

Deep Learning with CNTK

CogNitive ToolKit



Vitor
Meriat 

About me

Vitor is a computer scientist who is passionate about creating software that will positively change the world we live in.

Currently, he works as **Data Scientist and Machine Learning Engineer** at **ESX**, where he is helping to shape new disruptive services based in Cloud Computing, Big Data and Artificial Intelligence. **Microsoft MVP Artificial Intelligence**.



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GLOBAL AI BOOTCAMP



Microsoft



Agenda

- Why CNTK?
- What is CNTK - quick introduction
- How CNTK works
- Getting Started with CNTK

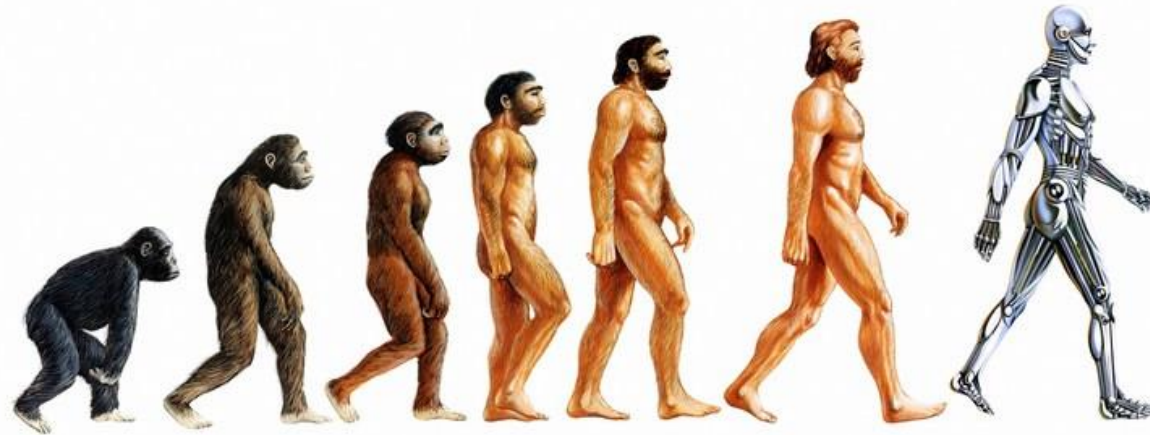


Artificial Intelligence

Machine Learning

Deep Learning

Cognitive Computing



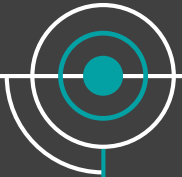
T I M E L I N E A I

Artificial
Intelligence

Machine
Learning

Deep
Learning

1950s



BECOMES A
REALITY

1970s



EMERGES AND
GAINS GROUND

1990s



EXPANDS AI

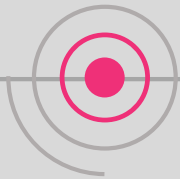
T I M E L I N E A I

1950s



Artificial
Intelligence

1970s



Machine
Learning

1990s

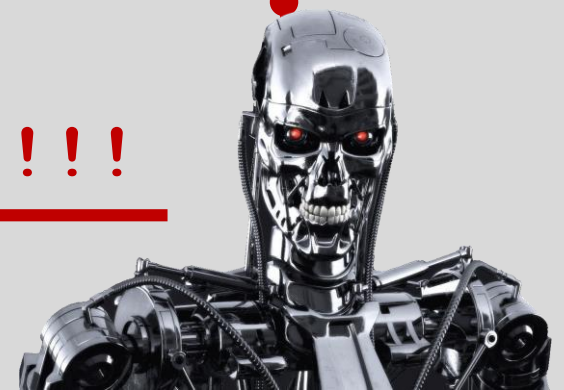


Deep
Learning

FUTURE



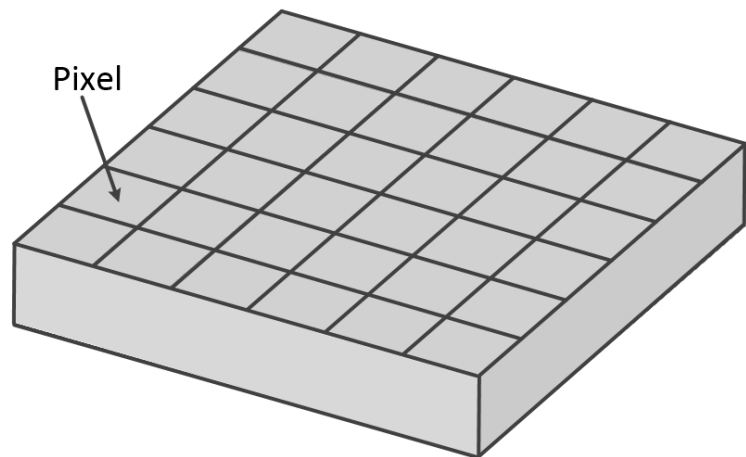
IS WE !!!



