

Machine learning foundations



Purpose of the training

The training is intended for people who want to gain basic knowledge of machine learning (ML). During the course, lecture and discussion parts alternate. The discussed items are illustrated by examples in Python.



Benefits of completing the training

Course participants gain the basic theoretical knowledge necessary to consciously use high-level implementation of ML methods. The follow-up of the training are workshops "Machine learning in Python," during which the course participants implement the discussed algorithms in a development environment.



Expected Listener Preparation

Basic knowledge of mathematics and statistics. Additionally, programming skills allow you to understand the Python examples illustrating the items discussed.



Training Language

- Language: English



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Training agenda

1. Introduction to ML

- Definition of ML
- ML vs. artificial intelligence
- Applications of ML
- Skills needed in ML
- Structured/unstructured data
- Features/instances/labels/predicted variable
- Classification/regression/clustering
- Types of ML
- Training/prediction/evaluation
- Splitting data into training and test sets
- Linear regression
- Logistic regression
- Algorithm vs. model
- ML workflow
- ML Frameworks
- Hello world of ML - iris classification

2. Data preparation

- Problems with data
- Basics of data exploration and visualization
- Feature types
- Feature encoding
- Standardization and scaling
- Outliers
- 3-sigma rule
- Dealing with missing data
- Feature selection/dimensionality reduction

3. Selected problems in ML

- Model evaluation
- Overfitting and underfitting
- Randomness and reproducibility
- Cross-validation
- Parameters vs. hyperparameters

- Hyperparameter optimization

4. Classical ML algorithms

- Taxonomy of ML algorithms
- K-nearest neighbors algorithm
- Decision tree
- Ensembling
- Random forest
- Multiclass and multilabel classification
- Clustering: k-means algorithm

5. Artificial neural networks

- Motivation and biological inspiration
- Neuron model
- Activation functions
- Multilayer perceptron – architecture
- Multilayer perceptron – prediction
- Multilayer perceptron – learning (backpropagation)
- Image encoding
- Batch learning
- Types of neural networks
- Interpretability of model
- Further learning
- Course summary: questions/comments/discussion