Machine Learning Course

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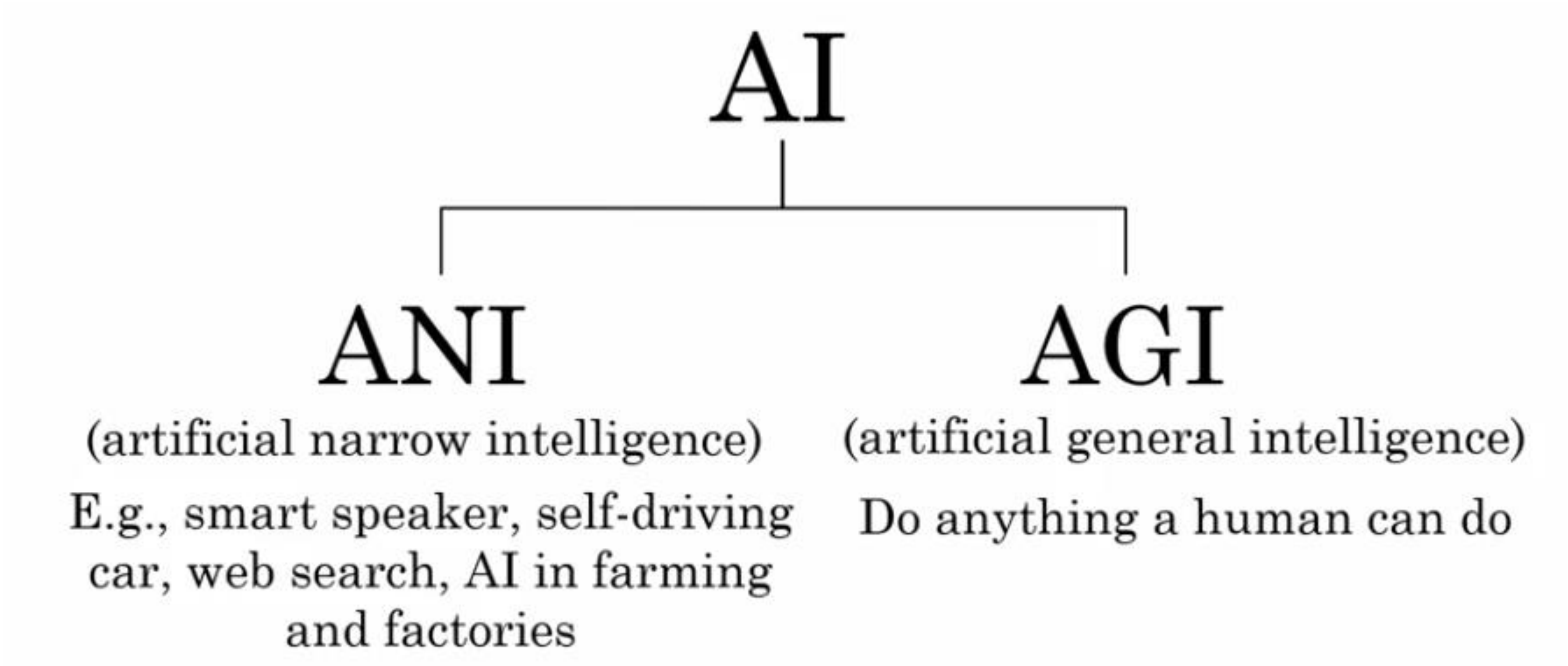
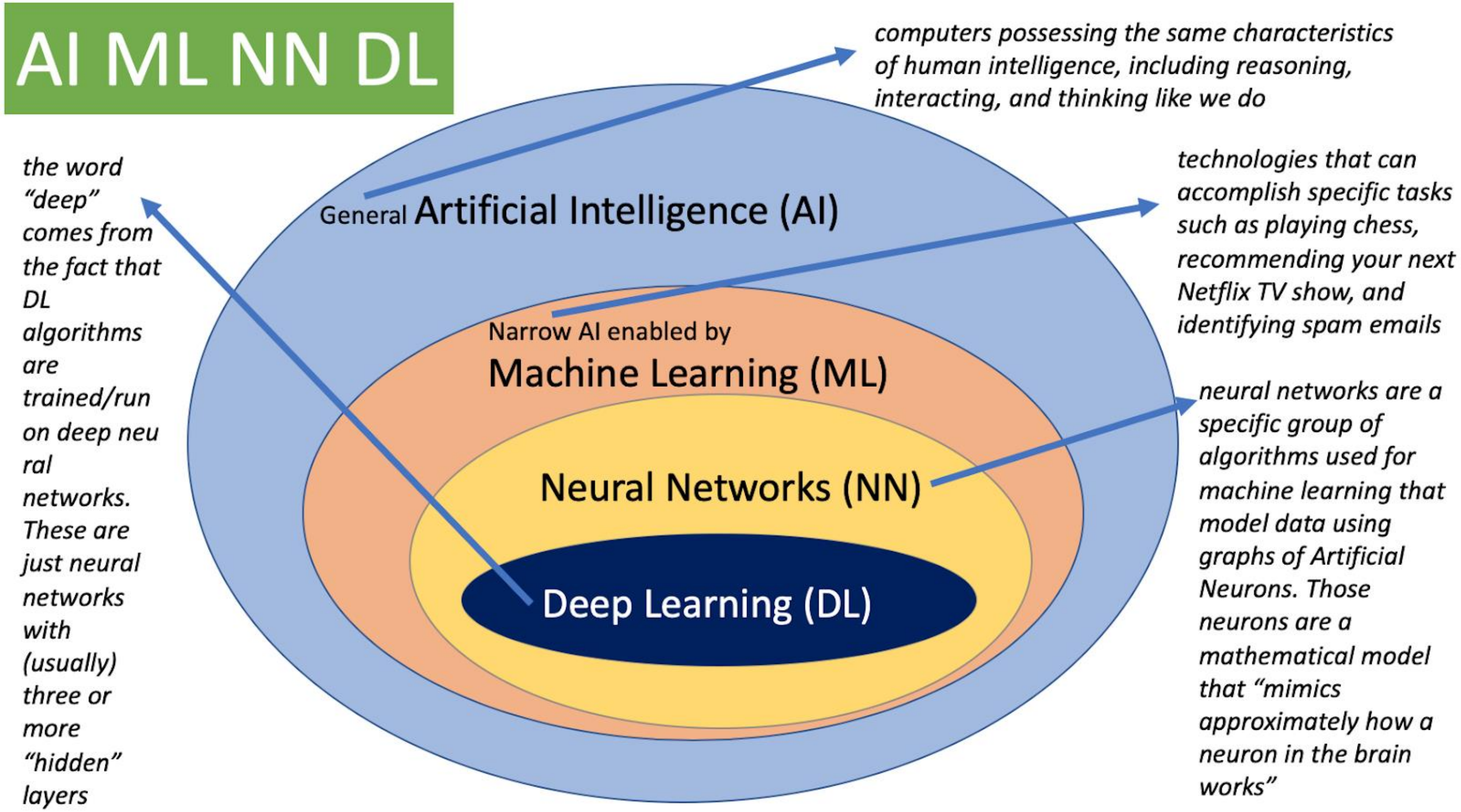
Introduction to Deep Learning

- **What is deep learning?**
- **What is the difference between DL and ML?**
- **How are ML and DL related to AI?**
- **What is AI?**

Artificial Intelligence



Artificial Intelligence



Machine Learning

- Machine Learning is the field of study that gives computers the ability to learn without being explicitly programmed.

