contributions on any aspect of theory as well as applications. CIARP has become a key research event, and one of the most important in Pattern Recognition for the Iberoamerican community.

As has been the case for previous editions of the conference, CIARP 2019 hosted worldwide participants with the aim of promoting and disseminating ongoing research on mathematical methods and computing techniques for Artificial Intelligence and Pattern Recognition, in particular in Bioinformatics, Cognitive and Humanoid Vision, Computer Vision, Image Analysis and Intelligent Data Analysis, as well as their application in a number of diverse areas such as industry, health, robotics, data mining, opinion mining and sentiment analysis, telecommunications, document analysis, and natural language processing and recognition. Moreover, CIARP 2019 was a forum for the scientific community to exchange research experience, to share new knowledge, and to increase the cooperation among research groups in Artificial Intelligence, Pattern Recognition, and related areas.

CIARP has always been an open international event, and this 24th edition received 128 contributions from 23 countries. The biggest presence was Cuba, Brazil, Colombia, Mexico, Germany, and Chile. We also received contributions from Argentina, Austria, Canada, Ecuador, France, Italy, India, Japan, The Netherlands, Pakistan, Portugal, Romania, Spain, Sweden, Tunisia, UK, and USA.

After a rigorous blind reviewing process, where three highly qualified reviewers reviewed each submission (362 reviews from 146 reviewers who spent significant time and effort in reviewing the papers), 70 papers authored by 239 authors from 14 countries were accepted, which is an acceptance rate of 54.69%. The scientific quality of all the accepted papers was above the overall mean rating. The reviewers were chosen based on their expertise ensuring that they came from different countries and institutions around the world. We would like to thank all the members of the Program Committee for their work, which we are sure contributed to improving the quality of the selected papers.

The conference was held during October 28–31, 2019, at the Hotel Nacional de Cuba, and consisted of four days of papers, tutorials, and keynotes. As has been the case for the most recent editions of the conference, CIARP 2019 was a single-track conference. The program comprised eight oral sessions: Image Analysis and Retrieval; Signals Analysis and Processing; Video Analysis; Mathematical Theory of Pattern Recognition; Applications of Pattern Recognition; Machine Learning and Neural Networks; Data Mining, Natural Language Processing and Text Mining; Speech Recognition. Also, one additional poster sessions included papers on all previous topics.

CIARP 2019 was endorsed by the IAPR, the International Association for Pattern Recognition and therefore the conference gave out the CIARP-IAPR Best Paper Award. This award and the Aurora Pons-Porrata Medal (to an Iberoamerican woman with a prestigious career in Pattern Recognition and related fields) will be published as a Special Section in the *Pattern Recognition Letters* journal. Also, authors of the 20–25 best papers, within the aims and scope of the journals, will be invited to prepare an extended version for a Special Issue of the *Intelligent Data Analysis* (IDA) journal (<http://www.iospress.nl/journal/intelligent-data-analysis>), with guest editors A. Fazel Famili and José E. Medina Pagolan, and for a Special Issue of the *Pattern Analysis and Applications* (PAAA) journal (<https://link.springer.com/journal/10044>), with guest editors José Ruiz Shulcloper and Heydi Mendez Vazquez.

The program also included four invited talks by eminent speakers: Petra Perner, Alberto Del Bimbo, Massimo Tistarelli, and Jean-François Bonastre. Additionally, four tutorials, given by Ingela Nyström, Petra Perner, Alberto Del Bimbo, and Massimo Tistarelli completed the program. It was a pleasure to work with this outstanding group of invited speakers.

CIARP 2019 was organized by Universidad de las Ciencias Informáticas (UCI) and the Cuban Association for Pattern Recognition (ACRP). We appreciate their valuable contributions to the success of CIARP 2019. We gratefully acknowledge the help of all members of the Organizing Committee and of the Local Committee for their unflagging work in the organization of CIARP 2019 that allowed us to put together an excellent conference and proceedings.

We are especially grateful to Alfred Hofmann, Anna Kramer, and Volha Shaparava of Springer for their support and advice during the preparation of this LNCS volume.

Special thanks are due to all authors who submitted to CIARP 2019, including those of papers that could not be accepted. Finally, we hope that these proceedings will be a useful reference for the Pattern Recognition research community.

