

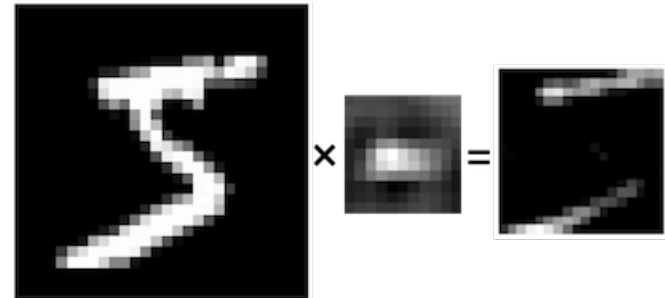
# Introduction to Deep Learning

## Opening Session

Andreas Krug, M.Sc.

[ankrug@uni-potsdam.de](mailto:ankrug@uni-potsdam.de)

15. October 2018



# Getting to know each other

“living statistics”

# Get to know each other

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

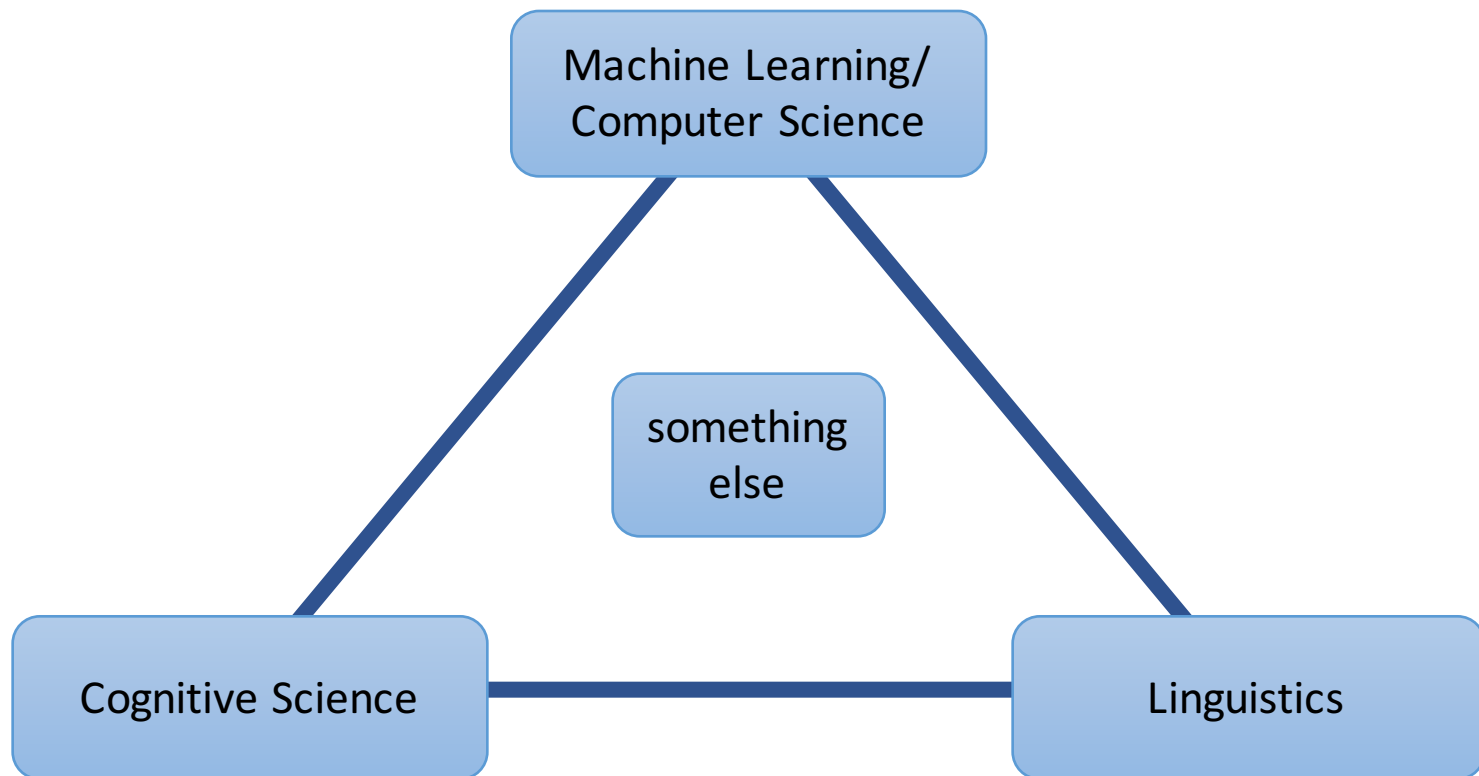
less  
time



more  
time

