

Foreword

Welcome to the tenth edition of the Proceedings of Machine Learning Research (PMLR) for the Asian Conference on Machine Learning (ACML). This volume contains 64 papers accepted to the Tenth Asian Conference on Machine Learning (ACML 2018) held in Beijing, China, from 14th to 16th November 2018. This volume continues the ACML tradition of having high-quality and original research papers in the area of machine learning following nine previous successful events held in China, Japan, Taiwan, Singapore, Australia, Vietnam, Hong Kong, New Zealand, and Korea 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. Despite originating in the Asia-Pacific region ACML has become a worldwide conference: Submissions from regions other than the Asia-Pacific were encouraged and this year proceedings include papers with authors based in Canada, Germany, France, Finland, Netherland, India, and the Northeast of the USA, as well as the Asia-Pacific region.

This year, we continued the tradition of having two cycles and double-blind review for the proceedings track; each cycle had its own submission deadline. Papers that could not be accepted in the first cycle, but received positive feedback, were correctable and could be accepted after careful revision, were encouraged to resubmit in the second cycle, allowing the review comments to be addressed. After removing invalid submissions, in total there were 230 submissions to the conference tracks, of which 57 were accepted into the main program, for an acceptance rate of 24.8%. A strict double-blind reviewing process was enforced, and each paper was assigned with one meta-reviewer, and at least 3 reviewers. As the number of submissions increased, we formed the Program Committee (PC) with 223 PC members (reviewers) and 47 Senior PC members (meta-reviewers) to maintain review quality, and each PC was allocated no more than 5 papers in any one cycle, based on paper bidding, similarity of subject areas, and the Toronto Paper Machine System (TPMS) similarity scores between the submitted paper and the published papers of the Program Committee. Program Committee contributed with expert opinions, which were essential to the quality and standard of papers selected for the conference and, without them the conference would have not been possible. 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.

As in the last two years, this year ACML also ran an additional journal track. The journal track Co-Chairs Masashi Sugiyama and Yung-Kyun Noh oversee the reviewing process of 35 submissions, out of which 7 papers are selected for conference presentation and publication in the Springer journal Machine Learning, for an acceptance rate of 20%. The journal track had a sequence of submission dates, which started earlier than the conference track schedule considering the longer process of journal review. For ACML this year the overall number of accepted papers, from both the journal and proceedings tracks, was 64 from 265 submissions for a 24.1% total acceptance rate.

All accepted papers from the two tracks received both an oral and poster presentation, and those accepted in the two cycles of the proceedings track are published in this volume. The submissions covered a broad range of topics, including Bayesian and probabilistic machine learning, deep learning, optimization and sparsity, weakly-supervised/unsupervised learning, multi-label/multi-instance/crowdsourced learning, adversarial/reinforcement learning and privacy, and applications to real world problems.

In addition to the submitted papers, we were very pleased to have two keynotes from leading experts, Daniel D. Lee (Cornell Tech) and Shai Ben-David (University of Waterloo), and invited talks from Wray Buntine (Monash University) and Jieping Ye (Didi Research). In addition to the main program, we had a half day of tutorials and workshops prior to the main conference organized by Tutorial Co-Chairs Liwei Wang and Grigorios Tsoumakas, Workshop Co-Chairs Sinno J. Pan and Yu-Feng Li. Two tutorials were delivered on: Dynamic System and Optimal Control Perspective of Deep Learning and Beyond, and Dual Learning: Algorithms, Applications and Challenges. In parallel to the tutorials, we had four workshops: ACML 2018 Workshop on Multi-output Learning (ACML-Mol18), The 3rd Asian Workshop on Reinforcement Learning (AWRL18), ACML 2018 Workshop on Machine Learning in China (MLChina18), and ACML 2018 Workshop on Machine Learning in Education. We thank all of the speakers and organizers for putting together such a fantastic program.