Computer Vision and Natural Language Processing

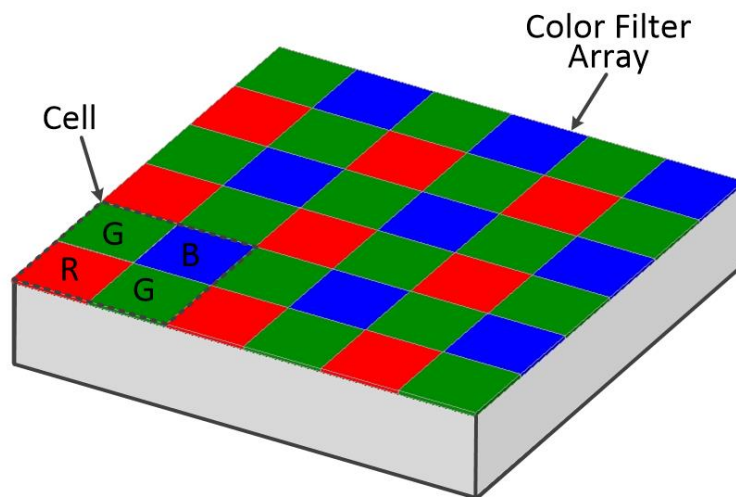


Monochrome Sensor



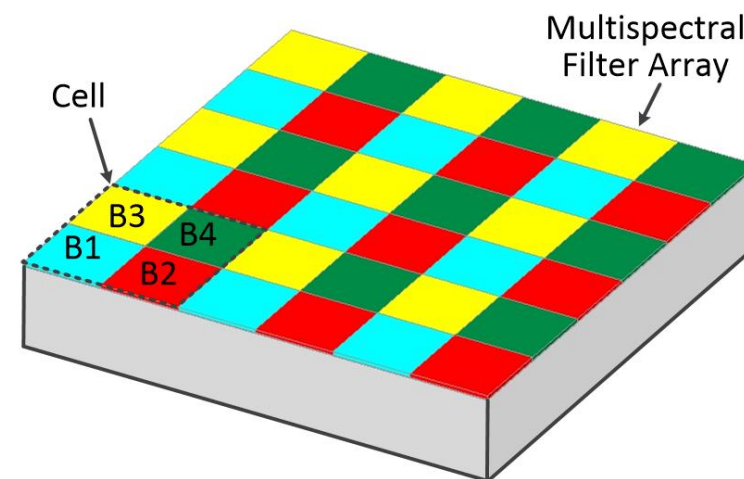
8bits

Color Sensor



24bits

Multispectral Sensor



Nbits

Word Embeddings

't'
'e'
'n'
's'
'o'
'r'

Vetor

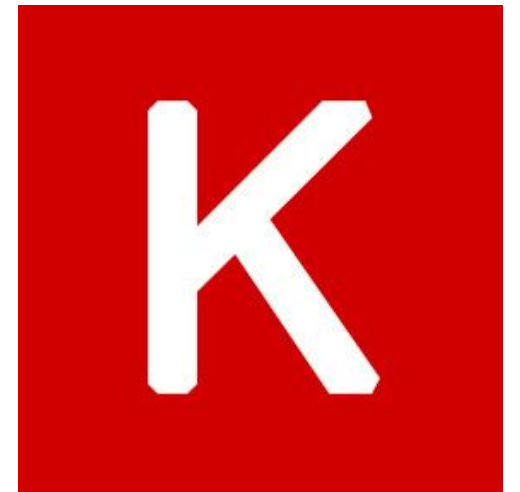
3	1	4	1
5	9	2	6
5	3	5	8
9	7	9	3
2	3	8	4
6	2	6	4

