The Vitality of Pattern Recognition and Image Analysis

Luisa Micó[a,*], João M. Sanches[b], Jaime S. Cardoso[c]

[a] *Universidad de Alicante*
[b] *Technical University of Lisbon*
[c] *University of Porto*

Not many decades ago, Pattern Recognition and Image Analysis (PR&IA) addressed with simple tasks applying shallow models. But things are changing, and quickly. Then, this highly dynamic discipline has been expanding greatly, also helped by the emergence of newer application such as in robotics, biometrics or multimedia systems. Just now, PR&IA tasks run the complete gamut: from preprogramed works to the stimulating challenge of getting computers to learn as they go. At their most formidable, PR&IA tasks require computers to look, interpret and report back. We are at a transition point where PR&AI are suddenly at the forefront. Progress has come about thanks in part to steady advance in the technologies needed to help machines understand visual data, including machine learning and data mining techniques.

The papers included in this special issue provide a snapshot of image analysis and pattern recognition research today. They are the very best of the 6th Iberian Conference on Pattern Recognition and Image Analysis (IbPRIA 2013), held on 5-7 June, 2013 in Madeira, Portugal. IbPRIA 2013 attracted 181 papers from 34 different countries. After the reviewing process, 105 papers were accepted for presentation in the conference. A selection of the best scored and presented at the conference was invited to submit to this special issue a substantially extended and revised version of the conference paper and the resulting manuscripts were sent out for full review. The process, including required revisions, was in accordance with the standing editorial policy of Neurocomputing, resulting in the final versions of the ten papers accepted and appearing in this special issue.

3D object detection and pose estimation in 3D data clouds is of wide interest, and rotationally symmetric objects arise often in practical environments. Figueiredo et al. present how rotational symmetry can be used to improve performance and memory costs by orders of magnitude for state of the art methods in 3D object detection. The authors present the baseline method, describe the improvements w.r.t. symmetric objects, analyse the theoretical gains, and perform several evaluations to compare robustness and performance to the baseline method.

*I am corresponding author
Email addresses: mico@dlsi.ua.es (Luisa Micó), jmrs@tecnico.ulisboa.pt (João M. Sanches), jaime.cardoso@fe.up.pt (Jaime S. Cardoso)

Gonçalves et al. address the visualization in minimally invasive surgeries. These medical procedures typically use near-lighting endoscopic cameras, which have wide or very wide field of view, and hence their images are affected by high radial distortion and small spatial resolution in the periphery of the image. The authors propose techniques to compensate the radial distortion and the reduced resolution of the image in its periphery, improving the perspective shape from shading results.

Francisco Alvaro et al. describe a bidimensional extension of Stochastic Context-Free Grammars for structure detection and segmentation of images of manuscripts. They used old documents from historical marriage license books to validate the proposed method and compare its performance with several inference algorithms for Probabilistic Graphical Models. The results showed that the proposed grammatical model outperformed the other methods.

Nascimento et al. tackle the classification of human activities in far-field surveillance settings using the trajectories performed by pedestrians. In these scenarios people are far from the camera, making it impossible to obtain detailed shape information. Trajectories are then used an important source of information about the activity. The authors model trajectories using a generative model of non-parametric vector fields; the main contribution being an algorithm based on the natural gradient to learn the proposed model from sets of observed trajectories.

Alejandro Rosales-Perez et al. address the important issue of feature selection and scaling in the general framework of supervised learning using support vector machines classifiers. They formulate the model selection procedure as a surrogate-assisted evolutionary multi-objective optimization problem, aiming to minimize simultaneously two components that are closely related to the error of a model: bias and variance components, which are estimated in an experimental fashion.

Sánchez et al. present a quite complete piece of work on detection and segmentation of human limbs, as well as a new large annotated dataset of human actions. The HuPBA 8k+ dataset contains more than 8000 labelled frames at pixel precision, including more than 120000 manually labelled samples of 14 different limbs. The authors also propose a two stage approach based on Error-Correcting Output Codes and Graph Cuts for the segmentation of human limbs in RGB images, which is evaluated in the HuPBA 8k+ dataset.

Raul Montoliu et al. propose a new strategy for activity characterization of handball videos based on low level features related with local motion instead the traditional approach based on global trajectories of the players. The authors compare the proposed approach with other state of the art methods and show the results are comparable but presents significative gains from a computational complexity point of view.

The paper by Afonso and Sanches presents a method for reconstructing ultrasound imaging or volumes from a partial set of observations, under the Rayleigh distributed multiplicative noise model. The proposed method is based on the total variation and Alternating Direction Method of Multipliers. The subject is relevant due to the applicability of 3D ultrasound imaging for characterizing diseases and its capabilities to overcome limitations of the 2D counterpart.

Matteo Taiana et al. demonstrate that corrupted data and features computed from incomplete (occluded) data in pedestrian detection algorithms can be useful to improve

accuracy of detection when compared with the traditional approaches that only use pure samples containing persons who are fully visible. The paper describes exhaustive experimental tests with the INRIA pedestrian data sets. They show, however, that there is an optimal level of impurity that maximizes the accuracy of the detection algorithm above which the performance starts to degrade.

Kasim Terzic et al. present an improved, biologically inspired and multiscale keypoint operator for image analysis. The proposed algorithm is faster than previous biologically-inspired models, making it possible its use in real-time application implemented on fast modern GPUs and CPUs. The authors also show that keypoints detection can be used in data selection steps to reduce the complexity of state-of-the-art object categorization algorithms.

Thank you

Finally, we express our gratitude to all of the authors who submitted proposals to this special issue, particularly for the hard work they put in preparing these versions. We also thank all the reviewers for providing valuable feedback and recommendations that have significantly improved the papers. For those whose proposals did not get accepted, and less than half of the invited papers were accepted, we would like to thank you for your effort and time but also would like to comfort you in that you made our decision extremely difficult. We are also very grateful to the Editor in Chief of Neurocomputing, Tom Heskes, for giving us the opportunity to publish this special issue. We hope that this issue provides useful information for further research in pattern recognition and image analysis.

Guest Editors
Luisa Micó
Departamento de Lenguajes y Sistemas Informáticos
Universidad de Alicante
E-mail address:mico@dlsi.ua.es

Joao M. Sanches
Institute for Systems and Robotics
Technical University of Lisbon
E-mail address: jmrs@tecnico.ulisboa.pt

Jaime S. Cardoso
INESC TEC and Faculty of Engineering
University of Porto
E-mail address: jaime.cardoso@fe.up.pt