

Deep learning software: an overview

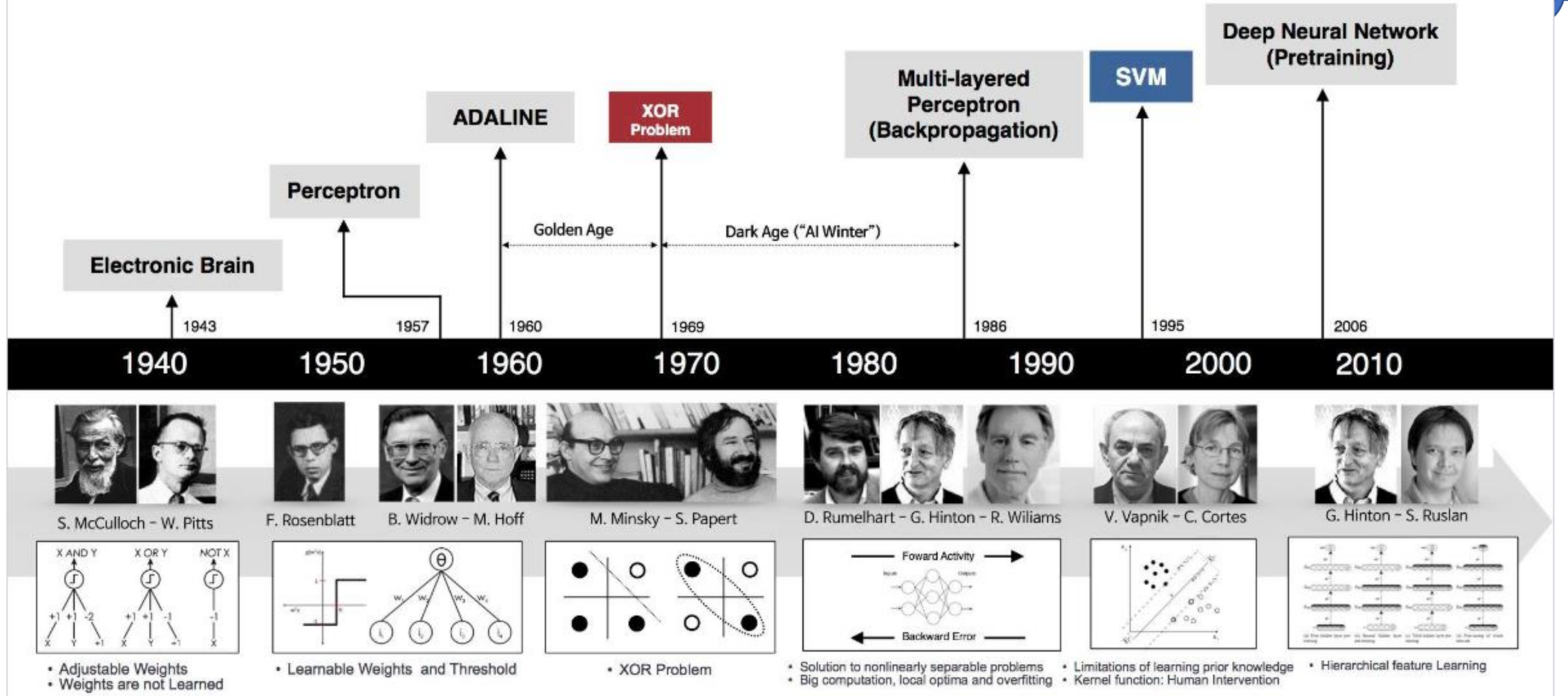
02476 Machine Learning Operations

Nicki Skafte Detlefsen,

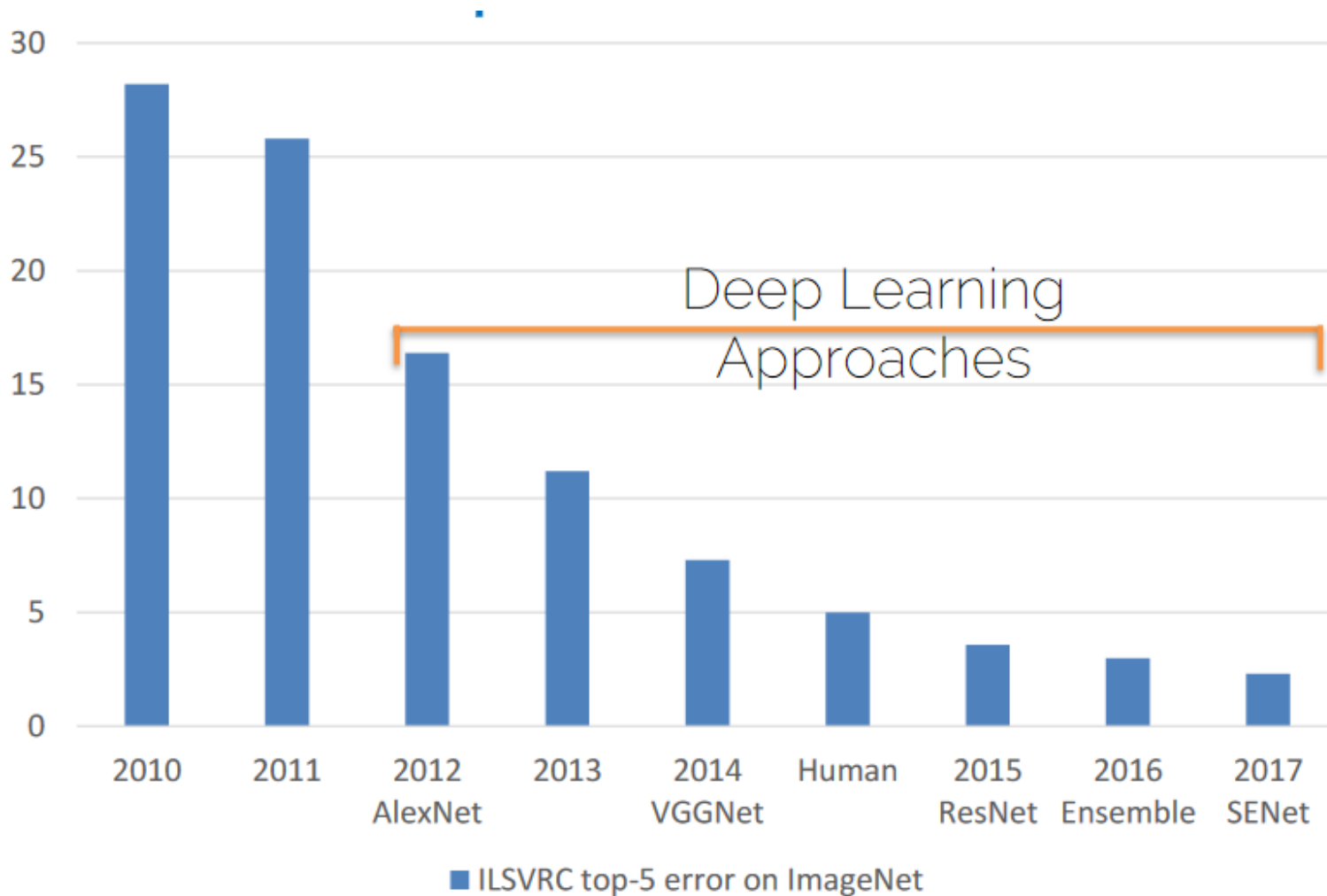
Postdoc

DTU Compute

History of deep learning



