Deep Learning e Visão Computacional com CNTK

VITOR MERIAT
@VITORMERIAT

Visual Studio Summit

#VSSUMMIT

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. Data science enthusiast, he works with Big Data projects, data analytics and **Microsoft MVP Azure**.

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linkedin.com/in/vitormeriat

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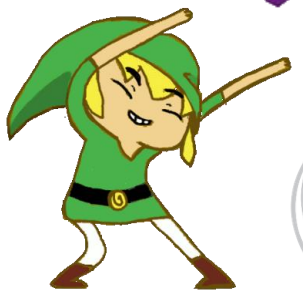
github.com/vitormeriat

youtube.com/vitormeriat



Visual Studio Summit

esx

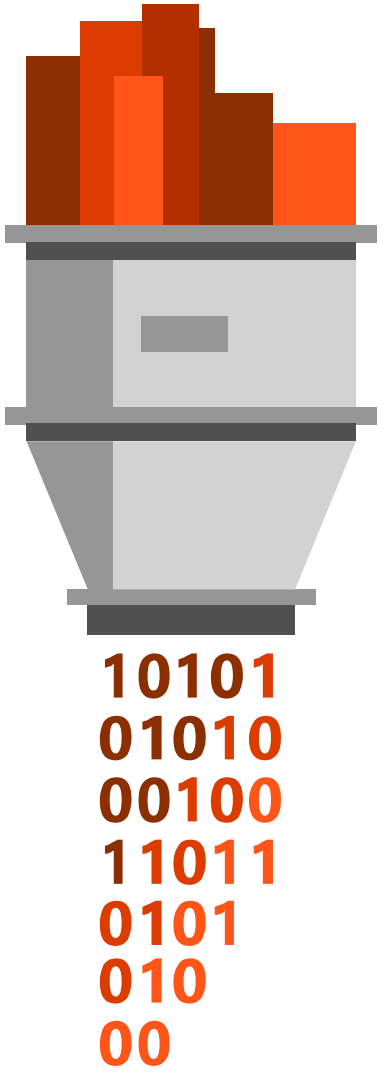
Microsoft

Microsoft® Most Valuable Professional

Agenda

O que é Visão Computacional e por que é uma assunto tão difícil;

Como Deep Learning e a Cloud Computing me ajudam com isso?



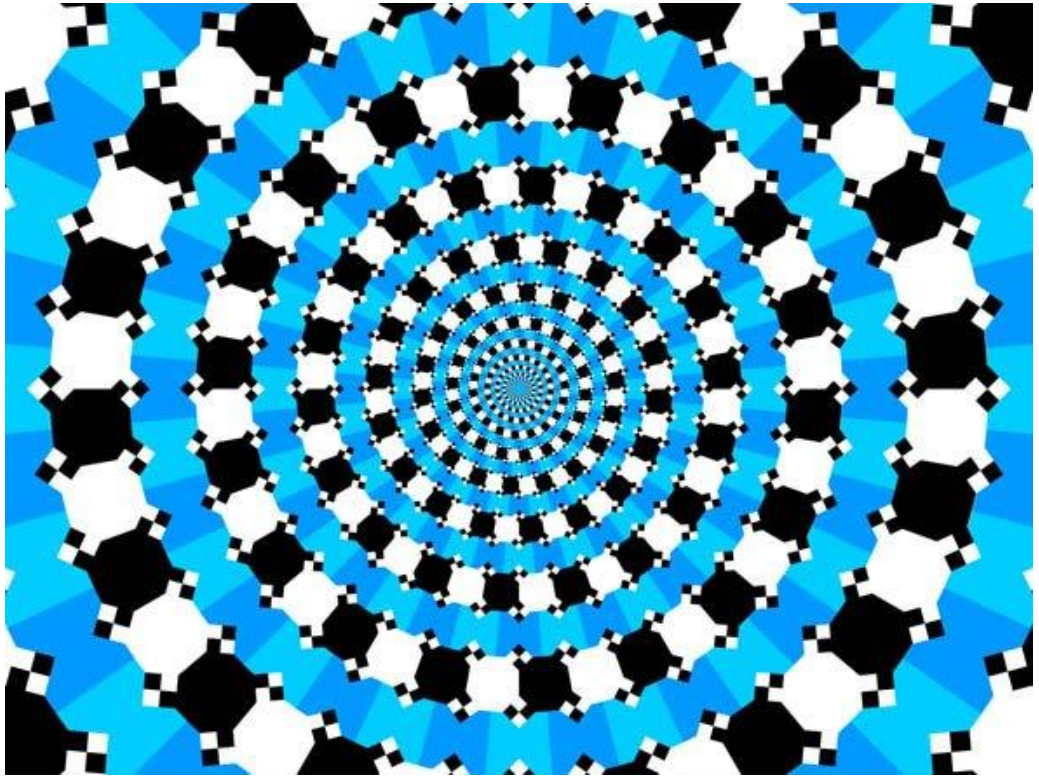

Fake Obama created using AI video tool - BBC News
BBC NEWS
WH .GOV
The researchers used 14 hours of footage of Barack Obama to produce their model.
SUBSCRIBE
0:34 / 1:25
HD

Visão é um problema inverso e mal-posto

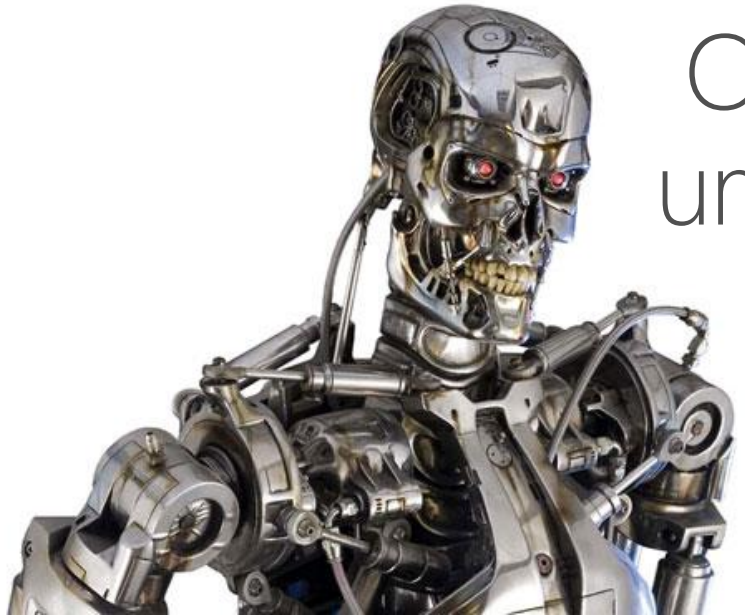
- Pequenas variações na imagem levam a interpretações distintas;
- Visão é ambígua
- Ruído piora o problema

Visão Computacional é difícil

- Ambiguidades
- Distorções
- Paradoxos
- Ficções



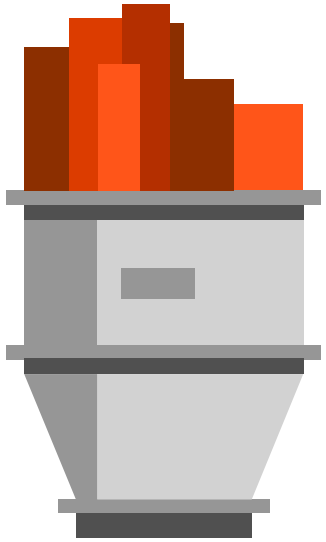
Eu quero ensiar para o meu computador que isso é um gato



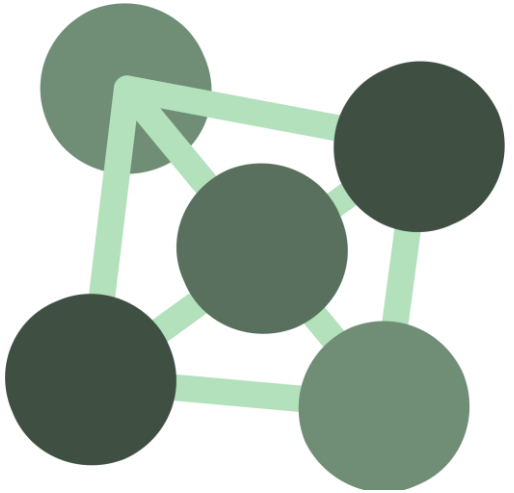
O que é
um gato?

