

# How autodiff changed the world

Machine Learning Operations

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Postdoc

DTU Compute

# Who am I?



- Bachelor, Master and PhD from DTU
- Currently: Postdoc at section for cognitive systems
- Focus: Inductive biases in deep learning
- Eager open-source contributor

The screenshot shows the GitHub profile of Nicki Skaftes. The profile includes a circular profile picture, the name 'Nicki Skaftes' with the handle 'SkaftesNicki', and a bio stating 'Postdoc at section for Cognitive Systems (CogSys), Technical University of Denmark (DTU). Main focus: Generative models and geometrical deep learning.' It also shows '49 followers · 3 following · 31 stars', location 'Denmark', and email 'skaftenicki@gmail.com'. The 'Pinned' section lists four repositories: 'ddtn', 'Deep\_LMNN', 'libcpab', and 'pyclust'. The 'Contributions' section shows a heatmap for the last year with 1,075 contributions. The 'Contribution activity' section shows a timeline for April 2021, indicating 42 commits in 4 repositories.

# Course settings



- 5 ECTS
- 3 weeks period
- Level: Master
- Grade: Pass/not passed
- Type of assessment: weekly project updates + final oral examination/presentation
- Recommended prerequisites: 02456 (Deep Learning) or
  - General understanding of machine learning (datasets, probability, classifiers, overfitting etc..) and
  - Basic knowledge about deep learning (backpropagation, convolutional neural network, auto-encoders etc..)
  - Coding in Pytorch