October 2019

Ingela Nyström
Yanio Hernández Heredia
Vladimir Milián Núñez

Organization

General Chairs

Ingela Nyström	Uppsala University, Sweden
Yanio Hernandez	Universidad de las Ciencias Informáticas, Cuba
Heydi Mendez-Vazquez	CENATAV, Cuba
Milton García-Borroto	CUJAE, Cuba

Program Chairs

Jose Ruiz Shulcloper	Universidad de las Ciencias Informáticas, Cuba
José Eladio Medina Pagola	Universidad de las Ciencias Informáticas, Cuba
Vladimir Milián Núñez	Universidad de las Ciencias Informáticas, Cuba

CIARP Steering Committee

Bernardete Ribeiro	APRP, Portugal
Eduardo Bayro-Corrochano	MACVNR, Mexico
César Beltrán-Castañón	APeRP, Peru
Julian Fierrez	AERFAI, Spain
José Ruiz Shulcloper	ACRP, Cuba
Marta Mejail	SARP, Argentina
Marcelo Mendoza	ACHiRP, Chile
Joao Paulo Papa	SIGPR-BR, Brazil
Álvaro Pardo	APRU, Uruguay

Local Committee

Beatriz Aragón Fernández	Universidad de las Ciencias Informáticas, Cuba
Nadiela Milan Cristo	Universidad de las Ciencias Informáticas, Cuba
Hector Raul Gonzalez Diez	Universidad de las Ciencias Informáticas, Cuba
Edel Garcia-Reyes	CENATAV, Cuba
Javier Lamar	CENATAV, Cuba

CIARP-IAPR Best Paper Award Committee

Jose Ruiz Shulcloper	Universidad de las Ciencias Informáticas, Cuba
Ingela Nyström	Uppsala University, Sweden
Petra Pernert	Institute of Computer Vision and Applied Computer Sciences IBAI Leipzig, Germany
Alberto Del Bimbo	Università degli Studi di Firenze, Italy
Massimo Tistarelli	Università di Sassari, Italy

Aurora Pons Porrata Award Committee

Olga Regina Pereira Bellon	Universidade Federal do Parana, Brazil
Maria Vanrell	Universitat Autònoma de Barcelona, Spain
Heydi Méndez Vázquez	CENATAV, Cuba

Program Committee

Sergey Ablameyko	Belarusian State University, Belarus
Niusvel Acosta-Mendoza	CENATAV, Cuba
Luis Alexandre	Universidade da Beira Interior, Portugal
Hector Allende	Universidad Técnica Federico Santa María, Chile
Fernando Alonso-Fernandez	Halmstad University, Sweden
Rene Alquezar	UPC, Spain
Leopoldo Altamirano	INAOE, Mexico
Mauricio Araya	Universidad Técnica Federico Santa María, Chile
Leticia Arco	VUB, Belgium
G. Arroyo-Figueroa	INEEL, Mexico
Akira Asano	Kansai University, Japan
Ali Ismail Awad	Luleå University of Technology, Sweden
Xiang Bai	Huazhong University of Science and Technology, China
Virginia Ballarin	National University of Mar del Plata, Argentina
Antonio Bandera	University of Malaga, Spain
Rafael Bello	UCLV, Cuba
Cesar Beltran Castanon	Pontificia Universidad Católica del Perú, Peru
José Miguel Benedí	Universitat Politècnica de València, Spain
Josef Bigun	Halmstad University, Sweden
Gunilla Borgfors	Information Technology, Sweden
Maria Elena Buemi	Universidad de Buenos Aires, Argentina
Lázaro Bustio-Martínez	INAOE, Mexico
Leticia Cagnina	Universidad Nacional de San Luis, Argentina
Luis V. Calderita	Universidad de Extremadura, Spain
Jose Ramon Calvo de Lara	CENATAV, Cuba
Sergio Daniel Cano-Ortiz	Universidad de Oriente, Cuba
Jesús Ariel Carrasco-Ochoa	INAOE, Mexico
César Castellanos	Universidad Nacional de Colombia, Colombia
Gerard Chollet	CNRS, France
Eduardo R. Concepcion-Morales	Universidad de Cienfuegos, Cuba
Raúl Cruz-Barbosa	Universidad Tecnológica de la Mixteca, Mexico
Mauricio Delbracio	Universidad de la República, Uruguay
Mariella Dimiccoli	Universitat Autònoma de Barcelona, Spain
Marcelo Errecalde	Universidad Nacional de San Luis, Argentina
Alfonso Estudillo-Romero	Universidad Nacional Autónoma de México, Mexico
Jacques Facon	Universidade Federal do Espírito Santo, Brazil