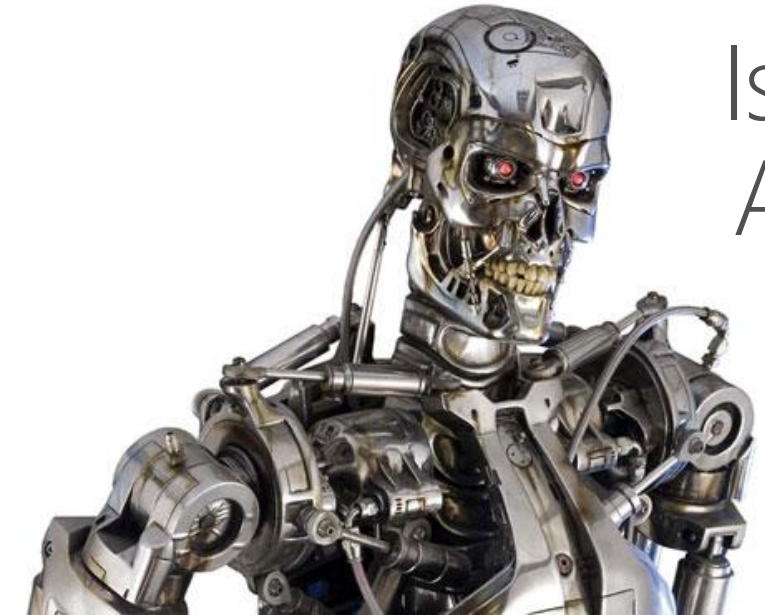
Eu sou
um gato

Vamos ensinar esse computar



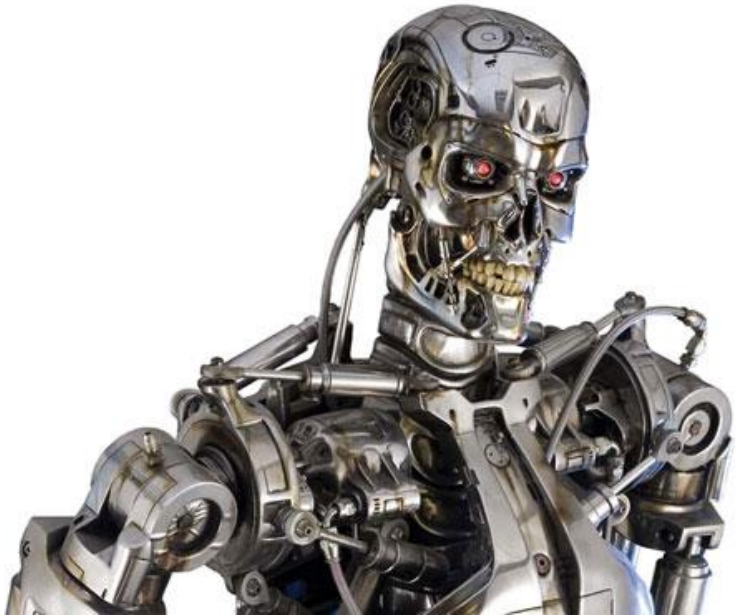
10101
01010
00100
11011
0101
010
00

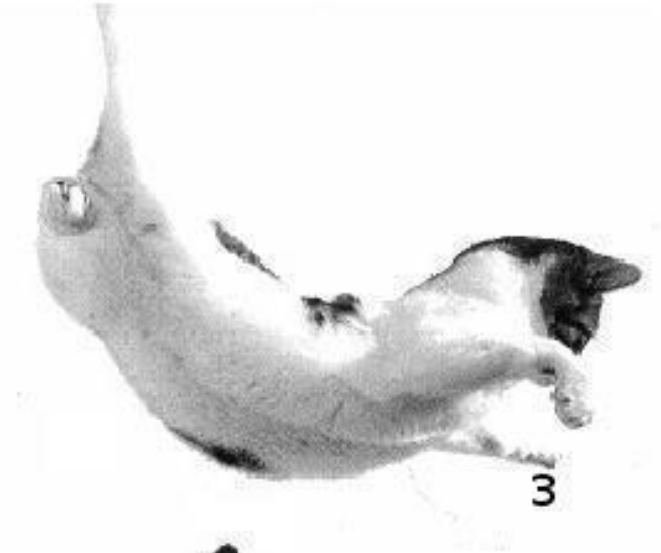


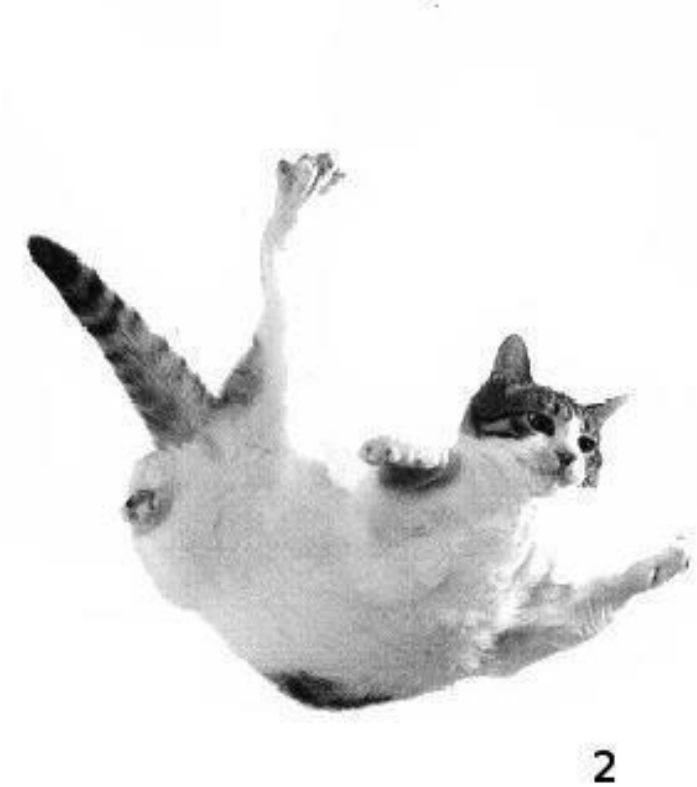


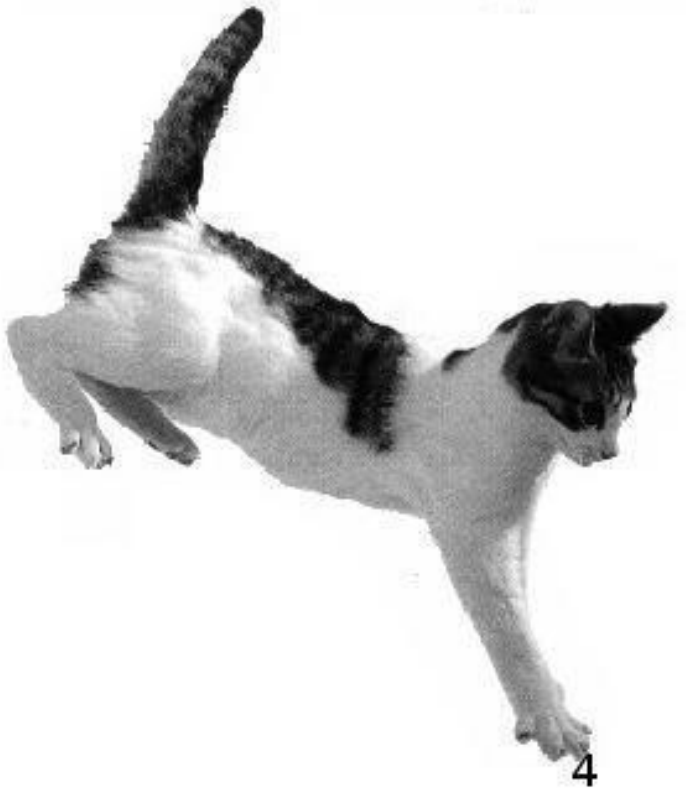
Isso é um gato.
Agora eu já sei.

WTF?!?!

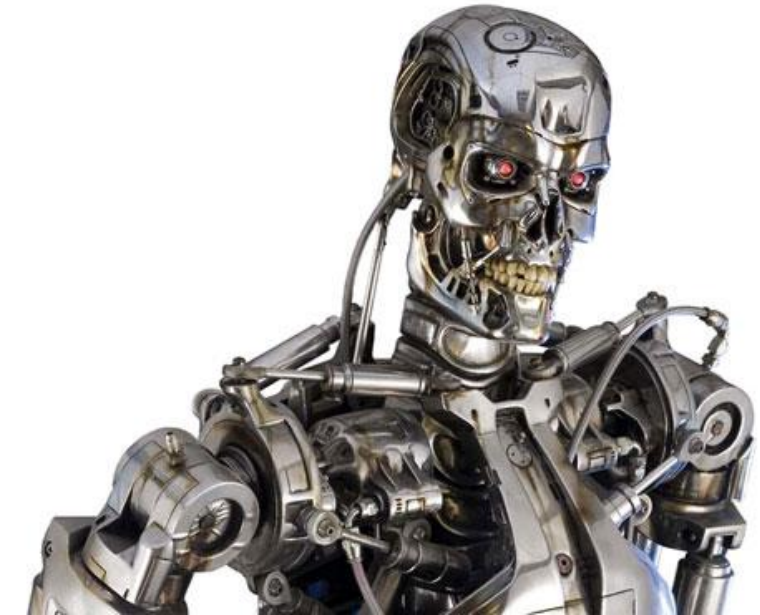








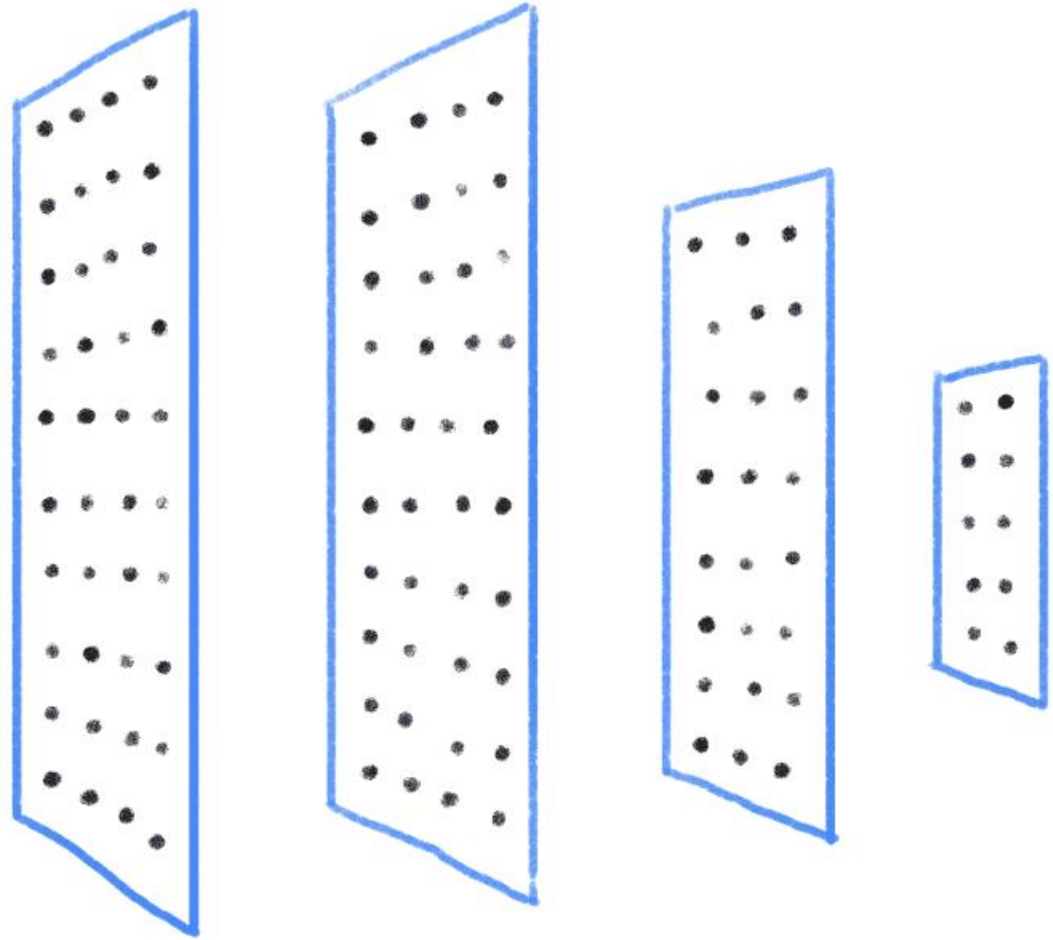
WTF?!?!