Matriz

2	1	8	8	1	8
2	8	4	5	9	0
2	3	5	3	6	0
7	4	7	1	3	5

Tensor

Deep Learning Frameworks





Microsoft
Cognitive
Toolkit

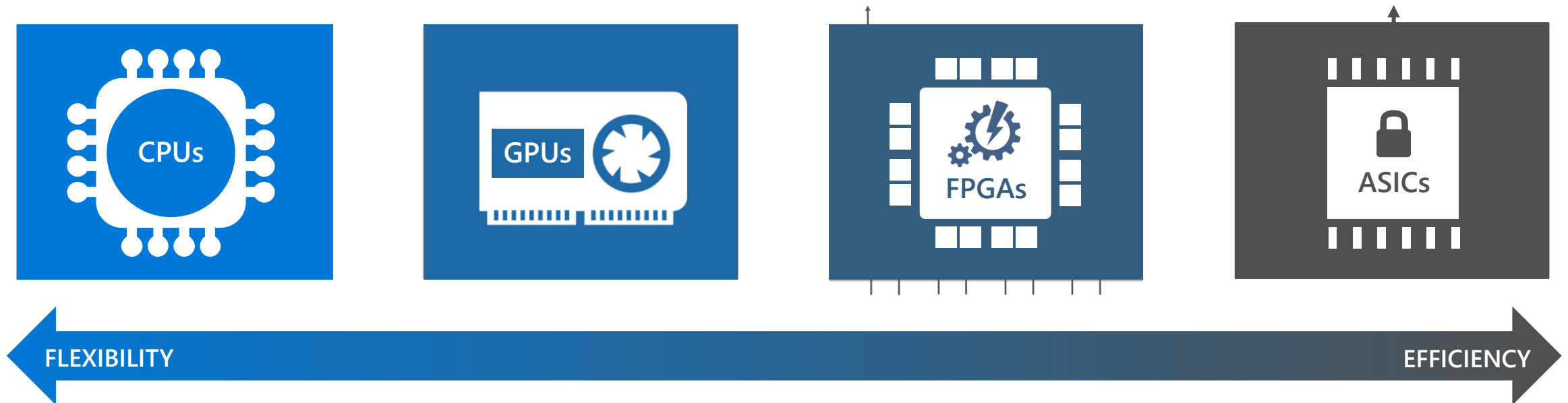
Silicon alternatives

TRAINING

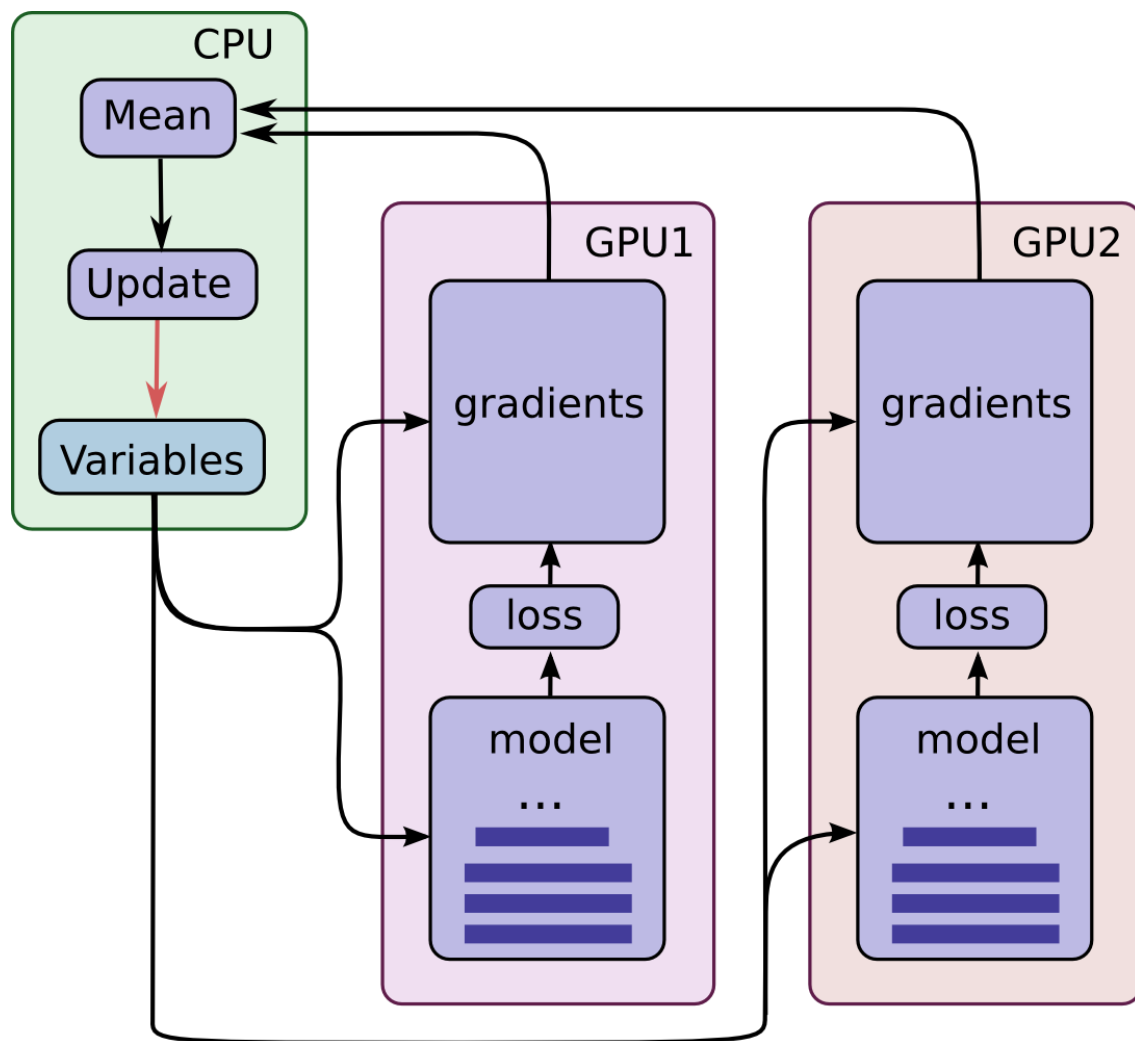
CPUs and GPUs, limited FPGAs,
ASICs under investigation

