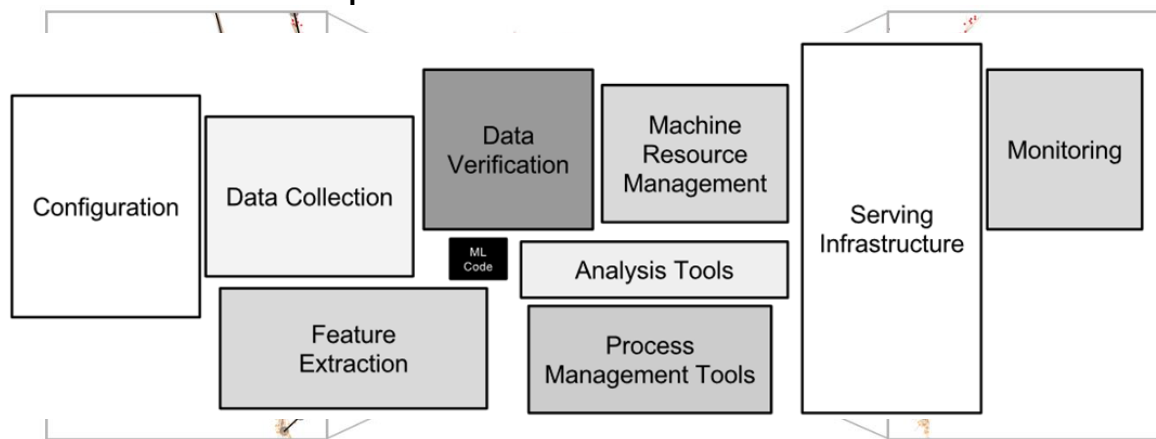


02476 Machine Learning Operations  
Nicki Skafte Detlefsen

# 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

Ioannis Louvis



Søren Hauberg  
Co-responsible



Alborz Shafiei  
Sabet



Ioannis  
Louvis



Laurits Fredsgaard  
Larsen



Andreas  
Abildtrup Hansen



Lina Skerath



Kristof Kenez  
Drexler



Ioannis Manganas



Eleftherios  
Katiforis

# Course setting

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

## 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

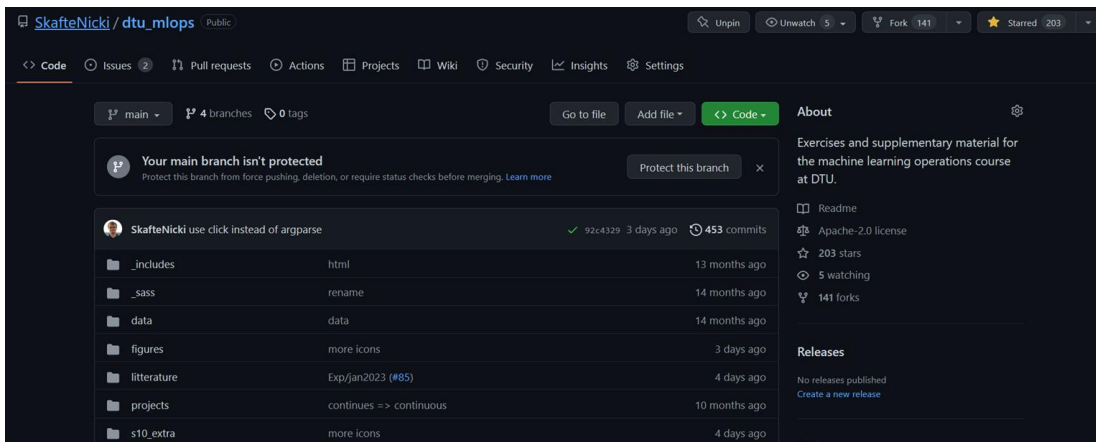
# Course webpage

Github:

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

Rendered page:

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



**Machine Learning Operations**

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

[Checkout the homepage!](#)

The diagram illustrates the MLOps lifecycle with three main stages: ML, DEV, and OPS, each with associated activities:

