Tools Seminar

Week 8 - Deep Learning

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Introduction

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- 2012, Jeff Dean and Andrew Ng used unsupervised learning to train neural network which learned to recognize cats

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- 2018, Google BERT model achieved the state-of-the-art performance in 11 NLP tasks

ImageNet & Deep Neural Network

ImageNet [Feifei Li, Stanford] Large Scale Visual Recognition Challenge

	LeNet	AlexNet	VGG	GoogleLeNet	ResNet
# of Layers	5	8	19	22	**152**
Top 5 Error	N/A	16.4%	7.3%	6.7%	3.57%
Year	1994	2012	2014	2014	2015

This is why it's called "**deep**" learning

2018 Turing Award

2018 Turing Award: Geoffrey Hinton, Yoshua Bengio, Yann LeCun

> *"for conceptual and engineering breakthroughs that have made deep neural networks a critical component of computing"*

- Geoffrey Hinton: Backpropagation, Boltzmann Machines, Improvements to Convolutional Neural Network (CNN)
- Yoshua Bengio: Probabilistic models of sequences, High-dimensional word embeddings and attention, Generative adversarial networks (GAN)
- Yann LeCun: CNN, backprop, Broadening the vision of neural networks

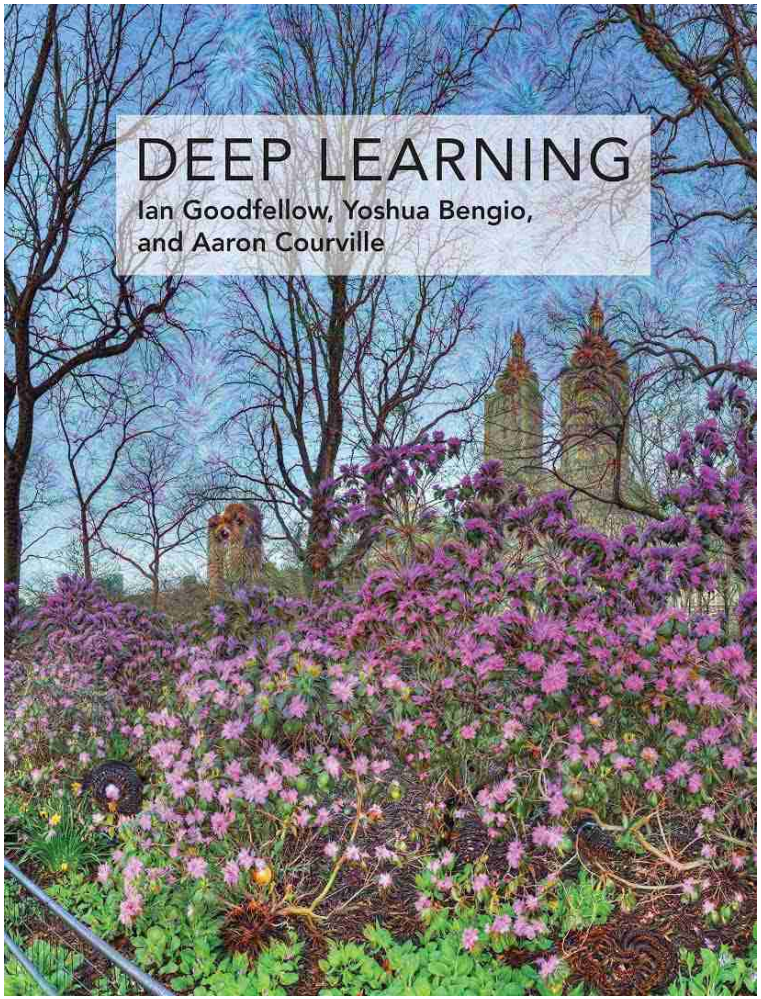
Impetus of Deep Learning

Looking back, we may know what leads to the boom of DL in 2010s

- Large amount of labeled **data**: ImageNet
- Improvement of **hardware**: GPU $\rightarrow$ GPGPU (general-purpose GPU)
- Improvement of **algorithms**: deep networks, dropout

Introductory Books and Courses

- Feifei Li, Stanford cs231n: Convolutional Neural Networks for Visual Recognition (highly recommended!)
- Chris Manning, Stanford cs224n: Natural Language Processing with Deep Learning
- Ian Goodfellow, Deep Learning Chinese version