EVALUATION

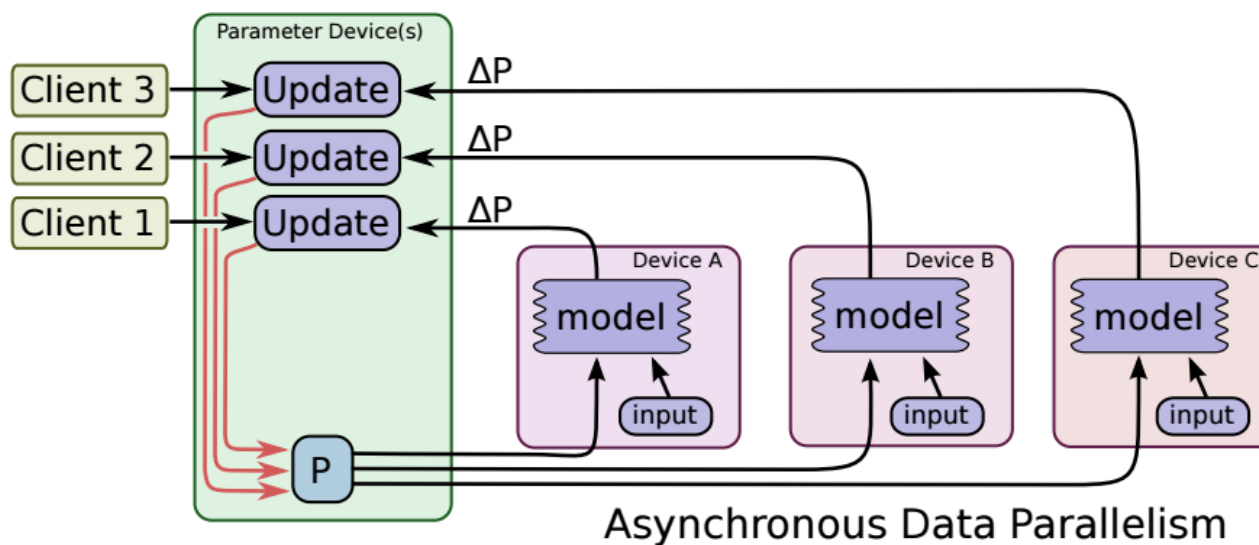
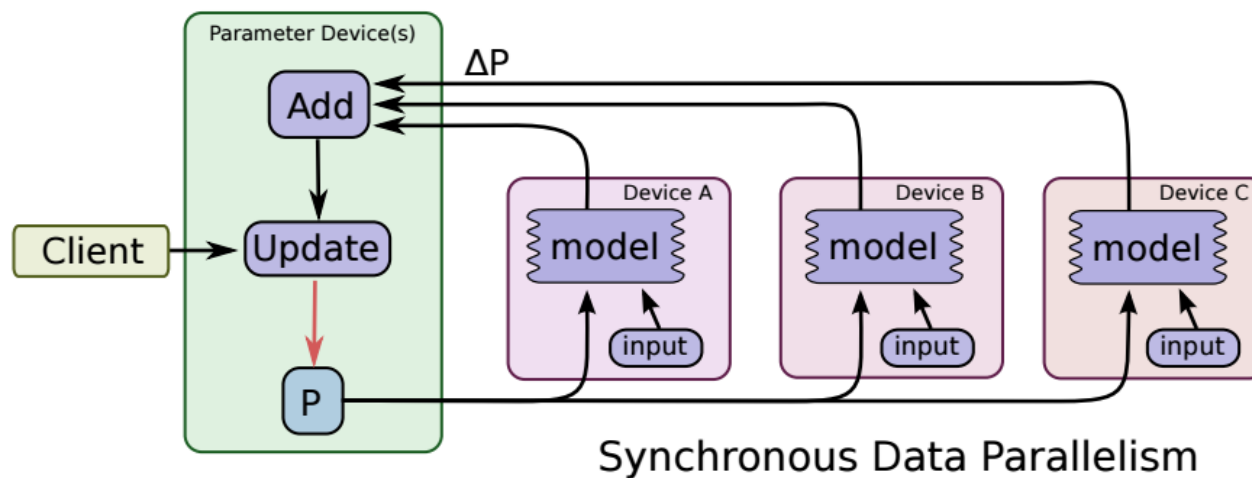
CPUs and FPGAs,
ASICs under investigation



Multiple GPU Cards



Parallel Training



What is CNTK?

- Microsoft **C**ong~~N~~itive **T**ool~~K~~it, first known as: **C**omputational **N**etwork **T**ool~~K~~it
- Created 2012
- By Microsoft Speech researchers
- Open source deep learning toolkit,
- Appeared on GitHub in January 2016,
- 15k+ GitHub stars,
- MIT License
- Production ready
- 190+ contributors:
- MS, MIT, Stanford, Intel, Nvidia ...

CNTK on .NET Platform

- First version with .NET Support
 - CNTK 2.2 (Sep. 2017)
- The latest version:
 - CNTK 2.6 (sep. 2018)
 - First version with .NET Core 2.0 support

CNTK is everywhere in Microsoft

- Microsoft Cognitive Services
- Skype Translator
- Office
- Cortana
- Bing
- HoloLens
- Microsoft Research
- Windows ML

How fast the CNTK is

<http://dlbench.comp.hkbu.edu.hk/>

Benchmarking by HKBU, Version 8

Single Tesla K80 GPU, CUDA: 8.0 CUDNN: v5.1

Caffe: 1.0rc5(39f28e4)

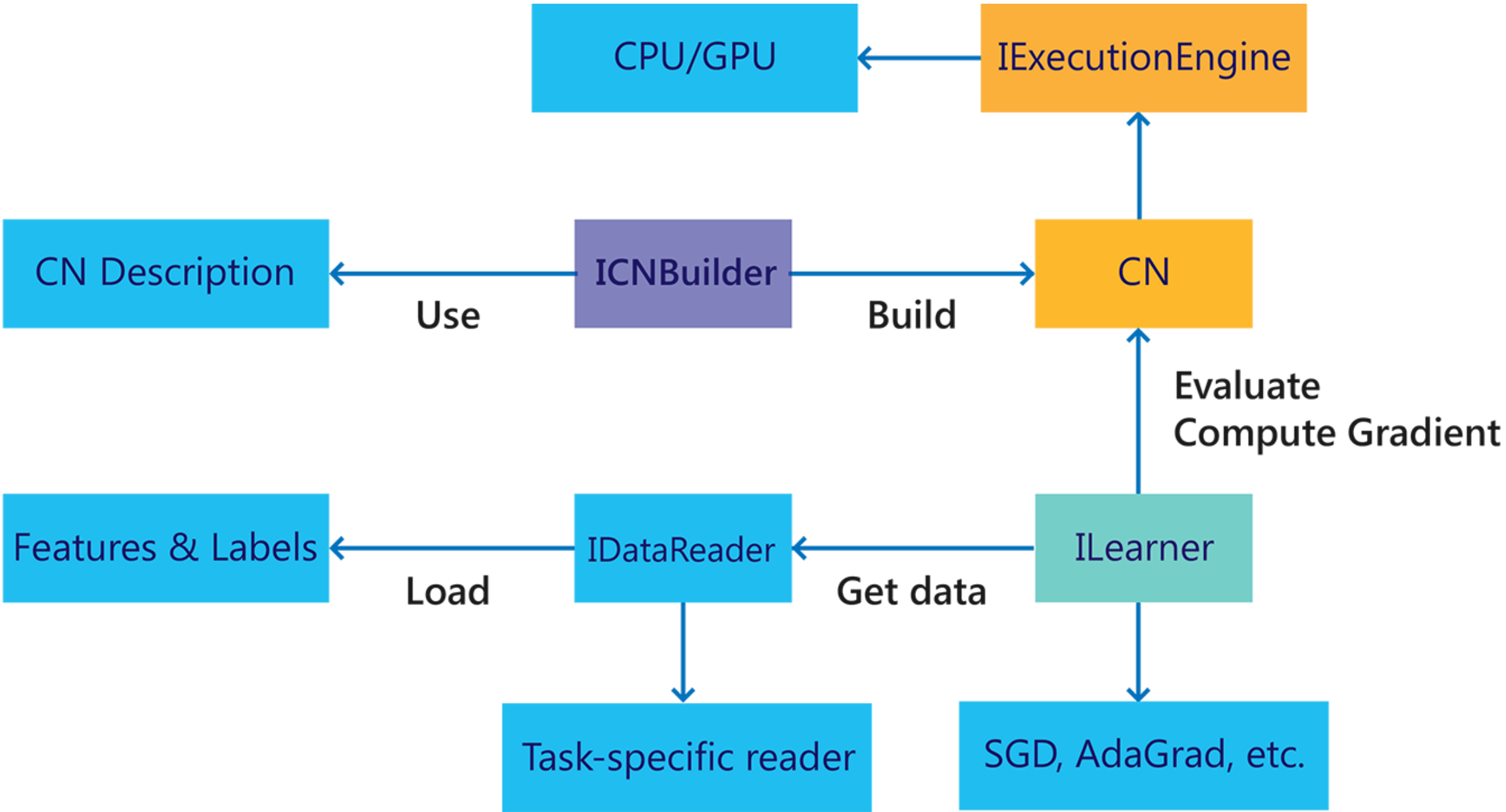
CNTK: 2.0 Beta10(1ae666d)

MXNet: 0.93(32dc3a2)

