

PhD research topic proposal
BME, Doctoral School of Mathematics and Computer Science

Name and degree of supervisor :

Bolla Marianna, Dsc.

Are you willing to supervise Stipendium Hungaricum applicants?

Not

Title of the topic:

Spectral properties of non-backtracking Laplacian matrices; application to spectral clustering and bond percolation on sparse graphs

Short description:

Classical spectral clustering considers the spectra of the Laplacian or modularity matrices assigned to the graph and uses the eigenvectors corresponding to the structural eigenvalues to find assortative clusters of the nodes. These spectra are mainly capable to find clusters of dense graphs. Recent results show that for sparse graphs the spectrum of the so-called non-backtracking (Hashimoto) matrix is more capable for clustering purposes. The main objective of the proposed research is to study the spectral properties of this matrix and find bond percolation thresholds when the clusters can be distinguished by belief propagation. Non-backtracking Laplacian matrices generate non-backtracking random walks, which are not Markovian on the original graph, but they are Markovian on the non-backtracking graph. Applications to large and sparse social or quantum chemistry networks are also considered.

Requirements:

MSc diploma; knowledge of topics: probability, linear algebra, basic graph theory

Contact:

E-mail:

marib@math.bme.hu

Place of work:

Dept. Stochastics, Inst. Mathematics, Budapest University of Technology and Economics