

ADVANCES IN NEURAL INFORMATION  
PROCESSING SYSTEMS 20

*Proceedings of the 2007 Conference*

<http://books.nips.cc/nips20.html>

edited by

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# Preface

This volume contains the papers presented at the twenty-first annual conference on Neural Information Processing Systems (NIPS), held in British Columbia, Canada from December 3rd through 6th, 2007. NIPS is an interdisciplinary conference that brings together researchers from a broad range of disciplines, including computer science, mathematics, physics neuroscience, science, psychology, and engineering. The papers presented at NIPS are as diverse as the background of their authors. Despite the proliferation of views and content, there is a common thread to all papers and topics presented at NIPS, namely, the goal of understanding learning processes, synthetic and natural.

The papers were accepted to NIPS after a thorough, thoughtful, and highly competitive review process. We received 975 submissions of which only 217 were accepted to the conference. Every paper was reviewed by at least three reviewers, using a double-blind process in which the reviewers did not know the identity of the authors. After the initial review process the authors had a chance to submit a rebuttal, which was read by the reviewers and one or more program committee members. Papers where the reviews were controversial or where reviewers had low confidence in their ability to judge the paper were reviewed by additional reviewers; a few papers were read by as many as six reviewers. The decisions on whether to accept or reject the papers were made over the course of two weeks, in a series of several virtual program committee meetings. Each decision was followed with a short summary by a program committee member who oversaw the review process of the paper.

As in previous years, the submissions covered a broad range of topics: supervised, semi-supervised, and unsupervised methods in machine learning; probabilistic graphical models; computational learning theory; control and reinforcement learning in single-agent and multi-agent systems; computer and biological vision; neuroscience and brain-computer interfaces; cognitive science; and numerous applications including natural language processing, speech and signal processing, computational biology, and many others. Consistent with the multidisciplinary nature of the conference, many papers fit under more than one area, and so authors were asked to describe their papers using a set of keywords, which helped in assigning the paper to program committee members and reviewers.

The papers that appeared in the conference were of high quality, by virtue of the high standards in the NIPS community, the rigorous review process and the highly competitive acceptance rate. Nonetheless, a few papers led by student authors stood a tad above the rest and received the Outstanding Student Paper Awards. These papers are: “Markov Chain Monte Carlo with People” by Adam Sanborn (student) and Thomas Griffiths and “New Outer Bounds on the Marginal Polytope” by David Sontag (student) and Tommi Jaakkola. In addition, three student papers received honorable mentions in the 2007 proceedings: “Inferring Elapsed Time from Stochastic Neural Processes” by Misha Ahrens (student) and Maneesh Sahani, “Efficient Inference for Distributions on Permutations” by Jonathan Huang (student),

Carlos Guestrin, and Leonidas Guibas, and “An Analysis of Convex Relaxations for MAP Estimation” by Pawan Mudigonda (student), Vladimir Kologorov, and Philip Torr. Papers were nominated by the program committee members based on the reviews and were eligible for consideration only if the non-student authors attested that the student performed over 50% of the work. The papers were reviewed by a special subcommittee, assisted by outside experts, who selected the final set of winners.

The interdisciplinary and broad nature of the conference was also exhibited in fascinating and thought provoking invited talks. The conference opened with an invited talk by Luis von Ahn from Carnegie Mellon University, who spoke about human computation. Mark Handcock, a statistician from University of Washington, discussed statistical Models for social networks with application to HIV epidemiology. Yair Censor, a mathematician from the University of Haifa in Israel, provided an in-depth review of the use of projection methods in various fields. David Heckerman from Microsoft Research described the use of probabilistic models for HIV vaccine design and genome-wide association studies. Elizabeth Spelke, a psychologist from Harvard University, gave a fascinating talk on knowledge and perception of number and geometry in kids and adults. Finally, Manabu Tanifuji from RIKEN Brain Science Institute described population coding of object images based on visual features and its relevance to view-invariant representation.

As in previous years, the conference was preceded by a day of tutorials and followed by two days of workshops. The tutorials included presenters from a remarkably broad range of subjects. Michael Lewicki from Carnegie Mellon University reviewed sensory coding and hierarchical representations. Robert Schapire from Princeton University discussed the theory and applications of boosting methods. Leon Bottou from NEC Laboratories of America and Alex Gray from Carnegie Mellon University reviewed approaches for large scale learning. Tomaso Poggio from the McGovern Institute for Brain Research at MIT gave a tutorial on visual recognition in primates and machines. Geoffrey Hinton from the University of Toronto in Canada delved into deep belief nets. Ben Taskar from the University of Pennsylvania described methods and algorithms for structured prediction.