# Course webpage

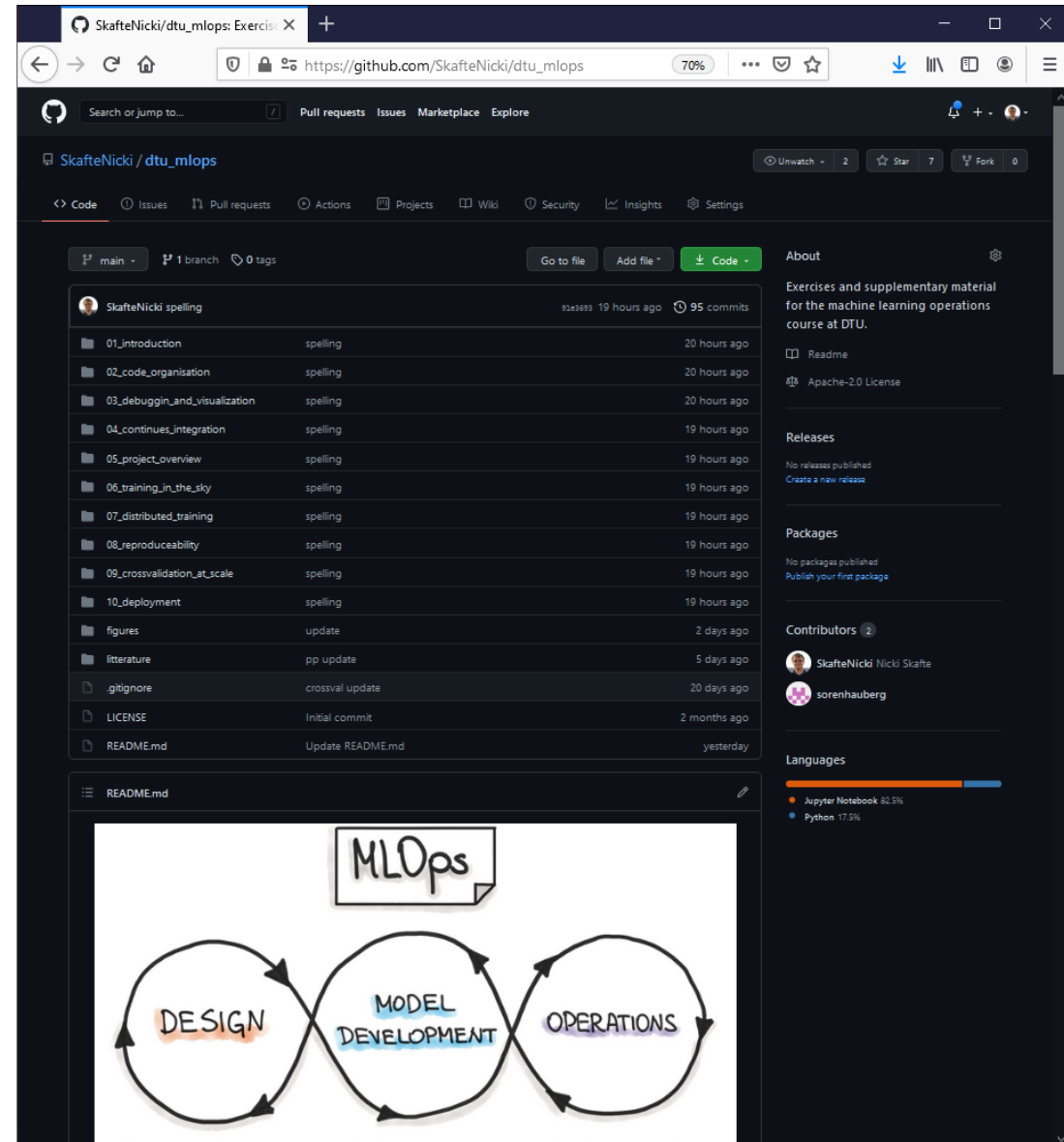


Webpage with lectures + exercises:

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

Join slack for communication:

[https://join.slack.com/t/slack-ddr8461/shared\\_invite/zt-qzk7ho8z-1tBT\\_SkkkxtpgMU8x197pg](https://join.slack.com/t/slack-ddr8461/shared_invite/zt-qzk7ho8z-1tBT_SkkkxtpgMU8x197pg)



# What is this course/What is it not

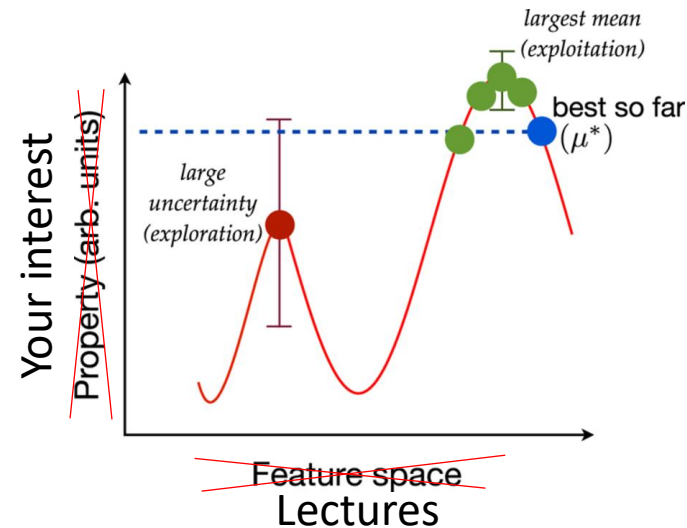


- Introduce the student to a number of coding practices, that will help them do state-of-the-art research. To provide hands-on experience with a number of frameworks for doing deep learning.
- Keywords:
  - Organization
  - Scalability
  - Reproducibility
  - Hands-on experience
- How deep learning models works (02456)

# What do I expect from you



- This course was developed over 1½ month, meaning that the material may be suboptimal
- We provide lectures, exercises and guidance but encourage self-study
- Make sure to both explore and exploit it!



- Provide all the feedback you have, I can take it!



