



Leveraging Physical Models in **Machine Learning**

**Computational Science Seminar sponsored jointly by
the University of Chicago, Argonne National Laboratory and Fermilab**

**Thursday, Dec. 12, 10:30 to 11:30 a.m. (US/Central)
Argonne National Laboratory TCS (Bldg 240) Room 1416
or watch simulcast at Fermilab or remotely**

**More information:
<https://indico.fnal.gov/event/22623/>**

Machine learning, at its heart, is the process of learning from examples. However, in many scientific domains, we not only have training data or examples from which to learn, but also physical models of either the data collection mechanism or the underlying physical phenomenon. In this talk, I will describe two settings in which physical models can be incorporated within a machine learning framework to yield improved predictive performance. First, we will consider using training data to help solve ill-posed linear inverse problems such as deblurring, deconvolution, inpainting, compressed sensing, and superresolution. Second, we will examine using a combination of observational data and simulated data to improve subseasonal climate forecasts. Treating both types of data as co-equal training samples can bias many learning methods and yield misleading results. I will describe an alternative framework that combines observational data with a correlation graph that can be estimated from large ensemble climate model outputs, and we will see how this approach leads to more accurate forecasts. Finally, we will discuss open problems and future directions at the intersection of machine learning and the physical sciences.



Speaker Bio: Rebecca Willett is a Professor of Statistics and Computer Science at the University of Chicago. Her research interests include network and imaging science with applications in medical imaging, wireless sensor networks, astronomy, and social networks. Prof. Willett completed her PhD in Electrical and Computer Engineering at Rice University. Prior to joining the University of Chicago, she held the position of Assistant and Associate Professor in the Electrical and Computer Engineering department at Duke University and then the position of Associate professor in the Electrical and Computer Engineering department at the University of Wisconsin-Madison. She has received several awards, including the National Science Foundation CAREER Award and the Air Force Office of Scientific Research Young Investigator Program award.