ESE 524 Detection and Estimation Theory

Semester: Spring 2018
Time: Tuesday and Thursday 2:30PM-5:30PM
Classroom: Louderman / 458

Instructor Information

Name: Arye Nehorai
Email: nehorai@ese.wustl.edu
Office Hour: Thursday 4:00 - 5:00 pm, Green hall 2160c (by appointment)

TA Information

Name: Eric Cawi
Email: ezcawi@wustl.edu
Office Hour: Monday and Wednesday 5:30 - 6:30 pm, Green hall 2120A

Prerequisite

ESE 520 Probability and Stochastic Processes or equivalent

Course Outline

- Estimation Theory
  - Estimator Performance
  - Sufficient Statistics
  - Cramér–Rao Lower Bound
  - Linear Models
  - Maximum-Likelihood (ML) estimation
  - Bayesian Inference
    - Noninformative Priors
    - Bayesian Inference for Multiparameter Models
    - Gaussian Linear Models
    - Bayesian Asymptotic
  - Kalman Filter
- Detection Theory
  - Bayesian Detection
    - Chernoff Bound
    - Multiple Hypothesis Testing
  - Frequentist Detection
    - Neyman-Pearson Test for Simple Hypotheses
    - Composite Hypothesis Test

Assignments

In most cases assigned biweekly on Tuesdays, starting from the second week. Due within two weeks in class. Knowledge in Matlab programming is required. The graded solutions will be returned in one or two weeks. Homework problems, solutions, and grades will be posted on Blackboard.

Exam Schedule

Midterm exam: Tuesday, March 20, 2018, 2:30PM-4:00PM
Final exam: Monday, May 7, 2018, 3:30PM - 5:30PM

Course Grading

Homework 25%
Midterm 25%
Final exam 50%

Grader Information

Eric Cawi, ezcawi@wustl.edu
Prateek Gundannavar Vijay, prateek@wustl.edu
Mianzhi Wang, mianzhi.wang@wustl.edu
Yijian Xiang, yijian.xiang@wustl.edu

Notes Readings (Required)

https://sites.google.com/view/detestth/lecture-notes?authuser=0

Reading List (Suggested)

1) Steven M. Kay, Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory, Prentice-Hall, 1993, ISBN-13: 978-0133457117
2) Steven M. Kay, Fundamentals of Statistical Signal Processing, Volume II: Detection Theory, Prentice-Hall, 1998, ISBN-13: 978-0135041352
3) Peter J. Bickel and Kjell A. Doksum, Mathematical Statistics: Basic Ideas and Selected Topics, Volumes I-II Package, Chapman and Hall/CRC, 2015, ISBN-13: 978-1498740319
4) Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, Donald B. Rubin, Bayesian Data Analysis, 3rd ed. Chapman & Hall, 2013, ISBN-13: 978-1439840955
5) Larry Wasserman, All of Statistics: A Concise Course in Statistical Inference, Springer, 2004, ISBN-13: 978-0387402727. The book listed in the slides was published in 1987
6) H. Vincent Poor, An Introduction to Signal Detection and Estimation, 2nd ed. Springer-Verlag, 1994, ISBN-13: 9783540941736
7) Harry L. Van Trees, Detection, Estimation, and Modulation Theory. Part I, Wiley, 1968, ISBN-13: 978-0471899556