Intro to Deep Learning

Intuit DAT15
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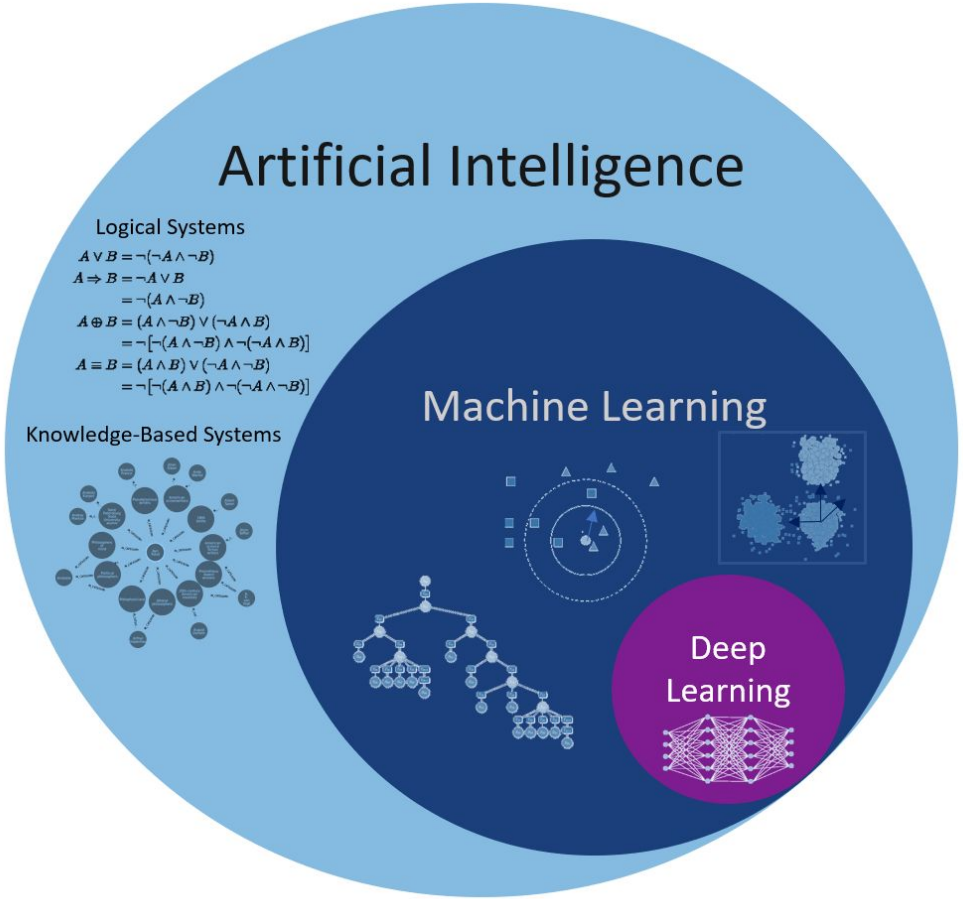
When you move on to deep learning

Deep Learning

- AI: any techniques which enables computers to mimic human behavior
- ML: AI techniques which use statistics and probability to perform without explicitly programming
- DL: ML techniques which use neural networks and massive data



History of Machine Learning

1950s: Pioneering machine learning research is conducted using simple algorithms

1960s: Bayesian methods are introduced for probabilistic inference in machine learning

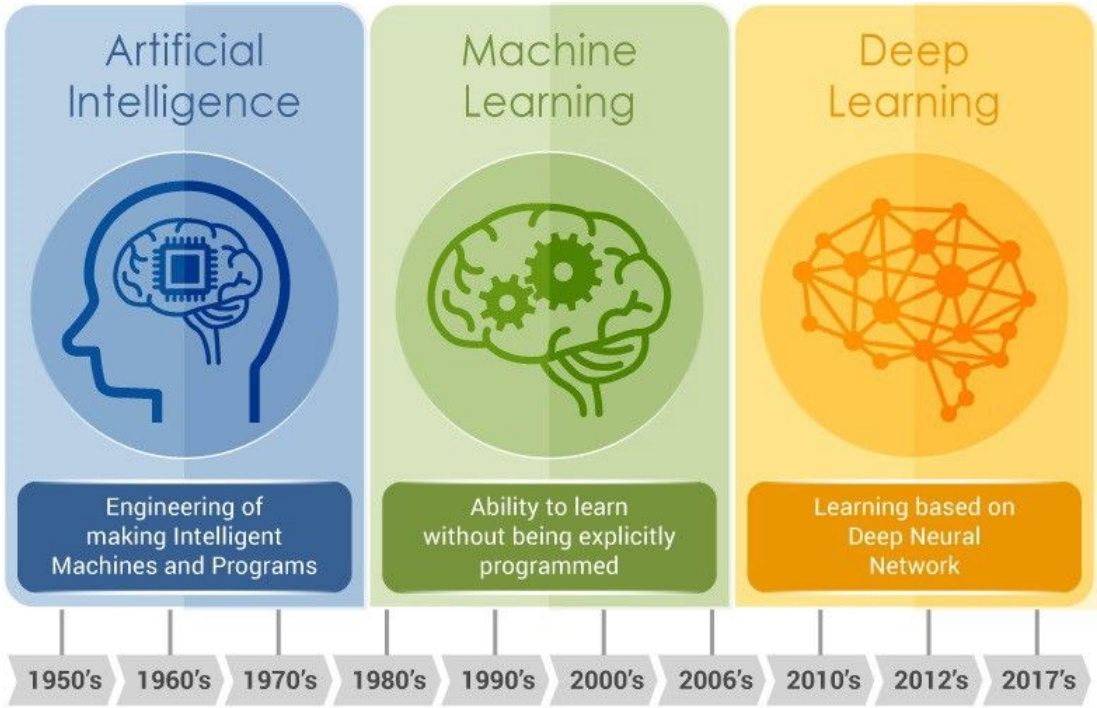
1970s: 'AI Winter' caused by pessimism about machine learning effectiveness

1980s: Rediscovery of backpropagation causes a resurgence in machine learning research