# 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?

less experienced  more experienced

# Get to know each other

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

less experienced  more experienced

# 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

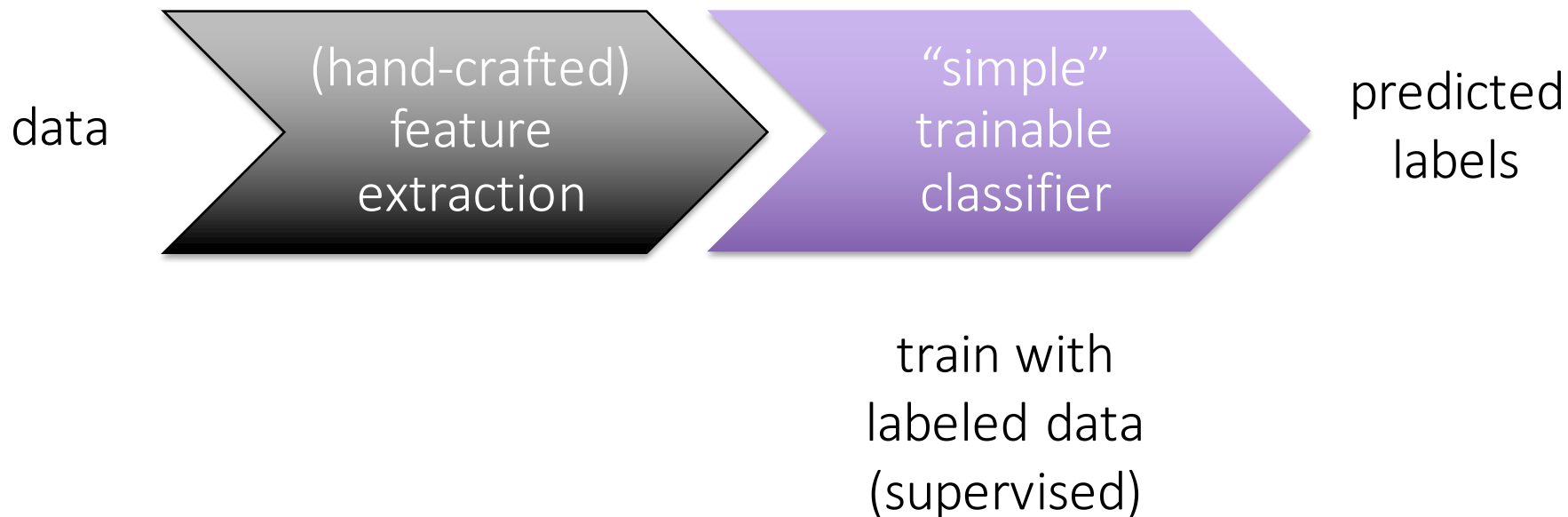
# Deep Learning

a brief introduction



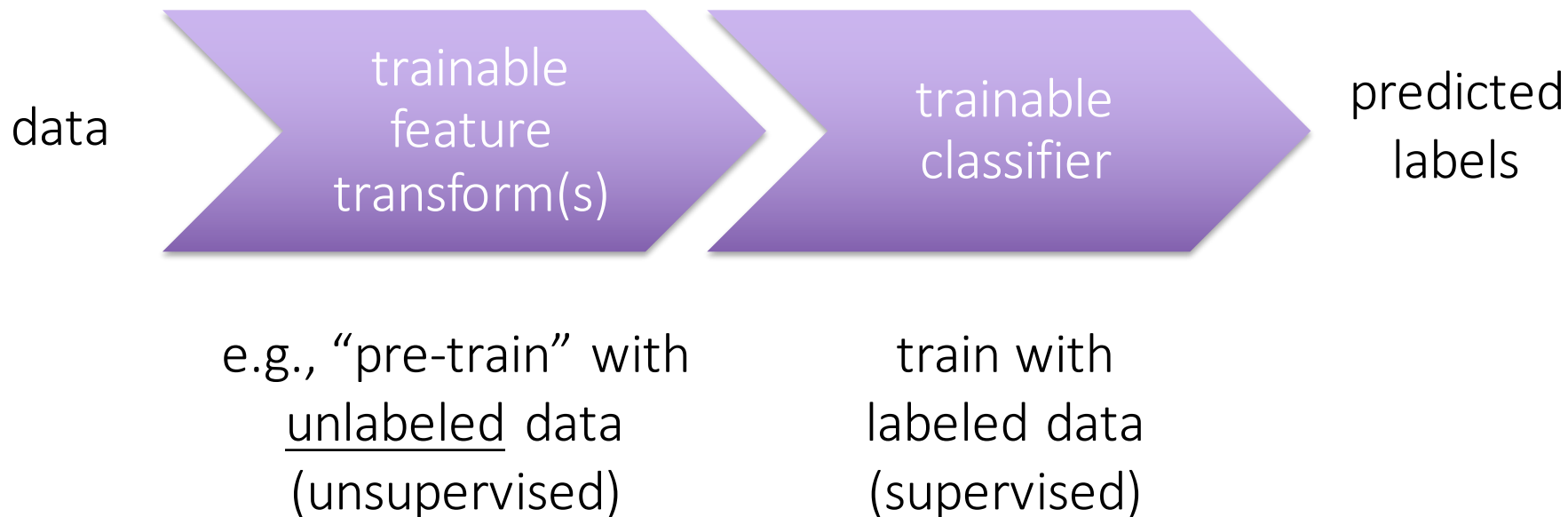
# Typical Machine Learning Workflow (for classification)

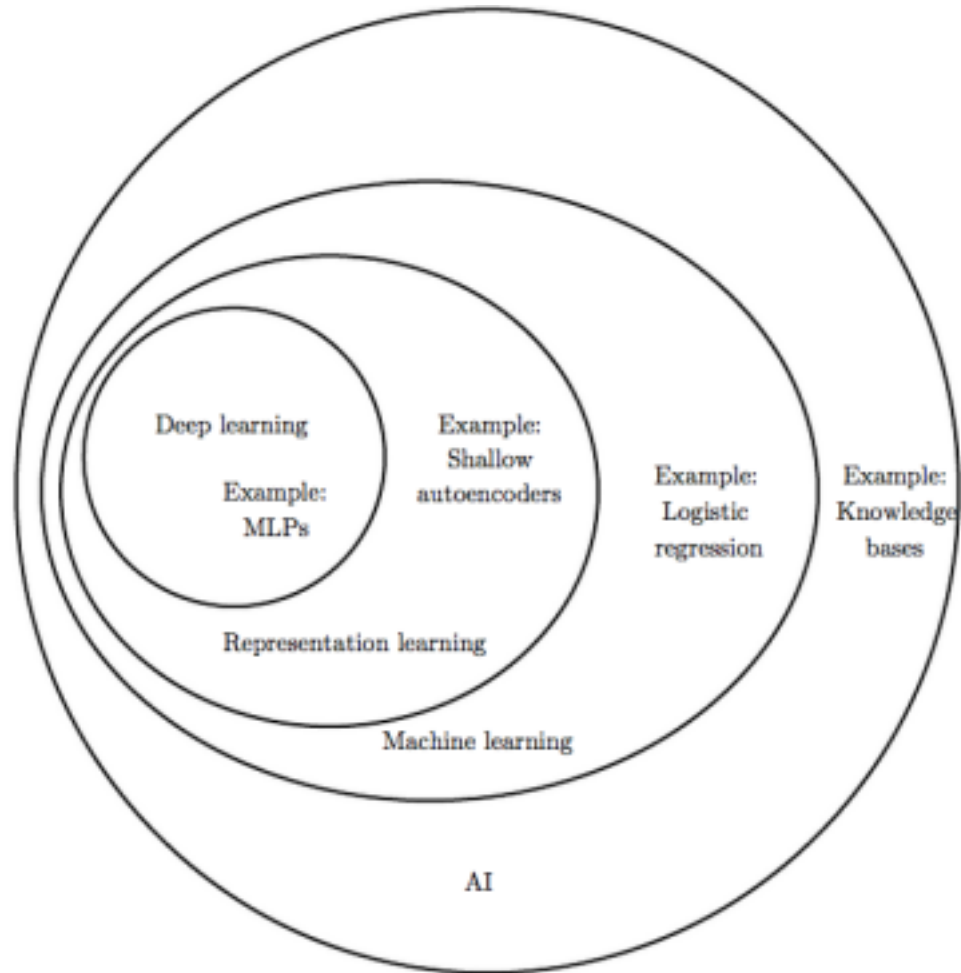
make use of domain  
knowledge from experts



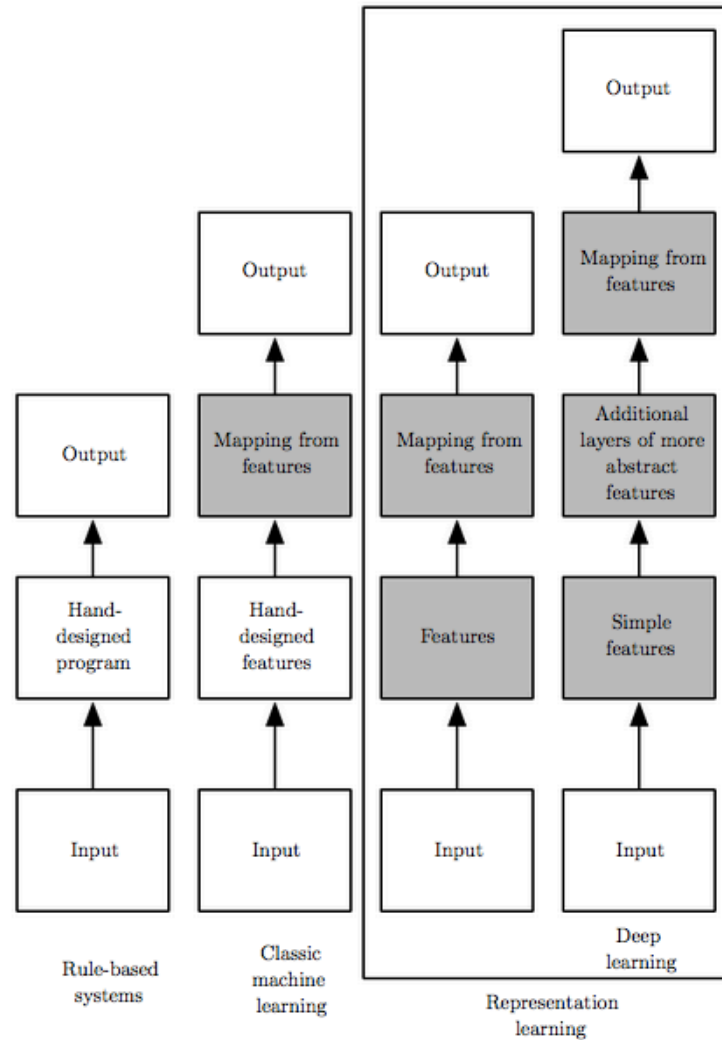
# Typical Deep Learning Workflow (for classification)

make use of abundant data  
and (GPU) compute power





[deeplearningbook.org]

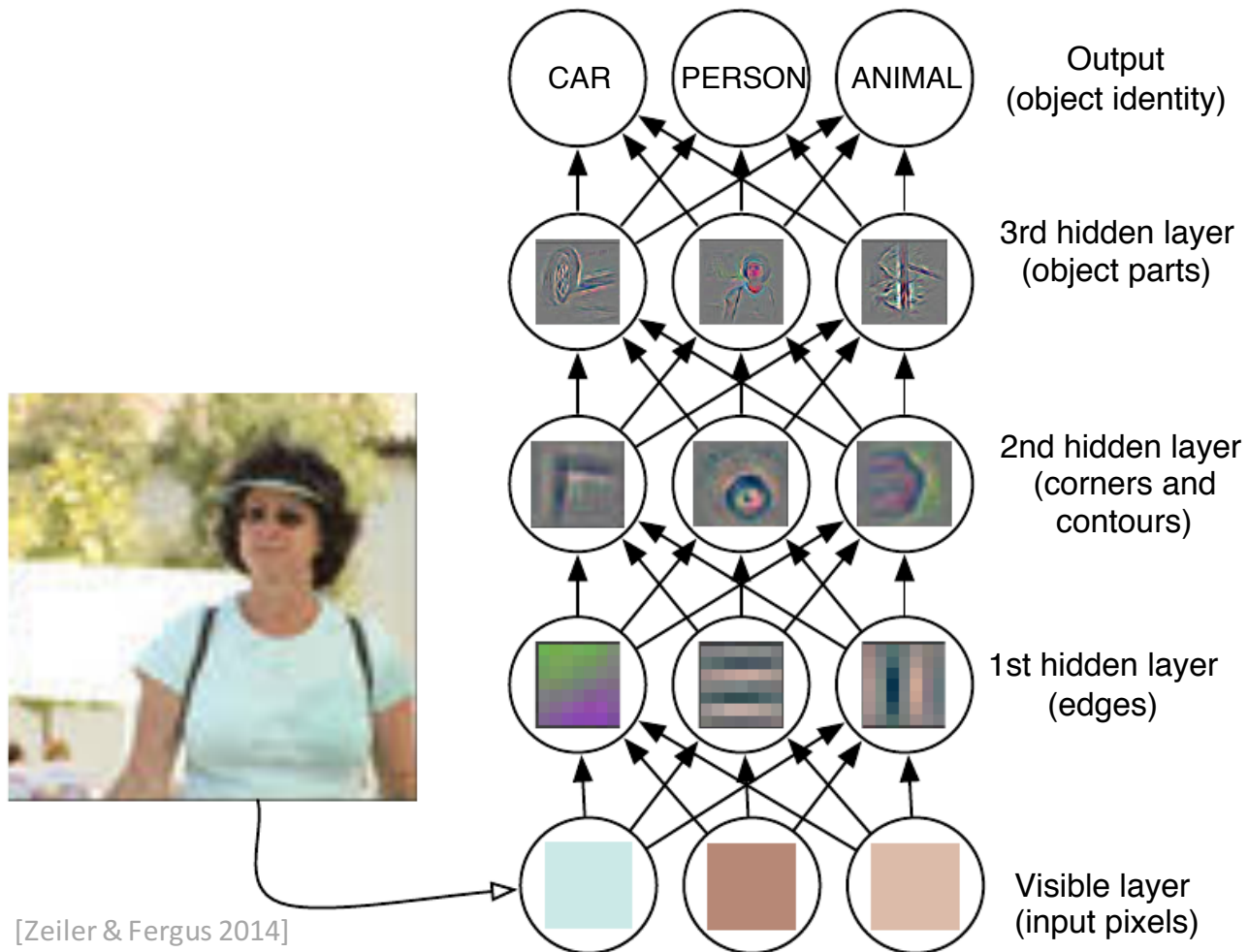


[deeplearningbook.org]

# 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



# 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

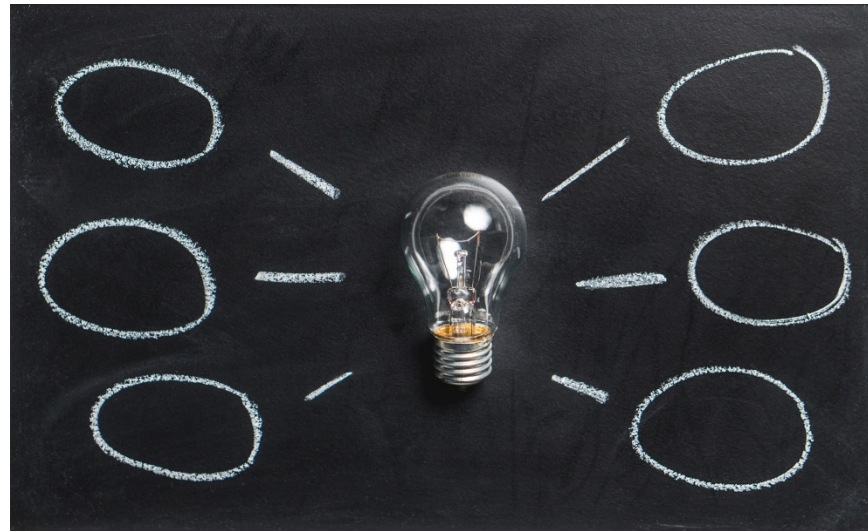
In the group

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



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

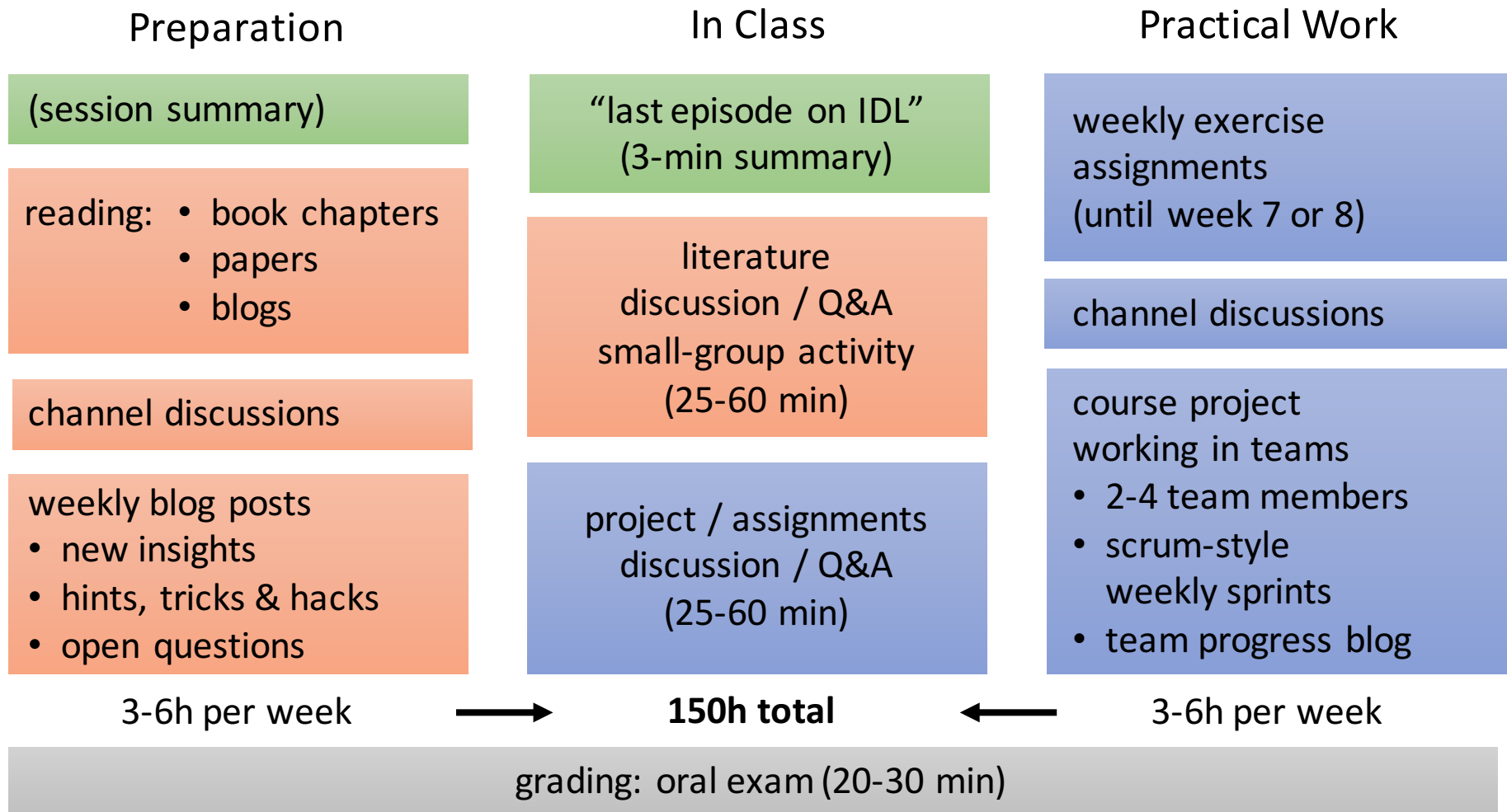
end of withdrawal period:  
November 20, 2018



→ This is **not** how you will learn...  
you will need to **participate**

The Nuremberg Funnel (1647)