José Kadir	Advanced Technologies Applications Center, Cuba
Febrer-Hernández	
Gustavo Fernandez	AIT Austrian Institute of Technology, Austria
Dominguez	
Alicia Fernández	Universidad de la República, Uruguay
Carlos Ferrer	Universidad Central Marta Abreu de Las Villas, Cuba
Francesc J. Ferri	Universitat de Valencia, Spain
Marcelo Fiori	Universidad de la República, Uruguay
Giorgio Fumera	University of Cagliari, Italy
Antonino Furnari	Università di Catania, Italy
Silvio Guimaraes	PUC Minas, Brazil
Edel Garcia-Reyes	CENATAV, Cuba
Jose Garcia-Rodriguez	University of Alicante, Spain
María Matilde García	UCLV, Cuba
Lorenzo	
Milton García-Borroto	CUJAE, Cuba
Eduardo Garea-Llano	CENATAV, Cuba
Alexander Gelbukh	Instituto Politécnico Nacional, Mexico
Petia Georgieva	University of Aveiro, Portugal
Daniela Godoy	National Council for Scientific and Technological Research, Argentina
Lev Goldfarb	IIS, Canada
Luis Gomez Deniz	University of Las Palmas de Gran Canaria, Spain
Marta Gomez-Barrero	Hochschule Darmstadt, Germany
Pilar Gomez-Gil	National Institute of Astrophysics, Optics and Electronics, Mexico
Hector Raul Gonzalez Diez	UCI, Cuba
Rocio Gonzalez-Diaz	University of Seville, Spain
Antoni Grau	Technical University of Catalonia, Spain
Miguel Angel Guevara	University of Minho, Portugal
Lopez	
Bilge Günsel	Istanbul Technical University, Turkey
Laurent Heutte	Université de Rouen, France
Michal Haindl	Institute of Information Theory and Automation ASCR, Czech Republic
Yanio Hernandez	Universidad de las Ciencias Informáticas, UCI
Javier Hernandez-Ortega	Universidad Autonoma de Madrid, Spain
Gabriel Hernandez-Sierra	Advanced Technologies Applications Center, Cuba
Raudel Hernández	CENATAV, Cuba
Xiaoyi Jiang	University of Münster, Germany
Maria-Jose Jimenez	University of Seville, Spain
Vitaly Kober	CICESE, Mexico
Martin Kampel	Vienna University of Technology, Austria
Tomas Krajník	Czech Technical University, Czech Republic
Walter Kropatsch	Vienna University of Technology, Austria
Manuel S. Lazo-Cortés	INAOE, Mexico

Marcos Levano	Universidad Católica de Temuco, Chile
Aristidis Likas	University of Ioannina, Greece
Hélio Lopes	PUC-Rio, Brazil
Aurelio Lopez-Lopez	Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico
Juan Valentín Lorenzo-Ginori	Universidad Central Marta Abreu de Las Villas, Cuba
Octavio Loyola-González	Tecnologico de Monterrey's Puebla Campus, Mexico
Cristian López Del Alamo	Universidad La Salle, Peru
Filip Malmberg	Uppsala University, Sweden
Rebeca Marfil	University of Malaga, Spain
Francesco Marra	University Federico II of Naples, Italy
Jose Francisco Martinez-Trinidad	Instituto Nacional de Astrofísica Óptica y Electrónica, Mexico
Nelson Mascarenhas	UFSCar, Brazil
Rosana Matuk Herrera	Universidad Nacional de Luján, Argentina
José Eladio Medina Pagola	UCI, Cuba
Jiri Mekyska	Brno University of Technology, Czech Republic
Heydi Mendez-Vazquez	CENATAV, Cuba
Ana Maria Mendonça	Universidade do Porto, Portugal
Marcelo Mendoza	Universidad Técnica Federico Santa María, Chile
Vladimir Milián Núñez	University of Informatics Sciences, Cuba
Miguel Moctezuma-Flores	UNAM, Fac Ingeniería, Mexico
Manuel Montes-y-Gómez	INAOE, Mexico
Eduardo Morales	Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE), Mexico
Aythami Morales	Universidad Autonoma de Madrid, Spain
Annette Morales-González	CENATAV, Cuba
Sebastian Moreno	Universidad Adolfo Ibañez, Chile
Vadim Mottl	Computing Center of the Russian Academy of Sciences, Russia
Pablo Muse	Universidad de la República, Uruguay
Alberto Muñoz	University Carlos III, Spain
Alfredo Muñoz-Briseño	CENATAV, Cuba
Michele Nappi	Università di Salerno, Italy
João Neves	IT - Instituto de Telecomunicações, Portugal
Lawrence O'Gorman	Nokia Bell Labs, USA
Volodymyr Ponomaryov	Instituto Poltecnico Nacional, Mexico
Kalman Palagyi	University of Szeged, Hungary
Joao Papa	Sao Paulo State University, Brazil
Glauco Vitor Pedrosa	University of Brasilia, Brazil
Billy Peralta	Andres Bello University, Chile
Eanes Pereira	UFCG, Brazil
Nicolai Petkov	University of Groningen, The Netherlands
Ignacio Ponzoni	Universidad Nacional del Sur, Argentina
Oswaldo Pérez-García	CENATAV, Cuba