CAT

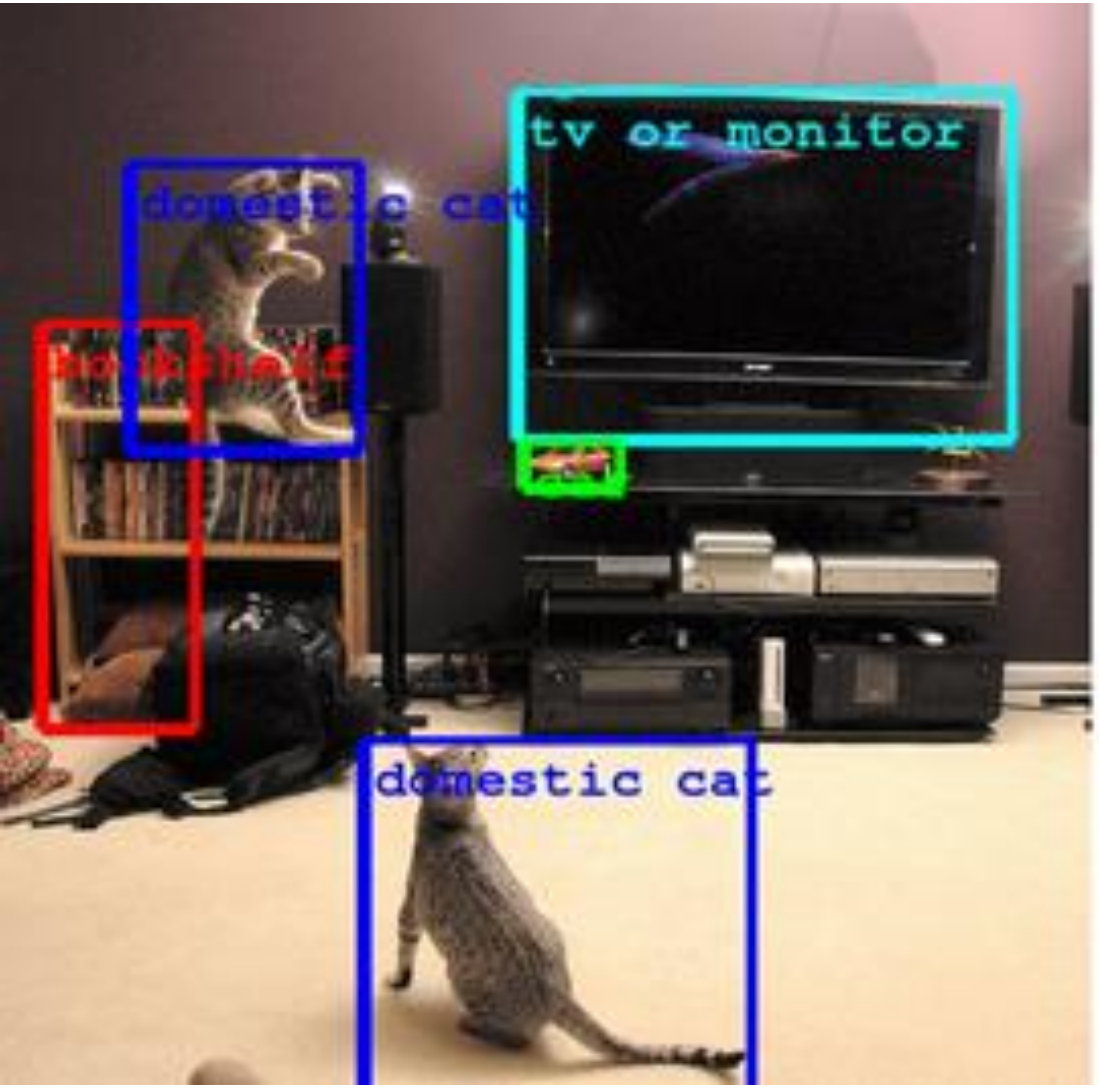
(LABELED PHOTOS)

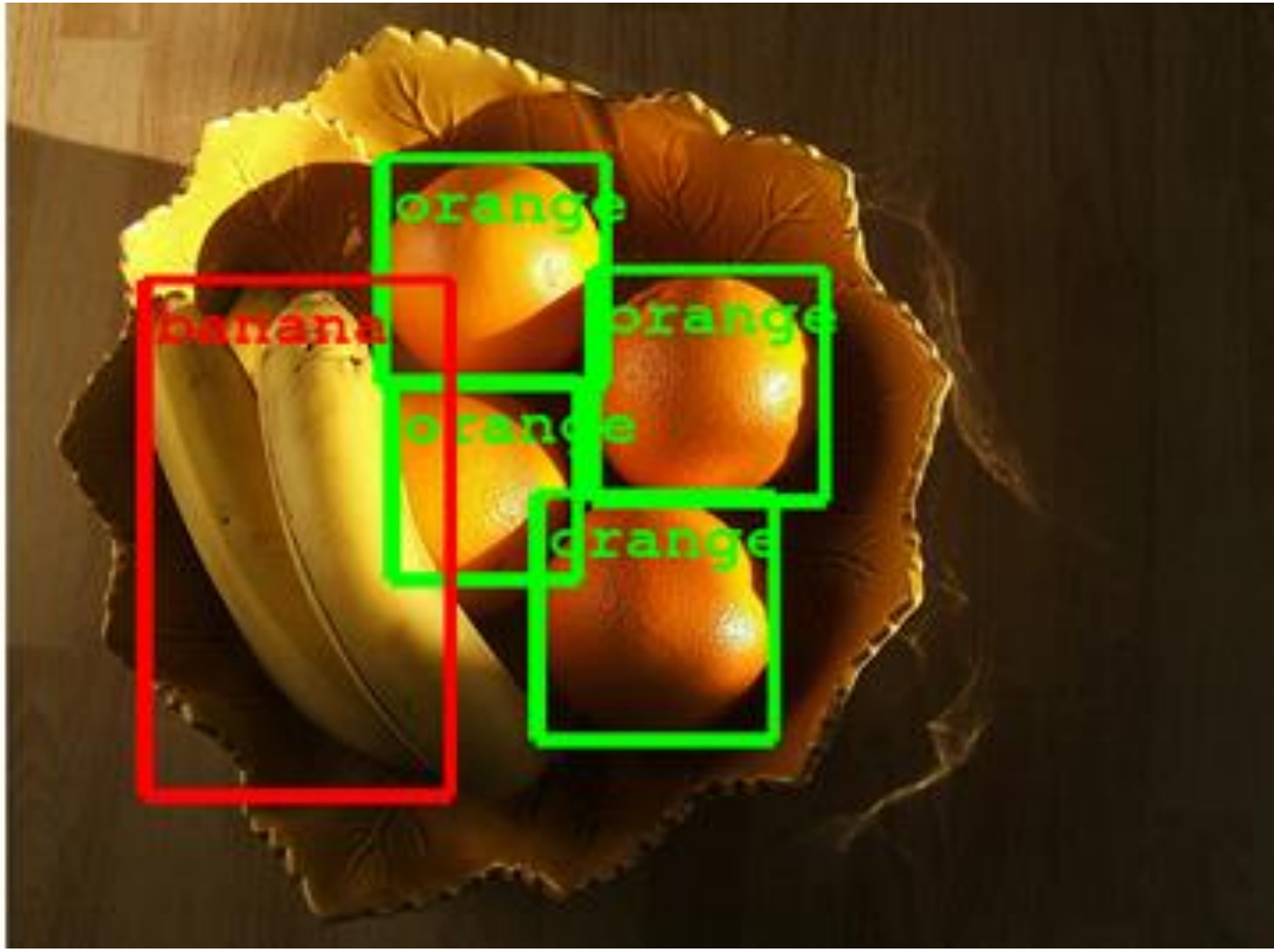
DOG



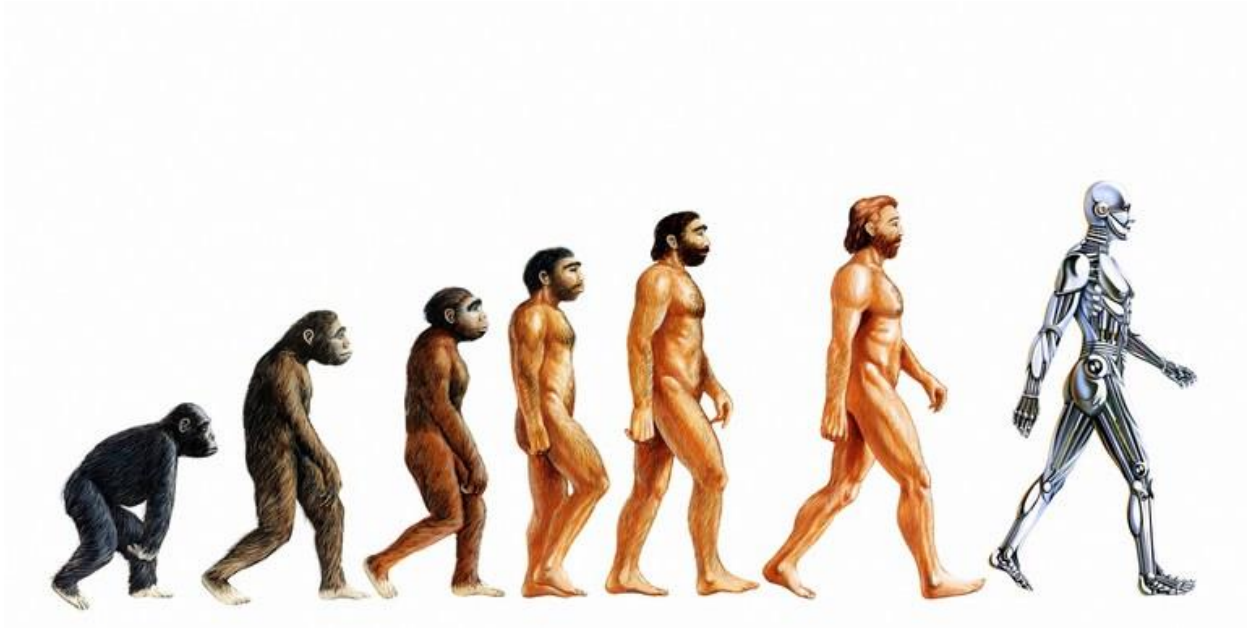
OUTPUT

REF: https://goo.gl/wmi5wB


tv or monitor
domestic cat
domestic cat


orange
orange
orange

Artificial Intelligence
Machine Learning
Deep Learning
Cognitive Computing

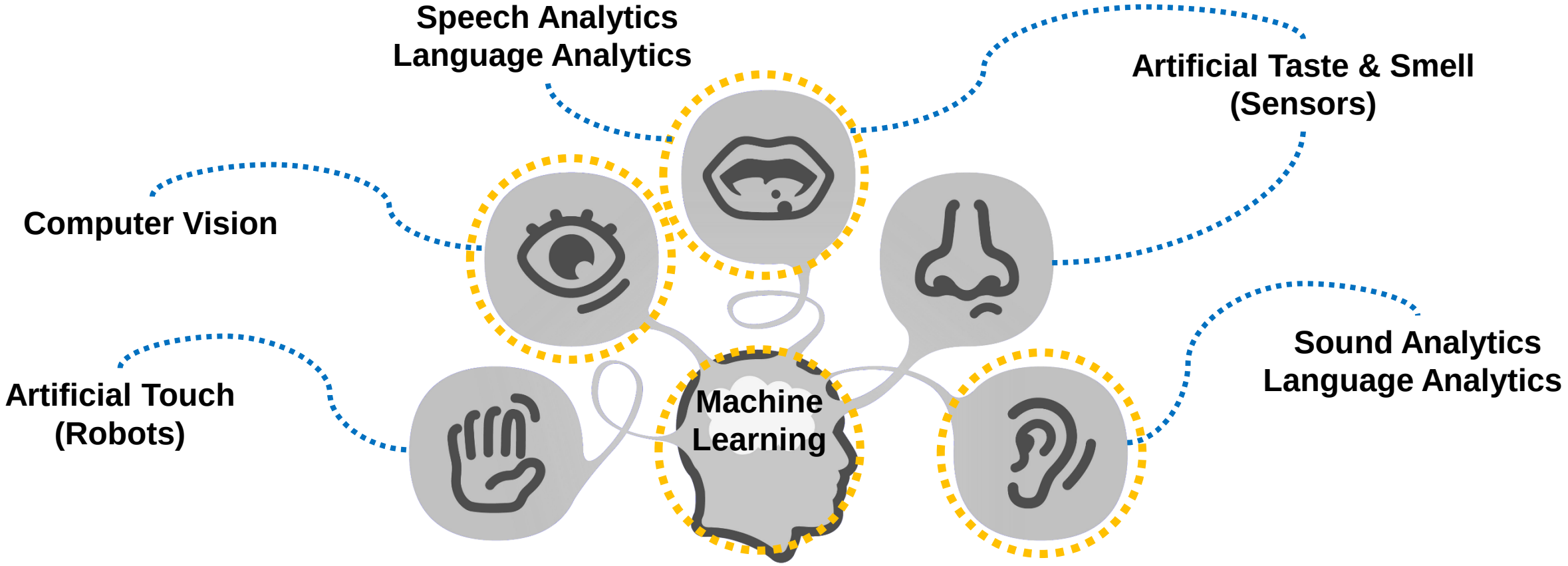


Microsoft Cognitive Toolkit

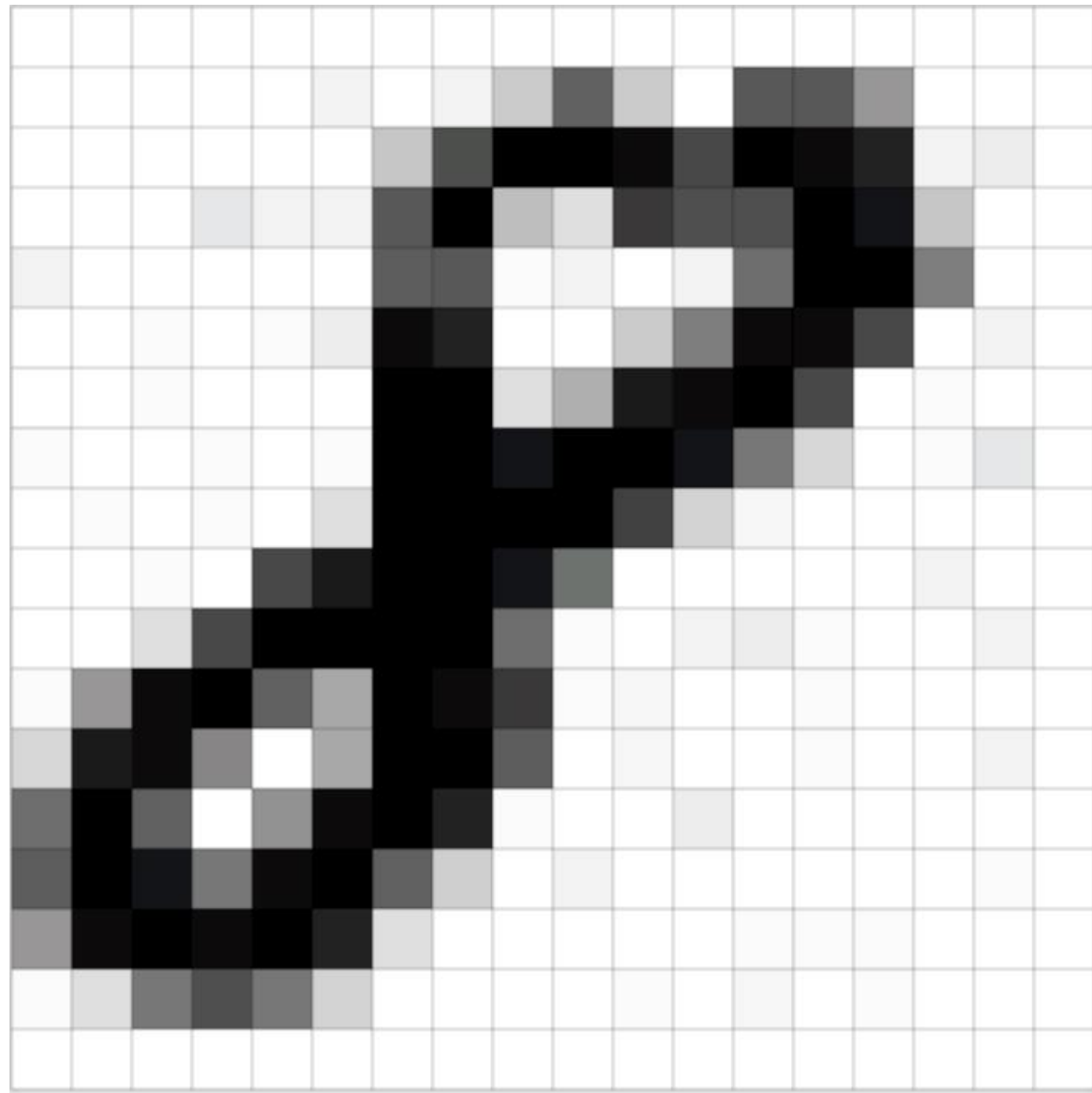
Microsoft

O que é computação cognitiva?

Área da Computação que estuda e desenvolve algoritmos que "tentam" imitar o processo da Inteligência Humana, de aprender, sentir, identificar e resolver problemas.



