Machine Learning Operations

02476 Machine Learning Operations

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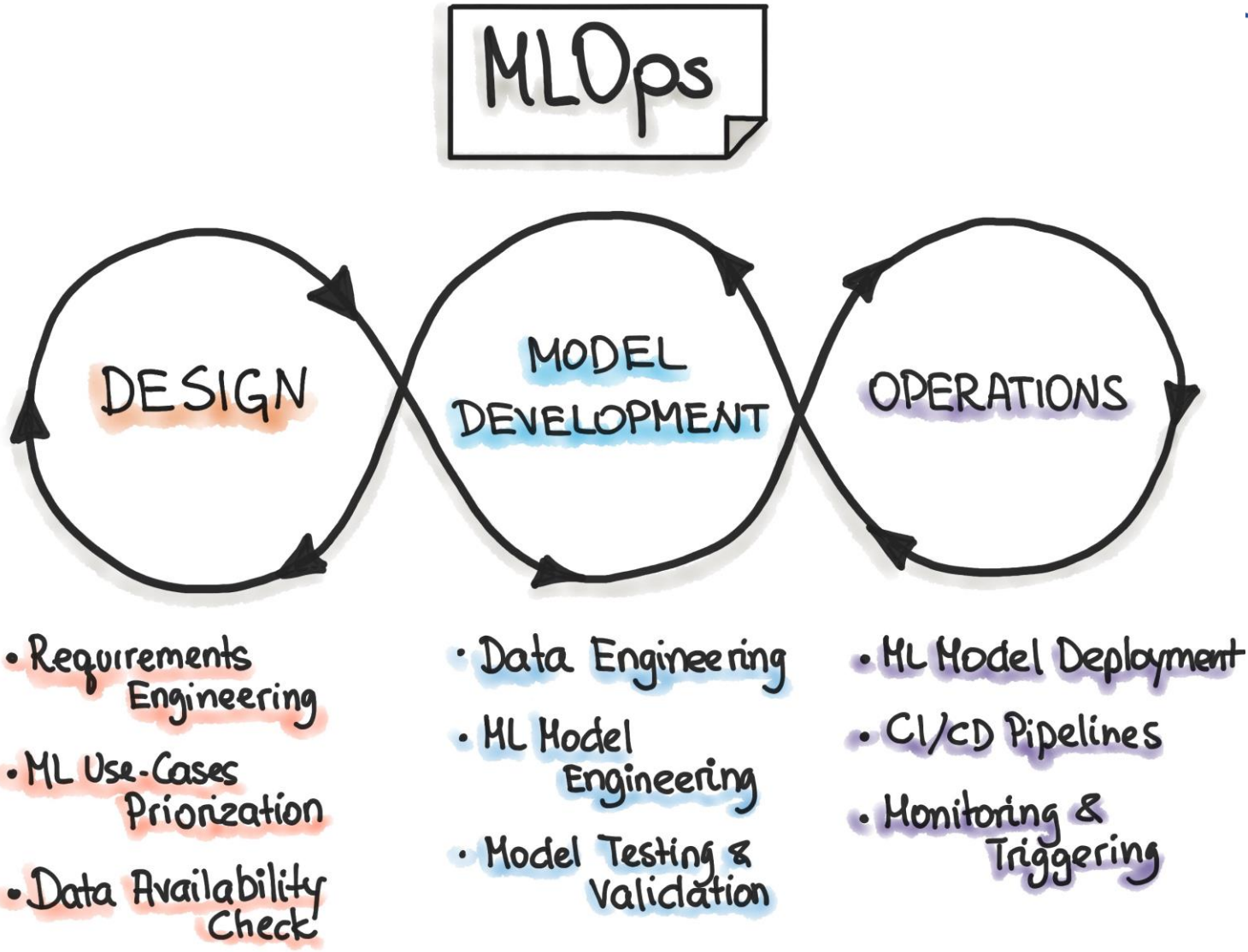
DTU Compute

Loosely based on https://www.youtube.com/watch?v=VU5Em1qkWDU

What is machine learning operations

Is a set of tools, processes, and mindset that aim to make ML Lifecycle ***reproducible***, ***trackable***, ***testable*** *and* ***maintainable***