Adrián Pérez-Suay	Universitat de València, Spain
Airel Pérez-Suárez	CENATAV, Cuba
Maria Alejandra Quiros Ramirez	Max Planck Institute for Intelligent Systems, Germany
José Felipe Ramírez Pérez	University of Informatics Sciences, Cuba
Gregory Randall	Universidad de la República, Uruguay
Pedro Real	Universidad de Sevilla, Spain
Carlos A Reyes-Garcia	INAOE, Mexico
Dayana Ribas	University of Zaragoza, Spain
Bernardete Ribeiro	University of Coimbra, Portugal
Edgar Roman-Rangel	ITAM, Mexico
Alejandro Rosales-Perez	Tecnologico de Monterrey, Mexico
Jose Ruiz Shulcloper	University of Informatics Sciences, Cuba
Cesar San Martin	Universidad de la Frontera, Chile
Guillermo Sanchez-Diaz	Universidad Autonoma de San Luis Potosi, Mexico
Carlo Sansone	University of Naples Federico II, Italy
William Schwartz	Universidade Federal de Minas Gerais, Brazil
Juan Humberto Sossa Azuela	Instituto Politecnico Nacional, Mexico
Elaine Sousa	University of São Paulo, Brazil
Enrique Sucar	INAOE, Mexico
Josep Salvador Sánchez Garreta	Universitat Jaume I, Spain
Antonio-José Sánchez-Salmerón	Universitat Politècnica de València, Spain
Alberto Taboada-Crispi	UCLV, Cuba
Ruben Tolosana	Universidad Autónoma de Madrid, Spain
Esau Villatoro-Tello	Universidad Autonoma Metropolitana, Mexico
Ventzeslav Valev	Bulgarian Academy of Sciences, Bulgaria
Sergio A Velastin	Cortexica Vision Systems Ltd, UK
Ruben Vera-Rodriguez	Universidad Autonoma de Madrid, Spain
Max Viergever	University Medical Center Utrecht, The Netherlands
Gui-Song Xia	Wuhan University, China
Vera Yashina	Federal Research Center Computer Science and Control of the Russian Academy of Sciences, Russia

Additional Reviewers

Carlos Caetano	Universidade Federal de Minas Gerais, Brazil
Delia Irazu Hernandez Farias	INAOE, Mexico
Abbas Khosravani	Telecom SudParis, France
Gabriel Lucas Silva Machado	Universidade Federal de Minas Gerais, Brazil
Cristian Martinez	UNSa, Argentina
Ana Montalvo	CENATAV, Cuba

Thierry Moreira	UNICAMP, Brazil
Antonio Carlos Nazaré	Universidade Federal de Minas Gerais, Brazil
Rosa María Ortega Mendoza	Universidad Politécnica de Tulancingo, Mexico
Dijana Petrovska Delacretaz	Telecom SudParis, France
Raphael Prates	Universidade Federal de Minas Gerais, Brazil
Luciano Arnaldo Romero Calla	Universidad La Salle de Arequipa, Peru
Claudio Santos	UFSCar, Brazil
Jefry Sastre Pérez	Pontifical Catholic University of Rio de Janeiro, Brazil
Guilherme Schardong	Pontifical Catholic University of Rio de Janeiro, Brazil
Luiz José Schirmer Silva	Pontifical Catholic University of Rio de Janeiro, Brazil
Marcos Cleison Silva Santana	São Paulo State University, Brazil
Caio Cesar Viana da Silva	Universidade Federal de Minas Gerais, Brazil
Tomas Vintř	Czech Technical University, Czech Republic