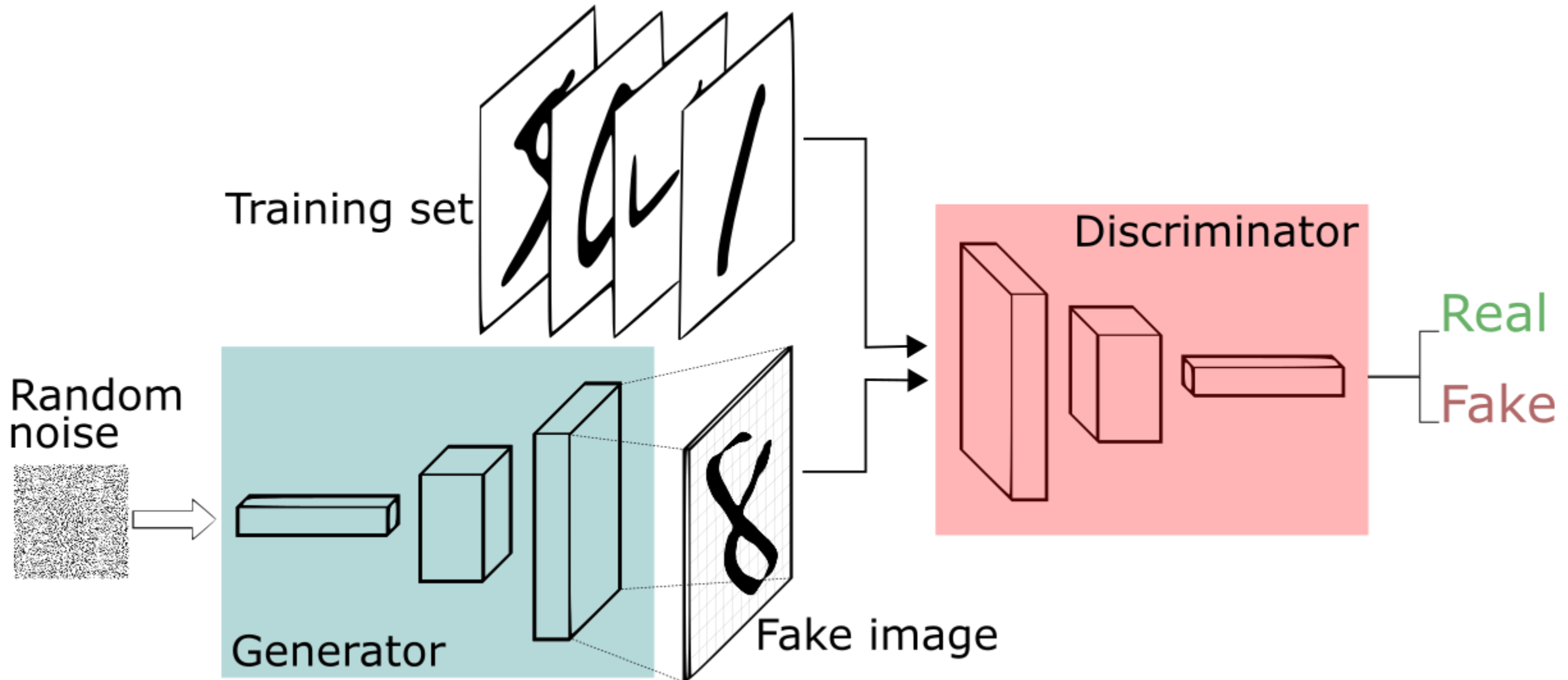
TensorFlow: 1.0(4ac9c09)

Torch: 7(748f5e3)

	Caffe	Cognitive Toolkit	MxNet	TensorFlow	Torch
FCN5 (1024)	55.329ms	51.038ms	60.448ms	62.044ms	52.154ms
AlexNet (256)	36.815ms	27.215ms	28.994ms	103.960ms	37.462ms
ResNet (32)	143.987ms	81.470ms	84.545ms	181.404ms	90.935ms
LSTM (256) (v7 benchmark)	-	43.581ms (44.917ms)	288.142ms (284.898ms)	- (223.547ms)	1130.606ms (906.958ms)

