Math 280, Winter 2005
Craig Tracy

Multivariate Analysis from a Random Matrix Theory Perspective

Large data samples usually involve vector valued observations. Statistical techniques for such large data samples go under the name *multivariate analysis*. These theories lead to probability measures on various spaces of matrices. Since the number of observations, n, and the number of properties of a single observation, p, are both large in many current problems, the problem is to find an asymptotic theory ($n \to \infty$, $p \to \infty$ such that $n/p \to \gamma > 0$) that is both theoretically revealing and computationally efficient. In recent years modern techniques from random matrix theory have made some progress on this regime though much remains to be understood.

The course will assume only basic knowledge of probability theory. The first two-thirds of the course will be classical multivariate statistics with lectures taken from R. J. Muirhead's book *Aspects of Multivariate Statistics*. (This book will not be an assigned text since the cost is prohibitive.) Thus such topics as invariant measures, Wishart distribution, Hotelling's T statistic and zonal polynomials will be covered. The last third will give an introduction to the new developments coming from random matrix theory, e.g. distribution of largest eigenvalues in terms of Painlevé functions. We also hope to have some guest lectures by statisticians who will introduce some of the current problems of large data sets.