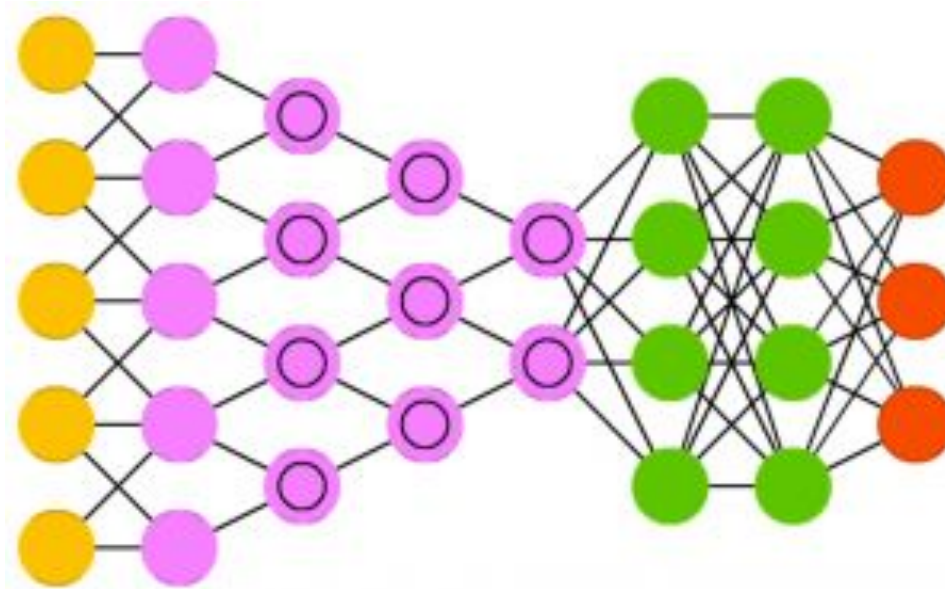


# **Redes Neurais Convolucionais**

## **CNN's**

# CNN's

→ Redes Neurais Convolucionais



# CNN's

→ Redes Neurais Convolucionais

- ◆ É uma rede *feed-forward*;

