Course Syllabus

EE563 Estimation Theory
Ming Hsieh Department of Electrical Engineering
University of Southern California
Fall 2015

Instructor
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Lectures: Tuesday and Thursday, 9:30am-10:50am, VKC-201
Discussion Sections: Friday 12pm-12:50pm, VHE-210

Course Description:
EE563 is a redesigned graduate-level course that teaches the principles and contemporary approaches of statistical inference and estimation theory. This is a core course for students who work in areas such as machine learning, communication, signal processing, control, computational neuroscience, and artificial intelligence. Instead of focusing on any one application, the course teaches the common core of methodology needed for all these applications. Where appropriate, examples from various fields will be provided to demonstrate how they can be solved using the learned methodologies.

Prerequisites:
The official prerequisite for this course is EE503 or equivalent. *EE562a* is *no longer a prerequisite* and will be waived. Fluency with basic probabilistic reasoning is necessary to take this course. If you are unsure of the equivalency of your prior courses with EE503, please contact the instructor.

Course Website:
The course material and problem sets will be posted on Blackboard:
https://blackboard.usc.edu

Course Grade:

Course grade is determined based on homework, midterm, and final exam:

Homework: 15%

Midterm: 35%

Final: 50%

Final exam will be on Tuesday December 10, 11am-1pm. Midterm will be tentatively held in the 8th week of the semester in lecture. Final exam will cover the entire course content with emphasis on the second half.

Course Topics:

The course will cover the following tentative topics on statistical inference and estimation theory.

(1) Bayesian hypothesis testing
(2) Non-Bayesian decision theory
(3) Bayesian parameter estimation: maximum a posteriori (MAP), Bayes' least-squares (BLS), linear least-squares (LLS) estimation
(4) Non-Bayesian parameter estimation: minimum-variance unbiased (MVU), Cramer-Rao bound (CRB), maximum-likelihood (ML), best linear unbiased (BLUE) estimation
(5) Exponential families
(6) Sufficient statistics
(7) Expectation-maximization (EM) algorithm
(8) Approximation methods: deterministic and stochastic
(9) Random processes, whitening, shaping, Karhunen Loeve (KL) expansions
(10) Kalman filtering and smoothing
(11) Approximate nonlinear filtering
(12) Parameter estimation in linear dynamical systems
(13) General Bayesian Tracking

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards*https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu/ or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.htmlprovides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* *http://emergency.usc.edu/*will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.