

Math 281C: Mathematical Statistics

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Lectures 2pm–3:20pm TuTh [[Zoom link](#)]

Office hour 1pm–2pm TuTh [[Zoom link](#)]

Overview This class is supposed to be an introduction to modern theoretical statistics; modern as opposed to the classical theory covered in Math 281A. Below is a tentative list of topics along with the main references.

Required background A graduate-level theoretical Statistics course at the level of Math 281A and a graduate-level probability course at the level of Math 280A.

List of topics

1. Aspects of Empirical Process Theory:
 - (a) Uniform Laws of Large Numbers (Ref: The book <Concentration Inequalities> by Boucheron, Lugosi and Massart)
 - Concentration of measure
 - Symmetrization and Rademacher complexity
 - Sub-Gaussian processes, metric entropy and chaining
 - (b) Statistical Applications of Uniform Laws of Large Numbers
 - Nonparametric classification (Ref: The survey paper <Theory of Classification: A survey of some recent advances> by Boucheron, Bousquet and Lugosi).
 - Consistency and rates of convergence for M -estimators (Ref: Chapter 5 of the book <Asymptotic Statistics> by van der Vaart)
 - (c) Uniform Central Limit Theorems
 - Stochastic convergence in metric spaces (Ref: Chapter 18 of the book <Asymptotic Statistics> by van der Vaart)
 - Sufficient conditions for uniform central limit theorems to hold (Ref: Chapter 19 of the book <Asymptotic Statistics> by van der Vaart)
 - Application to M -estimation (Ref: Chapter 5 of the book <Asymptotic Statistics> by van der Vaart)
2. Sparse Linear Models (Refs: Relevant parts of the book <Gaussian estimation> by Iain Johnstone for the orthogonal case and the book <High-Dimensional Statistics> by Martin Wainwright for standard Lasso results)

Evaluation Evaluation will be based on homework (70%) and a final exam (30%). Homework will be assigned weekly or biweekly, and must be turned in (via Canvas) by the end of the following Friday, starting Week 2. Homework should be submitted in .pdf files, generated by either \LaTeX (strongly recommended) or handwritten report. Late homework will not be accepted unless there is a reasonable justification.

Lecture notes I will provide lecture notes on a weekly basis.