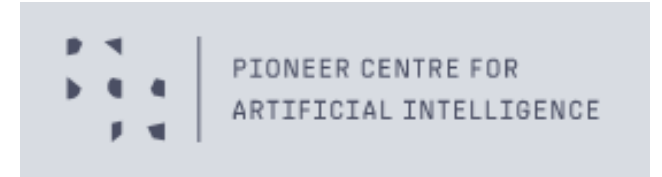
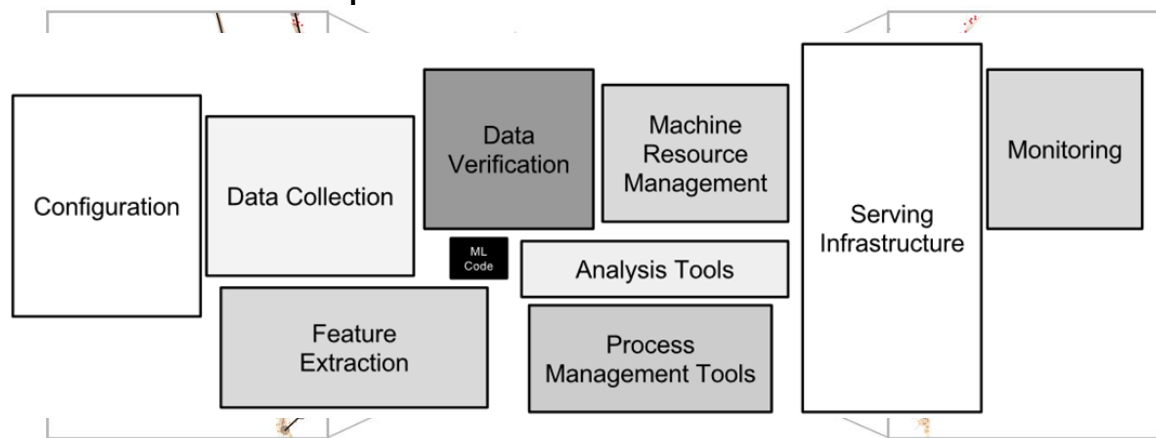


02476 Machine Learning Operations  
Nicki Skafte Detlefsen

# Intro to the course

# Who am I

- Bachelor, master, PhD from DTU
- Currently: Postdoc
- Old focus:
  - Inductive biases in deep learning
  - Probabilistic generative models
  - Manifold learning
- New focus:
  - MLOps



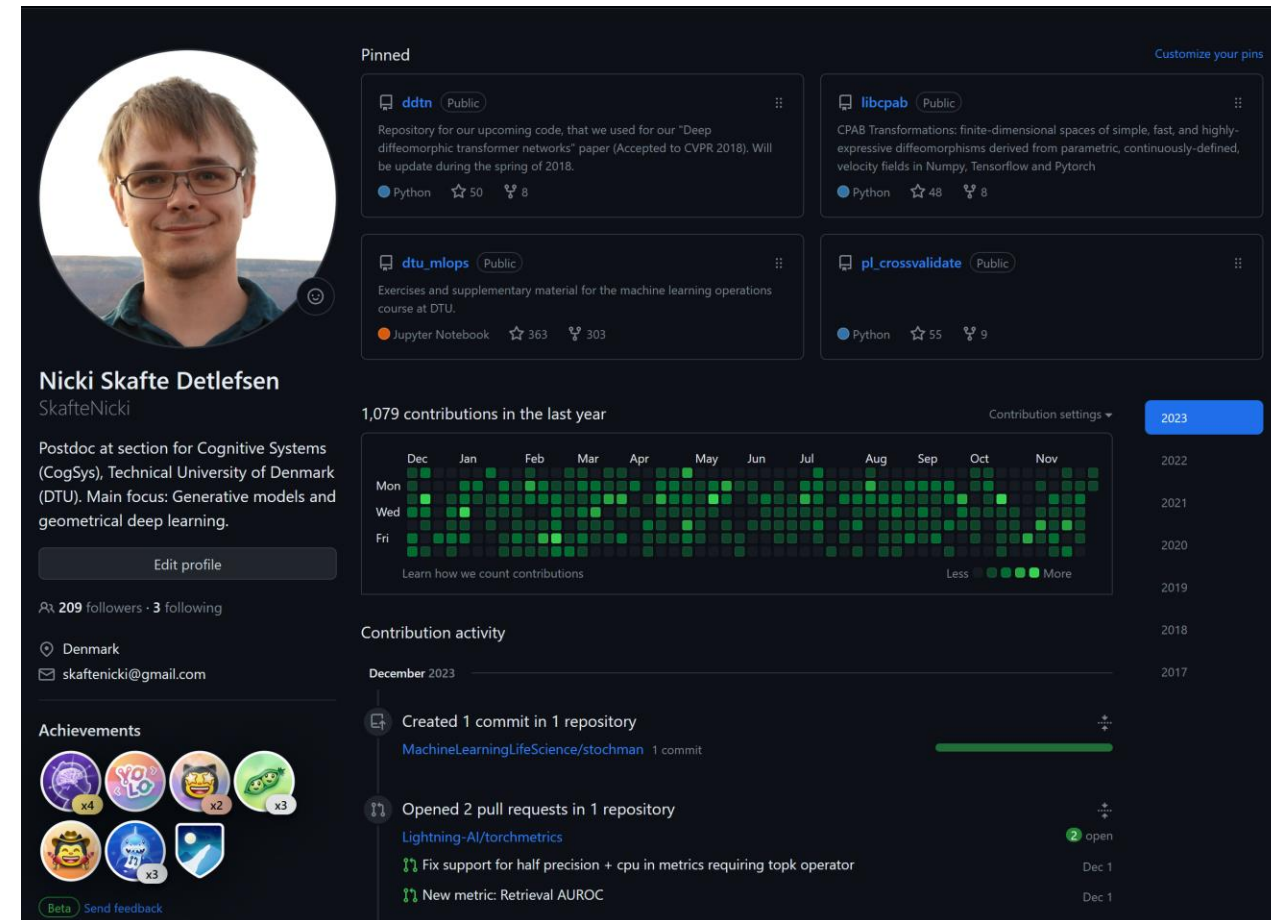
# My secret identity

 Eager open-source contributor

- Numpy
- Scikit-learn
- Pytorch

⚡ ML Engineer at <https://lightning.ai/>

- Pytorch-lightning
- Torchmetrics



# Who else to know about



Søren Hauberg  
Co-responsible

- ★ August Leander Høeg
- ★ Diogo Oliveira Marques Adegas
- ★ Anders Gjørbye Madsen
- ★ Amin Hasanpour
- ★ Laurits Fredsgaard Larsen
- ★ Shah Bekhsh
- ★ Lina Skerath
- ★ Fabian Scott
- ★ Junaid Ahmed Qazi
- ★ Ana Marija Pavicic

TAs are available from  
10:00-16:30 every day  
In general there is 1-4 on  
duty, either online or  
physical on campus

# Course setting

- 5 ECTS
- 3 weeks period
- Level: Master
- Grade: Pass/not passed
- Type of assessment:
  - Project report

## Recommended prerequisite

- General understanding of machine learning (datasets, probability, classifiers, overfitting etc.)
- Basic knowledge about deep learning (backpropagation, convolutional neural network, auto-encoders etc.)
- Coding in Pytorch

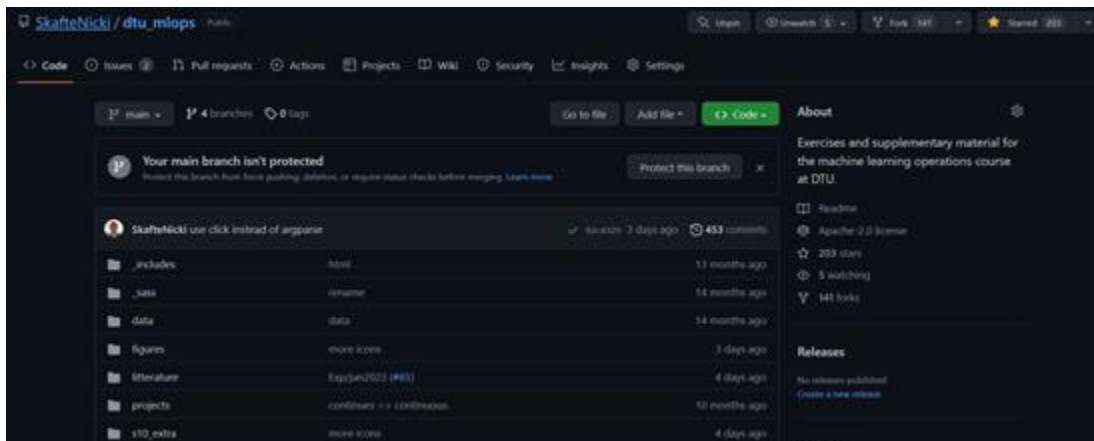
# Course webpage


Github:


[https://github.com/SkaftNicki/dtu\\_mlops](https://github.com/SkaftNicki/dtu_mlops)

Rendered page:

[https://skaftenicki.github.io/dtu\\_mlops/](https://skaftenicki.github.io/dtu_mlops/)




DTU-MLOps


GitHub  
372 310

Machine Learning Operations

Repository for [course 02476](#) at DTU.

[Checkout the homepage!](#)

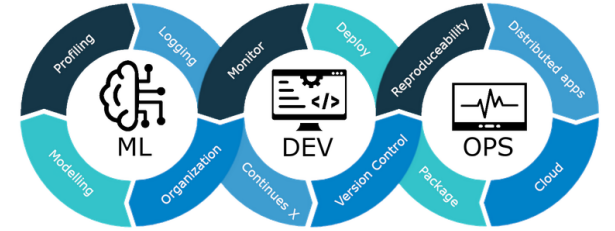


Table of contents

- Course information
- Course setup
- Course organization
- MLOps: What is it?
- Learning objectives
- References
- Contributing
- License

Course information

- Course responsible
- Postdoc [Nicki Skaft Dettelsen, nsde@dtu.dk](#)
- Professor [Søren Hauberg, sohou@dtu.dk](#)
- 5 ECTS (European Credit Transfer System), corresponding to 140 hours of work
- 3 week period in January
- Master level course

# Communication

Join the slack channel

[https://join.slack.com/t/dtumlops/shared\\_invite/zt-2utq0bupc-5gTBkFPjaTLkQVBc2C4Qqg](https://join.slack.com/t/dtumlops/shared_invite/zt-2utq0bupc-5gTBkFPjaTLkQVBc2C4Qqg)

General announcements

- Asking questions
- Communication with team members

For non-public info we use DTU learn

<https://learn.inside.dtu.dk>

# What is this course about?

What is this course:

*Introduce the student to several tools and software development practices that will help them organize, scale, deploy and monitor machine learning models either in a research or production setting. To provide hands-on experience with a number of frameworks, both local and in the cloud, for working with large scale machine learning pipelines.*

## Keywords

- ★ Organization
- ★ Scalability
- ★ Reproducibility
- ★ Hands-on experience



# What this course is not

⚠ How different machine learning models works

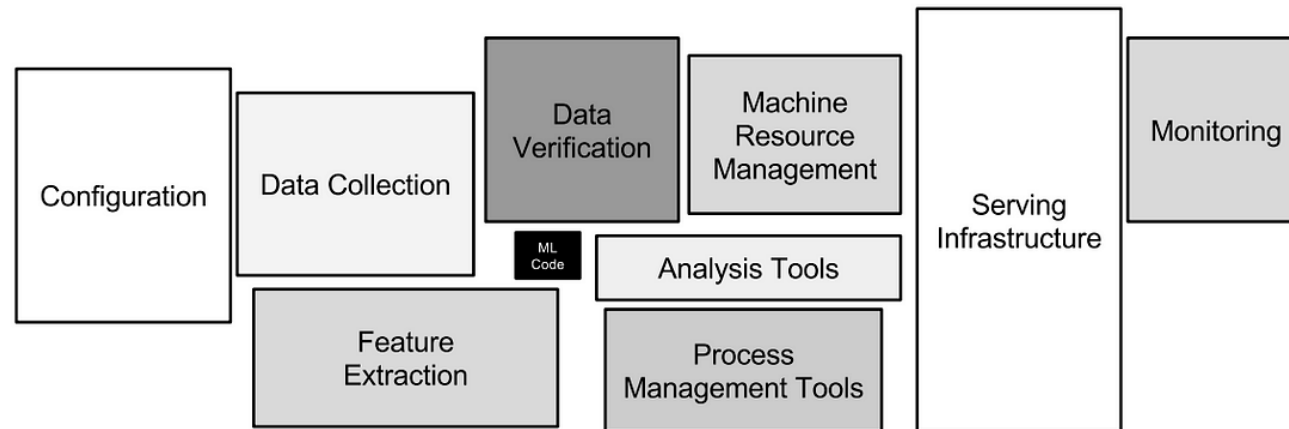


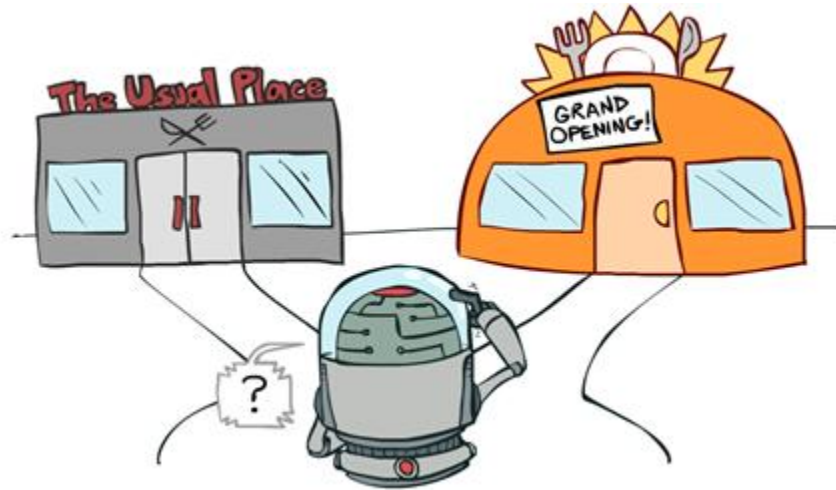
Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small black box in the middle. The required surrounding infrastructure is vast and complex.

# The teaching method of this course

The course is centered around two principals:

- 💡 *Learning by doing*
- 💡 *Hybrid learning*

We provide lectures, exercises and guidance but encourage self study.



Exploitation vs Exploration



# Organization of material

- 1 day = 1 session (S)
- 1 session = multiple modules (M)
- Core modules:
  - Essential in some way
- All other modules are highly recommended
- S10 contains additional modules

DTU-MLOps

Home

Timeplan

S1 - Development Environment >

S2 - Organisation and Version Control v

M5 - Git

M6 - Code structure

M7 - Good coding practice

M8 - Data version control

S3 - Reproduceability >

S4 - Debugging, Profiling and Logging >

## Git

**Core Module**

Proper collaboration with other people will require that you can work on the same codebase in an organized manner. This is the reason that **version control** exist. Simply stated, it is a way to keep track of:

- Who made changes to the code
- When did the change happen

What changes were made



Table of contents

Initial config

Git overview

? Exercises

Knowledge check

# What I hope from this course

- Have fun!
- That you get to fill your toolbox with useful frameworks
- (Maybe) Learn something along the way



# hygge

[hue-gah] *noun*

An atmosphere of warmth, wellbeing, and cosiness when you feel at peace and able to enjoy simple pleasures and being in the moment.

# A typical day in this course

## ⚡ Exercise days:

- Meet in at 9:00
- Lecture for 30-45 mins
  - I am still learning how to do lectures
  - Lectures are not meant to give teach you anything, but provide some context to the topic of the day
- Exercises until 14:00-17:00
  - Remember to take a lunch break
  - Workload will depend on you

## 🔥 Project days

- Sometimes a small lecture or company presentation
- Rest of the day you work on projects
- Office hour (may be virtual)

# Projects 🔥

Approximately 1/3 of the course time is spend on project work

More info here: [https://skaftenicki.github.io/dtu\\_mlops/pages/projects](https://skaftenicki.github.io/dtu_mlops/pages/projects)

Already now you are recommended to think about forming groups

- 4 people (3 and 5 is also acceptable)
- Thursday we will do some speed dating to form groups for people not already having one.
- Also feel free to write in the #find-a-group slack channel.