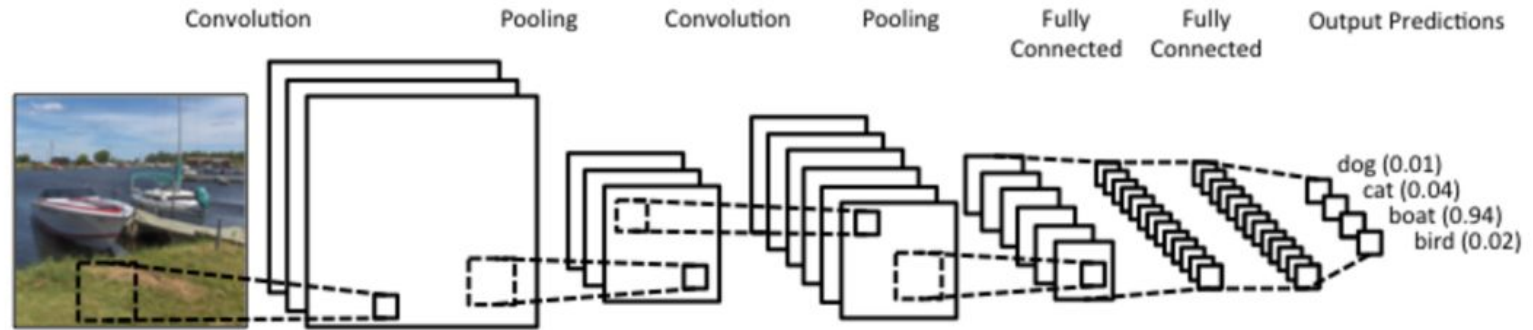
# CNN's

## → Redes Neurais Convolucionais

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

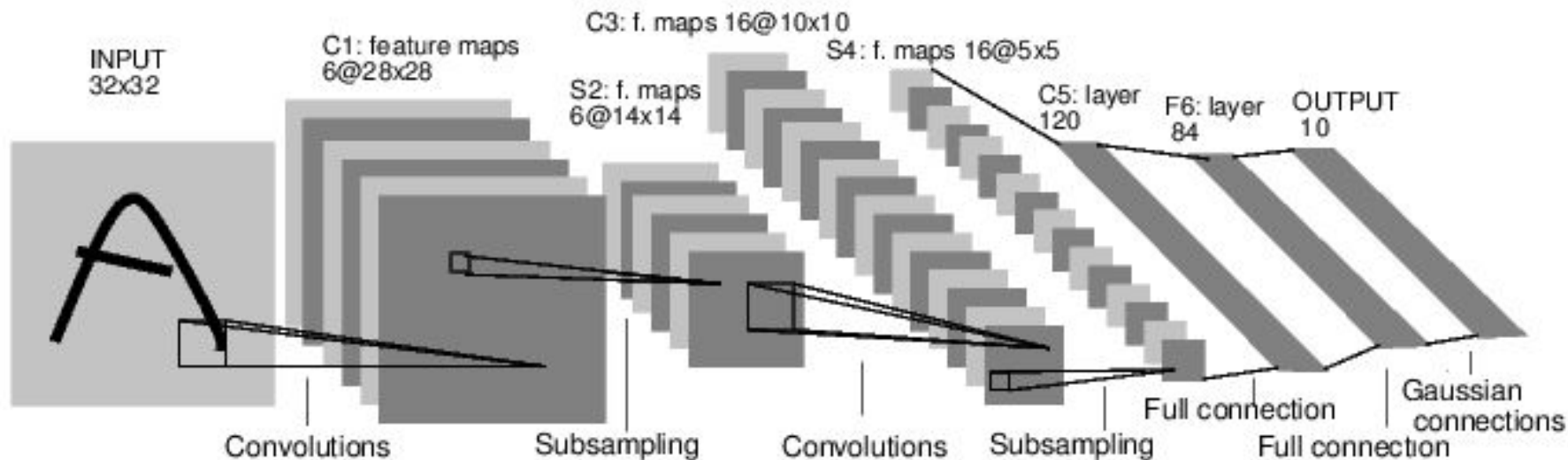
# CNN's

→ Redes Neurais Convolucionais



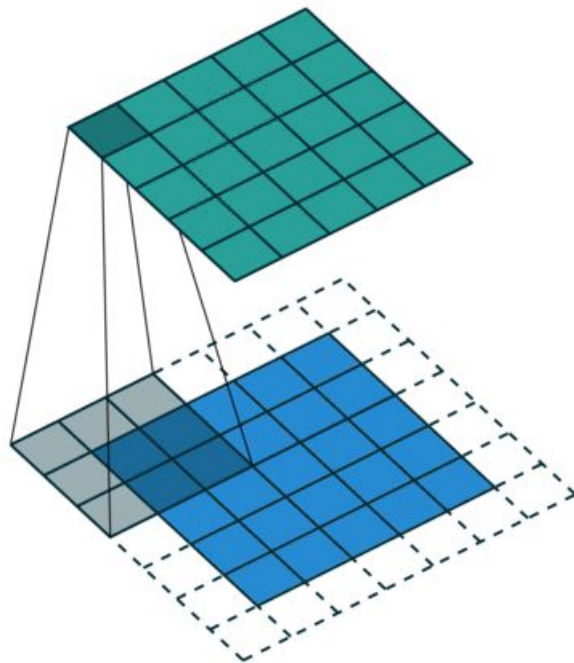
# CNN's

→ Redes Neurais Convolucionais



# CNN's

→ Convolução?



# CNN's

→ Convolução?

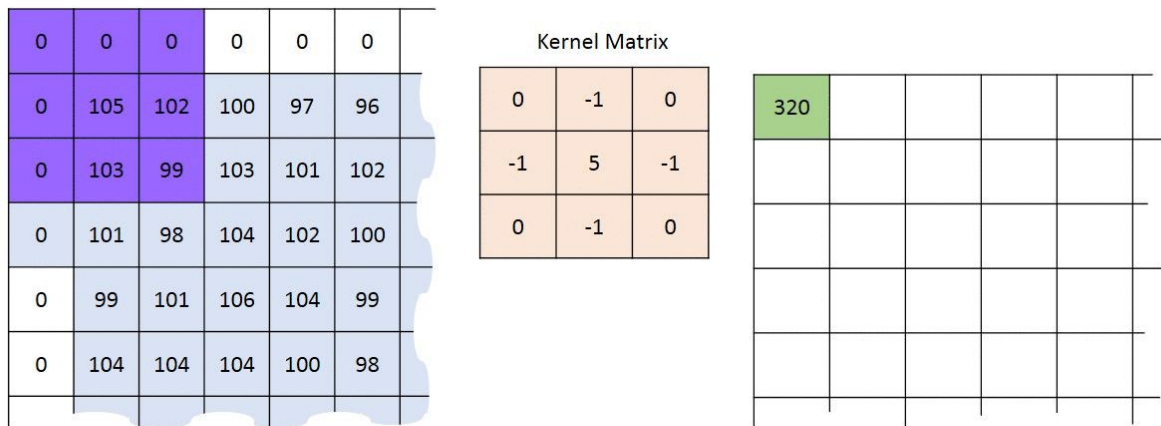


Image Matrix

Kernel Matrix

Output Matrix

$$\begin{aligned} &0 * 0 + 0 * -1 + 0 * 0 \\ &+ 0 * -1 + 105 * 5 + 102 * -1 \\ &+ 0 * 0 + 103 * -1 + 99 * 0 = 320 \end{aligned}$$

**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 **A** a imagem inicial então, **G<sub>x</sub>** e **G<sub>y</sub>** 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, **G**, e a direcção, **Θ**, do gradiente são dados por:

$$\mathbf{G} = \sqrt{\mathbf{G}_x^2 + \mathbf{G}_y^2}$$

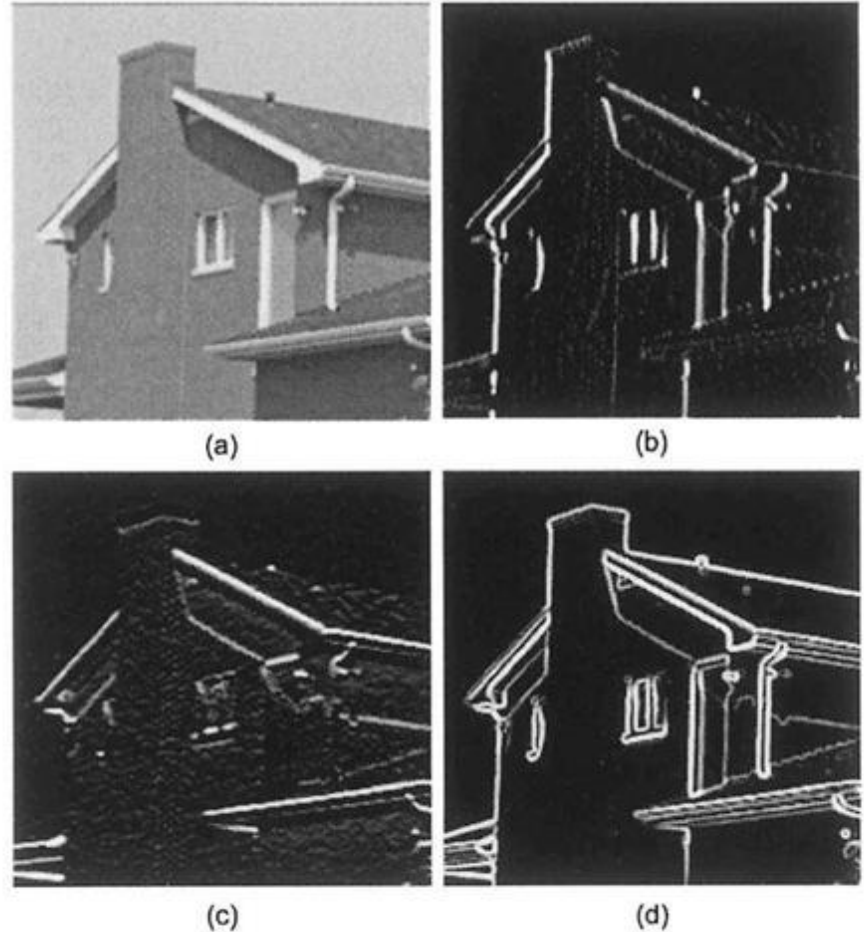
$$\Theta = \arctan\left(\frac{\mathbf{G}_y}{\mathbf{G}_x}\right)$$

