## Foreword

Welcome to the sixth edition of the JMLR Conference and Workshop Proceeding Series for the Asian Conference on Machine Learning. This volume contains 25 papers accepted to the Sixth Asian Conference on Machine Learning (ACML 2014) held in Nha Trang City, Vietnam from 26 to 28 November 2014. This volume continues the ACML tradition of having high-quality and original research papers in the area of machine learning following five previous successful events held in China, Japan, Taiwan, Singapore and Australia respectively. ACML aims at providing a leading international forum for researchers in machine learning and related fields to share their original research findings, new ideas and achievements. Submissions from other than the Asia-Pacific regions were also highly encouraged.

The conference has grown in strength over time. While located in Asia, the conference has always drawn wide attention from international community. This year, we received submissions from 20 counties scattered across Asia, Australasia, Europe, and North America. We continued the tradition of having two cycles and double-blind review; each cycle had its own submission deadline. Papers that could not be accepted in the first cycle, but received positive feedbacks, correctable and could be accepted after careful revision, were encouraged to resubmit in the second cycle, allowing the reviewer's comments to be addressed. After removing invalid submissions, there were 80 submissions, of which 25 papers were accepted into the main program, accounting for an acceptance rate of 31.25%. A strict double-blind reviewing process was enforced, and each paper was assigned with two meta-reviewers, and at least 4 reviewers. A major of papers had 4 reviews and one meta-review; none had less than 3 reviews. To maintain quality, each reviewer was allocated with no more than 6 papers. In total, there were 32 senior program committee members and 86 program committee members to provide expert opinion and reviews. Their contributions are essential to the quality and standard of papers selected in the conference. Without their contribution, the conference would have not been possible. Their names are acknowledged in the following pages. Finally, the Program Co-chairs considered all the reviews and meta-reviews by senior program committee members to make the final decisions for the papers.

All accepted papers received both an oral and poster presentation, and are published in this volume. Following the tradition of previous ACML(s), this year's conference was also a single track. The submissions covered a broad range of topics, including theoretical analyses, Bayesian and probabilistic models in machine learning, supervised, unsupervised, reinforcement learning and applications to real world problems.

In addition to the submitted papers, we were pleased to have three keynotes from leading experts. Yoram Singer (Google) talked about "When size matters: learning compact models from high dimensional large datasets", Hung Bui (Nuance) presented "Random Relations, Symmetry and Inference" and Zhi-Hua Zhou (Najing University) "From AdaBoost to large margin distribution machine". In addition to main program, we had one day of tutorials and workshops prior to the main conference organised by the Tutorial and Workshops Chairs. Two tutorials were delivered "Convex optimization for big data: scalable, randomized, and parallel algorithms for big data analytics" by Mark Schmidt and "Sparse

and low-rank representation with applications to visual content analysis" by Frank Wang. In parallel to the tutorials, we had a workshop on "Machine Learning and Its Applications in Vietnam" organised by Hung Bui, Son Nguyen and Tri Nguyen. We thank all the speakers and organisers for putting together a fantastic program.

We gratefully acknowledge our financial sponsors: The Air Force Office of Scientific Research USA, the Asian Office of Aerospace R&D USA, Deakin University, Ho Chi Minh City University of Technology, Japan Advanced Institute of Science and Technology, John von Neumann Institute VNU-HCM, Khanh Hoa Association for Information Communication Technology and Nha Trang University.

ACML Steering Committee Chair Zhi-Hua Zhou provided valuable advise and support during the whole process. The General Chairs Tu Bao Ho and Tru Hoang Cao took care of organizing issues and many other things to make sure the event ran smoothly. The Award Selection Committee, whose names are acknowledged below, for their valuable expertise and opinions in selecting the Best Paper Award. Our special thanks goes to the Local Co-Chairs Tuyen Huynh, Minh Triet Tran, Do Nhu An, Ngo Duy Khanh, the webmaster Thinh Nguyen and the local teams whose contributions were indispensable to make the event run.

Last but not least, a big thank you to all participants of ACML 2014 who made it such a great event!

