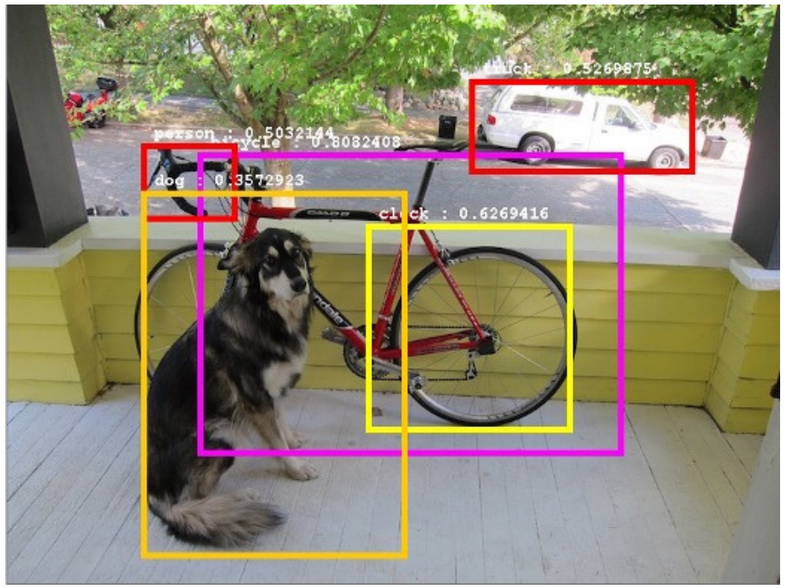
Algoritmos de Visão Computacional com IA

Professor Gabriel Lima | E-mail: gabriel.lima@maua.br



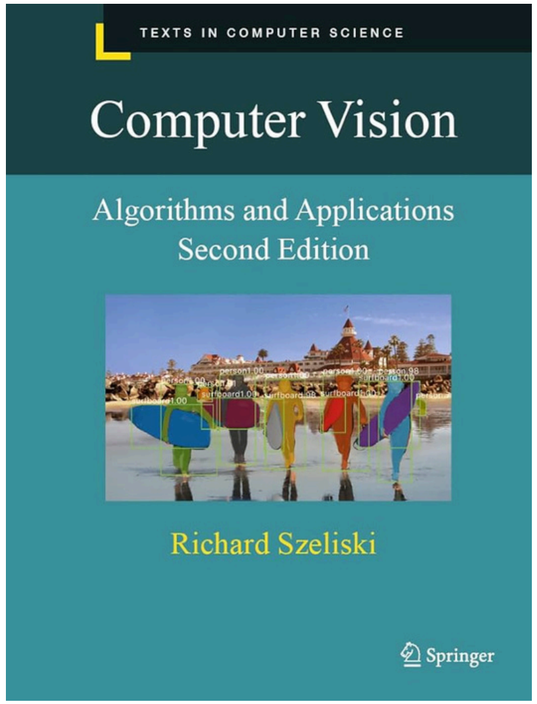
CRONOGRAMA DA AULA

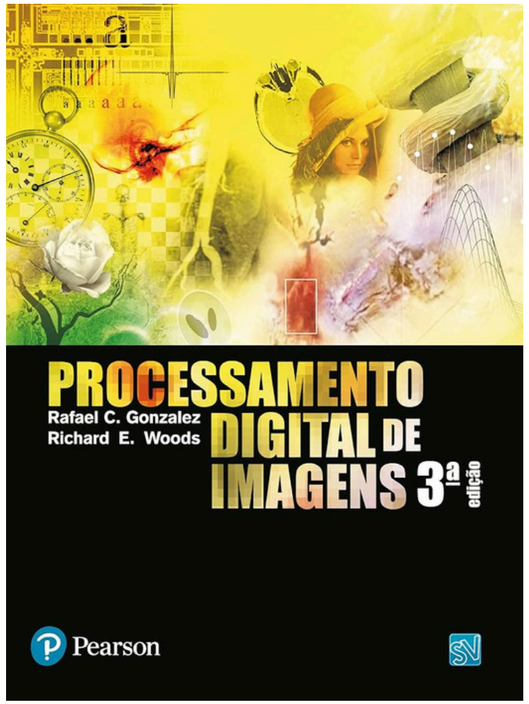
- Apresentação do Curso
- Definições
- História
- Principais Aplicações
- Entendendo a aquisição de Imagem
- Hardware
- Exercício – Prática

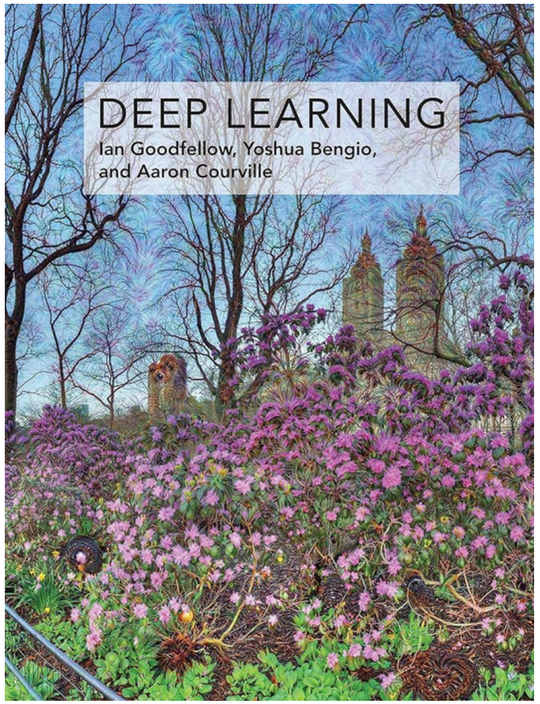
AVALIAÇÃO

1. Presença em Aula
2. Média simples do T1 e T2

BIBLIOGRAFIA







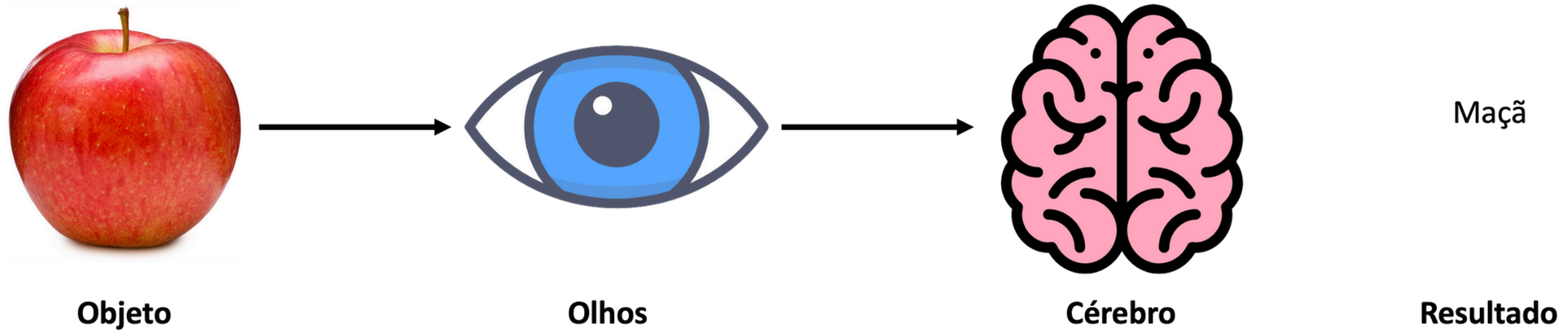
OBJETIVO DO CURSO

- Introduzir a diferença entre visão computacional clássica e com DeepLearning.
- Utilizar ferramentas (hardwares) de desenvolvimento de IA.
- Desenvolver aplicações de IA a partir de frameworks de mercado.

O QUE É VISÃO COMPUTACIONAL ?