No obvious way to hard-code the algorithms in many problems!

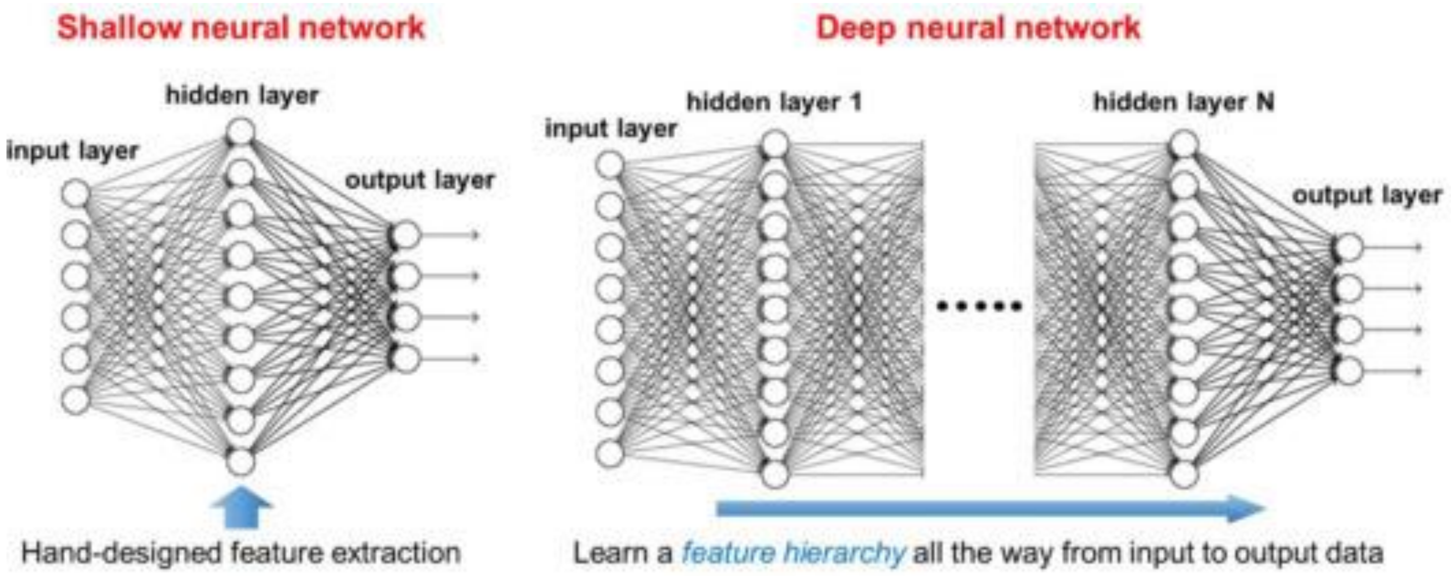
Learn from data!

Neural Network

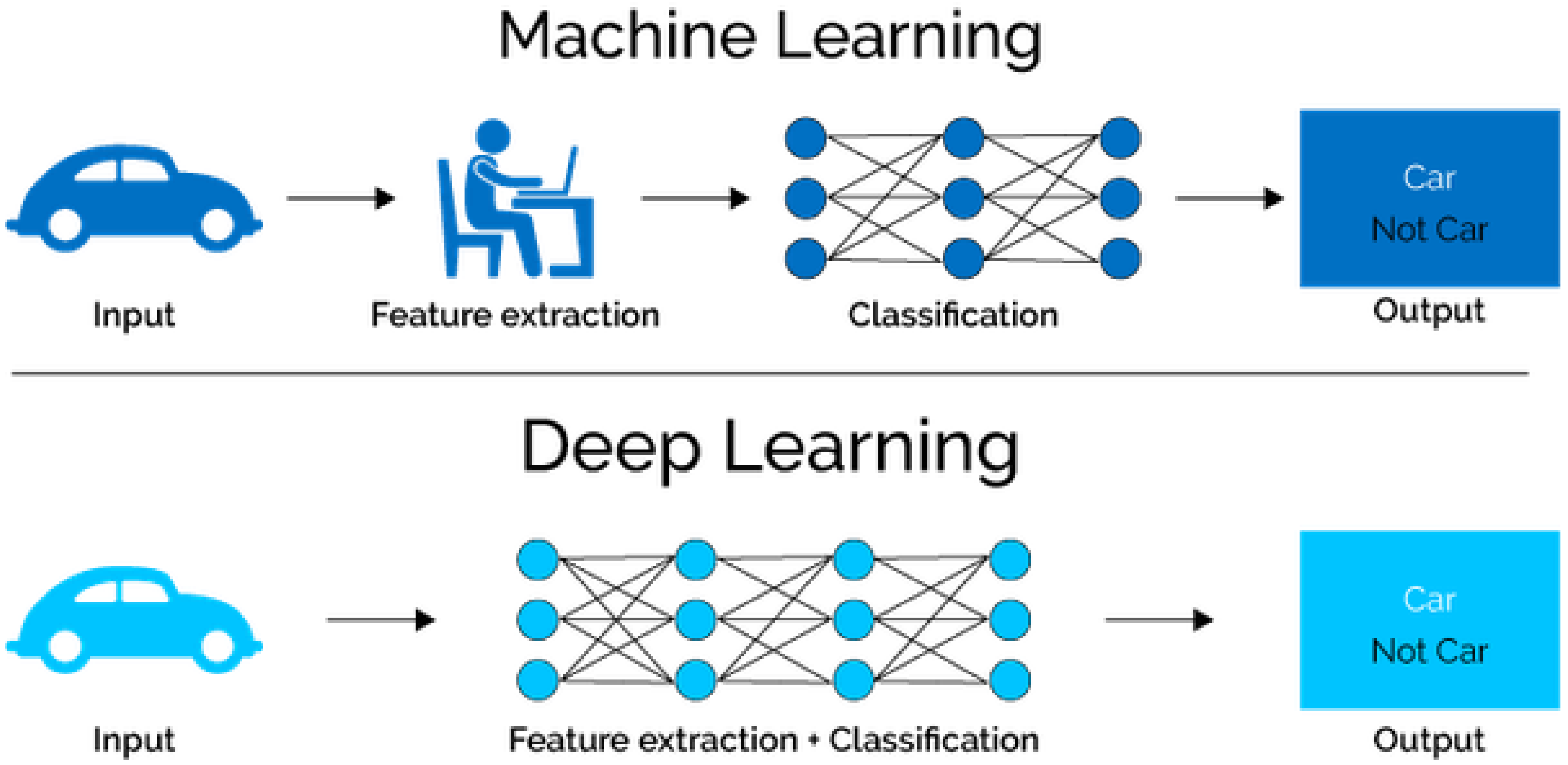
- Biological Neural Network
- Artificial Neural Network
  - Perceptron
  - Multi-layer Perceptron
  - Convolutional Neural Network
  - Recurrent Neural Network

