Estimation Theory

Course number: 430.714
Time: M/W 3:30-4:45PM
Location: Building 301 Room 104

Instructor: Prof. Songhwai Oh (오성회)
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Office hour: Friday 3:00-4:00PM, Building 133 Room 405

Course description: This course introduces classical and modern topics in estimation theory to graduate level students. Topics include minimum variance unbiased estimators, the Cramer-Rao bound, linear models, sufficient statistics, best linear unbiased estimators, maximum likelihood estimators, least squares, exponential family, multivariate Gaussian distribution, Bayes risk, minimum mean square error (MMSE), maximum a posteriori (MAP), linear MMSE, sequential linear MMSE, Bayesian filtering, Kalman filters, extended Kalman filters, unscented Kalman filters, particle filters, data association, multi-target tracking, and Gaussian process regression. Lectures will be in English.

Textbooks: There is no required textbook for this course. Recommended textbooks will be announced later.

Grading: Quiz or homework (30%), midterm (30%), and final (40%). Note that the percentages are approximate and the actual weights used to compute the final grades may be different.

Prerequisites: A solid background in probability and linear algebra.

Academic honesty: Same as the academic integrity policy of the university and the school.

Weekly plan (subject to change):

Week 1	Review of probability and linear system theory
Week 2	Minimum variance unbiased estimators, Cramer-Rao lower bound
Week 3	Linear models
Week 4	Sufficient statistics, best linear unbiased estimators, maximum likelihood
Week 5	Least squares, exponential family
Week 6	Bayesian approaches, multivariate Gaussian distribution
Week 7	Bayes risk, minimum mean square error (MMSE), maximum a posteriori (MAP)
Week 8	Linear MMSE and sequential linear MMSE
Week 9	Bayesian filtering
Week 10	Kalman filter, information filter
Week 11	Smoothing
Week 12	Extended Kalman filter
Week 13	Unscented Kalman filter, particle filter
Week 14	Data association and multi-target tracking
Week 15	Gaussian process regression