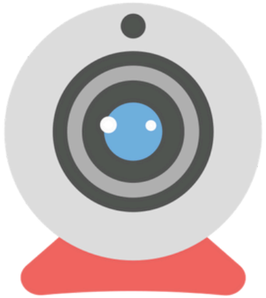
Visão computacional é a tentativa computacional de descrever o mundo conforme nós (humanos) vemos, a partir de uma ou mais imagens para que assim possamos reconstruir suas propriedades. [Richard Szeliski]

O QUE É VISÃO COMPUTACIONAL ?

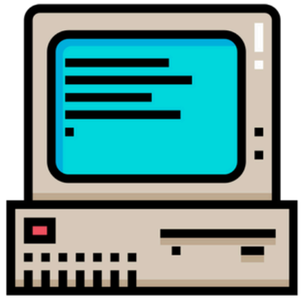


O QUE É VISÃO COMPUTACIONAL ?

Objeto



Dispositivo de Captura



Hardware

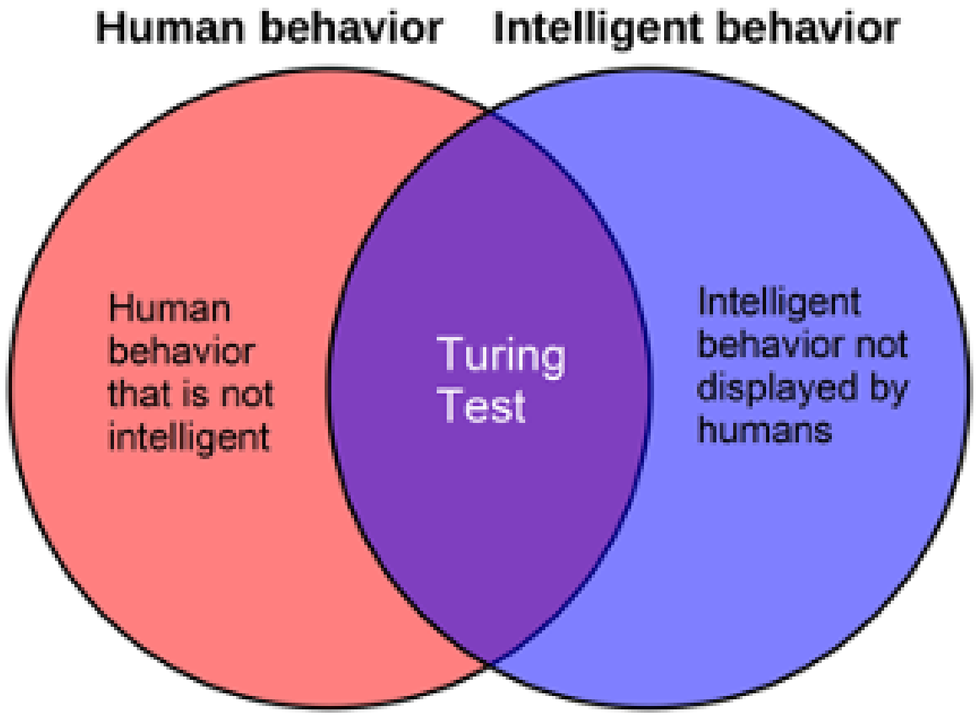
90% Maçã
5% Tomate
4% Pera
1% Bola

Resultado

O QUE É INTELIGÊNCIA ARTIFICIAL ?

Em termos gerais podemos definir Inteligência artificial como a emulação do comportamento humano ou biológico.

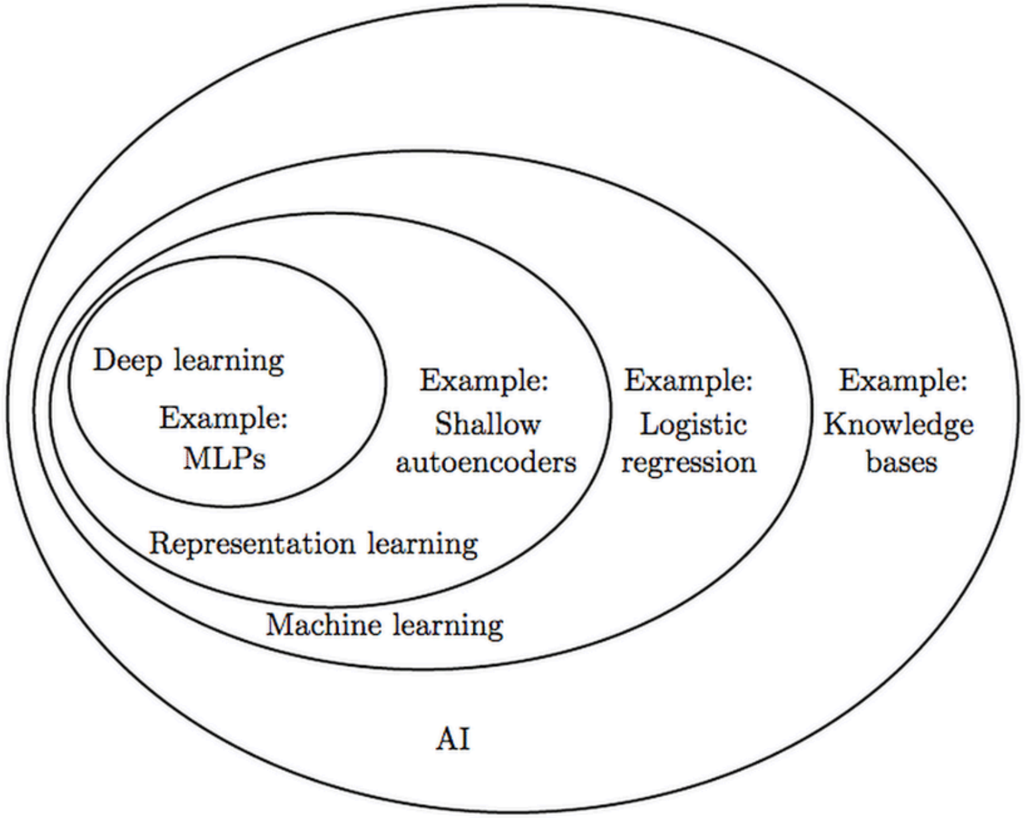
O QUE É INTELIGÊNCIA ARTIFICIAL ?



O QUE É INTELIGÊNCIA ARTIFICIAL ?

Atualmente, Inteligência artificial pode ser definida como um campo que contém diversos algoritmos para aplicações práticas. [Goodfellow]

