

## Workshop III: Validation and Guarantees in Learning Physical Models: from Patterns to Governing Equations to Laws of Nature

### Monday October 28, 2019

- 8:00–8:50 *Check-in/Breakfast (hosted by IPAM)*
- 8:50–9:00 *Welcome & Opening Remarks: Dean Miguel García-Garibay (Dean of Physical Sciences, UCLA) and Dima Shlyakhtenko (Director, IPAM)*
- 9:00–9:50 **Petros Koumoutsakos** (ETH Zurich)  
*Machine Learning for Fluid mechanics*
- 10:00–10:15 *Break*
- 10:15–11:05 **Mohammad Farazmand** (North Carolina State University)  
*Multiscale analysis of accelerated gradient methods in machine learning*
- 11:15–11:30 *Break*
- 11:30–12:20 **Krithika Manohar** (California Institute of Technology)  
*Kernel Analog Forecasting: Multiscale Problems*
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:20 **Boumediene Hamzi** (Imperial College)  
*Machine Learning and Dynamical Systems meet in Reproducing Kernel Hilbert Spaces*
- 3:30–3:45 *Break*
- 3:45–4:35 **Mauro Maggioni** (Johns Hopkins University)  
*Title: Learning Interaction laws in agent-based systems*
- 4:45–5:15 *Lightning Poster Presentations*
- 5:15–6:30 *Poster Session & Reception (Hosted by IPAM)*

### Tuesday October 29, 2019

- 8:00–9:00 *Check-in/Breakfast (hosted by IPAM)*
- 9:00–9:50 **Steve Brunton** (University of Washington)  
*Data-driven discovery and control of nonlinear flow physics*
- 10:00–10:15 *Break*
- 10:15–11:05 **Jean-Christophe Loiseau** (École Nationale Supérieure d'Arts et Métiers)  
*A brief overview of SINDy*
- 11:15–11:30 *Break*

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- 11:30–12:20 **Jens Eisert** (Freie Universität Berlin)  
*Learning classical and quantum dynamical laws from data*
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:20 **Paris Perdikaris** (University of Pennsylvania)  
*Overcoming gradient pathologies in constrained neural networks*
- 3:30–4:00 *Break*
- 4:00–4:50 **Maziar Raissi** (Brown University)  
*Hidden Physics Models: Machine Learning of Non-Linear Partial Differential Equations*

### Wednesday October 30, 2019

- 8:00–9:00 *Check-in/Breakfast (hosted by IPAM)*
- 9:00–9:50 **Klaus-Robert Müller** (Technische Universität Berlin)  
*Understanding ML models*
- 10:00–10:15 *Break*
- 10:15–11:05 **Bjoern Baumeier** (Technische Universiteit Eindhoven)  
*Towards Describing Macroscopic Behavior of Electronic Processes from ML-enhanced Multiscale Models*
- 11:15–11:30 *Break*
- 11:30–12:20 **Samory Kpotufe** (Princeton University)  
*Some new Insights On Transfer Learning*
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:20 **Gitta Kutyniok** (Technische Universität Berlin)  
*An Information Theoretic Approach to Validate Deep Learning-Based Algorithms*
- 3:30–4:00 *Break*
- 4:00–4:50 **John Maddocks** (École Polytechnique Fédérale de Lausanne (EPFL))  
*The cgDNA sequence-dependent coarse-grain model of dsDNA: Bridging the scales from Molecular Dynamics to Bioinformatics*

### Thursday October 31, 2019

- 8:00–9:00 *Check-in/Breakfast (hosted by IPAM)*
- 9:00–9:50 **Christof Schuette** (Freie Universität Berlin)  
*Learning reduced models in molecular dynamics: From finding transition manifolds to effective dynamics*
- 10:00–10:15 *Break*

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- 10:15–11:05 **Marina Meila** (University of Washington)  
*Validation and Reproducibility by Geometry, for Unsupervised Learning*
- 11:15–11:30 *Break*
- 11:30–12:20 **Jelena Bradic** (University of California, San Diego (UCSD))  
*Causality and machine learning for scientific discovery*
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:20 **Aaditya Ramdas** (Carnegie Mellon University)  
*Doubly-sequential experimentation*
- 3:30–4:00 *Break*
- 4:00–5:00 *Discussion*

## Friday November 1, 2019

- 8:00–9:00 *Check-in/Breakfast (hosted by IPAM)*
- 9:00–9:50 **Bing Brunton** (University of Washington)  
*Fields and flows in neural dynamics*
- 10:00–10:15 *Break*
- 10:15–11:05 **Stefan Klus** (Freie Universität Berlin)  
*Data-driven transfer operator approximation, model reduction, and system identification*
- 11:15–11:30 *Break*
- 11:30–12:20 **Denis Zorin** (New York University)  
*Machine learning-based surrogates for optimization with physical constraints*
- 12:30–2:30 *Lunch (on your own)*
- 2:30–3:20 **Joan Bruna** (New York University)  
*Geometric Insights into the Convergence of Nonlinear TD Learning*
- 3:30–4:00 *Break*
- 4:00–4:50 **Lukas Pospisil** (Technical University of Ostrava (VŠB))  
*Towards a low-cost scalable data-driven modeling of coupled systems and non-stationary time series analysis*
- 5:00 *Conclusion*

