

Course

ML - Machine Learnig

Version: 1 | Last Change: 23.09.2019 12:26 | Draft: 0 | Status: vom verantwortlichen Dozent freigegeben

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General information

Long name	Machine Learnig
Approving CModule	<a href="#">ML BaTIN</a>
Responsible	Prof. Dr. Lothar Thieling Professor Fakultät IME
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

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

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.

## ^ Lecture / Exercises

### Learning goals

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#### 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

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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

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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

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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

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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

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**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 implementationion, verification, validation and training of all neural presented networks

**Expenditure classroom teaching**

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

**Separate exam**

none

^ Practical training

Learning goals

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Skills

purposeful handling of the tools

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deal with complex tasks in a small team

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derive complex solutions that can be implemented using neural networks

Expenditure classroom teaching

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

Separate exam

none