

15D017

Computational Machine Learning

Overview and Objectives

The main idea behind the Computational Machine Learning course is for the students to get a good overview of modern Machine Learning methods along with practical hands on experience. The course will focus around supervised and unsupervised learning methods that are often used in industry settings. The course will have a strong emphasis on hands-on usage of the algorithms introduced, we will make use of python and the many Machine Learning libraries available in python on some real world datasets.

Students are expected to have a working installation of python on their laptops.

Course Outline

Stochastic Gradient Descent and variants

- Classification, Regression with SGD

Generalized Linear Models

- Logistics Regression
- Lasso
- Elastic Net

Kernel Methods

- SVM's
- Kernel PCA
- Spectral clustering

Naive Bayes

Gaussian Processes

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- Gaussian Process Regression and Classification

Decision Trees

- Classification Regression with Decision Trees

Ensemble methods

- Gradient Boosted methods, xgboost
- AdaBoost
- Random Forest

Feature Selection

Dimensionality reduction

- PCA

Nearest Neighbor Methods

- k-means

Hierarchical Clustering

Collaborative Filtering and Recommenders

- Memory-based methods
- Matrix Factorization, Tensor Factorization, Factorization Machines

Deep Learning Workshop

The workshops aim at introducing students to the basic concepts of Deep Learning. The workshop consist of 3 hours of introduction to the basic concepts of Neural Networks and the basic Deep Learning architectures along with 3 hours of hands-on programming of Deep Learning models using python and the keras package.

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- Basic Concepts in Deep Learning
- Stochastic Gradient Descent and variants
- Embedding methods
- Convolutional Neural Networks
- Recurrent Neural Networks

Machine Learning for Recommender Systems

The workshop aim to introduce students to the main methods used to create recommendations based on past user actions. The main idea behind recommender systems is to try and model user preferences using data that the user generated while interacting with a system. The workshop is divided in two parts the first part will be devoted to the introduction to the main machine learning methods used in recommender systems and the second part will be devoted in using these methods in class using python to build a recommender system.

- Introduction to the main concepts in Recommender Systems
- Memory-based Collaborative Filtering
- Model-based Collaborative Filtering
- Context-aware Recommender Systems
- Deep Learning for Recommender Systems

Evaluation

100% project

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Materials

Friedman, J., Hastie, T., & Tibshirani, R. 2nd ed. (2009). The elements of statistical learning. Springer.

Free

version <http://statweb.stanford.edu/~tibs/ElemStatLearn/>

Bishop, C. M. (2006). Pattern recognition and machine learning. Springer.