Introduction to Deep Learning (I2DL)

Tutorial 1: Organization

The Team

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Today's Outline

- Organization
  - Lectures, tutorials and schedule
  - Exam
  - Communication

- Exercises
  - General overview
  - Exercise 1

3. Numpy Introduction

Numpy is a high performance framework for operations on multi dimensional arrays. life as a Data Scientist in general.

```python
In [12]:  # Create a simple (2, 3) numpy array
          # [[ 1  2  3]
          #  [ 4  5  6]]
          a = np.array([[1,2,3], [4,5,6]])

          # Print the data type of this array
          print(a.dtype)

          # print the shape of this array
          print(a.shape)

          int64
          (2, 3)
```
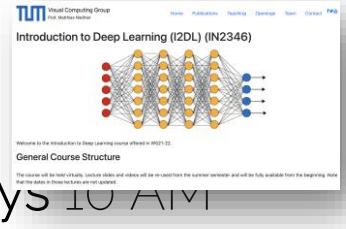
Organization

Lecture Material

- Lectures
  - This lecture is held virtually, offline
  - New lecture recordings and slides every **Tuesday**, pre-recorded
  - Available on our webpage https://niessner.github.io/I2DL/
  - Recommendation: watch in a weekly fashion

- Exercises (Tutorial session + Homework)
  - Recordings + slides + homework uploaded **Thursdays** 10 AM
  - Homework due following Wednesday 15:59

Tentative Schedule

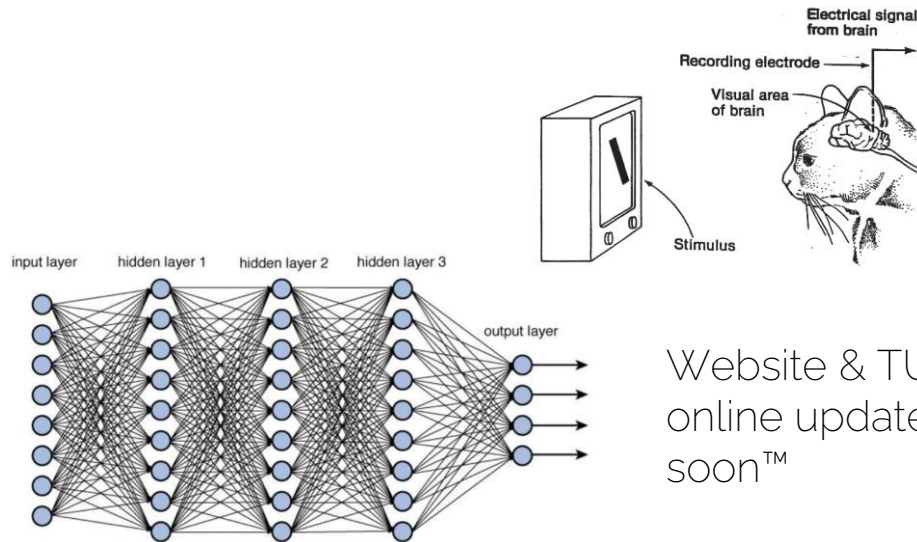Website & TUM-online update soon™

Img src: see lectures

Exam FAQ

Us waiting for the exam date

- ## Date
  Who knows, probably beginning / mid of February

- ## Place
  Probably on-site like the old usual exams, no remote exams or alternative available

- ## Retake?
 None this semester, can participate in the exam of next semester's class

Exam FAQ

- ## Do we get access to previous exams?
  Yes, including a mock exam etc. around week 10

- ## Do we have to code during the exam?
  No, mostly short questions and some multiple choice

- ## What about my bonus?
  Bonus from any previous iteration of I2DL will be transferred to this class and all future exam attempts (regardless of I2DL lecturer)

- ## For whom?
  TUM/LMU students (who will get a certificate)

Availability

- Website ([link](#))
  - Public
  - Will contain all videos, exercise material and solutions

