

Spectral graph matching and regularized quadratic relaxations

Zhou Fan

Yale University

E-mail: zhou.fan@yale.edu

Abstract: Given two unlabeled, edge-correlated graphs on the same set of vertices, we study the "graph matching" problem of matching the vertices of the first graph to those of the second. We propose a new spectral method for this problem, which first constructs a similarity matrix as a weighted sum of outer products between all pairs of eigenvectors of the two graphs, with weights given by a Cauchy kernel applied to the separation of the corresponding eigenvalues, then outputs a matching by a simple rounding procedure. The similarity matrix can also be interpreted as the solution to a regularized quadratic programming relaxation of the quadratic assignment problem. We show that for a correlated Erdos-Renyi model, this method returns the exact matching with high probability if the graphs differ by at most a $1/\text{polylog}(n)$ fraction of edges, both for dense graphs and for sparse graphs with at least $\text{polylog}(n)$ average degree.