Neural Network

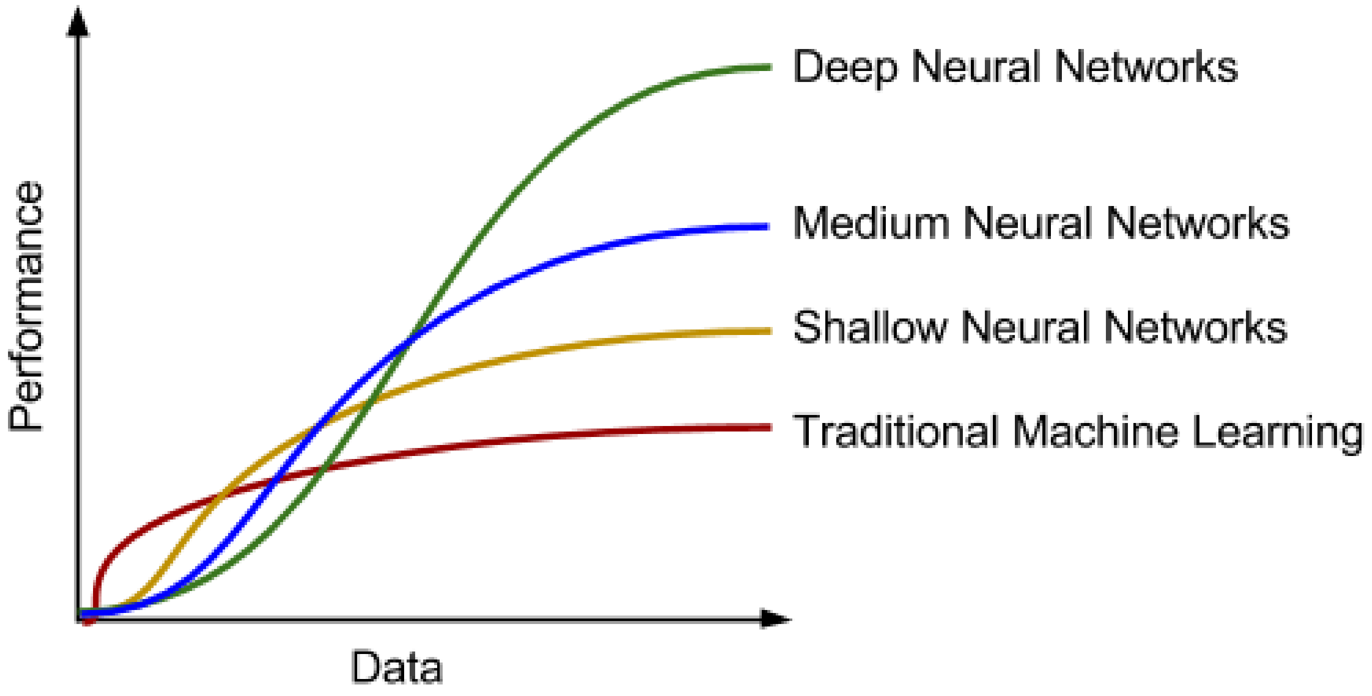
- Multi-layer Perceptron
  - Shallow MLP
  - Deep MLP