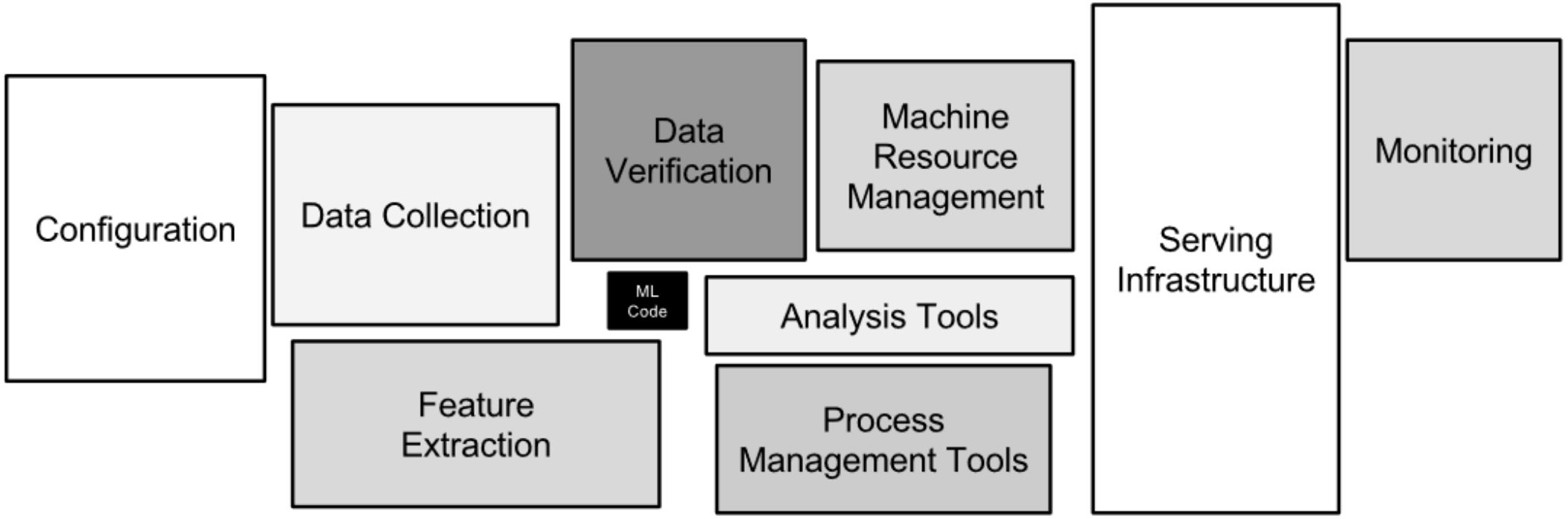
Notice: ITS A CYCLE!



Why should you care?