# What I hope from this course



- Have fun!
- Playing around with the different 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

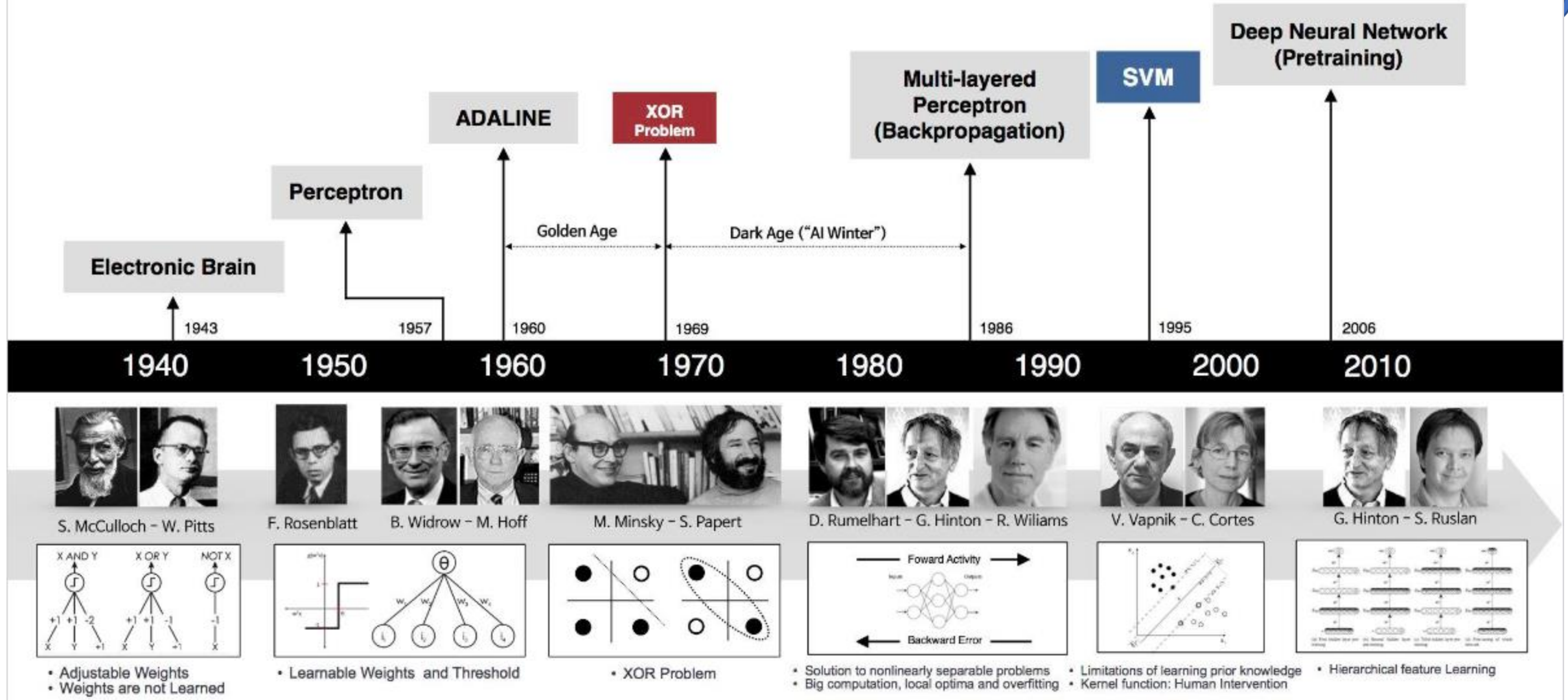
[hue-gah] *noun*

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

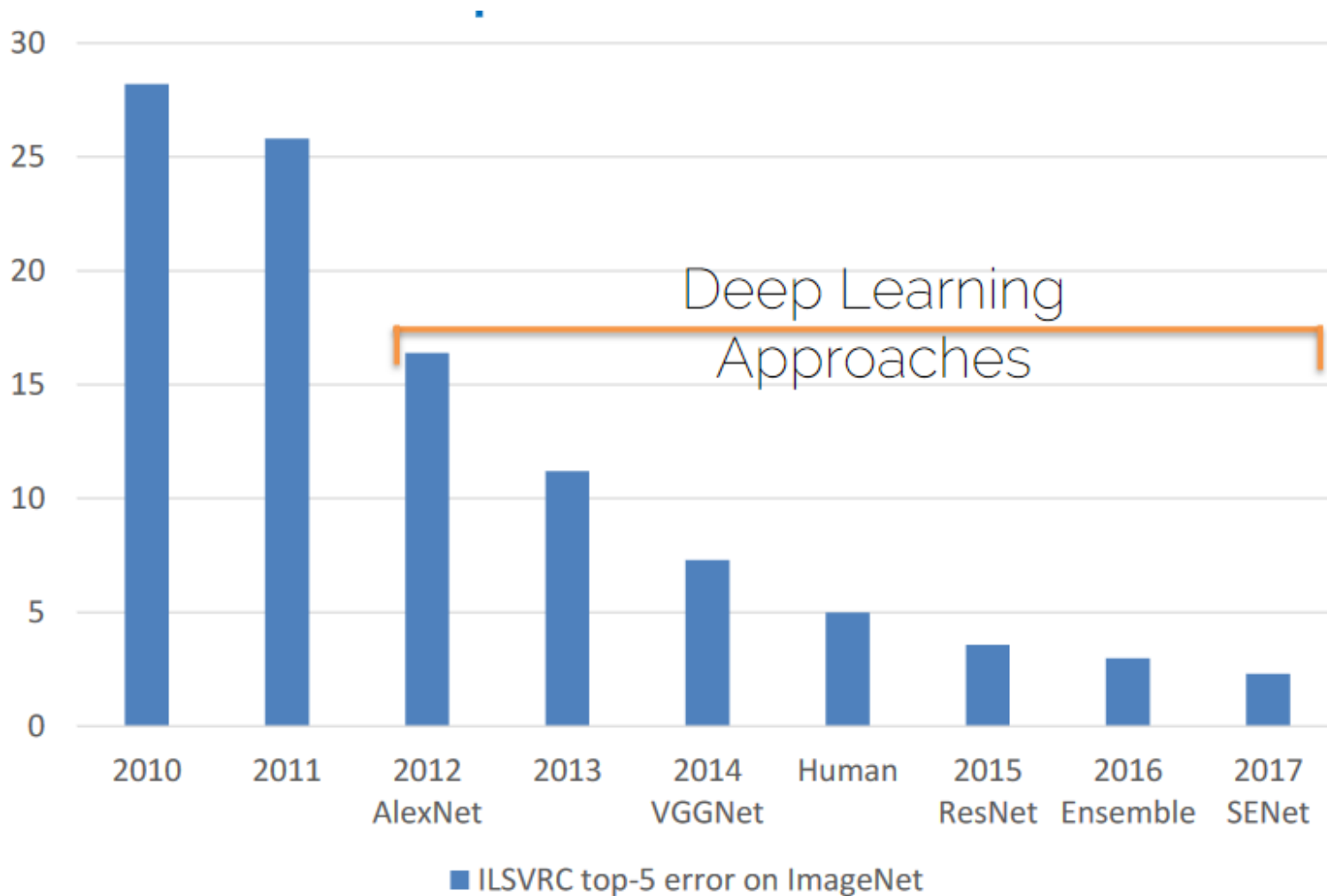
