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Mihai Cucuringu* (mihai.cucuringu@stats.ox.ac.uk), mihai.cucuringu@stats.ox.ac.uk,
Oxford, United Kingdom. *Spectral methods for clustering signed and directed graphs, and
constrained clustering.*

We study problems that share an important common feature: they can all be solved by exploiting the spectrum of their corresponding graph Laplacian. We first discuss a simple spectral approach to the well-studied constrained clustering problem, which captures constrained clustering as a generalized eigenvalue problem with graph Laplacians. The proposed algorithm works in nearly-linear time, provides guarantees for the quality of the clusters for 2-way partitioning, and consistently outperforms existing spectral approaches both in speed and quality. This line of work extends to the setting of clustering signed networks, where the edge weights between the nodes of the graph may take either positive or negative values, for which we provide theoretical guarantees in the setting of a signed stochastic block model. Finally, we discuss a spectral clustering algorithm for directed graphs based on a complex-valued representation of the adjacency matrix, which is provably able to capture the underlying cluster-structures, for which the information given by the direction of the edges is crucial. (Received September 13, 2020)