I. Introduction

II. Machine Learning Basics

I. III. Linear Models

II. IV. Neural Networks

V. Support Vector Machines

VI. Decision Trees

VII. Bayesian Learning

VIII. Learning Theory

III. IX. Deep Learning

X. Ensemble Methods and Meta Learning

XI. Reinforcement Learning
Objectives

- understand and explain basic concepts of machine learning
- understand formalized concepts and methods
- be able to implement concepts and methods in the form of algorithms
- be able to sensibly select, adapt, and apply relevant methods
- be able to educate oneself
Related Fields

1. Statistics [paradigms, models]
2. Mathematics
3. Artificial Intelligence [methods, algorithms]
4. Heuristic Search
5. Information Retrieval
6. Knowledge Processing
7. Natural Language Processing
8. Decision Support Systems [applications]
9. Medical Systems
10. Search Engines
11. Self-driving cars
12. Writing Support Systems
Literature

Machine Learning:


Literature

Machine Learning: (continued)

  *An Introduction to Support Vector Machines and Other Kernel-based Learning Methods* 

  *Classification and Regression Trees* 

- V. Vapnik. 
  *The Nature of Statistical Learning Theory* 
Software

Programming:

- The Jupyter Project.  
  *JupyterHub*  
  Version 3.0.  
  [jupyter.org](http://jupyter.org)

- Microsoft Corporation.  
  *Visual Studio Code*  
  Version 1.71.  
  [code.visualstudio.com](http://code.visualstudio.com)

- JetBrains, Inc.  
  *PyCharm IDE*  
  Version 2022.2.2.  
  [www.jetbrains.com/pycharm](http://www.jetbrains.com/pycharm)
Software

Machine Learning:

- *NumPy*
  Version 1.23.
  numpy.org

- *scikit-learn: Machine Learning in Python*
  Version 1.1.
  scikit-learn.org
Software

Statistics:

- R Development Core Team.  
  \textit{R}  
  Version 4.2.  
  www.r-project.org

- E. Jones, T. Oliphant, P. Peterson and others.  
  \textit{SciPy}  
  Version 1.9.  
  www.scipy.org

- J. W. Eaton.  
  \textit{GNU Octave}  
  Version 7.2.  
  www.gnu.org/software/octave
Software
Lab Class Setup

Moodle Server
Login / password
LTI secret key exchange
LTI token
Jupyter Hub
Start notebook
Notebook UI
Python code
Result
Jupyter Notebook
LTI token
LTI token

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Software
Lab Class Setup (continued)

Client

Web-Browser

BUW Server

Moodle

<<HTTPS + Web Sockets>>

<<LTI>>

Authentication cookie

<<HTTPS + Web Sockets>>

Betaweb

Kubernetes

Jupyterhub

Jupyter-notebook

Jupyter-notebook

Jupyter-notebook