# History of deep learning



# History of deep learning



# The Deep Learning Revolution





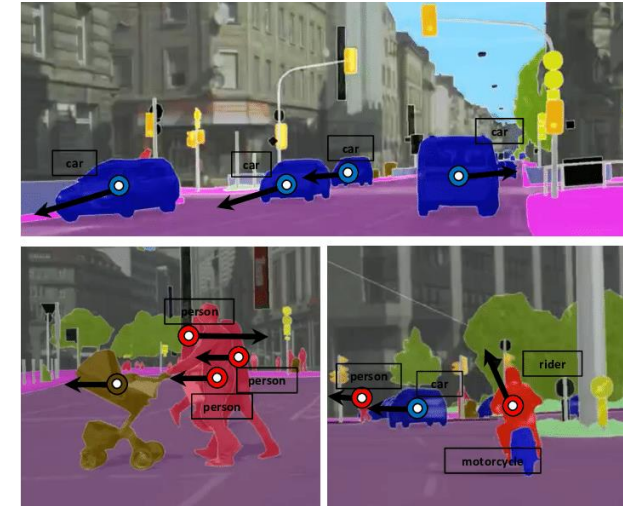
# Since then...



AlphaGO:  
Beating humans



Unet:  
High quality  
semantic  
segmentation



GPT-3  
Having  
conversations  
with humans

Q: What is your favorite animal?  
A: My favorite animal is a dog.

Q: Why?  
A: Because dogs are loyal and friendly.