# What is the course workload?



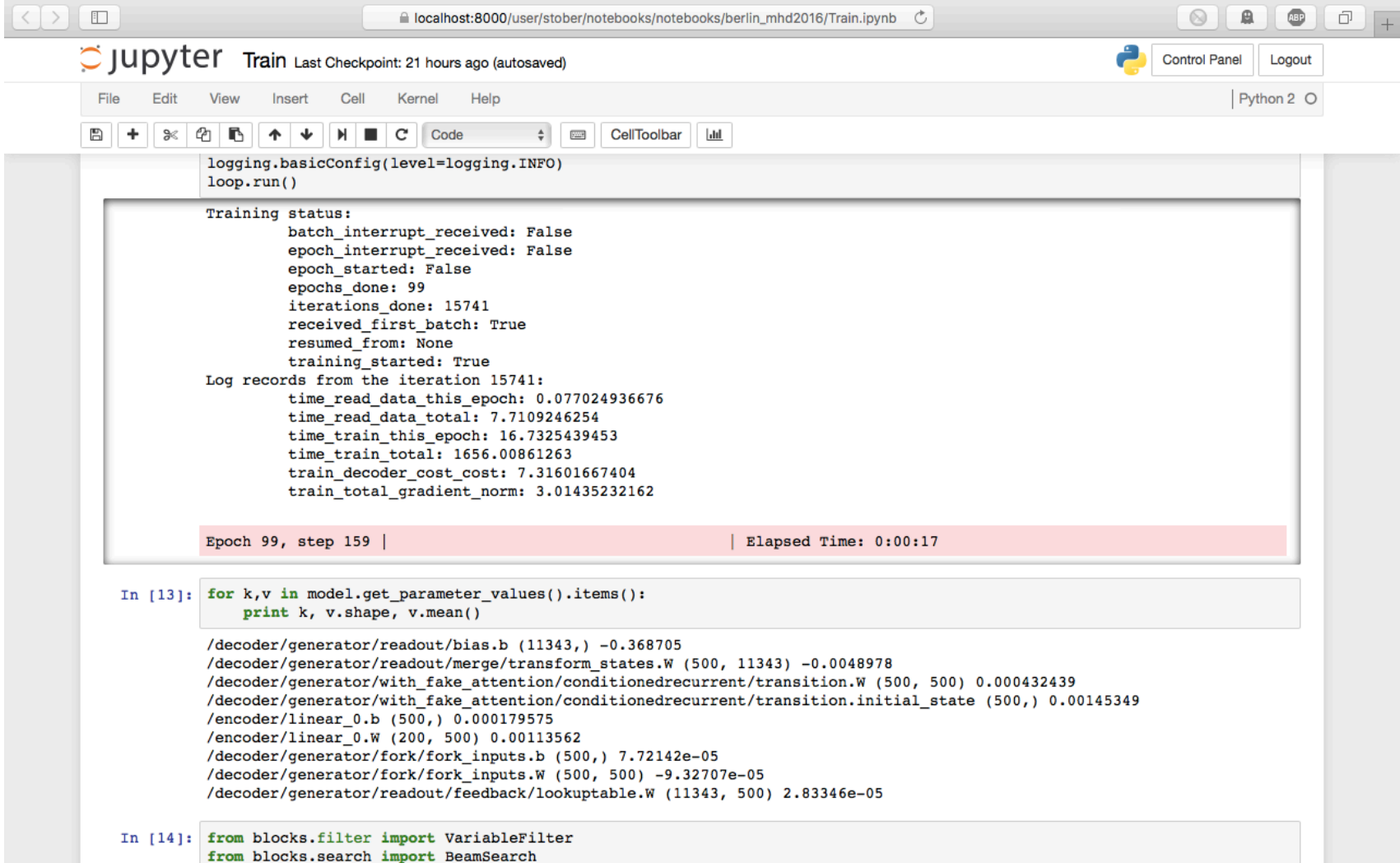
- MLPs, Gradient Descent & Backpropagation
- Convolutional Neural Networks
- Recurrent/Recursive Neural Networks
- Auto-Encoders
- Regularization Techniques
- Advanced Regularization Techniques
- Introspection & Inception
- Optimization Techniques
- Advanced Training Strategies

- 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



## 10 GPU Compute Servers

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



The screenshot shows a Jupyter Notebook interface with the following components:

