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Eigenvectors of random matrices: A survey

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A B S T R A C T

Eigenvectors of large matrices (and graphs) play an essential role in combinatorics and theoretical computer science. The goal of this survey is to provide an up-to-date account on properties of eigenvectors when the matrix (or graph) is random.

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1. Introduction

Eigenvectors of large matrices (and graphs) play an essential role in combinatorics and theoretical computer science. For instance, many properties of a graph can be deduced or estimated from its eigenvectors. In recent years, many algorithms have been developed which take advantage of this relationship to study various problems including spectral clustering [68,85], spectral partitioning [50,60], PageRank [57], and community detection [52,53].

The goal of this survey is to study basic properties of eigenvectors when the matrix (or graph) is random. As this survey is written with combinatorics/theoretical computer science readers in mind, we try to formalize the results in forms which are closest to their interest and give references for further extensions. Some of the results presented in this paper are new with proofs included, while many others have appeared in very recent papers.

We focus on the following models of random matrices.