MLOps

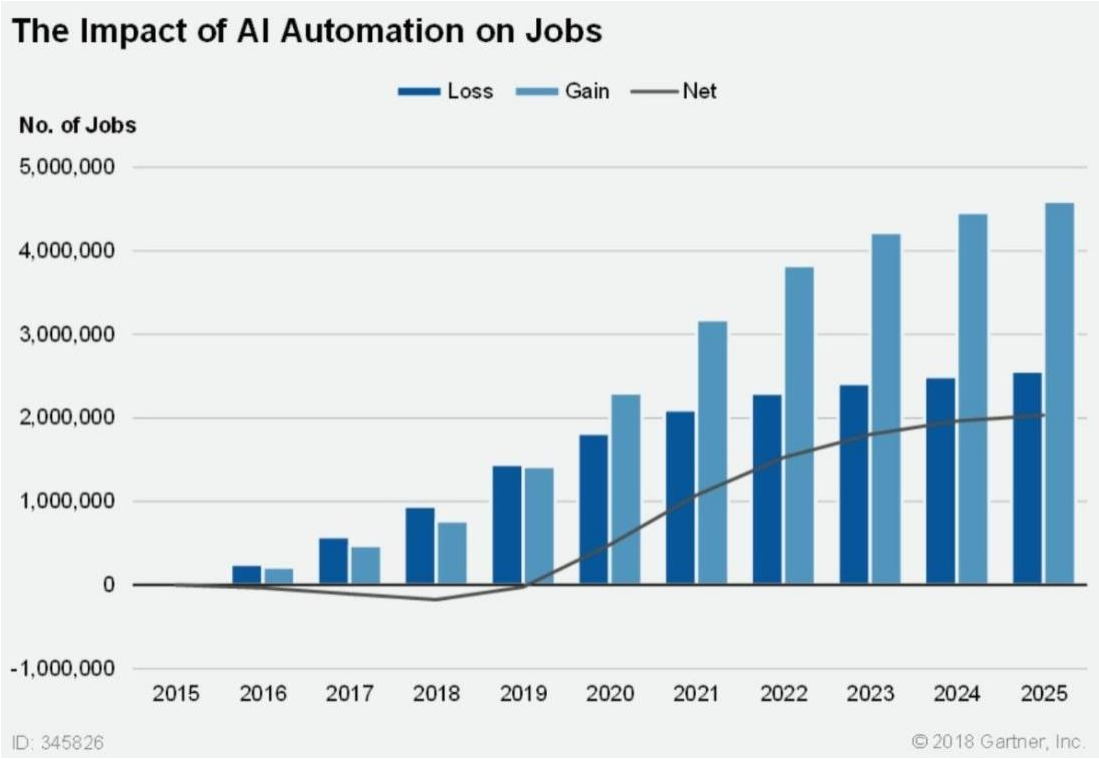
Teeny tiny part is actual ML code, the rest is operations



D. Sculley, Gary Holt, Daniel Golovin, Eugene Davydov, Todd Phillips, Dietmar Ebner, Vinay Chaudhary, Michael Young, Jean-Francois Crespo, and Dan Dennison. 2015. **Hidden technical debt in Machine learning systems**. In *Proceedings of the 28th International Conference on Neural Information Processing Systems - Volume 2* (*NIPS'15*). MIT Press, Cambridge, MA, USA, 2503–2511.

Why does companies care

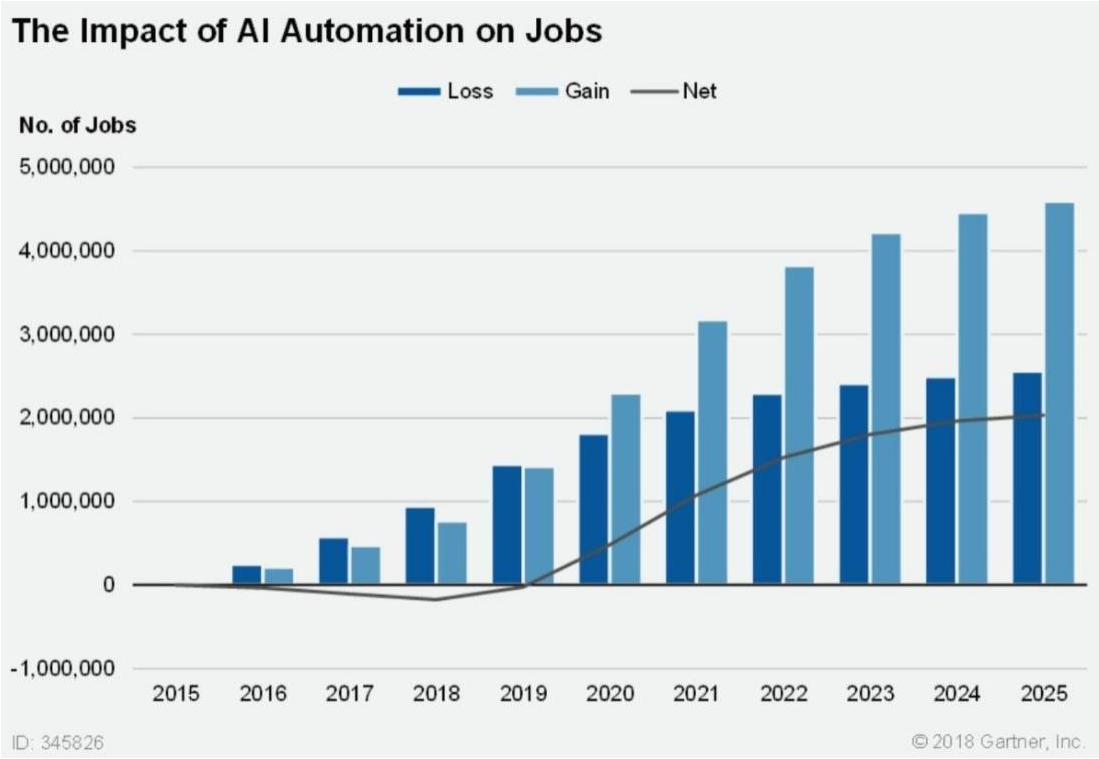
- ML automatization is going to increase over the years
- Examples:
  - Which stocks to buy or sell?
  - Where is the tumor in the picture
  - What should be the price of a banana today?