[https://pt.wikipedia.org/wiki/Filtro\\_Sobel](https://pt.wikipedia.org/wiki/Filtro_Sobel)

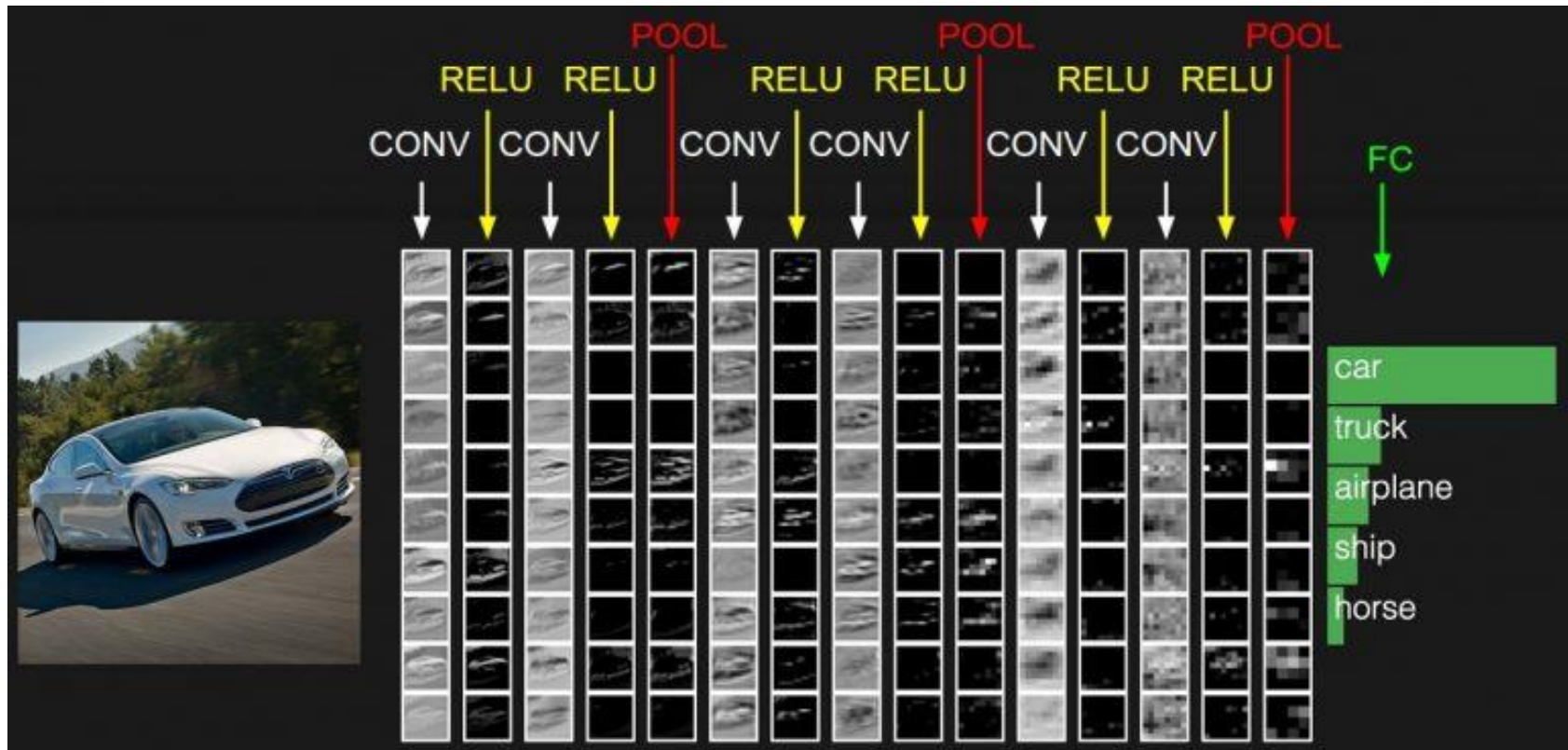
# CNN's

→ Exemplo de filtro (Sobel)

