Introduction to Deep Learning
Part III: Practical application
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Knowledge for Tomorrow

Curriculum

A: Theoretical introduction – Morning
I. Introduction and basics
II. Advanced concepts
III. Practical application

B. Hands-on seminar – Afternoon
Run prepared Jupyter Notebooks online on Binder, or locally on your own computer.

Curriculum

III. Practical application

- The PyTorch Framework

- Code & knowledge sources

- First Steps with PyTorch: Example Notebook

* Inspired by lectures from MIT; images taken from these, if not noted otherwise

Frameworks

Frameworks

PyTorch

- Developed by Facebook

- Based on Torch (Lua)

- "Autograd" module for differentiation

- Dynamic graph – easy debugging

- User-friendly, easy parallelization

- Used by Facebook, Microsoft, Salesforce, …

- Implemented in Python and C++

- Supports Python, C++

- BSD license

Frameworks
What do DL frameworks like PyTorch offer?

- **Tensor algebra**

```
In [5]:   1 import torch
          2
          3 x= torch.tensor([[1,2,3],[4,5,6]])
          4 y= torch.tensor([[7,8,9], [10,11,12]])
          5
          6 f= 2*x + y
          7 print(f)

tensor([[  9,  12,  15],
        [ 18,  21,  24]])
```

https://subscription.packtpub.com/book/web-development/9781789534092/1/ch01lvl1sec04/basic-pytorch-operations

Frameworks

What do DL frameworks like PyTorch offer?

- Tensor algebra

- **Pre-defined components**

torch.nn.BatchNorm2D
…

$\sum$

torch.nn.Linear
torch.nn.Conv2D
…

torch.nn.ReLU
torch.nn.Sigmoid
…

Frameworks
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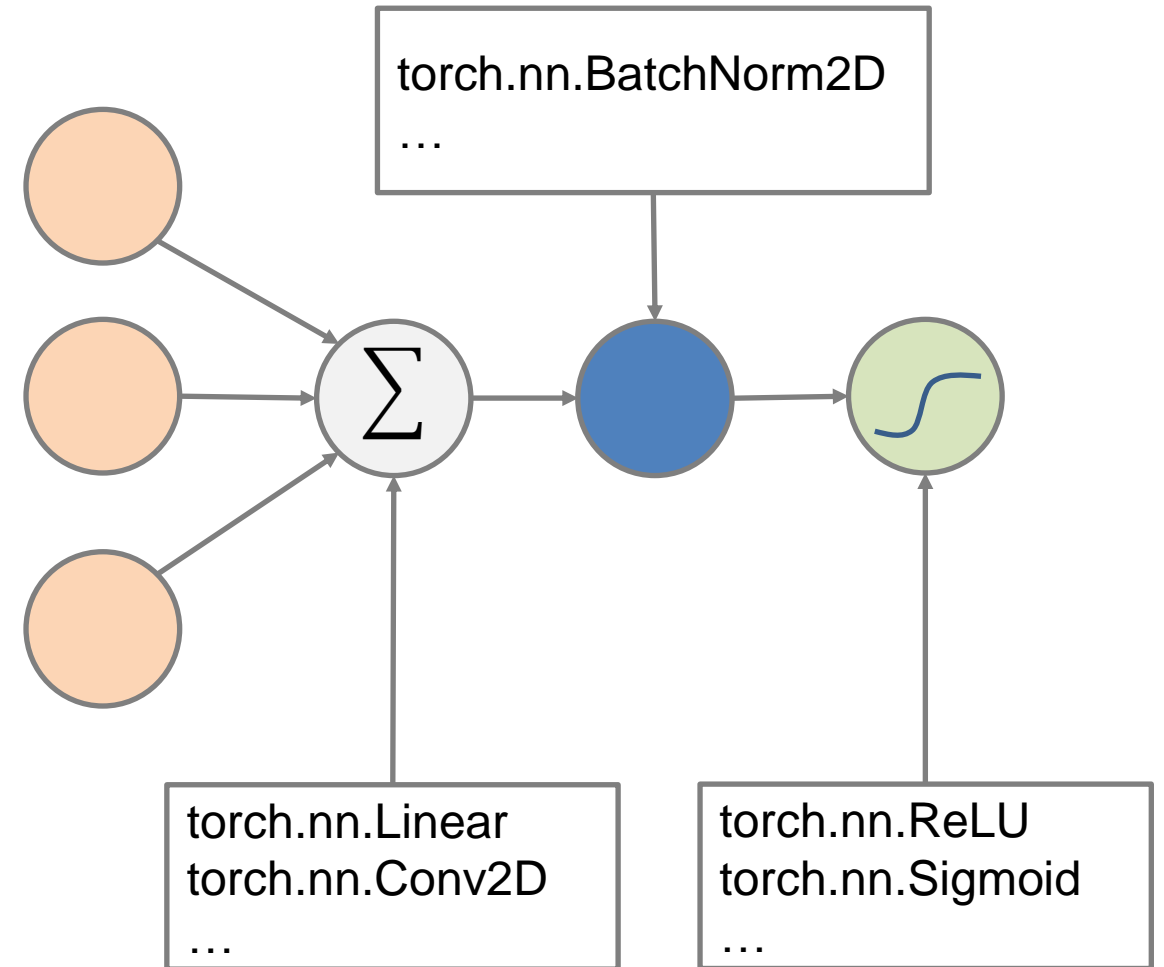
- **Computation graph and automatic differentiation**

https://blog.paperspace.com/pytorch-101-understanding-graphs-and-automatic-differentiation/
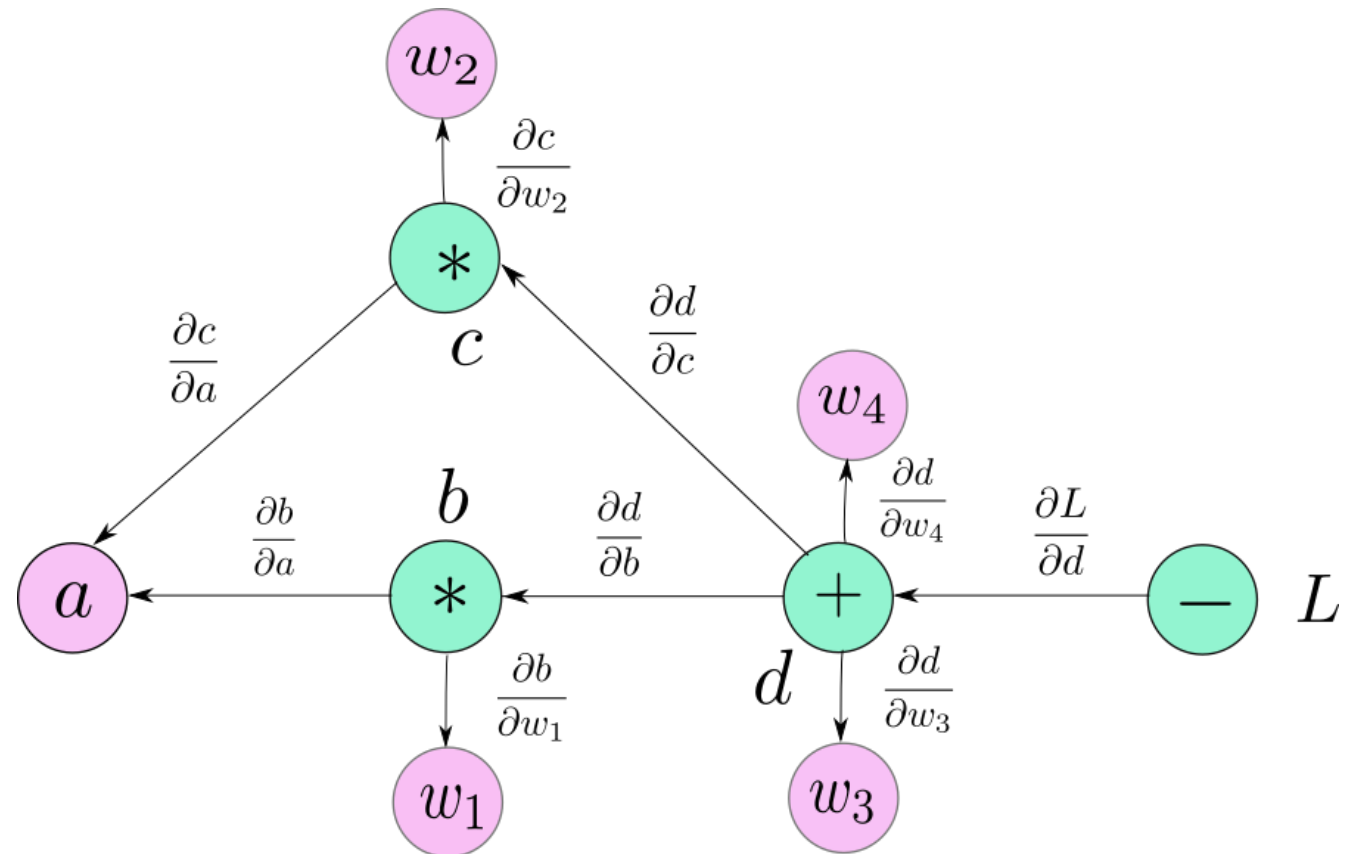
Frameworks
What do DL frameworks like PyTorch offer?

