Spatial preferential attachment networks

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We study graphs, in which new vertices are given a spatial position on the d-dimensional torus and are connected to existing vertices with a probability favouring short spatial distances and high degrees. In this model class we can independently tune the power law exponent of the degree distribution and the clustering exponent, ie. the rate at which the connection probability decreases with the distance of two vertices. In Jacob and Mrters (2015) we show that these networks are robust in a parameter domain that depends on both the power law and clustering exponents. An open problem is whether the graph is ultrasmall, i.e.the typical graph distance between two vertices is doubly logarithmic in the number of nodes. We conjecture that, contrary to most spatial models, an ultrasmall phase exists and, contrary to other scale-free network models, it does not depend exclusively on the power law exponent.