Prompt:

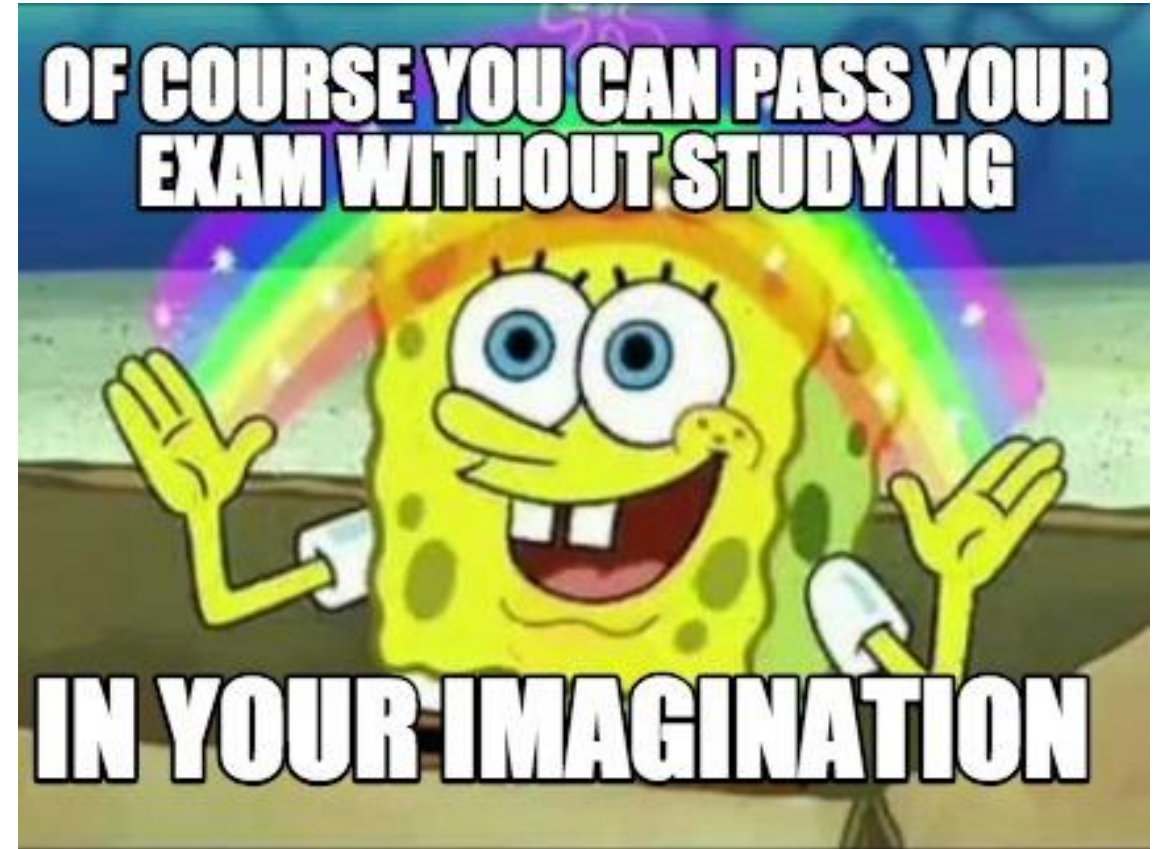
*Group of students working hard on a project*

# How to pass

- 💡 Do the exercises
- 💡 In the final project:

*Show that you can use the tools you learn about throughout the course*

We still have a 100% pass rate after approximately ~350 students.





# Exam

The exam only consist of a written part: A [template](#) with ~30 questions that you can fill out as you work on your projects. It will be part of your project Github repository.

More on this on Friday ⚠️.



# One hand-in during the course

- 💡 Signup as a group
- 💡 Hand-in the link to your Github project repository

**Text Submission 1**  
Unevaluated Friday, 7 January 2022 2:13 PM  
[https://github.com/\[redacted\]/Project-MLOps-\[redacted\]](https://github.com/[redacted]/Project-MLOps-[redacted])

DTU 02476 Machine Learning Operations Jan 24

Course Admin My Course ▾ Activities ▾ Aktiviteter ▾ Content Assignments Discussions Video & Streaming Help