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## Invited Talks

### Title: WHEN SIZE MATTERS: LEARNING COMPACT MODELS FROM HIGH DIMENSIONAL LARGE DATASETS

Presenter: Yoram Singer (Google)

Abstract:

We review the design, analysis, and implementation of stochastic optimization techniques, online algorithms, and modeling approaches for learning high dimensional spaces using large amounts of data. The focus is on algorithms and models that are efficient, accurate, and yield compact models. Concretely, we describe the Passive Aggressive (PA) online learning framework, the forward-backward shrinkage algorithm (Fobos), mirror descent for learning composite objectives (COMID), the adaptive gradient (AdaGrad) algorithm, and efficient adaptation of Nesterov's accelerated gradient method. We also discuss simple yet effective modeling approaches based on locality for learning from high dimensional data.

Bio:

Yoram Singer is a senior research scientist at Google. From 1999 through 2007 he was an associate professor at the Hebrew University of Jerusalem. From 1995 through 1999 he was a member of the technical staff at AT&T Research. He was the co-chair of the conference on Computational Learning Theory in 2004 and of Neural Information Processing Systems in 2007. He serves as an editor of the Journal of Machine Learning, IEEE Signal Processing Magazine, and IEEE Transactions on Pattern Analysis and Machine Intelligence.

### Title: RANDOM RELATIONS, SYMMETRY AND INFERENCE

Presenter: Bui Hai Hung (Adobe Research, USA)

Abstract:

AI knowledge and semantic representation typically makes use of relational structures such as graphs, relational database, and more generally first-order logic. Yet, algorithms that robustly process images, videos, texts and other sensory input are mostly derived from statistical principles. This poses the question of how these two approaches can be combined and leveraged. Towards this goal, I will discuss some recent development in learning and inference with random model of relational structures. The focus will be on the inference problems that arise in learning probabilistic models of random relational structures (e.g., random graphs). Despite the extreme denseness of the corresponding graphical models which renders traditional methods in graphical model inference inapplicable, we show that effective approximation can still be achieved. The key underlying idea is the exploitation of symmetry and exchangeability within the framework of convex variational inference.

Bio:

Dr. Bui Hai Hung is currently a senior research scientist at Adobe Research, USA. He is interested in a broad range of technical areas, including probabilistic graphical models, machine learning, artificial intelligence and has published one book and more than 60 research articles in these fields. Before joining Adobe, Hung spent two years at Nuance research lab and almost 10 years at the Artificial Intelligence Center, SRI International where he led numerous industrial and US government research projects on the applications of machine learning and probabilistic inference in natural language understanding, video understanding, and building personal intelligent assistants. Going further back in time, he was an assistant professor at Curtin University, Australia (2000-2003), Ph.D graduate in computer science (Curtin, 1998), graduate from Hanoi University of Science high school for gifted students, and a maths olympian (silver medal, IMO 1989, Braunschweig).

Title: FROM ADABOOST TO LARGE MARGIN DISTRIBUTION MACHINE

Presenter: Zhi-Hua Zhou (Nanjing University, China)

Abstract:

SVMs and Boosting are possibly the two most popular learning approaches during the past two decades. It is well known that the margin is a fundamental issue of SVMs, whereas recently the margin theory for Boosting has been defended, establishing a connection between these two mainstream approaches. The recent theoretical results disclosed that the margin distribution rather than a single margin is really crucial for the generalization performance, and suggested to optimize the margin distribution by maximizing the margin mean and minimizing the margin variance simultaneously. Inspired by this recognition, we advocate the large margin distribution learning, a promising research direction that has exhibited superiority in algorithm designs to traditional large margin learning.

Bio:

Zhi-Hua Zhou is a Professor, Founding Director of LAMDA, and Deputy Director of the National Key Lab for Novel Software Technology at Nanjing University. His research interests are mainly in machine learning, data mining, pattern recognition and multimedia information retrieval. He is author of the book Ënsemble Methods: Foundations and Algorithms; and founder of the ACML conference series. He is an ACM Distinguished Scientist, IAPR Fellow and IEEE Fellow.