- ML:** Profiling, Logging, Modelling
- DEV:** Monitor, Deploy, Organization, Continues
- OPS:** Reproducibility, Version Control, Package, Distributed apps, Cloud

**Table of contents:**

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

**Course information:**

- Course responsible
- Postdoc [Nicki Skafta Detlefsen, nsde@dtu.dk](#)
- Professor [Søren Hauberg, sohau@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-1j1zx8t4h-nTbUPibR9xCz58erDyyikw](https://join.slack.com/t/dtumlops/shared_invite/zt-1j1zx8t4h-nTbUPibR9xCz58erDyyikw)

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

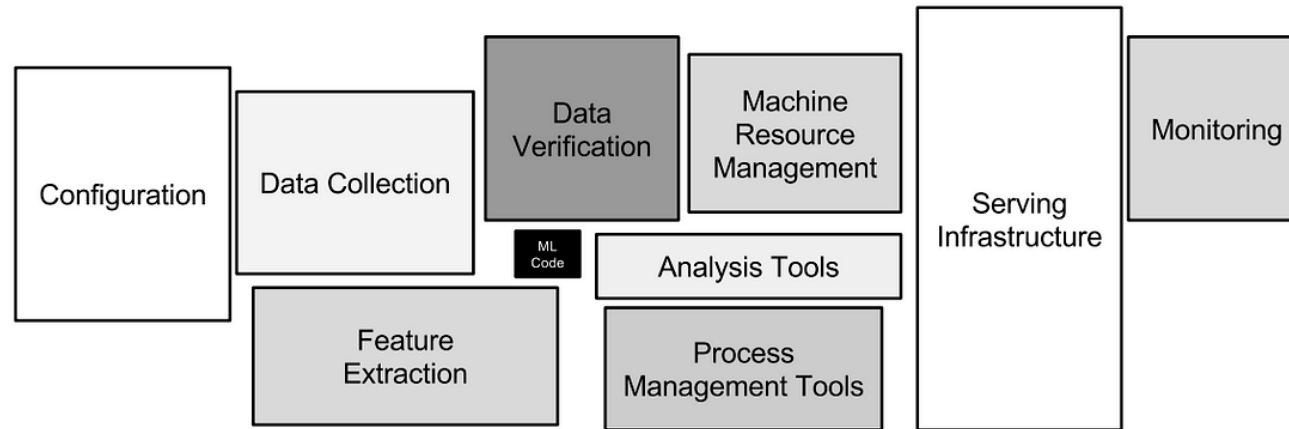


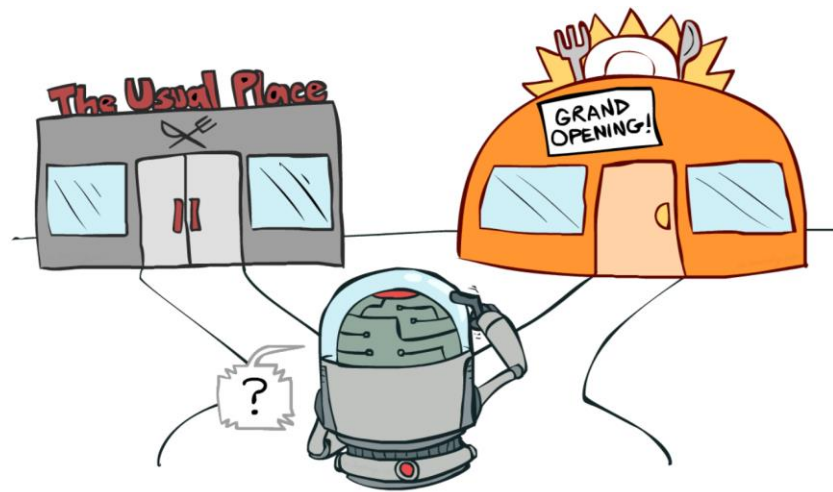
Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small black box in the middle. The required surrounding infrastructure is vast and complex.

# 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 ▾
  - 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



### 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

People with no idea  
about AI, telling me my  
AI will destroy the world

Me wondering why my  
neural network is  
classifying a cat as a dog..



# 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 15-30 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/projects](https://skaftenicki.github.io/dtu_mlops/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*

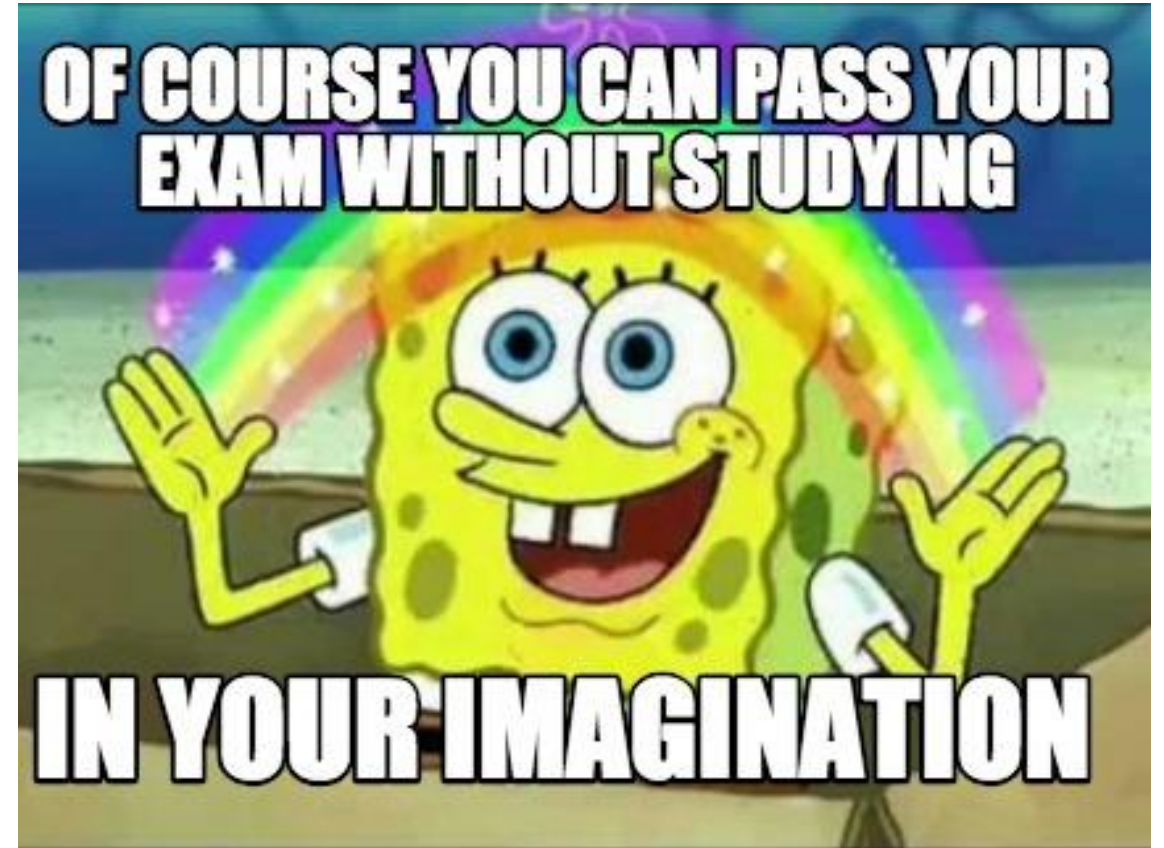


# How to pass

- 💡 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

Two parts

1. 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.
2. Oral part: demo day on the 19/1 (we still figuring out the exact format)

More on this on Saturday ⚠️.



