

# MATHEMATICAL FOUNDATIONS OF MACHINE LEARNING

(NMAG 469, FALL TERM 2019-2020)

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Machine learning is an interdisciplinary field in the intersection of mathematical statistics and computer sciences. Machine learning studies statistical models and algorithms for deriving predictors, or meaningful patterns from empirical data. Machine learning techniques are applied in search engine, speech recognition and natural language processing, image detection, robotics etc. In our course we address the following questions: What is the mathematical model of learning? How to quantify the difficulty/hardness/complexity of a learning problem? How to choose a learning model and learning algorithm? How to measure success of machine learning?

The syllabus of our course:

1. Supervised learning, unsupervised learning
2. Generalization ability of machine learning
3. Support vector machine, Kernel machine
4. Neural networks and deep learning
5. Bayesian machine learning and Bayesian networks.

*Recommended Literature.*

1. S. Shalev-Shwartz, and S. Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014.
2. Sergios Theodoridis, Machine Learning A Bayesian and Optimization Perspective, Elsevier, 2015.
3. M. Mohri, A. Rostamizadeh, A. Talwalkar, Foundations of Machine Learning, MIT Press, 2012.
4. H. V. Lê, Mathematical foundations of machine learning, lecture note <http://users.math.cas.cz/hvle/MFML.pdf>

During the course we shall discuss topics for term paper assignment which could be qualified as the exam.

**The first meeting shall take place at 10:40 AM Thursday October 2019, in the seminar room MU MFF UK (3rd floor).** Anybody interested in the lecture course please contact me per email [hvle@math.cas.cz](mailto:hvle@math.cas.cz) for arranging more suitable lecture time.

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