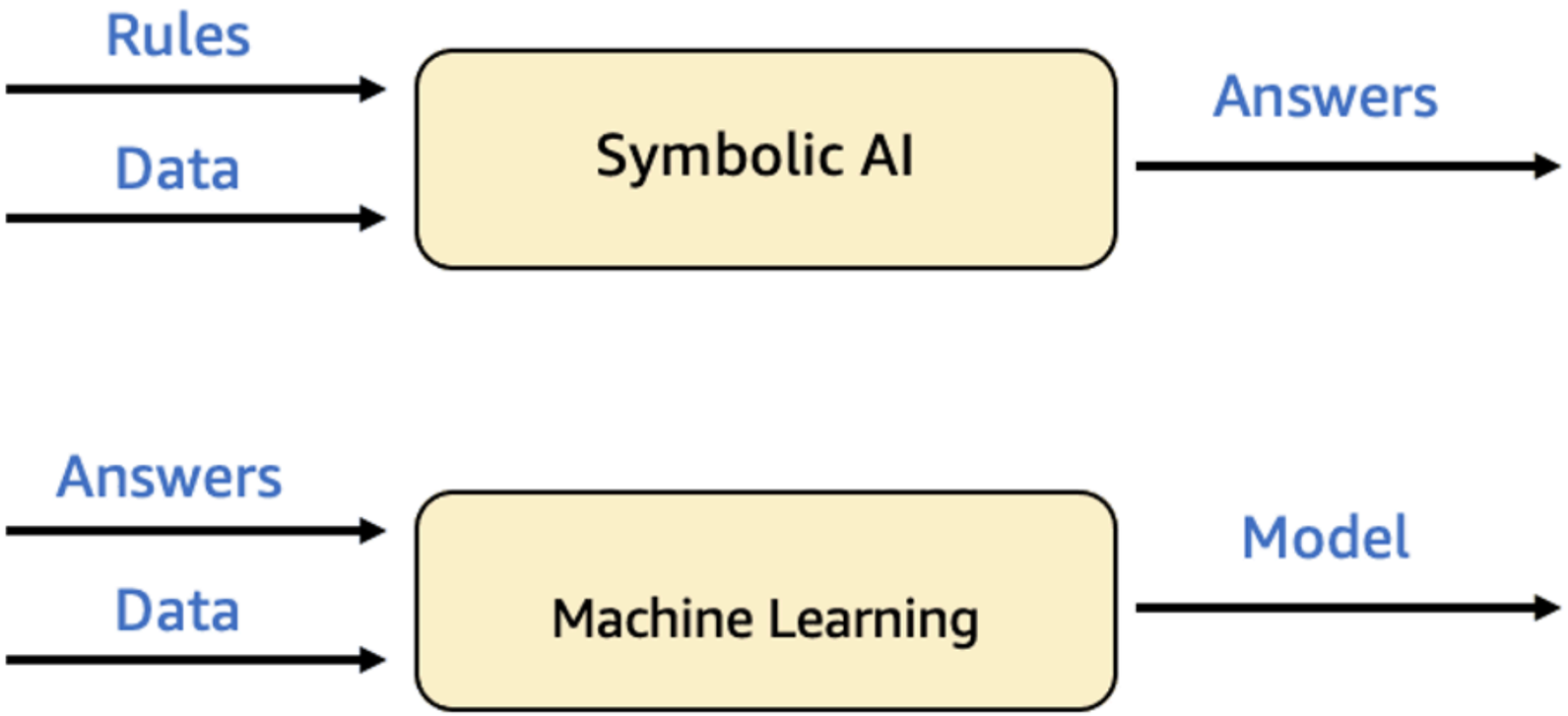
O QUE É INTELIGÊNCIA ARTIFICIAL ?



O QUE É MACHINE LEARNING?

Subcampo da Inteligência artificial, onde os computadores aprendem a partir de dados (experiência).

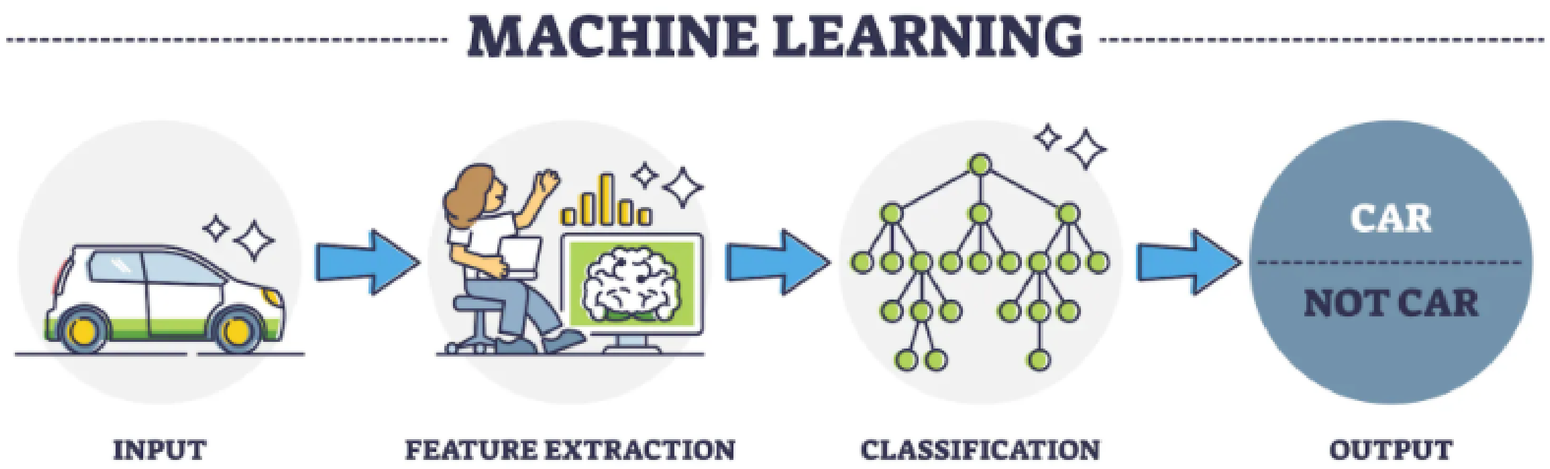
O QUE É MACHINE LEARNING ?



O QUE É MACHINE LEARNING?

- Outro paradigma de programação, uma vez que as regras não precisam ser inseridas no código.
- Fase de Treino necessário para a realização de alguma tarefa.
- Necessário uma fase de data Science para a extração de features.
- Algoritmo requer um feedback durante a fase do treino (Aprendizagem).

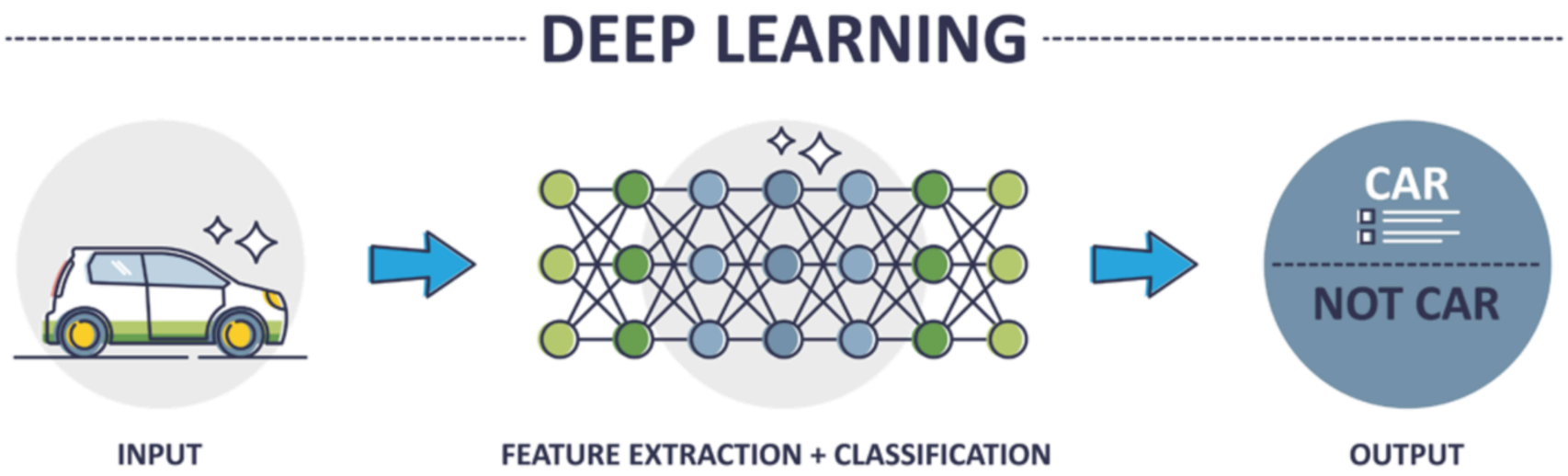
O QUE É MACHINE LEARNING?



O QUE É DEEP LEARNING?

Subcampo do machine learning que utiliza redes neurais profundas para extrair características de forma automática.

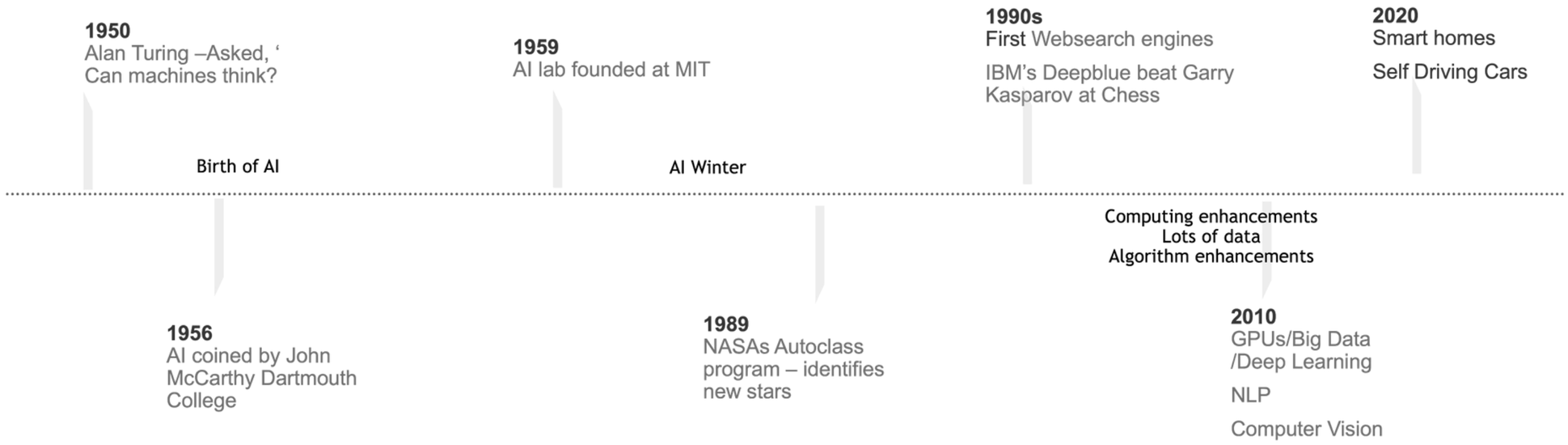
O QUE É DEEP LEARNING?



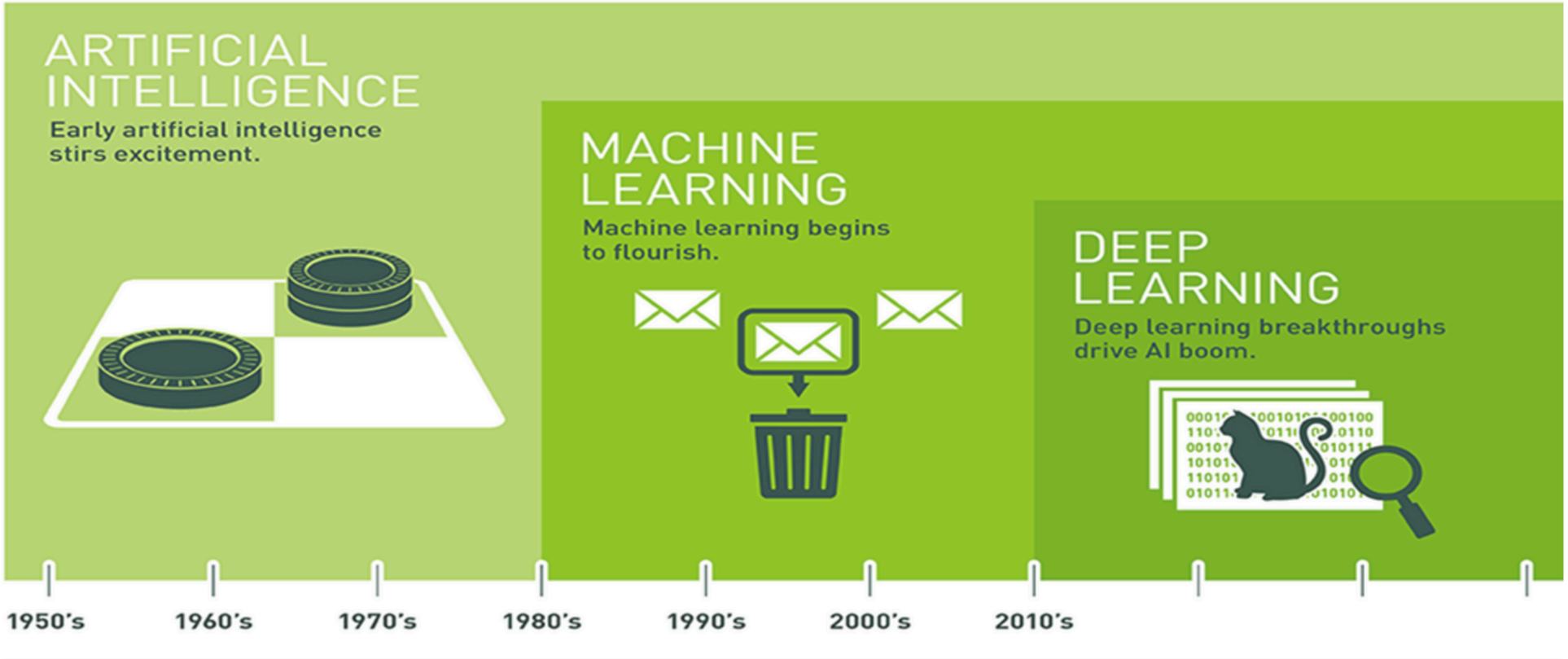
O QUE É VISÃO COMPUTACIONAL CLÁSSICA?

A visão Computacional clássica utiliza técnicas de processamento de imagens para a fase de extração de caracteristicas, não contemplando o uso de algoritmos de Deep learning.

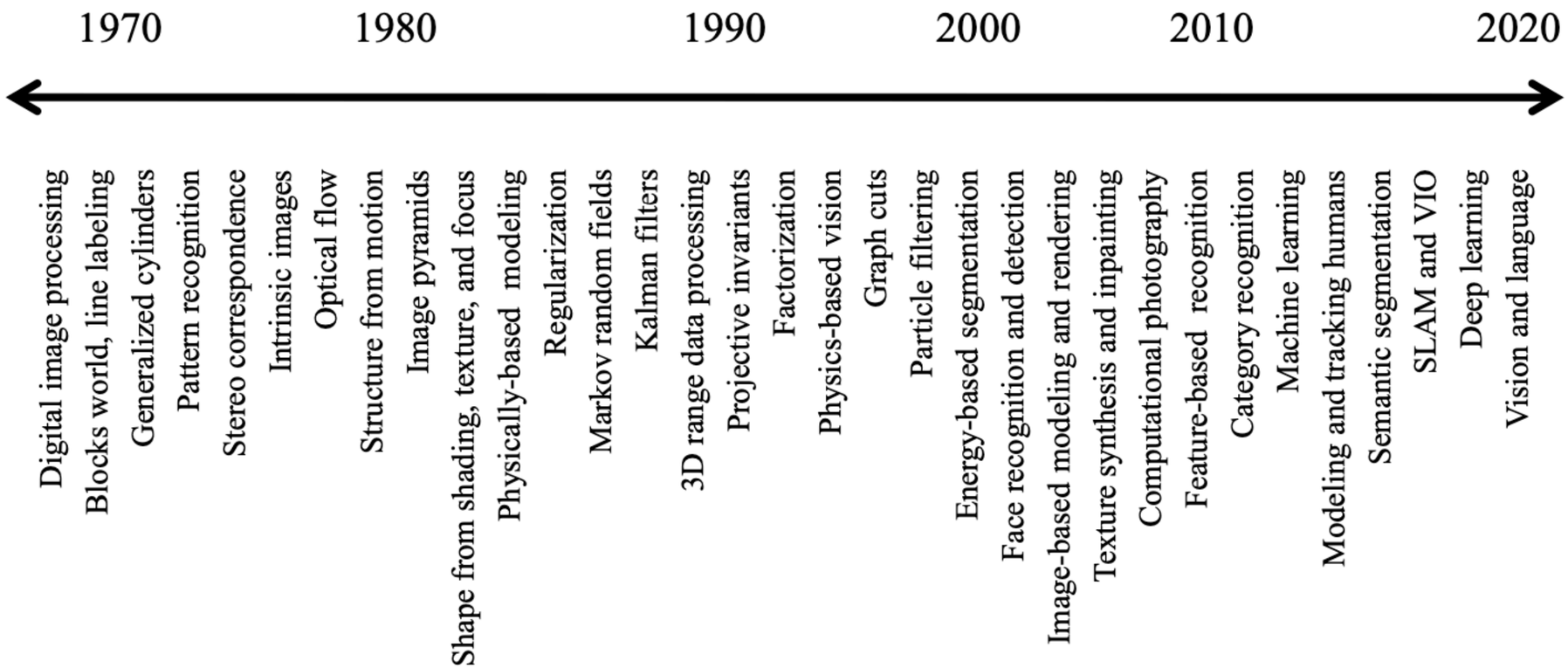
INTELIGÊNCIA ARTIFICIAL



INTELIGÊNCIA ARTIFICIAL



VISÃO COMPUTACIONAL



MEDICINA

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Deep Convolutional Neural Network Framework for Brain Tumor Classification using MRI Images