# 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

Nicki Skafte Detlefsen

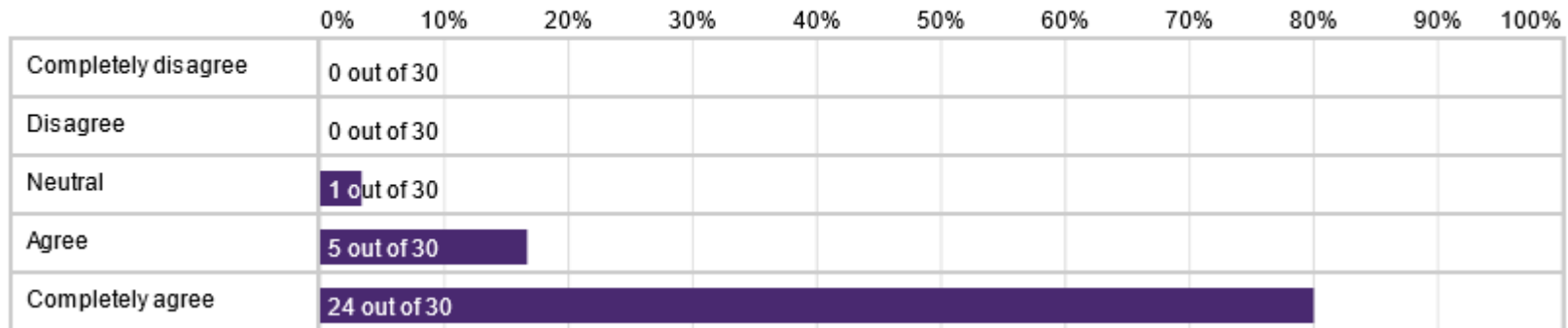
Course Admin My Course Activities Aktiviteter Content Assignments Discussions Video & Streaming Help

Settings Help

	Members	Assignment	Discussions	Locker
<input type="checkbox"/> Groups	0	Project reposi... ?		
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<input type="checkbox"/> MLOPS 4	0	Project reposi... ?		
<input type="checkbox"/> MLOPS 5	0	Project reposi... ?		

