

# Robust Statistics (L16)

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This is a topics course on the use of robustness in estimation and inference. We will begin with an overview of robustness theory from classical statistics, including notions such as the influence function and breakdown point, and the asymptotic theory of M-estimators. We will then survey a variety of more recent directions in machine learning and theoretical computer science where ideas in classical robustness theory have been leveraged and expanded. We will also briefly touch upon the topic of robust optimization and compare/contrast techniques from that field with statistical notions of robustness.

Below is a tentative list of topics:

- $M$ -estimation: quantitative robustness and asymptotic theory; scale estimates; regression estimates
- Robust covariance estimation
- Robust hypothesis testing
- Robust high-dimensional estimation
- Estimation under adversarial contamination
- Robust optimization; distributional robustness

## Pre-requisites

This course is appropriate for students with a general background in statistics. We will also assume proficiency in linear algebra and basic optimization. Some familiarity with machine learning will be helpful.

## Literature

1. Huber and Ronchetti, *Robust Statistics*, 2011.
2. Hampel, Ronchetti, and Rousseeuw, *Robust Statistics: The Approach Based on Influence Functions*, 2011.
3. Maronna, Martin, and Yohai, *Robust Statistics: Theory and Methods*, 2006.

## Additional support

Three examples sheets will be provided and three associated examples classes will be given. There will be a revision class in the Easter Term.