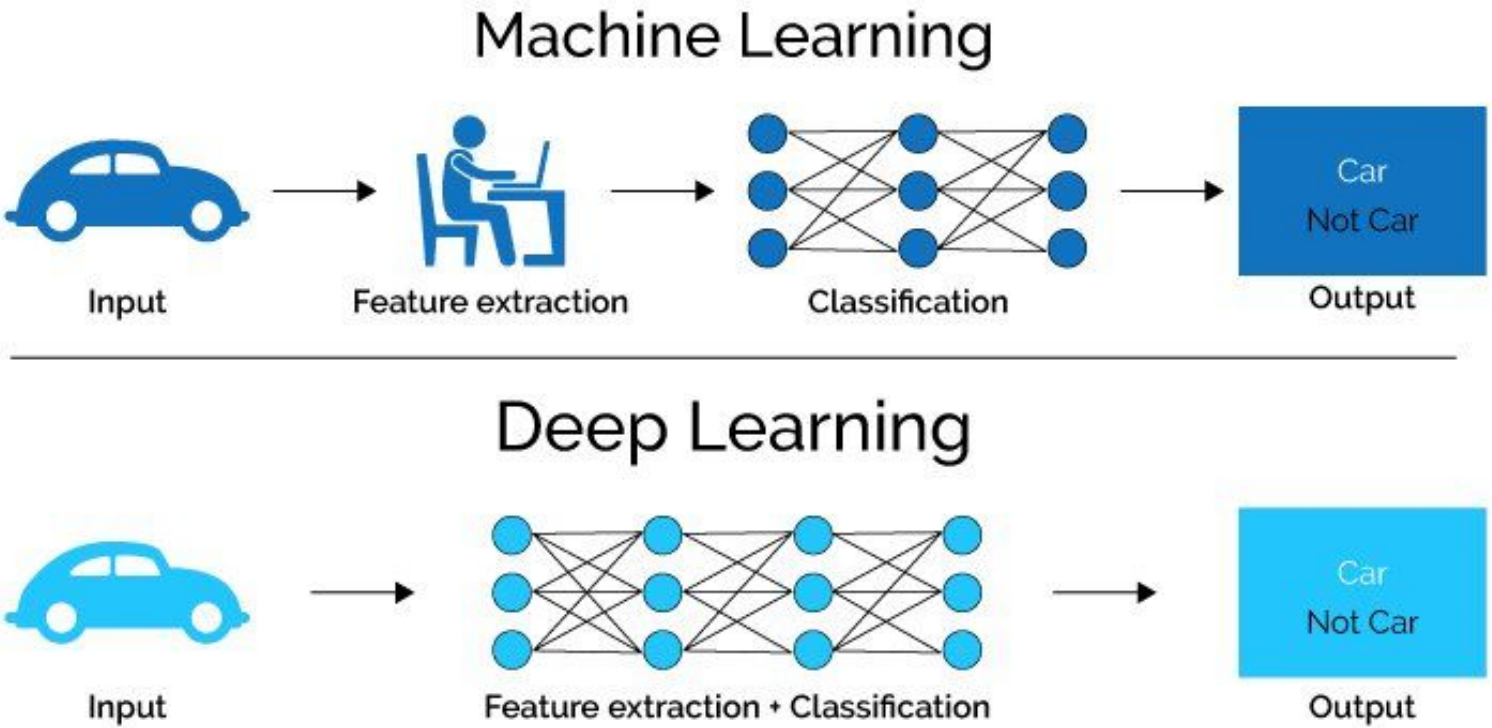
1990s: Support-vector machines (SVMs) and recurrent neural networks (RNNs) become popular

2000s: Kernel methods (a class of algorithms for pattern analysis) and unsupervised machine learning methods become widespread

2010s: Deep learning becomes feasible, which leads to machine learning becoming integral to many widely used software services and applications

