Abstract

Machine learning is ubiquitous across many areas of science and engineering. Today's learning pipeline involves storing big data in the cloud where it is used to train deep networks, which has seen impressive successes in vision and speech recognition. However, this framework fails to address application domains where data perpetually changes such as field robotics and econometrics. In this talk, we propose methods based on Bayesian statistics that can stably adapt in the face of changing data. Unfortunately, Bayesian methods classically suffer from the curse of dimensionality: their model complexity is proportionate to the time index, and so popular perception is they are inapplicable to streaming data scenarios. We survey our recent efforts to upend this perception through the introduction of online compression rules that nearly preserve optimality while ensuring the model complexity is at-worst finite. Specifically, we'll discuss compression rules for kernel regression/classification, their extensions in risk-aware learning and reinforcement learning, as well as Gaussian Process regression. These methods pave the way for new systems that may autonomously and accurately adapt.

Bio

Alec Koppel began as a Research Scientist at the U.S. Army Research Laboratory in the Computational and Information Sciences Directorate in September of 2017. He completed his Master's degree in Statistics and Doctorate in Electrical and Systems Engineering, both at the University of Pennsylvania (Penn) in August of 2017. He is also a participant in the Science, Mathematics, and Research for Transformation (SMART) Scholarship Program sponsored by the American Society of Engineering Education. Before coming to Penn, he completed his Master's degree in Systems Science and Mathematics and Bachelor's Degree in Mathematics, both at Washington University in St. Louis (WashU), Missouri. His research interests are in the areas of signal processing, optimization and learning theory. His current work focuses on optimization and learning methods for streaming data applications, with an emphasis on problems arising in autonomous systems. He co-authored a paper selected as a Best Paper Finalist at the 2017 IEEE Asilomar Conference on Signals, Systems, and Computers.