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

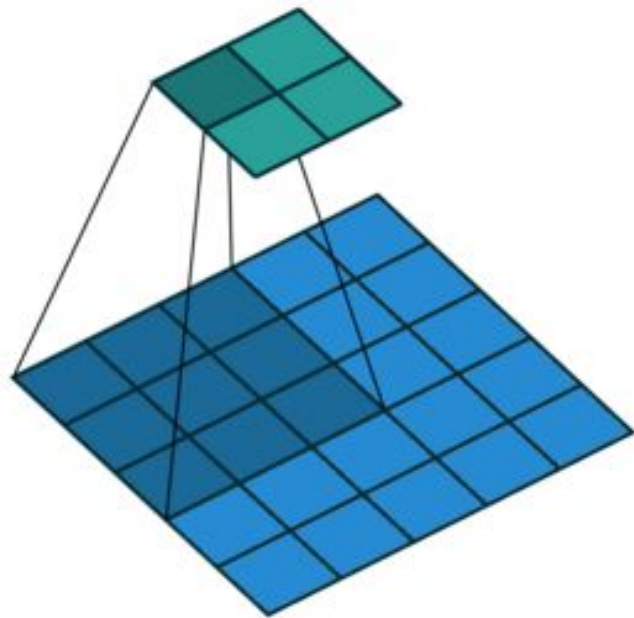


# CNN's



# CNN's

→ Pooling?



