ECE 254: Detection Theory

Instructor:

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Course Description:

Hypothesis testing, detection of signals in white and colored Gaussian noise; estimation of signal parameters; maximum-likelihood detection; resolution of signals; detection and estimation of stochastic signals; applications to radar, sonar, and communications.

Summary of Topics Discussed:

(1) Introduction – SKE, SKEP, SKEPII problems.
(2) Summary of various PDFs – Gaussian and Chi-squared.
(3) Statistical decision theory framework – NP and Bayesian approaches.
(4) Deterministic signals – Matched filter and generalized matched filter.
(5) Random signals – Gaussian signal in Gaussian noise, Rayleigh fading signal.
(6) Composite hypothesis testing (uncertain parameters) – Bayesian and GLRT detection receivers.
(7) Deterministic signals with unknown parameters – amplitude, phase, frequency, and arrival time.
(8) Unknown noise parameters.

Homework/Projects:

Approximately one computer-oriented homework assignment will be made per week. These can be worked on in groups and should be turned in as soon as possible for feedback. A mid-term and an end-term project will be assigned. These should represent individual effort (i.e. should be considered as take-home exams) and assistance should not be given nor received from anyone other than the instructor.

Grades:

No exams will be given. Grades will be assigned based on the weekly homework assignments and the mid/end-term projects. The homework assignments count 1/3 and the mid/end-term projects count 1/3 each.

Text: