(8) Deep Learning Software

→ CPU vs GPU

→ Deep Learning Framework
- → Caffe / Caffe2
- → Theano / TensorFlow
- → Torch / PyTorch

* Programming GPUs

- CUDA (NVIDIA only)
  - → Write C-like code that runs directly on the GPU
  - → Higher-level APIs: cuBLAS, cuFFT, cuDNN, etc
- OpenCL
  - → Similar to CUDA, but runs on anything
  - → Usually slower :(

⇒ If you aren't careful, training can bottleneck on reading data and transferring to GPU!

(Solutions)
- → Read all data into RAM
- → Use SSD instead of HDD
- → Use multiple CPU threads to prefetch data.

★ Deep Learning Frameworks

⇒ First generation of deep learning framework, were built in academia.

Caffe → UC Berkeley

Torch → NYU

Theano → U Montreal

⇒ Next generation of deep learning framework, developed from industries:

Caffe2 → Facebook

PyTorch →

TensorFlow → Google

⇒ The point of deep learning frameworks:

1) Easily build big computational graphs.
2) Easily compute gradients in computational graphs
3) Run it all efficiently on GPU
(wrap cuDNN, cuBLAS etc)

Keras

↳ Keras is a layer on top of TensorFlow, makes common things easy to do.

⇒ TensorFlow : Other High-Level Wrappers

- → Keras
- → TFLearn
- → TensorLayer
- → tf.layer
- → TF-Slim
- → tf.contrib.learn
- → Pretty Tensor
- → Sonnet

Ship with TensorFlow

From Google

From DeepMind

⇒ TensorFlow : Tensorboard

→ Add logging to code to record loss, stats, etc
→ Run server & get pretty graphs!

* PyTorch

ⓐ Three levels of Abstraction

Tensor: Imperative ndarray but runs on GPU

Variable: Node in a Computational graph, stores data and gradients

Module: A neural network layer; may store state or learnable weights.

ⓑ PyTorch : DataLoader

⇒ A DataLoader wraps a Dataset and provides minibatching, shuffling, multithreading, for you.

PyTorch : Visdom

{Similar to TensorBoard}

★ Caffe 2 Overview

→ Static graphs, somewhat similar to TensorFlow

→ Core written in C++

→ Nice Python interface.

→ Can train model in Python, then serialize and deploy without python.

→ Works on iOS/Android etc.

Google

Tensor-Flow

↑

{One framework to rule them all}

Facebook

PyTorch + Caffe 2

↑ ↑

{Research} {Production}