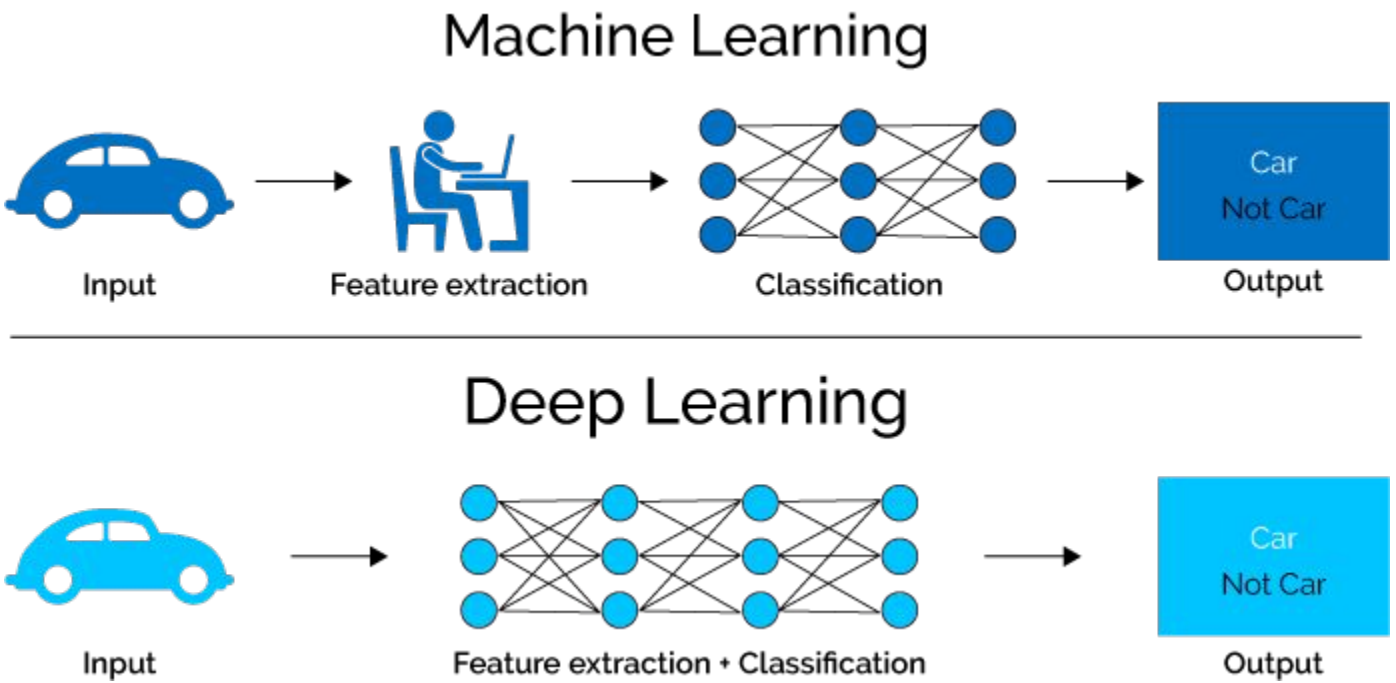
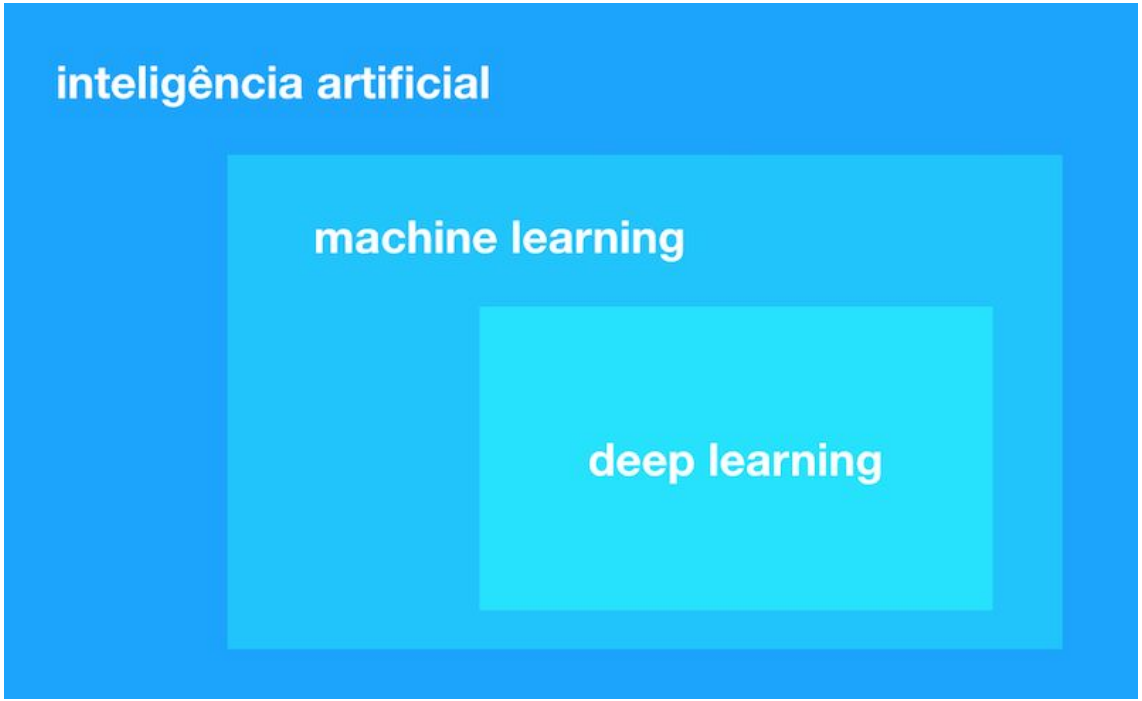
Modelos de Redes Neurais e Deep Learning

Machine Learning e Deep Learning



https://medium.com/swlh/ill-tell-you-why-deep-learning-is-so-popular-and-in-demand-5aca72628780

Machine Learning e Deep Learning



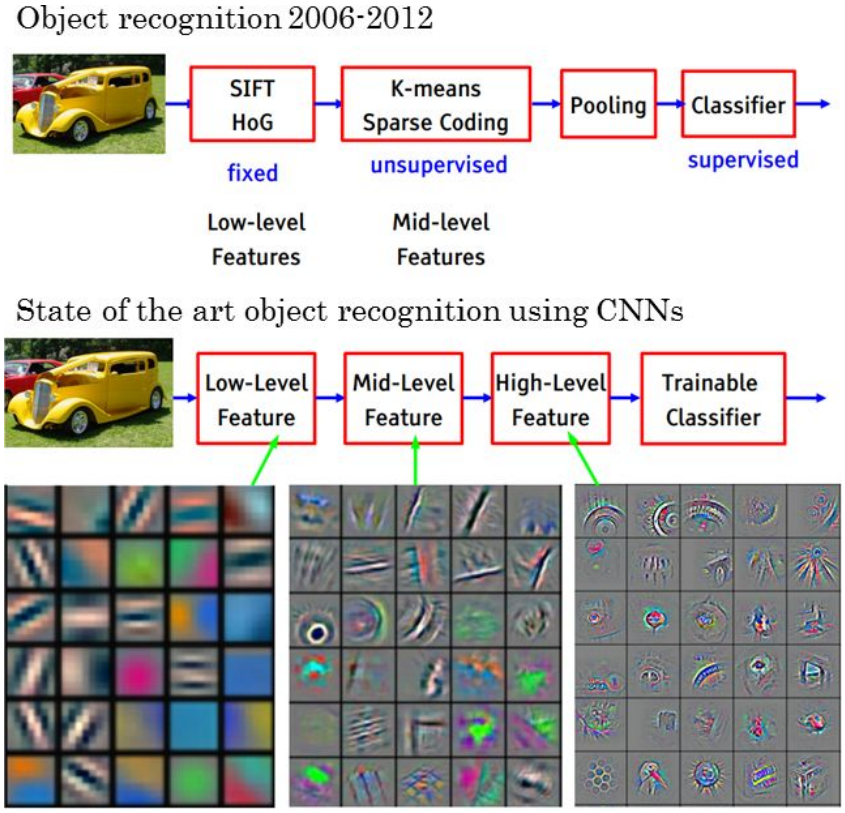
Machine Learning e Deep Learning

- Quando falamos de deep learning
  - Múltiplas camadas escondidas

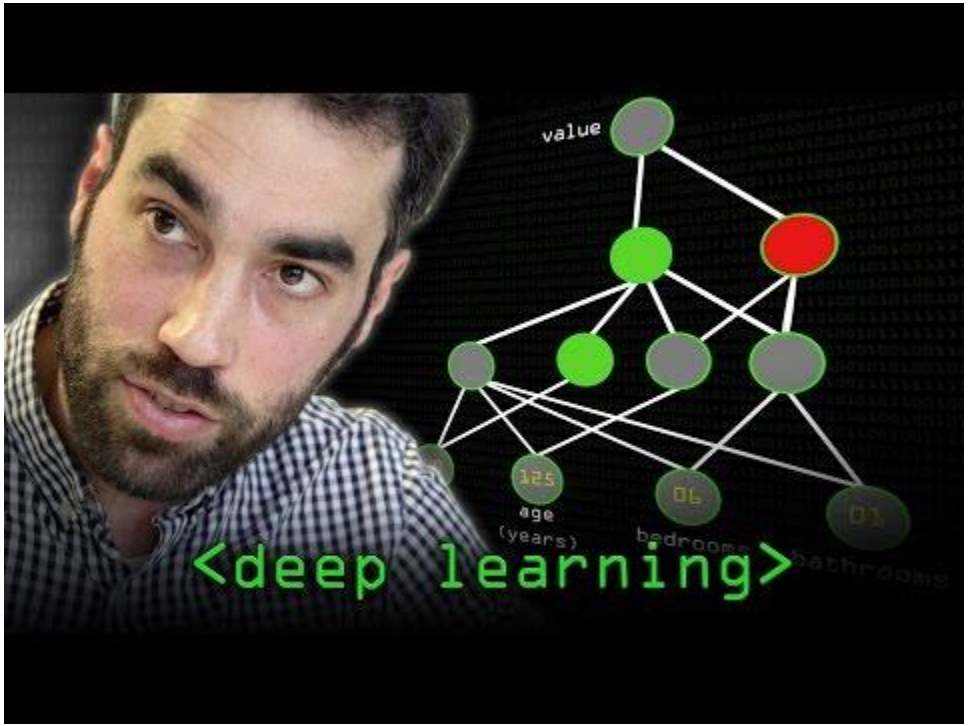
Machine Learning e Deep Learning

- Quando falamos de deep learning
  - Múltiplas camadas escondidas
  - As camadas formam uma hierarquia representativa para cada feature de entrada