- Tensor algebra

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- **Algorithmic optimization, parallelization, computation on GPU (CUDA)**
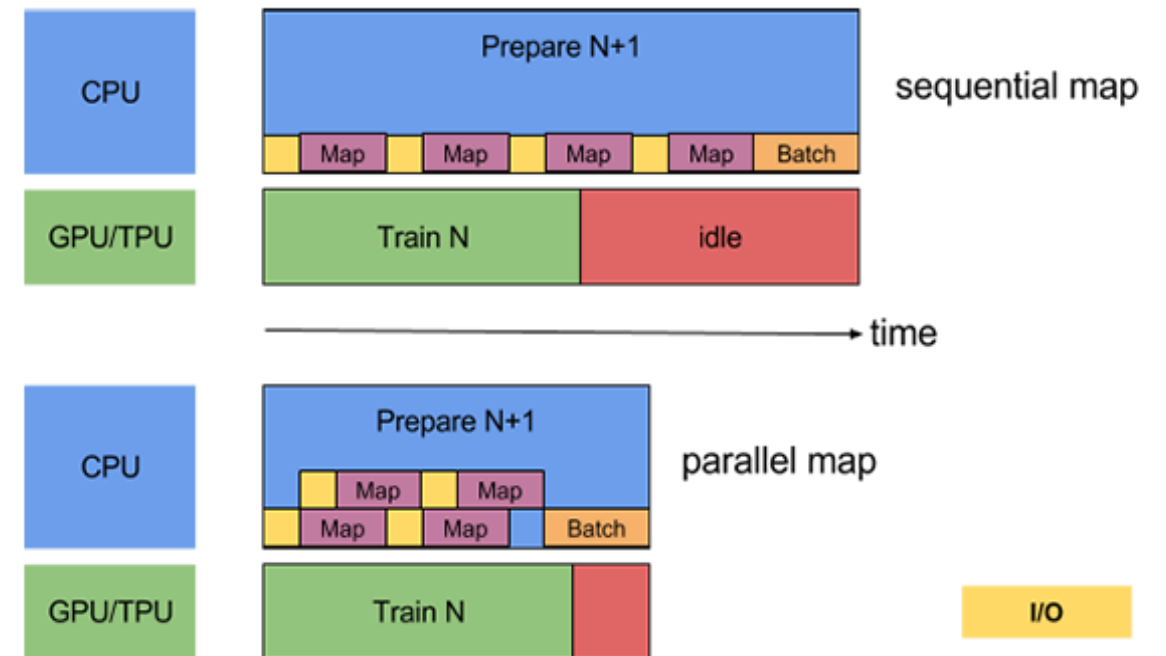
https://www.tensorflow.org/guide/data_performance

Frameworks
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- Algorithmic optimization, parallelization,
  computation on GPU (CUDA)

