Module Description, available in: EN

Advanced Topics in Deep Learning

General Information

Number of ECTS Credits

3

Module code

TSM_AdvDeLearn

Valid for academic year

2025-26

Last modification

2023-09-18

Coordinator of the module

Thomas Koller (HSLU, thomas.koller@hslu.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction					**X** E 100%		
Documentation					**X** E 100%		
Examination					**X** E 100%		

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Machine Learning Basics, Deep Learning, Programming (Python), Statistics, Linear Algebra

Brief course description of module objectives and content

The purpose of this module is to enhance students' understanding of deep learning techniques.

We will explore significant and current developments in deep learning, including generative models, attention networks, transformers, graph neural networks and other related techniques.

Furthermore, we will examine case studies that pertain to language, speech, or visual processing domains.

Aims, content, methods

Learning objectives and competencies to be acquired

Learning objectives:

- Know the Attention and Transformer architectures and how to use them in different applications.
- Know which architectures are suitable for which kind of machine learning problem
- Know how to apply self-supervised learning and the advantages and disadvantages of this method
- To know and apply the different methods of generative algorithms.
- Know how to interpret and explain results of predictions.

Module content with weighting of different components

- Refresher of basic deep learning methods such as MLP, CNN, RNN, Architectures, Backpropagation etc.
- Attention and transformers: concepts and applications in language and vision domains
- Self-supervised learning: contrastive and non-contrastive methods
- Graph Neural Networks and applications
- Generative models: VAEs, GANs, Diffusion models, Energy models, etc.
- Foundation models, few and zero-shot learning
- Interpretability, Explainability
- Special topics of the year, such as NNs for physical systems, 3D reconstruction, theoretical approaches and other

Teaching and learning methods

- Lectures / presence
- Tutorial / presence
- Exercises / presence
- Self-study

Literature

Assessment

Additional performance assessment during the semester

The module does not contain an additional performance assessment during the semester

Basic principle for exams

As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.

Standard final exam for a module and written resit exam

Kind of exam

Written exam

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

Calculator

Other permissible aids

Notes on Paper (10 pages A4, both sides written on)

Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted