

Course Manual ML

Machine Learnig

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– General information

Long name Machine Learnig

Approving CModule [ML BaTIN](#)

Responsible Prof. Dr. Lothar Thieling
Professor Fakultät IME

Valid from winter semester
2022/23

Level Bachelor

Semester in the year winter semester

Duration Semester

Hours in self-study 78

ECTS 5

Professors Prof. Dr. Lothar Thieling
Professor Fakultät IME

Requirements basic skills in Java
and/or C
basic skills in analysis
and linear algebra

Language German

Separate final exam Yes

Literature

Géron, Aurélien, Hands-On Machine Learning with Scikit-Learn and TensorFlow, O'Reilly Medi

Final exam

Details

The students should demonstrate the following competences in an oral exam: 1.) Safe handling of basic concepts and mechanisms. 2.) Analyze problems in the field of machine learning and solve them with suitable methods. 3.) Analyze existing solutions and explain the used algorithmic and theory.

Minimum standard At least 50% of the total number of points

Exam Type EN mündliche Prüfung, strukturierte Befragung

– Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	fundamentals types of learning simple classifiers simple predictors (Equalizer alias Linear Regression) challenges in learning linear regression as the simple predictor linear regression as the simple classifier training data (handling, analysis, processing) gradient descent quality measures learning curve multi-class classifier based on binary classifiers multi-label-classification logistic regression
Knowledge	simple neuronale Netze the artificial neuron as a simple classifier operation activation function bias training a neuron multi-layer-perceptron operation purposes of the layers backpropagation training algorithm tools for creating and training simple neural networks and handling training data handling, analysis and preparation of training data creating and configuring neural networks training neural networks verification of trained networks

Special requirements

none

Accompanying material	lecture foils (electronic), undefined, self-study tutorials for the tools
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Separate exam	No
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Knowledge Deep Neural Networks (DNNs)
basic problems
vanishing or exploding gradients
high training times
overfitting
solutions for the problems
mentioned above
appropriate initialization of the
weights, non-saturating activation
function, gradient clipping
accelerated optimization
procedures, reuse of pre-trained
layers
regularization to avoid overfitting
tools for creating and training
DNNs
handling, analysis and preparation
of training data
creating and configuring neural
networks
training of neural networks
verification and validation trained
networks

Knowledge Convolutional Neural Networks
(CNNs)
idea
architecture
convolutional layer
pooling layer
convolution as a basic operator for
training and detection
architectures of CNNs for different
problems
tools for implementation and
training CNNs

Knowledge Recurrent Neural Networks (RNNs)
idea
recurrent neurons
training of RNNs and Deep RNNs
Long Short Term Memory
architectures of RNNs for different
problems
tools for implementation and
training deep CNNs

Skills the presented neural networks
specify
describe
evaluate the pros and cons

solving problems using tools
for handling, analysis and
preparation of the training data
for implementation, verification,
validation and training of all neural
presented networks

Type	Attendance (h/Wk.)
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Lecture	2
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Exercises (whole course)	0
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Exercises (shared course)	0
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Tutorial (voluntary)	0
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– Practical training

Learning goals

Goal type	Description
Skills	purposeful handling of the tools
Skills	deal with complex tasks in a small team
Skills	derive complex solutions that can be implemented using neural networks

Special requirements

none

Accompanying material

problem and task description (electronic), tool chain for neural networks, self-study tutorials for the tools

Separate exam

No

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	2
Tutorial (voluntary)	0