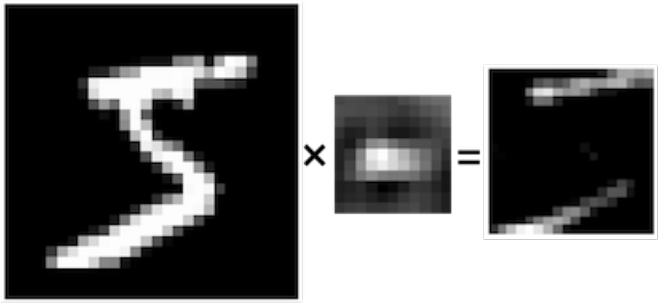
Universität Potsdam

Introduction to Deep Learning

Opening Session



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15. October 2018

Getting to know each other

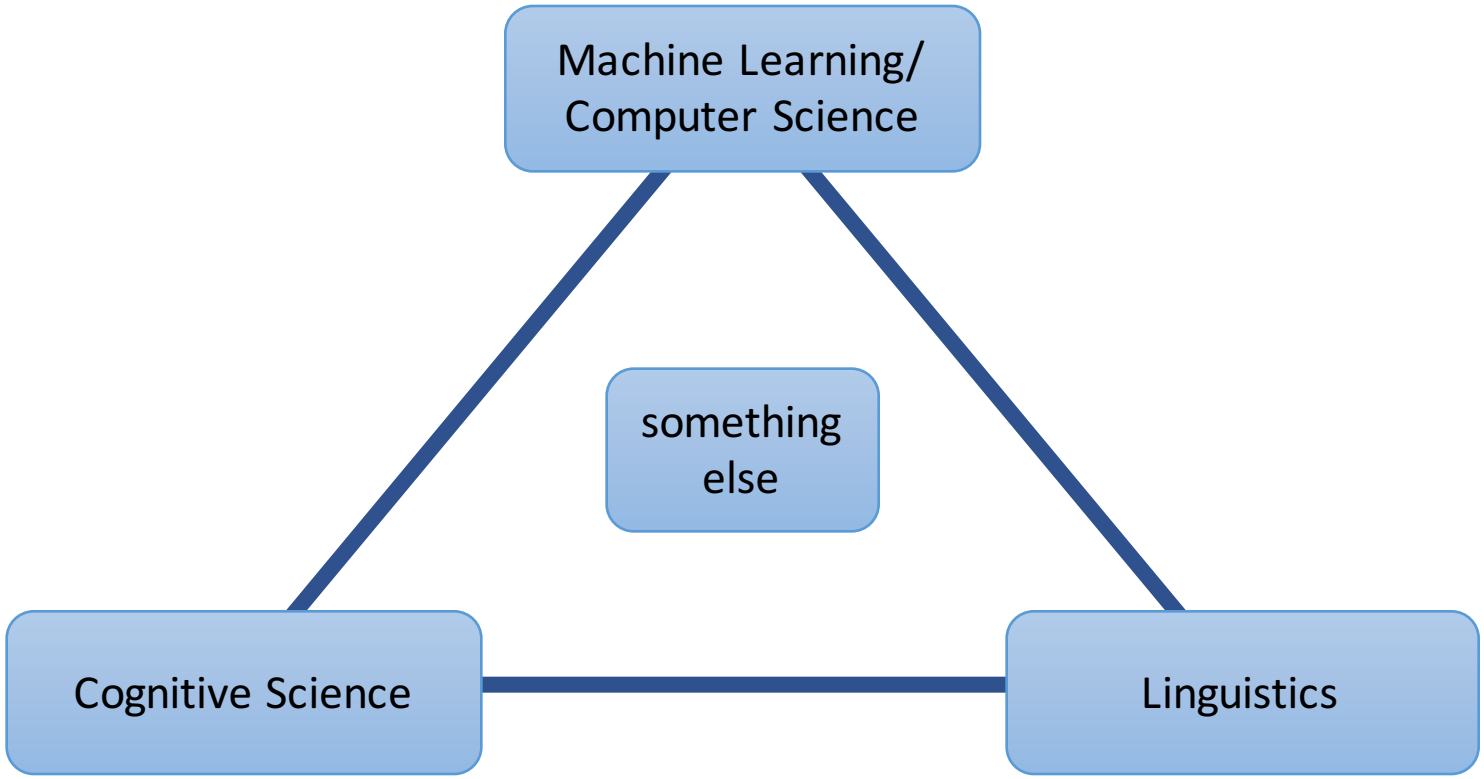
"living statistics"

Get to know each other

How long have you studied already
(Bachelor + Master + PhD)?

