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Detecting Highly-Cyclic Structure with Complex Eigenpairs

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Highly 3- and 4-cyclic subgraph topologies are detectable via calculation of eigenvectors associated with certain complex eigenvalues of Markov propagators. We characterize this phenomenon theoretically to understand the capabilities and limitations for utilizing eigenvectors in this venture. We provide algorithms for approximating these eigenvectors and give numerical results, both for software that utilizes complex arithmetic and software that is limited to real arithmetic. Additionally, we discuss the application of these techniques to motif detection.