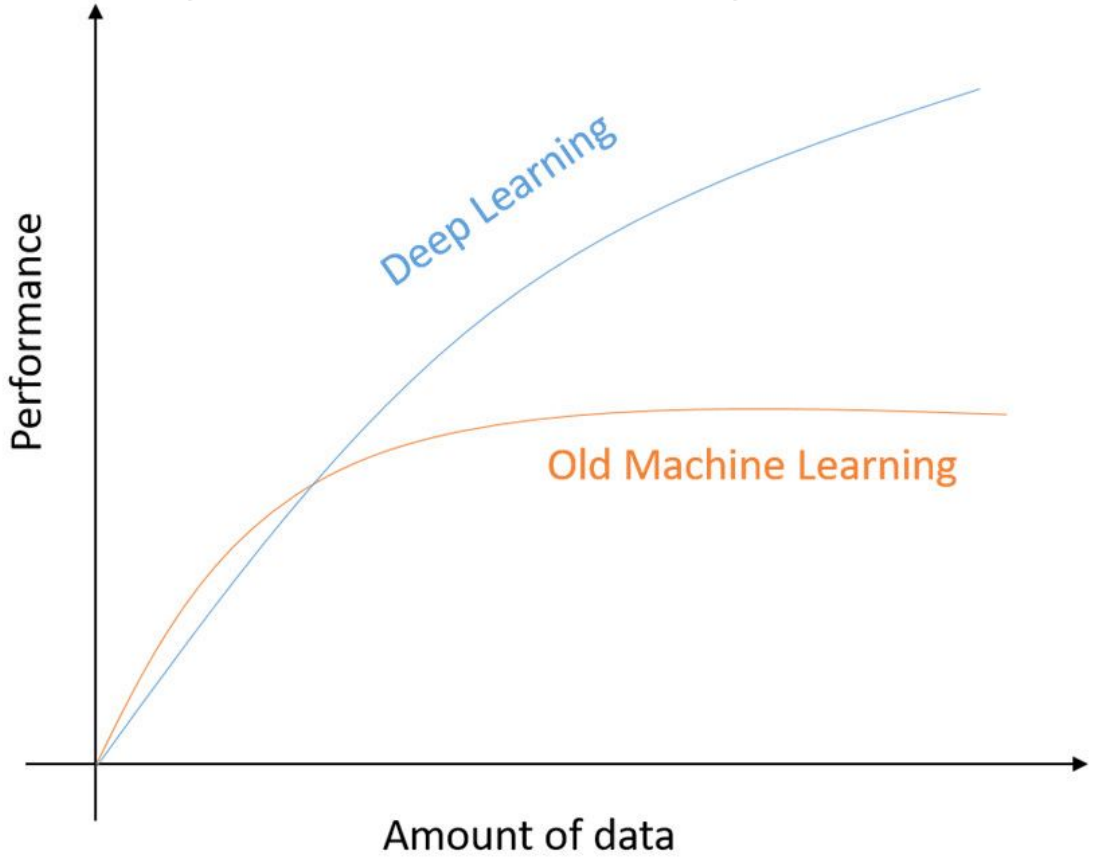


Traditional Machine Learning vs Deep Learning

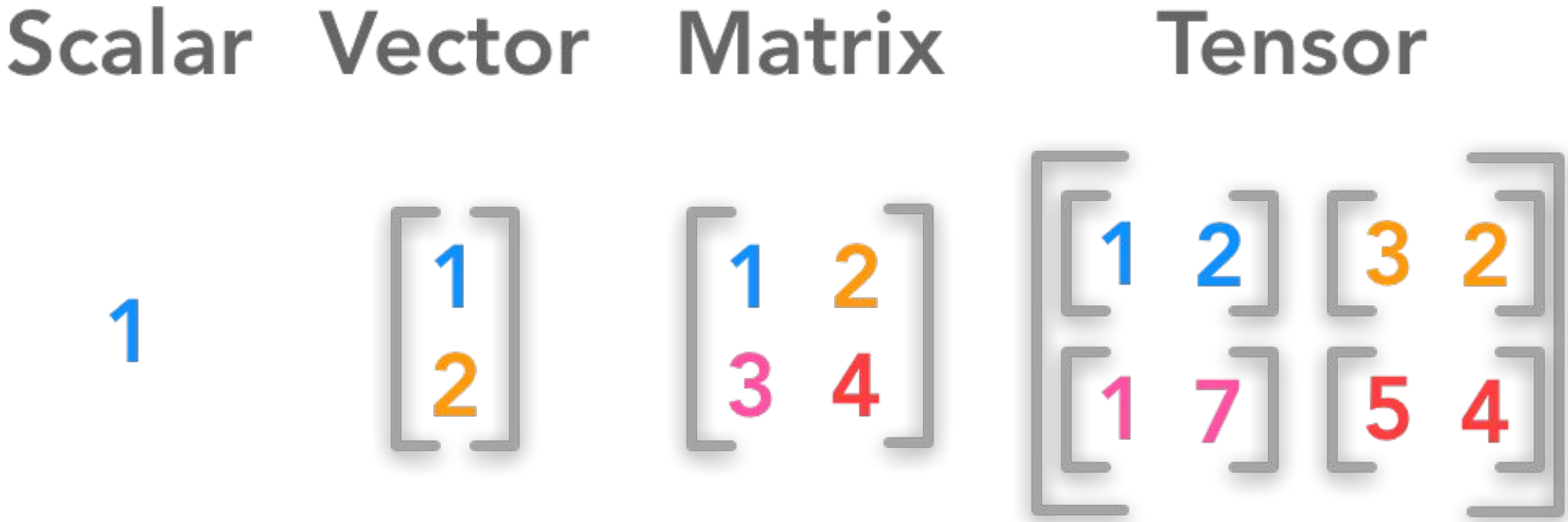


Traditional Machine Learning vs Deep Learning

Computer vision: For image classification using deep learning, the rule of thumb is that each classification requires 1000 images per class.



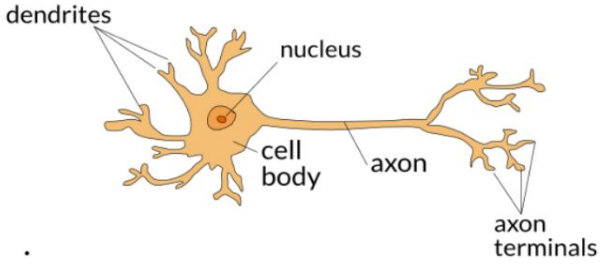
What's a tensor?

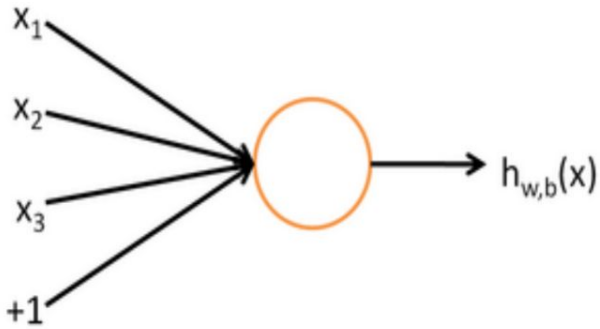


https://hadrienj.github.io/posts/Deep-Learning-Book-Series-2.1-Scalars-Vectors-Matrices-and-Tensors/

NEURAL NETWORKS

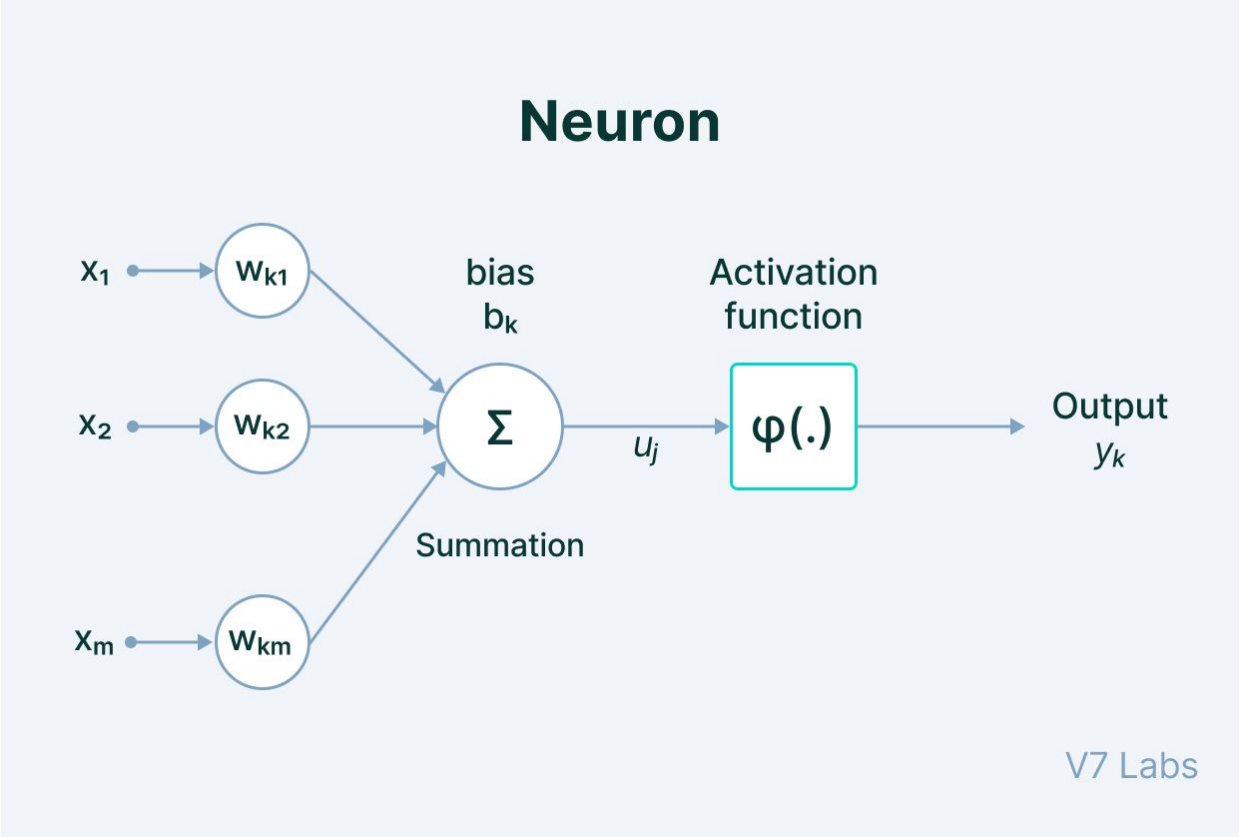
- Neurons – They act like a ‘true’ or ‘false’?
- They only fire after a minimum threshold has been reached
- A neuron’s signal is a proposition and they work like logic gates where they take in **multiple inputs** and produce a **single output**



