APPLIED MATHEMATICS COLLOQUIUM

EDGE EIGENVALUES IN GAUSSIAN ENSEMBLES AND APPLICATION TO STATISTICS

MOMAR DIENG
University of California, Davis

ABSTRACT:

The distribution of the (properly scaled) largest eigenvalue of a p variate Wishart distribution on n degrees of freedom with identity covariance converges to the well-known GOE Tracy-Widom distribution of Random Matrix Theory as $n, p \to \infty$ with $n/p = \gamma \geq 1$) (Johnstone, 2001). The result can be equivalently stated in terms of the square of the largest singular value of an $n \times p$ matrix X, all of whose entries are independent standard Gaussian variates, or the largest principal component of the covariance matrix $X'X$. This result is especially relevant to statisticians because of the explicit analytic form of the Tracy-Widom distributions. Building on the work of Tracy and Widom, we derive Painlevé--type expressions for the m^{th} largest eigenvalue distribution in the Gaussian Orthogonal and Symplectic Ensembles (GOE, GSE) in the edge scaling limit. This work generalizes to arbitrary m the m=1 results of Tracy and Widom. The results of Johnstone and Soshnikov imply the immediate relevance of our formulas for the m^{th} largest eigenvalue of the appropriate Wishart distribution. In the process, we also obtain a direct Random Matrix theoretic proof of an interesting interlacing property between GOE and GSE eigenvalues scaled at the edge.

MONDAY, MAY 2, 2005
4:15 PM
Building 4, Room 231

Refreshments at 3:30 PM in Building 2, Room 349.

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Massachusetts Institute of Technology
Department of Mathematics
Cambridge, MA 02139