MASTER OF SCIENCE IN ENGINEERING

Deep Learning

TSM-DeLearn

0. Objectives and organisation of the class

Andreas Fischer
Klaus Zahn

We are grateful to J. Hennebert and M. Melchior, that they provided their slides

TSM-DeLearn - organization

- Class
  - Tuesday at 15h00, 3 x 45 minutes with 5 minutes break
  - Tutorial lesson (1 hour per week – t.b.d.) via Zoom; Link: https://hslu.zoom.us/j/66337101880?pwd=b2srcXRZZU8zTmJPMGtMdW9uZTRIQT09
- Teachers
  - andreas.fischer@hefr.ch
  - klaus.zahn@hslu.ch
  - potentially: invited speakers (week # 14)

Weekly class synopsis

class. Concepts + theory +
In-class activities

home. Practical work (repetition)+
reading assignment (preparation)

Practical work organization

1. To be done in a group of max **2**
2. Submit solutions on Moodle (deadline always following Tuesday 15:00)
3. Your reports: **one** zip archive with iPython notebooks, pdf, …

Evaluation

- **Practical work**
  - Pass/Fail
  - You need 75% of homework passed to go to the exam
- **Written exam**
  - 120’ exam (max) with
    - specific questions
    - case-study questions
      - *“Let’s assume this problem, how would you go for developing a solution for it?”*
  - Permissible aids: 1 A4 sheet of paper (front and back) with handwritten notes; no electronic aids, this page is given back to the profs together with the exam

Calendar - may be adapted

Week #	Date	Topic	Lecturer
1	21.02.23	Org. of the class - Introduction	ZaK
2	28.02.23	Learning and Optimisation	ZaK
3	07.03.23	Learning (cont'd) and Shallow Networks	ZaK
4	14.03.23	Model Selection, Performance Measures, Bayes Law	ZaK
5	21.03.23	Curse of Dimensionality, Backpropagation	ZaK
6	28.03.23	Regularisation, Advanced Optimisation Strategies	ZaK
7	04.04.23	Deep Learning Hardware and Software - Frameworks Overview	ZaK
	11.04.23	Easter Break	
8	18.04.23	Convolutional Neural Nets (CNN), Keras API	FiA
9	25.04.23	CNN Advanced Architectures, Hierarchical Features, Visualisation	FiA
10	02.05.23	Transfer Learning, Autoencoders	FiA
11	09.05.23	Recurrent Neural Networks (RNN), Vanilla RNNs, Generative Models	FiA
12	16.05.23	LSTM, Word Embeddings, Attention	FiA
13	23.05.23	Reserve	FiA
14	30.05.23	/Repetition/Invited Speaker	FiA

Learning objectives and acquired competencies

Students will

- have a thorough understanding of **neural network architectures** including convolutional and recurrent networks.

- know **loss functions** (e.g. categorical cross entropy) that provide the optimization objective during training.

- understand the principles of **back propagation**

- know the benefits of **depths and representation learning**.

- have an overview of **open research questions**.

- develop the ability to decide **whether Deep Learning is suitable** for a given task.

- gain the ability to **build and train neural network models** in a Deep Learning Framework such as TensorFlow / Keras.

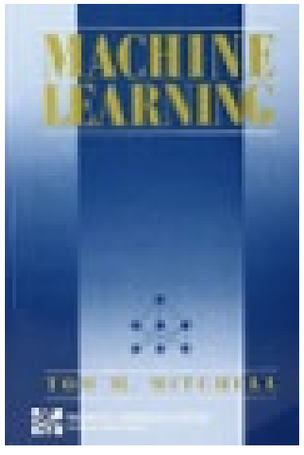
Link to Module Description

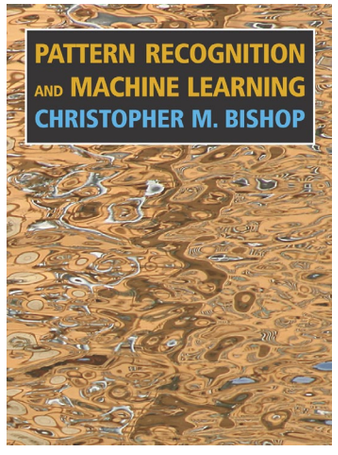
Learning Material

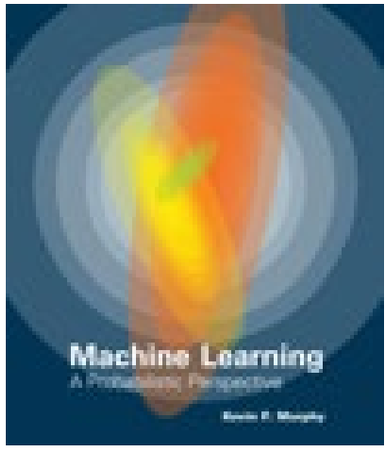
- Lecture Notes
  - Self-consistent presentation of the course content
- Online resources including publications and blog posts
- Books
  - references hereafter and given during class
- All e-documents on moodle.msengineering.ch
  - https://moodle.msengineering.ch/course/view.php?id=2060
  - Title: TSM-DeLearn - Deep Learning
  - Key: moodlemsekey

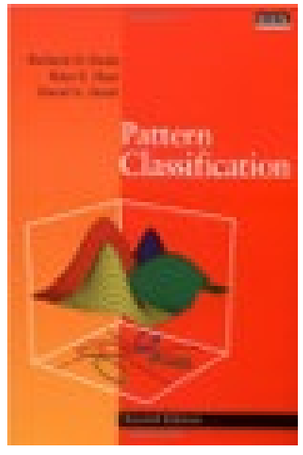
Recommended Literature

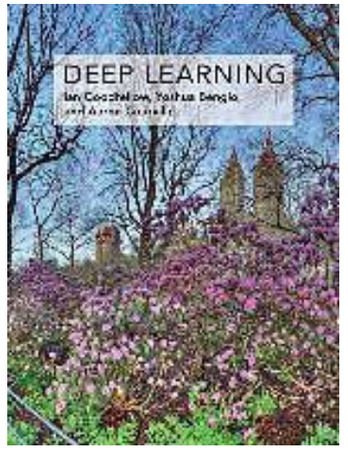
- T. Mitchell, “Machine Learning”, 1997
- C. M. Bishop, “Pattern Recognition and Machine Learning”, 2006
- K. Murphy, “Machine Learning – A Probabilistic Perspective”, 2012
- Duda et al., “Pattern Classification, 2nd Edition”, 2001
- Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, 2015, https://www.deeplearningbook.org/
- A. Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, 2017

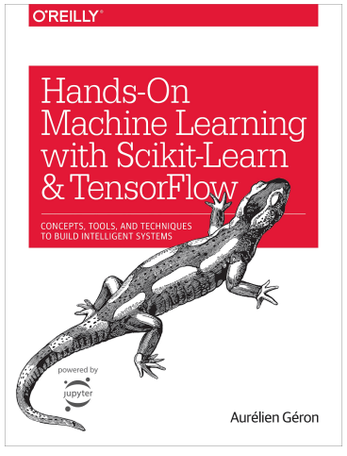












Conventions in slides

Definitions - Blue frames are definitions, i.e. things you should remember all your life :). These definitions are perfect targets for questions in tests or exams, but we do not limit ourselves to theses blue frames.

- When you see this speech bubble, it means *activity time* during the class! For example directed exercises.

This vignette is for remarks

Tools/Tips: red frames are for descriptions of tools or tips for deep learning. They point to hands-on information, useful for your journey as deep learning engineer.