Course Name	Mathematical foundations of learning theory
Contents and Objectives	Content: • Relevant tools from probability theory (Laplace-trafo, concentration inequalities, Hoeffding, Bernstein) • Statistical learning theory (generalization error, sample error, approximation error, empirical risk minimization ERM, bias-variance tradeoff, representer theorem) • Kernel ridge regression, regularized least squares • Reproducing kernel Hilbert spaces (kernel trick, Mercer's theorem and consequences) • Interpolation spaces, approximation error Objectives: Students acquire familiarity with the interplay between probability theory, optimization and functional analysis. In addition they will learn methods for the statistical analysis of learning methods and their numerical treatment.
Teaching	This course consists of lectures and exercise classes. • Lecture: Mathematical foundations of learning theory (4h/week) • Exercise class: Mathematical foundations of learning theory (2h/week) This class can be taught remotely.
Prerequisites	Basic knowledge of linear algebra, calculus and probability theory.
Examination	Oral exam (30 minutes)
Credits	8 ECTS points
Frequency	This course is given at least every second year.
Workload	The estimated total working time for this course is 240 hours.
Duration	This course is given during one semester.