ACML Steering Committee Chair Zhi-Hua Zhou and Co-Chair Masashi Sugiyama provided valuable advice and support during the whole process. The Honorary Chairs Zhi-Hua Zhou and Hiroshi Motoda provided timely services on various issues which could make serious trouble otherwise. The General Co-Chairs Jian Yu and Min-Ling Zhang took care of the whole process of organization to make sure the event ran smoothly. Sheng-Jun Huang took the role Publicity Chair, and has done a great job for advertising the important conference dates and make many people in machine learning community know about ACML. The sponsorship Chair Tao Qin has done a fantastic job on protecting the conference from being bank-corrupted. Our special thanks go to the Local Arrangements Co-Chairs Liping Jing and Caiyan Jia for resolving many local issues regarding Venue.

Last but not least, a big thank you to all participants of ACML 2018 who made it such a great event!

November 2018

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PREFACE

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Keynote Talks

TITLE: CLUSTERING - WHAT BOTH THEORETICIANS AND PRACTITIONERS ARE DOING WRONG

PRESENTER: SHAI BEN-DAVID (UNIVERSITY OF WATERLOO, CANADA)

ABSTRACT:

Unsupervised learning is widely recognized as one of the most important challenges facing machine learning nowadays. However, in spite of hundreds of papers on the topic being published every year, current theoretical understanding and practical implementations of such tasks, in particular of clustering, is very rudimentary. My talk focuses on clustering. I claim that the most significant challenge for clustering is model selection. In contrast with other common computational tasks, for clustering, different algorithms often yield drastically different outcomes. Therefore, the choice of a clustering algorithm, and their parameters (like the number of clusters) may play a crucial role in the usefulness of an output clustering solution. However, currently there exists no methodical guidance for clustering tool-selection for a given clustering task. Practitioners pick the algorithms they use without awareness to the implications of their choices, and the vast majority of theory of clustering papers focuses on analyzing the resources (time, sample sizes etc) needed to solve optimization problems that arise from picking some concrete clustering objective. However, the benefits of picking an efficient algorithm for a given objective pale in comparison to the costs of mismatch between the clustering objective picked and the intended use of clustering results. I will argue the severity of this problem and describe some recent proposals aiming to address this crucial lacuna.

BIO:

Shai Ben-David grew up in Jerusalem, Israel. He attended the Hebrew University studying mathematics, physics and psychology and received his PhD for a thesis in set theory. After a post doctorate at the University of Toronto he joined the CS Department at the Technion (Israel Institute of Technology). In August 2004 he joined the School of Computer Science at the University of Waterloo - his current affiliation. Over the years, Prof Ben-David has held visiting faculty positions at the Australian National University, Cornell University, ETH Zurich, TTI Chicago and the Simons institute at Berkeley. Prof. Ben-David has served as a program chair for the major machine learning theory conferences (COLT and ALT, and area chair for ICML, NIPS and AISTATS). He has co-authored the textbook "Understanding machine learning" and well over a hundred research papers on ML theory, computational complexity and logic.

TITLE: MACHINE LEARNING IN AUTONOMOUS SYSTEMS: THEORY AND PRACTICE

PRESENTER: DANIEL D. LEE (CORNELL TECH & SAMSUNG RESEARCH, USA)

ABSTRACT:

Current artificial intelligence (AI) systems for perception and action incorporate a number of techniques: optimal observer models, Bayesian filtering, probabilistic mapping, trajectory planning, dynamic navigation and feedback control. I will briefly describe and demonstrate some of these methods for autonomous driving and for legged and flying robots. In order to model data variability due to pose, illumination, and background changes, low-dimensional manifold representations have long been used in machine learning. But how well can such manifolds be processed by neural networks? I will highlight the role of neural representations and discuss differences between synthetic and biological approaches to computation and learning.

BIO:

Dr. Daniel D. Lee is currently Professor in Electrical and Computer Engineering at Cornell Tech and Executive Vice President for Samsung Research. He previously was the UPS Foundation Chair Professor in the School of Engineering and Applied Science at the University of Pennsylvania. He received his B.A. summa cum laude in Physics from Harvard University and his Ph.D. in Condensed Matter Physics from the Massachusetts Institute of Technology in 1995. After completing his studies, he was a researcher at AT&T and Lucent Bell Laboratories in the Theoretical Physics and Biological Computation departments. He is a Fellow of the IEEE and AAAI and has received the National Science Foundation CAREER award and the Lindback award for distinguished teaching. He was also a fellow of the Hebrew University Institute of Advanced Studies in Jerusalem, an affiliate of the Korea Advanced Institute of Science and Technology, and organized the US-Japan National Academy of Engineering Frontiers of Engineering symposium and Neural Information Processing Systems (NIPS) conference. His research focuses on understanding general computational principles in biological systems, and on applying that knowledge to build intelligent robotic systems that can learn from experience.

