ADVANCED STATISTICS

DAMIEN GARREAU

This course focuses on three pillars of modern statistical inference: parameter estimation, hypothesis testing, and model selection. Its aim is to provide a good understanding of the current methods via a thorough treatment of the existing theoretical guarantees. A particular emphasis will be placed on the asymptotic setting.

Plan :

- Introduction
  - probability theory, a quick reminder
  - stochastic convergences, usual probability distributions (esp. exponential family)
- Statistical estimation
  - M- and Z-estimators: consistency, asymptotic normality
  - local average estimators (nearest neighbor rule, histograms). consistency
  - information inequalities (Cramer-Rao, Fisher)
  - asymptotic efficiency
  - introduction to U-statistics
- Statistical testing
  - reminders (usual tests, type I and II error, p-value)
  - multiple testing (Bonferroni correction, Benjamini-Hochberg)
  - relative efficiency, asymptotic efficiency (Bahadur)
  - safe testing (Gruenwald)
- Model selection
  - introduction: Mallows C_p heuristic
  - penalised least-squares and oracle inequalities
  - the Lasso (recent results)

Prerequisites: Probability Theory.
First trimester.

Date: September 3, 2019.