- Piazza ([link](#))
  - Only for LMU/TUM students
  - Links and dates of office hours
  - Exam related information
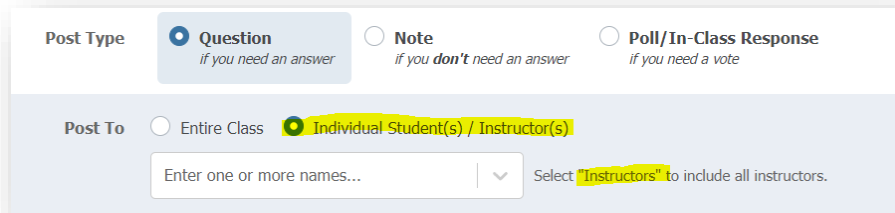 - Discussions about content
  - All other communication
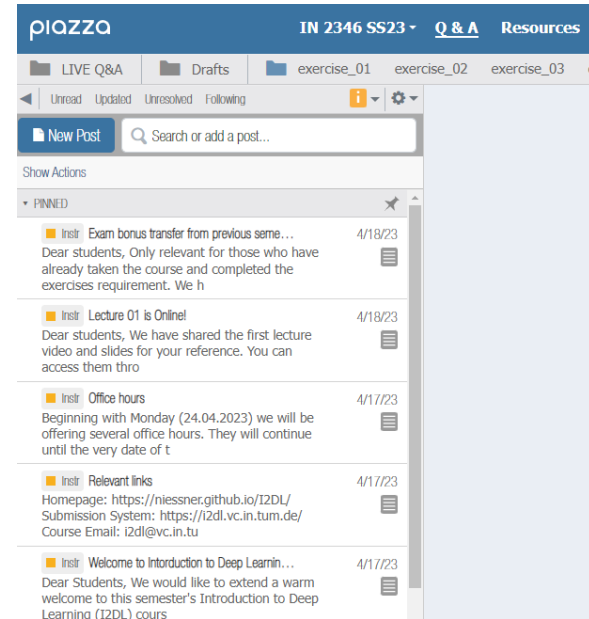
Availability - Office Hours

- Daily office hours offered by the tutors

- Via zoom
  Link and times - Piazza

- Casual, ask anything, be considerate

- Starting Monday

Availability – contact the staff

- Use piazza for all communication
  - Send private note/question to instructors for individual issues

- If you cannot use piazza to contact us:
  - i2dl@vc.in.tum.de
  - Please only use it if you cannot access piazza

Piazza

- Be courteous

- Participation in discussions is correlated with success in the exam

- Mark your followup questions as (un-)resolved accordingly if attention is needed by the instructors – resolve otherwise.
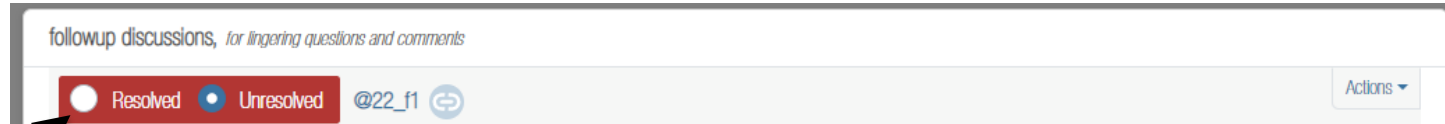
LMU Students & TUMOnline Issues

- Check out the google [form](#) we linked on our website.

> **I2DL WS23/24 - Introduction to Deep Learning (IN2346) - Registration for External Students**
>
> Dear students,
>
> this form is intended for students with TUM-affiliation (e.g., LMU students, TUM students, PhD students from TUM/LMU) who cannot register for courses, etc, who want to participate in our lecture but can not sign up through the TUM course registration system. By filling this form, you will be able to participate in Piazza, as well as the exercises and submit models to our submission portal.

Non TUM/LMU Students

- You can:
  - Participate at lectures as well as exercises
  - Exercises have evaluations in notebooks

- You can't:
  - Have access to our submission system
  - Take part in online discussions on Piazza or attend office hours
  - Participate in the exam

General Exercises & Bonus

From our own experience

"Neural networks are just an application of backpropagation"

"I use the Wasserstein loss, gradient clipping, Gulrajani's fix and my GAN is still diverging…"

"How the f*** should one choose reasonable hyperparameters"