Why does companies care

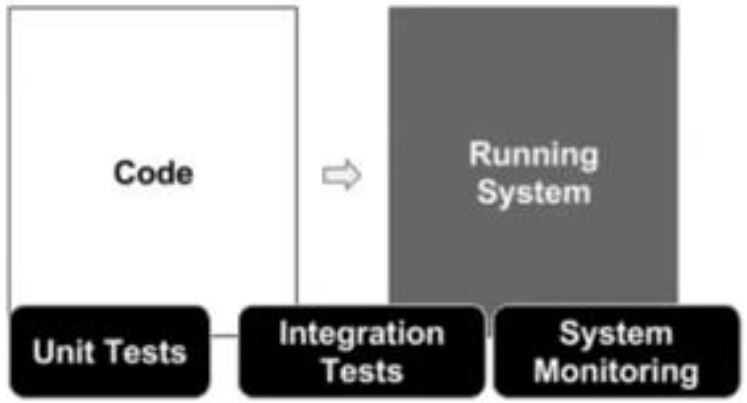
- Having automated model deployed with errors can cost ALOT of money:

  ”A famous example of the dangers here was Knight Capital´s system losing $465 millons in 45 minutes, apparently because of unexpected behavior from obsolete experimental codepaths” – Hidden Technical depth in Machine Learning Systems

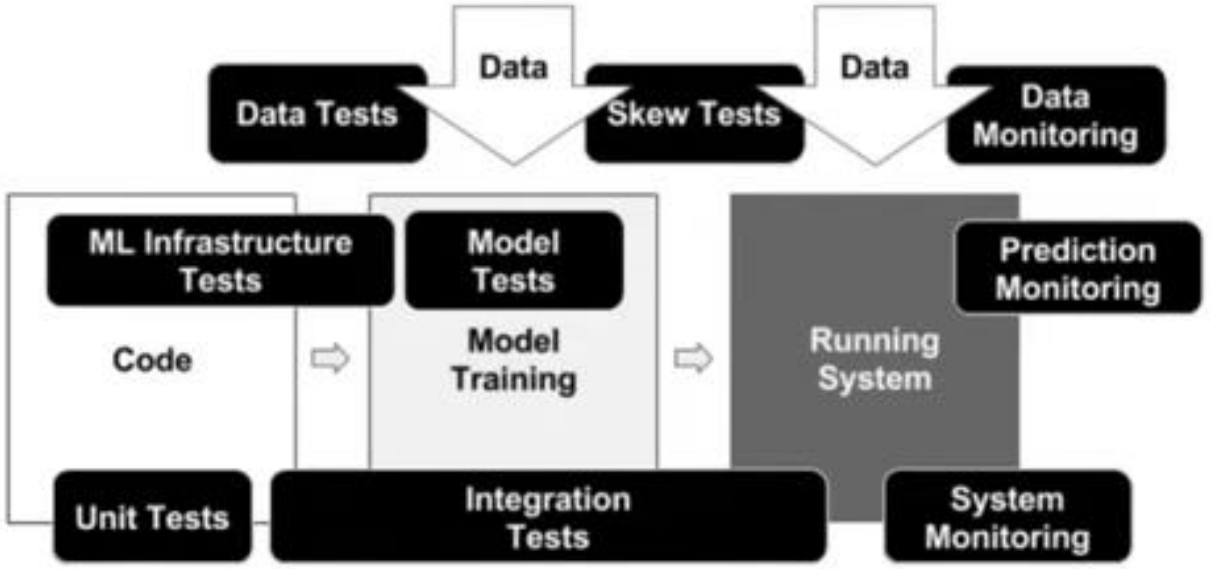


Why is MLOps harder than DevOps

- It involves a freaking lot of testing



Traditional System Testing and Monitoring

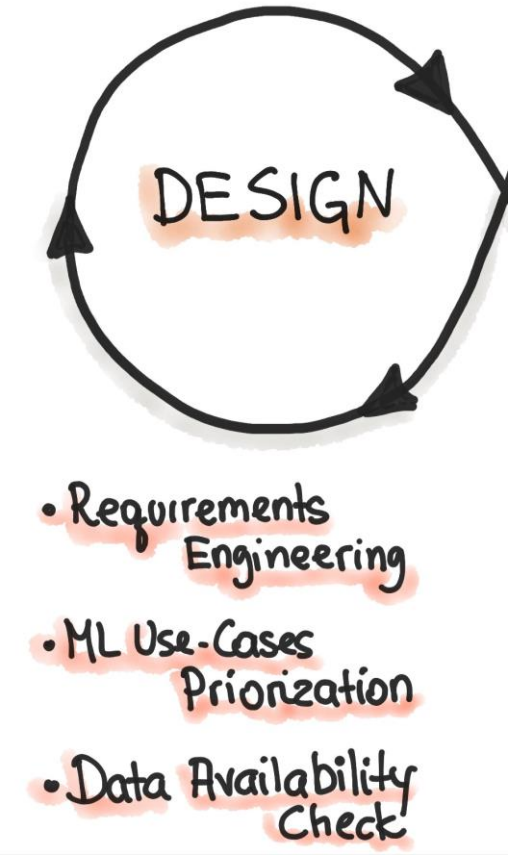


ML-Based System Testing and Monitoring

Design

MLOps

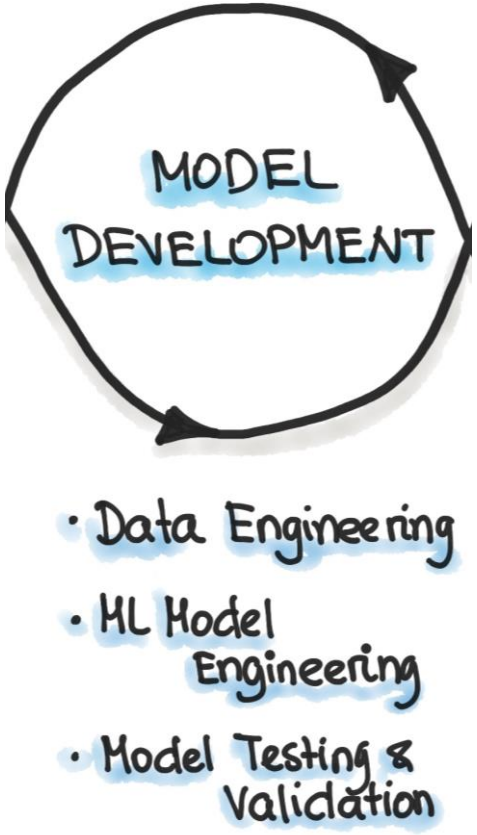
- The is the main part we train you at DTU
  - Analyze a problem
  - Look in litterature for references
  - Check if you have access to data for investigating this



Development

MLOps

- This is somewhat covered in other courses
  - Going from ideas to practical implementation
  - How should data be formatted to guide the development
  - How should model be validated and tested
- This course will introduce tools to be more organised in this phase