Q: What are two reasons that a dog might be in a bad mood?  
A: Two reasons that a dog might be in a bad mood are if it is hungry or if it is hot.

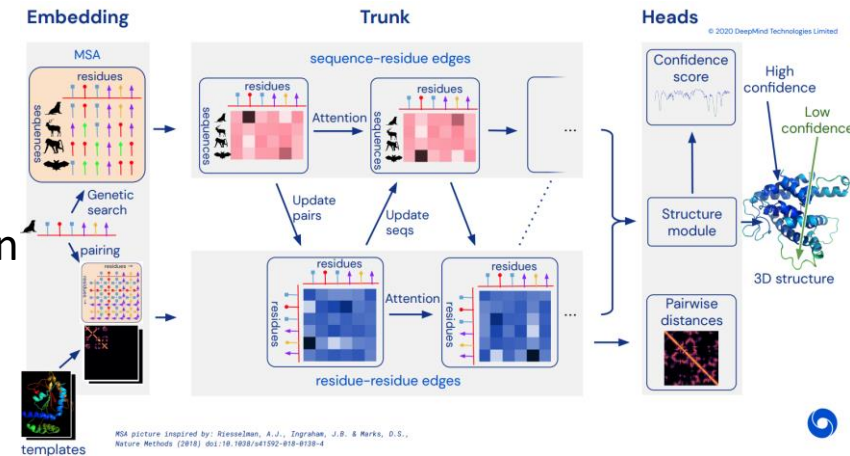
Q: How many eyes does a giraffe have?  
A: A giraffe has two eyes.

Q: How many legs does a frog have?  
A: A frog has four legs.