Machine Learning e Deep Learning



Machine Learning e Deep Learning

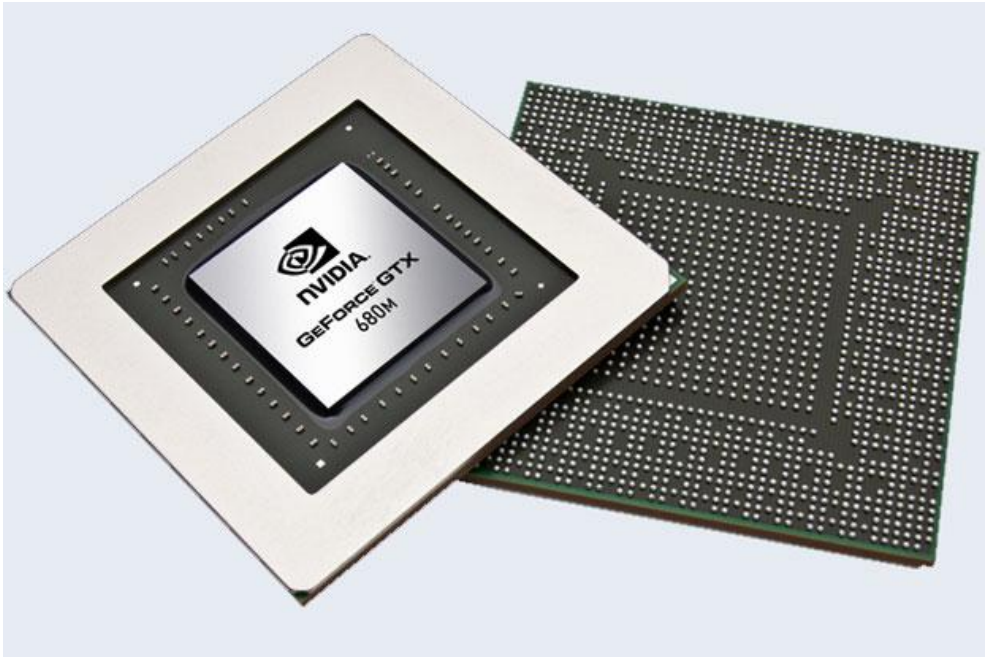


Machine Learning e Deep Learning

➔ CPU (Central Process Unit ou Unidade Central de Processamento)

Machine Learning e Deep Learning

➔ GPU (Graphics Processing Unit ou Unidade de Processamento Gráfico)

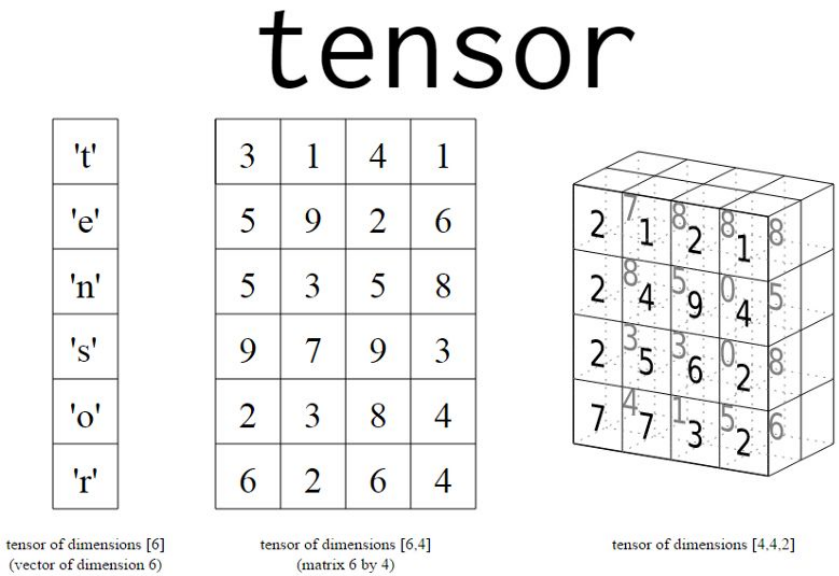


Machine Learning e Deep Learning

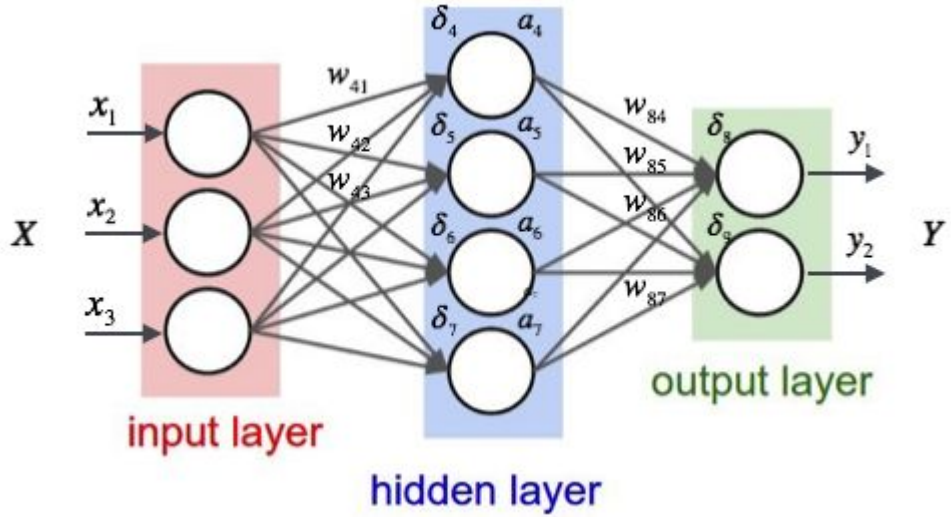
➔ TPU (Tensor Processing Unit ou Unidade Processamento de Tensor)

Machine Learning e Deep Learning

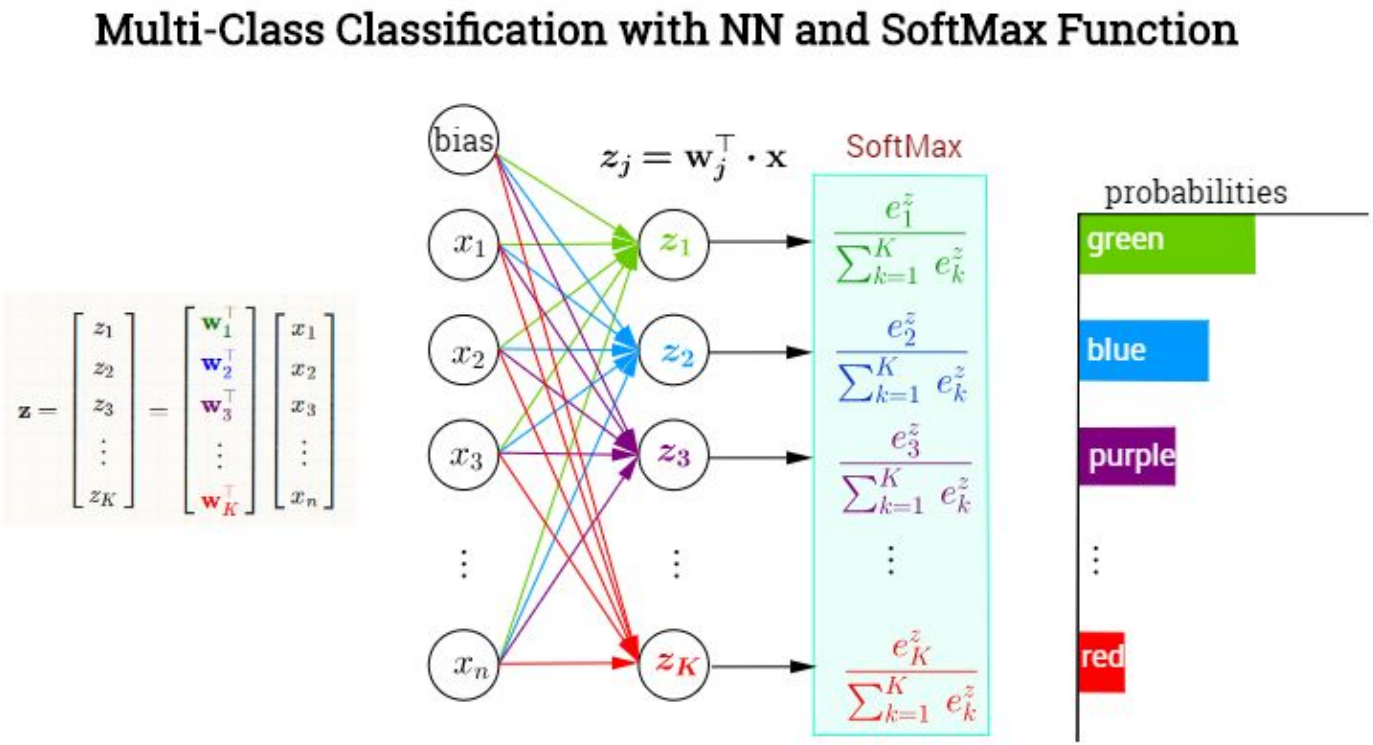
- O que é um tensor?
  - Tensores são entidades geométricas introduzidas na matemática e na física para generalizar a noção de escalares, vetores e matrizes. https://pt.wikipedia.org/wiki/Tensor