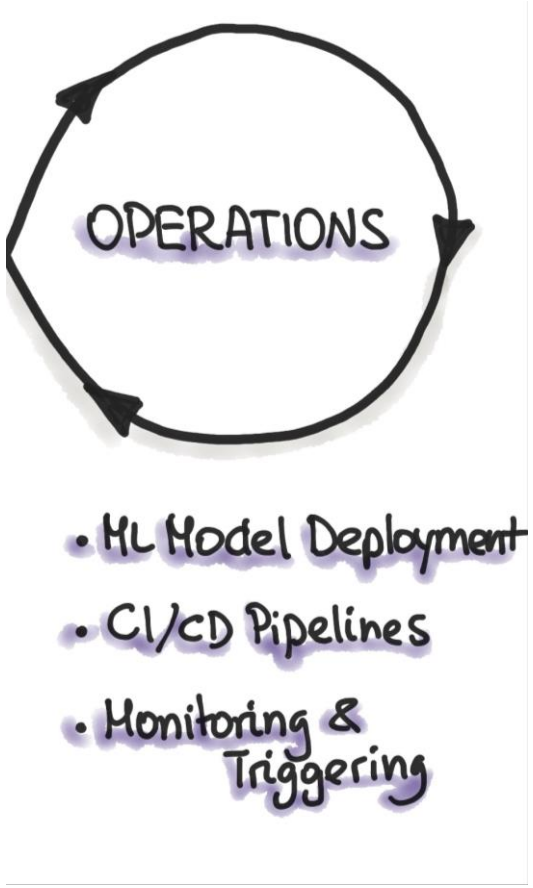


Operations (The new kid)

MLOps

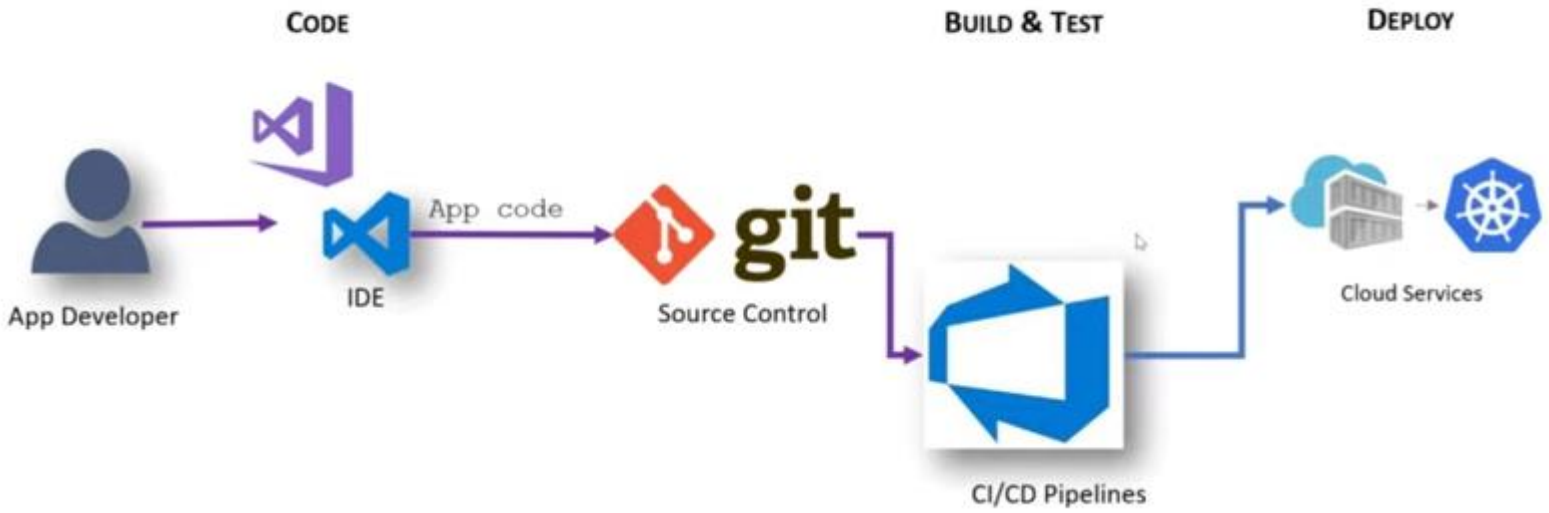
- To my knowledge, is not teached at DTU

- Operations = How to make sure models do not break
  - My hope is that you will get at feeling of this topic
  - Specifically we will touch apon deployment and CI