Get to know each other

What's your background/What did you study?



Get to know each other

How experienced are you in Machine Learning?

Get to know each other

How experienced are you in
Deep Learning (and in Tensorflow)?

Get to know each other

About me:

- Background in Bioinformatics
  - Mathematical modelling
  - Network analysis & optimization
- Since 2016 PhD student
  - Deep generative models
    (teaching “Learning Generative Models” class)
  - Introspection for deep neural networks

Deep Learning

a brief introduction

Typical Machine Learning Workflow (for classification)

make use of domain knowledge from experts

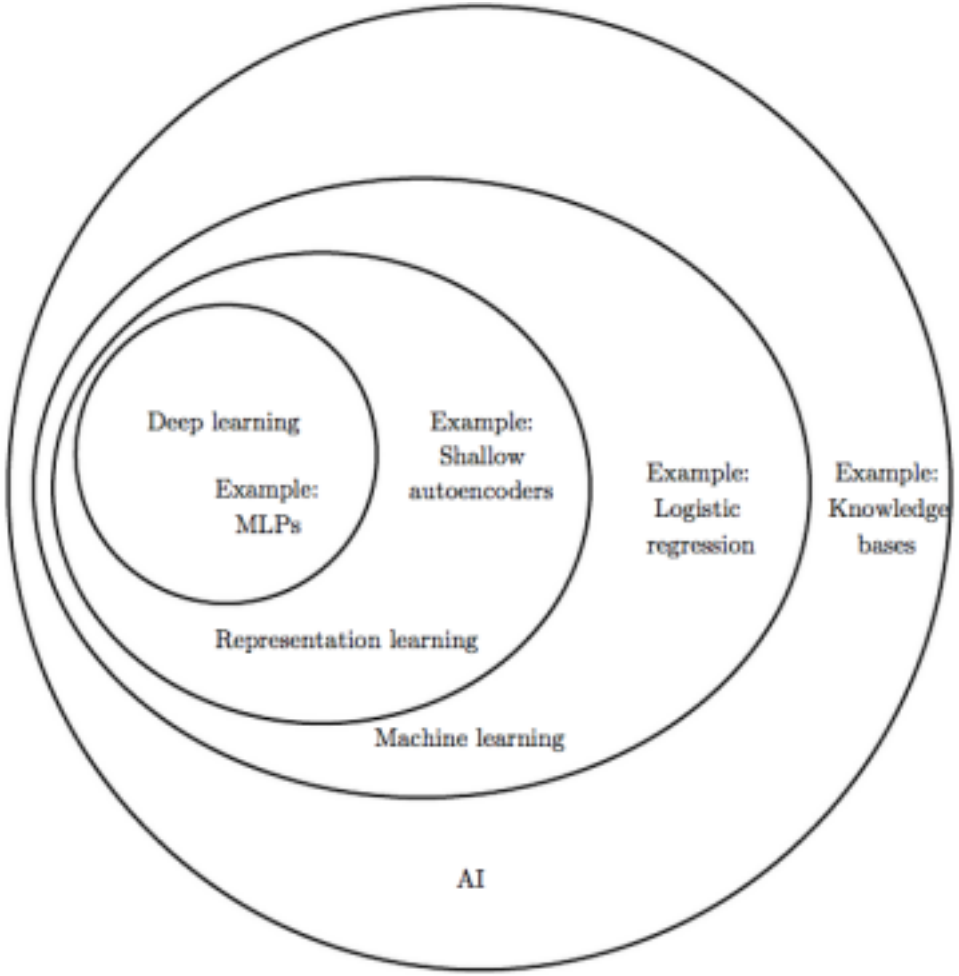
train with labeled data (supervised)

