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Co-citation used as an estimator of similarity in a geometric model of complex networks

The spatial preferred attachment (SPA) model is a model for networked information spaces such as domains of the World Wide Web, citation graphs, and on-line social networks. It uses a metric space to model the hidden attributes of the vertices – those vertices that are close in the space share similar characteristics, such as webpage topic, interests or geographical distance. In the model, vertices are elements of a metric space, and link formation depends on the metric distance between vertices.

Through theoretical analysis and simulation, it is shown that for graphs formed according to the SPA model it is possible to infer the metric distance between vertices from the link structure of the graph: the estimate is based on the number of common neighbours of a pair of vertices, the co-citation number. The co-citation method is an early step towards a "reverse engineering" of the model – reconstructing the geometry only through knowledge of the graph properties. This would be a very powerful tool in analyzing networks for which we have only information on the link structure, and not on the nature of the vertices.