AMSC808R / MATH 858R
Sparse and Low Rank Representations: Analytical Method and Industrial Applications

Instructor: Radu Balan , rvbalan@math.umd.edu
When: Tuesdays, Thursdays 12:30pm-1:45pm
Where: CSIC 4122
Office Information: CSIC 4131 , phone: x5-1217
Office Hours: by appointment
Course Topics:

1. Basic Functional Analysis: Hilbert space, projections, closed subspaces, function spaces; orthonormal bases; frames

2. Fourier analysis (series and transforms)

3. Shift-Invariant spaces: band-limited functions; spaces of splines/polynomial functions

4. Approximation Principles: Non-parametric vs. parametric models, linear vs. nonlinear, deterministic vs. stochastic estimation

5. Linear models:

   2.1 Stochastic approach: Karhunen-Loev decmposition; PCA; ICA

   2.2 Deterministic approach: case studies: spectral approximations; Fix-Strang conditions for shift-invariant spaces; Blind source separation for sparse signals.

6. Model selection:

   3.1 Classic principles: Akaike information criterion; Bayesian information criterion; Minimum description length

   3.2 Sparse models

7. Nonlinear models

   4.1 Matrix completion problem

   4.2 Phaseless reconstruction

Recommended Readings: selected list of papers posted on Canvas
Grading Info: Homeworks (25%), exam (25%), project/report (50%)