EEL 6537 Detection Theory

Credits: 3 credits

Text book, title, author, and year: T. A. Schonhoff and A. A. Giordano, *Detection and Estimation Theory*, Prentice Hall, 2006

Reference materials:

1. A. D. Whalen. Detection of Signals in Noise, Academic Press, 1971.
2. M. Srinath, P. Rajasekaran, and R. Viswanathan, Introduction to Statistical Signal Processing with Applications Prentice Hall, 1996.
3. C.W. Helstrom. Elements of Signal Detection & Estimation, Prentice Hall, 1995.

Specific course information:

Catalog description: This course provides an introduction to detection theory and its application to digital communications, radar and sonar systems. The decision-theory concepts covered include hypothesis testing for both deterministic and random data, optimum-receiver principles; detection of random signals in noise, coherent and noncoherent detection with multiple sensors. The course is designed for graduate students and may be taken by senior undergraduates with permission of the instructor.

Prerequisites: Prerequisites: EEL 4541 - Stochastic Processes and Random Signals

Specific goals for the course: The main objective of this course is to provide graduate students an overview of statistical decision making as it applies to digital communications, speech processing, radar and sonar systems. Specifically, this course will impart specialized communications skills in the following areas:

- A review of probability and mathematical stills needed to understand detection theory.
- A basic understanding of hypothesis testing as a decision making tool.
- Knowledge of how to design receivers to detect known or unknown signals in Gaussian noise.
- An understanding of how multiple sensors (centralized and decentralized) are used for detection.
- A basic understanding of the issues involved in detecting weak or random signals in noise.
- An overview of current research issues in detection theory.
- A detailed study of a practical detection problem by computer simulation.

Brief list of topics to be covered:

1. Introduction
2. Review of Probability
3. Hypothesis Testing
4. Detection of Signals in Noise
5. Estimation of Signal Parameters
6. Detection of Signals with Unknown Parameters
7. Nonparametric Detection
8. Decentralized Detection
9. Sequential Detection
10. Detection of Random Signals
11. Robust Detection
12. Applications and Current Research Issues