The workflow of standard DevOps

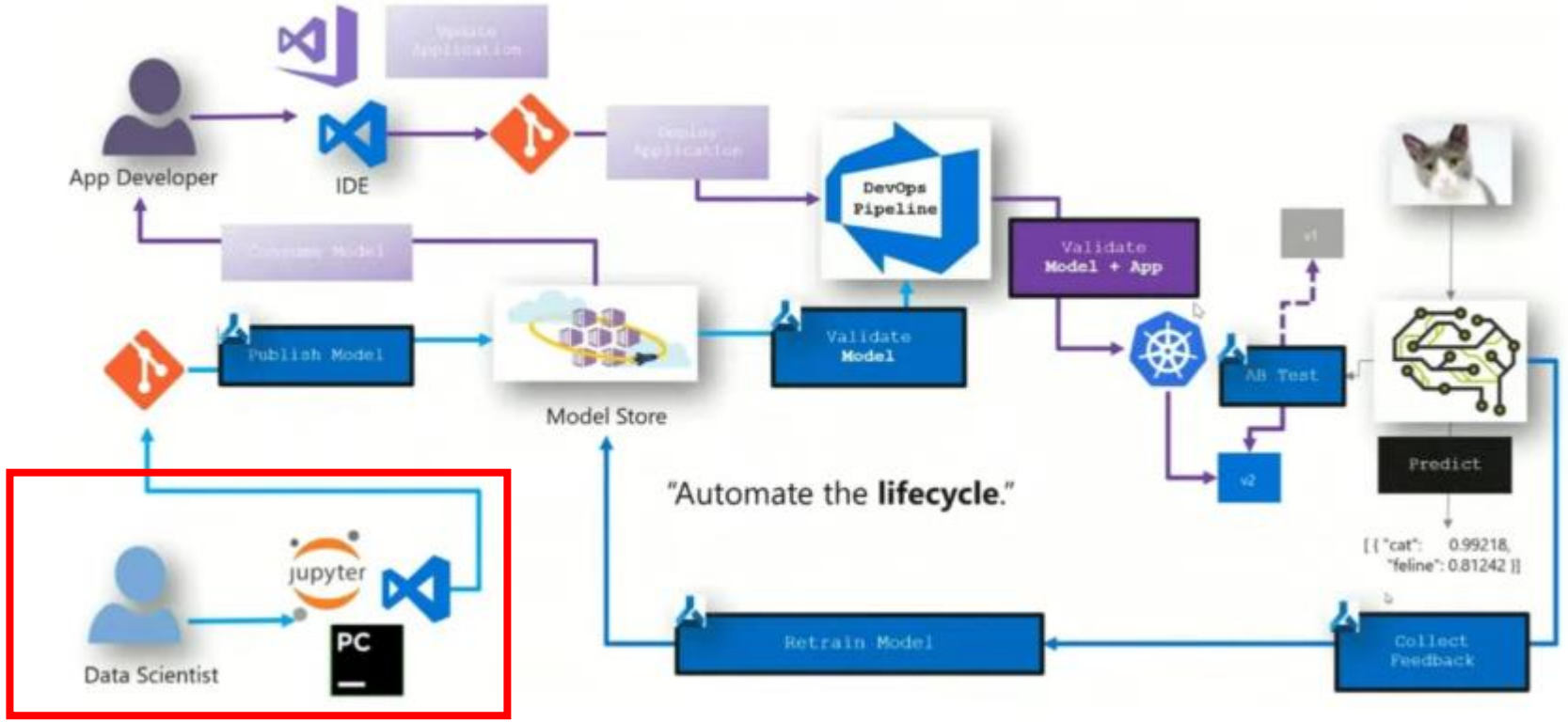
MLOps



The workflow of MLOps

MLOps

DevOps on steriods



This is what I expect you can do

The big difference is MLOps requires domain knowledge

MLOps at a high level

1. Optimizing workflows
   - Getting organized cost time initially but will save you time down the line
2. Versioning
   - Keep track of code changes, trained models etc. so everything can be backtracked
3. Automatization and Continuous X
   - Make sure that new changes automatically gets tested, deployed etc.
4. Reusability
   - Why rewrite the same code for a new project if you can reuse
5. Reproducibility
   - Make sure that your results can be redon by others

