Graz University of Technology

Institut für Diskrete Mathematik

Combinatorics Seminar

12.06.2026, 12:30

Online meeting (Webex) & AE06, Steyrergasse 30

Random Geometric Graphs: Ramsey Numbers and Testing Thresholds

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The random geometric graph $G(n, \mathbb{S}^d, p)$ is obtained by placing n random points independently and uniformly on the unit sphere $\mathbb{S}^d$, and connecting two points whenever they are sufficiently close, with the threshold chosen so that each edge appears with probability p. The underlying geometry of the model creates correlations between edges, making its behavior richer than that of the corresponding binomial random graph $G(n, p)$.

A striking recent application of these correlations is due to Ma, Shen, and Xie, who used high-dimensional random geometric graphs to obtain an exponential improvement over Erdős's celebrated lower bound for the Ramsey numbers $R(k, Ck)$, where $C > 1$ is fixed. I will present a simplification of their approach using Gaussian random geometric graphs, leading to a much shorter analysis and sharper quantitative bounds.

In the second part, I will discuss a complementary question: when does the geometry disappear? More precisely, for which dimensions d is $G(n, \mathbb{S}^d, p)$ statistically indistinguishable from $G(n, p)$? This problem, introduced by Bubeck, Ding, Eldan, and Racz, has attracted considerable interest across probability, theoretical computer science, and high-dimensional statistics. They conjectured that the threshold is governed by the signed triangle count, namely $d \approx n^3p^3$ up to logarithmic factors. I will outline a proof of this conjecture in a wide range of p.

Webex link:

https://tugraz.webex.com/tugraz/j.php?MTID=m6449da69552289b0d7eef2d0d2a27197

Fabian Burghart, Mihyun Kang, Ronen Wdowinski