THE LARGEST COMPONENT OF A HYPERBOLIC MODEL OF COMPLEX NETWORKS

Tobias Müller, Mathematical Institute, Universiteit Utrecht, t.muller@uu.nl

We consider the largest component of a model of random graphs that was introduced by Krioukov et al. in 2010. In this model, we distribute N points at random inside a disk of radius R in the hyperbolic plane, and we join two points by an edge if their (hyperbolic) distance is at most R. Here R is chosen to depend on N in a specific way, and the points follow a 'quasi-uniform' distribution controlled by a parameter α (where $\alpha = 1$ yields the uniform distribution).

As observed by Krioukov et al., and recently verified rigorously by Gugelmann et al., the model exhibits a number of phenomena usually associated with complex networks, including clustering and a power law degree sequence with exponent $2\alpha + 1$.

In joint work with M. Bode and N. Foutoulakis, we are able to show that $\alpha = 1$ is the threshold for the emergence of "giant". That is, when $\alpha > 1$ all components are sublinear, while if $\alpha < 1$ then there is a component of linear size. We are also able to show that $\alpha = \frac{1}{2}$ is the threshold for connectivity. That is, when $\alpha > \frac{1}{2}$ then the graph is disconnected, while if $\alpha < \frac{1}{2}$ then it is connected. (all statements holding with probability tending to one as N tends to infinity) The behavior at the threshold appears to be rather different than in all other models of random graphs we are aware of.

(Based on joint work with M. Bode and N. Fountoulakis)