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Institute of Mathematics
Stochastics

In the summer term 2022 I am teaching the course (module M27)

Mathematics for Machine Learning

The course will be taught in English to facilitate participation by international students.

Contents:

This course gives an introduction into mathematical methods and theory for machine learning. We will follow for a large part the book by Shalev-Schwartz and Ben-David, starting from PAC-learning models and VC-dimension, covering some selected further topics like boosting and Gaussian processes in ML for regression and classification. A second part of the lecture will introduce to so-called reinforcement learning for Markov decision processes (for motivation about "how a computer may learn to play Atari video games, just by trying...", check the article by V.Mnih et al.)

Prerequisites:

Content from compulsory modules at HU for bachelor degree (mono), incl. measure theory and Stochastics-I. Recommend is Stochastics-II (i.e. the BMS-course stochastic processes I), as you will need knowledge about conditional expectations, regular conditional distributions, or Markov chains, as in textbooks by A.Klenke or Meintrup/Schäffler, at some point.

First references: Further references will be given during the course.

- Shai Shalev-Shwartz and Shai Ben-David: Understanding Machine Learning: From Theory to Algorithms. Cambridge Univ. Press, 2014. (authors' web link)
- Richard S. Sutton and Andrw G Barto: Reinforcement Learning: an introduction. MIT press, 2020. (author' page web link)
- Mnih et al.: Playing Atari with Deep Reinforcement Learning, Deep Mind. article link,

Lecture: *Tuesday, 9 – 11, RUD25, R.1.013*
Class: *Tuesday 11—13, RUD25, R.1.013 (by Ms. **Martha Nansubuga**, bi-weekly. alternatingly with the Lab part provided through separate Module "M26 Projektübung Stochastik", own registration required, own credits…)*

First lecture (class): April 19th. (first tutorial in 2nd week of term.)

The **Moodle** course page will provide all current information about times or rooms for lectures, classes or lab sessions and possible changes, if any. Moodle access is to be send through **AGNES** for the respective module. Check www.math.hu-berlin.de/~becherer for further information.

Teaching assistant: Ms. Martha Nansubuga (nansubum+at+hu-berlin.de)
Office hours by appointment.