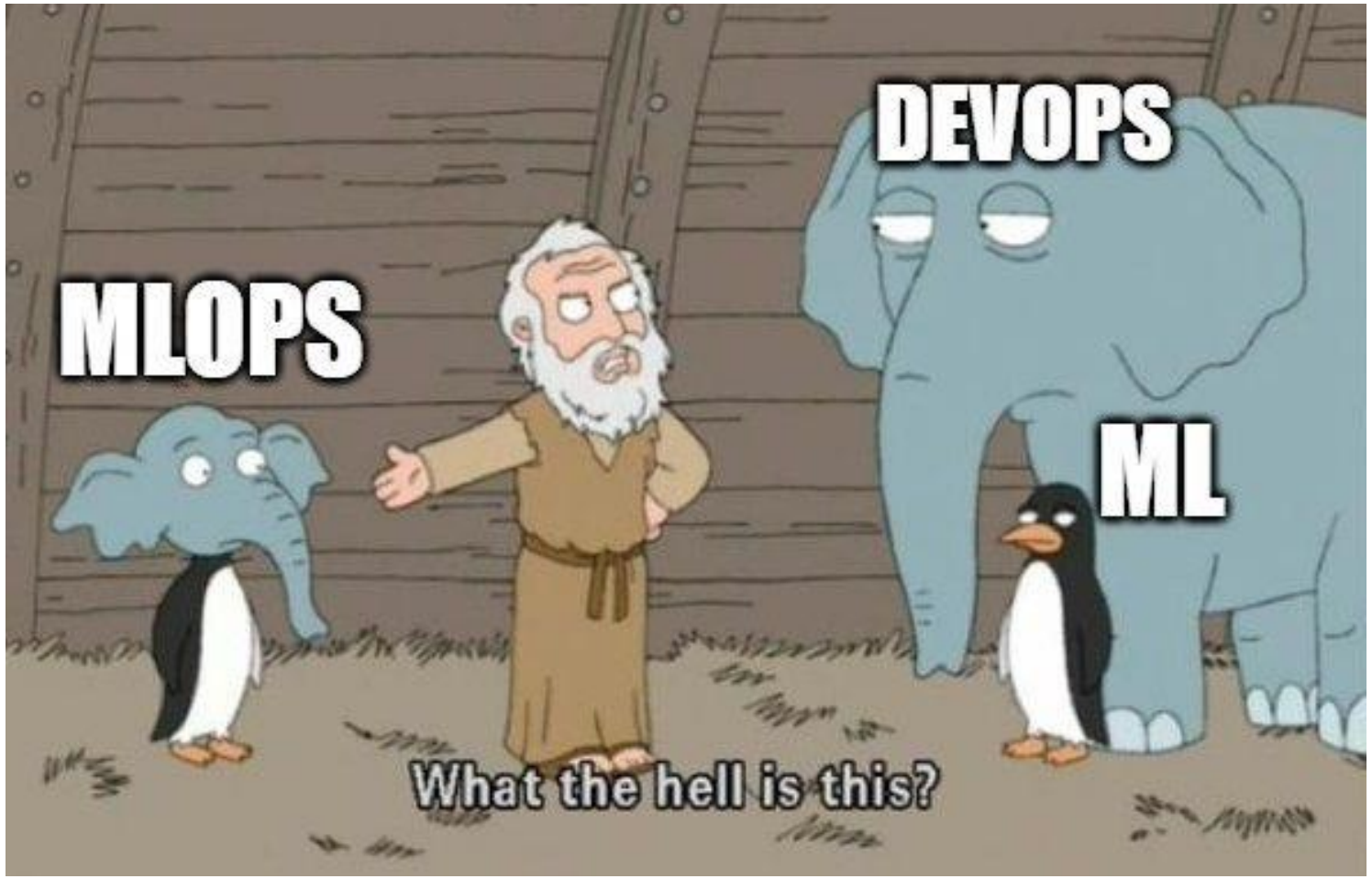
The first step of MLOps: Getting organised

Todays exercises is all about organising your workflow.

Note that

- While organization is maybe not that big of a deal on personal projects, it is a essential factor when working on large scale projects

Meme of the day



https://skaftenicki.github.io/dtu_mlops/s2_organisation_and_version_control/S2.html