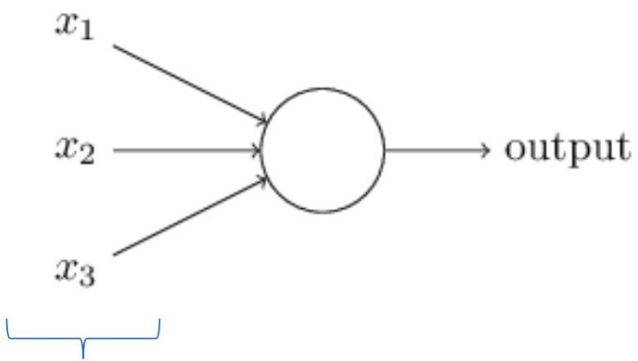


Artificial Neuron

- Inputs
- Weights
- Bias
- Activation Function
- Outputs



Activation Function



Input Variables

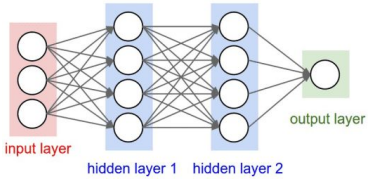
Activation Function

$$\text{output} = \begin{cases} 0 & \text{if } f(x_1, x_2, x_3) \leq threshold \\ 1 & \text{if } f(x_1, x_2, x_3) > threshold \end{cases}$$

Types of Neural Networks

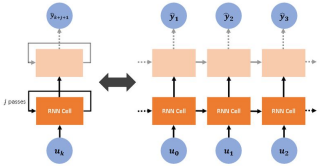
Feed-Forward Network (aka MLP)

- Mostly for learning purposes



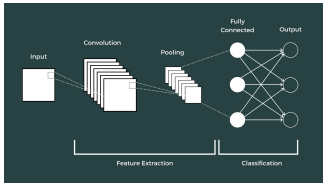
Recurrent Neural Network (RNN)

- Mostly for text recognition or time-series analysis

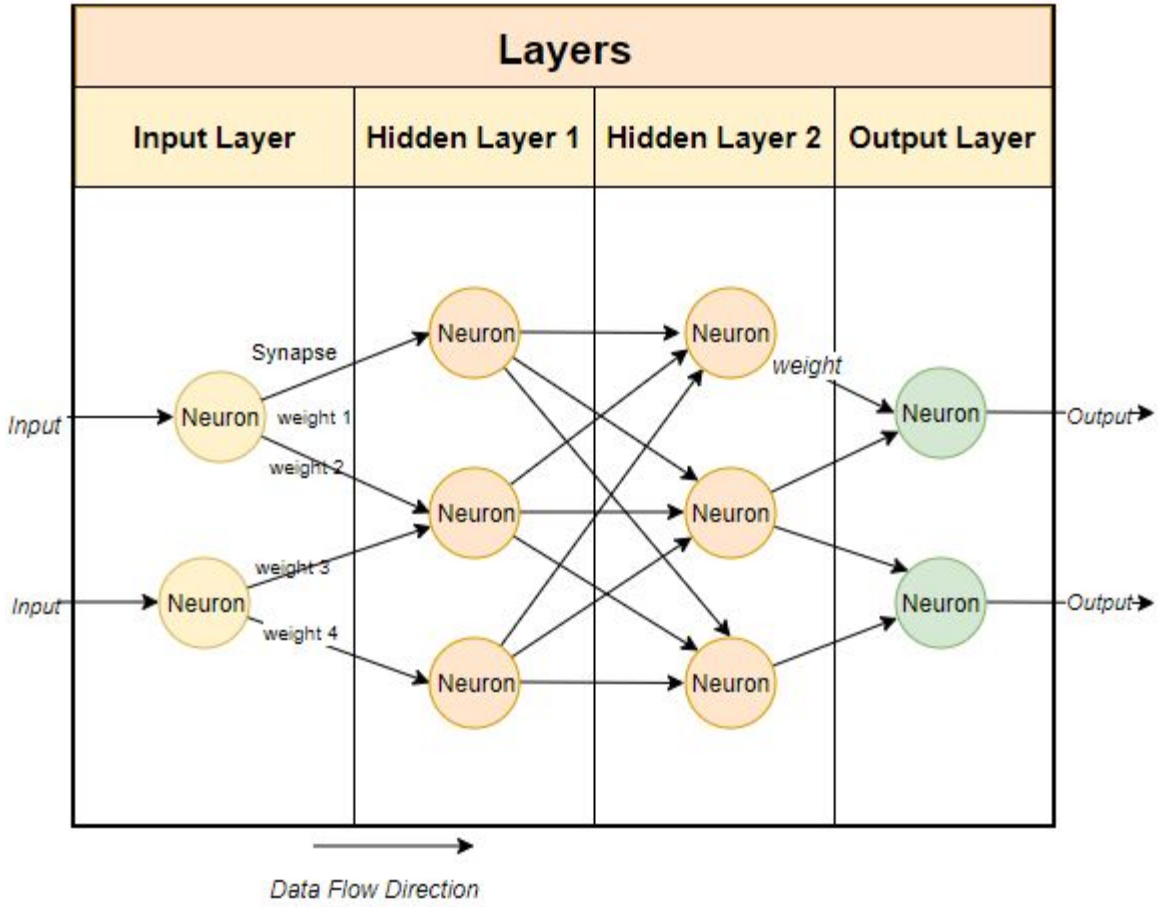


Convolutional Neural Network (CNN)

