Fast gradient methods for network flow problems

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Abstract

In this talk we present a new approach for finding approximate solutions to different network problems related to multi-commodity flows. We consider simple subgradient schemes and schemes based on the smoothing technique. The fastest of our methods solves the maximal concurrent flow problem in $O\left(\frac{\log q}{\delta^2}\right)$ iterations, where $\delta$ is the related accuracy, $m$ is the number of arcs in the graph, and $q$ is the number of commodity sources. Each iteration of these schemes is very simple and does not require any sophisticated operations (e.g. shortest path computation). Its complexity is of the order $O(mq \ln q)$ operations. The application of our approach needs a preliminary computational stage consisting in finding all node-to-node maximal flows, which takes $O(n^2m \ln n)$ operations, where $n$ is the number of nodes in the graph.