

Compressed sensing (Math 555): Detailed outline

This is a tentative outline. Roughly the following topics will be covered in roughly the following order. We begin the class following the book “A mathematical introduction to compressive sensing” by Rauhut and Foucart.

Chapter 1: An invitation to compressive sensing.

Chapter 2: Sparse solutions to underdetermined systems.

Chapter 3: Basic algorithms.

Chapter 4: Basis pursuit.

Chapter 5: Coherence.

Chapter 6: Restricted isometry property.

Chapter 9: Sparse recovery with random matrices.

- We use a new tool for this chapter that was developed at UBC in the class "Math 608D: Probability in high dimensions".

Chapter 12: Random sampling in bounded orthonormal systems.

The following topics will be covered in class but are not covered in the book:

Matrix completion

- Nuclear-norm minimization
- Estimation by projecting onto low-rank matrices
- General low-rank matrix recovery

Abstract model of compressed sensing

- The role of convex optimization
- Necessary and sufficient condition: Conditioning on descent cone