Invited Talks

TITLE: SOMETHING OLD, SOMETHING NEW, SOMETHING BORROWED, ...

PRESENTER: WRAY BUNTINE (MONASH UNIVERSITY, AUSTRALIA)

ABSTRACT:

Something Old: In this talk I will first describe some of our recent work with hierarchical probabilistic models that are not deep neural networks. Nevertheless, these are currently among the state of the art in classification and in topic modelling: k-dependence Bayesian

networks and hierarchical topic models, respectively, and both are deep models in a different sense. These represent some of the leading edge machine learning technology prior to the advent of deep neural networks. Something New: On deep neural networks, I will describe as a point of comparison some of the state of the art applications I am familiar with: multi-task learning, document classification, and learning to learn. These build on the RNNs widely used in semi-structured learning. The old and the new are remarkably different. So what are the new capabilities deep neural networks have yielded? Do we even need the old technology? What can we do next? Something Borrowed: to complete the story, I'll introduce some efforts to combine the two approaches, borrowing from earlier work in statistics.

BIO:

Wray Buntine is a full professor at Monash University from 2014 and is director of the Master of Data Science, the Faculty of IT's newest and in-demand degree. He was previously at NICTA Canberra, Helsinki Institute for Information Technology where he ran a semantic search project, NASA Ames Research Center, University of California, Berkeley, and Google. He is known for his theoretical and applied work and in probabilistic methods for document and text analysis, social networks, data mining and machine learning.

TITLE: AI FOR TRANSPORTATION

PRESENTER: JIEPING YE (DIDI AI LABS & UNIVERSITY OF MICHIGAN, USA)

ABSTRACT:

Didi Chuxing is the worlds leading mobile transportation platform that offers a full range of app-based transportation options for 550 million users. Every day, DiDi's platform receives over 100TB new data, processes more than 40 billion routing requests, and acquires over 15 billion location points. In this talk, I will show how AI technologies have been applied to analyze such big transportation data to improve the travel experience for millions of users.

BIO:

Dr. Jieping Ye is head of Didi AI Labs, a VP of Didi Chuxing and a Didi Fellow. He is also an associate professor of University of Michigan, Ann Arbor. His research interests include big data, machine learning, and data mining with applications in transportation and biomedicine. He has served as a Senior Program Committee/Area Chair/Program Committee Vice Chair of many conferences including NIPS, ICML, KDD, IJCAI, ICDM, and SDM. He has served as an Associate Editor of Data Mining and Knowledge Discovery, IEEE Transactions on Knowledge and Data Engineering, and IEEE Transactions on Pattern Analysis and Machine Intelligence. He won the NSF CAREER Award in 2010. His papers have been selected for the outstanding student paper at ICML in 2004, the KDD best research paper runner up in 2013, and the KDD best student paper award in 2014.

Tutorials

TITLE: DYNAMIC SYSTEM AND OPTIMAL CONTROL PERSPECTIVE OF DEEP LEARNING AND BEYOND

PRESENTER: BIN DONG

ABSTRACT:

Deep learning has achieved great success in many machine learning tasks and has major academic and industrial impacts. Deep architecture design has been one of the key topics in deep learning. Most of architecture designs are empirical and in lack of guiding principles. This tutorial will review some of the recent work on linking dynamic systems with deep architecture, and understanding deep neural network training as optimal control. It will show how we can take advantage of the rich knowledge in dynamic system and optimal control to provide guidance in designing new and effective deep architectures. On the other hand, such perspective also enables us to bring deep learning in applied mathematics to tackle challenging problems.