Contents

Keynote Lecture

Incremental Learning of People Identities	3
<i>Federico Bartoli, Federico Pernici, Matteo Bruni, and Alberto Del Bimbo</i>	
Case-Based Reasoning – Methods, Techniques, and Applications	16
<i>Petra Perner</i>	
Foveated Vision for Deepface Recognition	31
<i>Souad Khellat-Kihel, Andrea Lagorio, and Massimo Tistarelli</i>	
Representation Learning for Underdefined Tasks	42
<i>Jean-François Bonastre</i>	

Data Mining, Natural Language Processing and Text Mining

Applying Self-attention for Stance Classification	51
<i>Margarita Bugueño and Marcelo Mendoza</i>	
Applying OWA Operator in the Semantic Processing for Automatic Keyphrase Extraction	62
<i>Manuel Barreiro-Guerrero, Alfredo Simón-Cuevas, Yamel Pérez-Guadarrama, Francisco P. Romero, and José A. Olivas</i>	
Brazilian Presidential Elections in the Era of Misinformation: A Machine Learning Approach to Analyse Fake News	72
<i>Jairo L. Alves, Leila Weitzel, Paulo Quaresma, Carlos E. Cardoso, and Luan Cunha</i>	
Improved Document Filtering by Multilevel Term Relations	85
<i>Adrian Fonseca Bruzón, Aurelio López-López, and José E. Medina Pagola</i>	
TSTM: A Model to Predict Topics' Popularity in News Providers	96
<i>Mario Alfonso Prado-Romero, Alessandro Celi, Giovanni Stilo, and Alex Coto-Santiesteban</i>	
Meta-learning of Text Classification Tasks	107
<i>Jorge G. Madrid and Hugo Jair Escalante</i>	
Portuguese POS Tagging Using BLSTM Without Handcrafted Features	120
<i>Rômulo César Costa de Sousa and Hélio Lopes</i>	

A Binary Variational Autoencoder for Hashing	131
<i>Francisco Mena and Ricardo Nanculef</i>	
Prototypes Generation from Multi-label Datasets Based on Granular Computing	142
<i>Marilyn Bello, Gonzalo Nápoles, Koen Vanhoof, and Rafael Bello</i>	
A Simple Proposal for Sentiment Analysis on Movies Reviews with Hidden Markov Models	152
<i>Billy Peralta, Victor Tirapegui, Christian Pieringer, and Luis Caro</i>	
Optimizing Natural Language Processing Pipelines: Opinion Mining Case Study	163
<i>Suilan Estevez-Velarde, Yoan Gutiérrez, Andrés Montoyo, and Yudivián Almeida-Cruz</i>	
Predicting Customer Profitability Dynamically over Time: An Experimental Comparative Study	174
<i>Daqing Chen, Kun Guo, and Bo Li</i>	
Image Analysis and Retrieval	
Face Spoofing Detection on Low-Power Devices Using Embeddings with Spatial and Frequency-Based Descriptors	187
<i>Rafael Henrique Vareto, Matheus A. Diniz, and William Robson Schwartz</i>	
Video Iris Recognition Based on Iris Image Quality Evaluation and Semantic Classification	198
<i>Eduardo Garea-Llano, Annette Morales-González, and Dailé Osorio-Roig</i>	
YOLO-FD: YOLO for Face Detection	209
<i>Luan P. e Silva, Júlio C. Batista, Olga R. P. Bellon, and Luciano Silva</i>	
On Using Document Scanners for Minutiae-Based Palmprint Recognition . . .	219
<i>Manuel Aguado-Martínez, José Hernández-Palancar, Katy Castillo-Rosado, Christof Kauba, Simon Kirchgasser, and Andreas Uhl</i>	
Stacking Fingerprint Matching Algorithms for Latent Fingerprint Identification	230
<i>Danilo Valdes-Ramirez, Miguel Angel Medina-Pérez, and Raúl Monroy</i>	
Detecting Steading Conversational Groups on an Still Image: A Single Relational Fuzzy Approach	241
<i>Elvis Ferrera-Cedeño, Niusvel Acosta-Mendoza, and Andrés Gago-Alonso</i>	