Reference URL https://goo.gl/eN6zvh



0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	12	0	11	39	137	37	0	152	147	84	0	0	0
0	0	1	0	0	0	41	160	250	255	235	162	255	238	206	11	13	0
0	0	0	16	9	9	150	251	45	21	184	159	154	255	233	40	0	0
10	0	0	0	0	0	145	146	3	10	0	11	124	253	255	107	0	0
0	0	3	0	4	15	236	216	0	0	38	109	247	240	169	0	11	0
1	0	2	0	0	0	253	253	23	62	224	241	255	164	0	5	0	0
6	0	0	4	0	3	252	250	228	255	255	234	112	28	0	2	17	0
0	2	1	4	0	21	255	253	251	255	172	31	8	0	1	0	0	0
0	0	4	0	163	225	251	255	229	120	0	0	0	0	0	11	0	0
0	0	21	162	255	255	254	255	126	6	0	10	14	6	0	0	9	0
3	79	242	255	141	66	255	245	189	7	8	0	0	5	0	0	0	0
26	221	237	98	0	67	251	255	144	0	8	0	0	7	0	0	11	0
125	255	141	0	87	244	255	208	3	0	0	13	0	1	0	1	0	0
145	248	228	116	235	255	141	34	0	11	0	1	0	0	0	1	3	0
85	237	253	246	255	210	21	1	0	1	0	0	6	2	4	0	0	0
6	23	112	157	114	32	0	0	0	0	2	0	8	0	7	0	0	0
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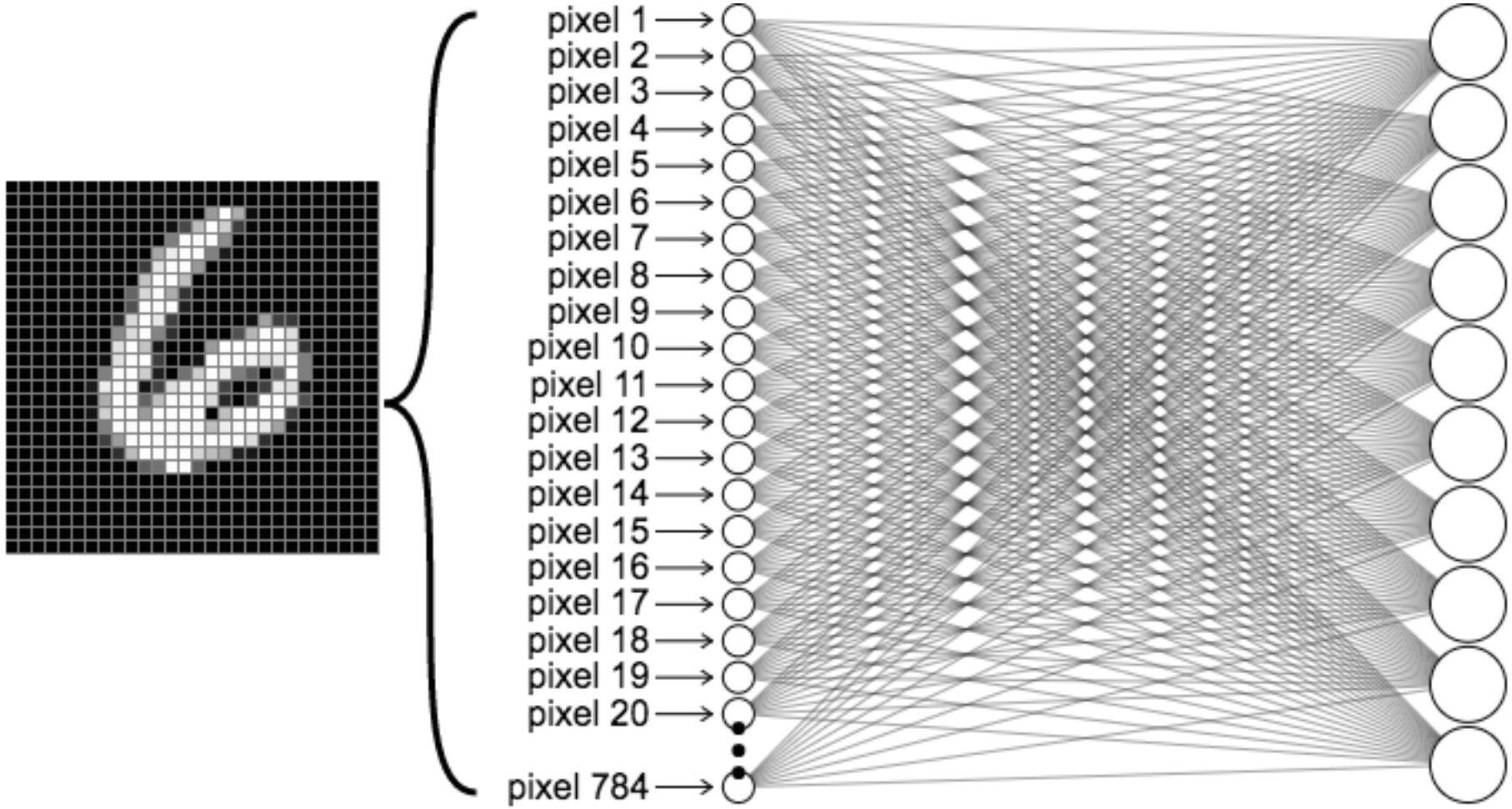

pixel 1
pixel 2
pixel 3
pixel 4
pixel 5
pixel 6
pixel 7
pixel 8
pixel 9
pixel 10
pixel 11
pixel 12
pixel 13
pixel 14
pixel 15
pixel 16
pixel 17
pixel 18
pixel 19
pixel 20
pixel 784

Escalar

s = np.array(8)

s.shape = ( )

[8]

Vetor

v = np.array([1,2,3])

v.shape = (3,)

[1,2,3]

Matriz

m = np.array([[1,2,3], [4,5,6], [7,8,9]])

m.shape = (3, 3)

[1,2,3]

[4,5,6]

[7,8,9]

Tensor

```
t = np.array([[[[1],[2]],[[3],[4]],[[5],[6]]],
              [[[7],[8]],[[9],[10]],[[11],[12]]],
              [[[13],[14]],[[15],[16]],[[17],[17]]]])
```

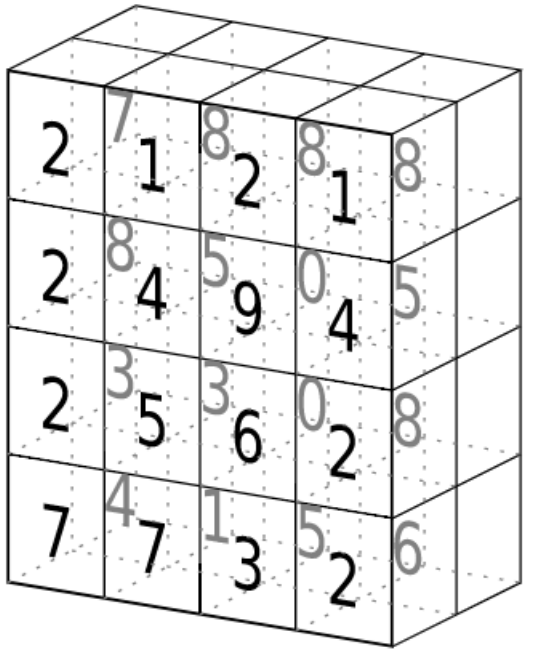
t.shape = (3, 3, 2, 1)

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

Vetor

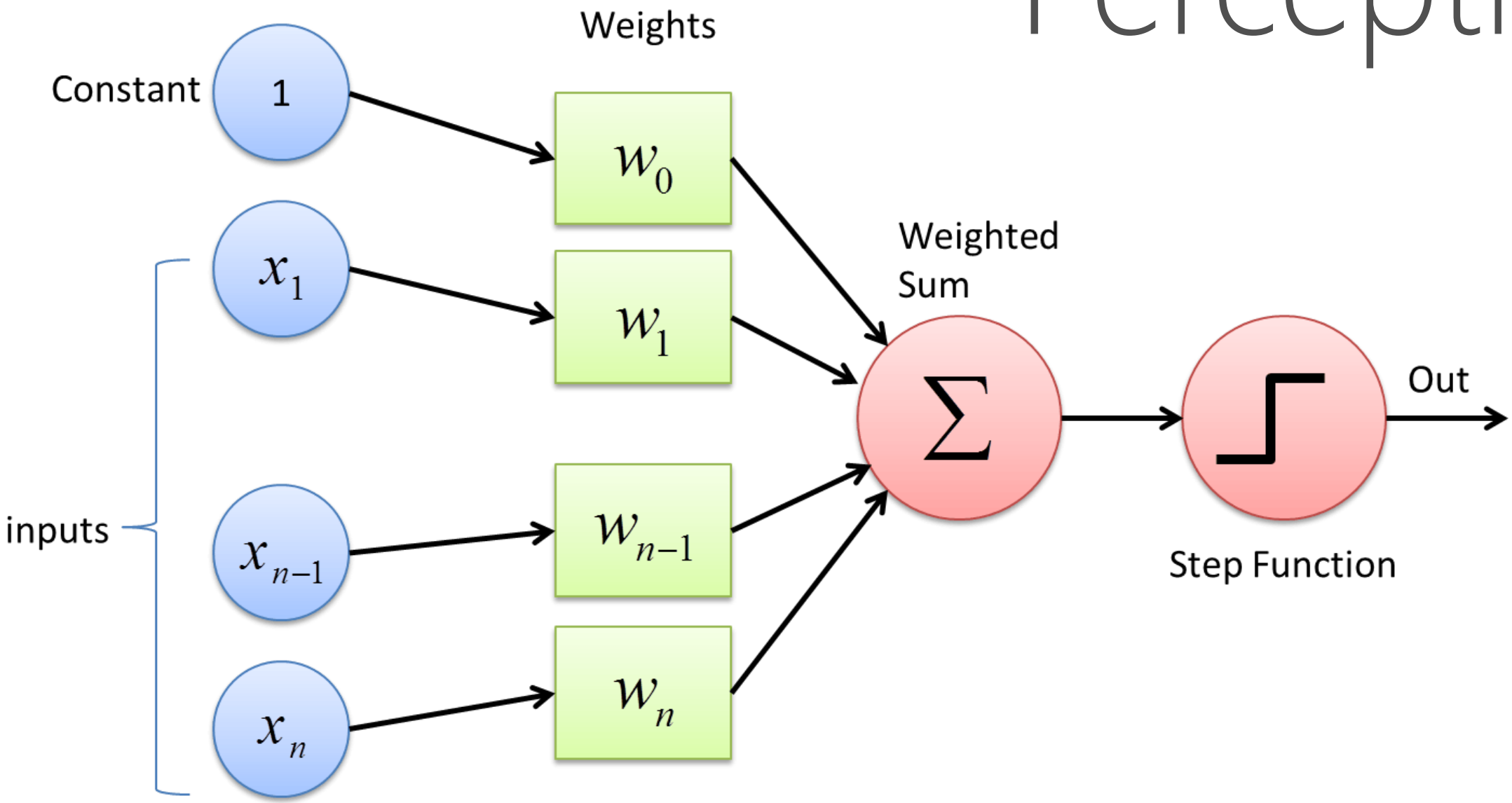
3	1	4	1
5	9	2	6
5	3	5	8
9	7	9	3
2	3	8	4
6	2	6	4