The Deep Learning Revolution



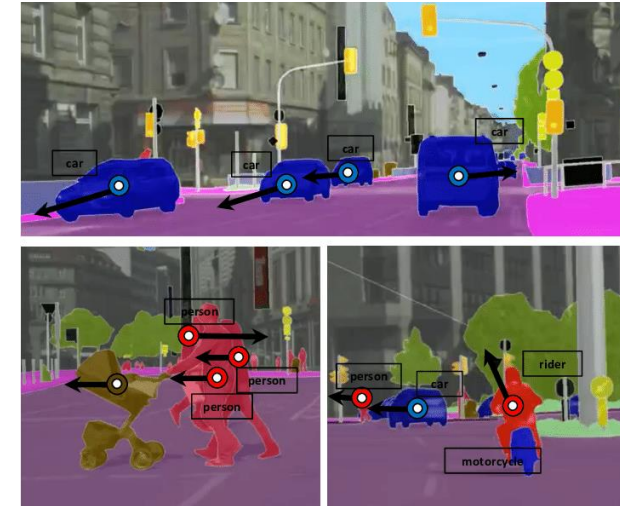
Since then...



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.

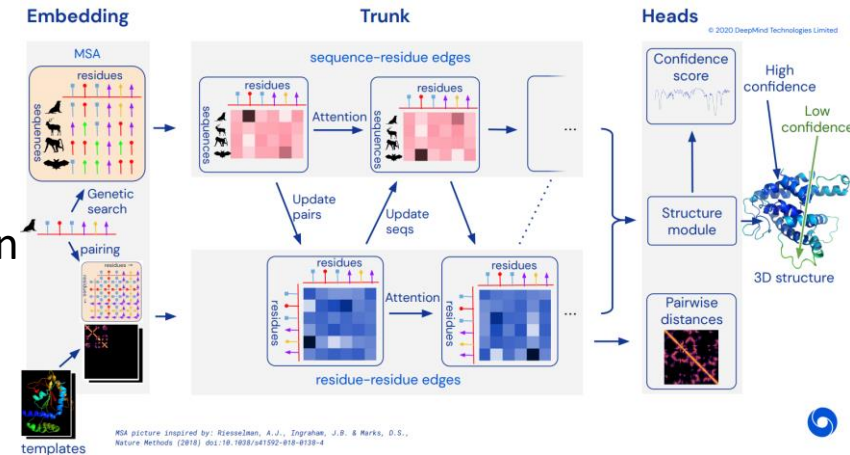
Q: How many eyes does a giraffe have?
A: A giraffe has two eyes.

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

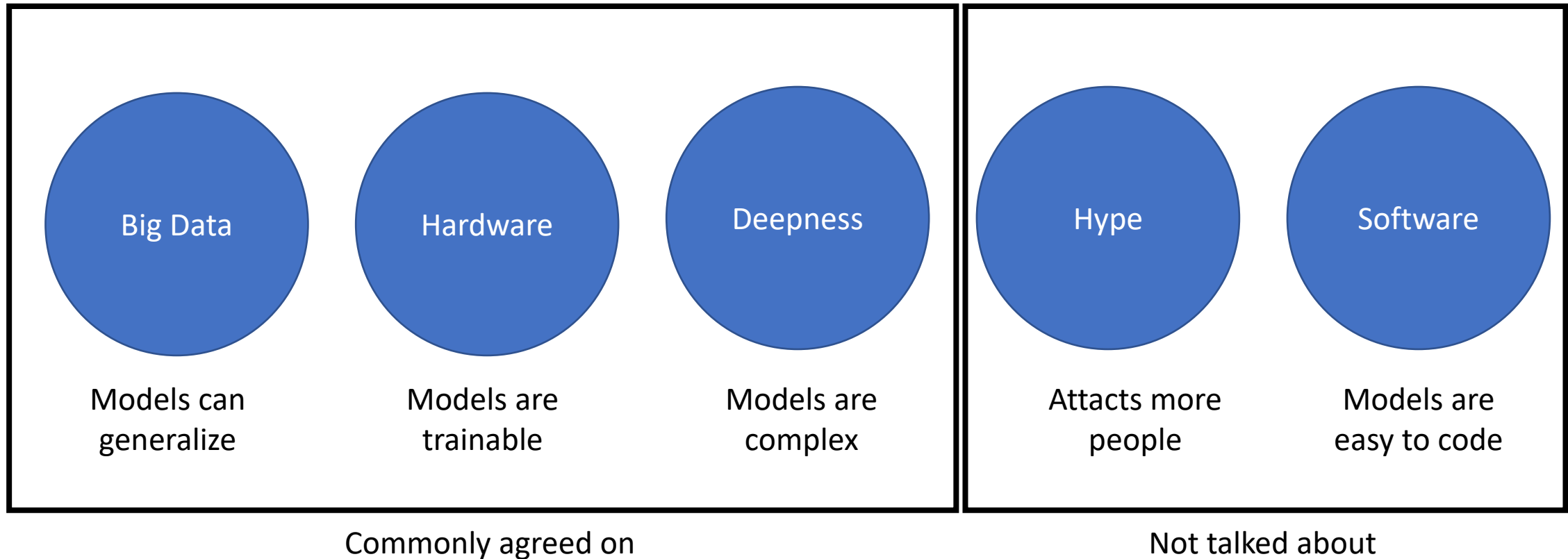
Q: Are there any animals with three legs?
A: No, there are no animals with three legs.

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

AlphaFold:
Solving protein
engineering



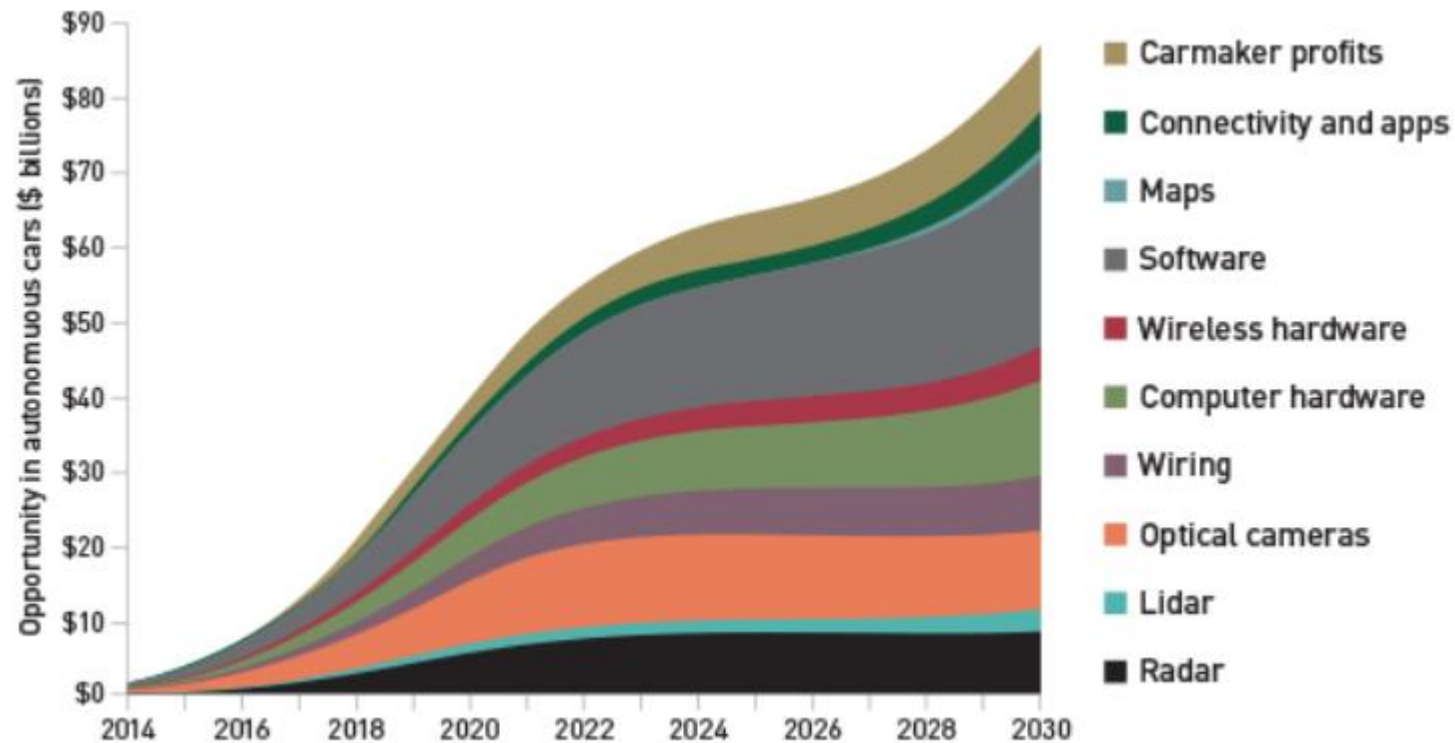
What has changed?