Deep Learning

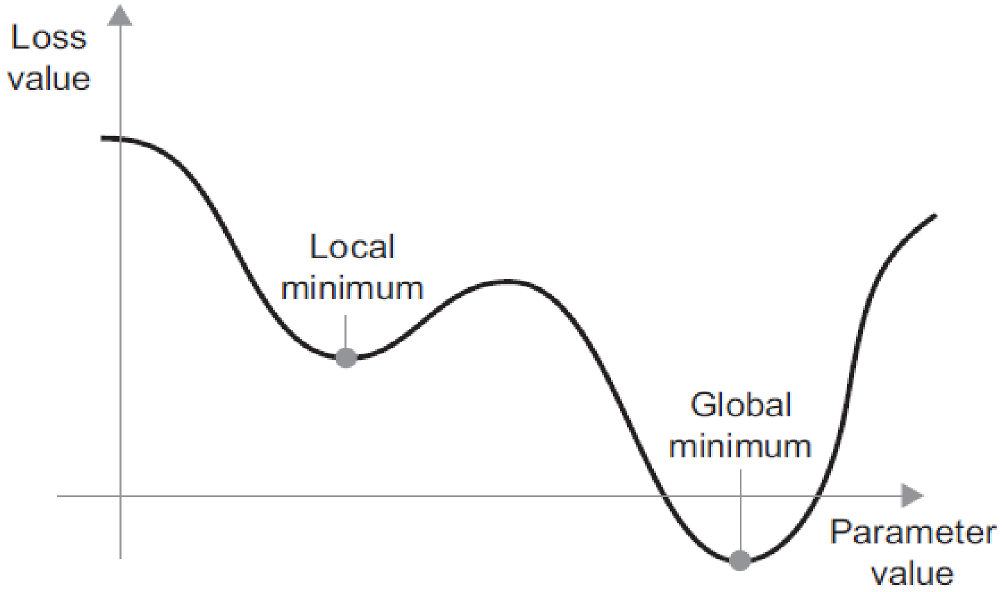


Deep Learning



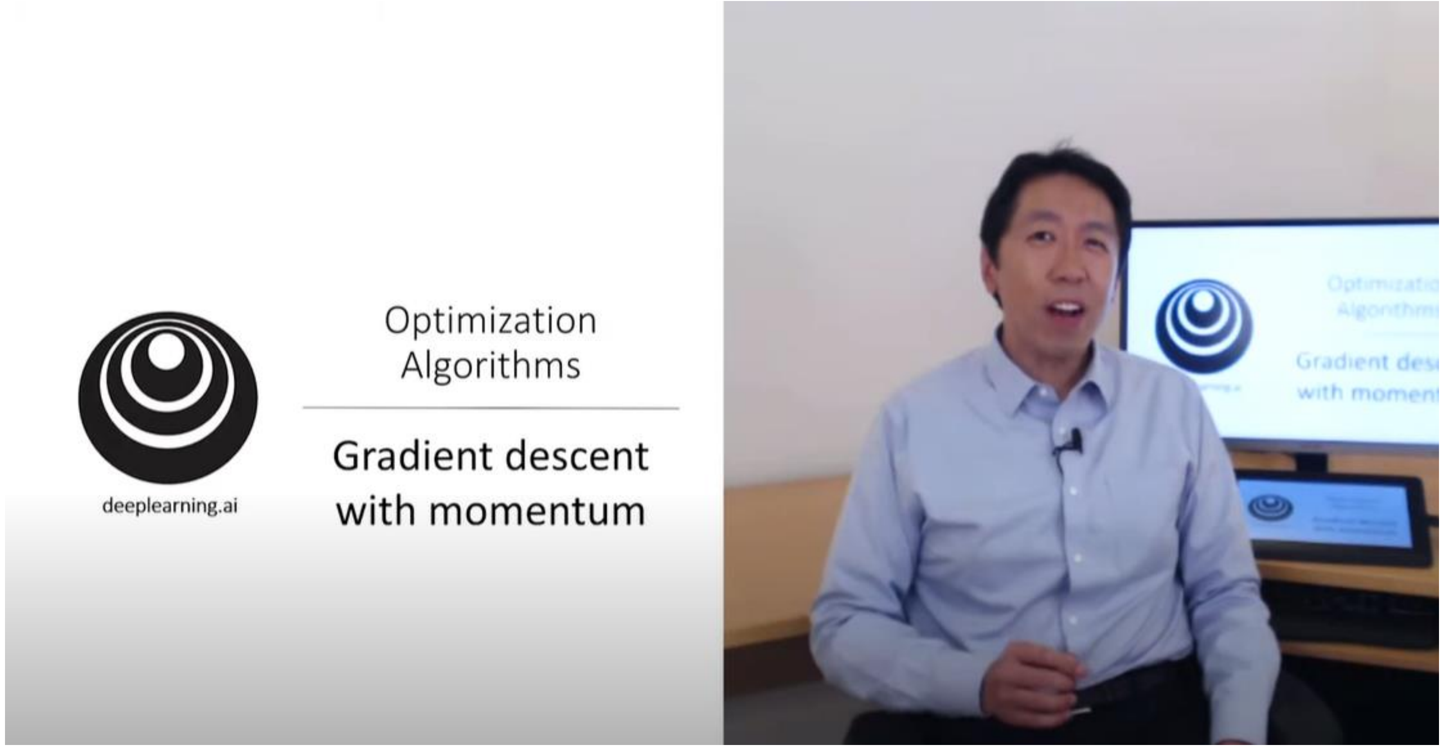
Momentum

As you can see, around a certain parameter value, there is a *local minimum*: around that point, moving left would result in the loss increasing, but so would moving right. If the parameter under consideration were being optimized via SGD with a small learning rate, then the optimization process would get stuck at the local minimum instead of making its way to the global minimum. You can avoid such issues by using momentum, which draws inspiration from physics. A useful mental image here is to think of the optimization process as a small ball rolling down the loss curve. If it has enough momentum, the ball won't get stuck in a ravine and will end up at the global minimum. Momentum is implemented by moving the ball at each step based not only on the current slope value (current acceleration) but also on the current velocity (resulting from past acceleration). In practice, this means updating the parameter w based not only on the current gradient value but also on the previous parameter update.



Momentum

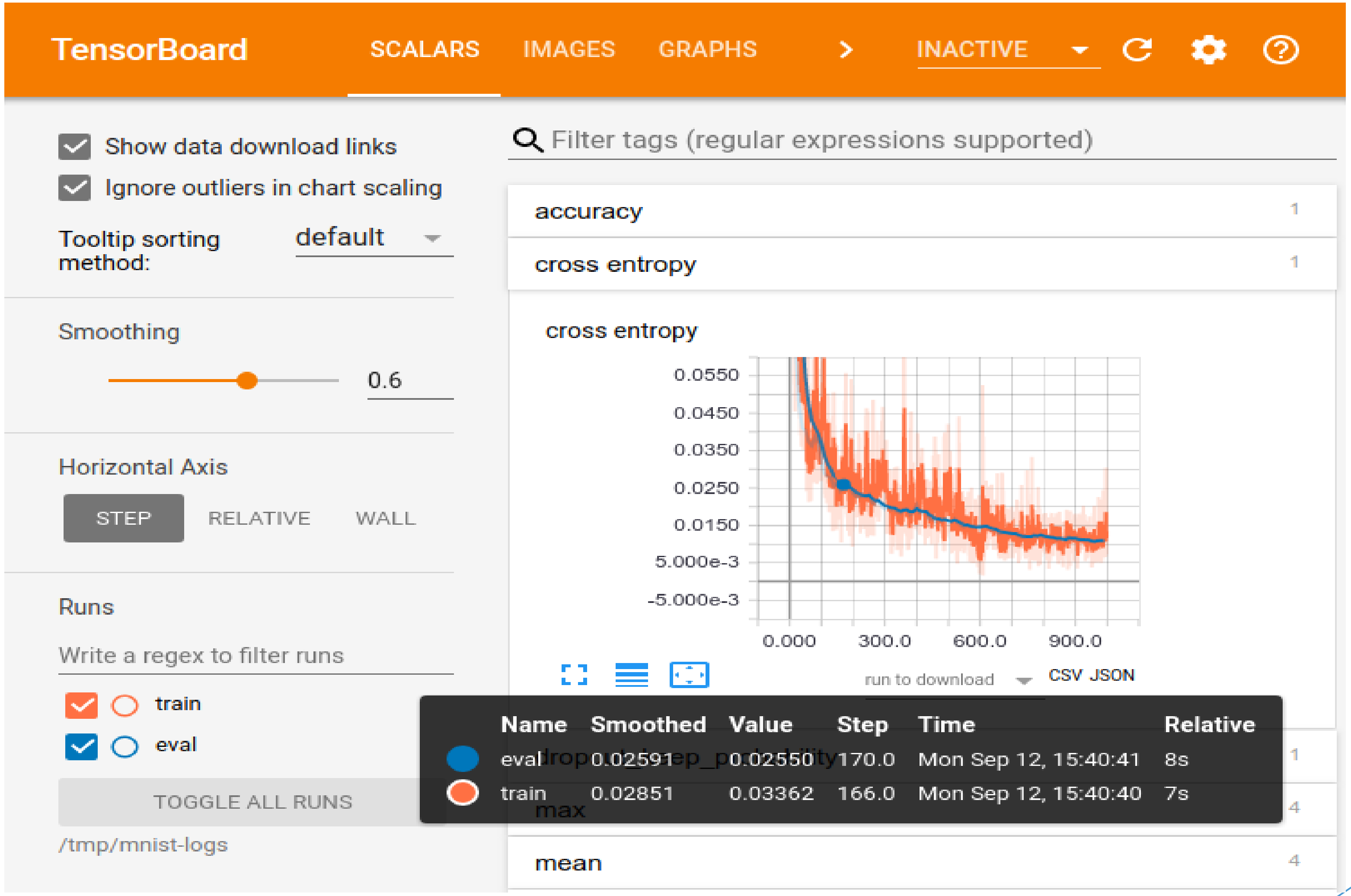
https://www.youtube.com/watch?v=k8fTYJPd3_I