- **Pretrained networks
  (for finetuning on your own task)**
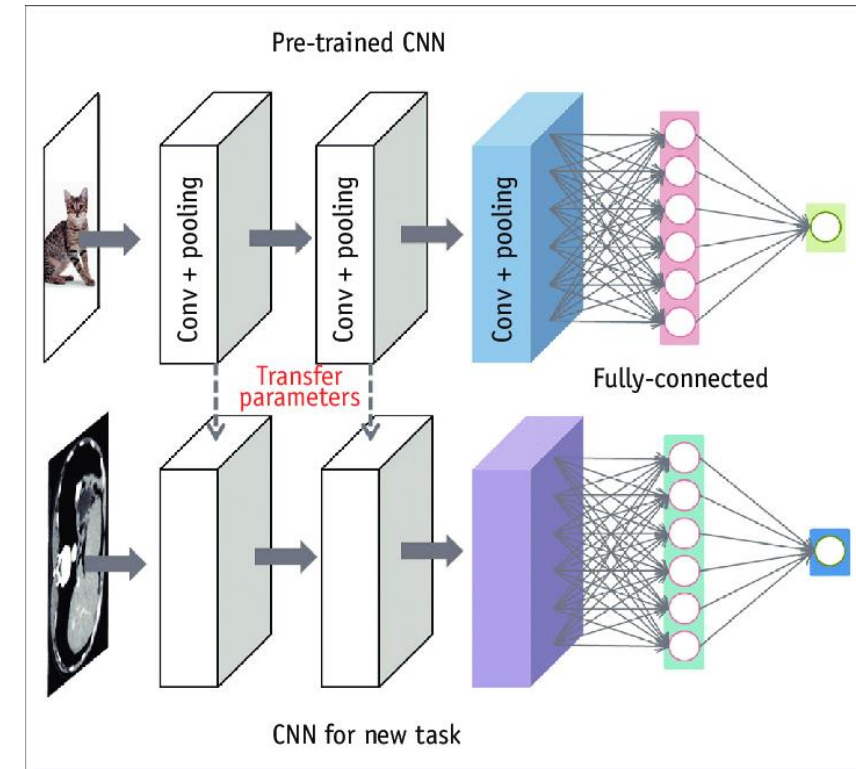
Do, Synho, Kyoung Doo Song, and Joo Won Chung. "Basics of deep learning: a radiologist's guide to understanding published radiology articles on deep learning." *Korean journal of radiology* 21.1 (2020): 33-41.

Frameworks

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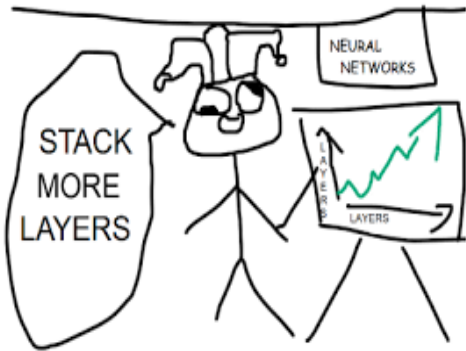
Flexibility for new experiments
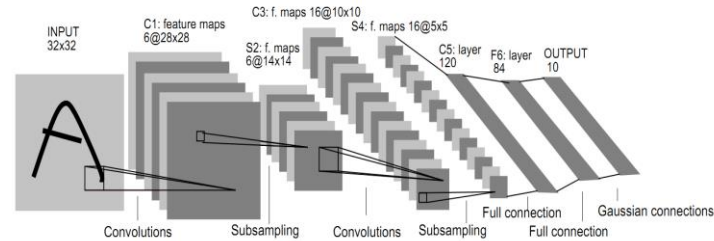
Non-linear execution (graphs)

Language usually Python

Code & knowledge sources

Code   &   Knowledge

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GitHub

www.github.com

Free implementations of multiple methods.

Code & Knowledge

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Online Courses

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https://medium.com/

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Intuitive descriptions and explanations

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Intuitive descriptions and explanations

Journals and Books
http://www.deeplearningbook.org/

Bishop: Pattern Recognition with Machine Learning

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Available Preprints
www.arxiv.com

Now often the first point of publication for DL papers.

Not peer-reviewed!

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Code & knowledge sources
Code: Github

- Many free of popular and implementationsnew methods

- Many conferences now require public code for reproducibility

- Usually a good first step for testing and adapting a new method

Code & knowledge sources
Knowledge: arXiv

- Now often the first point of publication for DL papers (sometimes the only one)

- Not peer-reviewed!

