

# Elective MS course: SPECTRAL CLUSTERING

## Exam topics

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1. Graph based matrices and quadratic placement problems.
2. Laplacian matrices, estimating minimal and maximal multiway cuts with the Laplacian spectra; idea of the spectral relaxation.
3. Laplacian matrices and partition cuts; finding near optimal cuts with metric clustering of the representatives assigned to the vertices by means of the eigenvectors (k-means algorithm).
4. Normalized Laplacian matrices and normalized cuts; finding near optimal cuts with metric clustering of the representatives assigned to the vertices by means of the eigenvectors (weighted k-means algorithm).
5. Modularity matrices, Newman–Girvan modularity. Relation of the normalized modularity matrix to the normalized Laplacian.
6. Theory of Reproducing Kernel Hilbert-spaces, application to image segmentation.
7. Revealing the underlying block-structure in large, noisy networks; perturbation theorems. Stochastic block model, eigenvalues of a Wigner noise.
8. Convergence of graph sequences, graphons, testable graph parameters.
9. Generalized random and quasirandom graphs.
10. Random graph models, stochastic block models, parameter estimation with the EM algorithm.