- Browser Address Bar:** localhost:8000/user/stober/notebooks/notebooks/berlin\_mhd2016/Train.ipynb
- Jupyter Header:** jupyter Train Last Checkpoint: 21 hours ago (autosaved) [Control Panel] [Logout]
- Menu Bar:** File Edit View Insert Cell Kernel Help
- Toolbar:** Includes icons for saving, opening, and running code, along with a dropdown menu set to 'Code'.
- Code Cell:**

```
logging.basicConfig(level=logging.INFO)
loop.run()

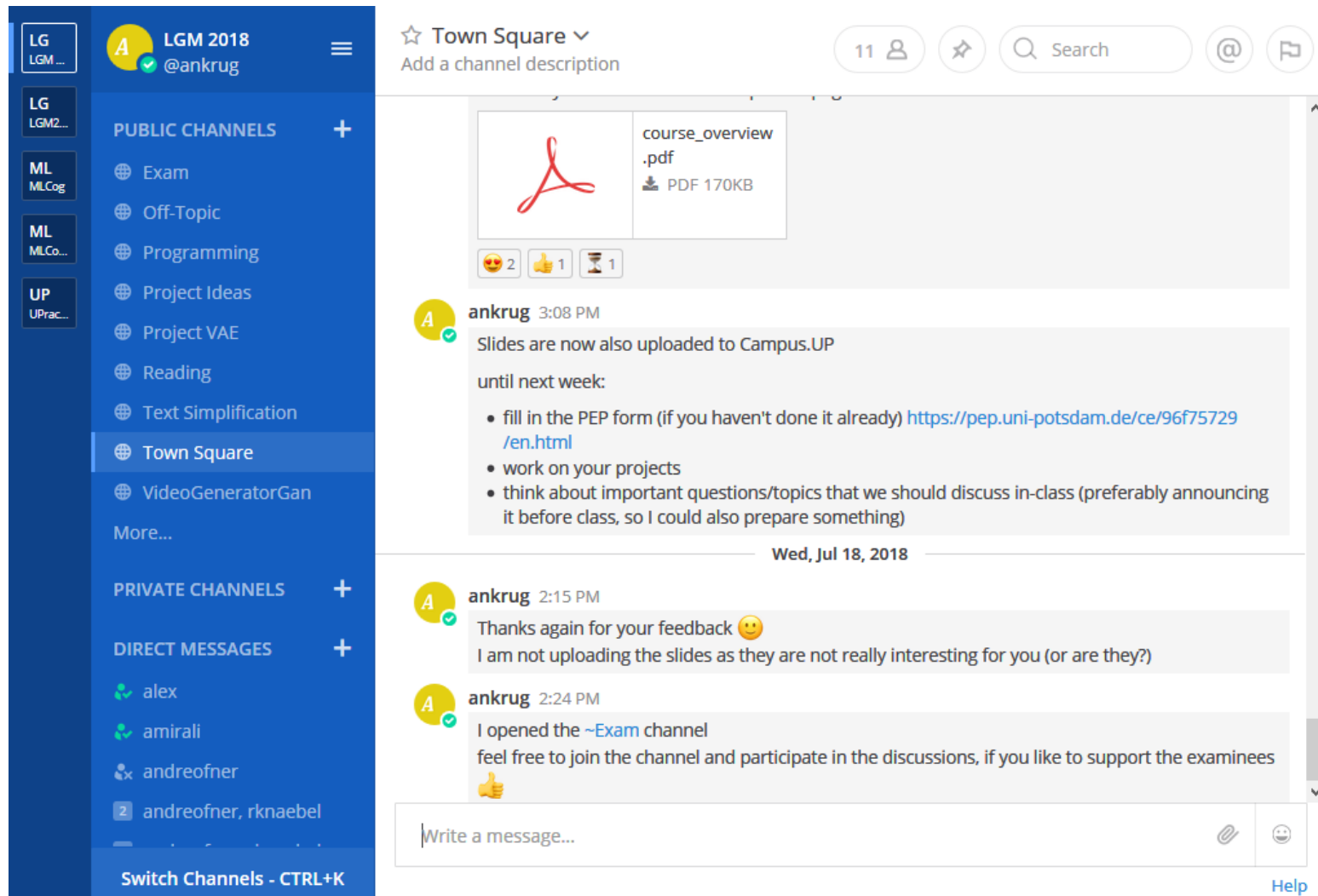
Training status:
  batch_interrupt_received: False
  epoch_interrupt_received: False
  epoch_started: False
  epochs_done: 99
  iterations_done: 15741
  received_first_batch: True
  resumed_from: None
  training_started: True
Log records from the iteration 15741:
  time_read_data_this_epoch: 0.077024936676
  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
```
- Execution Status Bar:** Epoch 99, step 159 | Elapsed Time: 0:00:17
- Code Cell [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
```
- Code Cell [14]:**