Typical Deep Learning Workflow (for classification)

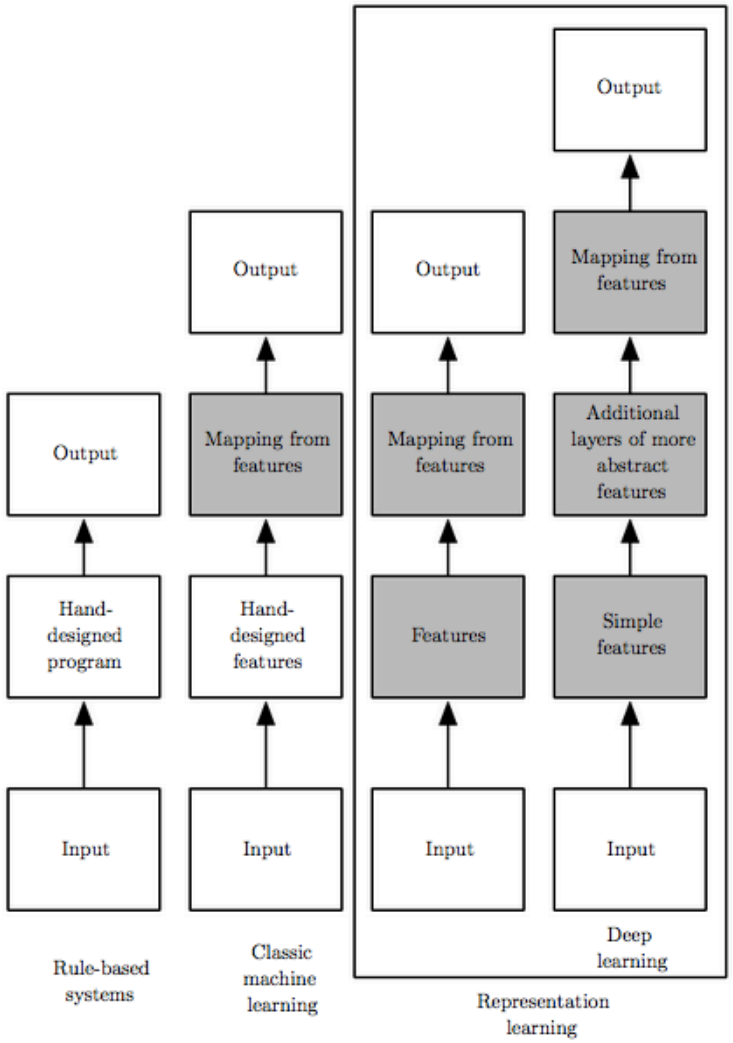
make use of abundant data and (GPU) compute power

e.g., “pre-train” with unlabeled data (unsupervised)

train with labeled data (supervised)



[deeplearningbook.org]

