Graph-distance evolution in growing preferential attachment graphs

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Abstract

We study the evolution of the graph distance and weighted distance between two fixed vertices in dynamically growing random graph models. More precisely, we consider preferential attachment models with power-law exponent $\tau \in (2,3)$, sample two vertices u_t, v_t uniformly at random when the graph has t vertices, and study the evolution of the graph distance between these two fixed vertices as the surrounding graph grows. This yields a discrete-time stochastic process in $t' \geq t$, called the distance evolution. We show that there is a tight strip around the function $4\frac{\log\log(t)-\log(1\vee\log(t'/t))}{|\log(\tau-2)|} \vee 2$ that the distance evolution never leaves with high probability as t tends to infinity. We extend our results to weighted distances, where every edge is equipped with an i.i.d. copy of a non-negative random variable L.

This is joint work with Júlia Komjáthy.