

A Polynomial Time Approximation Algorithm for Graph Isomorphism

Yu-Chuan YU

Department of Mathematics National Changhua University of Education

Abstract

In previous studies, It is obvious that $GI \in NP$ but unknown whether $GI \in co-NP$. As that implies, no polynomial time algorithm is known (despite many published claims), but neither is GI known to be NP-complete. NP-completeness is considered unlikely since it would imply collapse of the polynomial-time hierarchy (Goldreich et al., 1991). The fastest proven running time for GI has stood for three decades at $e^{O(\sqrt{n \log n})}$ (Babai et al., 1983). However, it is possible to apply the cospectrum property of the adjacency matrix to filter out potential solutions for a given pair of matrices A, B . This paper further investigates the cospectrum and utilizes the Singular Value Decomposition (SVD) to estimate a permutation matrix P such that $PAP^T = B$. Through testing, the predicted accuracy exceeds 90

Keywords: Graph Isomorphism; Approximation Algorithm; Polynomial Time; Cospectrum; Eigen decomposition; SVD