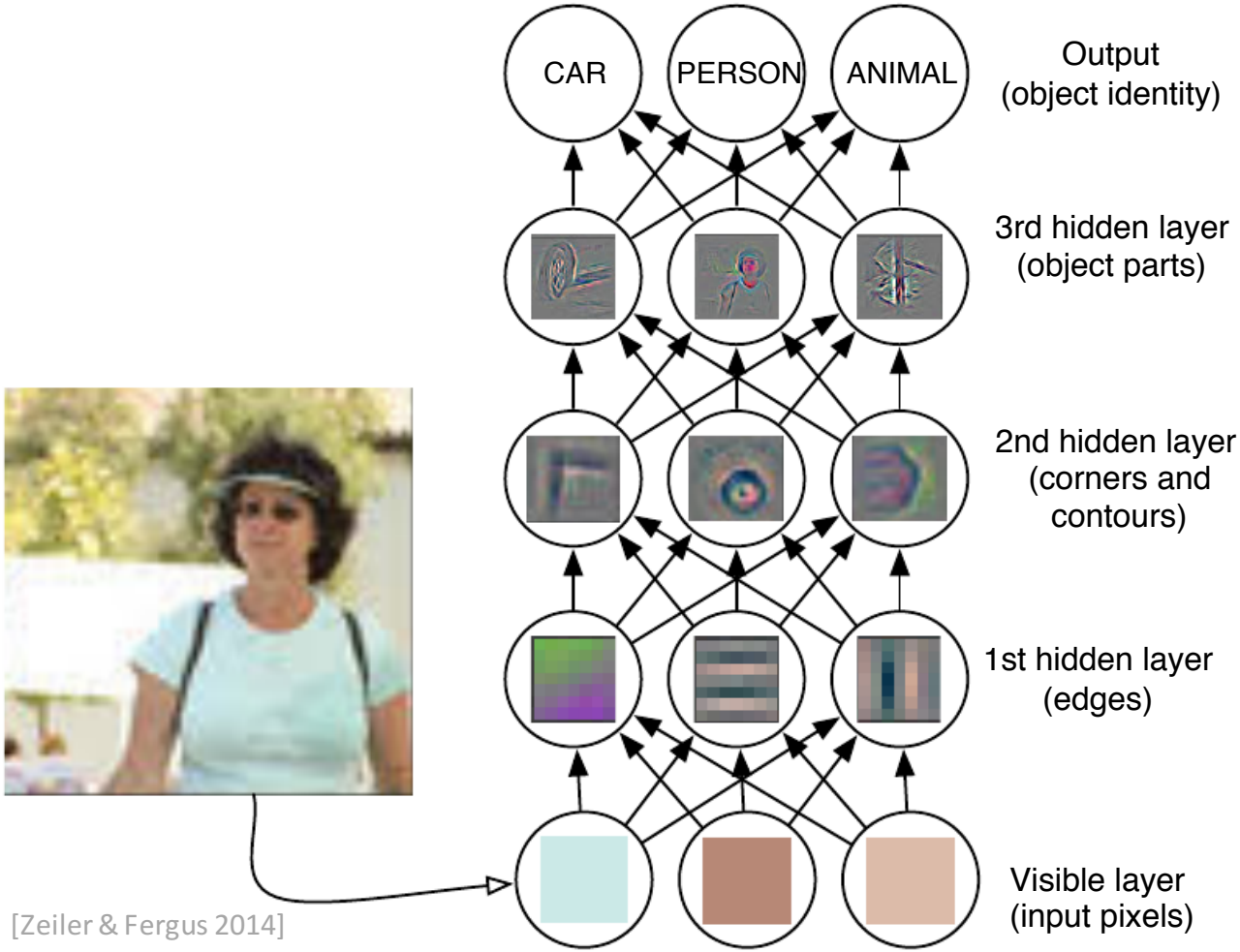


[deeplearningbook.org]

The Promise of Deep Learning

- learn suitable feature representations along with the actual learning task
- using a general-purpose learning procedure

An example Deep Net



[Zeiler & Fergus 2014]

Course design

What do you expect?

Group task:

1. Writing down expectations for the course individually
   ~5min
2. Discuss and collect within the group
   ~10min
3. Collecting the expectations on a flip chart/board
   ~10min

Group task: individual stage

What are your expectations for this course?

For example regarding:

- topics
- skills
- course format
- lecturer

Group task: group stage

Asking each in turn to

1. briefly introduce yourself
2. share your expectations

In the group

1. discuss about uncertainties
2. collect & order the flash cards

Group task: panel stage

- each group
  - shortly present your collection
  - pin the flash cards to the blackboard

Learning Goals

At the end of the course, you are able to …

- **confidently** apply DL techniques to develop a solution for a given problem
- follow recent DL publications and **critically** assess their contributions
- formulate **hypotheses** and design & conduct DL experiments to **validate** them
- **document** progress & design decisions for **reproducibility** and transparency

Please add your goals!

Course Format

this course may not be suitable for …

- mere credit collectors
- passive attendees
- remote students

end of withdrawal period:
November 20, 2018

The Nuremberg Funnel (1647)

→ This is **not** how you will learn…

you will need to **participate**

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What is the course workload?

