Statistical Physics meets Statistical Inference
Phys 578, Spring 2022
Instructor: Armita Nourmohammad

Course description:

With the growing amount of data ranging from cosmological measurements to biological data and finance, statistical inference has become ubiquitous in different scientific disciplines to learn quantitive models from data and to interpret the structure of these models. A large body of work has shown that statistical inference is tightly connected to concepts from statistical physics and limits of inference could be understood in terms of physical phenomena such as phase transitions. In addition, statistical physics of disordered systems have been impactful in development of algorithms for inference problems, including compressed sensing, machine learning, and generalized linear regression. In this course we explore fundamentals of inference techniques through the lens of statistical physics. Specifically, we will cover topics on information theory, probabilistic inference, optimization, and machine learning, and will discuss applications of these approaches to learning from large datasets. Inspired by these topics, students will work in groups on small projects and will present their work at the end of the quarter.

The course is listed as Phys 578. Undergraduate students interested in the course should directly contact the instructor and present their grade in Phys 328 for permission to enroll.

Tentative Syllabus:

1. Information theory
2. Bayesian inference
3. Optimization & learning statistical models from data
4. Inference of generative physical models
5. Statistical physics of machine learning