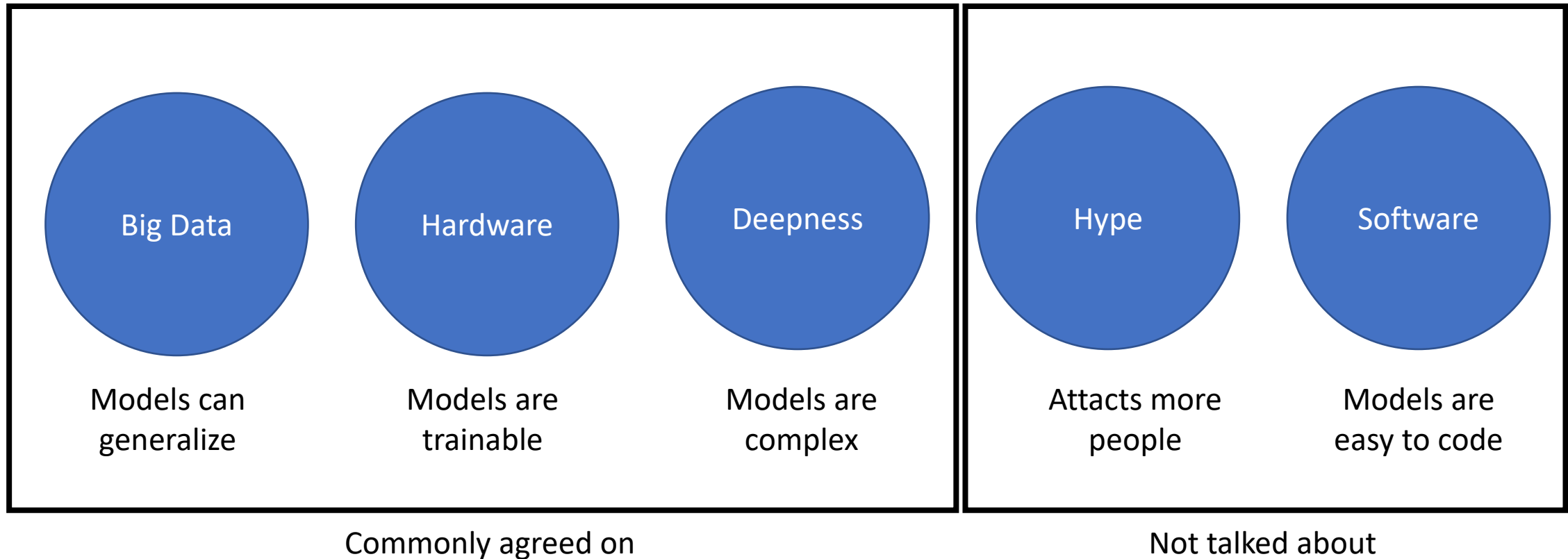
Q: Are there any animals with three legs?  
A: No, there are no animals with three legs.

Q: Why don't animals have three legs?  
