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Mathematisches Kolloquium

Ranking of nodes in large random networks

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Eingeladen von den Doktoranden der Mathematik

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In the analysis of large networks, such as social networks and the World Wide Web, it is often useful to rank nodes by their importance. Many algorithms have been created for this purpose. Most prominent example is the PageRank algorithm designed by Google to rank web pages. Intuitively, PageRank is interpreted as a fraction of time that a surfer, hopping from one webpage to another, spends on a particular page. Mathematically, PageRank is defined as an eigenvector of the transition probability matrix. A natural yet largely open question is: how the underlying structure of a networks affects the ranking scores? For example, real-life networks are often scale-free, that is, there are a few nodes with enormous number of connections. Numerous empirical results show that in such networks, PageRank also has the scale-free property. Although this observation is intuitive, up to date, it could not be proved in full generality. This talk will provide an overview of formal analysis for the PageRank distribution. One approach involves formulating the problem in terms of a stochastic fixed-point equation, which enables the analysis of PageRank on trees and on random graphs that can be coupled with a tree. Such random graphs include several highly influential models, e.g., the configuration model, where degrees of the nodes are fixed but connections are made purely at random. Another approach exploits the recent notion of local weak convergence of sparse graph sequences, and builds on the right balance between local and global properties of PageRank.

The talk is based on joint work with Mariana Olvera-Cravioto, Yana Volkovich, Ninguyan Chen, Remco van der Hofstad, Alessandro

Der Vortrag ist für ein breites Publikum geeignet