Properties of a random network with duplication and deletion

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In the last decades, inspired by the examination of large real networks, various types of random graph models with preferential attachment dynamics (meaning that vertices with larger degree have larger chance to get new edges as the graph evolves randomly) were introduced and analysed.

An important feature of these graph sequences is the scale-free property. However, scale-free property captures only the behavior of the degrees of vertices, and does not examine other kinds of structures. For example, especially in biological networks, such as proteomes (the nodes are proteins, and two of them are connected if they interact in natural biological processes), it happens that we can find groups of vertices having a similar neighborhood, that is, most of their neighbors are the same. One can say that these networks are highly clustered; loosely speaking, there are large cliques, in which almost every vertex is connected to almost every other one, and there are only a few edges going between cliques.

A simple way to generate cliques is duplication: when a new vertex is added, we choose an old vertex randomly, and connect the new vertex to the neighbors of the old one. In other words, the new vertex becomes a copy of the old vertex.

In the talk we present a continuous time random graph process that evolves by duplicating or deleting the edges of randomly chosen vertices. We prove the existence of an a.s. asymptotic degree distribution, with stretched exponential decay. We also study the order of magnitude of the maximal degree.