Syllabus
Introduction to Mathematics for Machine Learning, 4hp

Issued by the WASP graduate school management group *draft*

Main field of study
AI/ MLX

Course level
PhD student course

- AS track: introductory
- AI track: elective
- Joint curriculum: introductory

Course offered for
PhD students in the WASP graduate school

Entry requirements
This is an introductory course targeting students with a less strong background in mathematics.

Intended learning outcomes
The students should get the theoretical mathematical background knowledge expected for the machine learning parts of all WASP-courses. They should obtain basic knowledge and be able to handle basic problems within the four pillars covered: linear algebra, calculus, probability and optimization.

Course content
The course covers four pillars: linear algebra, calculus, probability and optimization. Contents for the pillars can be roughly summarized as follows:

Linear algebra: Systems of linear equations, matrices, fundamental properties of matrices, solving systems of linear equations, decomposition of matrices, vector spaces, affine spaces, norms.

Calculus: Differentiation of univariate and multivariate functions, differentiation of vector-valued functions, automatic differentiation, higher-order derivatives.

Probability: Probability space, discrete and continuous probabilities, Bayes theorem, statistics and independence of random variables, important distributions, transformations of random variables.

Optimization: Local minimizer and global minimizer, different classes of optimization problems, convexity, unconstrained minimization, gradient-based methods for unconstrained minimization, convex optimization, linear programming.

The contents very roughly follow Deisenroth et al's book *Mathematics for Machine learning*, part I, pp. 1-222.

Teaching and working methods
There will be two onsite meetings of two days each. The first meeting covers linear algebra and calculus, the second meeting covers probability and optimization.

Examination

There will be two sets of homework assignments, coupled to the contents of the two onsite 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

Pass or fail