```
from blocks.filter import VariableFilter
from blocks.search import BeamSearch
```

# Mattermost Channel



The screenshot shows the Mattermost web interface. On the left is a sidebar with a list of channels and direct messages. The main area displays the 'Town Square' channel, which has 11 members. A PDF file named 'course\_overview.pdf' (170KB) has been uploaded. Below the upload, there are reaction buttons (emojis) and a message from 'ankrug' at 3:08 PM. The message states that slides are now uploaded to Campus.UP until next week and lists three bullet points: fill in the PEP form, work on projects, and think about important questions/topics. A date separator 'Wed, Jul 18, 2018' is shown. Below this, there are two more messages from 'ankrug': one at 2:15 PM thanking for feedback and another at 2:24 PM announcing a new channel for exam support.

**Left Sidebar:**

- LG LGM...
- LG LGM2...
- ML MLCo...
- ML MLCo...
- UP UPPrac...
- PUBLIC CHANNELS** +
  - Exam
  - Off-Topic
  - Programming
  - Project Ideas
  - Project VAE
  - Reading
  - Text Simplification
  - Town Square**
  - VideoGeneratorGan
  - More...
- PRIVATE CHANNELS** +
- DIRECT MESSAGES** +
  - alex
  - amirali
  - andreofer
  - andreofer, rknaebel
- Switch Channels - CTRL+K

**Channel Header:**

☆ Town Square ▾  
Add a channel description

11 👤 ⭐ 🔍 Search @ 📎

**Upload:**

course\_overview.pdf  
PDF 170KB

👍 2 🙌 1 🕒 1

**Message 1:**

**ankrug** 3:08 PM  
Slides are now also uploaded to Campus.UP until next week:

- fill in the PEP form (if you haven't done it already) <https://pep.uni-potsdam.de/ce/96f75729/en.html>
- work on your projects
- think about important questions/topics that we should discuss in-class (preferably announcing it before class, so I could also prepare something)

Wed, Jul 18, 2018

**Message 2:**

**ankrug** 2:15 PM  
Thanks again for your feedback 😊  
I am not uploading the slides as they are not really interesting for you (or are they?)

**Message 3:**

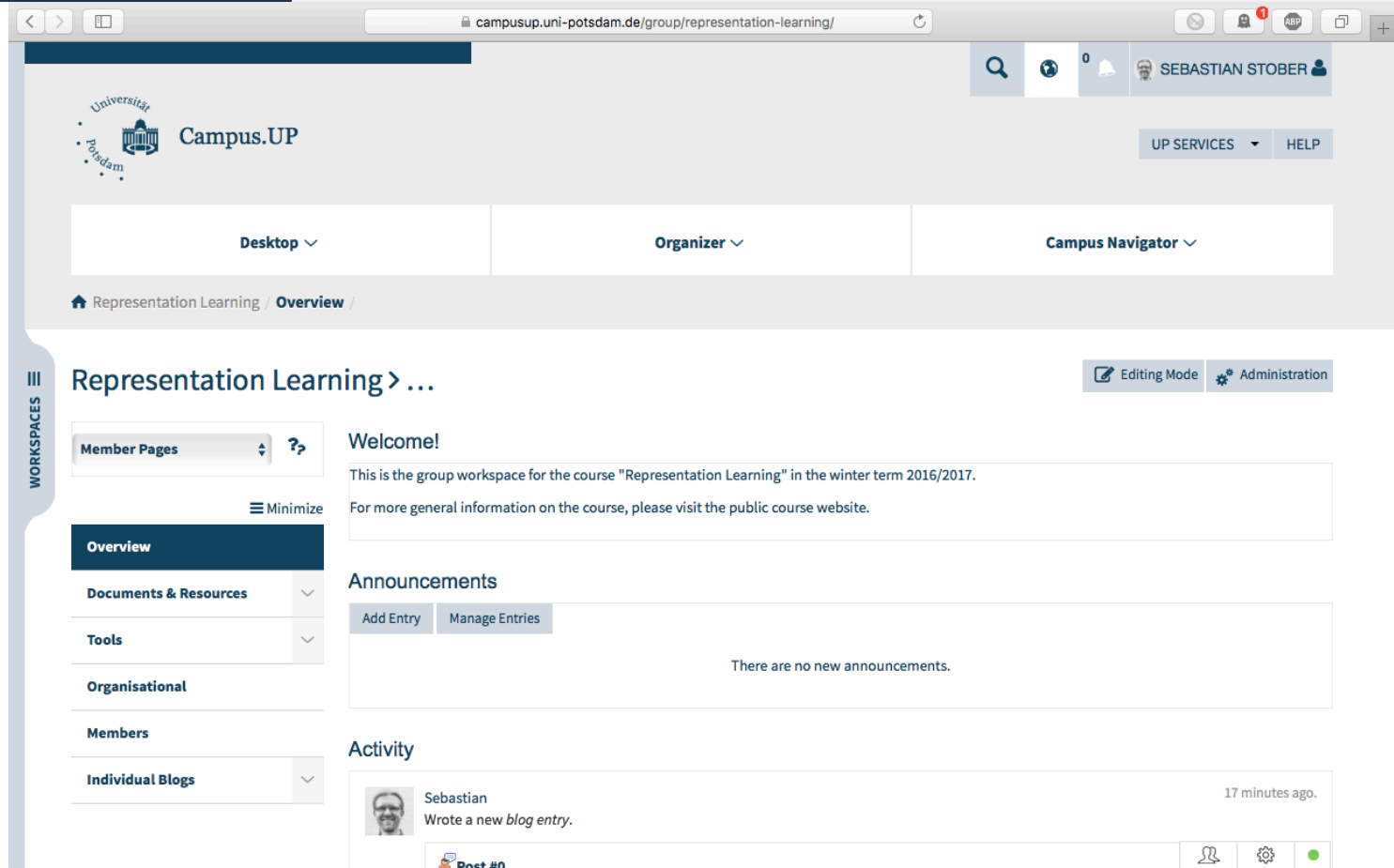
**ankrug** 2:24 PM  
I opened the ~Exam channel  
feel free to join the channel and participate in the discussions, if you like to support the examinees 🙌

**Input Area:**

Write a message... 📎 😊

[Help](#)

# Campus.UP Workspace



The screenshot shows the Campus.UP Workspace interface for the 'Representation Learning' group. The browser address bar displays 'campusup.uni-potsdam.de/group/representation-learning/'. The interface includes a top navigation bar with the University of Potsdam logo, the 'Campus.UP' title, and user information for 'SEBASTIAN STOBER'. Below this is a secondary navigation bar with 'Desktop', 'Organizer', and 'Campus Navigator' tabs. The main content area is titled 'Representation Learning > ...' and includes a 'Member Pages' dropdown, a 'Minimize' button, and a sidebar with links to 'Overview', 'Documents & Resources', 'Tools', 'Organisational', 'Members', and 'Individual Blogs'. The main content area features a 'Welcome!' message, an 'Announcements' section with 'Add Entry' and 'Manage Entries' buttons, and an 'Activity' section showing a recent blog entry by Sebastian.

<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

- 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/](https://mlcogup.github.io/idl_ws18/)