Computational Learning Theory

Third week of machine learning workshop

Outline

- Introduction to different machine learning paradigms
  - Supervised learning
  - Unsupervised (self-supervised) learning
  - Semi-supervised learning
  - Reinforcement learning
  - Online learning
  - Active learning
- Introduction to different notion of learning
  - PAC (Probably approximate correct) learning
  - SQ (Statistical query learning)
- Introduction to different paradigm (algorithms) for leaning from finite samples
  - Empirical risk minimization
  - Structural risk minimization
  - Invariant risk minimization
- PAC Learning
  - Definition of domain instance, hypothesis (concept) class, target concept, data generating process, generalization error
  - Realizability assumption
  - Empirical risk minimization paradigm
  - Overfitting, how to avoid overfitting by considering finite hypothesis class
  - Finite hypothesis classes, which hold realizability assumption, are PAC learnable.

- Agnostic PAC learning

References

1. Understanding Machine Learning: From Theory to Algorithms. Textbook by Shai Ben-David and Shai Shalev-Shwartz. 2014
2. Foundations of Machine Learning (Adaptive Computation and Machine Learning series) Second edition – 2018. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar
3. An Introduction to Computational Learning Theory. Book by Michael Kearns and Umesh Virkumar Vazirani. The MIT Press, 1994.