Fast approximation graph partitioning algorithms

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We study graph partitioning problems on graphs with edge capacities and vertex weights. The problems of b–balanced cuts and k–multiway separators are unified by a new problem called minimum capacity ρ–separators. A ρ–separator is a subset of edges whose removal partitions the vertex set into connected components such that the sum of the vertex weights in each component is at most ρ times the weight of the graph.

We present a new and simple $O(\log n)$–approximation algorithm for minimum capacity ρ–separators which is based on spreading metrics yielding an $O(\log n)$–approximation algorithm both for b–balanced cuts and for k–multiway separators.

The algorithm is based on a technique called spreading metrics that enables us to formulate directly the minimum capacity ρ-separator problem as an integer program. The deterministic running time for computing a separator (ignoring ploy-logarithmic factors) is $O(m^2 n)$ and the randomized running time is $O(m^2)$.