



JOINT INSTITUTE
交大密西根学院

VE564 Summer2021

Statistical Signal Processing

Prof. H. Qiao

UM-SJTU Joint Institute

May 11, 2021

Instructor: Heng Qiao

Lectures: TuTh 10:00 - 11:40 AM; CRQ303

Office Hours: Tuesdays 8:30 - 9:30AM, and by appointments

Office Location: Longbin Building 438

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Feishu Group: ve564Summer2021

TA: TBA

- **Office Hours:** TBA
- **Office Location:** TBA
- **Recitation Sessions:** TBA

Main References:

- Fundamentals of Statistical Signal Processing, Volume 1: Estimation Theory, Steven Kay, 1993
- Fundamentals of Statistical Signal Processing, Volume 2: Detection Theory, Steven Kay, 1998

Other References:

- Statistical Signal Processing, Louis Scharf, 1991
- An Introduction to Signal Detection and Estimation, Vincent Poor, 2nd ed., 1994
- P. Moulin and V.V. Veeravalli, Statistical Inference for Engineers and Data Scientists, Cambridge University Press, 2019.
- E. L. Lehmann and G. Casella, Theory of Point Estimation, Springer, 1998.

Grading Policy

- Attendance: 10%
- Homework: 15 %
- Project: 20 %
- Mid-term Exam: 25%
- Final Exam: 30%

Before this course

- You should have some ideas about linear algebra, probability and statistics
- You should have an (vague) image of signal processing
- You are intrigued by the underlying methodologies of understanding the "random" nature

After this course

- You should know how to model your problem with meaningful parameters
- You should master several classic estimation/detection techniques
- You should know how to come up with the estimator/detector tailored to your problem and evaluate its performance

1. Part 1: Estimation

- Prerequisites: Linear Algebra, Vector Spaces, Matrix Factorization, Multivariate Normal Distributions
- Sufficient Statistics. Bias-Variance Tradeoff. Minimum Variance Unbiased Estimators
- Linear Unbiased Estimators, Cramèr-Rao Bound, Minimax Estimator
- Maximum Likelihood Estimators, Least Squares
- Bayes Estimators
- Wiener Filtering, Kalman Filtering

2. Part 2: Detection

- Neyman-Pearson Detectors
- Matched Filters, (Generalized) Likelihood Ratio Tests
- Bayes Detectors
- Multiple Hypotheses