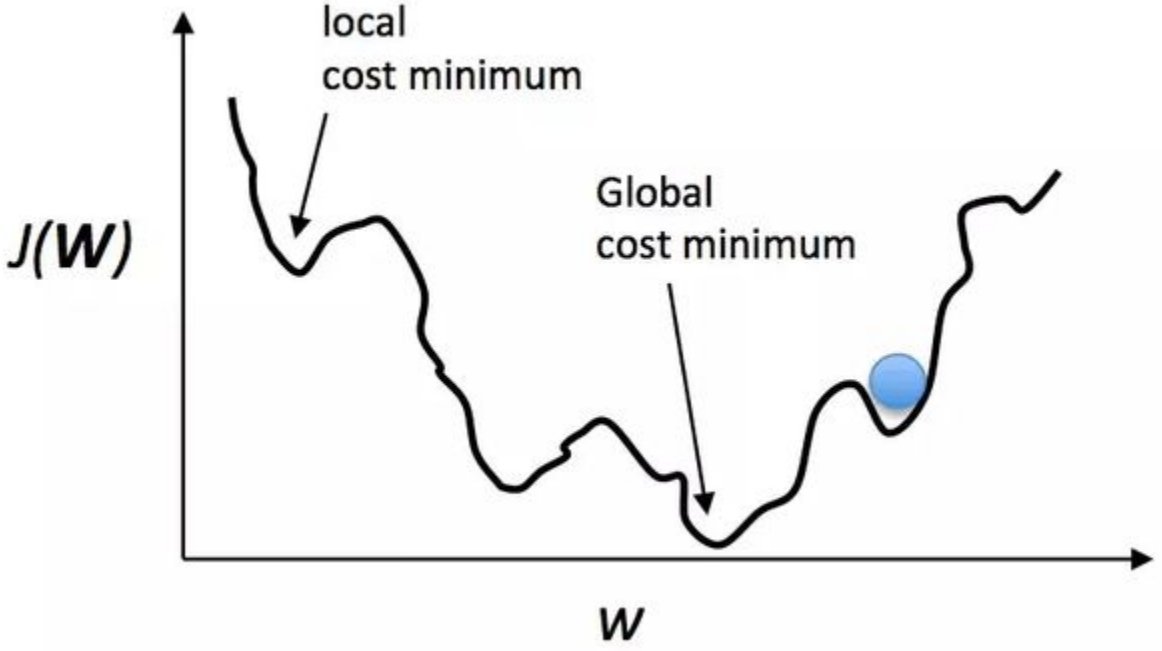
Rede Neural


X
x_1
x_2
x_3
w_{41}
w_{42}
w_{43}
δ_4 a_4
δ_5 a_5
δ_6 a_6
δ_7 a_7
w_{84}
w_{85}
w_{86}
w_{87}
δ_8
δ_9
y_1
y_2
Y
input layer
hidden layer
output layer

