Probability in high dimensions (Math 608D): Description

In the study of probabilistic objects, many surprising, elegant, and useful phenomena occur in the high-dimensional setting (e.g., central limit theorem). We study these phenomena and their applications. We focus on the high-dimensional, but non-asymptotic, regime.

Topics include:

a) concentration of measure,

b) random matrix theory,

c) extrema of stochastic processes, and

d) the behaviour of convex bodies (e.g., the ell_1 ball) in high dimensions as seen through a probabilistic lens.

Applications include:

a) compressed sensing,

b) dimension reduction,

c) statistical covariance estimation, and

d) constrained maximum-likelihood estimation.

This course is based on a similar course from Roman Vershynin: http://www-personal.umich.edu/~romanv/teaching/2012-13/709/709.html. We will cover most of the material in lectures 1-4, 6-18, and 21-24.