Single depth slice

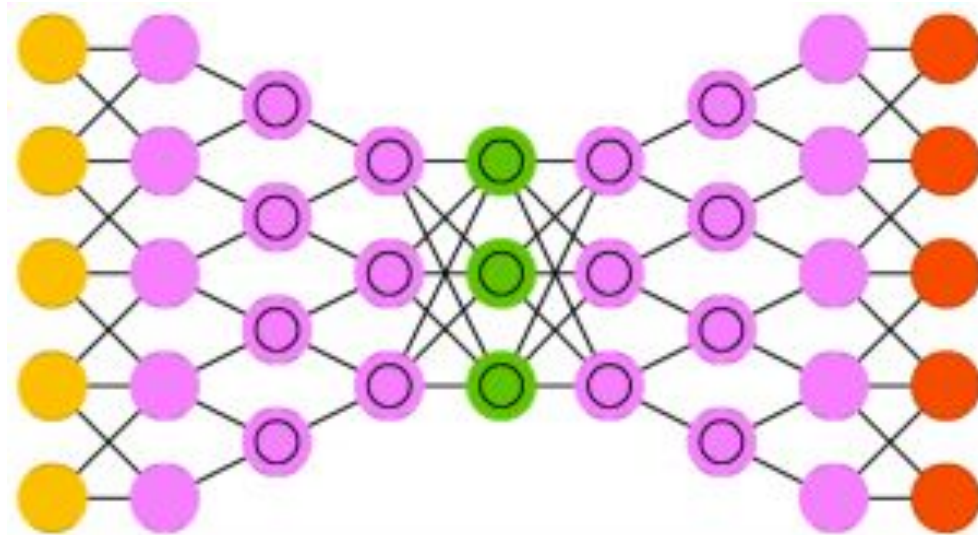
x	1	1	2	4
	5	6	7	8
	3	2	1	0
	1	2	3	4
	y			

max pool with 2x2 filters  
and stride 2

6	8
3	4

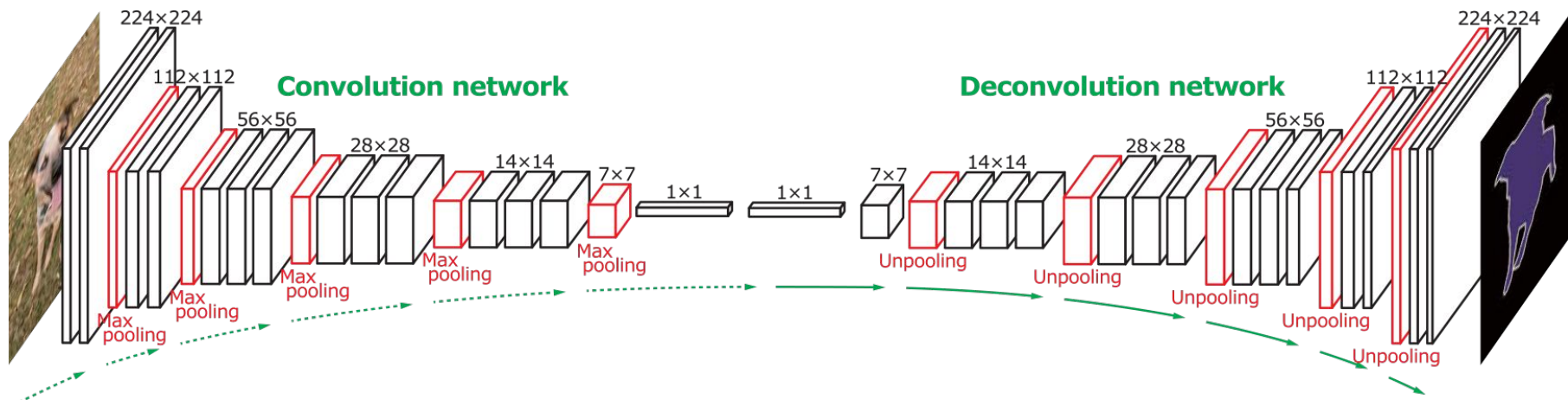
# CNN's

→ Redes Neurais Convolucionais Gráficas inversas Profundas



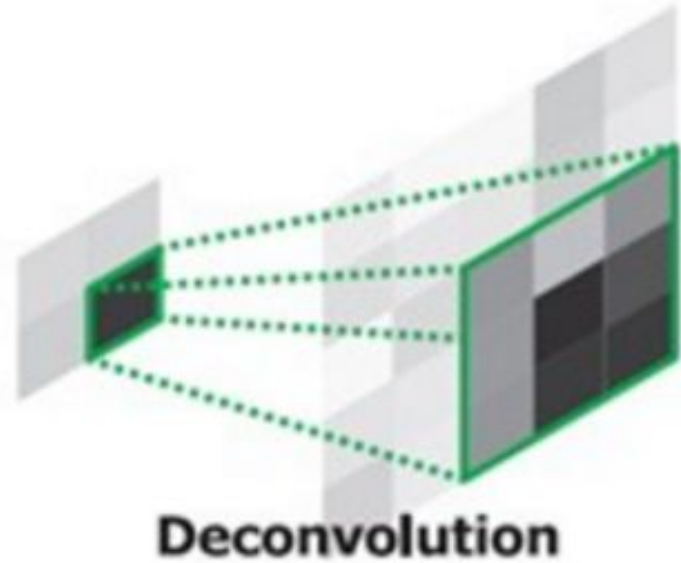
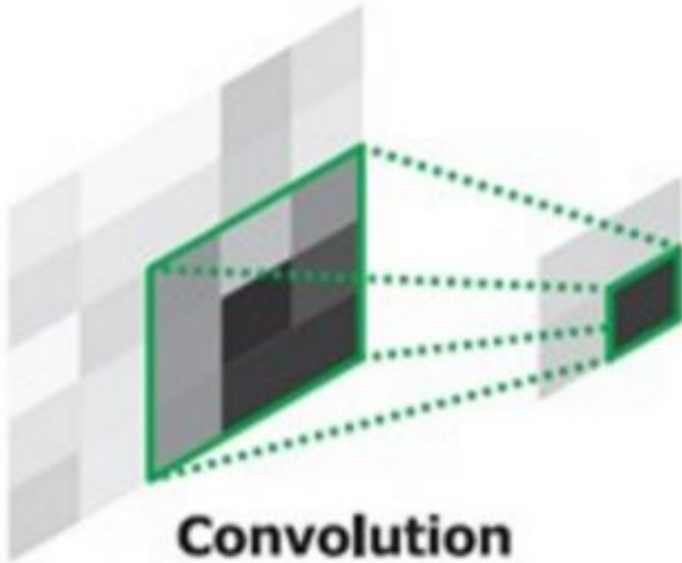
# CNN's

→ Redes Neurais Convolucionais Gráficas inversas Profundas



# CNN's

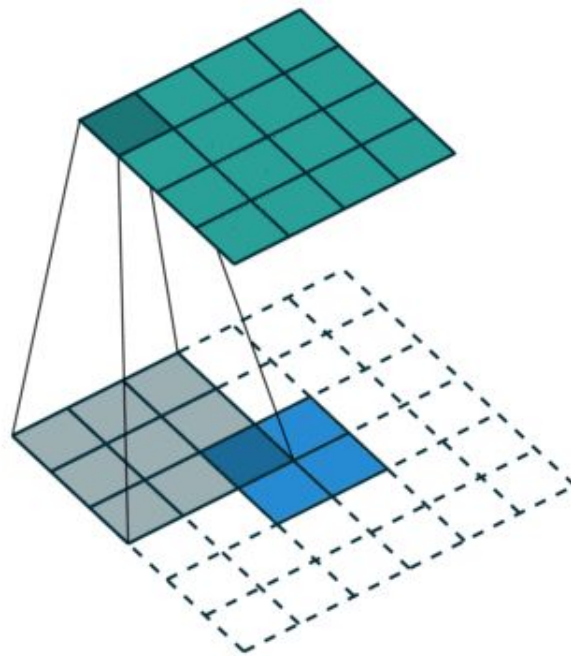
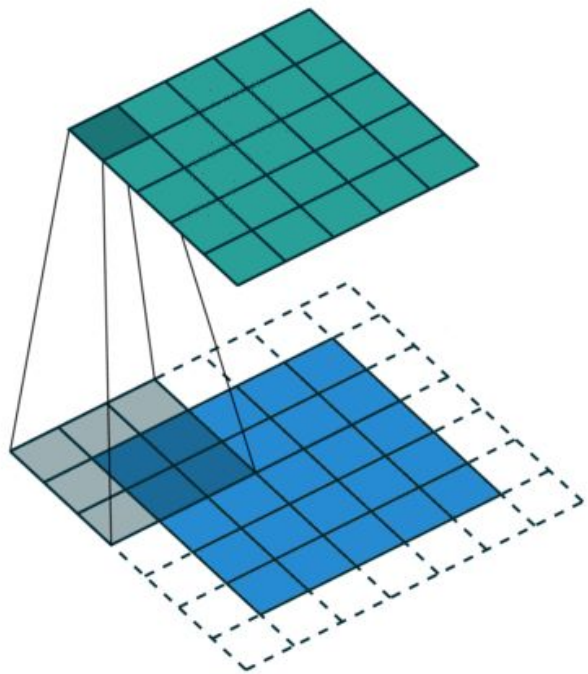
→ Convolution e Deconvolution?