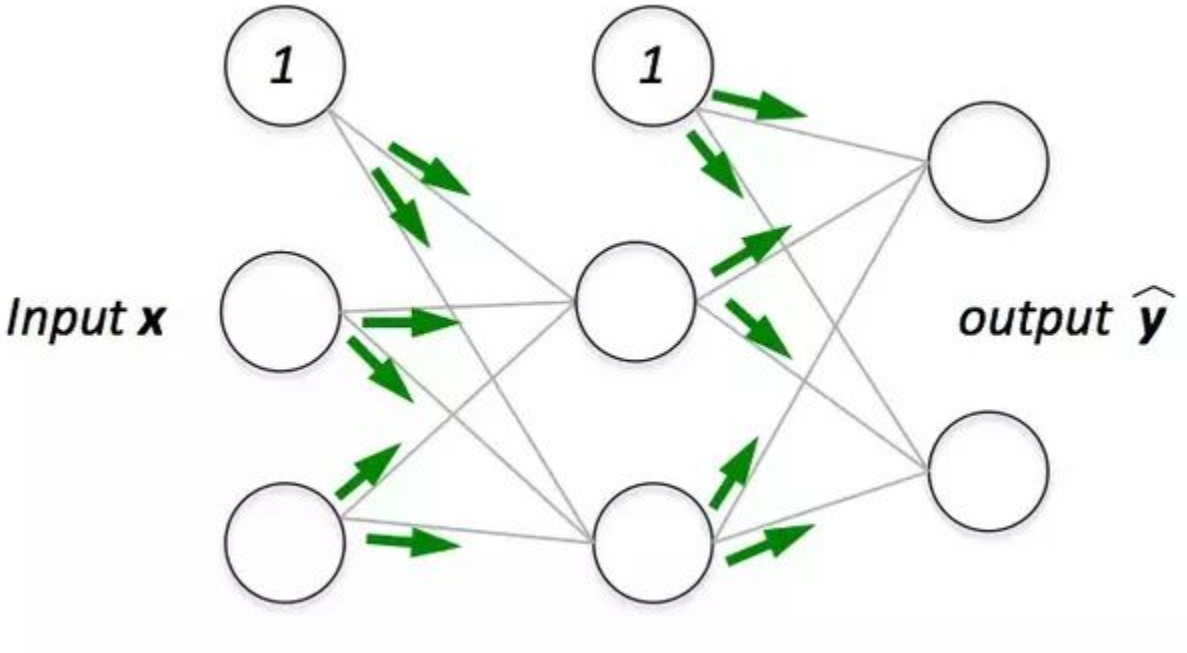
Cross Entropy



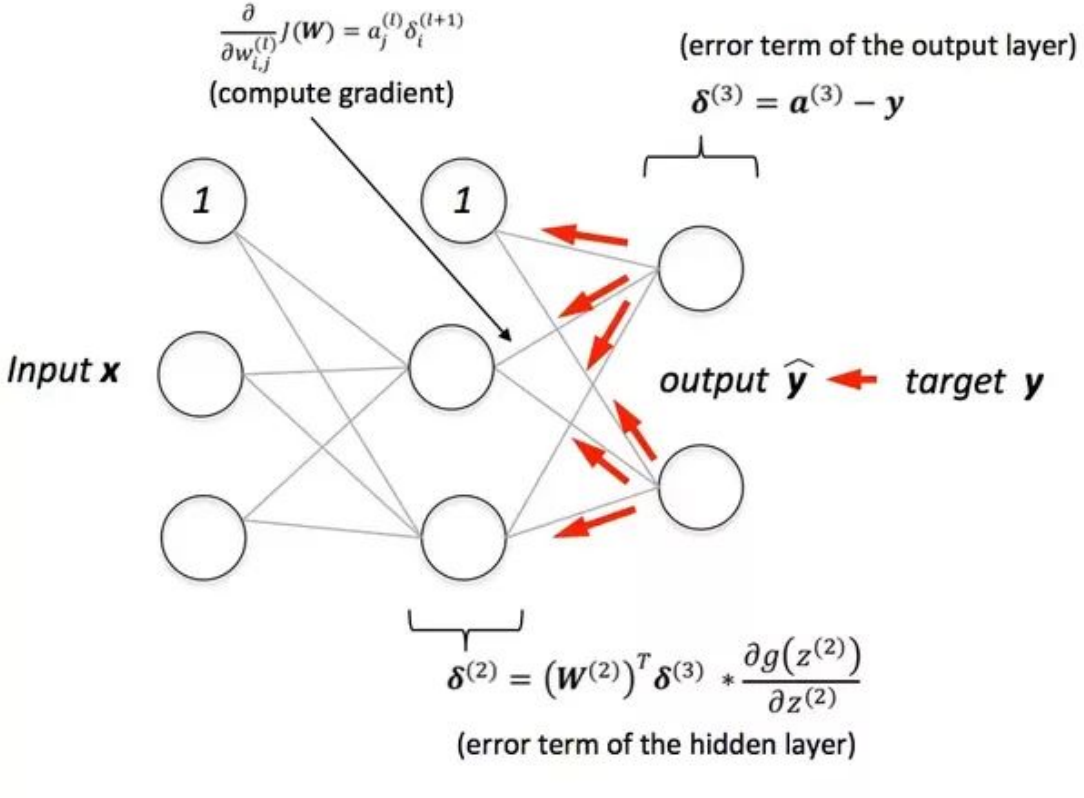
Back Propagation



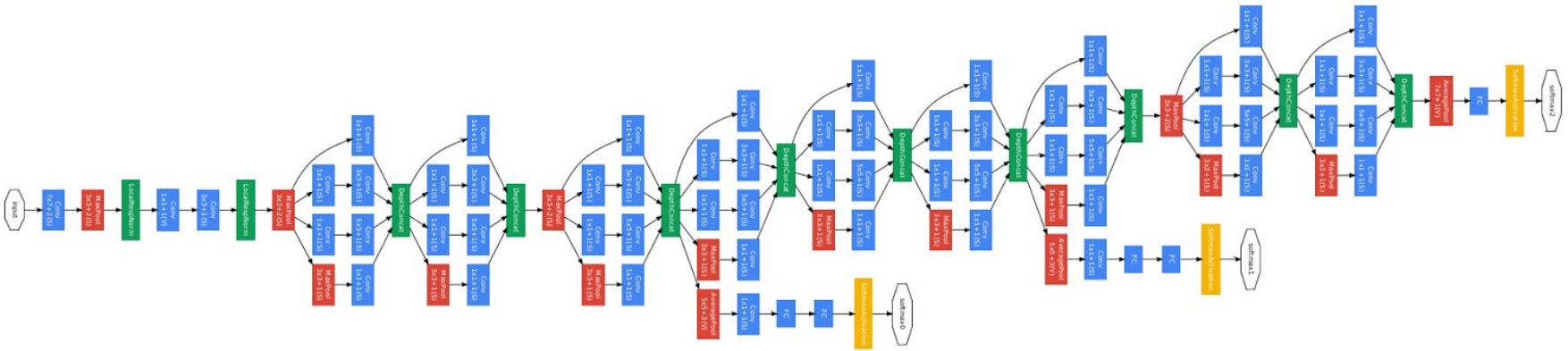
Back Propagation



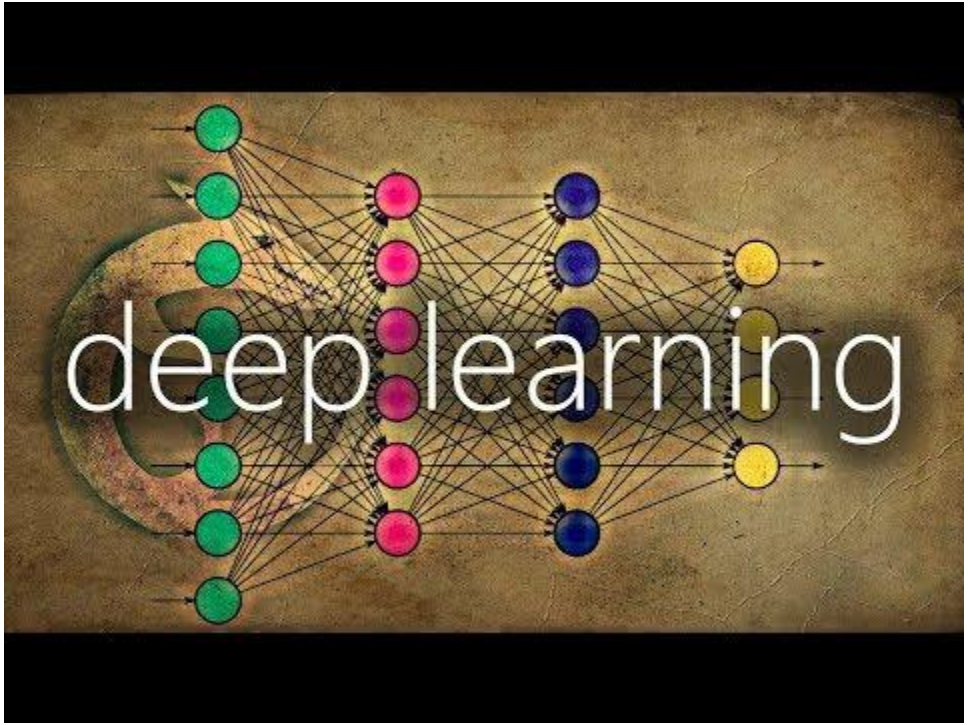
Back Propagation



Arquiteturas

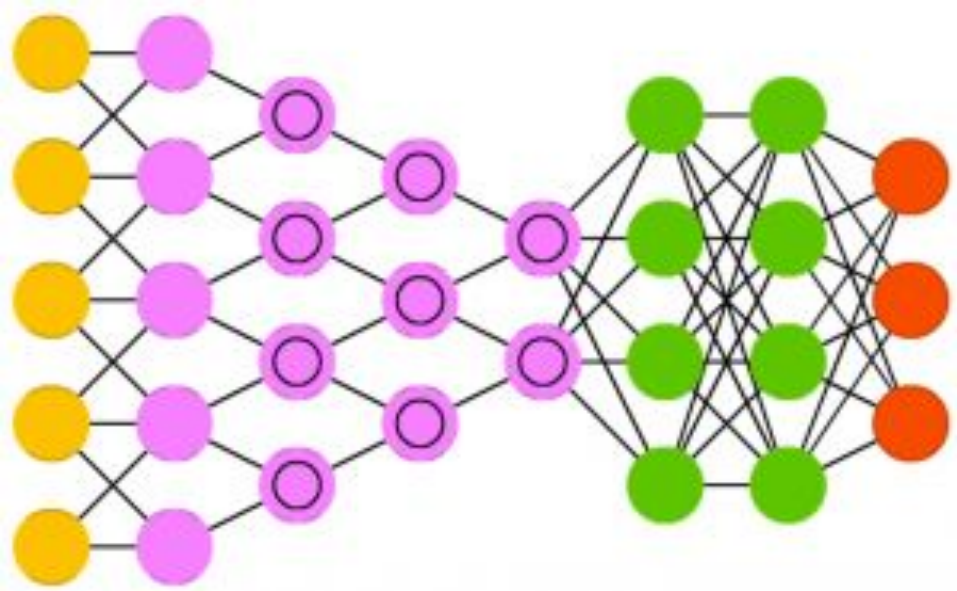


Rede Neural



CNN’s

➔ Redes Neurais Convolucionais



CNN’s

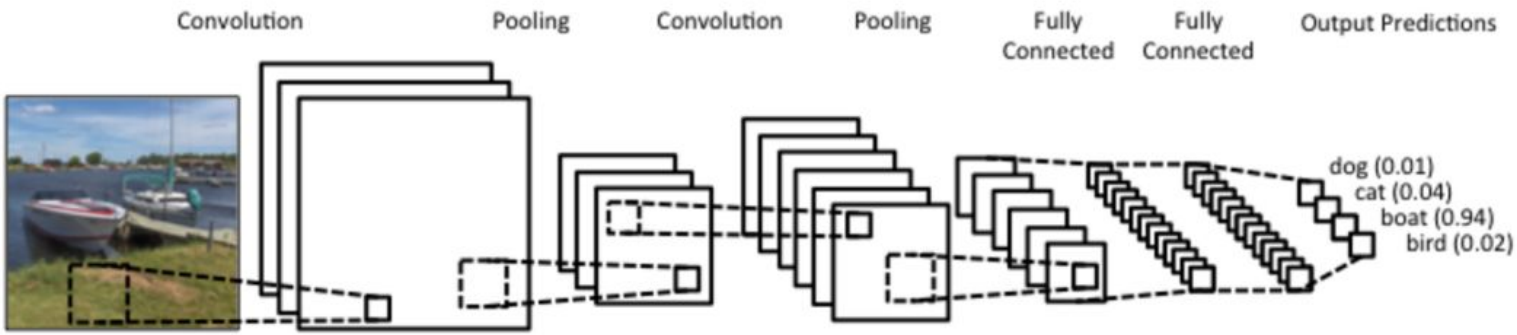
- Redes Neurais Convolucionais
  - É uma rede *feed-forward*;

CNN’s

- Redes Neurais Convolucionais
  - É uma rede *feed-forward*;
  - Boa aplicabilidade para problemas que envolvem análise de imagens.