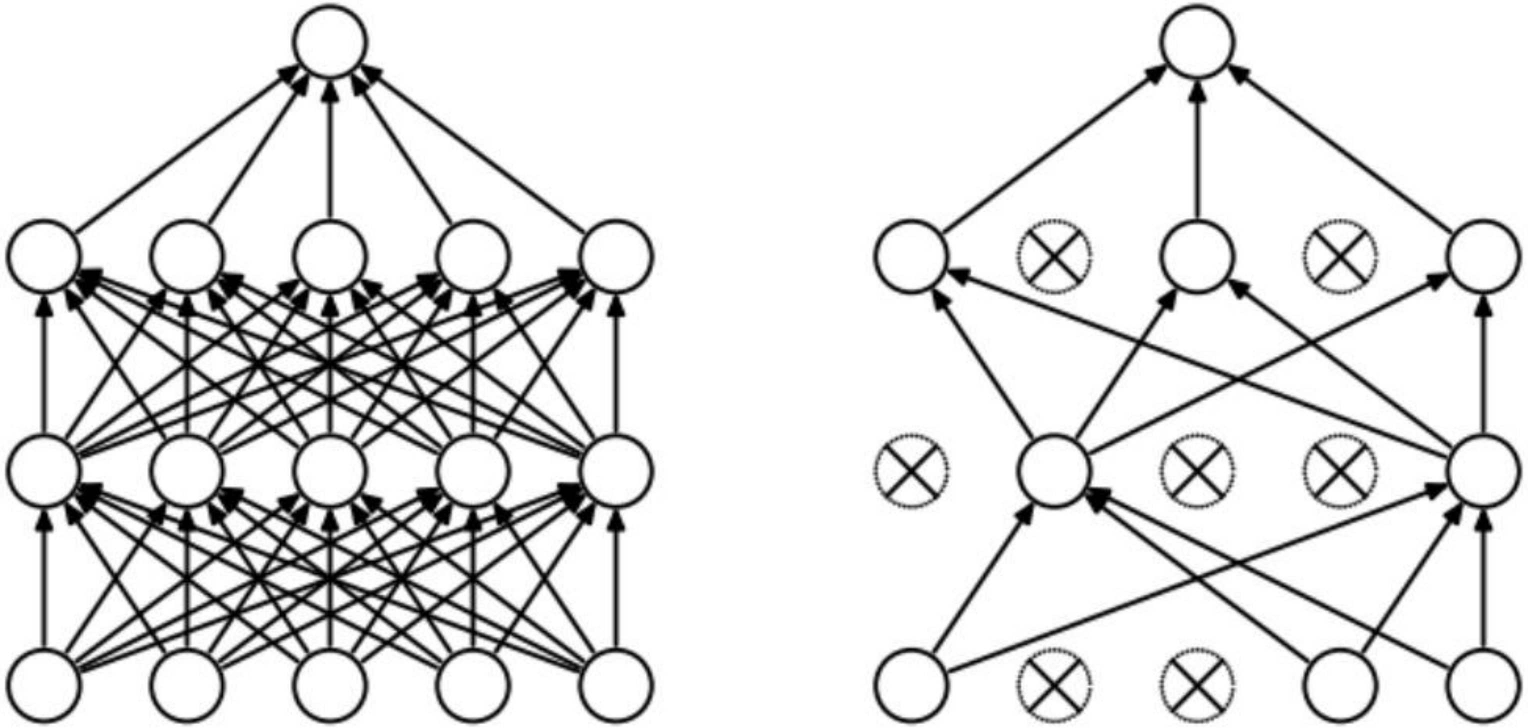
Learning Rate

- **Constant Learning Rate**
- **Time-Based Decay**
- **Step Decay**
- **Exponential Decay**
- **Differential Learning Rate**
- **Learning Rate Annealing**

Tensorboard

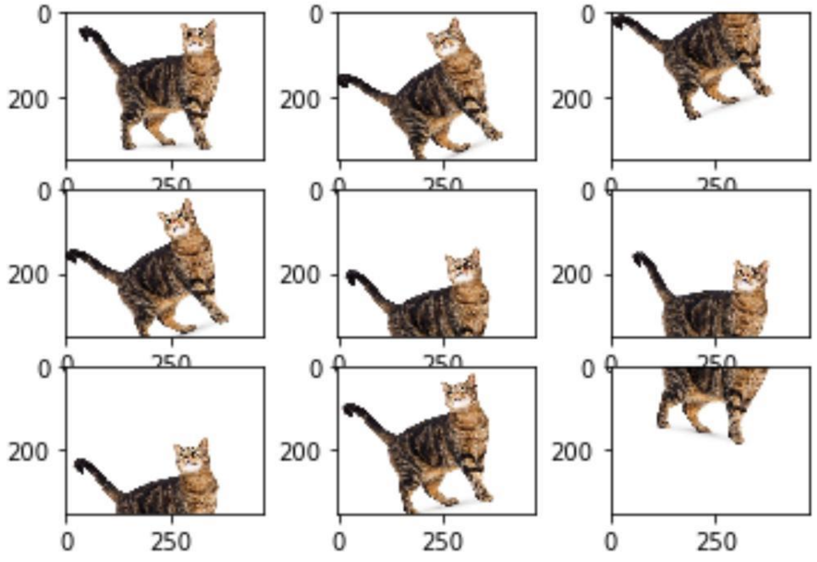


Dropout

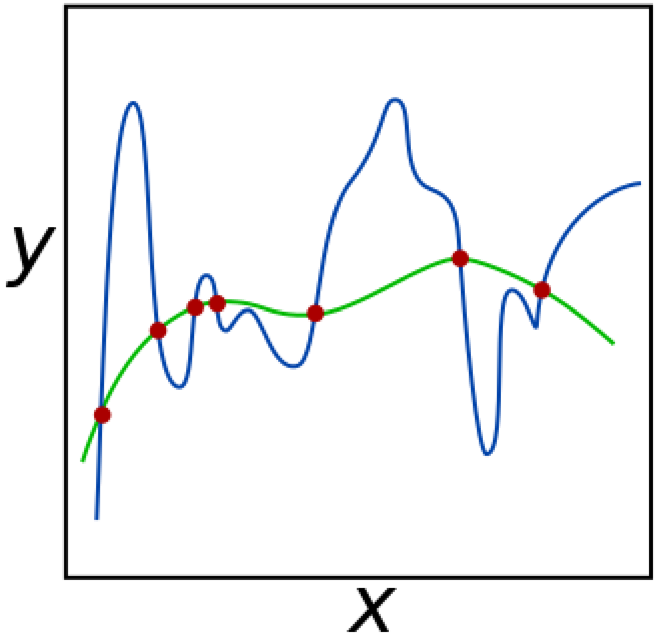


(a) Standard Neural Net (b) After applying dropout.