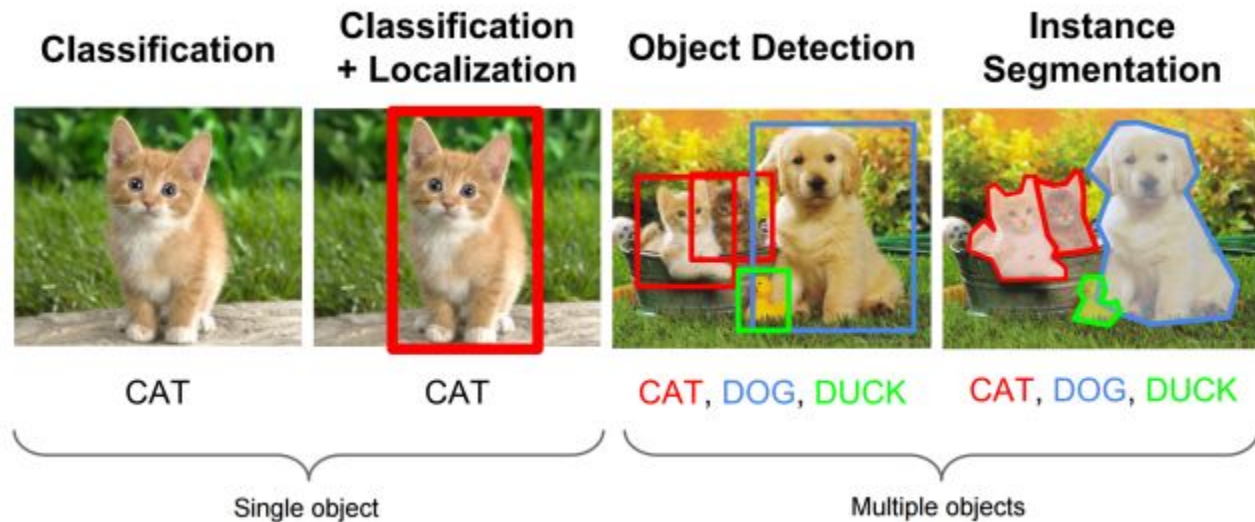
# CNN's

→ Convolution e Deconvolution?