Preparation	In Class	Practical Work
(session summary)	"last episode on IDL" (3-min summary)	weekly exercise assignments (until week 7 or 8)
reading: • book chapters • papers • blogs	literature discussion / Q&A small-group activity (25-60 min)	channel discussions
channel discussions		course project working in teams • 2-4 team members • scrum-style weekly sprints • team progress blog
weekly blog posts • new insights • hints, tricks & hacks • open questions	project / assignments discussion / Q&A (25-60 min)	
3-6h per week →	**150h total**	← 3-6h per week

grading: oral exam (20-30 min)

Topics (tentative)

- MLPs, Gradient Descent & Backpropagation
- Convolutional Neural Networks
- Recurrent/Recursive Neural Networks
- Auto-Encoders
- Regularization Techniques
- Advanced Regularization Techniques
- Introspection & Inception
- Optimization Techniques
- Advanced Training Strategies

Online Tools

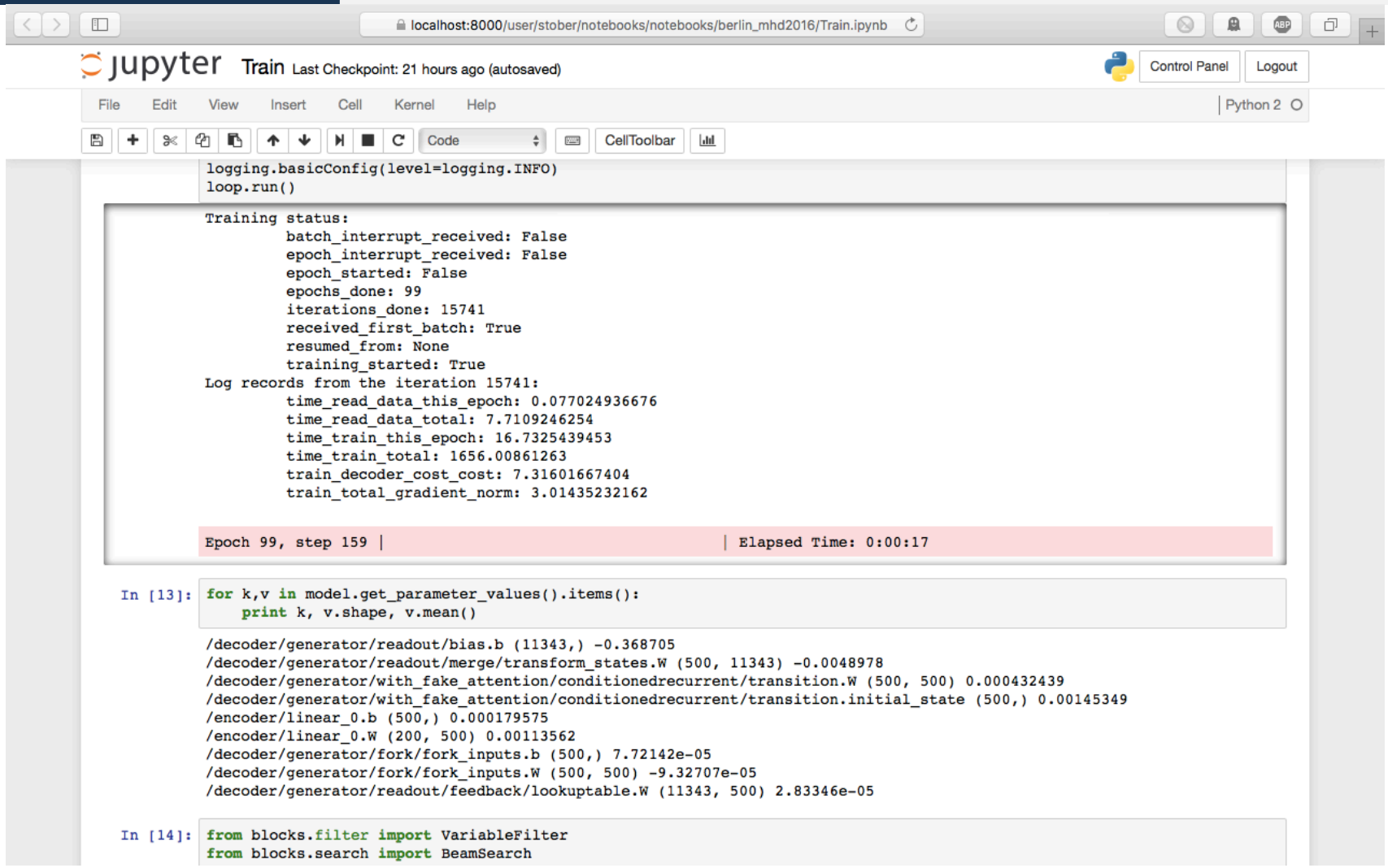
- Mattermost (~Slack) channel
  - channels (course / personal / team)
  - Messaging
- Campus.UP workspace
  - blogs (course / personal / team)
  - forum
  - wiki
- GPU compute environment
  - shell access & jupyterhub for notebooks