Data Augmentation



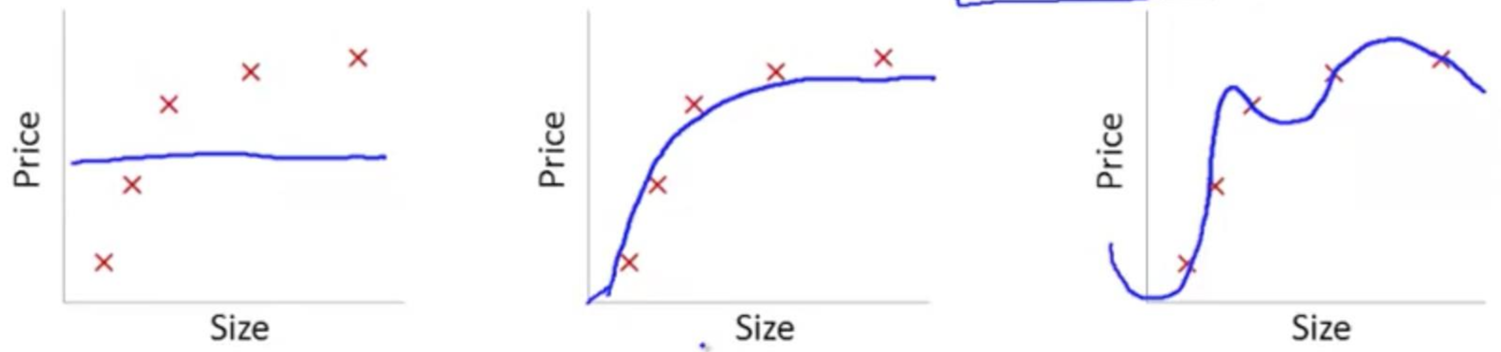
Weight Regularization



Weight Regulariztion

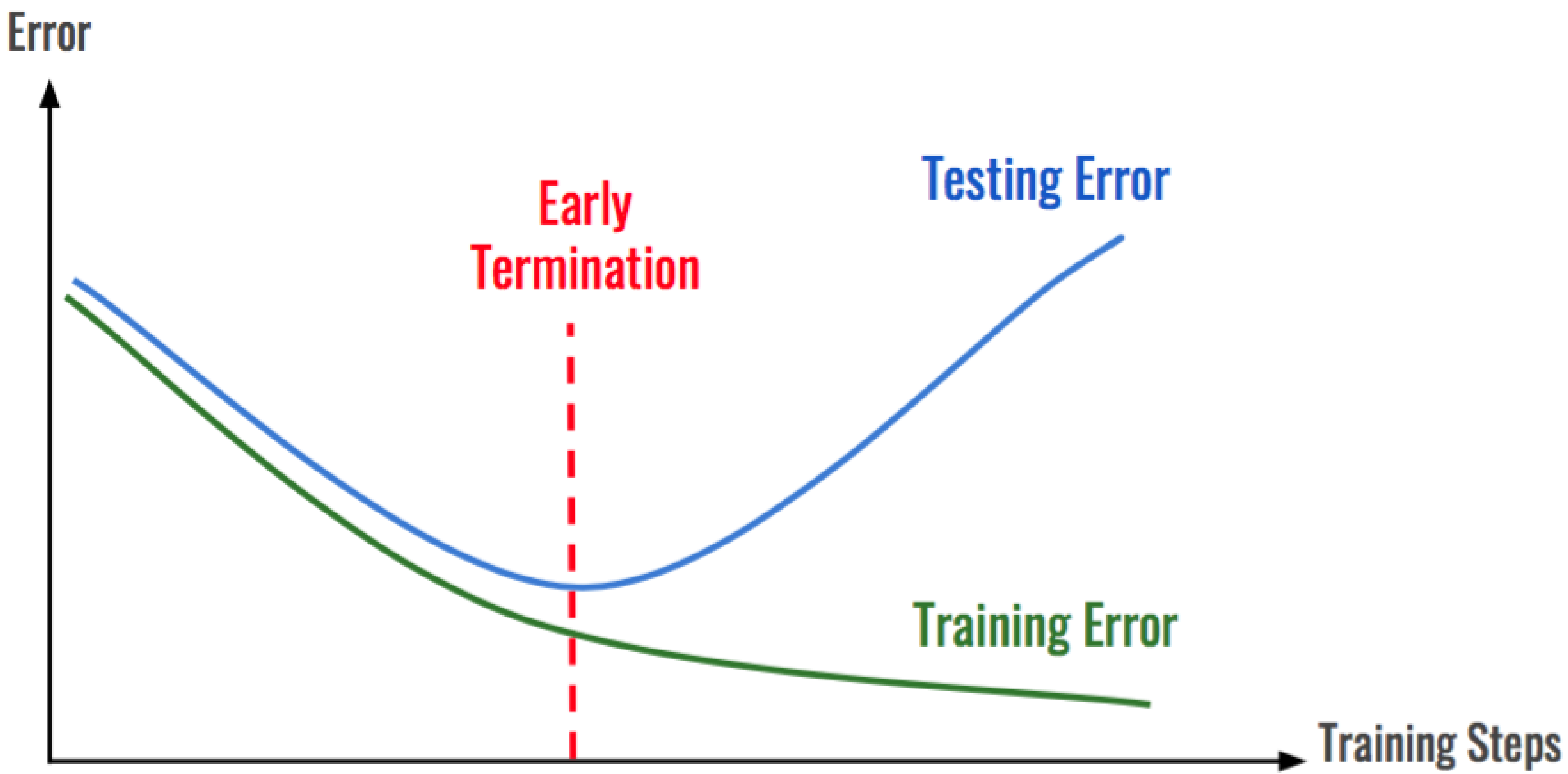
Model: $\boxed{h_\theta(x) = \theta_0} + \theta_1 x + \theta_2 x^2 + \theta_3 x^3 + \theta_4 x^4$

$$J(\theta) = \frac{1}{2m}\sum_{i=1}^{m}(h_\theta(x^{(i)}) - y^{(i)})^2 + \boxed{\frac{\lambda}{2m}\sum_{j=1}^{m}\theta_j^2}$$



