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This course will provide a in-depth exploration of the foundational theory and practical applications of statistical machine learning, which plays a significant role in statistical data analysis and data mining. We will primarily focus on supervised and unsupervised learning, with an emphasis on supervised learning. The course will cover essential theoretical concepts such as maximum likelihood estimation and Bayesian inference, as well as introduce the concept of Probably Approximately Correct (PAC) learning.
 Throughout the course, you will gain familiarity with various probabilistic models and predictive algorithms, including logistic regression, perceptrons, and neural networks. Additionally, we will touch upon advanced topics like semi-supervised learning, transfer learning, and sparse modeling, providing you with insights into the latest developments in the field of machine learning. In addition, opportunities for hands-on data analysis exercises will also be provided.

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Understanding basic concepts, problems, and techniques of statistical learning and some of the recent topics.

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1. Statistical Machine Learning
- Introduction to machine learning: historical perspective, basic concepts, and applications
- Regression and classification: linear regression, logistic regression, and neural networks.
- Inference framework and statistical learning theory: maximum likelihood estimation, regularization, Bayesian inference, Vapnik-Chervonenkis theory
- Model selection: performance measures, cross-validation, hyper-parameter selection

2. Advanced topics
- Semi-supervised learning
- Transfer learning
- Sparse modeling
- Deep neural networks
- Graph learning

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Reports and/or final exam.

Statistical Learning Theory(2)

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Hastie, Friedman, Tibshirani   The Elements of Statistical Learning   Springer
Shai Shalev-Shwartz and Shai Ben-David   Understanding Machine Learning: From Theory to Algorithms
    Cambridge University Press

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Basic knowledge about probability and statistics

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