Spectral statistics of random matrices and random graphs

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Abstract

In this lecture, we will discuss the recent progress regarding eigenvalue and eigenvector statistics of random matrices. We will focus on random matrix models beyond the standard Wigner ensembles; in particular, the random band matrices and random d-regular graphs. Specifically, we will explain the delocalization and the universality of eigenvalue statistics for random band matrices in high dimensions. For random d-regular graphs on N vertices with $1 \ll d \ll N^{2/3}$, we will show that the extremal eigenvalues are concentrated at scale $N^{-2/3}$ and their fluctuations are governed by the Tracy–Widom statistics.