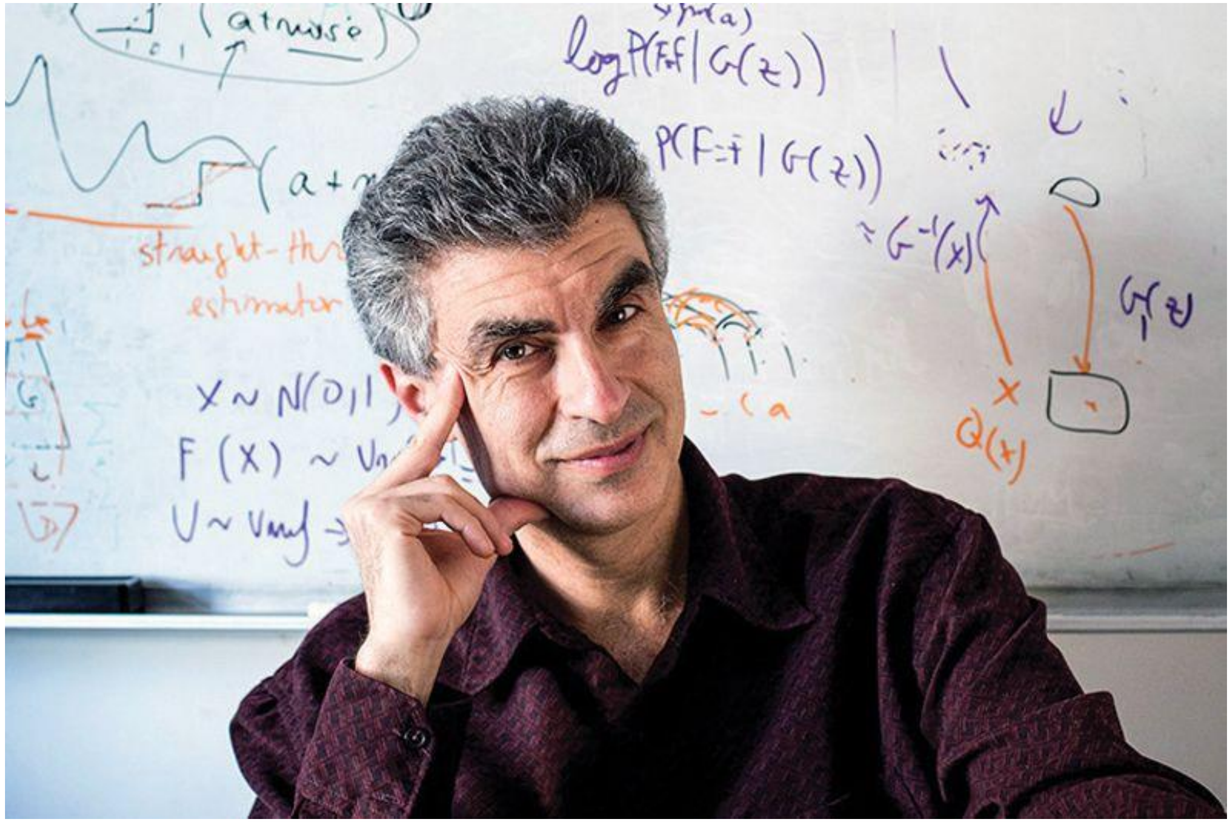
Large λ	Intermediate λ	Small λ
High bias (underfit)	"Just right"	High variance (overfit)
$\lambda = 10000.\ \theta_1 \approx 0, \theta_2 \approx 0, \ldots$		$\lambda = 0$

Early Stopping



Well-established Researchers

Well-established Researchers



Well-established Researchers

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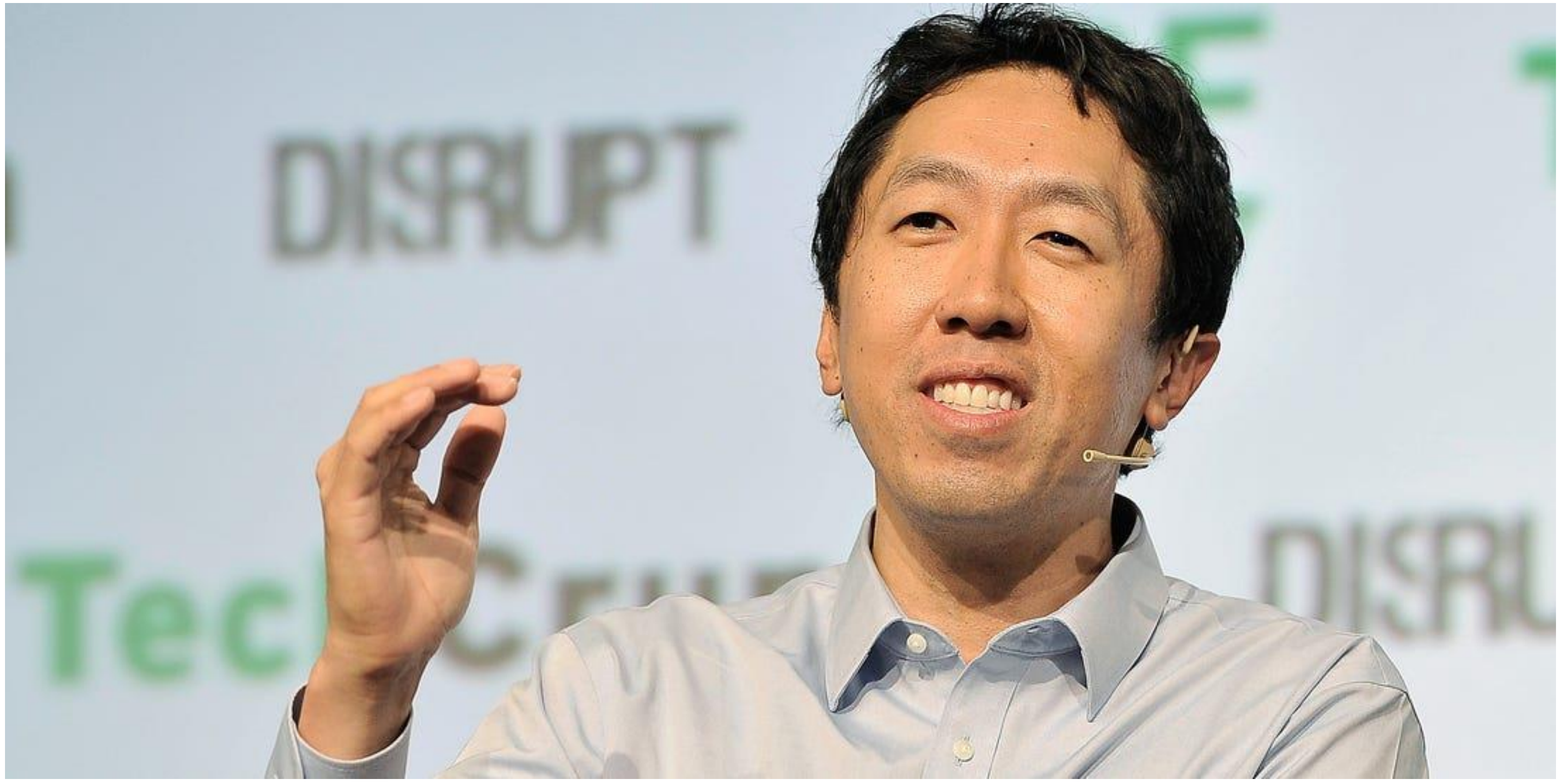