- Helpful tool:

http://www.arxiv-sanity.com/

Code & knowledge sources
Knowledge: Blogs

https://medium.com/topic/artificial-intelligence
https://medium.com/topic/machine-learning

Real-time Object Detection with YOLO, YOLOv2 and now YOLOv3

Jonathan Hui   Follow
Mar 18, 2018 · 18 min read

You only look once (YOLO) is an object detection system targeted for real-time processing. We will introduce YOLO, YOLOv2 and YOLO9000 in this article. For those only interested in YOLOv3, please forward to the bottom of the article. Here is the accuracy and speed comparison provided by the YOLO web site.

Model	Train	Test	mAP	FLOPS	FPS
SSD300	COCO trainval	test-dev	41.2	-	46
SSD500	COCO trainval	test-dev	46.5	-	19
YOLOv2 608x608	COCO trainval	test-dev	48.1	62.94 Bn	40
Tiny YOLO	COCO trainval	-	-	7.07 Bn	200
SSD321	COCO trainval	test-dev	45.4	-	16
DSSD321	COCO trainval	test-dev	46.1	-	12
R-FCN	COCO trainval	test-dev	51.9	-	12
SSD513	COCO trainval	test-dev	50.4	-	8
DSSD513	COCO trainval	test-dev	53.3	-	6
FPN FRCN	COCO trainval	test-dev	59.1	-	6
Retinanet 50-500	COCO trainval	test-dev	50.9		14

Code & knowledge sources
Knowledge: Conferences (selection)