Matriz

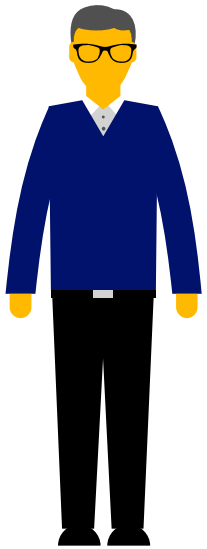


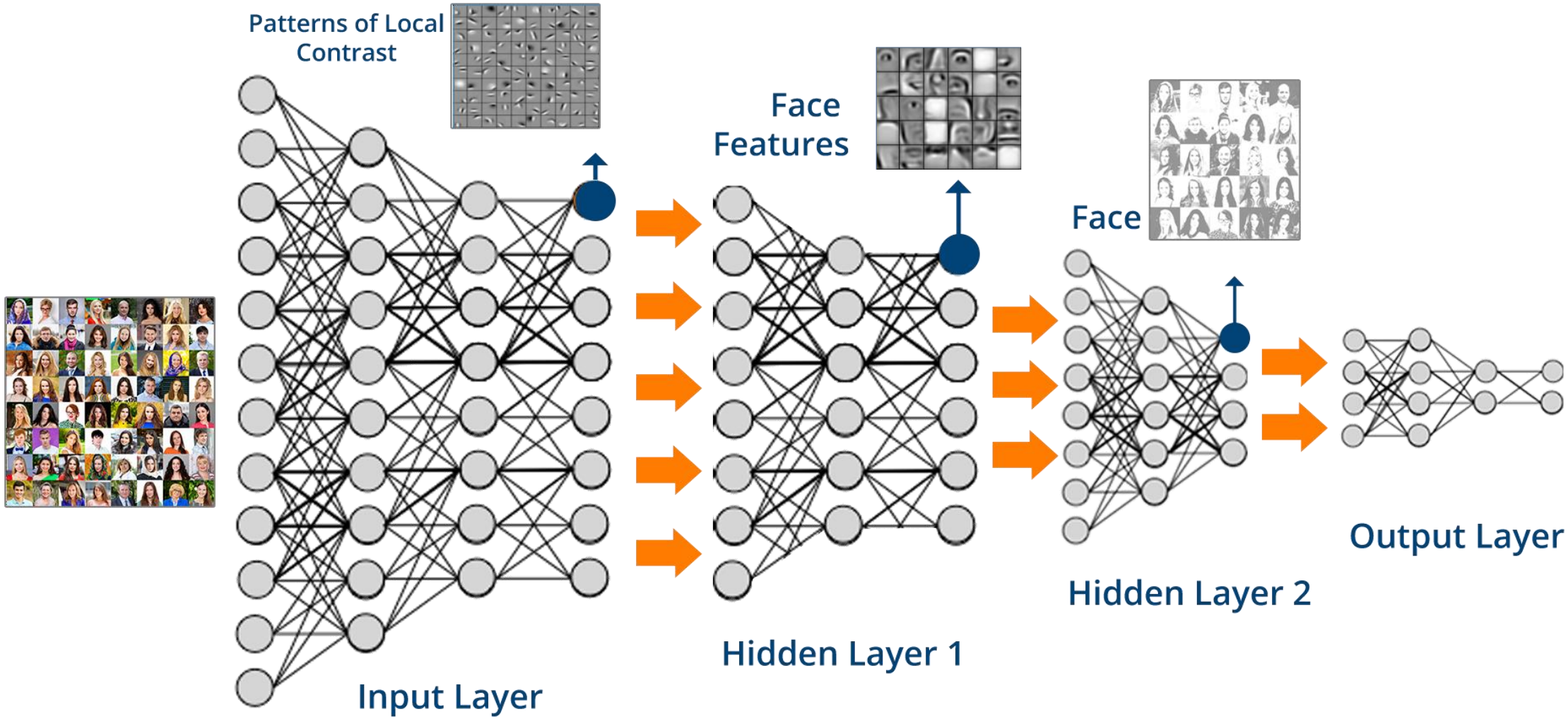
Tensor

Perceptron

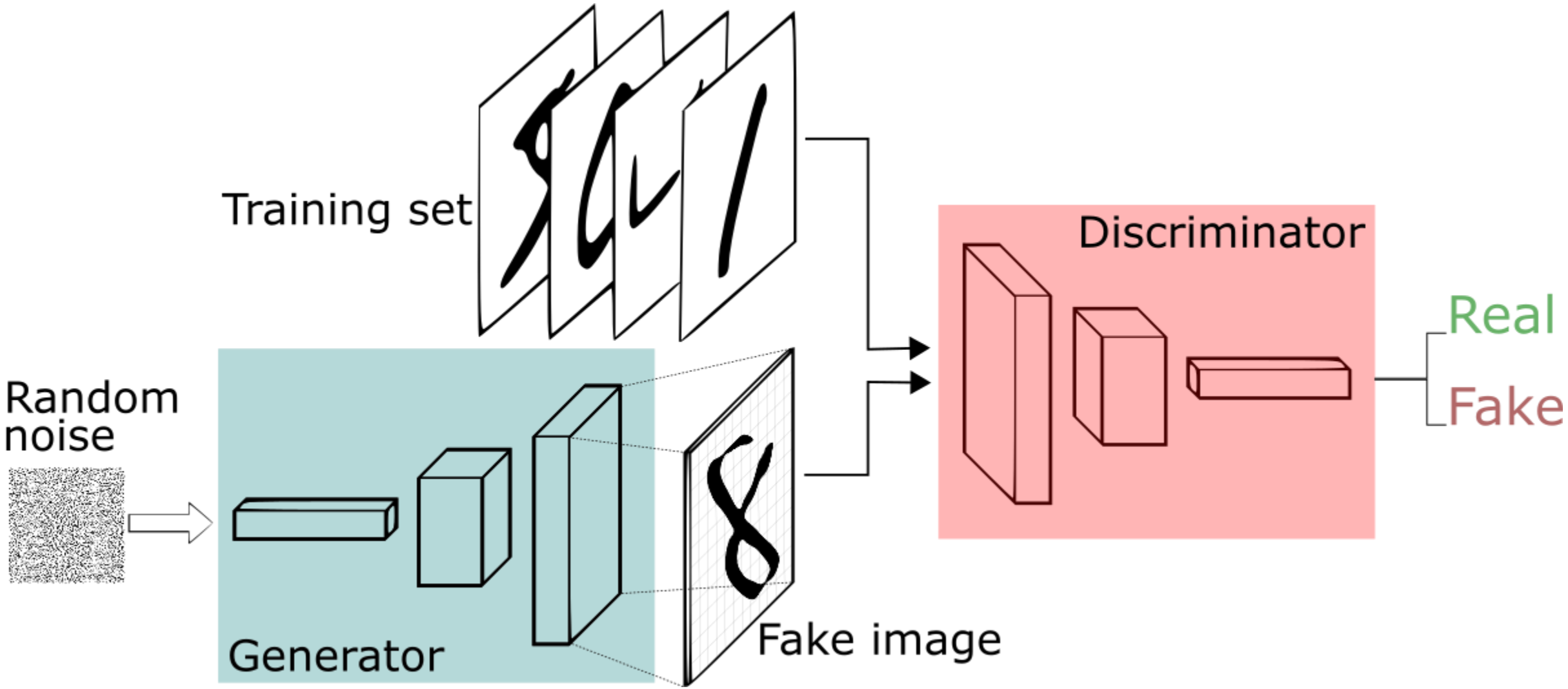

Weights
Constant
1
w_0
x_1
w_1
Weighted
Sum
Σ
Out
inputs
x_{n-1}
w_{n-1}
x_n
w_n
Step Function

What?