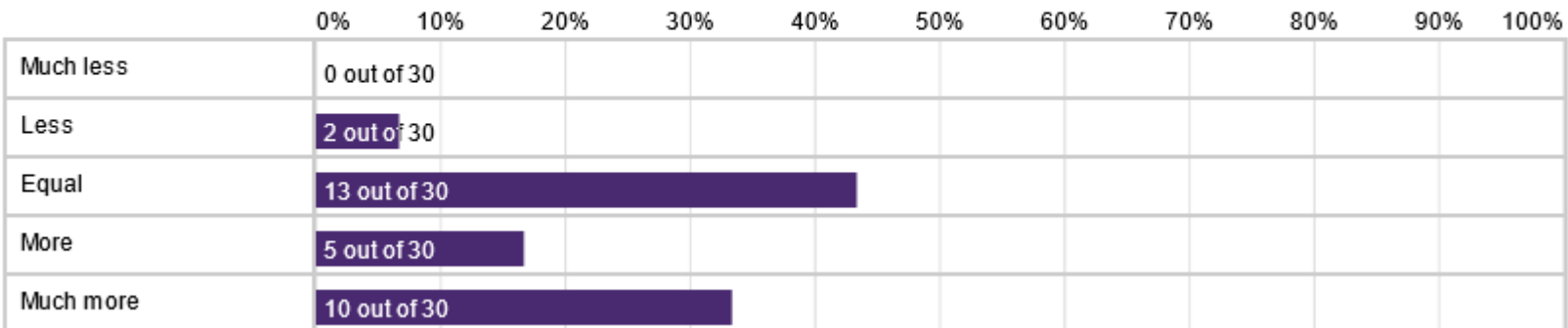
# The course in 2 statistics

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



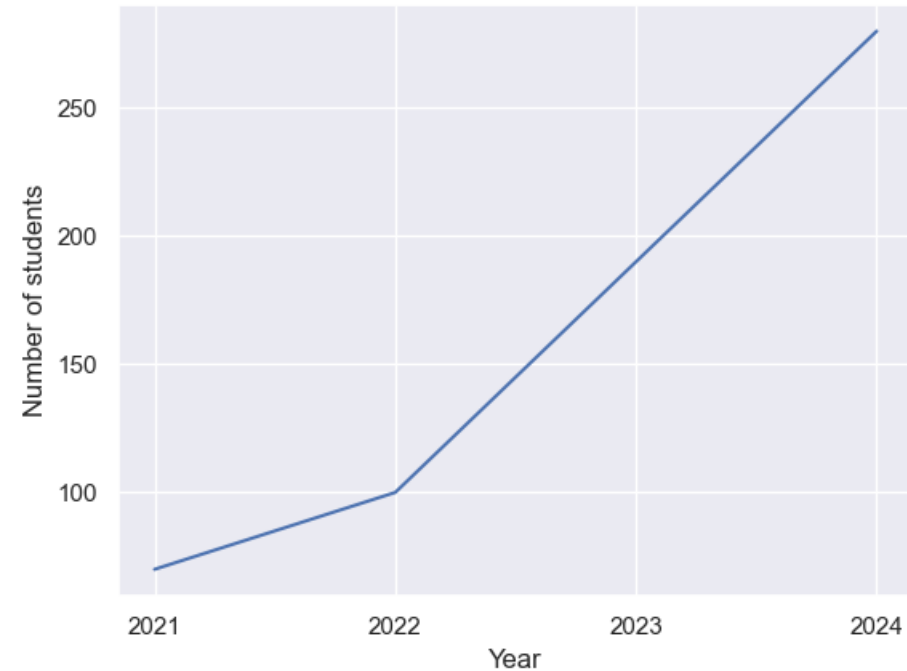
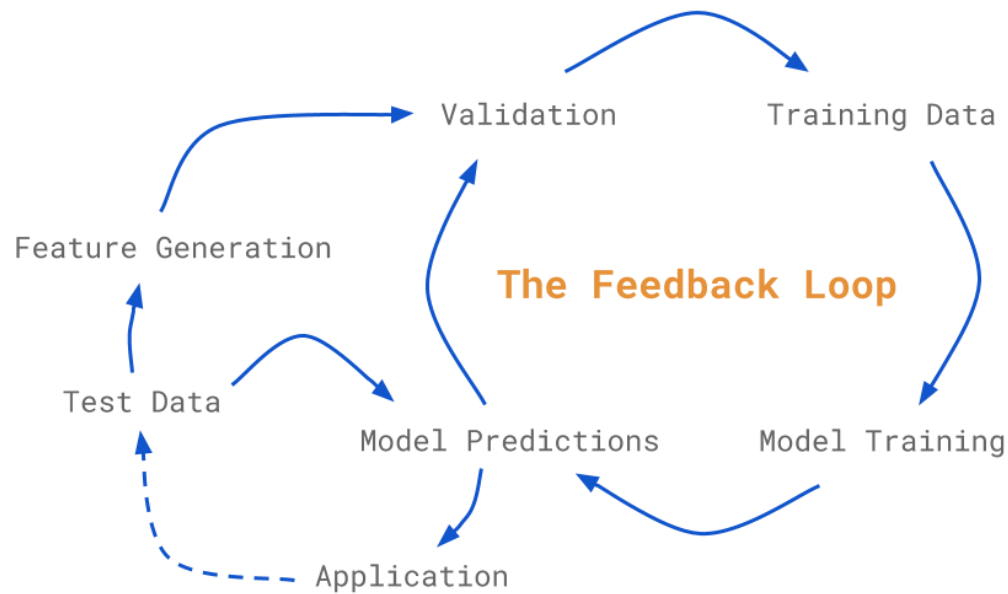
**2.1 5 ECTS credits correspond to nine working hours per week for the 13-week period (45 working hours per week for the three-week period).**

**I think the time I have spent on this course is**



# It is not a perfect course

Some would say we are on v3.0 of the course; I would argue that we are on v0.0.3.  
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 prioritize students on campus

- \* the oral exam is taken 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



# Memes

Let's try to have some fun  
while learning

LEARNING ML/DL  
FROM UNIVERSITY

ONLINE COURSES

FROM YOUTUBE

FROM ARTICLES

FROM MEMES