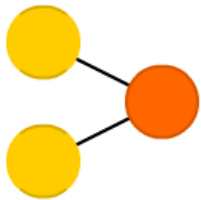


Generative Adversarial Networks

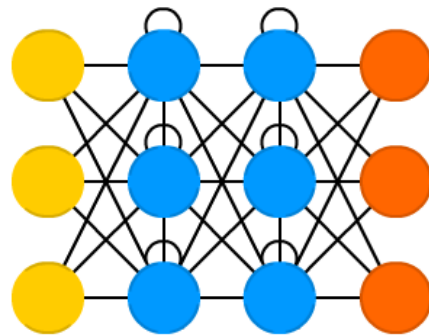


Deep Learning Architectures

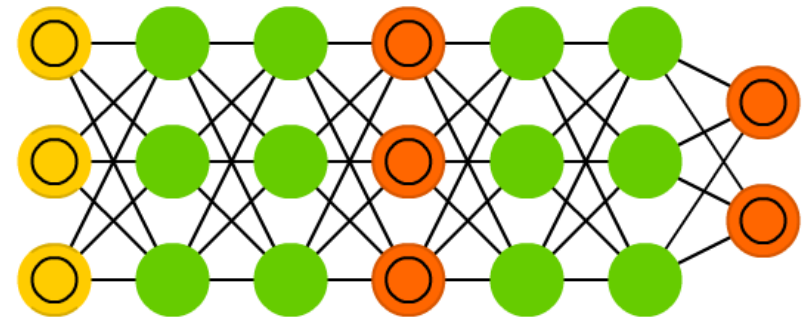
Perceptron



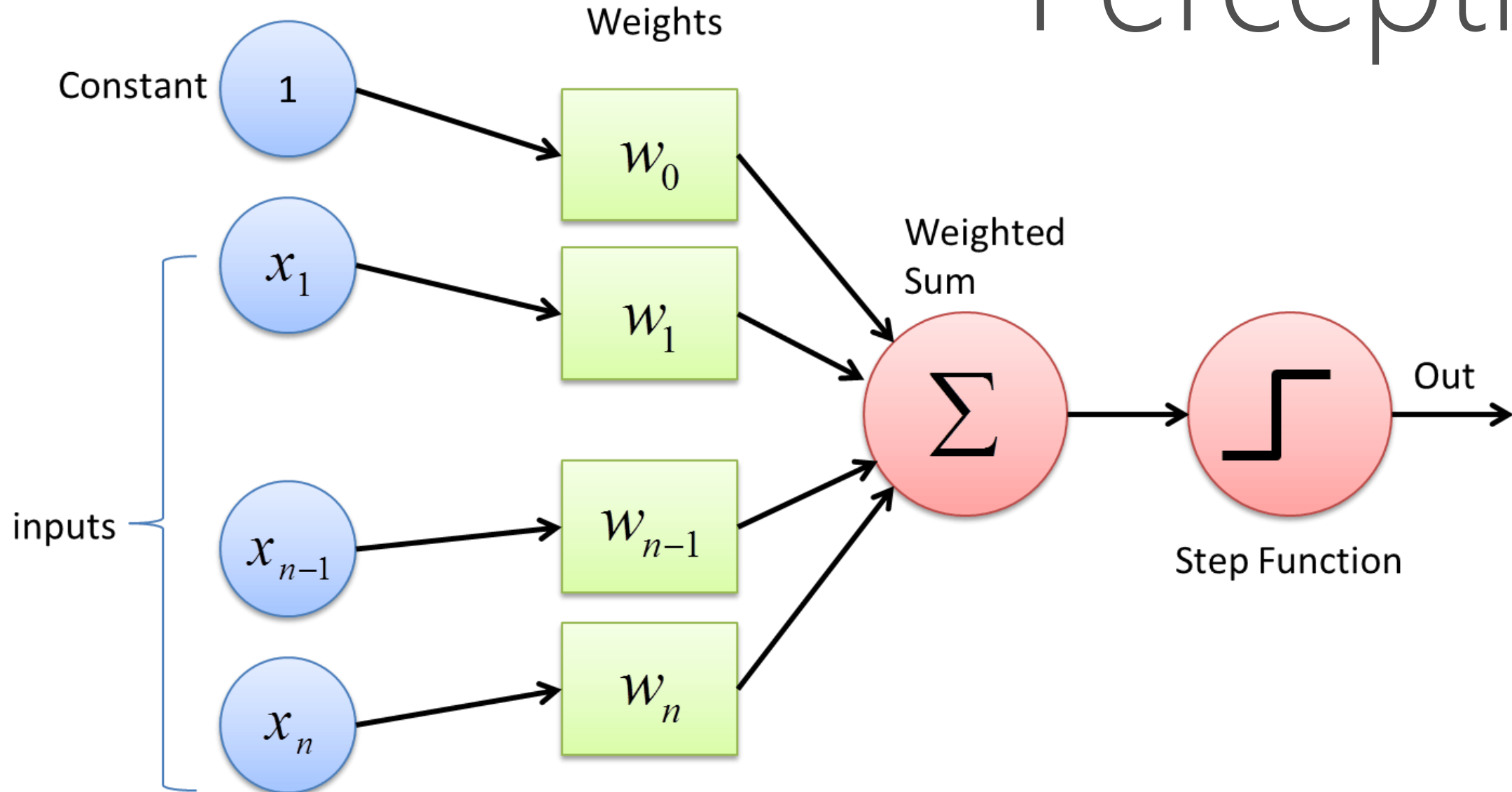
Recurrent
Neural
Network
(RNN)



