

Multidisciplinary Simulation, Estimation, and Assimilation Systems

Seminar Series

Maziar Raissi

Assistant Professor of Applied Mathematics
Division of Applied Mathematics
Brown University

Hidden Physics Models: Machine Learning of Non-Linear Partial Differential Equations

Abstract: A grand challenge with great opportunities is to develop a coherent framework that enables blending conservation laws, physical principles, and/or phenomenological behaviours expressed by differential equations with the vast data sets available in many fields of engineering, science, and technology. At the intersection of probabilistic machine learning, deep learning, and scientific computations, this work is pursuing the overall vision to establish promising new directions for harnessing the long-standing developments of classical methods in applied mathematics and mathematical physics to design learning machines with the ability to operate in complex domains without requiring large quantities of data. To materialize this vision, this work is exploring two complementary directions: (1) designing data-efficient learning machines capable of leveraging the underlying laws of physics, expressed by time dependent and non-linear differential equations, to extract patterns from high-dimensional data generated from experiments, and (2) designing novel numerical algorithms that can seamlessly blend equations and noisy multi-fidelity data, infer latent quantities of interest (e.g., the solution to a differential equation), and naturally quantify uncertainty in computations. The latter is aligned in spirit with the emerging field of probabilistic numerics.

Biography: Maziar Raissi is currently an Assistant Professor of Applied Mathematics (research) in the Division of Applied Mathematics at Brown University. He received his Ph.D. in Applied Mathematics & Statistics, and Scientific Computations from University of Maryland – College Park in December 2016. His expertise lies at the intersection of Probabilistic Machine Learning, Deep Learning, and Data Driven Scientific Computing. In particular, he has been actively involved in the design of learning machines that leverage the underlying physical laws and/or governing equations to extract patterns from high-dimensional data generated from experiments.

Friday, November 30, 2018

3:00 PM; Rm. 5-314

Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139

Host:

Pierre Lermusiaux
<http://mseas.mit.edu>

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