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



The Google logo, featuring its characteristic multi-colored letters: blue 'G', red 'o', yellow 'o', blue 'g', green 'l', and red 'e'.



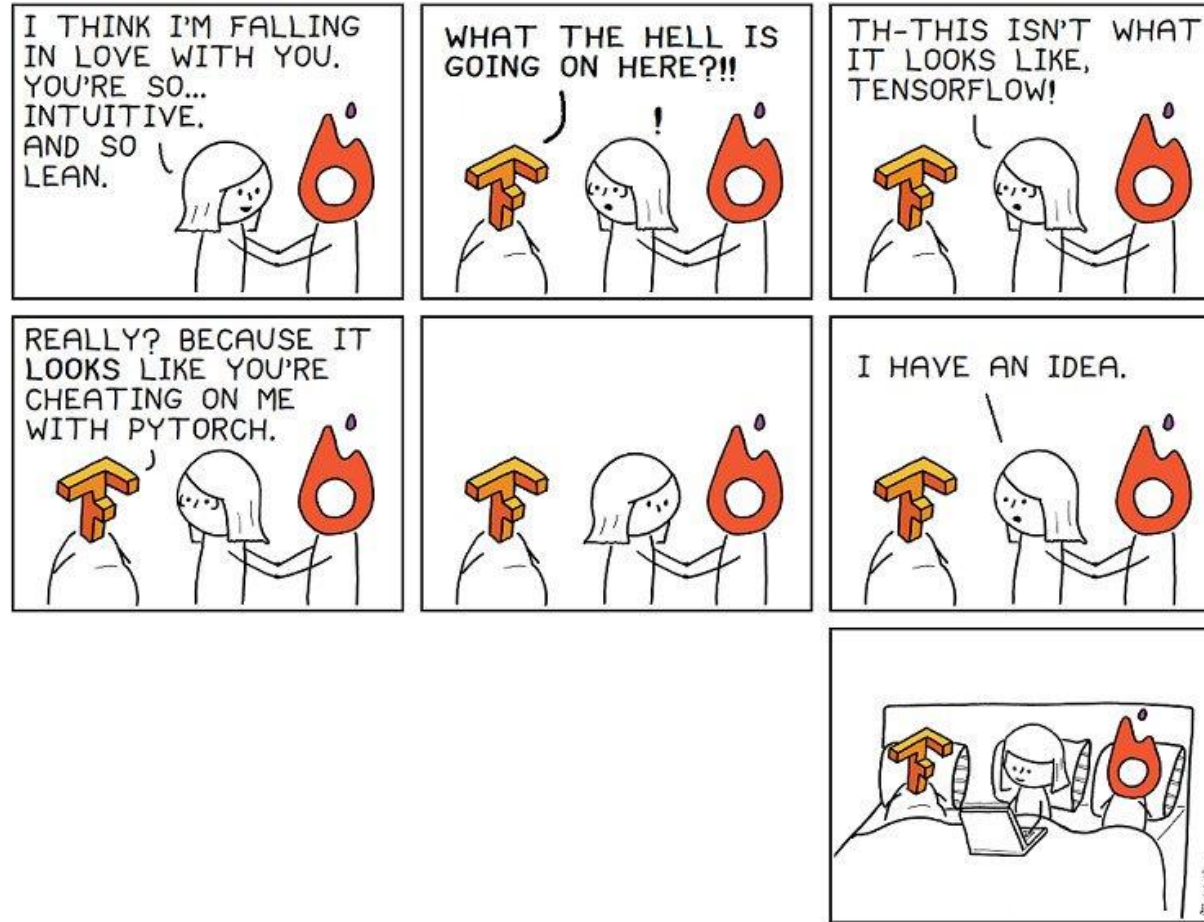
The Facebook logo, consisting of the word "facebook" in white lowercase letters on a dark blue rectangular background.