## Tutorials

Title: Convex Optimization for Big Data: Scalable, randomized, and parallel algorithms for big data analytics

Presenter: PROF. MARK SCHMIDT

Abstract:

Convex optimization is now ubiquitous in machine learning, due to the rise of many successful techniques like support vector machines, conditional random fields, structured sparsity, and rank minimization. These formulations are employed in a wide variety of machine learning applications including compressive sensing, medical imaging, geophysics, and bioinformatics. However, at the same time we are collecting datasets of unprecedented sizes. Internet, text, and imaging problems (among a myriad of other examples) no longer produce data sizes from megabytes to gigabytes, but rather from terabytes to exabytes (and beyond). Unfortunately, classical convex optimization algorithms are unable to cope with the desire to model increasingly-complex phenomenon and to handle the ever-increasing dataset sizes. In this tutorial we discuss three key classes of scalable modern convex optimization algorithms:

1. First-order methods including gradient methods for smooth problems, proximal-gradient methods for simple non-smooth problems, and alternating-direction methods of multipliers for more complex non-smooth structures
2. Randomized methods including randomized coordinate descent, stochastic gradient methods, and randomized linear algebra
3. Parallel and distributed methods that use reduced or decentralized communication and allow asynchronous or fault-tolerant execution. Combining these three classes (first-order, randomized, and distributed) will lead to the ultra-scalability of the next generation of convex solvers.

Bio:

Mark Schmidt is an assistant professor working in the field of machine learning and large-scale optimization in the Department of Computer Science at the University of British Columbia. He previously worked in the Natural Language Laboratory at Simon Fraser University, and from 2011 through 2013 worked at the École normale supérieure in Paris on inexact and stochastic convex optimization methods. He finished his M.Sc. in 2005 at the University of Alberta working as part of the Brain Tumor Analysis Project, and his Ph.D. in 2010 at the University of British Columbia working on graphical model structure learning with L1-regularization. He has also worked at Siemens Medical Solutions on heart motion abnormality detection, and with Michael Friedlander in the Scientific Computing Laboratory at the University of British Columbia on semi-stochastic optimization methods.

Title: Sparse and Low-Rank Representation with Applications to Visual Content Analysis

Presenter: DR. FRANK WANG

Abstract:

Recent studies and progresses of sparse and low-rank data representation have led to numerous groundbreaking results in the fields of signal processing, machine learning, and computer vision. While sparse models view data as a compact linear combination of few representative atoms (patterns), low-rank models allow one to analyze large batches of data by recovering the low-rank structures from incomplete, corrupted, or even noisy observations. In this tutorial, we will first emphasize on modeling and recovering low-dimensional structures from (visual) data, with several examples particularly drawn from a number of computer vision and image processing tasks. The second part of the tutorial will cover a number of algorithms for performing the above modeling processes, and introduce popular optimization techniques or solvers for solving the associated problems. In the third part of the tutorial, we will highlight numerous applications with focuses on computer vision, which benefit from the learning of sparse or low-rank visual representation. The tutorial will conclude with the discussions of possible extensions or variants, as well as the challenges and open problems for sparse and low-rank models.

Bio:

Y.-C. Frank Wang is an Associate Research Fellow working in the fields of computer vision, pattern recognition, and machine learning in the Research Center for IT Innovation (CITI) at Academia Sinica, Taiwan. He finished his B.S. in 2001 at the Department of Electrical Engineering of National Taiwan University, and obtained his M.S. and Ph.D. in Electrical and Computer Engineering at Carnegie Mellon University in 2004 and 2009, respectively. Dr. Wang leads the Multimedia and Machine Learning Lab at CITI. His team received the First Place Award at Taiwan Tech Trek by the National Science Council (NSC) of Taiwan in 2011. Dr. Wang's works have been nominated for Best Paper Awards at IAPR MVA, IEEE ICIP, and IEEE ICME. In 2013, he was selected among the Outstanding Young Researchers by NSC.

## Workshop

Machine Learning and Its Applications in Vietnam

Organisers: Hung Bui, Son Nguyen, Tri Nguyen

To take the advantage of the opportunity that ACML will be held in Vietnam for the first time (also the first among the major machine learning conferences), this full-day workshop is dedicated for Vietnamese machine learning researchers and practitioners. Our main objective is to create a forum that brings together internationally acclaimed Vietnamese researchers in machine learning with students, junior researchers, and industrial partners in Vietnam in order to share ideas and expertise.

Another objective is to foster connections and possible collaborations between Vietnamese and international machine learning communities. To do so, the workshop aims to act as showcase of the maturity of the Vietnamese machine learning research community which has been rapidly growing in the last decades. Given this, the workshop also aims to be a basis for future collaborations between the participants (researchers, students, and industrial partners), which will be beneficial for both the Vietnamese and the wider international machine learning communities.

## Conference Organisation

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