

Basic Practice Training of Artificial Intelligence, Machine Learning, and Data Mining

Course Description:

This course is designed to introduce the foundations required for data analysis and machine learning. The course will cover fundamentals necessary to understand the key methods and principles in modern data analysis and machine learning. Topics covered will include foundations of statistical learning, Bayesian & frequentist viewpoints to data analysis, and an overview of classical approaches to machine learning and data analysis.

Textbooks:

Slides will be self-contained. For further study, the following books might be helpful:

Introduction to Probability, by Dimitri P. Bertsekas and John N. Tsitsiklis

Introduction to Data Mining, by P. Tan, M. Steinbach, V. Kumar, Addison Wesley, 2006.

Assignments and Evaluation:

Students will be evaluated on the basis of two homeworks, each with equal weight, and two exams: a midterm covering the first four lectures, and a final covering the last four lectures.

Course Schedule:

1. Overview of ML & Data Analysis
2. Frequentist Data Analysis: Intro;
3. Frequentist Data Analysis: MLE, Risk Minimization
4. Bayesian Data Analysis: Intro;
5. Bayesian Data Analysis: MAP
6. Hypothesis Testing;
7. Supervised Learning: Classification, Regression
8. Unsupervised Learning: Clustering, Feature Learning;
9. Supervised Learning: Practice
10. Unsupervised Learning: Practice
11. Overview of AI & Deep Learning
12. Computer Vision in the Deep Learning Era
13. Neural Networks: MLP & CNN
14. Neural Networks: Transformer
15. Self-supervised Deep Learning
16. Large Language & Multimodal Models