GPU Compute Servers

10 GPU Compute Servers

- 8 Pascal Geforce 1080 Ti GPUs
- 256 GB RAM
- 24 CPU cores
- jupyterhub server for notebooks
- fully dockerized

Jupyterhub


localhost:8000/user/stober/notebooks/notebooks/berlin_mhd2016/Train.ipynb
jupyter Train Last Checkpoint: 21 hours ago (autosaved)
Control Panel
Logout
File Edit View Insert Cell Kernel Help
Python 2
Code
CellToolbar
logging.basicConfig(level=logging.INFO)
loop.run()
Training status:
batch_interrupt_received: False
epoch_interrupt_received: False
epoch_started: False
epochs_done: 99
iterations_done: 15741
received_first_batch: True
resumed_from: None
training_started: True
Log records from the iteration 15741:
time_read_data_this_epoch: 0.077024936676
time_read_data_total: 7.7109246254
time_train_this_epoch: 16.7325439453
time_train_total: 1656.00861263
train_decoder_cost_cost: 7.31601667404
train_total_gradient_norm: 3.01435232162
Epoch 99, step 159 |
| Elapsed Time: 0:00:17
In [13]:
for k,v in model.get_parameter_values().items():
print k, v.shape, v.mean()
/decoder/generator/readout/bias.b (11343,) -0.368705
/decoder/generator/readout/merge/transform_states.W (500, 11343) -0.0048978
/decoder/generator/with_fake_attention/conditionedrecurrent/transition.W (500, 500) 0.000432439
/decoder/generator/with_fake_attention/conditionedrecurrent/transition.initial_state (500,) 0.00145349
/encoder/linear_0.b (500,) 0.000179575
/encoder/linear_0.W (200, 500) 0.00113562
/decoder/generator/fork/fork_inputs.b (500,) 7.72142e-05
/decoder/generator/fork/fork_inputs.W (500, 500) -9.32707e-05
/decoder/generator/readout/feedback/lookuptable.W (11343, 500) 2.83346e-05
In [14]:
from blocks.filter import VariableFilter
from blocks.search import BeamSearch

