

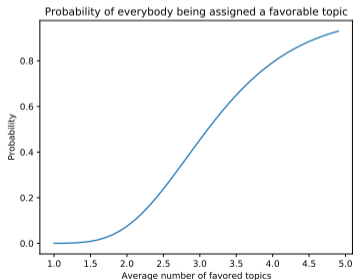


Seminar Neural Networks and Deep Learning



Today

- Kick-Off Meeting
- Some Formalities
- Short Overview of the Topics



- Choose a couple topics
 - Since we are only a few, you can make these requests quite complicated (I prefer topic 1, but I would also take 3 or 7, except when I can do it in german, then I would prefer topic 12)
- Send your choice to Simon.Kluettermann@cs.tu-dortmund.de (till tomorrow 20.10.2021 23:59)
- You will be assigned one in the next days
- Earlier submission will not be preferred, so take your time



Objective of this Seminar

- Introduction to a wide range of machine learning
 - Researching current scientific ideas
 - Understanding state-of-the-art techniques
 - Writing a clear and concise scientific report
 - Presenting and discussing your findings

→Not a bad start for a final thesis.... →maybe just talk to your supervisor about this



Timeline

- 1 3min Presentations in Class (November 2, 15:30-17:00)
 - 2 Presentation in Class (Weekly, Tuesdays 15:30-17:00, starting November 16)
 - 3 Discussion of your Topics (afterwards)
 - 4 Writing of your Report (till two weeks after your Presentation)
- All parts required!

 - Everything will be done in english. If this is a problem for you, please write Simon.Kluettermann@cs.tu.dortmund.de



Tasks of this Seminar

- 1 Choose a couple of topics from our list, you will be assigned to one of them
- 2 Read and understand the chapters given to you
- 3 Find, read and understand related literature. Try to get a wide picture of your Topic.
 - You will often find alternative sources
 - Some Topics include a programming sections, but for all topics some programming can be useful.
- Final Results:
 - Presentation (30min +10min questions)
 - Written Report (at least 6 Pages double column, ACM template equivalent. Imagine yourself explaining your Topic to another student)



Topics

- Based on a Book "Neural Networks and Deep Learning"
- by C. Aggarwal, ISBN 978-3-319-94463-0
- Freely available through University Network (Springer Link)
- Some Topics contain programming assignments. We suggest using google colab for them.

Week 1: November 9

Topic1: Basics of NN, Feed Forward Networks, loss functions and activations
Chapters 1.2,1.4,1.5 and train a simple Dense Neural Network on MNIST

Topic2: Alternative Models, Least Square Regression and SVMs
Chapters 2.1-2.4

Week 2: November 16

Topic1: What is Backpropagation?

Chapters 3.1,3.2 and 3.7

Topic2: How to use Backpropagation

Chapters 3.3-3.6

Week 3: November 23

Topic1: Methods against overfitting: Regularisation, Early Stopping and Ensemble Methods
Chapters 4.4-4.6

Topic2: Advanced training methods: Continuation/Curriculum Learning, Parameter Sharing
and Pretraining
Chapters 4.7-4.9

Week 4: November 30

Topic1: What are recurrent NN and Echo State Networks/Reservoir Computing
Chapters 7.1-7.4 also train a simple RNN

Topic2: Compare LSTMs and GRUs
Chapters 7.5 and 7.6, also briefly summarize 3 applications for RNNs (see for example Chapter 7.7)

Week 5: December 7

Topic1: Convolutions in Practice

Chapter 8.2, the Introductions to convolutions from AIMA4, pages 811-813 and train a simple convolutional neural network on MNIST

Topic2: Convolutions in Theory

Chapters 8.1, 8.3 and briefly summarize 3 applications (see for example chapter 8.6)



Week 6: December 14

Topic1: Hopfield Networks and Boltzmann Machines

Chapters 6.1-6.4 and briefly summarize 1-2 applications (see for example chapter 6.5) or implement a simple model

Topic2: Graph Machine Learning

Chapter 2.7 + 1 other source, my suggestions: distill.pub on GNN

Week 7: December 21

Topic1: Explaining Autoencoders

Chapter 2.5 and train a simple Autoencoder on MNIST

Topic2: Advanced Autoencoder concepts

Chapters 4.10 and 8.5



Week 8: January 11

Topic1: Introduction to Reinforcement Learning

Chapters 9.1-9.4 also implement an RL algorithm for a simple game

Topic2: Advanced RL algorithms

Chapters 9.5, 9.6 and briefly summarize 3 applications for RL (for example Chapter 9.7)



Week 9: January 18

Topic1: GANs

Chapter 10.4 and train a simple GAN on MNIST

Topic2: A brief summary of unsupervised Machine Learning

A Paper, for example "A Survey on Unsupervised Machine Learning Algorithms for Automation, Classification and Maintenance" by Khanum et al 2015



Week 10: January 25

Topic1: Attention Mechanisms

Chapters 10.2 and look for alternative sources!

Topic2: Competitive Learning

Chapters 10.5 and look for alternative sources!



- Week 1: Intro to ML *2
- Week 2: Backpropagation *2
- Week 3: Training techniques *2
- Week 4: Recurrent NN *2
- Week 5: Convolutions *2
- Week 6: Boltzmann Machines, Graph ML
- Week 7: Autoencoders *2
- Week 8: Reinforcement Learning *2
- Week 9: GANs, unsupervised ML
- Week 10: Attention Mechanisms and Competitive Learning