Title:
An Asymptotic Berry-Esseen Result for the Largest Eigenvalue of Complex White Wishart Matrices

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Abstract:

A number of results concerning the convergence in distribution of the largest eigenvalue of a large class of random covariance matrices have recently been obtained.

In particular, it was shown in [**?**], [**?**], and [**?**] that if X is an $n \times N$ matrix whose entries are i.i.d standard complex Gaussian and l_1 is the largest eigenvalue of X^*X, there exist sequences $m_{n,N}$ and $s_{n,N}$ such that $(l_1 - m_{n,N})/s_{n,N}$ converges in distribution to the Tracy-Widom law of order 2, denoted W_2, a distribution whose density is known and computable. Its cumulative distribution function is denoted F_2.

In this paper, we show that we can find a function M, and sequences and such that when n and N go to infinity, with $n/N\gamma \in (0,\infty)$, we have, with $l_{n,N} = (l_1 -)/,$

$$\forall s, \qquad (n \wedge N)^{2/3} |P(l_{n,N} \leq s) - F_2(s)| \leq M(s) \ .$$

The surprisingly good 2/3 rate helps explain the fact that the limiting distribution F_2 is a good approximation to the empirical distribution of $l_{n,N}$ in simulations, an important fact from the point of view of (for instance, statistical) applications.