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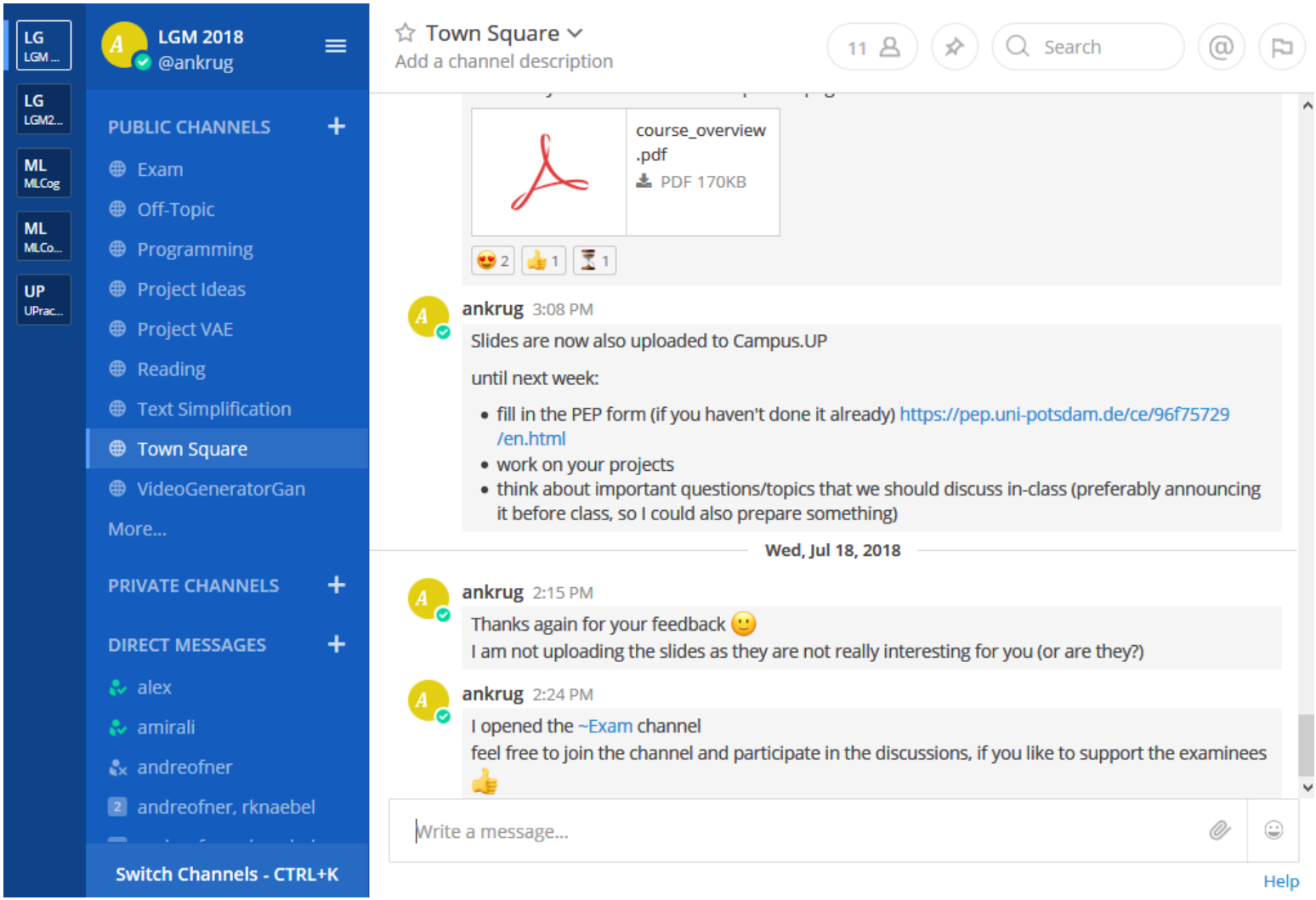
Mattermost Channel