The PyTorch logo, featuring an orange circular icon with a flame-like shape inside, followed by the word "PyTorch" in a black sans-serif font.

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

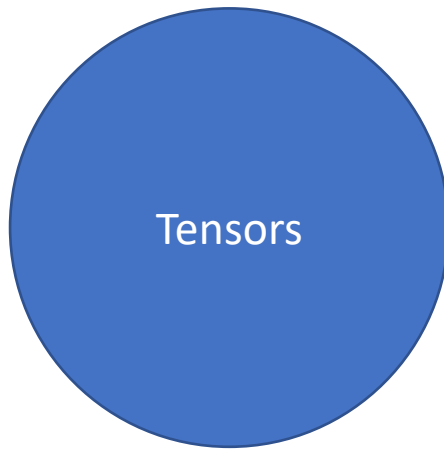


**Remember, it's
not a competition.**

How to make a modern deep learning framework

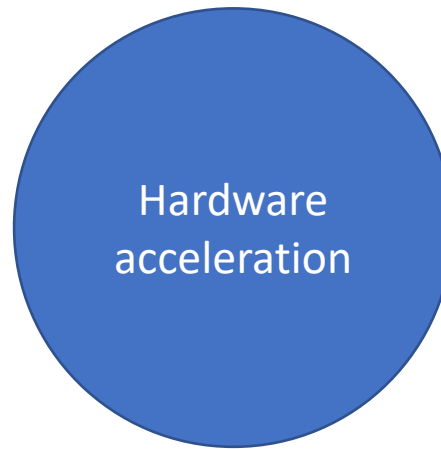


3 key elements



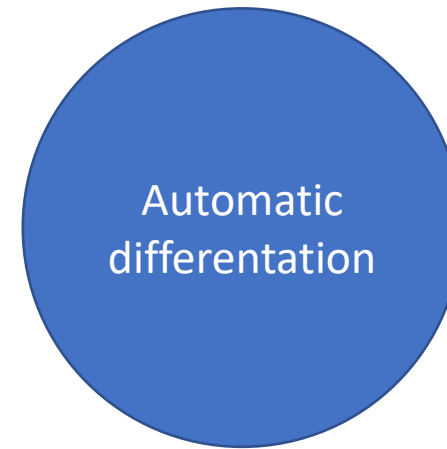
Tensors

Abstraction to
higher order data



Hardware
acceleration

Faster
computations



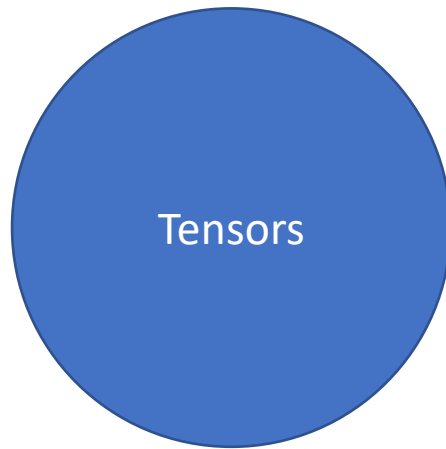
Automatic
differentiation

Ease of use

How to make a modern deep learning framework



3 key elements



Abstraction to
higher order data

A tensor is an N-dimensional array of data



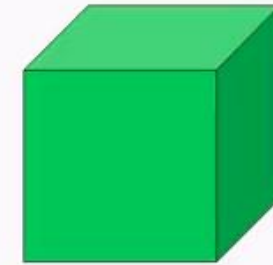
Rank 0