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Frameworks

Deep Learning Frameworks

Framework: A large package consisting of lots of deep learning primatives/operators, and users can easily call them by API

- Google: Tensorflow (commonly used in industry)
  - Static computation graph
  - Jeff Dean
- Facebook: PyTorch (commonly used in academics)
  - Dynamic computation graph
  - Yangqing Jia, Caffe
- Amazon: MXNet
  - Tianqi Chen (UW $\rightarrow$ CMU)

* We focus on **PyTorch** in this seminar

PyTorch

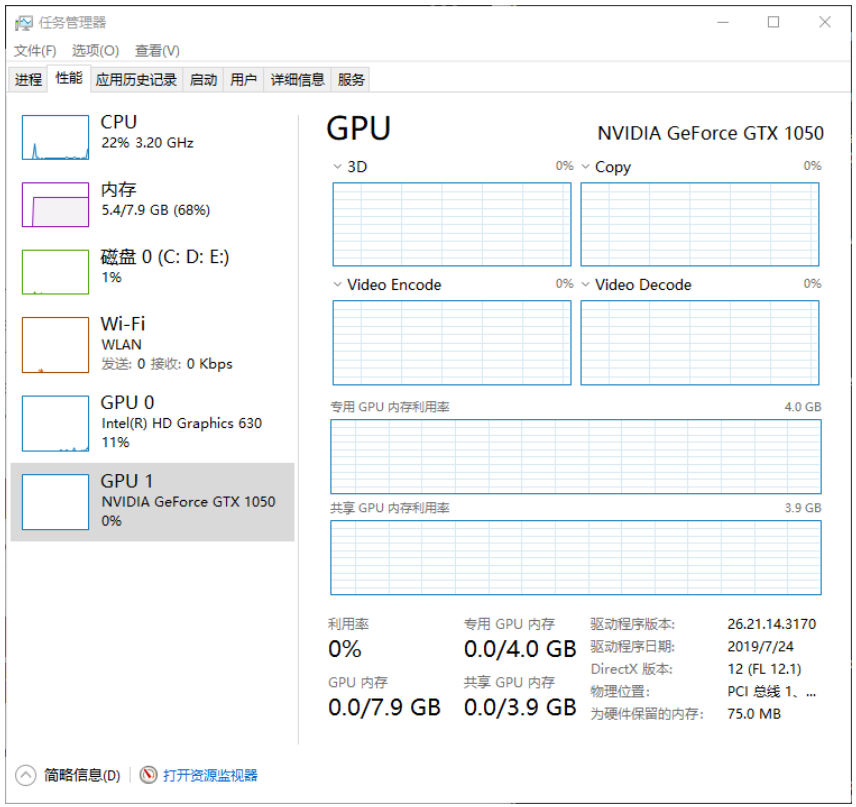
PyTorch: A Python-based scientific computing package

- A replacement for NumPy to use the power of GPUs
- A deep learning research platform that provides maximum flexibility and speed

Since it is highly embedded in Python, PyTorch is very Pythonic and easy-to-use

Pytorch Installation

Firstly check if your computer has discrete graphics card (GPU)



Install Nvidia driver: https://zhuanlan.zhihu.com/p/54350088

- CUDA 10.1
- cuDNN 7

Pytorch Installation

Select your configuration on this website and run the installation command

- Windows: Need to install Anaconda first
- WSL does not support GPU! Do NOT install Pytorch on WSL!
- Mac does not support GPU too (if you do not have external interface)!

e.g. For Windows with no GPUs

```
pip install torch==1.4.0+cpu torchvision==0.5.0+cpu -f https://
    ↪ download.pytorch.org/whl/torch_stable.html
```

Tutorials

PyTorch has very detailed documentations, make the best of them!

- Tutorials: https://pytorch.org/tutorials/
- Chinese tutorials: https://pytorch.apachecn.org/
- Documentation / API: https://pytorch.org/docs/stable/index.html
- Deep Learning with PyTorch: A 60 Minute Blitz
  - Chinese version
  - You can download the `.ipynb` file or directly run on Colab

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Summary

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- Introduction
- Deep Learning Framework: PyTorch
  - Once you get in some trouble concerning PyTorch, you can search the Docs of PyTorch for details. Alternatively you can try to find if there are similar problems on *PyTorch Discuss*.