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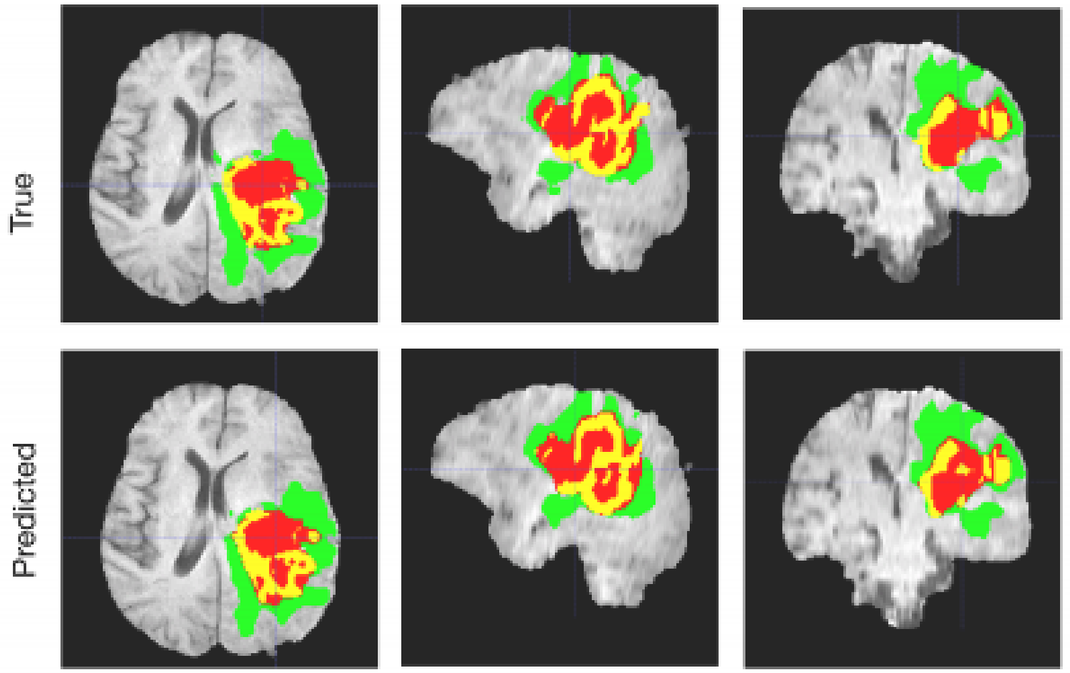
***Abstract*—Brain cancer is one of the high-risk diseases and increases the death rate in all countries, affecting both men and women. The early diagnosis and severity of brain cancer leads to better medical treatment and save people's lives. The machine learning procedure has been applied for early detection and treatment of brain cancer in the biomedical field by classifying them into low-risk and high-risk groups. In cancer research, the predictive and classification model has been developed using Deep Convolutional Neural Network (DCNN) algorithms for accurate decision making. The Magnetic Resonance Image (MRI) classification technique DCNN is advanced to detect and match feature points of training and test images. The DCNN classifier based on the outcome of feature points then classifies images. The key notion of this proposed research effort is to implement and execute the proposed DCNN algorithm on cancer patient datasets for risk level classification. The brain cancer affected patient details are collected from UCI machine learning data repository for experimental analysis. In this research study, the DCNN algorithm is proposed and it gives better accuracy and faster than the KNN, CNN and SVM.**

main root of cancer death among children, men and humans. Brain cancer prediction in the early stage can save humans' lives. According to WHO reports, brain cancer can be cured if it is detected in the early stages. The early finding of brain cancer can raise the lifespan of the affected patient. Machine learning integrates statistics and artificial intelligence algorithms to effectively predict the occurrence of tumor cells in the brain. The tumor or nodule is formed when the person has the abnormal growth of the cell and not all nodules are tumors. The non-cancerous cells are benign and cancerous cells are called malignant nodules. Brain cancer has a lower survival rate and is based on the location of nodules, size and texture. The proposed system provides an effective method for predicting lung cancer in the early stage more precisely and accurately. The brain image dataset is collected from the UCI dataset repository for machine learning and the classifier algorithm is executed on ResNet with up to 152 layers.



AGRICULTURA

Fruit Fly Classification via Convolutional Neural Network

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***Abstract*—The recognition of fruit fly is an important part of the quarantine work, for which it is of great significance to establish the fruit fly feature automatic extraction classification system. Depending on the manual design of machine learning algorithm and the feature of the model classification, the existing fruit flies classification system needs to be improved in many ways, such as its complicated process, the excessive requirement for specialty, incapability of automatic feature extraction. Given these problems, the research on automatic feature extraction of classification model has been conducted, the convolutional neural network algorithm has been come up with. This algorithm can automatically extract feature classification training, try to find the solution to the problems of beforehand artificial designing and extracting in the existing fruit fly classification system, is helping to greatly improve the staff's efficiency. Experimental results show that the method can identify the Bactrocera dorsalis, Bactrocera cucurbitae, Bactrocera tau, Bactrocera scutellata, with the overall accuracy of 97.19%, and have a good application prospect.**

***Keywords*—Fruit Fly Feature Extraction; Deep Learning; Convolutional Neural Network; Image Recognition; Fruit Fly Classification**

with the Euclidean distance between the punctuation marks of fruit fly wings [4-6]. From the perspective of practicability and requirements for collecting objects, most scholars choose the fruit fly wings as the research object and use the feature points on the fruit fly wings to establish an automatic classification model. The model algorithm mainly includes BP neural network, support vector machine, AdaBoost and random forest. Zhang Lei et al. proposed the Local Binary Pattern (LBP) feature of the image of the wing and the mid-thoracic back plate, applying the AdaBoost algorithm to classify and test the eight fruit flies, the average classification accuracy rate in more than 80% [3]. Wang Lu et al. extracted features by marking punctuation marks of the fruit fly manually, and applied the Random Forest algorithm to successfully classify five species of fruit fly, with an accuracy rate of 92.9% [4]. According to the research results of Wang Lu [4] and Yan Lixia et al. [5], Peng Yingqiong and Liao Muxin et al. used the Euclidean distance between the markers as the classification feature and extracted 15 of them as the feature value. BP neural network algorithm model is proposed to realize for the automatic classification system of four fruit flies, the average classification accuracy is over 90% [6]. Li Zhen et al. combined with the HSV color space to

CIDADES INTELIGENTES

Detection of Different Classes Moving Object in Public Surveillance Using Artificial Neural Network (ANN)

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***Abstract*— Public surveillance monitoring is rapidly finding its way into Intelligent Surveillance Systems. Street crimes such as snatch theft is increasing drastically in recent years, cause a serious threat to human life worldwide. In this paper, a moving object detection and classification model was developed using novel Artificial Neural Network (ANN) simulation with the aim to identify its suitability for different classes of moving objects, particularly in public surveillance conditions. The result demonstrated that the proposed method consistently performs well with different classes of moving objects such as, motorcyclist, and pedestrian. Thus, it is reliable to detect different classes of moving object in public surveillance camera. It is also computationally fast and applicable for detecting moving objects in real-time.**

Keywords*— object detection; public surveillance; street crime; rate of occurrence; neural network*

I. INTRODUCTION

The public surveillance field has founded into interest to many researchers in the past recent years. The increasing number of street crime cases has demanded more accurate and reliable public surveillance system. Crime activity such as snatch theft is increasing drastically, especially in the global economic downturn. There seems to be a worrying trend culture of crime permeating throughout the nation. According to the Department of Statistic Malaysia, there are 26664 cases of street crimes have been reported in 2011 [*1*]. In 2012, the statistic shows that the number of the cases reported has been decreased only by 15.3%. This worrying figure proves that the problem is still far from being solved. Having thousands of cases reported in a year has caused a worry to the public. Therefore, the Malaysian government has taken an initiative in reducing crime through Government Transformation Plan (GTP) 1.0.