Tensor
scalar



Rank 1
Tensor
vector



Rank 2
Tensor
matrix



Rank 3
Tensor



Rank 4
Tensor

How to make a modern deep learning framework



3 key elements



CPU



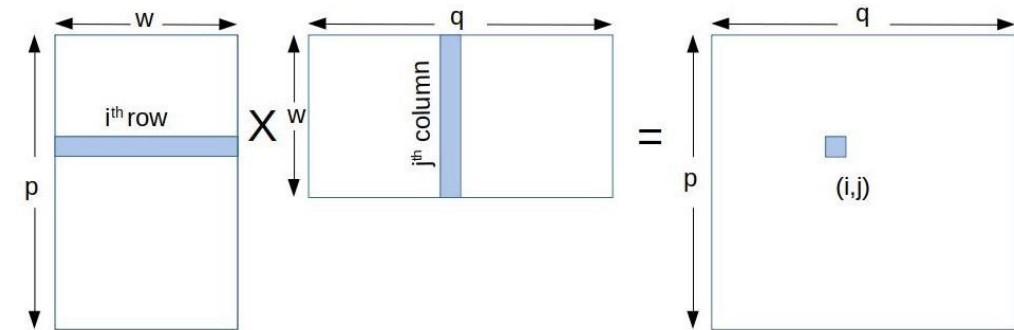
GPU



TPU

Hardware
acceleration

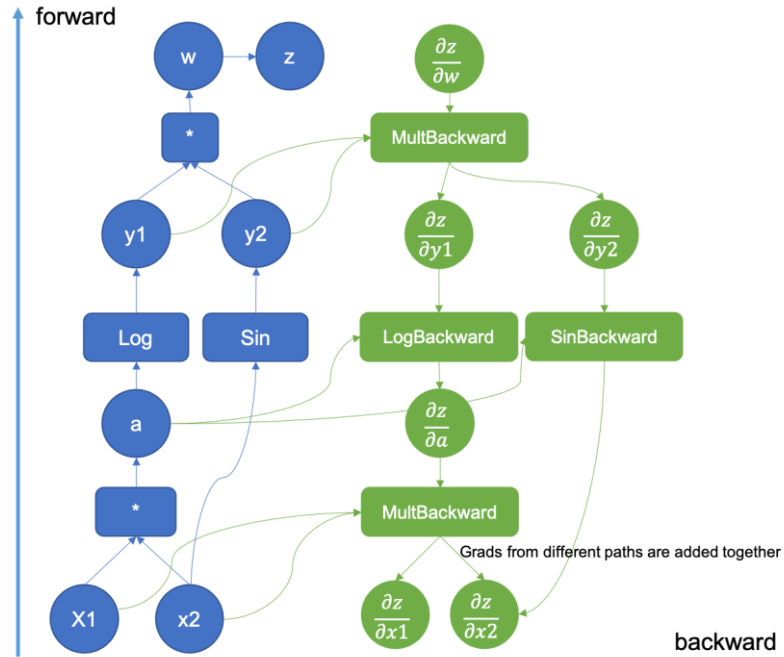
Faster
computations



How to make a modern deep learning framework



3 key elements



Automatic
differentiation

Ease of use

```
(base) C:\Users\nsde>python
Python 3.8.5 (default, Sep 3 2020, 21:29:08) [MSC v.1916 64 bit (AMD64)] :: Anaconda, Inc. on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import torch
>>> 2*torch.ones(5, requires_grad=True)
tensor([2., 2., 2., 2., 2.], grad_fn=<MulBackward0>)
>>>
```

Meme of the day



https://skaftenicki.github.io/dtu_mlops/s1_getting_started/S1.html