On asymptotic properties of the rank of a special random adjacency matrix

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Abstract

Consider the matrix $\Delta_n = ((I(X_i + X_j > 0)))_{i,j=1,2,\ldots,n}$ where X_i are i.i.d. and their distribution is continuous and symmetric around 0. We show that the rank r_n of this matrix is equal in distribution to $2\Sigma_{i=1}^{n-1} I(\xi_i=1,\xi_{i+1}=0)+I(\xi_n=1)$ where ξ_i are i.i.d. Ber(1,1/2).

As a consequence $n^{-1/2}(r_n/n-1/2)$ is asymptotically normal with mean zero and variance 1/4. We also show that $n^{-1}r_n$ converges to 1/2 almost surely.

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