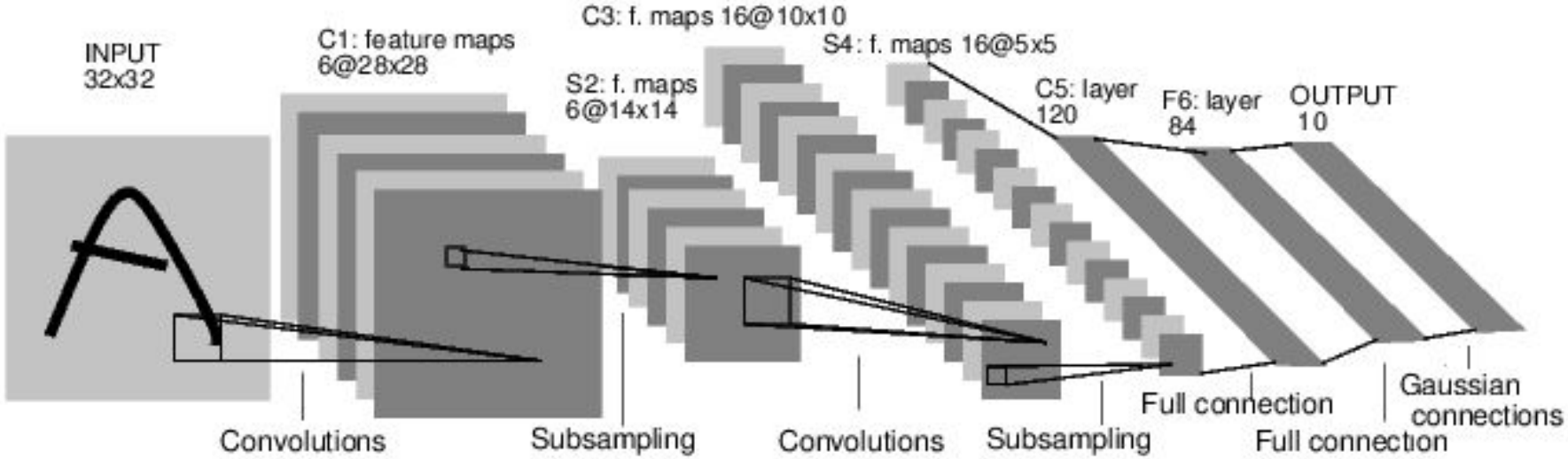
CNN’s

➔ Redes Neurais Convolucionais



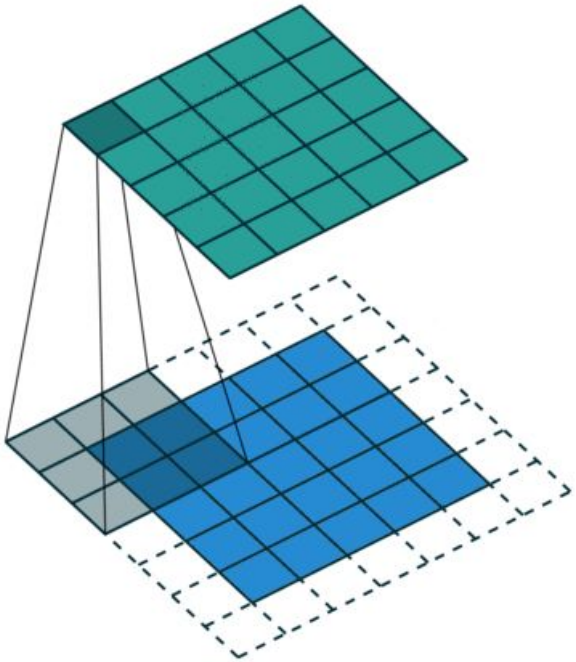
CNN’s

➔ Redes Neurais Convolucionais



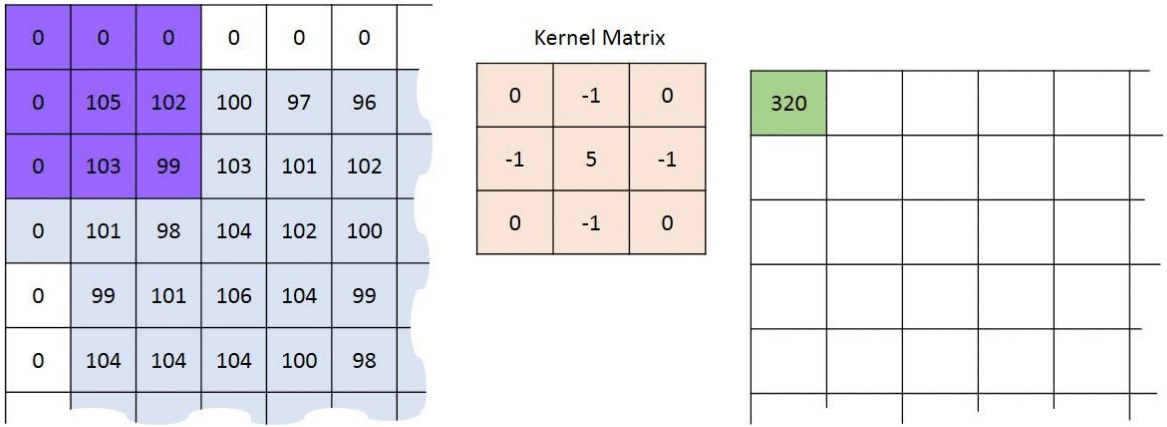
CNN’s

➔ Convolução?



CNN’s

➔ Convolução?



Convolution with horizontal and vertical strides = 1

CNN's

➔ Exemplo de filtro (Sobel)

Matematicamente este operador utiliza duas matrizes 3×3 que são convoluídas com a imagem original para calcular aproximações das derivadas - uma para as variações horizontais e uma para as verticais. Sendo $\mathbf{A}$ a imagem inicial então, $\mathbf{G_x}$ e $\mathbf{G_y}$ serão duas imagens que em cada ponto contêm uma aproximação às derivadas horizontal e vertical de A.

$$\mathbf{G_x} = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix} * \mathbf{A} \quad \text{e} \quad \mathbf{G_y} = \begin{bmatrix} +1 & +2 & +1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} * \mathbf{A}$$

Portanto a magnitude, $\mathbf{G}$, e a direcção, $\mathbf{\Theta}$, do gradiente são dados por:

$$\mathbf{G} = \sqrt{\mathbf{G_x}^2 + \mathbf{G_y}^2}$$

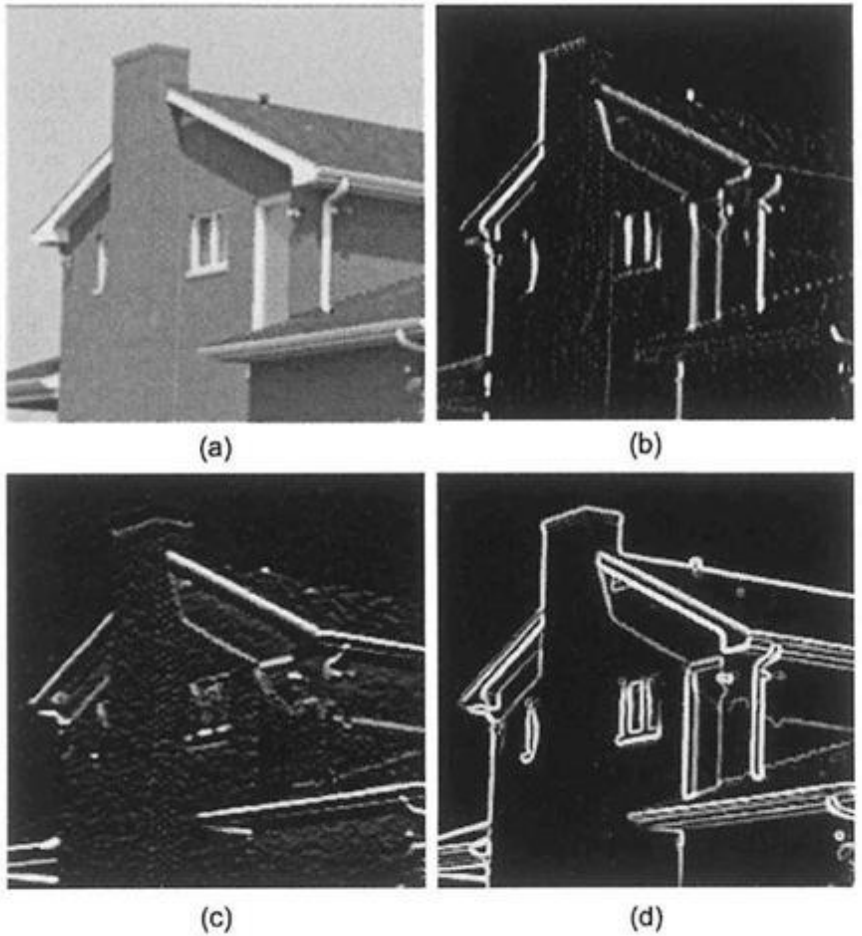
$$\mathbf{\Theta} = \arctan\left(\frac{\mathbf{G_y}}{\mathbf{G_x}}\right)$$

https://pt.wikipedia.org/wiki/Filtro_Sobel

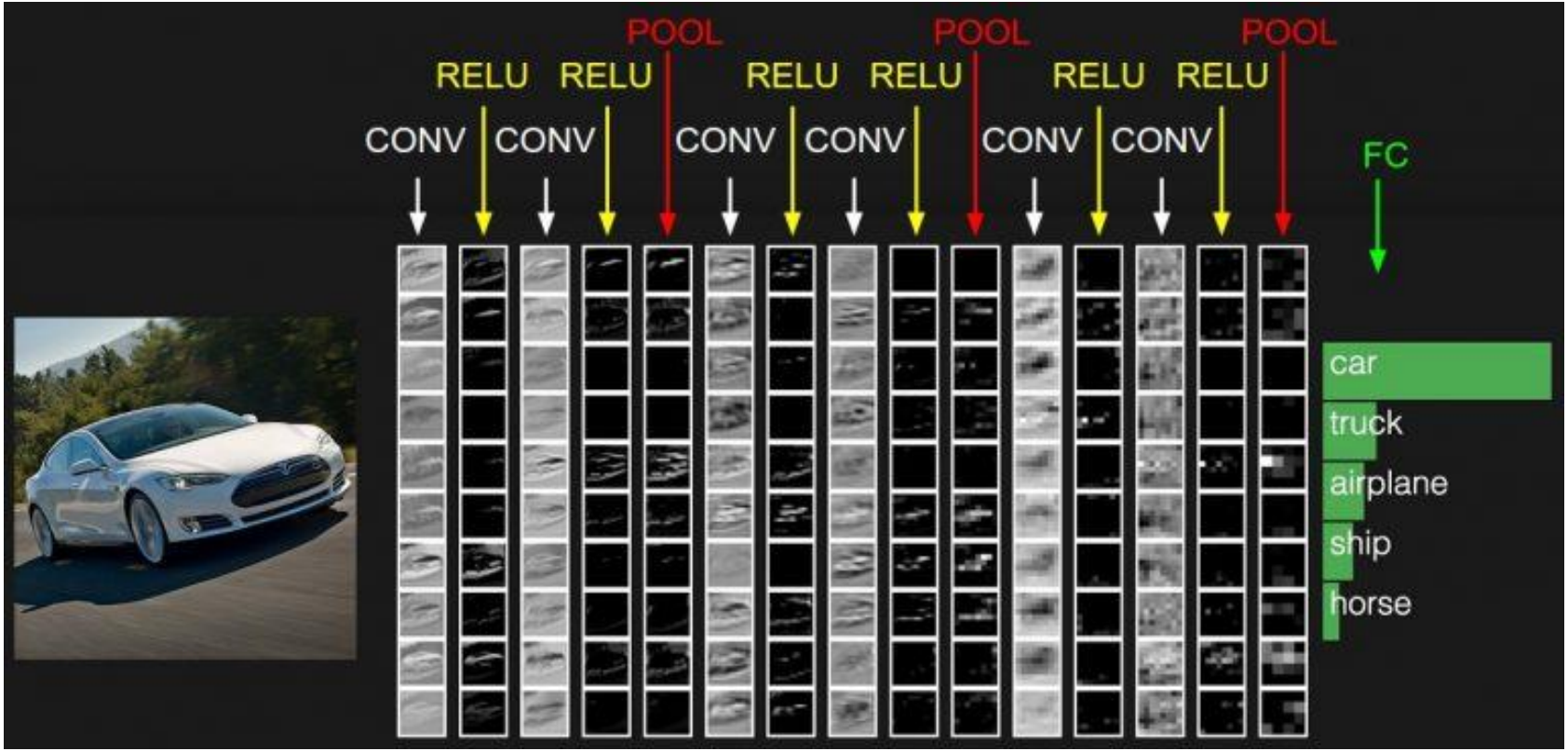
CNN’s

➔ Exemplo de filtro (Sobel)

a) Imagem original
b) Sobel (Gx)
c) Sobel (Gy)
d) Sobel (Magnitude G)

