E1244 Jan 3:0

Detection and Estimation Theory

Instructor

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Department: ECE

Course Time: Tue., Thu., 11:30 AM - 1 PM

Lecture venue:

Detailed Course Page:

Announcements

The first lecture of the 2018 session is at 11:30 AM on January 2, 2018.

Brief description of the course

The course presents an introductory treatment of the problems of detection and estimation in the framework of statistical inference. Detection, broadly speaking, attempts to answer whether a property is satisfied, while estimation attempts to find the value of a quantity, based on observations or data. The course is theoretical in flavour, and is suitable for beginning graduate students who wish to gain a basic understanding of the tools of mathematical statistics.

Prerequisites

Probability and random processes

Syllabus

Hypothesis testing, Neyman-Pearson theorem, likelihood ratio test and generalized likelihood ratio test, uniformly most powerful test, multiple-decision problems, detection of deterministic and random signals in Gaussian noise, detection in non-Gaussian noise, sequential detection, introduction to nonparametric testing. Parameter Estimation: Unbiasedness, consistency, Cramer-Rao bound, sufficient statistics, Rao-Blackwell theorem, best linear unbiased estimation, maximum likelihood estimation. Bayesian estimation: MMSE and

MAP estimators, Wiener filter, Kalman filter, Levinson-Durbin and innovation algorithms.

Course outcomes

1. Study the qualitative problems of detection and estimation in the framework of statistical inference.

2. Gain an understanding of, and develop the ability to design, automated systems for detection and estimation (these are often key subsystems of larger systems in real life).

3. Write down hypothesis tests and estimation schemes (e.g., Likelihood ratio tests, Maximum likelihood estimators) for typical problems of interest.

Grading policy

Homework assignments (including programming exercises): 30%, Scribing lecture notes: 10%, Midterm exam: 20%, Final exam: 40%

Assignments

Resources

The course will primarily follow the following texts:

1. An Introduction to Signal Detection and Estimation, Vincent Poor, Second Edition, 1994.

2. Statistical Inference, George Casella and Roger L. Berger, Second Edition, 2002.