**Module title**
Deep Learning – Methods and applications

<table>
<thead>
<tr>
<th>Module code</th>
<th>Level</th>
<th>Hours per week</th>
<th>ECTS credits</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tba.</td>
<td>Bachelor (B.Sc.)</td>
<td>4</td>
<td>5</td>
<td>14 weeks</td>
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<thead>
<tr>
<th>Module instructor</th>
<th>Lecture type</th>
<th>Prerequisite(s)</th>
<th>Grading</th>
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<tbody>
<tr>
<td>Prof. Dr. Vincent Barra</td>
<td>Regular lecture, online consultations, Jupyter notebook exercises</td>
<td>Linear Algebra, Optimization, Python</td>
<td>Assignment</td>
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<table>
<thead>
<tr>
<th>Content</th>
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</table>
| • Introductory course  
  o Introduction to Machine Learning and Deep Learning  
  o Introduction to the development tools |
| • Artificial neural networks: perceptron and multilayer perceptron  
  o Artificial neuron model  
  o Perceptron  
  o Multilayer perceptron  
  o Backpropagation algorithm |
| • Convolutional neural Networks  
  o Layers definition  
  o Initialization  
  o Regularization  
  o Explainability |
| • Recurrent Neural Networks  
  o RNN training  
  o LSTM and GRU |
| • Autoencoders  
  o Definition  
  o Sparse, contrastive and denoising autoencoders  
  o Variational autoencoders |
| • Transfer Learning  
  o Some classical deep neural networks  
  o Transfer learning and fine tuning |
| • Matching Networks  
  o Siamese networks  
  o Triplets networks |
| • Generative Adversarial Networks  
  o Definition  
  o Training  
  o Applications |

Upon the end of the module the students will have attained the following subject-matter competencies…

- Understand Machine Learning and Artificial Neural Networks (1)
- Understand Deep Learning paradigm and architectures (1)
- Analyse a classification or regression problem and solve using Deep Learning approaches (3)
- Code and Employ Neural Networks and Deep Learning Architectures (2, 3)

Upon the end of the module the students will have attained the following personal and social competencies…

- Read, write, and present in an academic environment in English language (3).
- Interactively discuss subject-matter topics with other students and reflect their viewpoints (3).
- Organize themselves independently (3)
- Create work results with certain boundary conditions set for a given due date (3).
Textbook/teaching material

- F Chollet, *Deep Learning with Python*, Manning, 2018

Note: this is not the official course descriptor according to the “Studien- und Prüfungsordnung” (SPO)