TITLE: DUAL LEARNING: ALGORITHMS, APPLICATIONS AND CHALLENGES

PRESENTER: TAO QIN

ABSTRACT:

While structural duality is common in AI, most learning algorithms have not exploited it in learning/inference. Dual learning is a new learning framework that leverages the primal-dual structure of AI tasks to obtain effective feedback or regularization signals to enhance the learning/inference process. Dual learning has been studied in different learning settings. This tutorial will first introduce several dual learning algorithms: (1) dual unsupervised learning, (2) dual supervised learning, (3) dual transfer learning, and (4) dual inference. Then it will cover multiple applications, including neural machine translation, image understanding, sentiment analysis, question answering/generation, image translation, etc. At the end, the tutorial will describe several challenges of dual learning, such as theoretical understanding, efficiency and scalability, and discuss future research directions.

Workshops

ACML 2018 WORKSHOP ON MULTI-OUTPUT LEARNING (ACML-MOL18)

ORGANISERS: WEIWEI LIU, XIAOBO SHEN, YEW-SOON ONG, IVOR W. TSANG, CHEN GONG

Multi-output learning aims to predict multiple outputs for an input, where the output values are characterized by diverse data types, such as binary, nominal, ordinal and real-valued variables. Such learning tasks arise in a variety of real-world applications, ranging from document classification, computer emulation, sensor network analysis, concept-based information retrieval, human action/causal induction, to video analysis, image annotation/retrieval, gene function prediction and brain science. Due to its popularity in applications, multi-output learning has also been widely explored in machine learning community, such as multi-label/multi-class classification, multi-target regression, hierarchical classification with class taxonomies, label sequence learning, sequence alignment learning, and supervised grammar learning, and so on.

The theoretical properties of existing approaches for multi-output data are still not well understood. This triggers practitioners to develop novel methodologies and theories to deeply understand multi-output learning tasks. Moreover, the emerging trends of ultrahigh input and output dimensionality, and the complexly structured objects, lead to formidable challenges for multi-output learning. Therefore, it is imperative to propose practical mechanisms and efficient optimization algorithms for large-scale applications. Deep learning has gained much popularity in today's research, and has been developed in recent years to deal with multi-label and multi-class classification problems. However, it remains non-trivial for practitioners to design novel deep neural networks that are appropriate for more comprehensive multi-output learning domains.

THE 3RD ASIAN WORKSHOP ON REINFORCEMENT LEARNING (AWRL18)

ORGANISERS: PAUL WENG, YANG YU, ZONGZHANG ZHANG, LI ZHAO

The Asian Workshop on Reinforcement Learning (AWRL) focuses on both theoretical foundations, models, algorithms, and practical applications. We intend to make this an exciting event for researchers and practitioners in RL worldwide as a forum for the discussion of open problems, future research directions and application domains of RL.

AWRL 2018 will consist of keynote talks, invited paper presentations, and discussion sessions spread over a one-day period.

ACML 2018 WORKSHOP ON MACHINE LEARNING IN CHINA (MLCHINA18)

ORGANISERS: DEYU MENG, LIJUN ZHANG

During the past decade, machine learning researches in China have been growing in a blooming way. This is witnessed by the increasing number of works appeared in major machine learning related conferences and journals, and also numerous successful applications of machine learning techniques in major Chinese high-tech companies such as Huawei, Tencent, Baidu, Alibaba, etc. There are also many domestic machine learning conferences regularly held in China which attract a significant number of participants, such as the biennial Chinese Conference on Machine Learning, the annual Chinese Workshop on Machine Learning and Applications, the annual Chinese Vision and Learning Seminar, etc.

To take full advantage of the opportunity that ACML is to be held in Beijing, a dedicated full-day workshop for machine learning researchers and practitioners in China is organized. This workshop would be a great chance for sharing ideas and expertise among interested participants, encouraging students and junior researchers to get suggestions and advices from senior experts, and also fostering connections and possible collaborations between Chinese and International machine learning communities.

ACML 2018 WORKSHOP ON MACHINE LEARNING IN EDUCATION

ORGANISERS: WEI CUI, XIANGEN HU, SAM WANG, ZHEN XUE

As AlphaGo defeated the world's best Go player in 2016, AI is brought into the classroom to individualize learning in the form of adaptive learning. It analyzes the students and note their weaknesses and strengths, then changes the course around so that students can polish up areas which they may be struggling with. It also responds to the students' needs and personalize the course to best fit their talents. We take this chance to discuss the most recent development of machine learning technology used in education and to provide a forum for communication of researchers active in machine learning used in education.

Conference Organisation

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