Friday, November 9
11 a.m.–noon
Wegmans Hall auditorium, room 1400

Mathematics of Deep Learning

with René Vidal

Herschel L. Seder Professor of Biomedical Engineering and Inaugural Director of the Mathematical Institute for Data Science at the Johns Hopkins University

The performance of recognition systems has increased dramatically over the past few years thanks to the introduction of deep networks for representation learning. But the mathematical reasons for this success remain elusive. A key issue is that the neural network training problem is nonconvex, hence optimization algorithms may not return a global minima. Also, the regularization properties of algorithms such as dropout remain poorly understood. Professor René Vidal will review recent work on the theory of deep learning that aims to understand how to design the network architecture, regularize the network weights, and guarantee global optimality. He will present sufficient conditions to guarantee that local minima are globally optimal and that a local descent strategy can reach a global minima from any initialization; such conditions apply to problems in matrix factorization, tensor factorization, and deep learning. His analysis of the optimization and regularization properties of dropout in the case of matrix factorization will include examples from neuroscience and computer vision.

René Vidal's research focuses on the development of theory and algorithms for the analysis of complex high-dimensional datasets such as images, videos, time series, and biomedical data. Vidal has been associate editor of the journals *TPAMI* and *CVIU*; program chair of ICCV and CVPR; and coauthor of *Generalized Principal Component Analysis* (2016) and more than 200 articles in machine learning, computer vision, biomedical image analysis, hybrid systems, robotics, and signal processing. A fellow of the IEEE, IAPR, and Sloan Foundation and an ONR Young Investigator, Vidal has received many awards for his work, including the 2012 J. K. Aggarwal Prize for "outstanding contributions to generalized principal component analysis (GPCA) and subspace clustering in computer vision and pattern recognition" and best paper awards in machine learning, computer vision, controls, and medical robotics.

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