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Preface

Now in its ninth edition, IbPRIA has become a key research event in pattern recognition and image analysis on the Iberian Peninsula organized by the national IAPR associations for pattern recognition in Spain (AERFAI) and Portugal (APRP).

Most of the research reported here therefore comes from authors from Spain and Portugal. Out of the 401 authors who presented work to IbPRIA 2019, 29% are from Spain and 20% are from Portugal. More than 50% of the authors are from another 32 countries from around the world, with high representation from countries like Algeria, Brazil, Colombia, India, Italy, or Mexico. Our efforts to strengthen the bonds between the research conducted on the Iberian Peninsula and other countries are patent in the program, which emphasizes interactive poster sessions and includes a special session dedicated to international research cooperation.

On the other hand, we are witnessing a deep transformation in our field, now increasingly dominated by advances occurring in industry. We have also tried to integrate IBPRIA in this vortex by including in the program a number of panel discussions with international research leaders from companies like Google, Microsoft, Telefonica, Vodafone, and Accenture.

IbPRIA 2019 received 137 submissions. The review process for IbPRIA 2019 was diligent and required careful consideration of more than 400 reviews from 100 reviewers who spent significant time and effort in reviewing the papers. In the end 99 papers were accepted, which is an acceptance rate of 72%. To form the final program 30 papers were selected for oral presentations (22% acceptance rate) and 69 as poster presentations.

We hope that this book will result in a valuable resource for the pattern recognition research community. We would like to thank all who made this possible, especially the authors and reviewers.

August 2019

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Abstracts of Invited Tutorials

Machine Learning with Scikit-Learn

Gaël Varoquaux

Parietal, Inria, Inria Saclay Île-De-France, Palaiseau, France

Abstract. This tutorial briefly covered how to do machine learning with scikit-learn. The presenter did not go into detail, but rather tried to give pointers to important aspects of the software as well as key concepts in machine learning.

Computer Vision for Affective Computing

Agata Lapedriza Garcia

Universitat Oberta de Catalunya, Barcelona, Spain

Abstract. Over the past decade we have observed an increasing interest in developing technologies for automatic emotion recognition. The capacity of automatically recognizing emotions has many applications in environments where machines need to interact and collaborate with humans. However, how can machines recognize emotions? In this tutorial we gave an introduction to affective computing (also known as emotional artificial intelligence), the discipline that studies and develops systems and devices that can recognize, interpret, process, or simulate emotions or feelings. After a general introduction to affective computing, we focused on techniques for emotion recognition, paying special attention to the problem of emotion recognition from images. We reviewed some research on emotion recognition based on face and body analysis and we discussed the importance of analyzing scenes and context, in addition to faces, in order to better recognize emotions. In particular, we showed how emotion recognition can be approached from a scene understanding perspective.

Bayesian Optimization

Daniel Hernandez-Lobato

Universidad Autonoma de Madrid, Spain

Abstract. Many optimization problems are characterized by an objective function that is very expensive to evaluate. More precisely, the evaluation may involve carrying out a time-consuming experiment. This also means that the objective may lack a closed-form expression and, moreover, that the evaluation process can be noisy. That is, two measurements of the objective function at the same input location can give different results. Examples of these problems include tuning the hyper-parameters of a deep neural network, adjusting the parameters of the control system of a robot, or finding new materials for, e.g., solar energy production. Standard optimization methods give sub-optimal results when tackling this type of problem. In this tutorial, I presented a general overview of Bayesian optimization (BO), a collection of methods that can be used to efficiently solve problems with the characteristics described. For this, BO methods fit, at each iteration, a probabilistic model to the observations of the objective function. This model is typically a Gaussian process whose predictive distribution captures the potential values of the objective in regions of the space in which there are no observations. This uncertainty is then used to build an acquisition function whose maximum indicates where to perform the next evaluation of the objective with the goal of solving the problem in the smallest number of steps. Because the acquisition function only depends on the probabilistic model and not on the actual objective, it can be cheaply optimized. Therefore, BO methods make, at each iteration, intelligent decisions about where to evaluate the objective next. This can save a lot of computational time. In this tutorial, I explained in detail each of the steps performed by BO methods and, focusing on information theory-based methods, I also describe some extensions to address problems dealing with multiple evaluations in parallel, and multiple constraints and/or objectives. I conclude with a description of BO software, open problems, and future research directions in the field. The tutorial was followed by an afternoon session in which some of the concepts and methods described were put in practice. More precisely, BO software was used for tuning the hyper-parameters of machine learning algorithms.

