Syllabus
Mathematics for Machine Learning, 6hp

Issued by the WASP graduate school management group 2024-12-02

Main field of study
AI/Math

Course level
PhD student course
- AS track: elective
- AI track: elective
- Joint curriculum: foundational

Course offered for
PhD Students in the WASP graduate school

Entry requirements
The participants are assumed to have a background in mathematics corresponding to the contents of the WASP-course "Introduction to Mathematics for Machine Learning".

Intended learning outcomes
After completing the course, students should be able to

Module1:
- Apply basic principles of estimation and hypothesis testing.
- Apply concentration inequalities and asymptotic theory to analyze the properties of different methods.
- Apply statistical inference principles to construct optimal estimators and tests.
- Describe the basics of statistical decision theory.
- Describe the basics of Bayesian statistics.

Module2:
- Define and describe some basic properties of a Markov chain.
- Define and describe some standard computational methods for statistical inference, such as Markov chain Monte Carlo methods and regularized regression methods, and their properties.
- Describe bootstrap and random forests.
- Describe the boosting methodology.
- Describe some standard methods for stochastic optimization.
- Apply the above methods for different computational tasks.

Course content
In Module 1, we cover principles of statistical inference, concentration inequalities, asymptotic statistics, confidence intervals, risk and statistical decision theory.

In Module 2, we cover the basics of computer intensive methods, including Markov chain Monte Carlo, with applications in Bayesian statistics, bootstrap, Lasso, random forest, boosting and stochastic optimization.

Teaching and working methods

The course includes two 3-day meetings with intense teaching on-site, typically a mixture of lectures and exercises. The first meeting covers module 1 and the second covers module 2.

Examination

There will be two sets of homework assignments, coupled with the contents of the two on-site meetings. To pass the course, a minimum requirement on each of the modules must be met, and the homework assignments must be completed within the timeframe given.

Grades

Fail or Pass

Information for the intranet

Course literature
<...>

Abstract
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