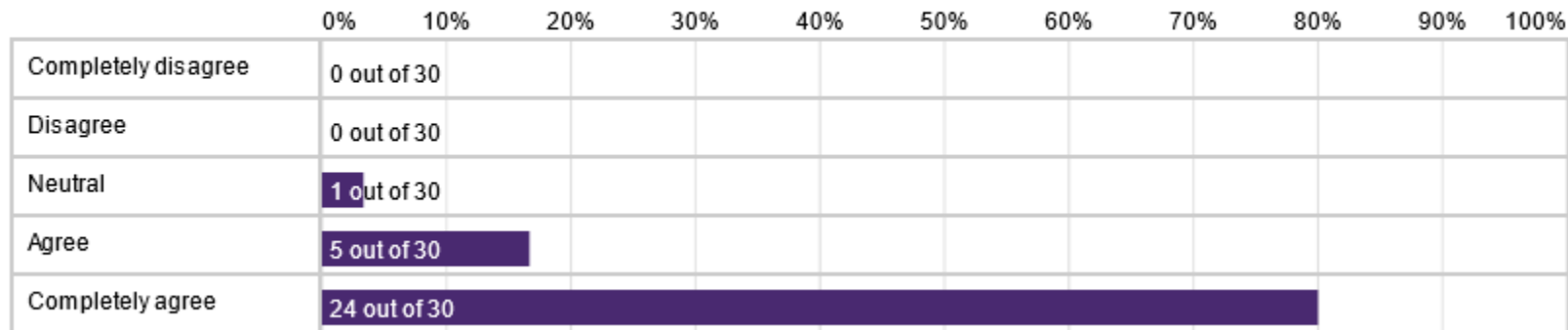
Settings Help

Announcements  
Calendar  
Classlist  
Classlist Lookup  
Class Progress  
Content Statistics  
Course Evaluation  
Grades  
Groups  
Manage Files  
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|                                  | Members | Assignment          | Discussions | Locker |
|----------------------------------|---------|---------------------|-------------|--------|
| <input type="checkbox"/> Groups  | 0       | Project reposi... ? |             |        |
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| <input type="checkbox"/> MLOPS 3 | 0       | Project reposi... ? |             |        |
| <input type="checkbox"/> MLOPS 4 | 0       | Project reposi... ? |             |        |
| <input type="checkbox"/> MLOPS 5 | 0       | Project reposi... ? |             |        |