A: Animals don't have three legs because they would fall over.

AlphaFold:  
Solving protein  
engineering



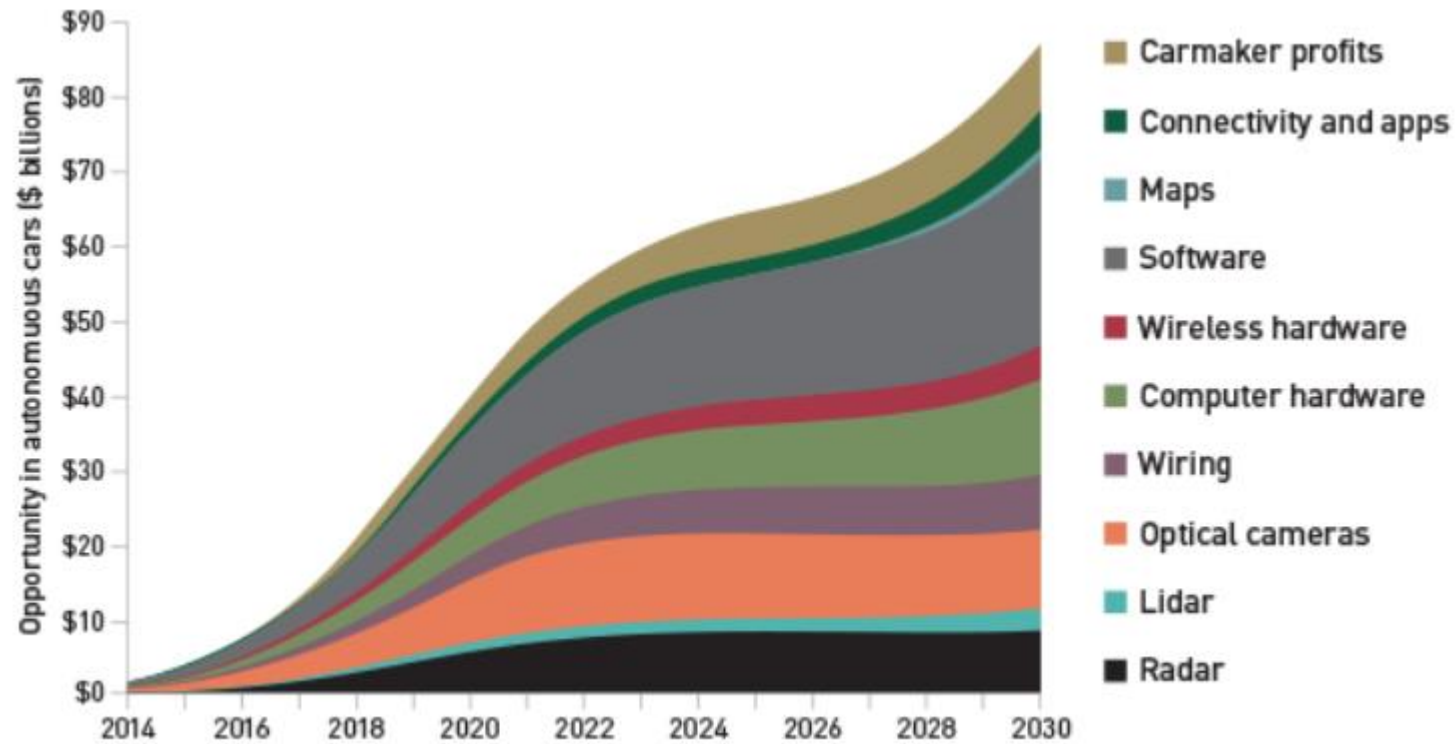
# What has changed?