...and of course many domain-specific conferences

Code & knowledge sources
Knowledge: Books


http://www.deeplearningbook.org/
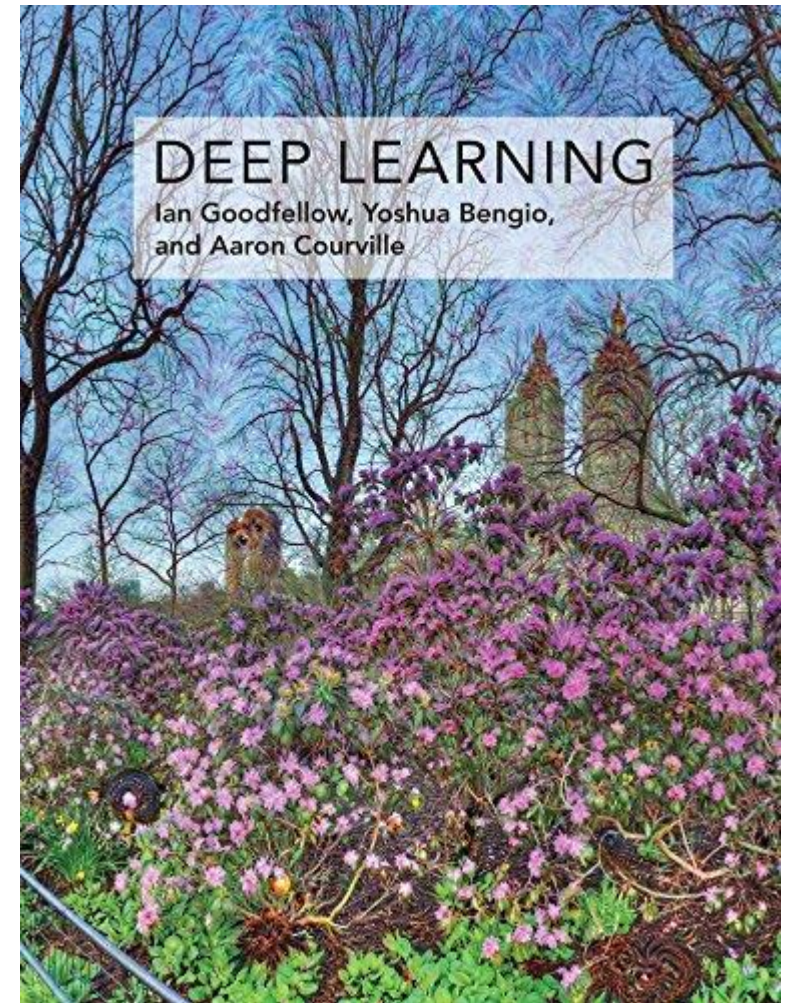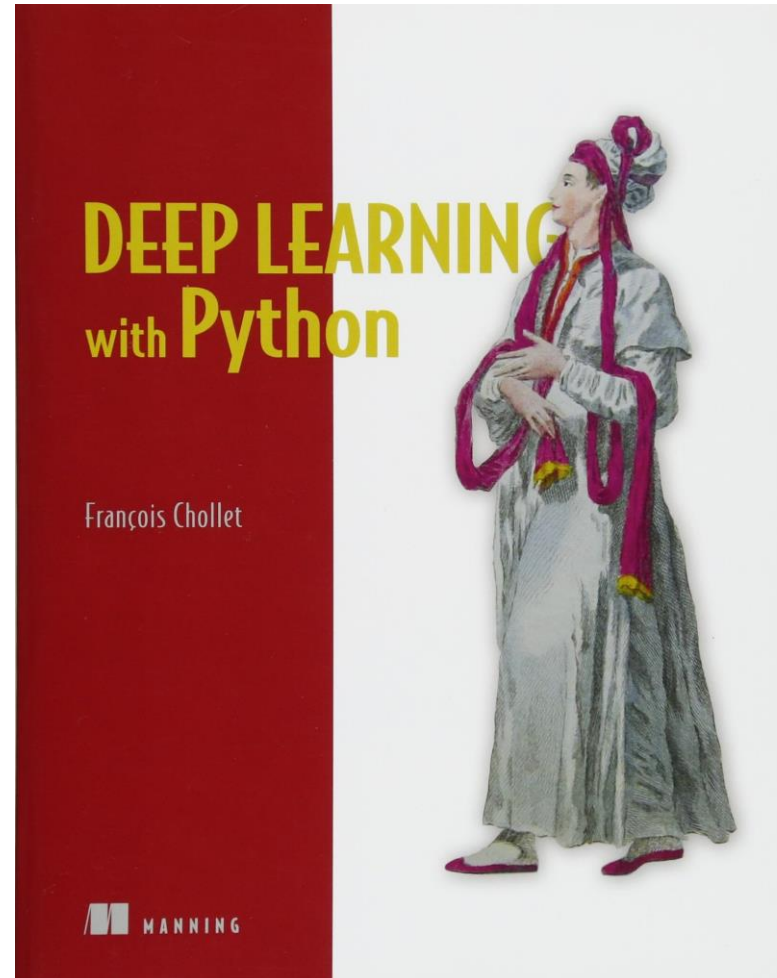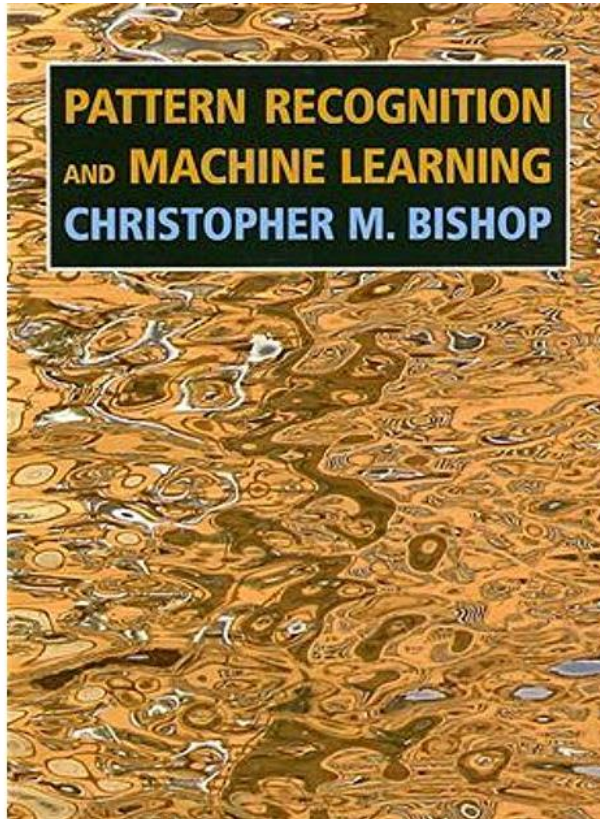
Code & knowledge sources

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