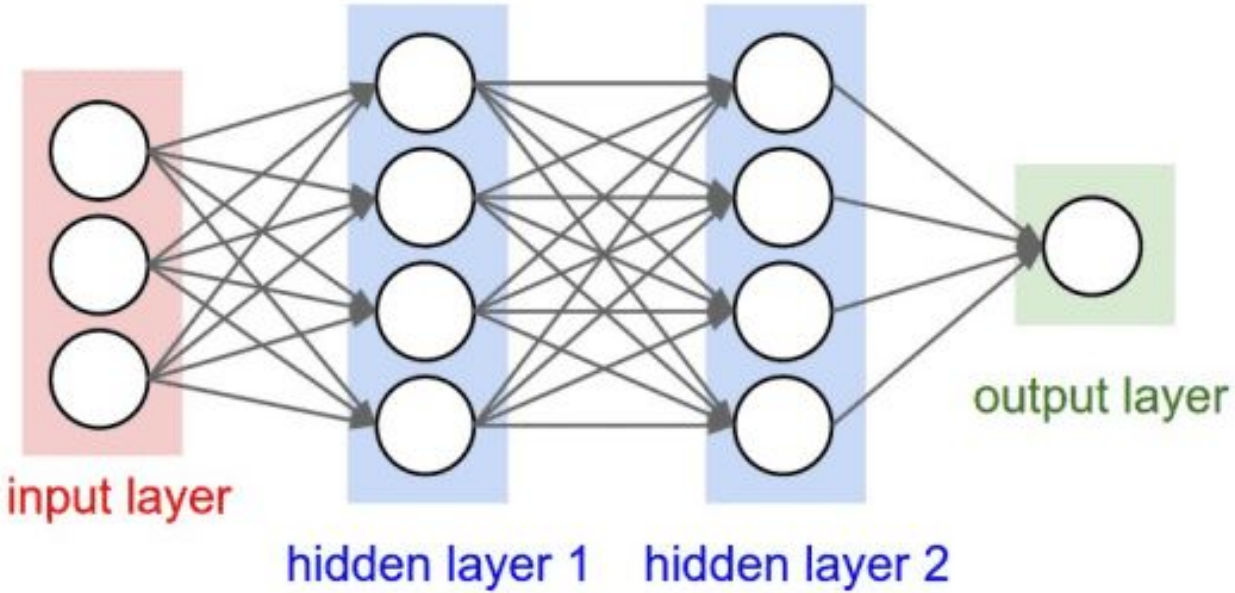
- Mostly for Computer Vision



Feed-Forward Neural Network

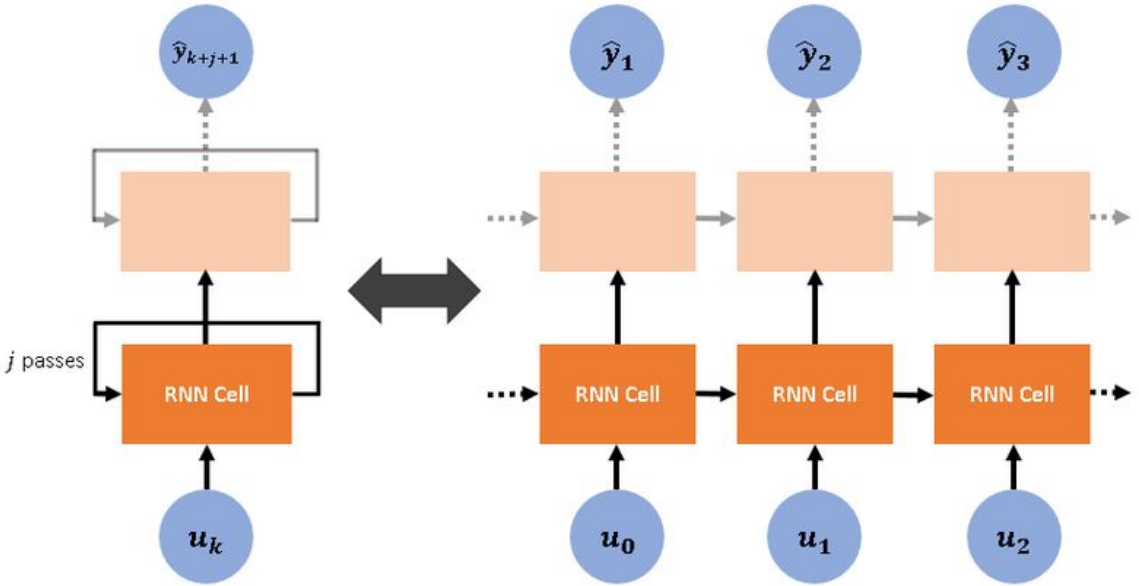


Feed-Forward Network (aka MLP)

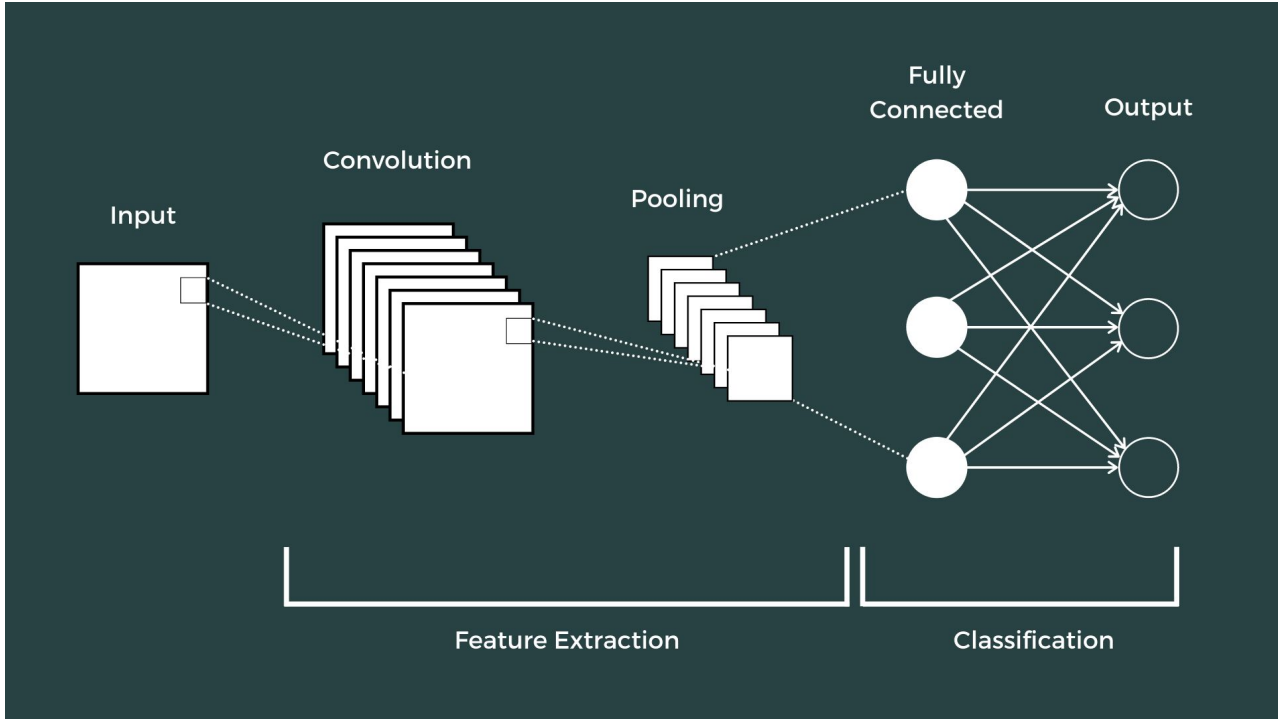


Recurrent Neural Network (RNN)