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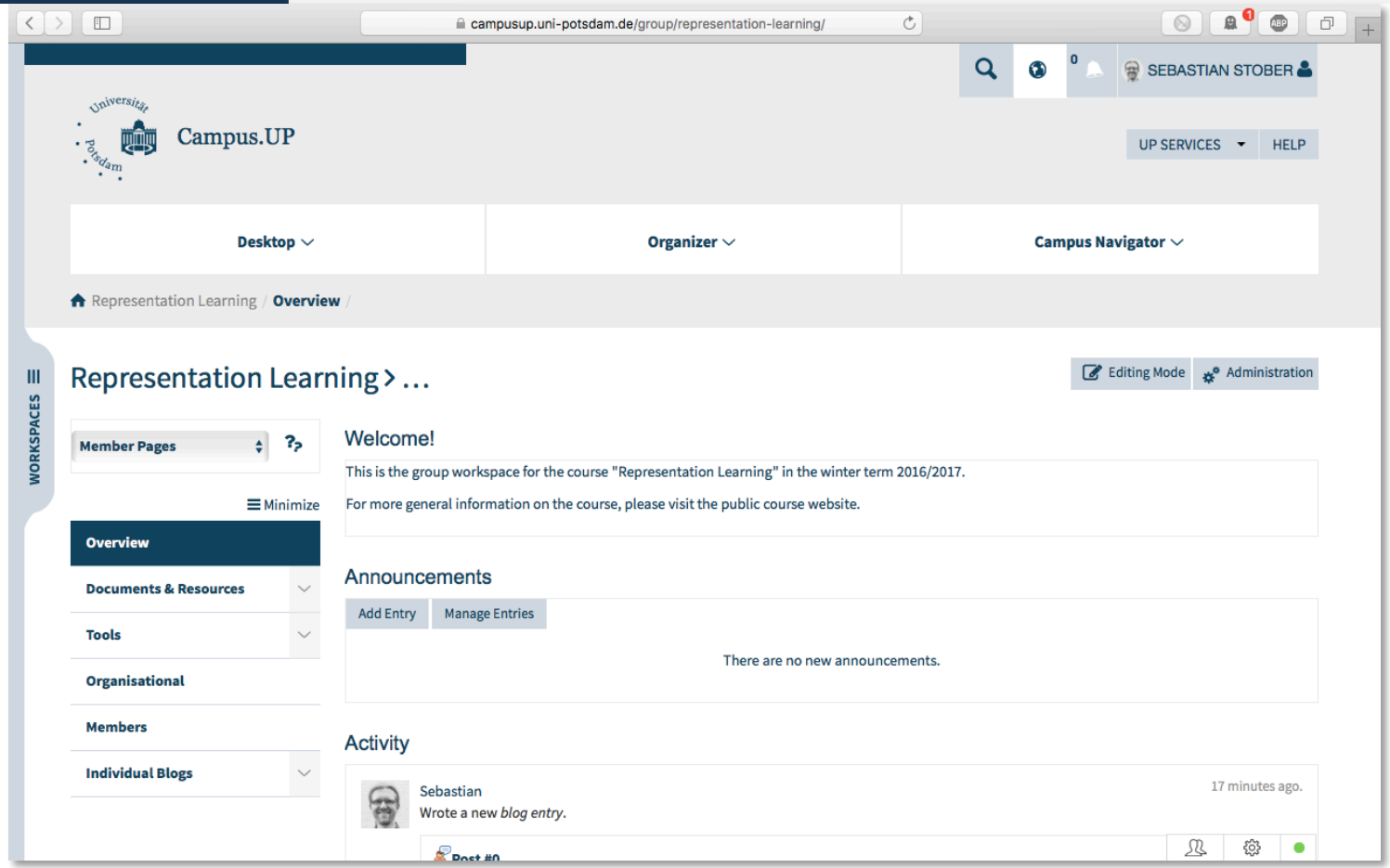
Campus.UP Workspace



https://campusup.uni-potsdam.de

Session Summaries

last episode on
“Introduction to Deep Learning”
…

- rotating job!
  (2 persons per session)

- short summary in course Wiki
  + 3-min intro recap at next session
  - key topics
  - results of the discussion
  - optional photos

Q&A Channel

- guide for what is covered in class
  deadline: Friday noon (12:00)

- do not hesitate to post questions!
  (If you got one, you are probably not the only one!)

- post a comment if you know the answer

Contribute

- ask – in your channel and Q&A
- comment / like / rate
- answer
- document
  - hints, tricks & hacks
- recommend
  - additional readings (papers, blogs, etc.)
- give (constructive) feedback

Programming exercises

- programming exercises are mandatory!
- solutions need to be submitted by Sunday 18:00 (day before lecture)
- you should be able to present your solution in course (random selection)
- 1 missed exercise can be excused
- more than 1 missed exercise leads to exclusion from course by November 20!

Questions?

Assignments until next week

- Join Campus.UP Workspace
  "Introduction to Deep Learning WS2018"
  https://campusup.uni-potsdam.de/group/introduction-to-deep-learning-ws2018/
  - introduce yourself in a short blog post including Picture, Name, Background, Motivation
- Join Mattermost
  find the link on Campus.UP or ask me via Mail (I don't want this to be available for everyone)
- Reading:
  MLPs, Gradient Descent & Backpropagation
- Programming exercise:
  First steps in Tensorflow

Slides & assignments on:
https://mlcogup.github.io/idl_ws18/