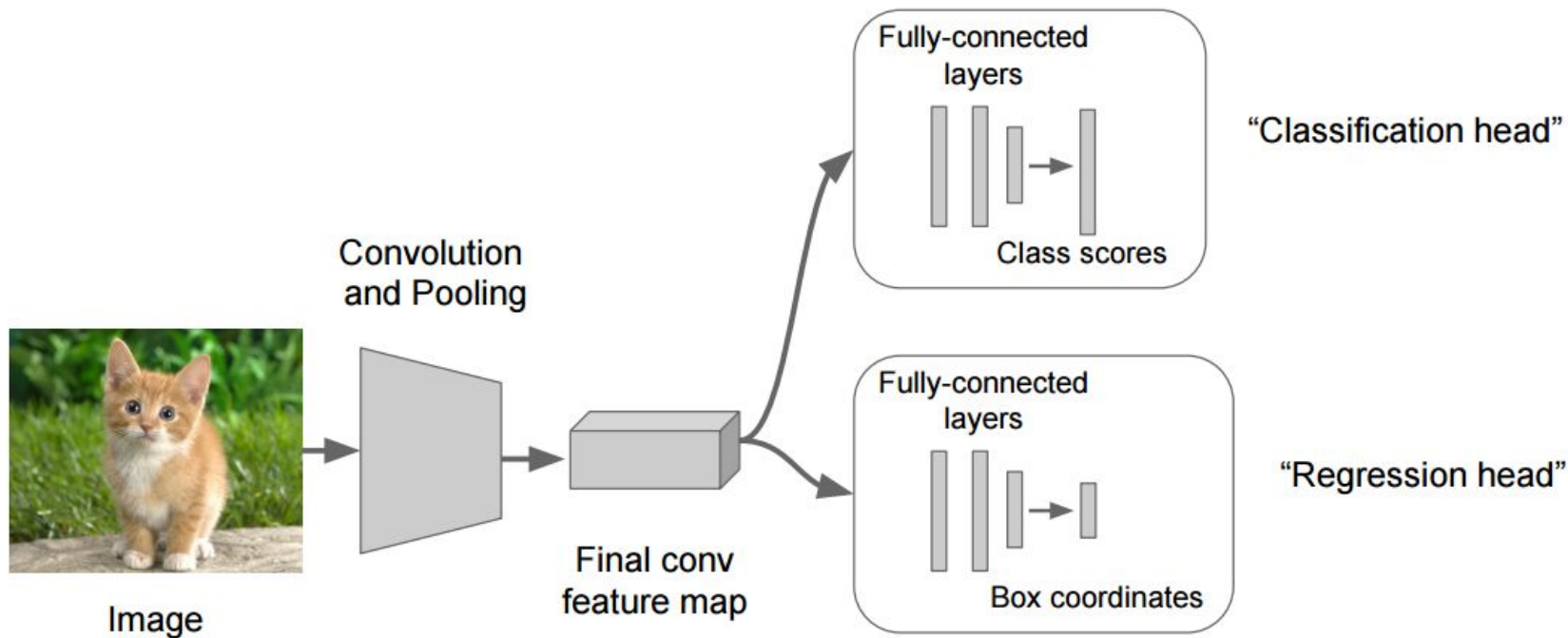


# CNN's



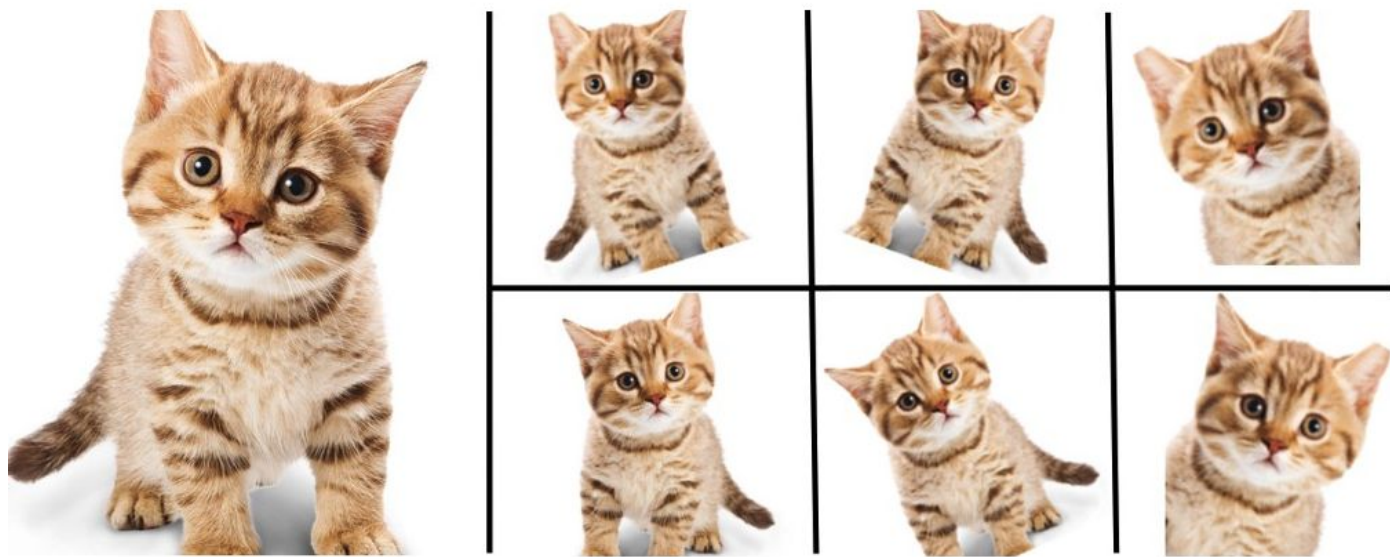
# CNN's

→ Classificar e Localizar



# CNN's

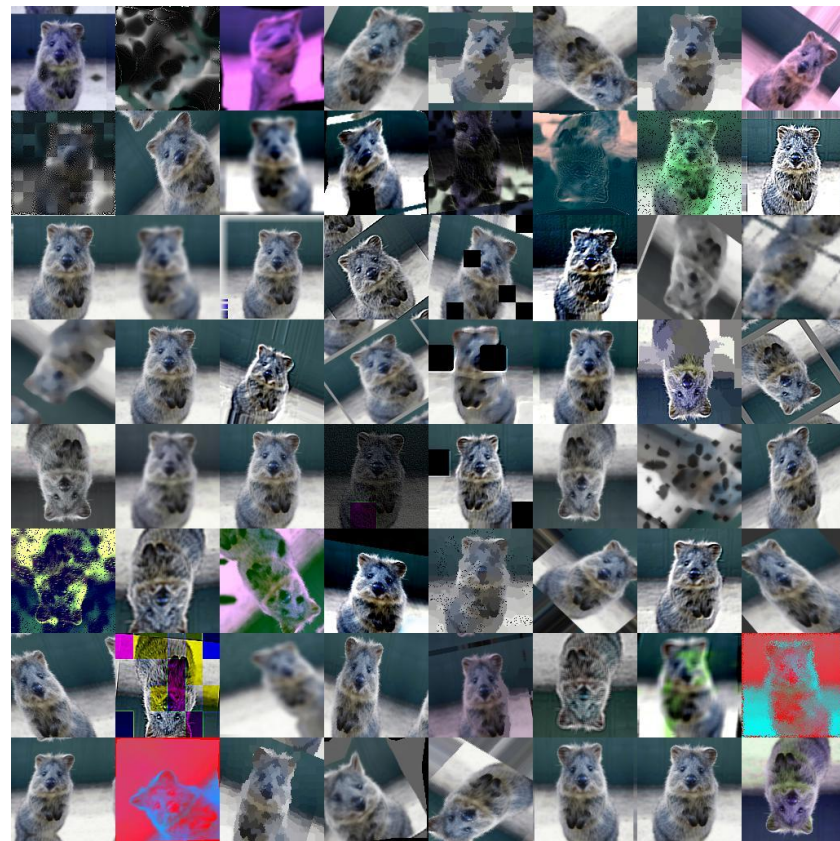
→ Image Augmentation



## Enlarge your Dataset

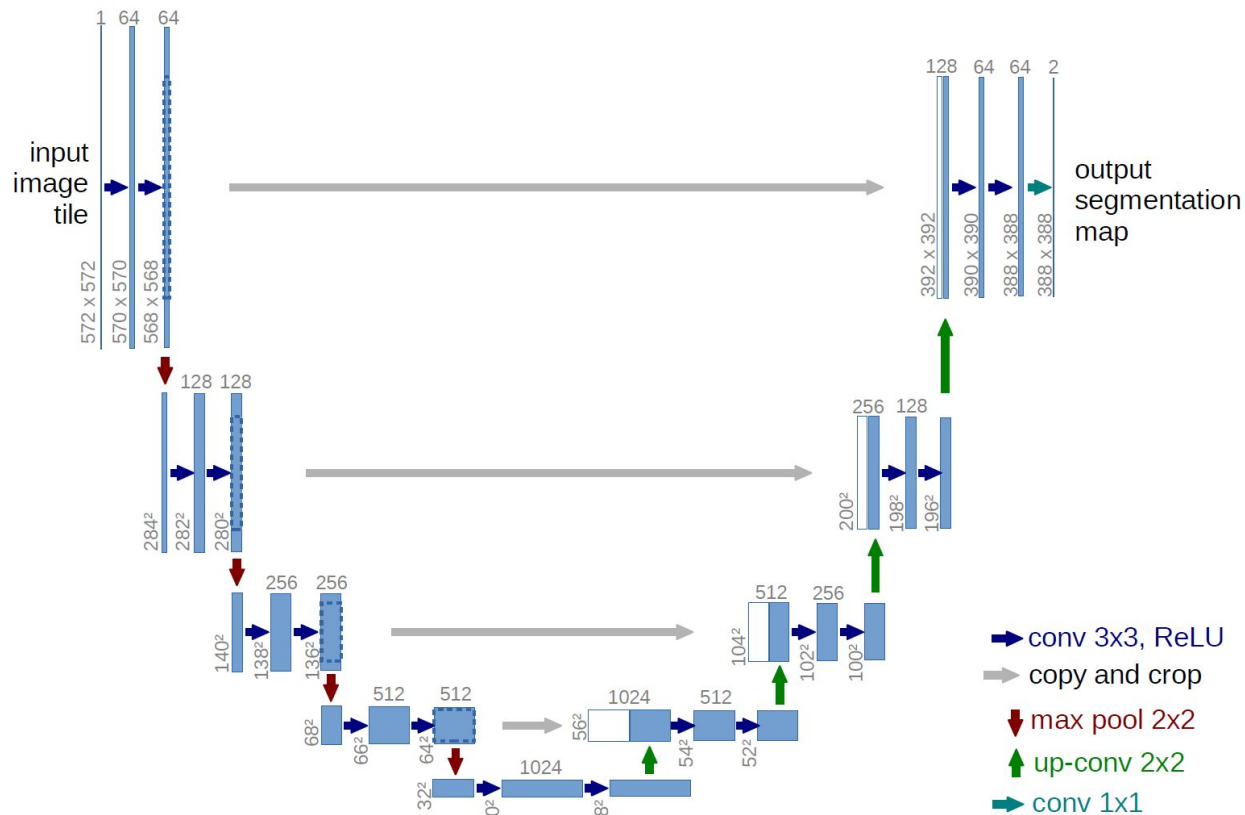