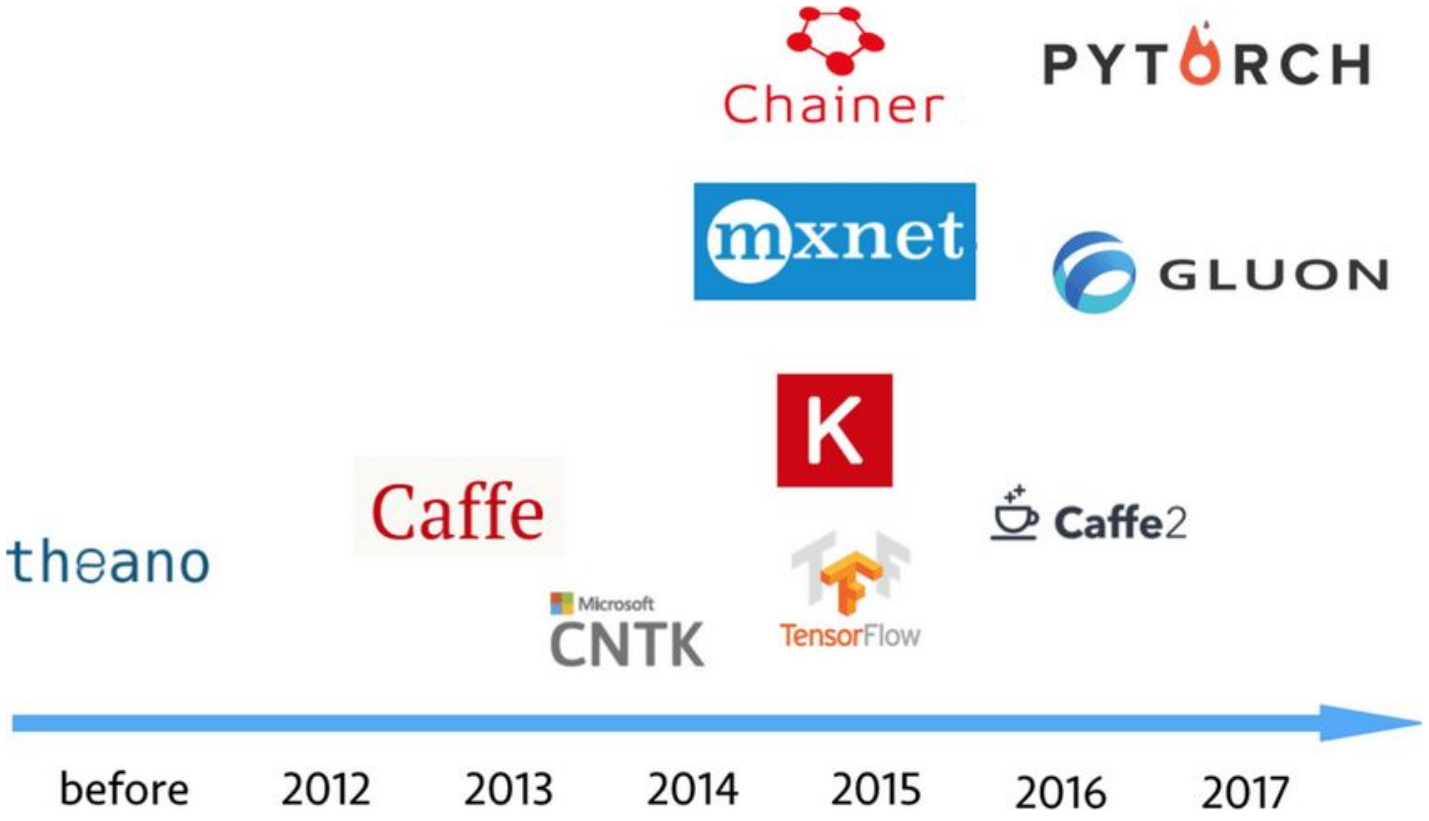
- Traditional RNN
  - For modeling “serial” data (time or text)
  - Suffers from “vanishing gradient” problem
- Advancements:
  - Long Short-Term Memory (LSTM)
  - Gated Recurrent Unit (GRU)



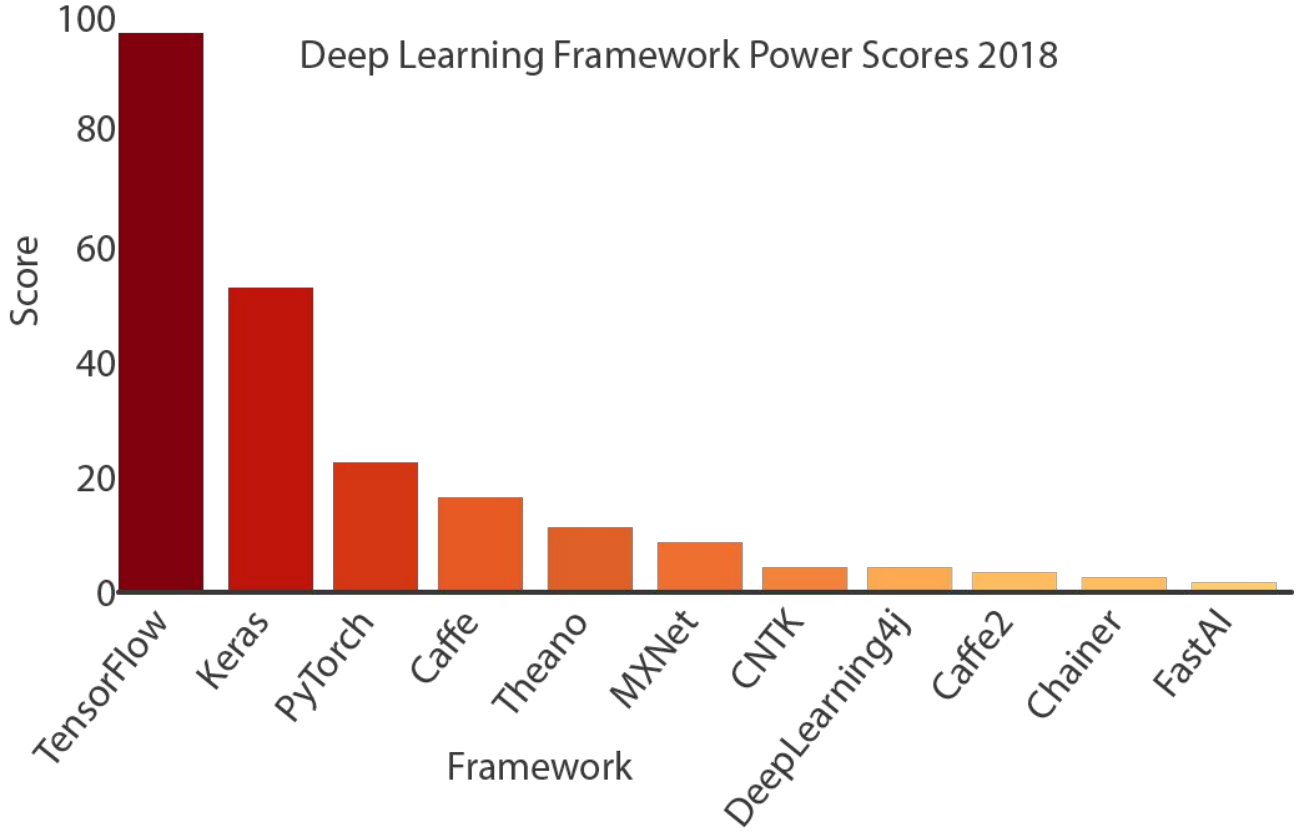
Convolutional Neural Network (CNN)



