Summary

Information Theory and Signal Processing are key underpinnings of Data Science. They provide frameworks for signal representation and for fundamental performance bounds.

Content

This class presents basic concepts of Information Theory and Signal Processing and their relevance to emerging problems in Data Science and Machine Learning.

A tentative list of topics covered is:
1. Signal Representations
2. Measures of Information
3. Compression and Quantization
4. Sparsity
5. Exponential Families, Maximum Entropy
6. Detection and Estimation Theory

Keywords

Information Theory, Signal Processing, Statistical Signal Processing, Machine Learning, Data Science.

Learning Prerequisites

Required courses

COM-300 Modèles stochastiques pour les communications

Recommended courses

Statistics

Important concepts to start the course

Solid understanding of linear algebra and probability as well as real and complex analysis.

Learning Outcomes

By the end of the course, the student must be able to:

• Formulate the fundamental concepts of signal processing such as basis representations and sampling
• Formulate the fundamental concepts of information theory such as entropy and mutual information
• Analyze problems in statistical settings using fundamental bounds from information theory
• Formulate problems using robust and universal techniques

Teaching methods
Ex cathedra lectures, exercises, and small projects.

**Expected student activities**
Follow lectures; independent work on problems (homework and small projects).

**Assessment methods**
Written final exam during the exam session.
Homework Problem Sets during the semester.
10% homework, 90% final exam.

**Supervision**
Assistants Yes

**Resources**
**Bibliography**

**Notes/Handbook**
Lectures notes

**Websites**