# CNN's

→ Image Augmentation



# CNN's

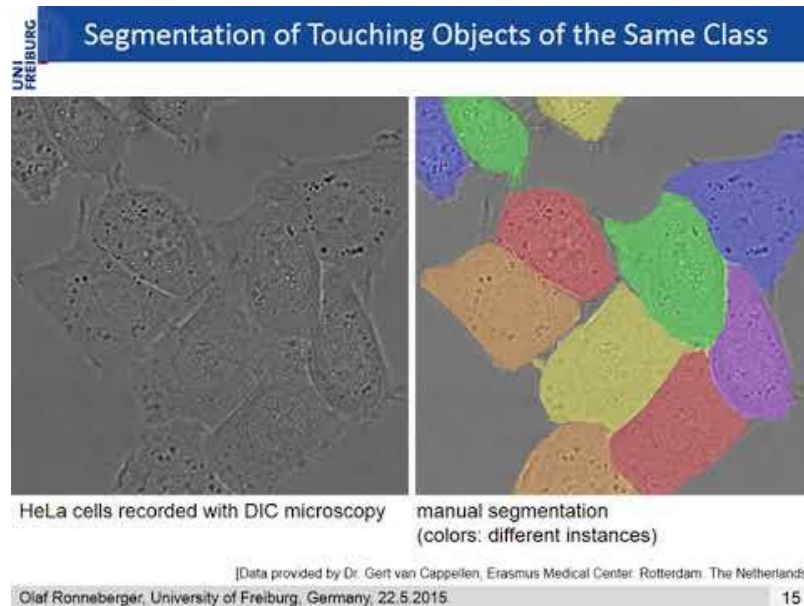
→ U-Net



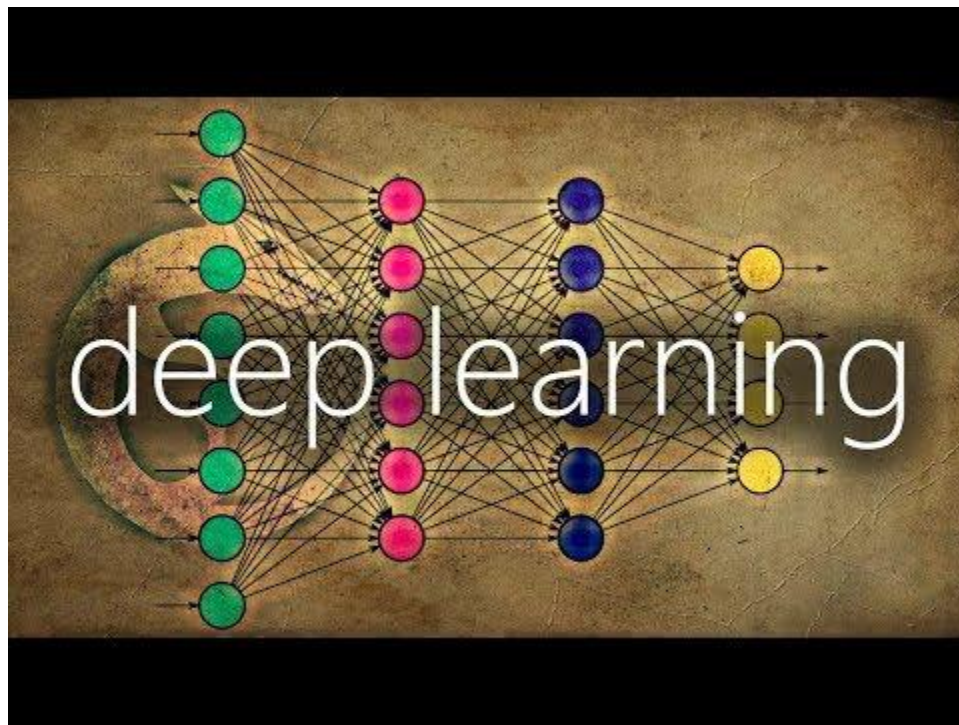


# CNN's

→ U-Net



# CNN's



# CNN's - Atividade 1

Clique [aqui](#) para abrir a atividade



# CNN's - Atividade 2

Clique [aqui](#) para abrir a atividade