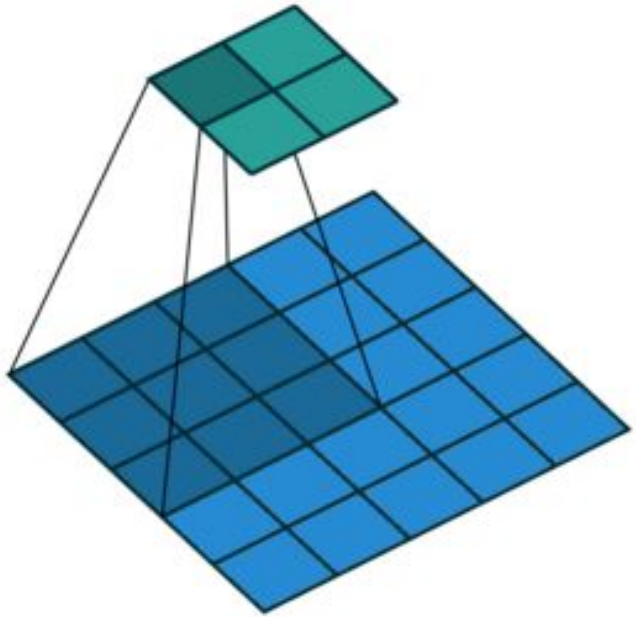


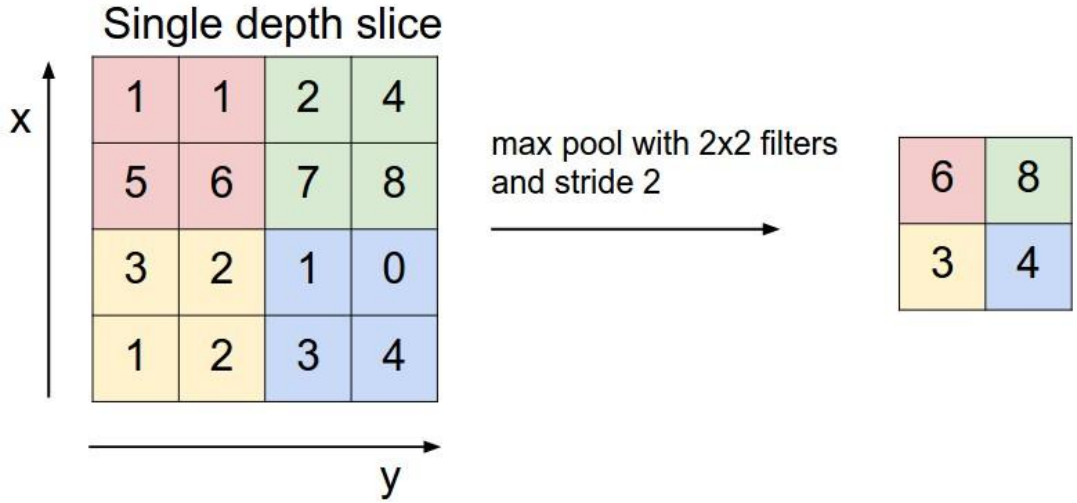
CNN’s


POOL
POOL
POOL
RELU
RELU
RELU
RELU
RELU
RELU
CONV
CONV
CONV
CONV
CONV
CONV
FC
car
truck
airplane
ship
horse

CNN’s

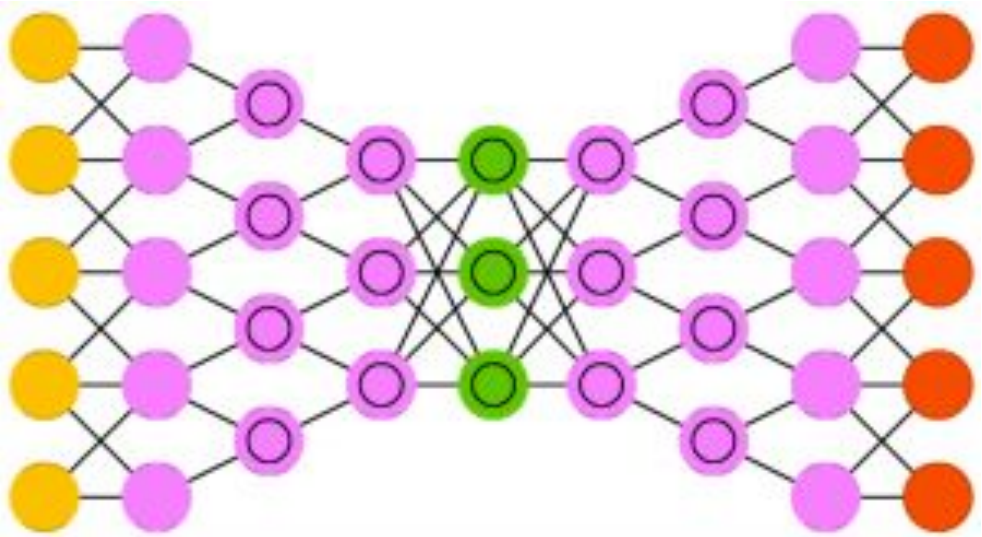
➔ Pooling?





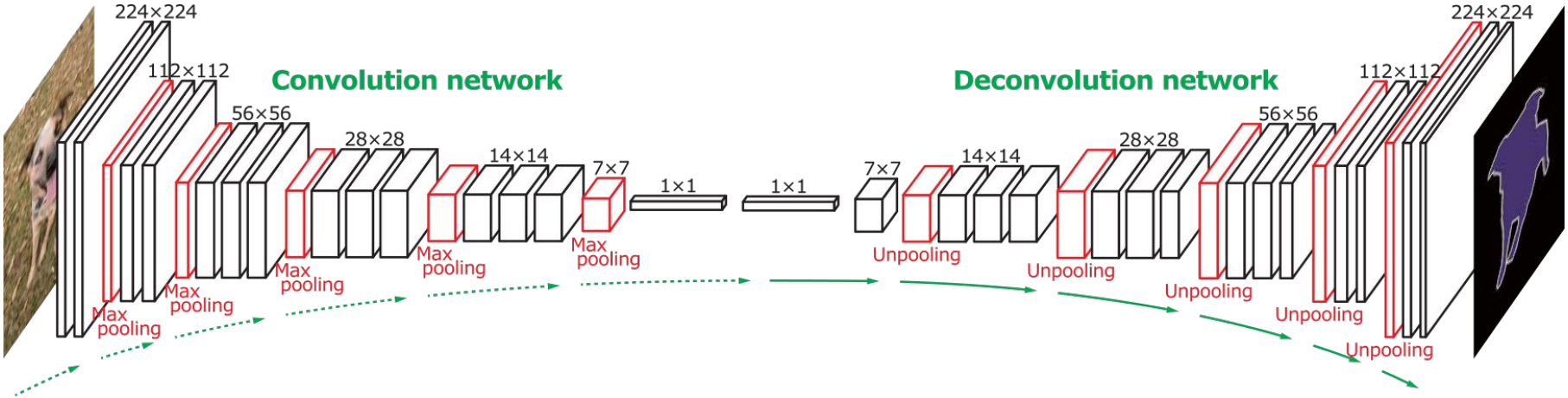
CNN’s

➔ Redes Neurais Convolucionais Gráficas inversas Profundas



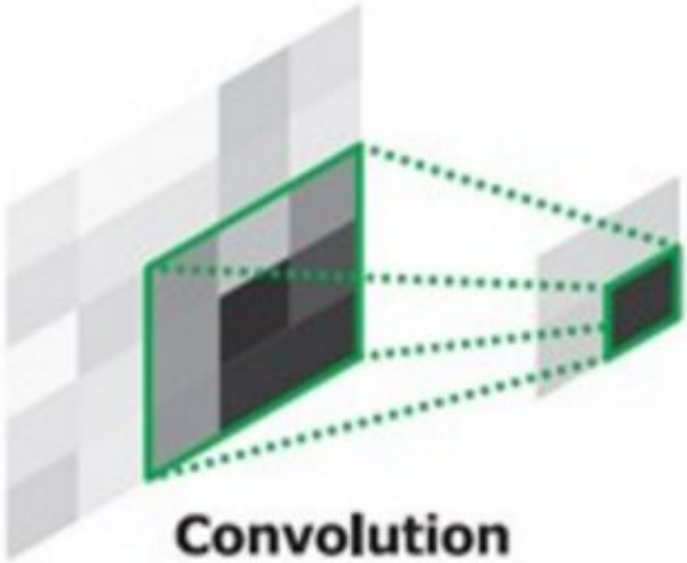
CNN’s

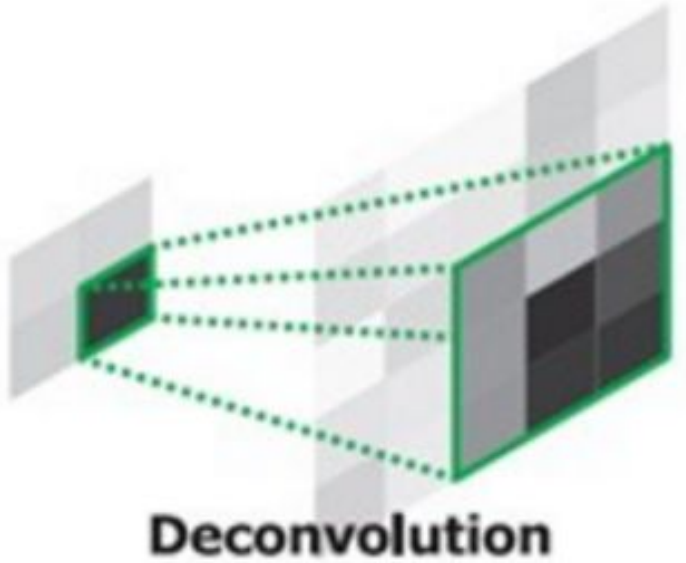
➔ Redes Neurais Convolucionais Gráficas inversas Profundas