Extensive research has been carried out into the detection

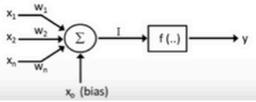
II. ARTIFICIAL NEURAL NETWORKS AND THEIR APPLICATIONS

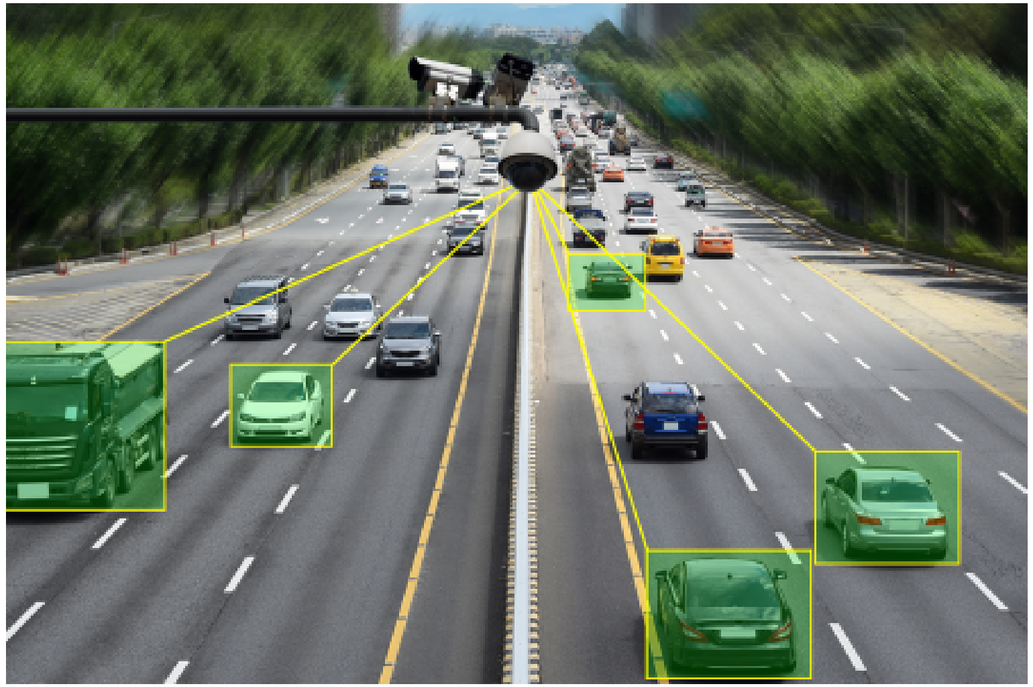
Artificial Neural Network (ANN) is a tool to process a set of information, represent the complex relationship into a manner similar to the human brain. It is a part of artificial intelligence system which has been used recently to solve a wide variety of computer vision problems. ANN is known to be an algorithm that capable to exploit non-linear relationships between variables. Neural networks are a flexible non-linear regression and discriminate models, data reduction models, and non-linear dynamical systems [*2*]. They consist of a large number of 'neurons', usually organized into layers to form a network.

It is a network of artificial neurons connected in such a way that enables it to store information and model input-output of a process. The key element of this model is the novel structure of the information processing system.

The typical artificial neural network is composed of three main components, which are the neurons, layers and activation functions [*3*].

The large network is built by many artificial neurons. Each neuron has an input value (x), weight (w) and a bias value (b) where shown in Equation 1. The value of each neuron is the value of the input multiply by the weight, plus the bias. Figure 1 shows a single neuron with multiple inputs and one output.