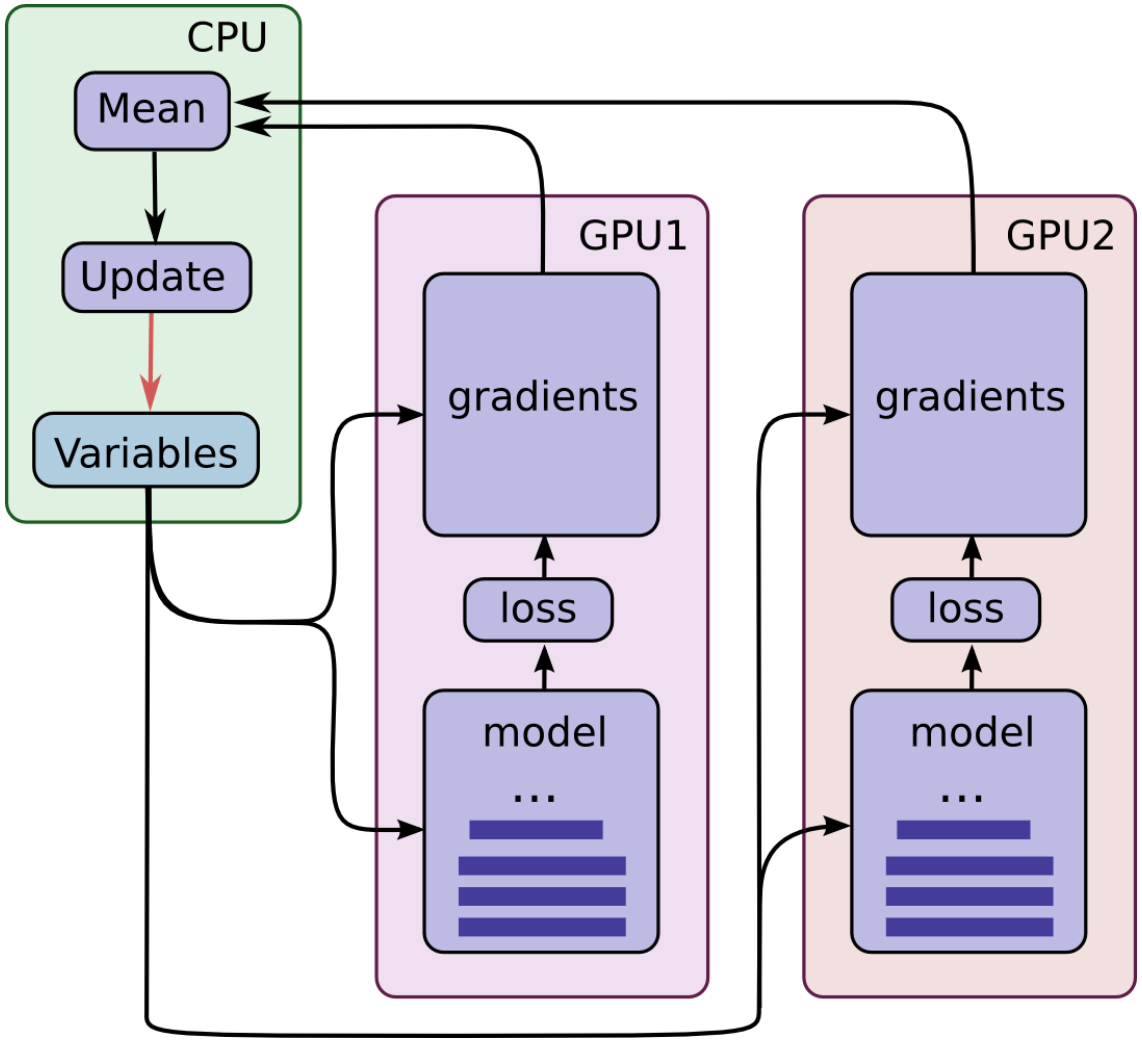



Patterns of Local Contrast
Face Features
Face
Input Layer
Hidden Layer 1
Hidden Layer 2
Output Layer

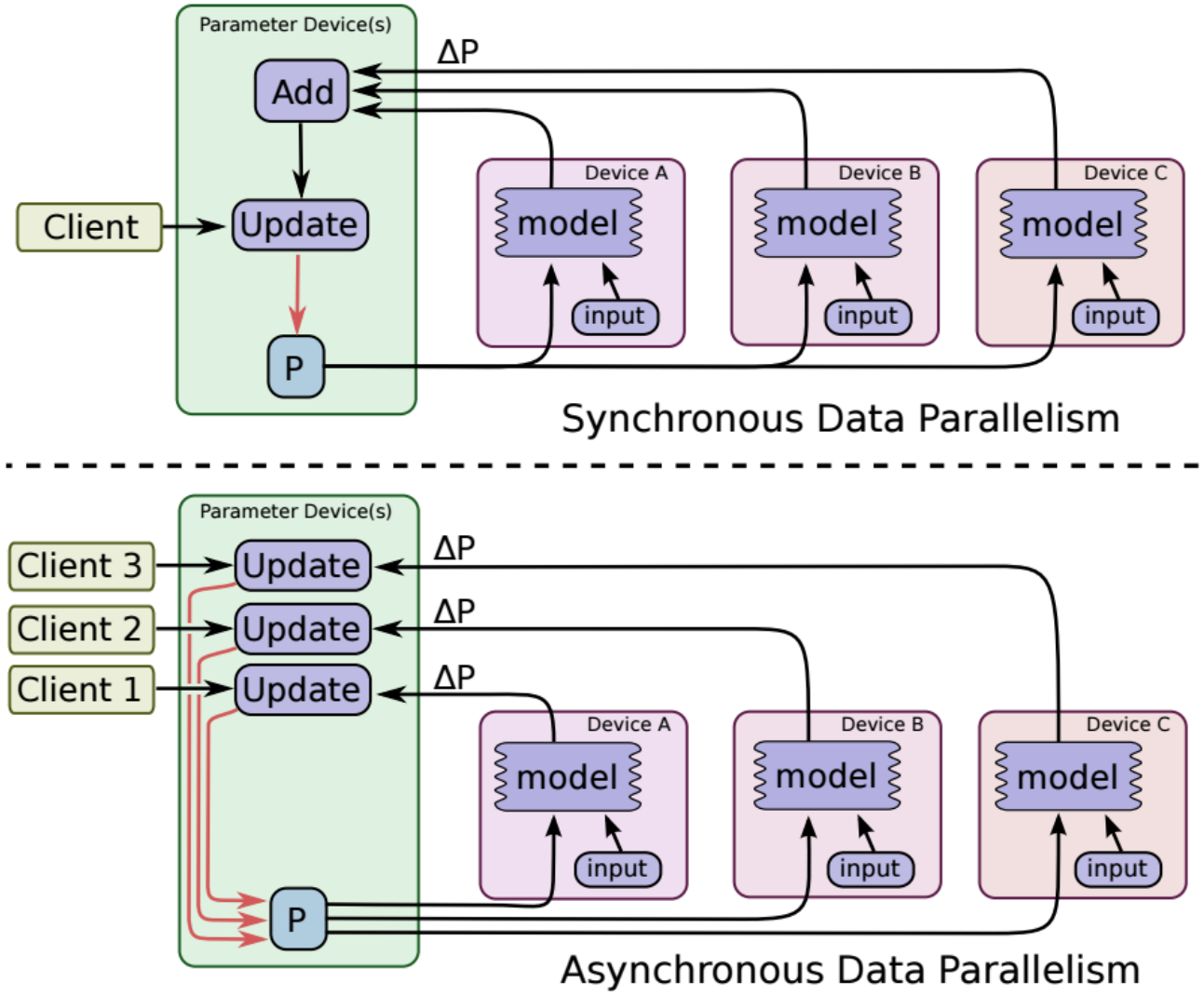
Generative Adversarial Networks



Multiple GPU Cards



Parallel Training



A faster, more efficient, more intelligent cloud

The need for **SCALE**

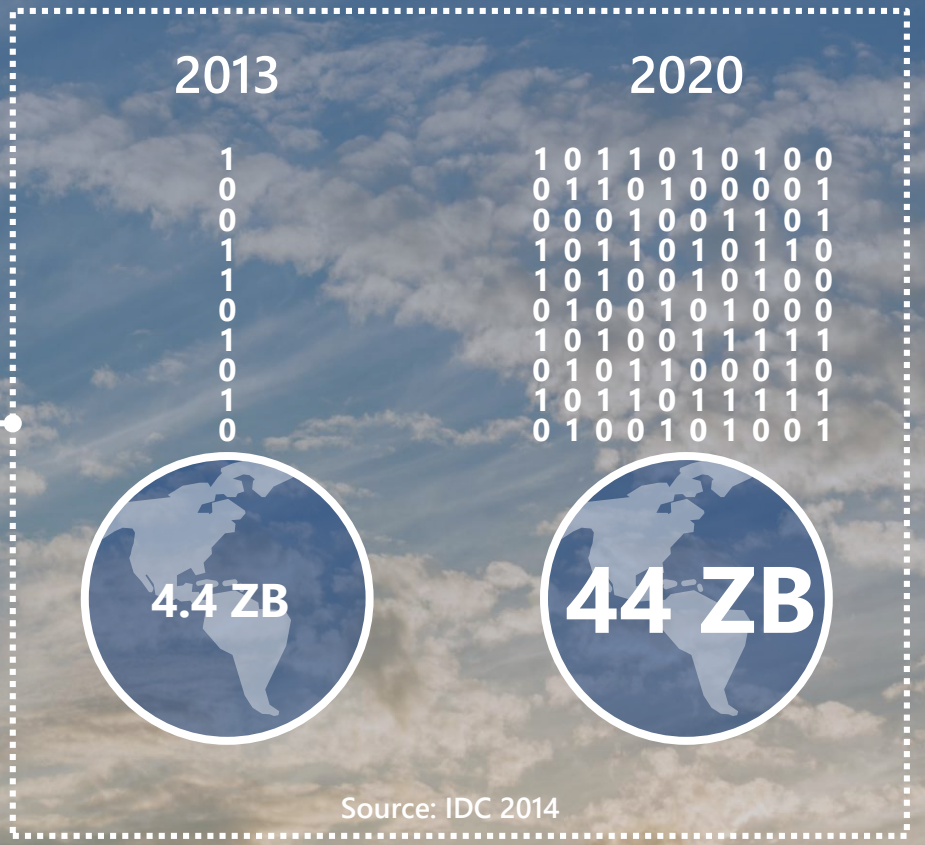
Data explosion: 2013 4.4 ZB - 2020 44 ZB
ML, DNN, AI are driving requirements up faster

The need for **LOW-LATENCY**

Autonomous decision making
Real-time insights into connected devices
Interactive user experiences

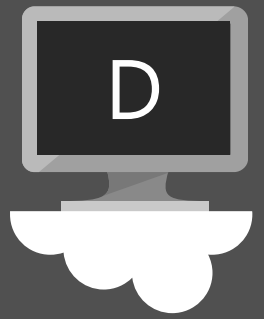
The need for **THROUGHPUT**

Cloud-scale services
Searches and recommendations (Indexing the Internet!)