Multi-task Learning for Low-Resolution License Plate Recognition	251
<i>Gabriel Resende Gonçalves, Matheus Alves Diniz, Rayson Laroca, David Menotti, and William Robson Schwartz</i>	
Colour Feature Extraction and Polynomial Algorithm for Classification of Lymphoma Images	262
<i>Alessandro S. Martins, Leandro A. Neves, Paulo R. Faria, Thaina A. A. Tosta, Daniel O. T. Bruno, Leonardo C. Longo, and Marcelo Zanchetta do Nascimento</i>	
Deep Generic Features for Tattoo Identification	272
<i>Miguel Nicolás-Díaz, Annette Morales-González, and Heydi Méndez-Vázquez</i>	
Analysis of the Impact of Ear Alignment on Unconstrained Ear Recognition	283
<i>Elaine Grenot-Castellano, Yoanna Martínez-Díaz, and Francisco José Silva-Mata</i>	
Breast Lesion Discrimination Using Saliency Features from MRI Sequences and MKL-Based Classification	294
<i>Henry Johán Areiza-Laverde, Carlos Andrés Duarte-Salazar, Liliana Hernández, Andrés Eduardo Castro-Ospina, and Gloria M. Díaz</i>	
Role of EMG Rectification for Corticomuscular and Intermuscular Coherence Estimation of Spinocerebellar Ataxia Type 2 (SCA2).	306
<i>Y. Ruiz-Gonzalez, L. Velázquez-Pérez, R. Rodríguez-Labrada, R. Torres-Vega, and U. Ziemann</i>	
Face Recognition on Mobile Devices Based on Frames Selection	316
<i>Nelson Méndez-Llanes, Katy Castillo-Rosado, Heydi Méndez-Vázquez, Souad Khellat-Kihel, and Massimo Tistarelli</i>	
Brain Tumour Segmentation from Multispectral MR Image Data Using Ensemble Learning Methods.	326
<i>Ágnes Györfi, Levente Kovács, and László Szilágyi</i>	
Computer Vision Approaches to Detect Bean Defects	336
<i>Peterson A. Belan, Robson A. G. de Macedo, and Sidnei A. de Araújo</i>	
Automated Identification of Breast Cancer Using Digitized Mammogram Images	346
<i>Bryan Chachalo, Erik Solis, Eddy Andrade, Santiago Pozo, Robinson Guachi, Saravana Prakash Thirumuruganandham, and Lorena Guachi-Guachi</i>	

Sparse-Based Feature Selection for Discriminating Between Crops and Weeds Using Field Images	357
<i>Daniel Guillermo García-Murillo, Andrés M. Álvarez, David Cárdenas-Peña, William Hincapié-Restrepo, and German Castellanos-Dominguez</i>	
Automated Nuclei Segmentation in Dysplastic Histopathological Oral Tissues Using Deep Neural Networks	365
<i>Adriano Barbosa Silva, Alessandro S. Martins, Leandro A. Neves, Paulo R. Faria, Thaina A. A. Tosta, and Marcelo Zanchetta do Nascimento</i>	
A Study on Histogram Normalization for Brain Tumour Segmentation from Multispectral MR Image Data	375
<i>Ágnes Györfi, Zoltán Karetka-Mezei, David Iclănzan, Levente Kovács, and László Szilágyi</i>	
Machine Learning and Neural Networks	
Probabilistic Forecasting Using Monte Carlo Dropout Neural Networks	387
<i>Cristián Serpell, Ignacio Araya, Carlos Valle, and Héctor Allende</i>	
Hermite Convolutional Networks	398
<i>Leonardo Ledesma, Jimena Olveres, and Boris Escalante-Ramírez</i>	
Analytical Solution for the Optimal Addition of an Item to a Composite of Scores for Maximum Reliability	408
<i>Carlos A. Ferrer, Idileisy Torres-Rodríguez, Alberto Taboada-Crispi, and Elmar Nöth</i>	
A New Method to Evaluate Subgroup Discovery Algorithms	417
<i>Lisandra Bravo Ilisástigui, Diana Martín Rodríguez, and Milton García-Borroto</i>	
Mathematical Theory of Pattern Recognition	
KAdam: Using the Kalman Filter to Improve Adam algorithm	429
<i>José David Camacho, Carlos Villaseñor, Alma Y. Alanis, Carlos Lopez-Franco, and Nancy Arana-Daniel</i>	
Evaluating Restrictions in Pattern Based Classifiers	439
<i>Andy González-Méndez, Diana Martín-Rodríguez, and Milton García-Borroto</i>	
BRIEF-Based Mid-Level Representations for Time Series Classification	449
<i>Renato Souza, Raquel Almeida, Roberto Miranda, Zenilton Kleber G. do Patrocínio Jr., Simon Malinowski, and Silvio Jamil F. Guimarães</i>	