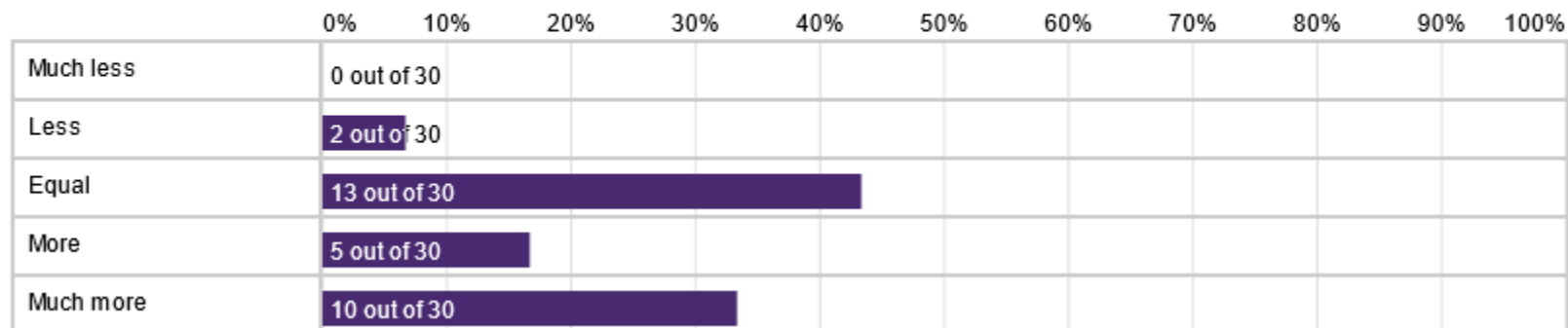
# The course in 2 statistics

## 1.1 I have learned a lot from this course.



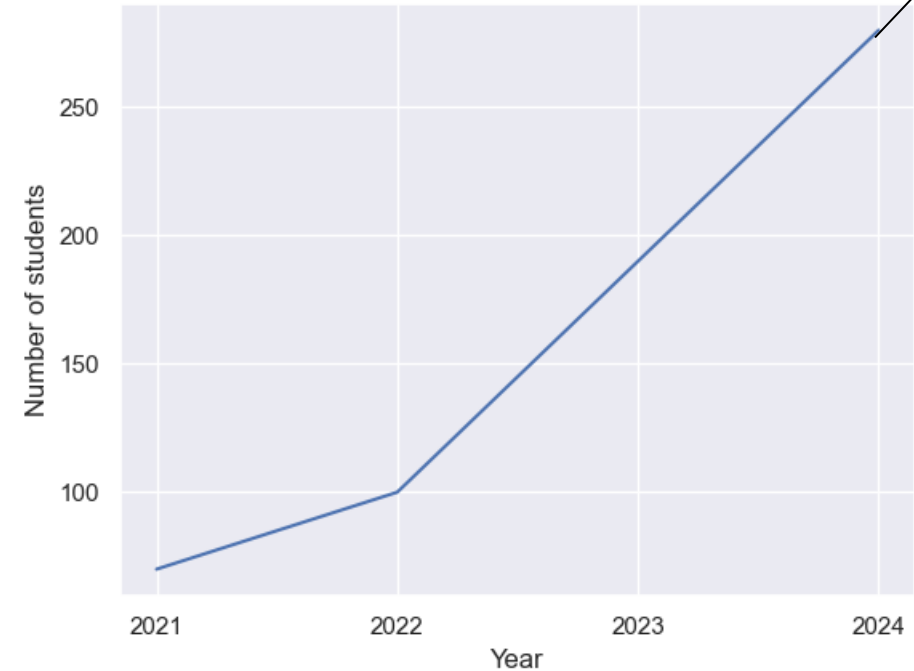
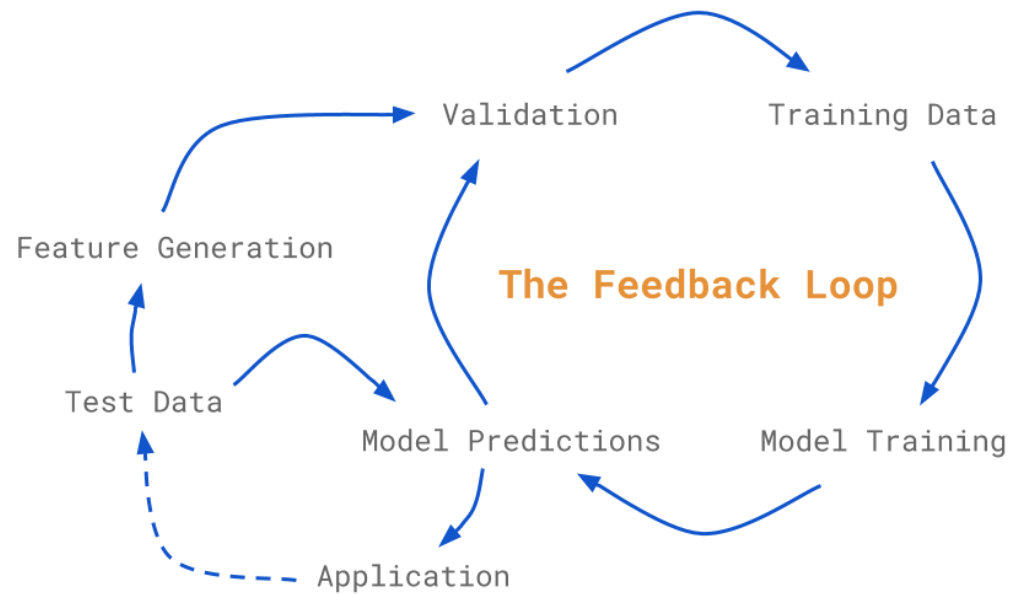
2.1 5 ECTS credits correspond to nine working hours per week for the 13-week period (45 working hours per week for the three-week period).

I think the time I have spent on this course is



# It is not a perfect course

Some would say we are on v4.0 of the course; I would argue that we are on v0.0.4.  
Please come talk to me if you have suggestions for improvements.



# FAQ

? Can I work from home

💡 Yes, but note that

- \* for the project days you need to agree with your group on this
- \* we have limited TA resources and will priorities students on campus
- \* the oral exam is takes place physically

? Can I use ChatGPT or similar

💡 Yes all you want, but make sure you still learn something

? What if I become sick during the course

💡 If you can work from home, then that is the best option. Second best option, is to make sure you still contribute to the final project but skip doing some of the exercises

# How to get help ?

- ⚡ We have auditorium 72, group area mid, group area west, but use whatever space you can find in the building
- ⚡ Nicki will be in the auditorium from 8-14
- ⚡ TAs will be around from 11-16:30 in auditorium + group areas



# Memes

Let's try to have some fun  
while learning

LEARNING ML/DL  
FROM UNIVERSITY

ONLINE COURSES

FROM YOUTUBE

FROM ARTICLES

FROM MEMES

