

# Lecture Notes in Artificial Intelligence 7081

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# Partially Supervised Learning

First IAPR TC3 Workshop, PSL 2011  
Ulm, Germany, September 15-16, 2011  
Revised Selected Papers

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# Preface

Partially supervised learning (PSL) is a rapidly evolving area of machine learning. In many applications unlabeled data may be relatively easy to collect, whereas labeling these data is difficult, expensive or/and time consuming as it needs the effort of human experts. PSL is a general framework for learning with labeled and unlabeled data, for instance, in classification, it is assumed that each learning sample consists of a feature vector and some information about its class. In the PSL framework this information might be a crisp label, or a label plus a confidence value, or it might be an imprecise and/or uncertain soft label defined through a certain type of uncertainty model (fuzzy, Dempster–Shafer), or it might be that information about a class label is not available.

The PSL framework thus generalizes many kinds of learning paradigms including supervised and unsupervised learning, semi-supervised learning for classification and regression, transductive learning, semi-supervised clustering, policy learning in partially observable environments, and many others. Therefore PSL methods and algorithms are of great interest in both practical applications and theory. Research in the field of PSL is still in its early stages and has great potential for further growth, thus leaving plenty of room for further development.

This First IAPR-TC3 Workshop on Partially Supervised Learning (PSL 2011), whose proceedings are presented in this volume, endeavored to bring together recent novel research in this area and to provide a forum for further discussion. The workshop was held at the University of Ulm (<http://neuro.informatik.uni-ulm.de/PSL2011/>), Germany, during September 15–16, 2011. It was supported by the International Association of Pattern Recognition (IAPR) and by the IAPR Technical Committee on Neural Networks and Computational Intelligence (TC 3). IAPR-TC3 is one of the 20 Technical Committees of IAPR, focusing on the application of computational intelligence to pattern recognition.

PSL 2011 focused on a number of different topics, covering methodological issues as well as real-world applications of PSL. The main methodological issues were: combination of supervised and unsupervised learning; diffusion learning; semi-supervised classification, regression, and clustering; learning with deep architectures; active learning; PSL with vague, fuzzy, or uncertain teaching signals; PSL in multiple classifier systems and ensembles; PSL in neural nets, machine learning, or statistical pattern recognition; PSL in cognitive systems. Applications of PSL included: image and signal processing; multi-modal information processing; sensor/information fusion; human–computer interaction; data mining and Web mining; forensic anthropology; bioinformatics.

The workshop featured regular oral presentations and a poster session, plus three brilliant invited speeches, namely: “Unlabeled Data and Multiple Views,” delivered by Zhi-Hua Zhou (LAMDA Group, National Key Laboratory for

Novel Software Technology, Nanjing University, Nanjing, China); “Online Semi-Supervised Ensemble Updates for fMRI Data,” delivered by Catrin Plumpton (University of Wales, Bangor, UK); and, “How Partially Supervised Learning Can Facilitate and Enhance User State Analysis in Naturalistic HCI,” delivered by Stefan Scherer (Trinity College Dublin, Ireland). It is our firm conviction that all the papers in this book are of high quality and significance to the area of PSL. We sincerely hope that readers of this volume may, in turn, enjoy it and get inspired from the different contributions.

We would like to acknowledge the fact that the organization of the workshop made its first steps within the framework of the Vigoni Project for international exchanges between the universities of Siena (Italy) and Ulm (Germany). Also, we wish to acknowledge the generosity of the PSL 2011 sponsors: IAPR, IAPR-TC3, the University of Ulm which hosted this event, and the Transregional Collaborative Research Centre SFB/TRR 62 *Companion-Technology for Cognitive Technical Systems* for generous financial support. We are grateful to all the authors who submitted a paper to the workshop, since their efforts and invaluable contributions led to a great event. Special thanks to the local organization crew based in Ulm, namely, Michael Glodek, Martin Schels, Miriam K. Schmidt and Sascha Meudt. The contribution from the members of the Program Committee in promoting the event and reviewing the papers is gratefully acknowledged. Finally, we wish to express our gratitude to Springer for publishing these proceedings within their LNCS/LNAI series, and for their constant support.

October 2011

Friedhelm Schwenker  
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for Cognitive Technical Systems*  
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