Continuous Hyper-parameter Configuration for Particle Swarm Optimization via Auto-tuning	458
<i>Jairo Rojas-Delgado, Vladimir Milián Núñez, Rafael Trujillo-Rasúa, and Rafael Bello</i>	
Feature Extraction of Long Non-coding RNAs: A Fourier and Numerical Mapping Approach	469
<i>Robson Parmezan Bonidia, Lucas Dias Hiera Sampaio, Fabrício Martins Lopes, and Danilo Sipoli Sanches</i>	
Combinatorial Optimization Approach for Arabic Word Recognition Based on Adaptive Simulated Annealing	480
<i>Zeineb Zouaoui, Imen Ben Cheikh, and Mohamed Jemni</i>	
Pattern Recognition and Applications	
Revisiting Machine Learning from Crowds a Mixture Model for Grouping Annotations.	493
<i>Francisco Mena and Ricardo Ñanculef</i>	
A Model Based on Genetic Algorithm for Colorectal Cancer Diagnosis	504
<i>Daniela F. Taino, Matheus G. Ribeiro, Guilherme Freire Roberto, Geraldo F. D. Zafalon, Marcelo Zanchetta do Nascimento, Thaina A. Tosta, Alessandro S. Martins, and Leandro A. Neves</i>	
A Spatiotemporal Analysis of Taxis Demand: A Case Study in the Manizales City	514
<i>Andres Felipe Giraldo-Forero, Sebastian Garcia-Lopez, Paula Andrea Rodriguez-Marin, Juan Martinez, Yohan Ricardo Céspedes-Villar, Oscar Cardona, Juan Camilo Acosta, and Luis Carlos Trujillo</i>	
A Supervised Laplacian Eigenmap Algorithm for Visualization of Multi-label Data: SLE-ML	525
<i>Mariko Tai and Mineichi Kudo</i>	
Material Fracture Life Prediction Using Linear Regression Techniques Under High Temperature Creep Conditions	535
<i>Roberto Fernandez Martinez, Pello Jimbert, Jose Ignacio Barbero, Lorena M. Callejo, and Igor Somocueto</i>	
Knowledge Extraction from Vector Machine Support in the Context of Depression in Children and Adolescents.	545
<i>Thiago Lima, Renata Santana, Maycoln Teodoro, and Cristiane Nobre</i>	
Multi-domain Aspect Extraction Based on Deep and Lifelong Learning	556
<i>Dionis López and Leticia Arco</i>	

