Monitoring Properties of Large, Distributed, Dynamic Graphs

Abstract:

Graphs that are prevalent in current applications (the Internet, Facebook etc.) are not only very large and highly dynamic, but also distributed between many servers, none of which sees the graph in its entirety. The distributed monitoring problem deals with the question of imposing conditions on the local graphs, such that as long as they hold, it is guaranteed that some desired property holds for the global graph.

While defining local conditions for linear properties (e.g. average degree) is relatively easy, they are more difficult to derive for non-linear functions over the graph. We propose a solution and a general definition of solution optimality, and demonstrate how to apply it to two important graph properties – spectral gap and number of triangles. We also define an absolute lower bound on the communication overhead for distributed monitoring, and compare our algorithm to it, with good results. Performance improves as the graph becomes larger and denser -- that is, when distributing it is more important.