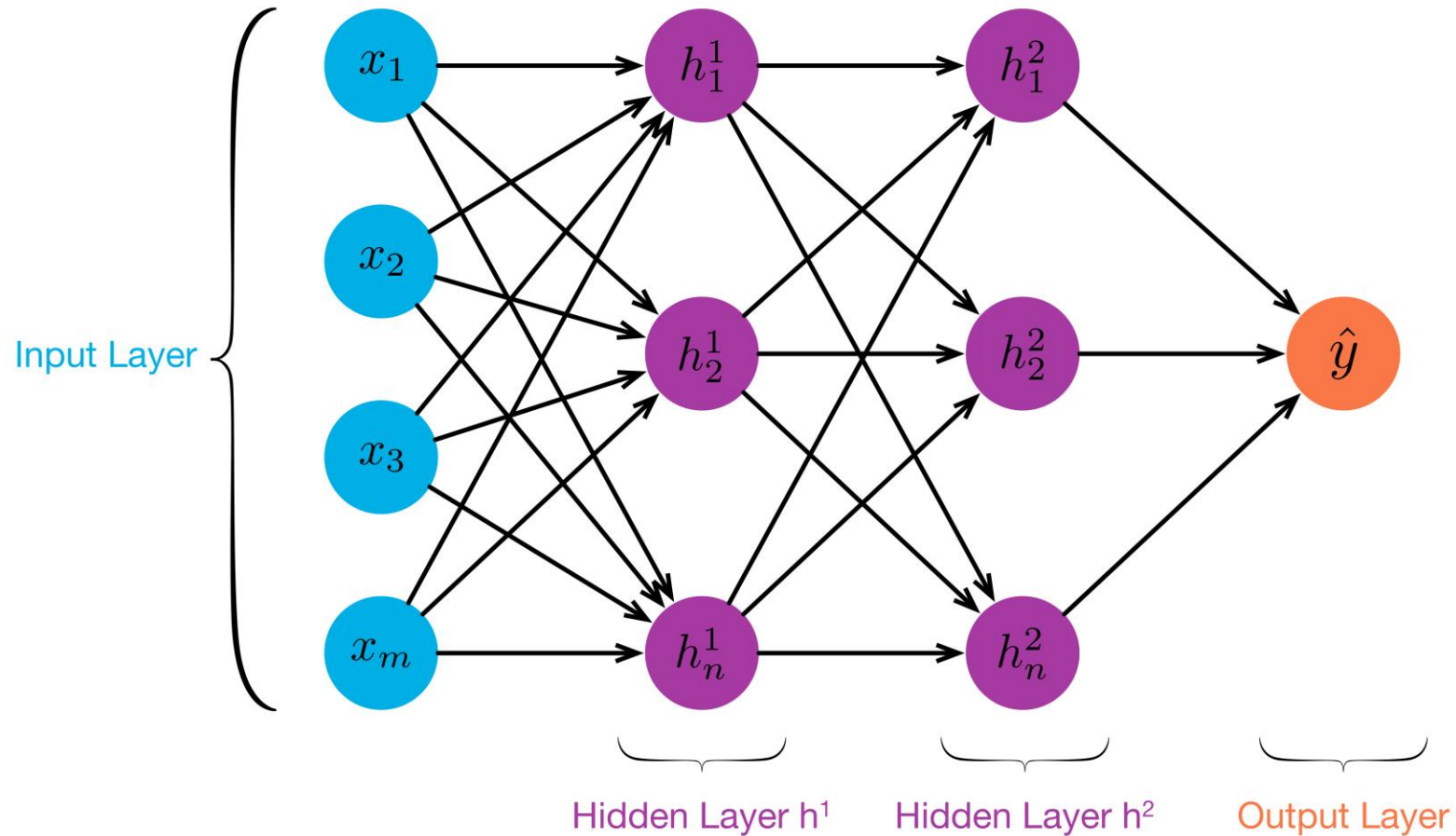
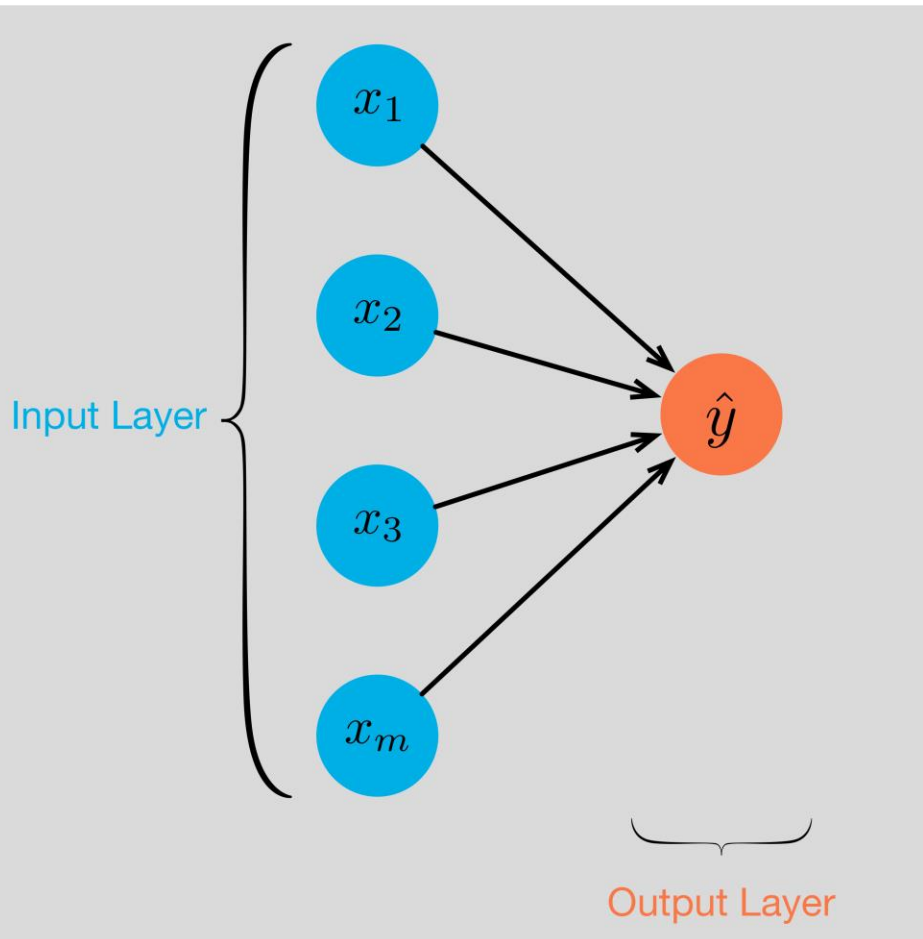
Generative
Adversarial
Network
(GAN)



Perceptron



Single-Layer and Multi-Layer



Thank you!

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