Confidence

None   Average   Expert

Competence

Img src: google images dunning kruger
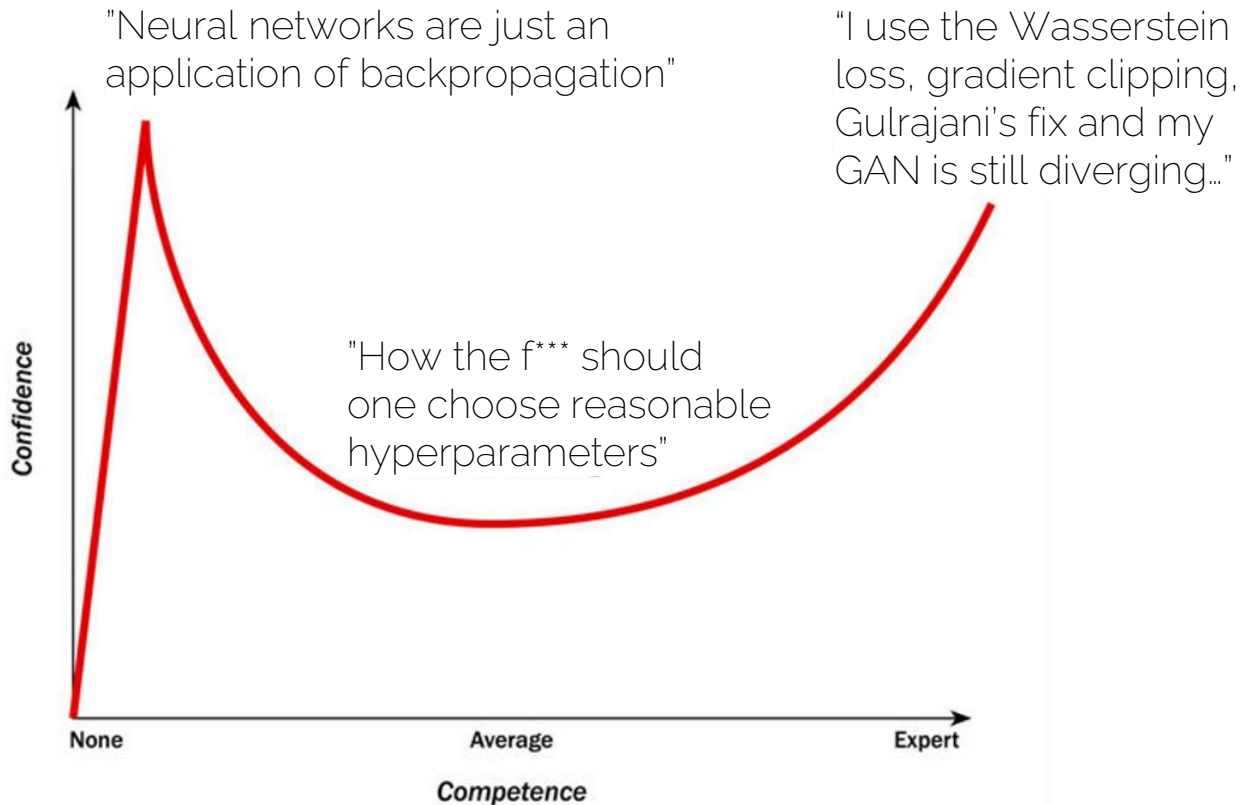
Exercises – Tentative Schedule

Lectures

Introduction
0: Organization
1: What is Deep Learning?
2: Machine Learning Basics

Neural Networks
3: Introduction
4: Optimization
5: Stochastic Gradient Descent
6: Training Neural Networks
7: Training Neural Networks
8: Training Neural Networks

Advanced Architectures
9: Introduction to CNNs
10: More on CNNs
11: Sequence Models
12: Advanced Deep Learning Topics

Exercises

Exercise 01: Organization
Exercise 02: Math Recap

Exercise 03: Datasets
Exercise 04: Linear Regression
Exercise 05: Neural Networks
Exercise 06: Hyperparameter Tuning

Exercise 07: Introduction to Pytorch
Exercise 08: Autoencoder

Exercise 09: Convolutional Networks
Exercise 10: Semantic Segmentation
Exercise 11: Sequence Models

Exercises - Goal

- Goal
  Gather enough experience to start your own individual (research) project

- Focus
  - Reimplementations
  - Introduction to common libraries
  - Applications
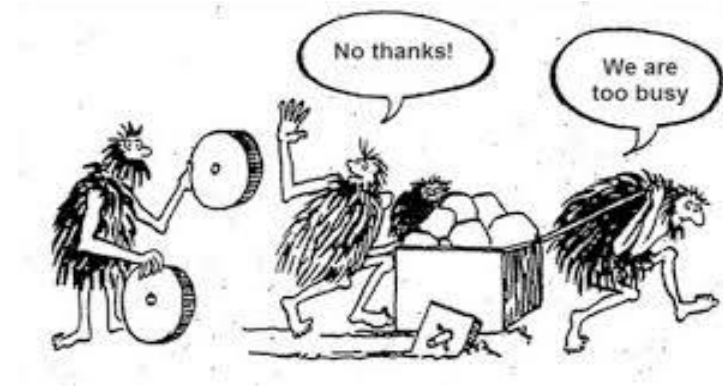
Tutorials Sessions & Exercises Format