CNN’s

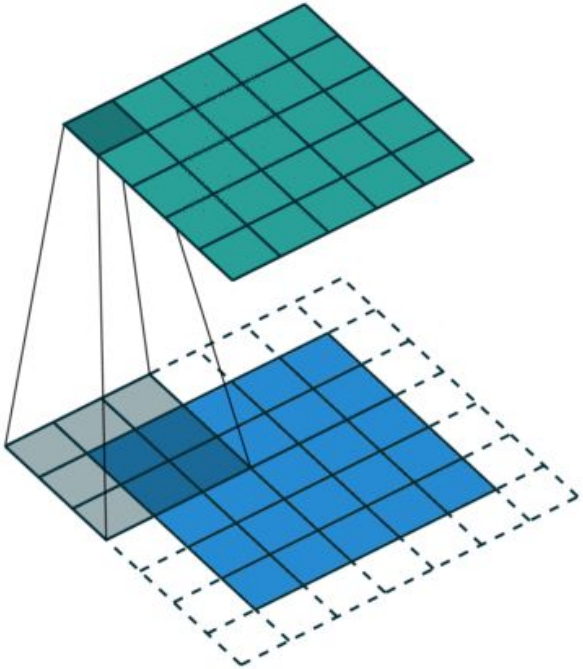
➔ Convolution e Deconvolution?

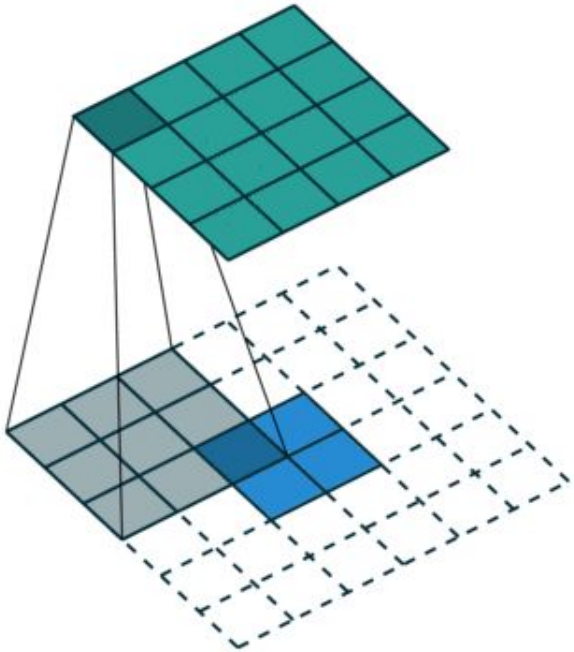




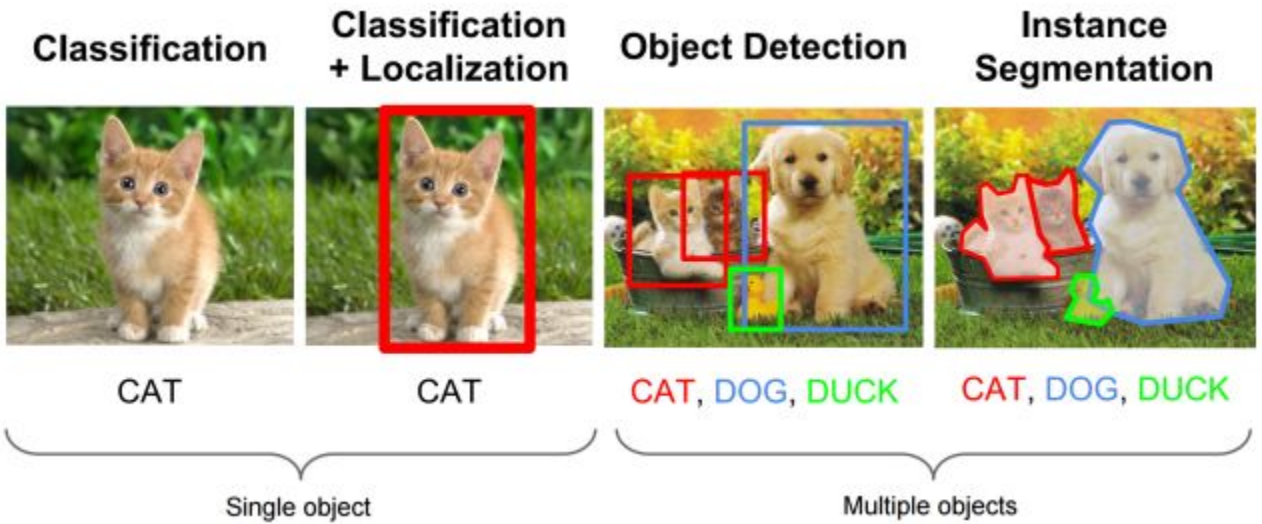
CNN’s

➔ Convolution e Deconvolution?



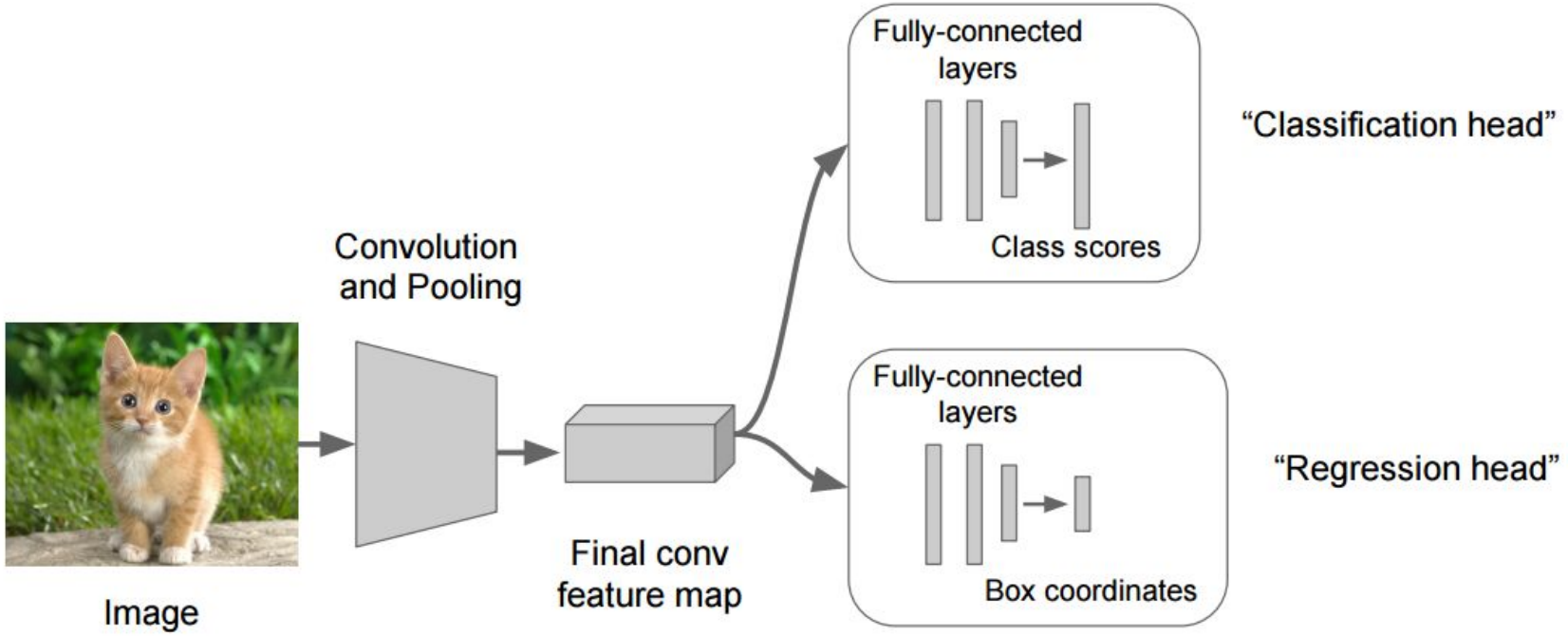


CNN’s


Classification
Classification + Localization
Object Detection
Instance Segmentation
CAT
CAT
CAT, DOG, DUCK
CAT, DOG, DUCK
Single object
Multiple objects