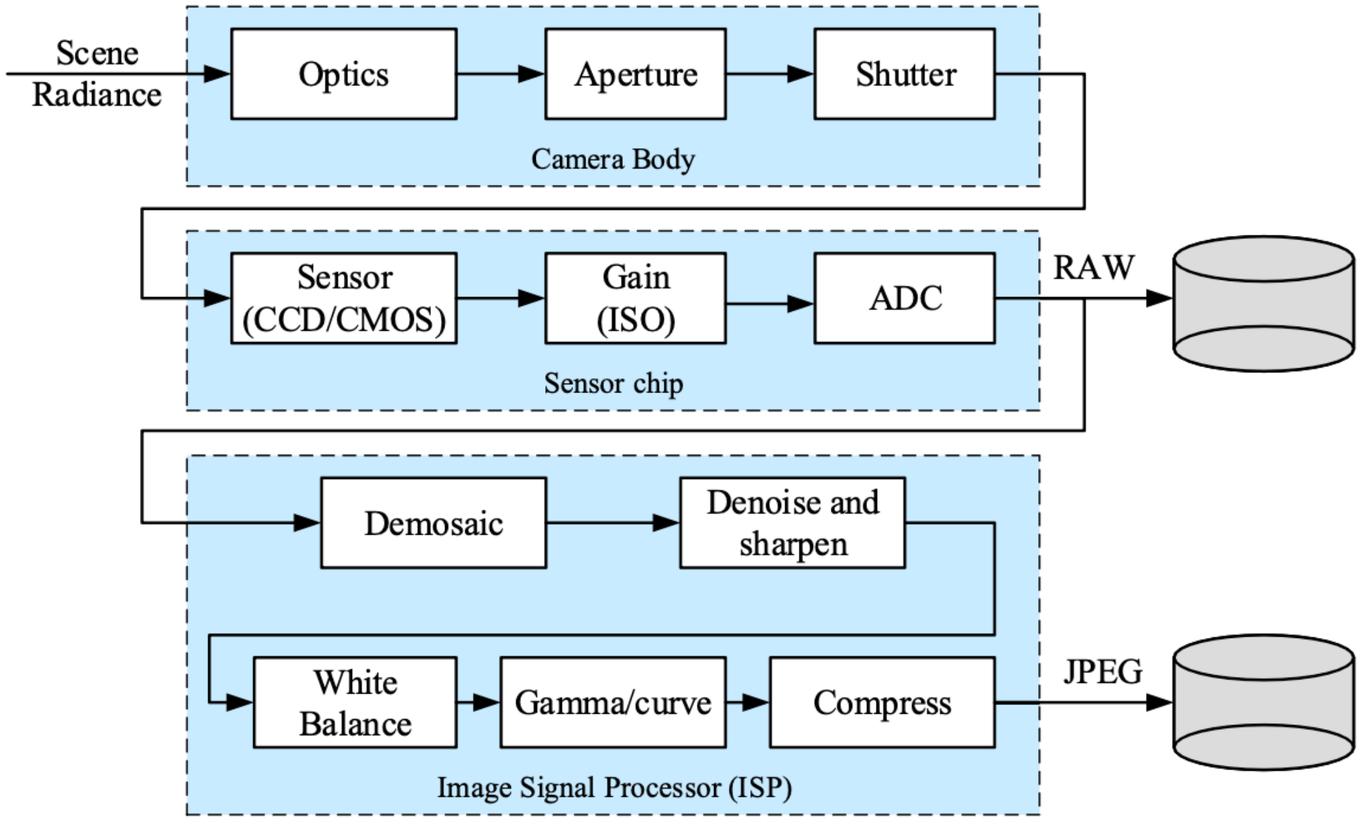




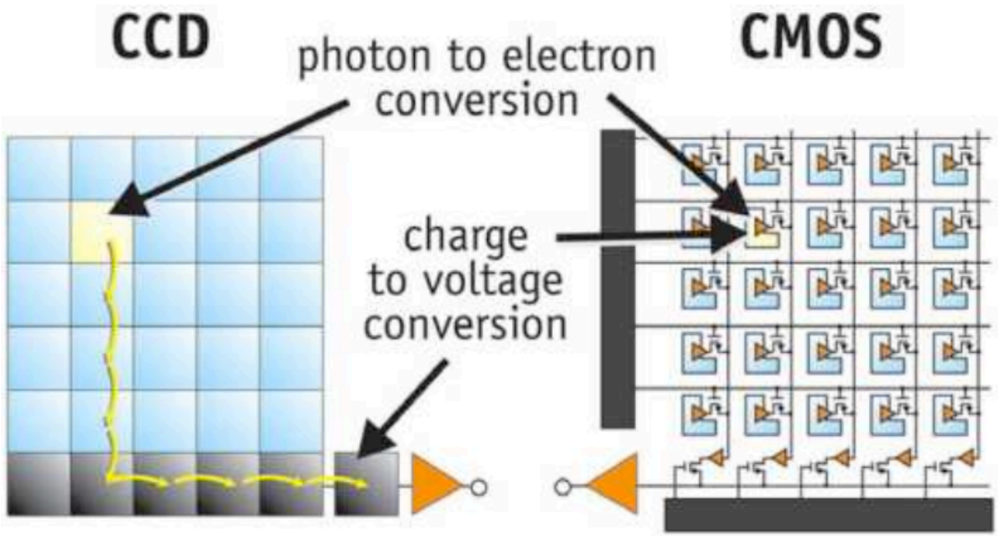
OUTROS

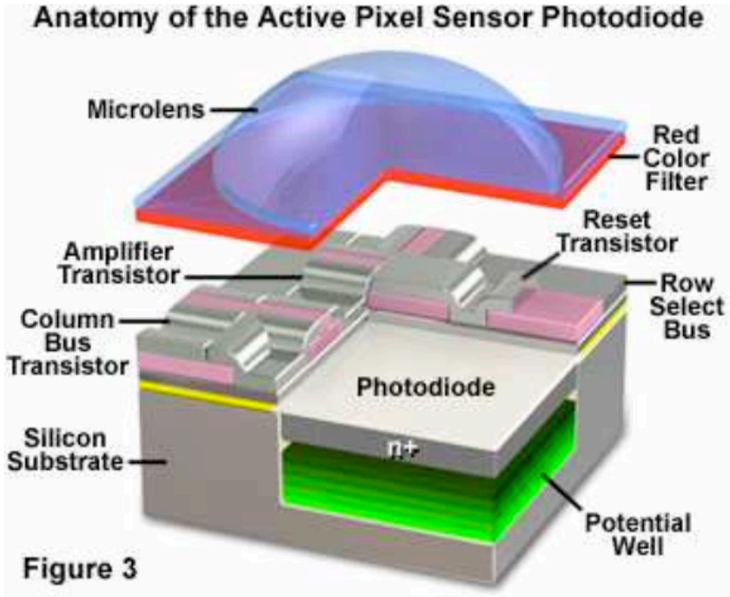

Classify
Detect
Segment
Track
Pose
PERSON
TRIPOD
SAFETY VEST
Person 82%
Traffic cone 86%
Car 86%
Car 98%
Car 97%

