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Motif Estimation, Polynomial Chaos, and the Ising Model

Network sampling is an indispensable tool for understanding features of large-scale complex networks where it is practically impossible to search/query all the nodes. In this talk we will discuss a unified framework for statistical inference for counting motifs, such as edges, triangles, and wedges, in the commonly used subgraph sampling model. In this setting, natural estimates of the motif counts can be expressed as polynomial chaos functions (random multilinear forms), where Gaussian fluctuations are governed by an interesting fourth-moment phenomenon. In the special case of the quadratic chaos, which appears in several contexts, such as the Hamiltonian of the Ising model, non-parametric statistical tests, and random graph-coloring problems, we will provide a complete characterization of all possible distributional limits. Implications of these results for estimation problems in Ising model on inhomogeneous random graphs will also be discussed.

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Bhaswar B. Bhattacharya received his Ph.D. from the Department of Statistics at Stanford University in 2016. Prior to that, he obtained his Bachelor and Master degrees in Statistics from the Indian Statistical Institute, Kolkata in 2009 and 2011, respectively. His research interests include combinatorial probability, non-parametric statistics, inference on networks, and discrete and computational geometry.

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