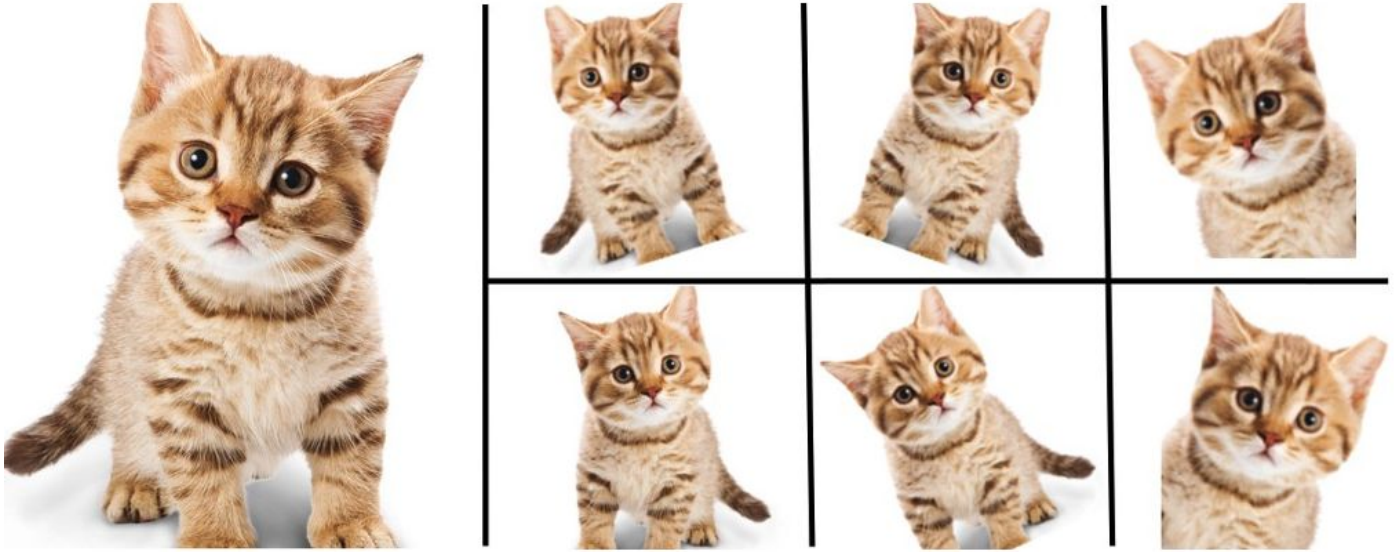
CNN’s

➔ Classificar e Localizar



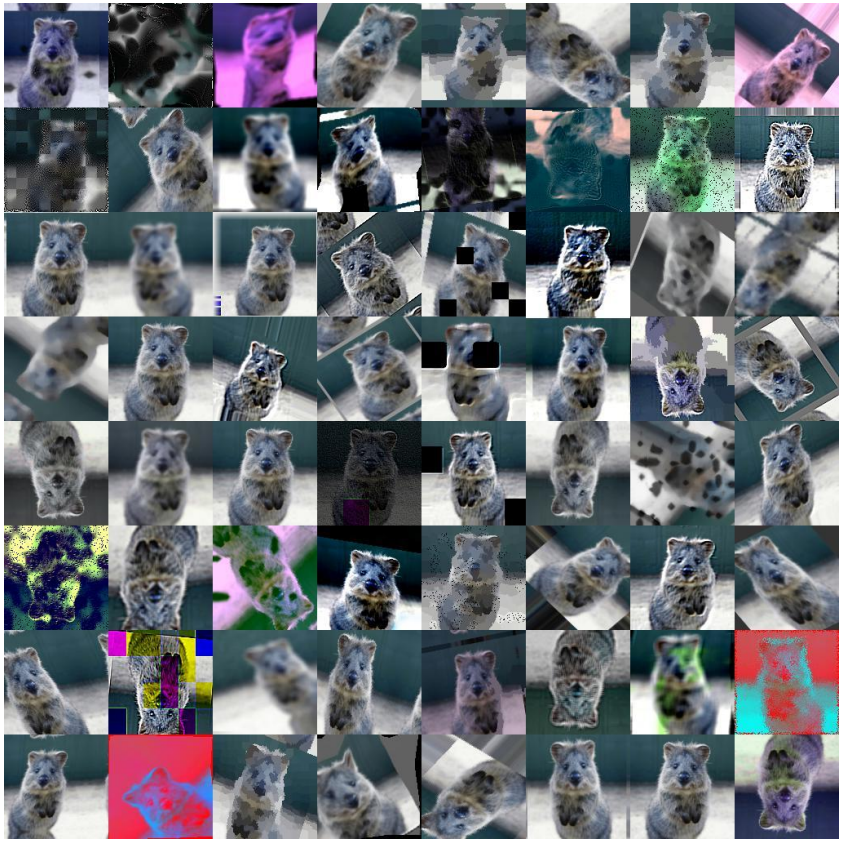
CNN’s

➔ Image Augmentation



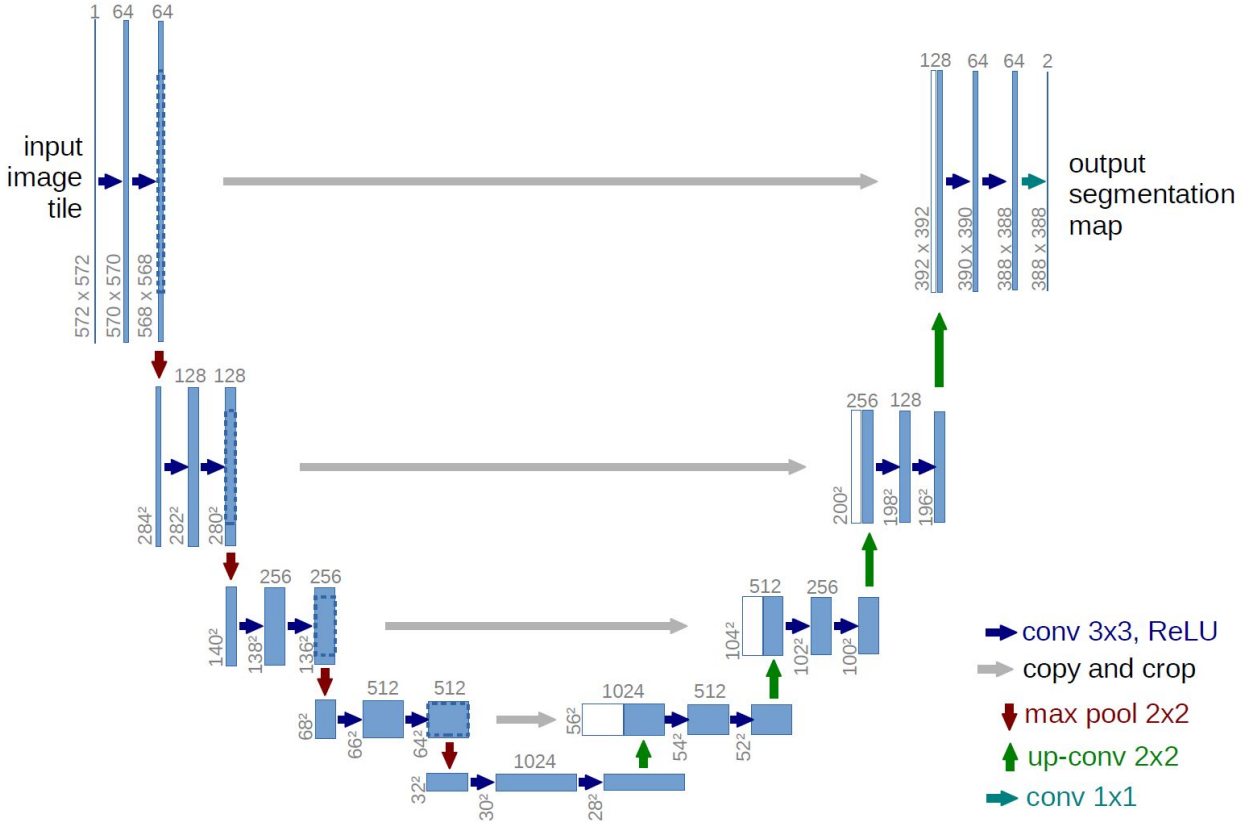
CNN’s

➔ Image Augmentation



CNN’s

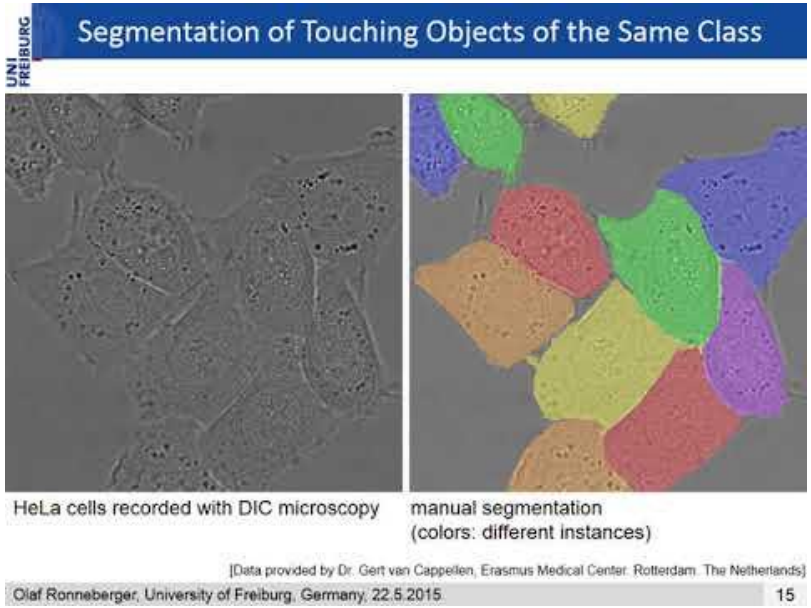
➔ U-Net



https://lmb.informatik.uni-freiburg.de/people/ronneber/u-net/

CNN’s

➔ U-Net


UNI FREIBURG
Segmentation of Touching Objects of the Same Class
HeLa cells recorded with DIC microscopy
manual segmentation
(colors: different instances)
[Data provided by Dr. Gert van Cappellen, Erasmus Medical Center, Rotterdam, The Netherlands]
Olaf Ronneberger, University of Freiburg, Germany, 22.5.2015
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CNN’s