- ## Presentation: video w/ slides
  Posted to webpage and Piazza

- ## Video length
  Tutorial sessions are usually much shorter than the lecture

- ## Exam
  All tutorial sessions and optional exercises (incl. coding) are exam-relevant

- ## Main work
  Interactive coding notebooks (don't underestimate them – start early!)
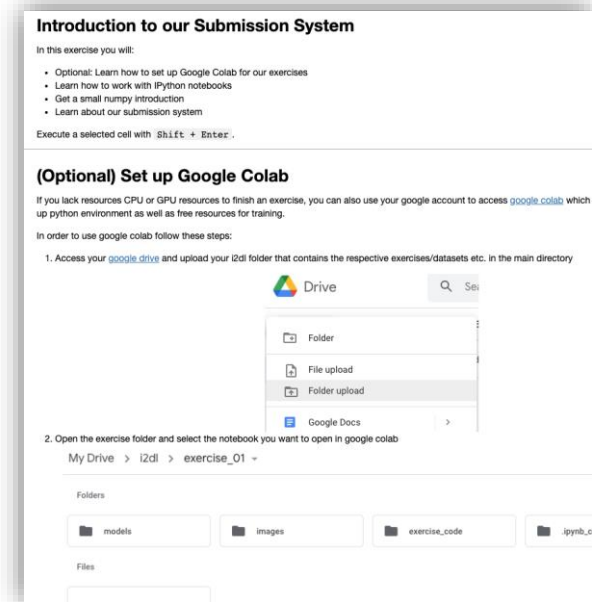
Why Python?

- Very easy to write development code thanks to an intuitive syntax

- Most used language used in deep learning research
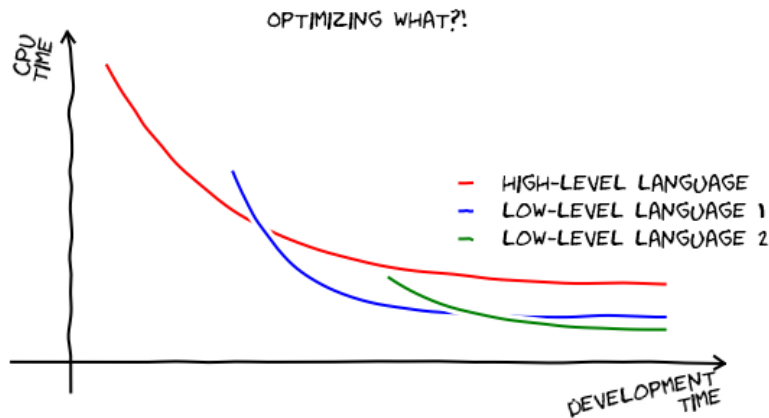
Exercises – Tech Stack

- Python
  Jupyter notebooks
  Numpy

- Deep Learning library
  Pytorch

- Hardware requirements
  – Minimum: CPU
  – Preferred: Nvidia GPU
  – Alternative: Google Colab

Extra Spice: Leaderboard (Ex6, 9-11)

- Compete against your fellow students on our datasets for a variety of tasks
- Some of the best solutions will be featured in exercise discussions

Leaderboard

The leaderboard shows for each exercise the highest scoring submission from each user. Only valid submissions are displayed.

Exercise 1 | Exercise 3 | Exercise 4 | Exercise 5 | Exercise 6 | Exercise 7 | Exercise 8 | Exercise 9 | Exercise 10 | Exercise 11

#	User	Score
1	a0005	68.77
2	a0010	64.41

11 Exercises - Content

Exercise 01: Organization
Exercise 02: Math Recap

Intro

Exercise 03: Dataset and Dataloader
Exercise 04: Solver and Linear Regression
Exercise 05: Neural Networks
Exercise 06: Hyperparameter Tuning

Numpy
(Reinvent the wheel)

Exercise 07: Introduction to Pytorch
Exercise 08: Autoencoder

Pytorch/Tensorboard

Exercise 09: Convolutional Neural
           Networks
Exercise 10: Semantic Segmentation
Exercise 11: Sequence Models

Applications
(Hands-off)

Submissions & Bonus

- Submissions
  - 9 (out of 11) exercises labelled as *submissions*
  - submissions have a fixed, mostly one week due date until they have to be solved and successfully uploaded.