New Azure VM Sizes

Lowest Price



SSD Storage
Fast CPUs

New generation
of D family VMs

High memory and
Large SSDs

New A-Series

Compute Intensive

NVIDIA GPUs
K80 Compute

NVIDIA GPUs
M60 Visualization

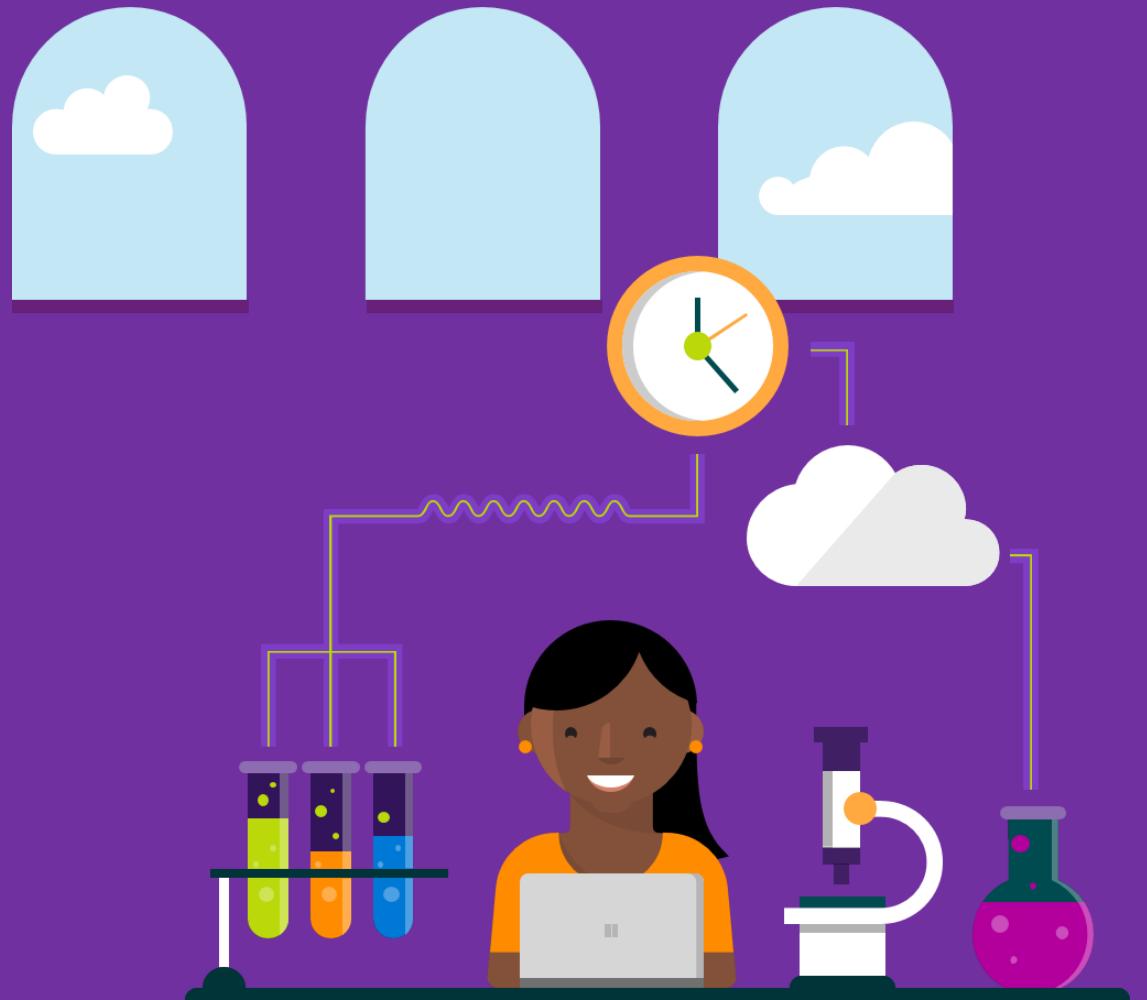
Fastest CPU
IB Connectivity

Large SSDs

SAP Large Instances

Azure Batch AI Training

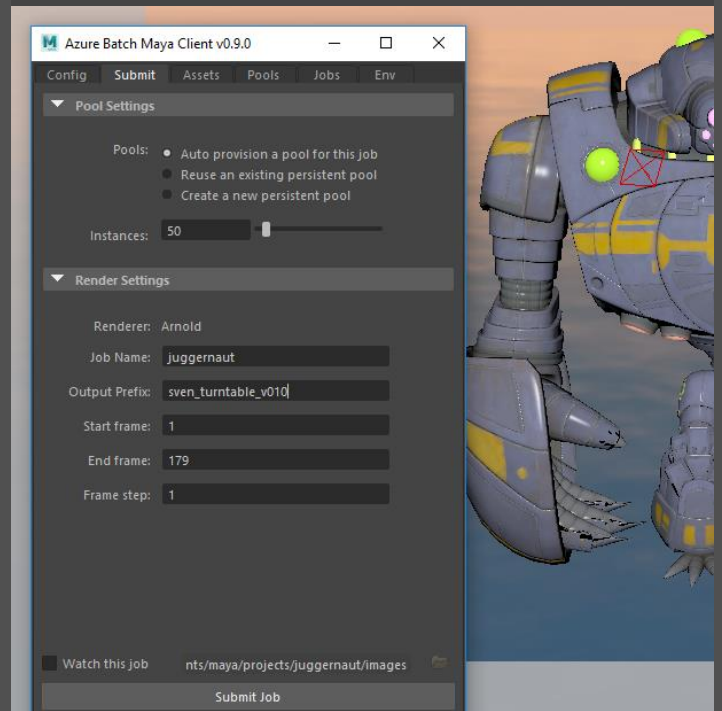
AI Training At Scale with Azure



Announcing
Azure Batch Rendering Service

Autodesk 3ds Max / Maya

Integrated Client Plugin



Azure Batch

AUTODESK® MAYA®

3DS MAX

SOLIDANGLE arnold

VM Renderer

VM Renderer

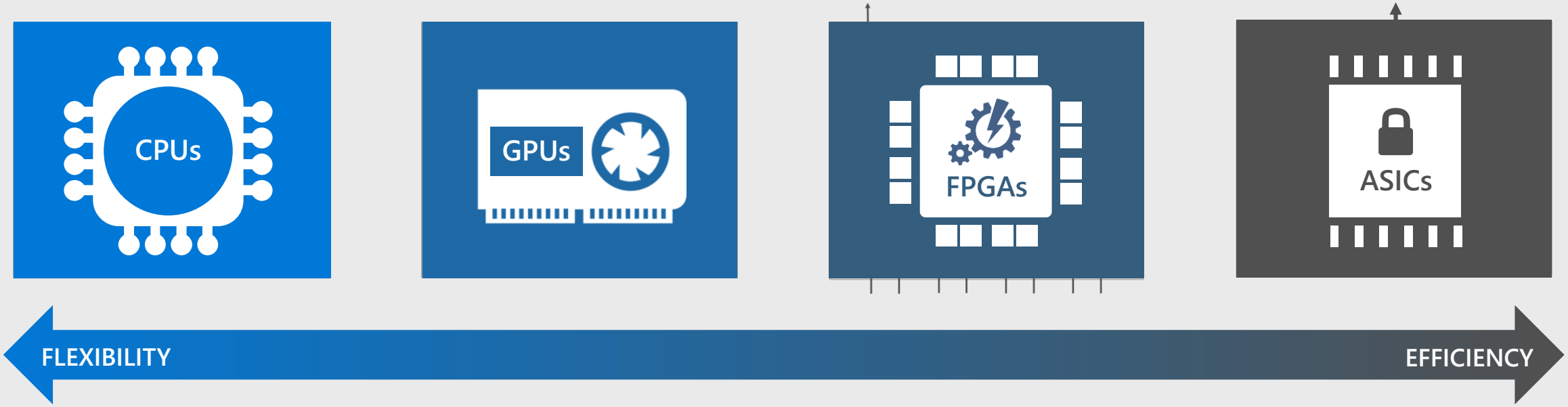
VM Renderer

Monitoring
Reporting
Single bill

Silicon alternatives

TRAINING
CPUs and GPUs, limited FPGAs,
ASICs under investigation

EVALUATION
CPUs and FPGAs,
ASICs under investigation



The power of deep learning on FPGA

Performance

- Tens to hundreds of TOPS of effective inference throughput at low batch sizes
- Ultra-low latency serving on modern DNNs
- >10X better than CPUs and GPUs
- Scale to many FPGAs in single DNN service

Flexibility

- FPGAs ideal for adapting to rapidly evolving ML
- CNNs, LSTMs, MLPs, reinforcement learning, feature extraction, decision trees, etc.
- Inference-optimized numerical precision
- Custom binarized, ternarized, tiny precision nets
- Sparsity, deep compression for larger, faster models

Scale

- Microsoft has the world's largest cloud investment in FPGAs
- Multiple Exa-Ops of aggregate AI capacity
- We have built powerful DNN serving platform on our FPGA fabric

MUITO OBRIGADO!

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