Abstracts of Invited Talks

Building Computer Vision Systems that Really Work

Andrew Fitzgibbon

Microsoft, Cambridge, UK

Abstract. I have been shipping advanced computer vision systems for two decades. In 1999, prize-winning research from Oxford University was spun out to become the Emmy-award-winning camera tracker "boujou," which has been used to insert computer graphics into live-action footage in pretty much every movie made since its release, from the "Harry Potter" series to "Bridget Jones's Diary." In 2007, I was part of the team that delivered human body tracking in Kinect for Xbox 360, and in 2015 I moved from Microsoft Research to the Windows division to work on Microsoft's HoloLens, an AR headset brimming with cutting-edge computer vision technology.

In all of these projects, the academic state of the art has had to be leapfrogged in accuracy and efficiency, sometimes by several orders of magnitude. Sometimes that is just raw engineering, sometimes it means completely new ways of looking at the research. I talked about this interplay, between mathematics and code, and showed how each helps to understand the other. If I had to nominate one key to success, it would be a focus on, well, everything: from cache misses to end-to-end experience, and on always being willing to change one's mind.

Face Analysis for Multimodal Emotional Interfaces

Matti Pietikäinen

University of Oulu, Finland

Abstract. Emotions are central for human intelligence, and should have a similar role in artificial intelligence. There is a growing need to develop multimodal emotional interfaces, which are able to read the emotions of people and adapt their operations accordingly. Among the areas of application are emotional chatbots, personal assistants, human–robot interaction, emotion-aware games, health and medicine, on-line learning, safe car driving, security, and user/customer experience analysis. Facial image analysis will play a key role in developing emotionally intelligent systems. In this talk, first an introduction to emotions, face information, and applications of emotion analysis was presented. Then, highlights of our recent research on facial image analysis were introduced, including methods for image and video description, face and facial (micro-)expression recognition, and heart-rate measurement from face videos. Some examples of multimodal emotion analysis were presented. Finally, future challenges for building multimodal emotional interfaces were discussed.

Fun with Human–Machine Collaboration for Computer Vision

Vittorio Ferrari

Google, Zurich, Switzerland

Abstract. Training computer vision models typically requires tedious and time-consuming manual annotation, which hinders scaling, especially for complex tasks such as full image segmentation. In this talk, I presented recent human–machine collaboration techniques from my team, where the machine assists a human in annotating the training data and training a new model. These can substantially reduce human effort and also yield more interesting interfaces to interact with. The talk explored several cases, including segmentation of individual objects, joint segmentation of all objects and background regions in an image, using speech together with mouse inputs, and annotating object classes using free-form text written by undirected annotators.

Towards Human Behavior Modeling from (Big) Mobile Data

Nuria Oliver

Vodafone, Barcelona, Spain

Abstract. Human Behavior Modeling and Understanding is a key challenge in the development of intelligent systems and a great asset to help us make better decisions. Over the course of the past 23 years, I have worked on building automatic data-driven machine-learning based models of human behaviors for a variety of applications, including smart rooms, smart cars, smart offices, smart mobile phones, and smart cities.

In this talk, I described three such projects. The first project is a smartphone app to automatically detect boredom. This project received the best paper award at Ubicomp 2015. The second project, MobiScore, tackles the challenge of financial inclusion by building machine-learning-based models of credit scoring from mobile network data. MobiScore enables people who do not have a bank account and hence are excluded from the financial system to get access to credit. Finally, the third project focuses on automatically detecting crime hotspots in a city through the analysis of mobile data.

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