NIPS 2007 inaugurated a “Neuro-Thursday” that was designed to let neuroscience researchers who attend the NIPS workshops also experience part of the main NIPS program. In addition to the invited talk by Professor Tanifuji, there were six outstanding plenary talks. The afternoon of Neuro-Thursday was devoted to a special meeting on the foundations and recent advances in deep learning architectures.

Putting together a conference of this scale is only made possible by the contributions of many people. We gratefully acknowledge our corporate sponsors: Google, Microsoft Research, PASCAL, Intel Research, Yahoo!, IBM Research, Toyota Research Labs, Two Sigma, and Springer/Machine Learning Journal. We benefited greatly from the invaluable help and advice of the NIPS board, headed by the Terry Sejnowski. Key roles were performed by the NIPS 2007 Organizing Committee: the tutorials chair, Chris J.C. Burges (Microsoft Research); the workshop chairs, Adrienne Fairhall (University of Washington) and Bob Williamson (NICTA); the demonstration chairs, Giacomo Indiveri (ETH Zurich) and Xubo Song (Oregon Graduate Institute); the publications chair, Sam Roweis (University of Toronto); the electronic proceedings chair, Andrew McCallum (University of Massachusetts, Amherst), the volunteers chair, Fernando Perez-Cruz (Princeton University); and the publicity chair, Sumit Basu (Microsoft Research). Last but not least, our work would have been impossible without the help of certain key individuals: Mary Ellen Perry, who is the ultimate authority on all things NIPS; her highly capable staff at the Salk Institute, including Chris Adams, Lee Campbell, Sarah Cercone, Chris Hie-

stand, Sheri Leon, Kristen Michener, Rosemary Miller, and Bryan Nielsen; Thomas Preuss, the Confmaster guru, who was always available to help fix problems; and last but not least, our amazing Workflow Master, Rajat Raina, whose help was essential for dealing with the sheer volume of tasks we needed to complete.

The high quality of the review process depended directly on the tireless efforts of our outstanding program committee, which consisted of the following members: Francis Bach (Ecole des Mines de Paris), Michael Black (Brown University), Nicolò Cesa-Bianchi (Università degli Studi di Milano), Olivier Chapelle (Yahoo! Research), Sanjoy Dasgupta (UC San Diego), Virginia de Sa (UC San Diego), David Fleet (University of Toronto), Isabelle Guyon (ClopiNet), Bert Kappen (University of Nijmegen), Dan Klein (UC Berkeley), Chih-Jen Lin (National Taiwan University), Kevin Murphy (University of British Columbia), William Noble (University of Washington), Stefan Schaal (University of Southern California), Dale Schuurmans (University of Alberta), Odelia Schwartz (Salk Institute and Albert Einstein College of Medicine), Fei Sha (UC Berkeley), Mark Steyvers (UC Irvine), Alan Stocker (New York University), Yee Whye Teh (Gatsby Unit, UCL), Nikos Vlassis (Technical University of Crete), Ulrike von Luxburg (MPI for Biological Cybernetics), Chris Williams (University of Edinburgh), and Andrew Zisserman (University of Oxford). It was a privilege and pleasure to work with such a professional and hardworking group of scientists. We thank the NIPS 2007 reviewers, listed in the following pages for their tireless efforts in providing thoughtful evaluations of the papers submitted to the conference.

Finally, we would like to thank you, the real force behind NIPS, the researchers and scientists from around the world who submitted papers, attended the conference, and described your latest and greatest achievements. You made this conference so unique and stellar. Thank you for making our work as the program chairs such a pleasant, rewarding, and educational task.

John Platt, Microsoft Research  
Daphne Koller, Stanford University  
Yoram Singer, Google and the Hebrew University of Jerusalem  
Sam Roweis, University of Toronto and Google  
January 2009

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NIPS gratefully acknowledges the generosity of those individuals and organizations who have provided financial support for the NIPS 2007 conference. The financial support enabled us to sponsor student travel and participation, the outstanding student paper awards, the demonstration track and the opening buffet.

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