

Module title Deep Learning – Methods and applications				
Module code Tba.	Level Bachelor (B.Sc.)	Hours per week 4	ECTS credits 5	Duration 14 weeks
Module instructor Prof. Dr. Vincent Barra Clermont-Auvergne University, France		Lecture type Regular lecture, online consultations, Jupyter notebook exercises	Prerequisite(s) Linear Algebra, Optimization, Python	Grading Assignment
Content				
<ul style="list-style-type: none"> • Introductory course <ul style="list-style-type: none"> ◦ Introduction to Machine Learning and Deep Learning ◦ Introduction to the development tools • Artificial neural networks: perceptron and multilayer perceptron <ul style="list-style-type: none"> ◦ Artificial neuron model ◦ Perceptron ◦ Multilayer perceptron ◦ Backpropagation algorithm • Convolutional neural Networks <ul style="list-style-type: none"> ◦ Layers definition ◦ Initialization ◦ Regularization ◦ Explainability • Recurrent Neural Networks <ul style="list-style-type: none"> ◦ RNN training ◦ LSTM and GRU • Autoencoders <ul style="list-style-type: none"> ◦ Definition ◦ Sparse, contrastive and denoising autoencoders ◦ Variational autoencoders • Transfer Learning <ul style="list-style-type: none"> ◦ Some classical deep neural networks ◦ Transfer learning and fine tuning • Matching Networks <ul style="list-style-type: none"> ◦ Siamese networks ◦ Triplets networks • Generative Adversarial Networks <ul style="list-style-type: none"> ◦ Definition ◦ Training ◦ Applications 				
Upon the end of the module the students will have attained the following subject-matter competencies...				
<ul style="list-style-type: none"> • 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...				
<ul style="list-style-type: none"> • 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

- I Goodfellow, Y Bengio and A Courville, A. (2016). *Deep Learning*. MIT Press (<https://www.deeplearningbook.org>)
- S Haykin. *Neural networks and machine learning*, Prentice Hall, 2008.
- F Chollet, *Deep Learning with Python*, Manning, 2018

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