A CÂMERA DIGITAL

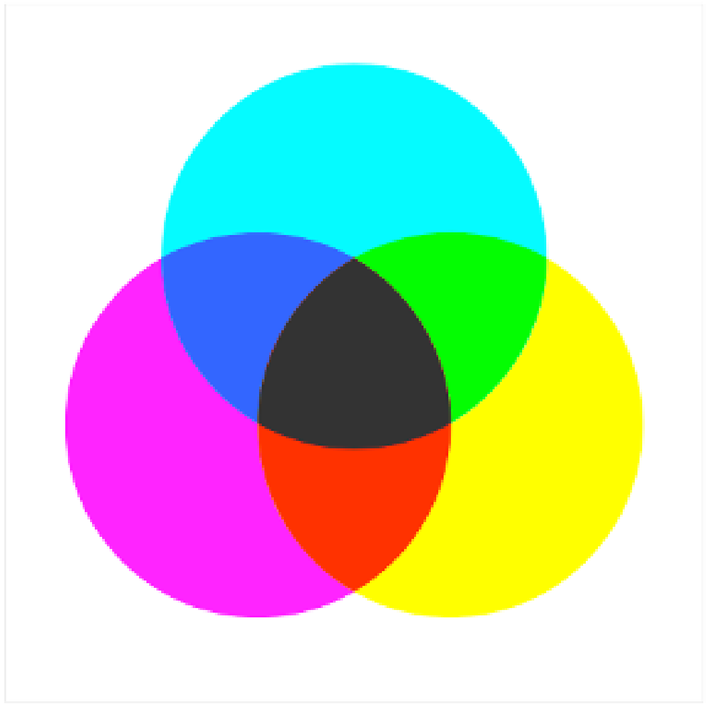


A CÂMERA DIGITAL





CORES



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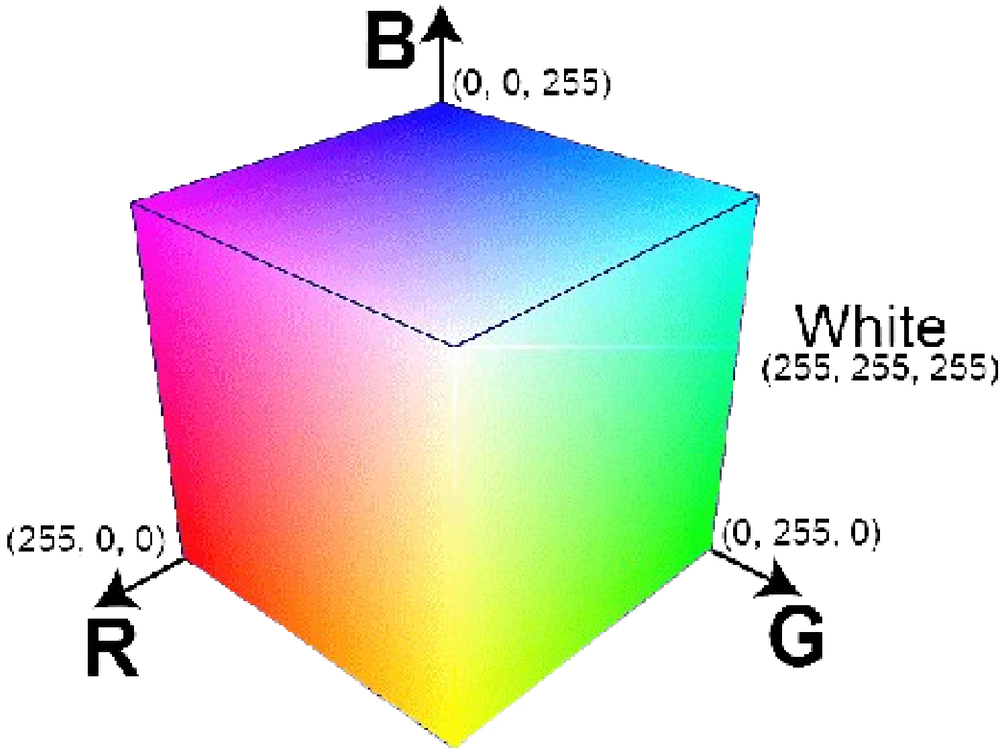
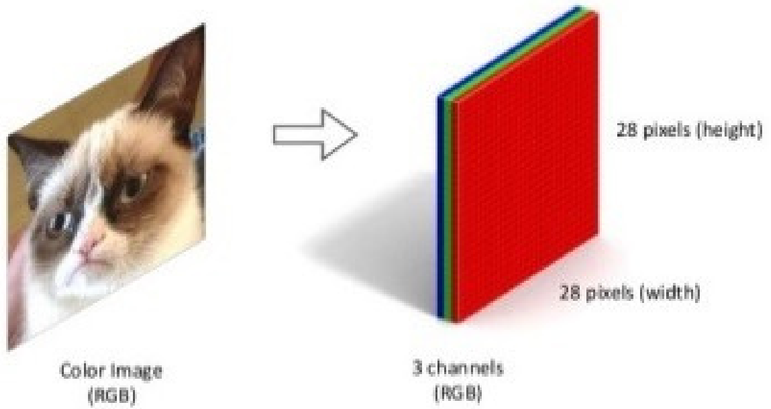
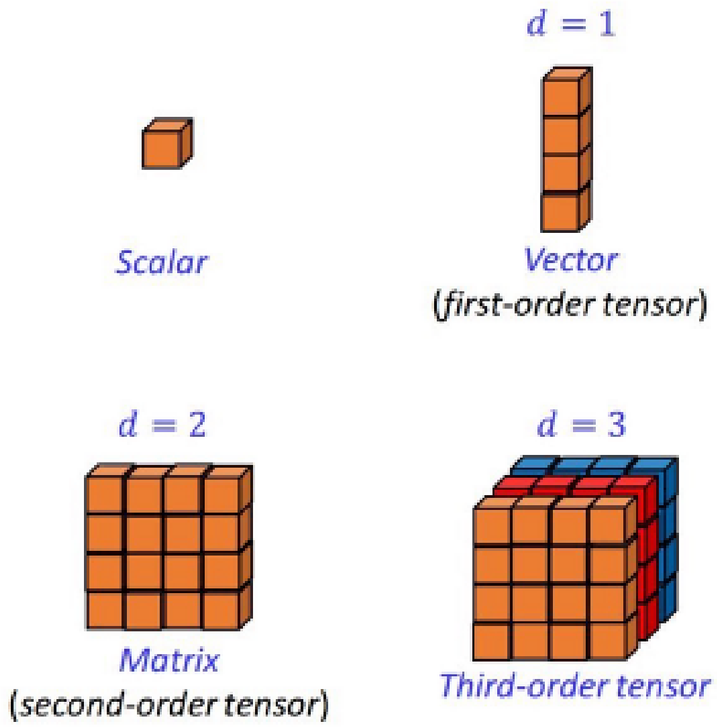


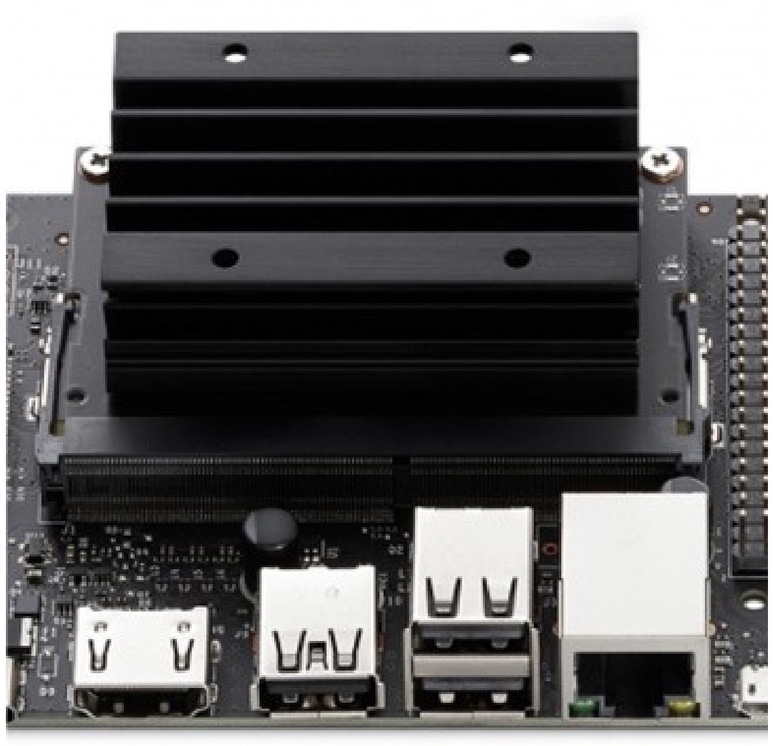
IMAGEM


28 pixels (height)
28 pixels (width)
Color Image
(RGB)
3 channels
(RGB)
3 Colour Channels
Height: 4 Units
(Pixels)
Width: 4 Units

TENSOR


$d = 1$
Scalar
Vector
(first-order tensor)
$d = 2$
Matrix
(second-order tensor)
$d = 3$
Third-order tensor

NVIDIA – JETSON NANO

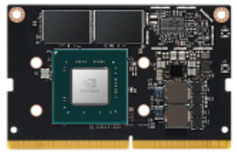


NVIDIA – JETSON NANO

THE JETSON FAMILY

for AI at the Edge and Autonomous System designs

JETSON NANO
0.5 TFLOPS (FP16)



5 - 10W
45mm x 70mm

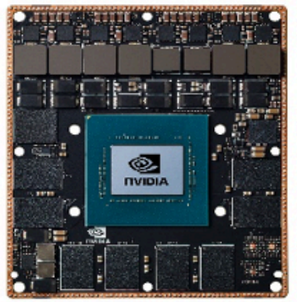
JETSON TX2 NX
1.3 TFLOPS (FP16)

7.5 - 15W
45mm x 70mm

JETSON XAVIER NX
6 TFLOPS (FP16)
21 TOPS (INT8)

10 - 15W
45mm x 70mm

JETSON AGX XAVIER series
11 TFLOPS (FP16)
32 TOPS (INT8)



10 - 30W
100mm x 87mm

AI at the edge — Fully autonomous machines

NVIDIA – JETSON NANO

JETSON DEVELOPER KITS

for Engineers, Makers, and Learners

JETSON NANO 2GB

5W | 10W
0.5 TFLOPS (FP16)
$59

JETSON NANO

5W | 10W
0.5 TFLOPS (FP16)
$99

JETSON XAVIER NX

10W | 15W
6 TFLOPS (FP16) | 21 TOPS (INT8)
$399

JETSON AGX XAVIER

10 | 15W | 30W
11 TFLOPS (FP16) | 32 TOPS (INT8)
$699

NVIDIA – JETSON NANO

Developer Kit Technical Specifications	
GPU	128-core NVIDIA Maxwell™
CPU	Quad-core ARM® A57 @ 1.43 GHz
Memory	2 GB 64-bit LPDDR4 25.6 GB/s
Storage	microSD (Card not included)
Video Encoder	4Kp30 | 4x 1080p30 | 9x 720p30 (H.264/H.265)
Video Decoder	4Kp60 | 2x 4Kp30 | 8x 1080p30 | 18x 720p30 (H.264/H.265)
Connectivity	Gigabit Ethernet, 802.11ac wireless*
Camera	1x MIPI CSI-2 connector
Display	HDMI
USB	1x USB 3.0 Type A, 2x USB 2.0 Type A, 1x USB 2.0 Micro-B
Others	40-pin header (GPIO, I2C, I2S, SPI, UART) 12-pin header (Power and related signals, UART) 4-pin fan header*
Mechanical	100 mm x 80 mm x 29 mm

EXERCÍCIO

A aula de hoje tem como objetivo mostrar na prática como manipular imagens a partir das bibliotecas Opencv e numpy.

NumPy

Let’s Code!

É hora de colocarmos em prática os conceitos aprendidos.