Well-established Researchers

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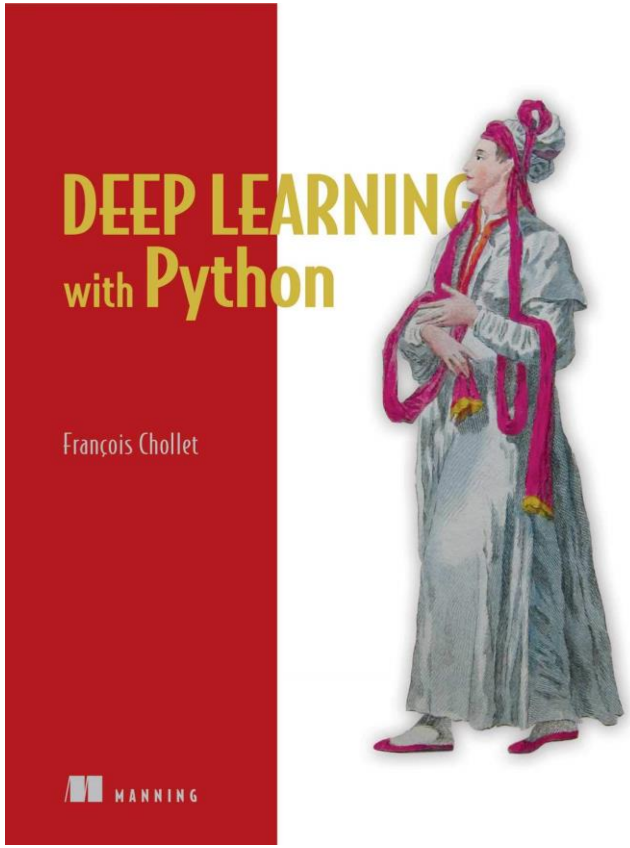
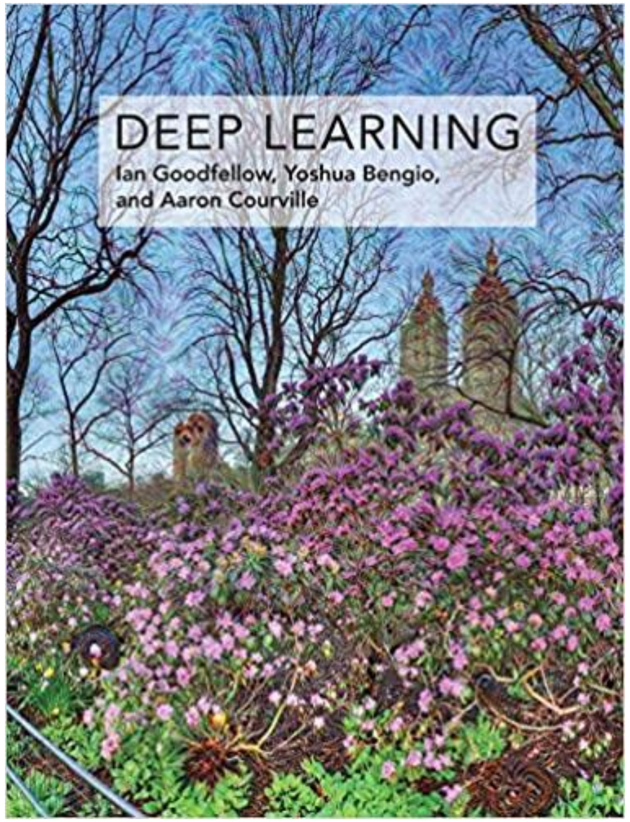
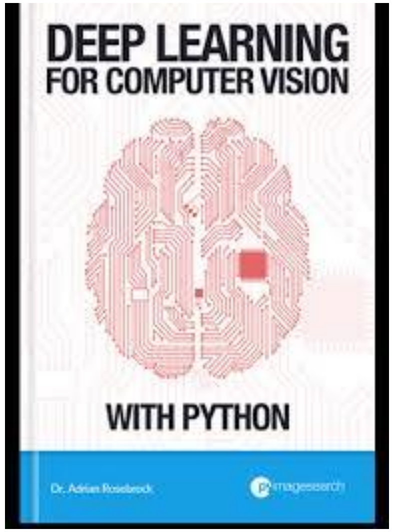
Great Deep Learning Books







Great Deep Learning Courses

deeplearning.ai

coursera

Great Deep Learning Courses

CS231n: Convolutional Neural Networks for Visual Recognition

Spring 2020

Previous Years: [Winter 2015] [Winter 2016] [Spring 2017] [Spring 2018] [Spring 2019]

*This network is running live in your browser

Course Description

Computer Vision has become ubiquitous in our society, with applications in search, image understanding, apps, mapping, medicine, drones, and self-driving cars. Core to many of these applications are visual recognition tasks such as image classification, localization and detection. Recent developments in neural network (aka "deep learning") approaches have greatly advanced the performance of these state-of-the-art visual recognition systems. This course is a deep dive into details of the deep learning architectures with a focus on learning end-to-end models for these tasks, particularly image classification. During the 10-week course, students

Great Deep Learning Courses

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- Getting started ▼
- Lessons (Part 1) ▼
- Lessons (Part 2) ▼
- Server setup ▼
- Returning to work ▼
- Production ▼
- fastai v1 ▼

Practical Deep Learning for Coders, v3

Table of Contents

Getting started

Welcome! If you're new to all this deep learning stuff, then don't worry—we'll take you through it all step by step. (And if you're an old hand, then you may want to check out our advanced course: Deep Learning From The Foundations.) We do however assume that you've been coding for at least a year, and also that (if you haven't used Python before) you'll be putting in the extra time to learn whatever Python you need as you go. (For learning Python, we have a list of python learning resources available.)

You might be surprised by what you *don't* need to become a top deep learning practitioner. You need one year of coding experience, a GPU and appropriate software (see below), and that's it. You don't need much data, you don't need university-level math, and you don't need a giant data center. For more on this, see our article: What you need to do deep learning.

The easiest way to get started is to just start watching the first video right now! On the sidebar just click “Lessons” and then click on lesson 1, and you'll be on your way. If you want an overview of the topics that are covered in the course, have a look at this article.