

Workshop IV: Using Physical Insights for Machine Learning

Monday November 18, 2019

- 8:00–8:55 *Check-In/Light Breakfast (Hosted by IPAM)*
- 8:55–9:00 *Welcome & Opening Remarks: Dean Miguel García-Garibay (Dean of Physical Sciences, UCLA) and Dima Shlyakhtenko (Director, IPAM)*
- 9:00–9:50 **Lenka Zdeborová** (Commissariat à l'Énergie Atomique (CEA))
Understanding machine learning via exactly solvable statistical physics models
- 10:00–10:15 *Break*
- 10:15–11:05 **Rémi Monasson** (Centre National de la Recherche Scientifique (CNRS))
Capacity-resolution trade-off in the optimal learning of multiple low-dimensional manifolds by attractor neural networks
- 11:15–11:30 *Break*
- 11:30–12:20 **Eric Vanden-Eijnden** (Courant Institute of Mathematical Sciences)
Trainability and accuracy of artificial neural networks
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:20 **Risi Kondor** (University of Chicago & Flatiron Institute)
Covariant neural network architectures for learning physics
- 3:30–3:45 *Break*
- 3:45–4:35 **Michele Ceriotti** (École Polytechnique Fédérale de Lausanne (EPFL))
Machine learning for atomic and molecular simulations
- 4:45–5:15 *Lightning Poster Presentations*
- 5:15–6:30 *Poster Session & Reception (Hosted by IPAM)*

Tuesday November 19, 2019

- 8:00–9:00 *Check-in/Breakfast (hosted by IPAM)*
- 9:00–9:50 **Yann LeCun** (Facebook)
Energy-Based Self-Supervised Learning
- 10:00–10:15 *Break*
- 10:15–11:05 **Gérard Ben Arous** (New York University)
Which is worse: a weak signal lost in entropy or trapping by topological complexity?
- 11:15–11:30 *Break*

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- 11:30–12:20 **Chiara Cammarota** (King's College London)
High-dimensional cost landscape and gradient descent in Tensor PCA and its generalisations
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:20 **Masayuki Ohzeki** (Tohoku University)
Quantum annealing and machine learning - new directions of quantum
- 3:30–4:00 *Break*
- 4:00–4:50 **Haim Sompolinsky** (The Hebrew University of Jerusalem)
Statistical Mechanics of Deep Manifolds: Mean Field Geometry in High Dimension

Wednesday November 20, 2019

- 8:00–9:00 *Check-in/Breakfast (hosted by IPAM)*
- 9:00–9:50 **Riccardo Zecchina** (Bocconi University)
Evidence of local entropy optimization in machine learning, physics and neuroscience
- 10:00–10:15 *Break*
- 10:15–11:05 **Daniel Roberts** (Diffeeo)
Deep learning as a toy model of the $1/N$ -expansion and renormalization
- 11:15–11:30 *Break*
- 11:30–12:20 **Carlo Baldassi** (Bocconi University)
On the existence of wide flat minima in neural network landscapes: analytic and algorithm approaches
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:20 **Maria Schuld** (University of KwaZulu-Natal)
Innovating machine learning with near-term quantum computing
- 3:30–4:00 *Break*
- 4:00–4:50 **Maxwell Hutchinson** (Citrine Informatics)
Boltzmann Trees: a physically inspired randomization for robust modeling of physical data

Thursday November 21, 2019

- 8:00–9:00 *Check-in/Breakfast (hosted by IPAM)*
- 9:00–9:50 **Andrea Montanari** (Stanford University)
Thermodynamic limits for neural networks
- 10:00–10:15 *Break*

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- 10:15–11:05 **Marc Mezard** (Ecole Normale Supérieure)
Machine learning with neural networks: the importance of data structure
- 11:15–11:30 *Break*
- 11:30–12:20 **Soledad Villar** (New York University)
Graph neural networks for combinatorial optimization problems on graphs
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:30 **Chris Sutton** (Fritz-Haber-Institut der Max-Planck-Gesellschaft)
Subgroup Discovery for Assessing the Domain of Applicability of Machine Learning Models
- 3:30–4:00 *Break*
- 4:00–4:50 **Matthias Rupp** (Citrine Informatics & Fritz-Haber-Institut der Max-Planck-Gesellschaft)
How to assess scientific machine learning models? Prediction errors and predictive uncertainty quantification

Friday November 22, 2019

- 8:00–9:00 *Check-in/Breakfast (hosted by IPAM)*
- 9:00–9:50 **Yue Lu** (Harvard University)
Spectral Methods and the Landscapes of High-Dimensional Inference Problems
- 10:00–10:15 *Break*
- 10:15–11:05 **Gabor Csányi** (University of Cambridge)
Representation and regression problems for molecular structure and dynamics
- 11:15–11:30 *Break*
- 11:30–12:20 **Yuxin Chen** (University of Chicago)
Bayesian Experimental Design in the Physical Sciences

