Meeting: 1000, Albuquerque, New Mexico, SS 1A, Special Session on Random Matrix Theory and Growth Processes

1000-60-159

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Distribution Functions for Edge Eigenvalues in Orthogonal and Symplectic Ensembles: Painlevé Representations. Preliminary report.

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 F_1 Tracy-Widom distribution of RMT as $n, p \to \infty$ with $n/p = \gamma \geq 1$ (Johnstone, 2001). Equivalently, the result can be 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 (Johnstone obtains useful predictions for sample parameter values as small as $n = p = 5$). Building on the work of Tracy and Widom, we derive general analytic expressions for the distribution m^{th} largest eigenvalue distribution in the Gaussian Orthogonal and Symplectic Ensembles (GOE, GSE) in terms of solutions to Painlevé II. These are immediately relevant to the behavior of the m^{th} largest eigenvalue of the appropriate Wishart distribution. In the process we also obtain an RMT proof of an interesting interlacing property between GOE and GSE eigenvalues scaled at the edge.

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