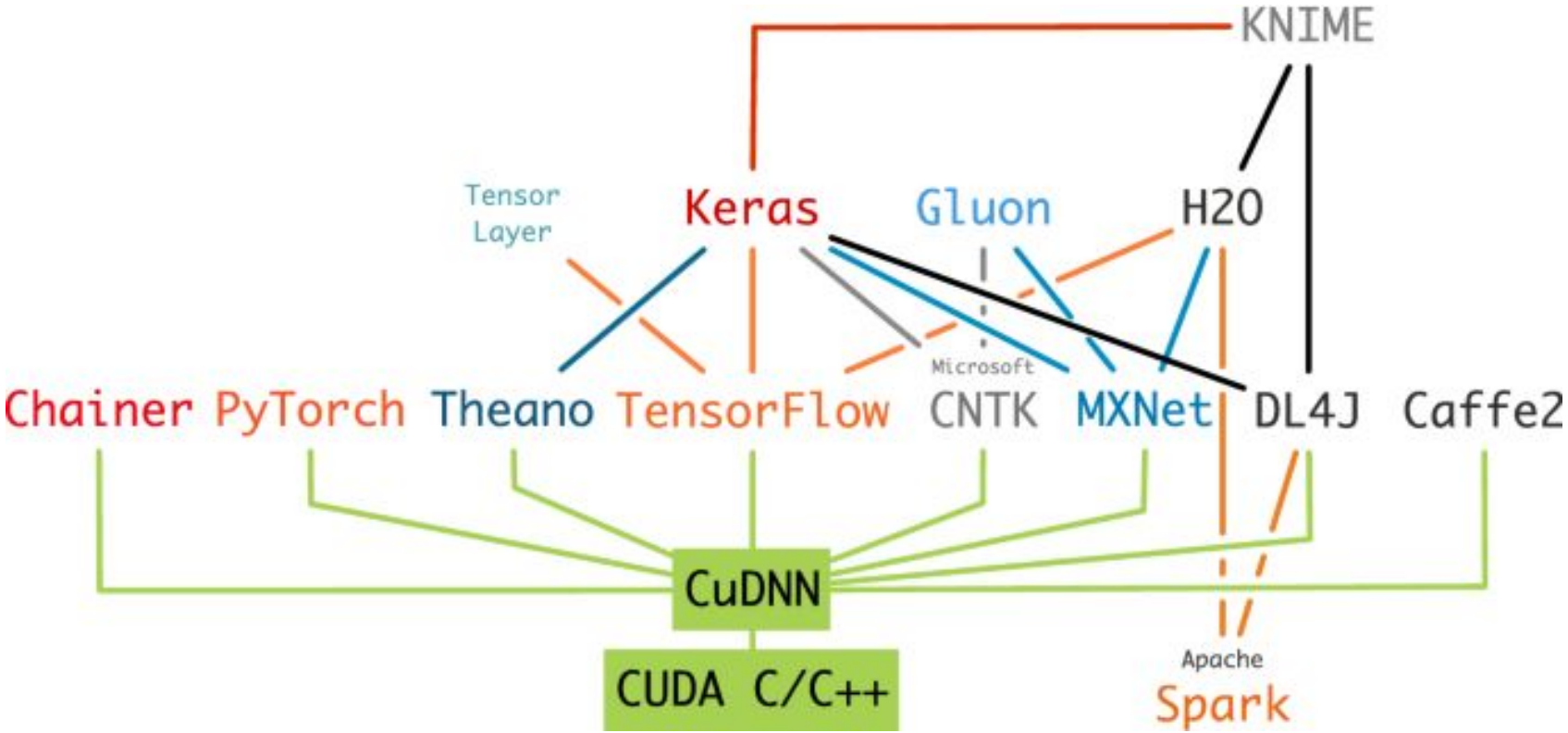
Deep Learning Libraries (timeline)



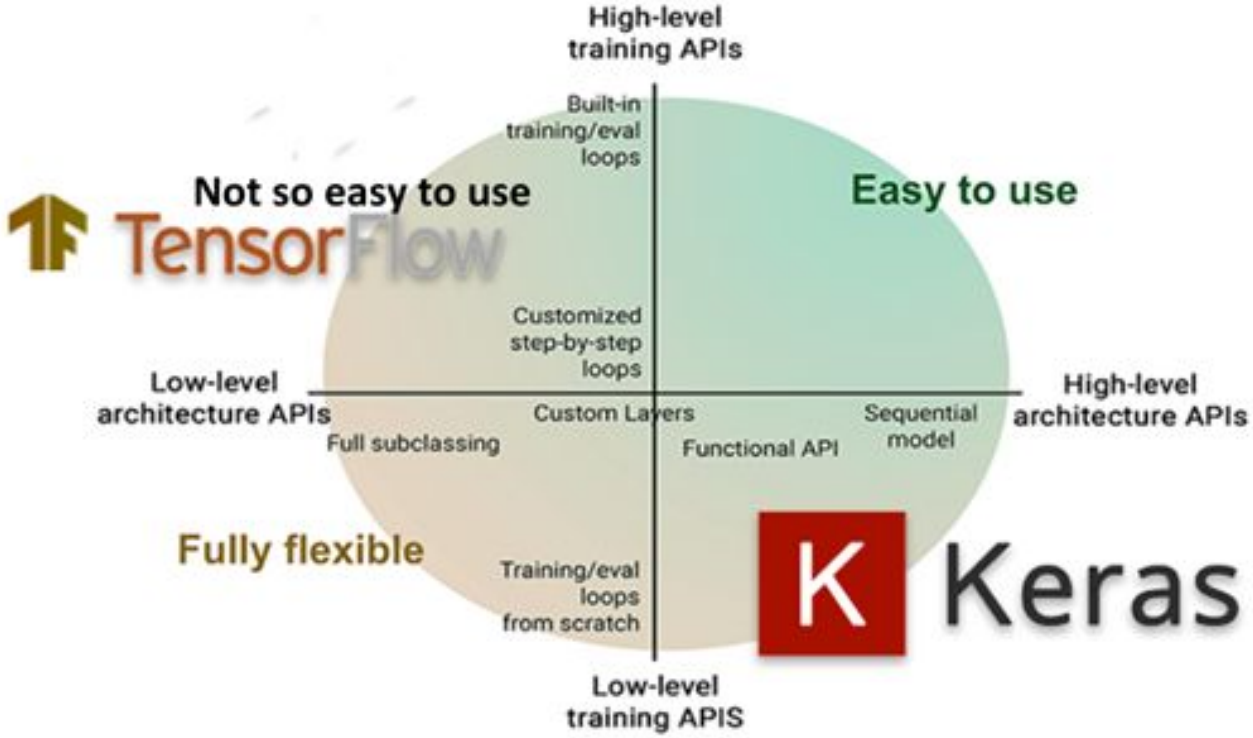
Deep Learning Libraries (popularity)



