THE STATIONARY DISTRIBUTION OF RANDOM WALKS ON RANDOM DIRECTED GRAPHS

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The analysis of stochastic processes on random undirected graph is definitely one of the mainstream topics in modern probability. Nevertheless, the case in which the underlying graph is directed is much less studied and understood. One of the first difficulties one has to face when dealing with such geometries concerns the stationary distribution of the simplest stochastic process that can take place on a network: the simple random walk. In fact, in the case of undirected graphs, the stationary distribution coincides (up to normalization) with the degree sequence. Contrarily, in the case of directed graphs the stationary distribution depends on the features of the network on a complex non-local way.

During the talk I will present some recent finding on the stationary distribution of the random walk on the so-called *Directed Configuration Model*—a natural model of sparse random directed graphs. In particular, I will show some results on the extremal values of the stationary distribution and on the whole right-tail of its empirical distribution. In linear algebraic terms, this amount to find the right scaling of the largest entries of the Perron-Froboenius eigenvector of a random non-Hermitian stochastic matrix.

In the last part of the talk I will motivate the interest in such results by explaining how they can be turned into precise asymptotic estimates of other quantities related to the random walk behavior, such as mixing, hitting and cover times.

The result presented in the talk have been obtained jointly with my advisor Pietro Caputo and with Xing Shi Cai and Guillem Perarnau.

References

[1] Pietro Caputo and Matteo Quattropani, *Stationary distribution and cover time of sparse directed configuration models*, Probability Theory and Related Fields, 178, pp. 1011–1066 , 2020.

[2] Xing Shi Cai, Pietro Caputo, Guillem Perarnau and Matteo Quattropani, *Rankings in directed configuration models with heavy tailed in-degrees*, arXiv preprint, arXiv:2104.08389, 2021

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