A Framework for Distributed Data Processing	566
<i>José Kadir Febrer-Hernández and Vitali Herrera Semenets</i>	
Articulation Analysis in the Speech of Children with Cleft Lip and Palate . . .	575
<i>H. A. Carvajal-Castaño and Juan Rafael Orozco-Arroyave</i>	
Signals Analysis and Processing	
A Wavelet Entropy Based Methodology for Classification Among Healthy, Mild Cognitive Impairment and Alzheimer’s Disease People	589
<i>Jorge Esteban Santos Toural, Arquímedes Montoya Pedrón, and Enrique Juan Marañón</i>	
Trainable COPE Features for Sound Event Detection.	599
<i>Nicola Strisciuglio and Nicolai Petkov</i>	
Incremental Training of Neural Network for Motor Tasks Recognition Based on Brain-Computer Interface	610
<i>Nayid Triana Guzmán, Álvaro David Orjuela-Cañón, and Andrés Leonardo Jutinico Alarcon</i>	
Supervised Relevance Analysis for Multiple Stein Kernels for Spatio-Spectral Component Selection in BCI Discrimination Tasks.	620
<i>Camilo López-Montes, David Cárdenas-Peña, and G. Castellanos-Dominguez</i>	
Performance of Different Average Methods for the Automatic Detection of Evoked Potentials	629
<i>Idileisy Torres-Rodríguez, Carlos Ariel Ferrer-Riesgo, Juan Carlos Oliva Pérez, and Alberto Taboada-Crispi</i>	
Discrimination of Shoulder Flexion/Extension Motor Imagery Through EEG Spatial Features to Command an Upper Limb Robotic Exoskeleton	637
<i>Ramón Amado Reinoso-Leblanch, Yunier Prieur-Coloma, Leondry Mayeta-Revilla, Roberto Sagaró-Zamora, Denis Delisle-Rodriguez, Teodiano Bastos, and Alberto López-Delis</i>	
Automatic Identification of Traditional Colombian Music Genres Based on Audio Content Analysis and Machine Learning Techniques	646
<i>Diego A. Cruz, Cristian C. Cristancho, and Jorge E. Camargo</i>	
Dual Watermarking for Handwritten Document Image Authentication and Copyright Protection for JPEG Compression Attacks	656
<i>Ernesto Avila-Domenech, Anier Soria-Lorente, and Alberto Taboada-Crispi</i>	

Speech Recognition

A Survey of the Effects of Data Augmentation for Automatic Speech Recognition Systems	669
<i>Jose Manuel Ramirez, Ana Montalvo, and Jose Ramon Calvo</i>	
Multi-channel Convolutional Neural Networks for Automatic Detection of Speech Deficits in Cochlear Implant Users	679
<i>Tomas Arias-Vergara, Juan Camilo Vasquez-Correa, Sandra Gollwitzer, Juan Rafael Orozco-Arroyave, Maria Schuster, and Elmar Nöth</i>	
Articulation and Empirical Mode Decomposition Features in Diadochokinetic Exercises for the Speech Assessment of Parkinson's Disease Patients	688
<i>Juan Camilo Vásquez-Correa, Cristian D. Rios-Urrego, Alice Rueda, Juan Rafael Orozco-Arroyave, Sri Krishnan, and Elmar Nöth</i>	
Convolutional Neural Networks and a Transfer Learning Strategy to Classify Parkinson's Disease from Speech in Three Different Languages	697
<i>Juan Camilo Vásquez-Correa, Tomas Arias-Vergara, Cristian D. Rios-Urrego, Maria Schuster, Jan Rusz, Juan Rafael Orozco-Arroyave, and Elmar Nöth</i>	
Bidirectional Alignment of Glottal Pulse Length Sequences for the Evaluation of Pitch Detection Algorithms	707
<i>Carlos A. Ferrer, Reinier Rodríguez Guillén, and Elmar Nöth</i>	

Video Analysis

Gait Recognition Using Pose Estimation and Signal Processing	719
<i>Vítor Cézar de Lima and William Robson Schwartz</i>	
A Novel Scheme for Training Two-Stream CNNs for Action Recognition . . .	729
<i>Reinier Oves García, Eduardo F. Morales, and L. Enrique Sucar</i>	
Parkinsonian Ocular Fixation Patterns from Magnified Videos and CNN Features.	740
<i>Isail Salazar, Said Pertuz, William Contreras, and Fabio Martínez</i>	
Does Pooling Really Matter? An Evaluation on Gait Recognition	751
<i>Claudio Filipi Goncalves dos Santos, Thierry Pinheiro Moreira, Danilo Colombo, and João Paulo Papa</i>	
Virtual Hand Training Platform Controlled Through Online Recognition of Motion Intention	761
<i>César Quinayás, Fernando Barrera, Andrés Ruiz, and Alberto Delis</i>	

Video Popularity Forecasting to Improve Cache Miss Rate in Content Delivery Networks	769
<i>Jairo Rojas-Delgado, Rafael Trujillo-Rasúa, Rafael Bello, and Gerdys E. Jiménez Moya</i>	
Piggybacking Detection Based on Coupled Body-Feet Recognition at Entrance Control	780
<i>Dirk Siegmund, Vinh Phuc Tran, Julian von Wilmsdorff, Florian Kirchbuchner, and Arjan Kuijper</i>	
Author Index	791