- Bonus
  - Passing exam grade get's a -0.3 bonus
  - Need to have passed **8/9** submissions

11 Exercises – 9 Submissions

Exercise 01: Organization
Exercise 02: Math Recap

Intro

Exercise 03: Dataset and Dataloader
Exercise 04: Solver and Linear Regression
Exercise 05: Neural Networks
Exercise 06: Hyperparameter Tuning

Numpy
(Reinvent the wheel)

Exercise 07: Introduction to Pytorch
Exercise 08: Autoencoder

Pytorch/Tensorboard

Exercise 09: Convolutional Neural
Networks
Exercise 10: Semantic Segmentation
Exercise 11: Recurrent Neural Networks

Applications
(Hands-off)

How to pass this class

- The Efficient
  Binges the lecture videos at x2 speed
  Reads through all lecture notes, exercise slides and screenshots
  from their friend's jupter notebook

- The 'I just want to do applications'
  Visits every lecture, reads through exercise material
  Works through the pytorch exercise and applications during the
  semester break

- The Alpha
  Works through weekly lecture and exercise content, gets passing
  submissions in, asks questions on moodle and tries to answer
  other student's posts

Exercise 1

Exercise 1 Goal

- Get your python environment up and running

- Familiarize yourself with our notebooks

- Familiarize yourself with our submission system

- It's short and technical

Overview

- Start date/availability
  With the release of this tutorial
  Find it on the Website/Piazza

- Submission deadline
  Always planned for Wednesday 15:59, updated deadline always in the submission system.

- Content
  - First experience with our environment and submission system
  - Optional: python refresher

- <u>Counts for the bonus</u> (i.e it's one of the 9 submissions for the bonus)

Instructions

- Download the zipped folder

- Extract zip locally and follow the instructions in the README.md file to:
  - Install anaconda to create a new python environment
  - Set up your repository using the requirments.txt file
  - Execute `jupyter notebook` in the i2dl folder. We recommend using VSCode if you want an IDE.

  New python users: http://nbviewer.jupyter.org/github/jrjohansson/scientific-python-lectures/blob/master/Lecture-1-Introduction-to-Python-Programming.ipynb

Hitchhiker's Guide: Notebooks

1. Run cells from top to bottom

2. Be careful when changing notebook cells

3. Edit external code in browser or in your favorite IDE

   – Don't code outside our boxes in exercise_code files

4. Checking other code

   – Generally optional

   – Look out for green boxes

Task: Check Code

Please read `make_dataset(directory, class`
tasks. Additionally, it would be wise decision to ge
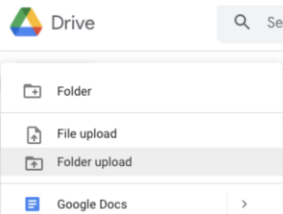projects. As it is not beginner friendly, we removed i

Google Colab Instructions

You really don't need colab at all for the first five exercises

(Optional) Set up Google Colab

If you lack resources CPU or GPU resources to finish an exercise or have issues setting up a local python environment, you can also use your google account to access google colab which provides an already set up python environment as well as free resources for training.

In order to use google colab follow these steps:

1. Access your google drive and upload your i2dl folder that contains the respective exercises/datasets etc. in the main directory

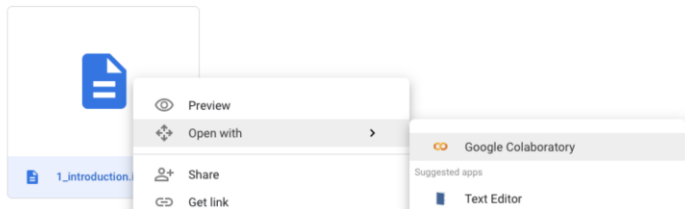2. Open the exercise folder and select the notebook you want to open in google colab

Exercise Submission

- Register on submission webpage
  https://i2dl.vc.in.tum.de/

  – Sign up with valid matriculation number
  – Get id and password via email (it will display the email address)

- Submit models:
  – Upload created zip file
  – Note: You will submit your whole code folder as well

FAQ

- I don't want to code in notebooks. Can I use my favourite IDE?
  - Yes

- Cool, so I can just change the whole code structure?
  - No
  - You can write any helper functions, but keep the skeleton classes intact (i.e., don't rename important functions or variables)
  - You will upload all files and those will be archived on our end

FAQ

- ## How do I know that I passed?
  - Once you submit a score that surpasses the threshold, you will receive an email that contains a message which tells you that you passed this submission

- ## Help, I got this message a second time!?
  - You will receive this message every time you submit an exercise that exceeds the score
  - Your best perfoming model will count, not the latest submitted one

FAQ

- Where can I get assistance?
  - Piazza. Ask there. Maybe someone has asked the same question before.
  - Office hours
  - Other students

Upcoming Lecture

- Next lecture: Lecture 2: Machine Learning basics

- Next Tutorial: Math Recap (+ Math exercise sheet)

See you next week ☺