

## SYLLABUS: EE 631 Detection & Estimation I, Fall 2019

**Course Information:** Times: MoWe 3:30PM - 4:50PM; Location: TBD; 3 credits

**Prerequisites:** EE 531 Prob & Stoc Procs for Eng

**Instructor:** Prof. Shaofeng Zou, 228 Davis Hall, [szou3@buffalo.edu](mailto:szou3@buffalo.edu)

**Office Hour:** Friday 1:00PM-2:00PM, 228 Davis Hall (other times by appointment)

**Textbook:**

P. Moulin and V. V. Veeravalli, *Statistical Inference for Engineers and Data Scientists*. Cambridge University Press, 2018.

**General references:**

S. M. Kay, *Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory*. Prentice Hall PTR, 1993.

S. M. Kay, *Fundamentals of Statistical Signal Processing, Volume II: Detection Theory*. Prentice Hall PTR, 1994.

H. V. Poor, *An introduction to signal detection and estimation*. Springer Science & Business Media, 2013.

**Course Description:** This course focuses on statistical inference problems in engineering and data science. Two fundamental problems in statistical inference will be considered: detection and estimation. The first part of this course introduces statistical decision theory. The following topics will be covered: M-ary and binary hypothesis testing, Bayesian/minimax/Neyman-Pearson setting, composite hypotheses, signal detection, performance bounds, large deviations and error exponents. The second part of the course focuses on parameter estimation theory. The following topics will be covered: Bayesian parameter estimation, MMSE, MMAE, MAP estimation, minimum variance unbiased estimation, information inequalities, Cramer-Rao lower bound, MLE and signal estimation.

**Student Learning Outcomes:**

- 1) Understand basic statistical inference tools;
- 2) Be capable of designing, applying and analyzing hypothesis testing and Bayesian algorithms for signal detection from noisy data;
- 3) Be capable of using classical and Bayesian tools to solve parameter estimation problems from noisy data, and further conducting analysis theoretically;

**Homework, Exams (No late submissions will be accepted):**

- 1) Homework will be assigned every two weeks (approx.). *Score: 40%*
- 2) Mid-term. *Score: 30%*. Final exam. *Score: 30%*

**Academic Integrity**

Academic integrity is a fundamental university value. The students shall follow the university guidelines.

<https://catalog.buffalo.edu/policies/integrity.html>

<https://grad.buffalo.edu/succeed/current-students/policy-library.html>

**Accessibility Resources**

If you have any disability which requires reasonable accommodations to enable you to participate in this course, please contact the Office of Accessibility Resources, 25 Capen Hall, 645-2608, and also the instructor of this course. The office will provide you with information and review appropriate arrangements for reasonable accommodations.

<https://www.buffalo.edu/studentlife/who-we-are/departments/accessibility.html>