Course goals:

Successful students (i) will be familiar with recent progress at the interface of high-dimensional statistics and statistical physics, (ii) will be able to apply physics tools (replica/cavity method) to new problems and (iii) will master recent rigorous techniques (interpolation method, cavity method, gaussian comparison etc.) used to formalize these ideas.

Course format:

The course will be lecture based. We will do explicit computations during lecture to familiarize ourselves with these tools.

Typical enrollees:

Probability at the level of STAT 210 and real analysis at the level of MATH 112 are required.
This is an advanced graduate course, so we will assume a certain degree of mathematical maturity.

When is course typically offered?

This course is offered in Spring.

What can students expect from you as an instructor?

I hope to explain the connections between statistical physics and high-dimensional statistics. I welcome questions during/after the lecture for clarifications/further explanations. I hope to make the class interactive, and foster an environment of open discussion.

Assignments and grading:

Homework assignments will be assigned to reinforce the concepts covered in lecture. We will have about 4 problem sets through the semester. This class will not have any examinations. The course evaluations will be based on the homeworks and a semester-long class project. The two components will be weighted as Homework (60%), Project (40%).

To introduce some areas of modern research having significant overlap with the course material, 40% of the course grade will be based on a course project. Projects should be done in pairs (we will help with this pairing if required). The project topic should interface with modern research, and the techniques should overlap with the course material. We hope this will lead to better appreciation of the topics covered. Groups can either survey an emerging research area, or conduct a small independent research project. Possible research projects will be shared at the start of the semester. Students are encouraged to pick project topics close to their research areas. You are free to choose a project topic outside this list as well. The projects will be assessed based on a final project report (10 pages) and a final presentation. The presentations will be held in class during the last two weeks.

Course material:

The course will be based mainly on this survey article. We will use other resources for specific topics covered in class.

Syllabus:

Here is the syllabus for this year.

Absence and late work policies:

We will allow one late day for the submission of the homework---please email us to use the late day.