# Why you should jump the wagon



“... the deep learning market is expected to be worth USD 1,722.9 Million by 2022”



# The DL software landscape



Google



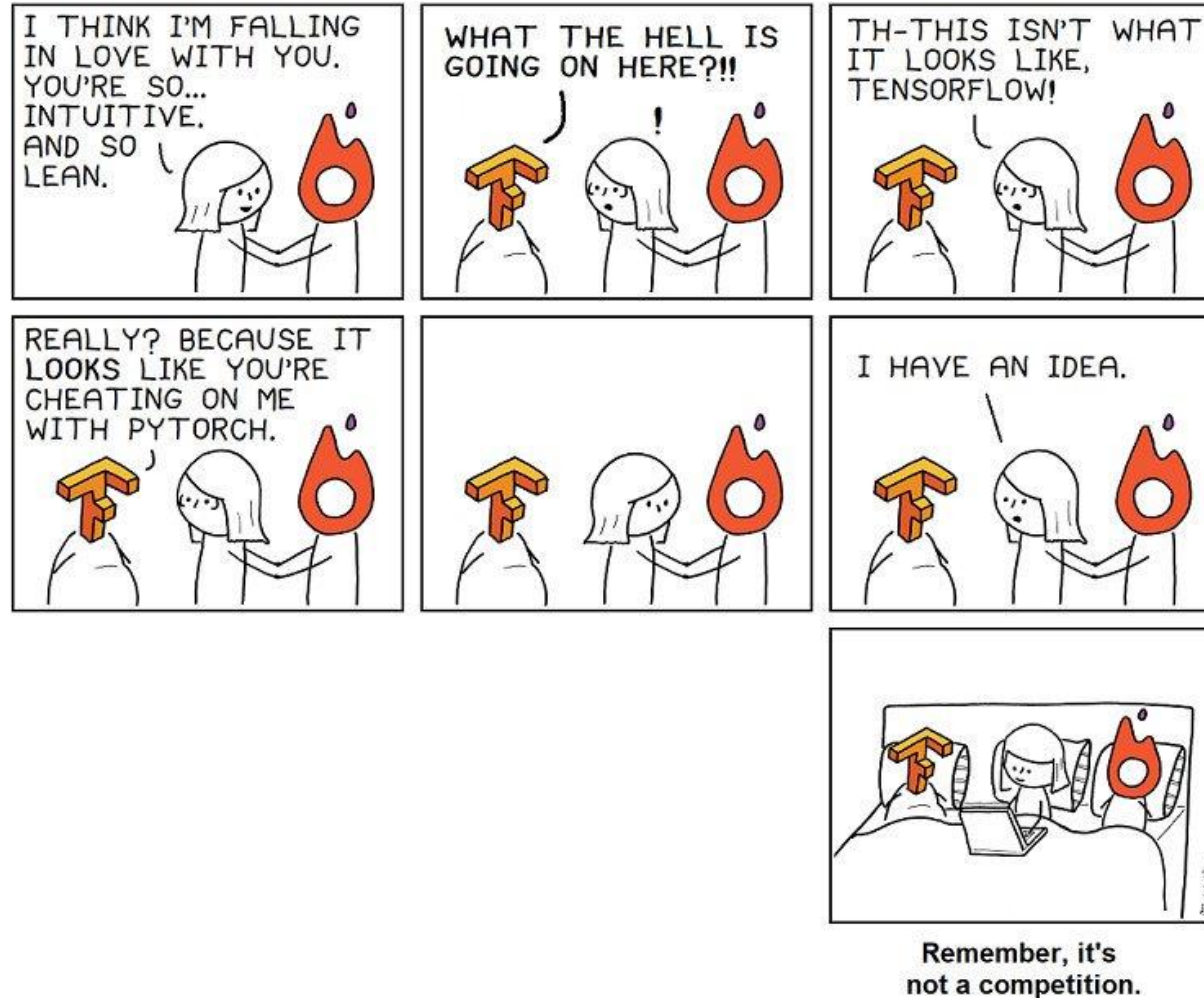
facebook



No point in discussion who is best. The (biased) facts are:

- Tensorflow are too a large extend used in production
- Pytorch is used in research

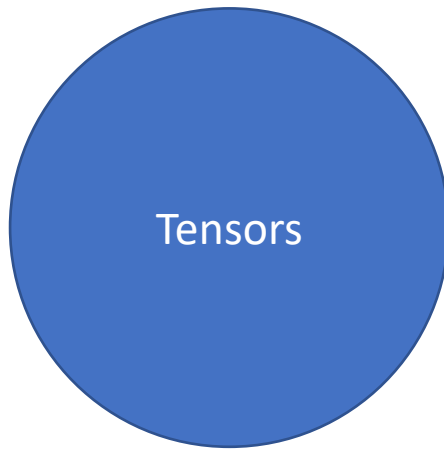
# If you have the time, I recommend learning both



# How to make a modern deep learning framework

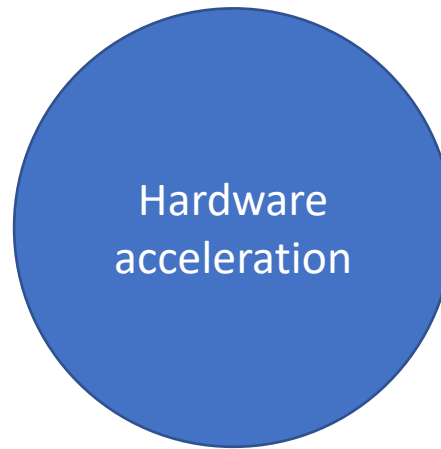


## 3 key elements



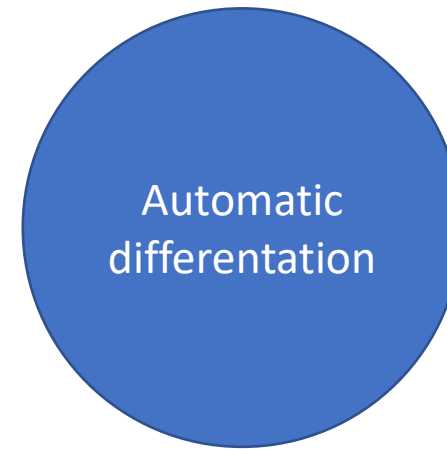
Tensors

Abstraction to  
higher order data



Hardware  
acceleration

Faster  
computations



Automatic  
differentiation

Ease of use



# Meme of the day