Wrappers and Frameworks



Keras and Tensorflow



Keras is basically a part of Tensorflow

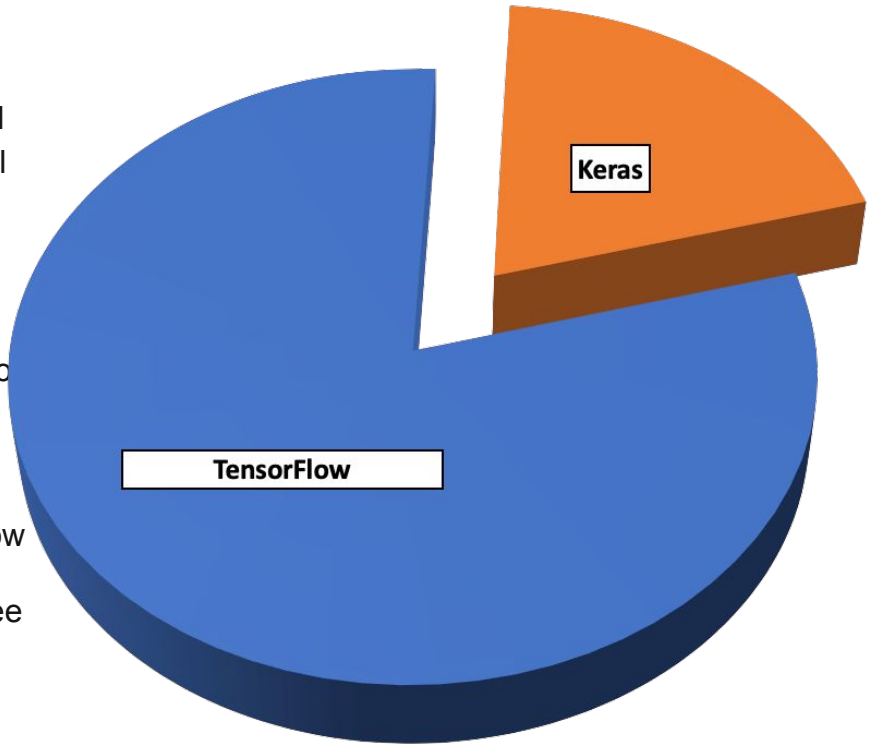
Keras and TensorFlow are often wrongly assumed as competitive frameworks.

Keras is a high-level API for developing neural network models and does not handle low-level computations.

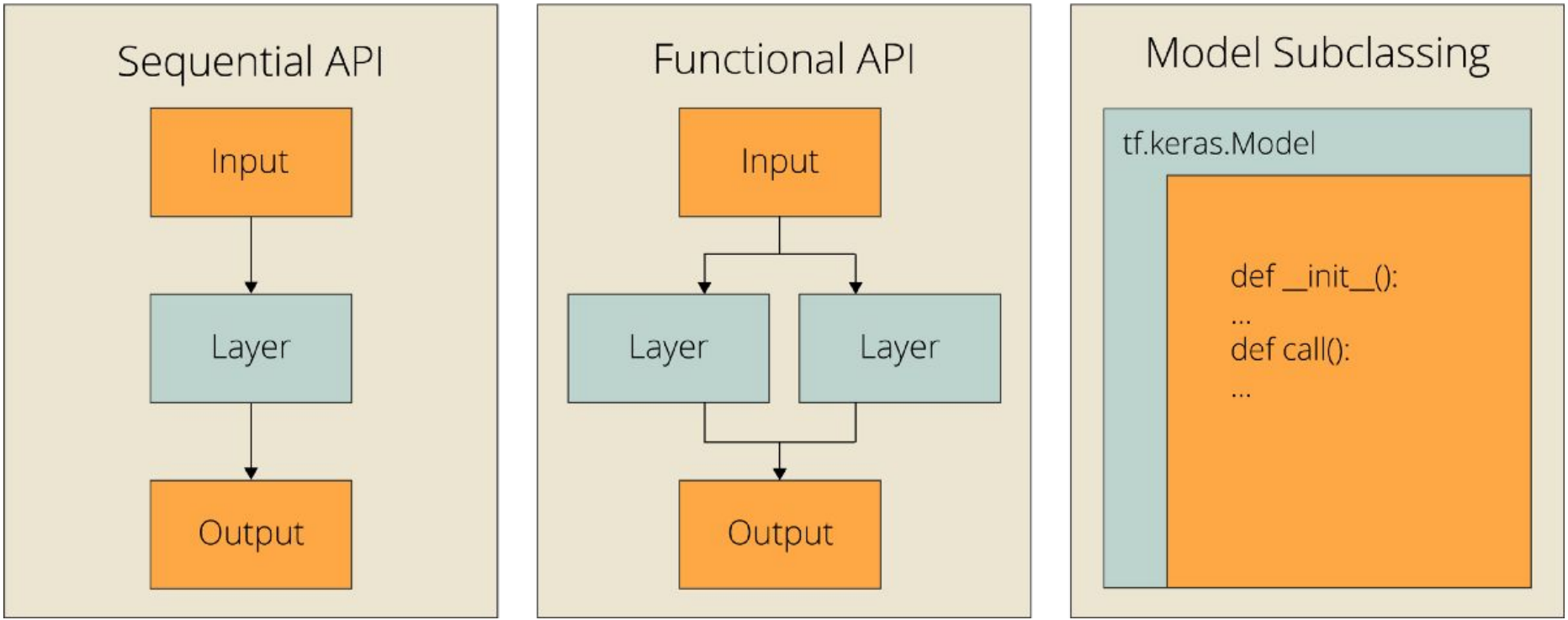
As per the latest release of Keras, Keras will mainly focus on its integration with the TensorFlow core API while continuing to suppo fixes for Theano/CNTK.

The tf.keras submodule/package is the implementation of the Keras API for TensorFlow

https://developer.ibm.com/articles/compare-dee p-learning-frameworks/



Keras API


Sequential API
Input
Layer
Output
Functional API
Input
Layer
Layer
Output
Model Subclassing
tf.keras.Model
def __init__():
...
def call():
...