Computer Vision and Artificial Intelligence for robots by Carbon Robotics

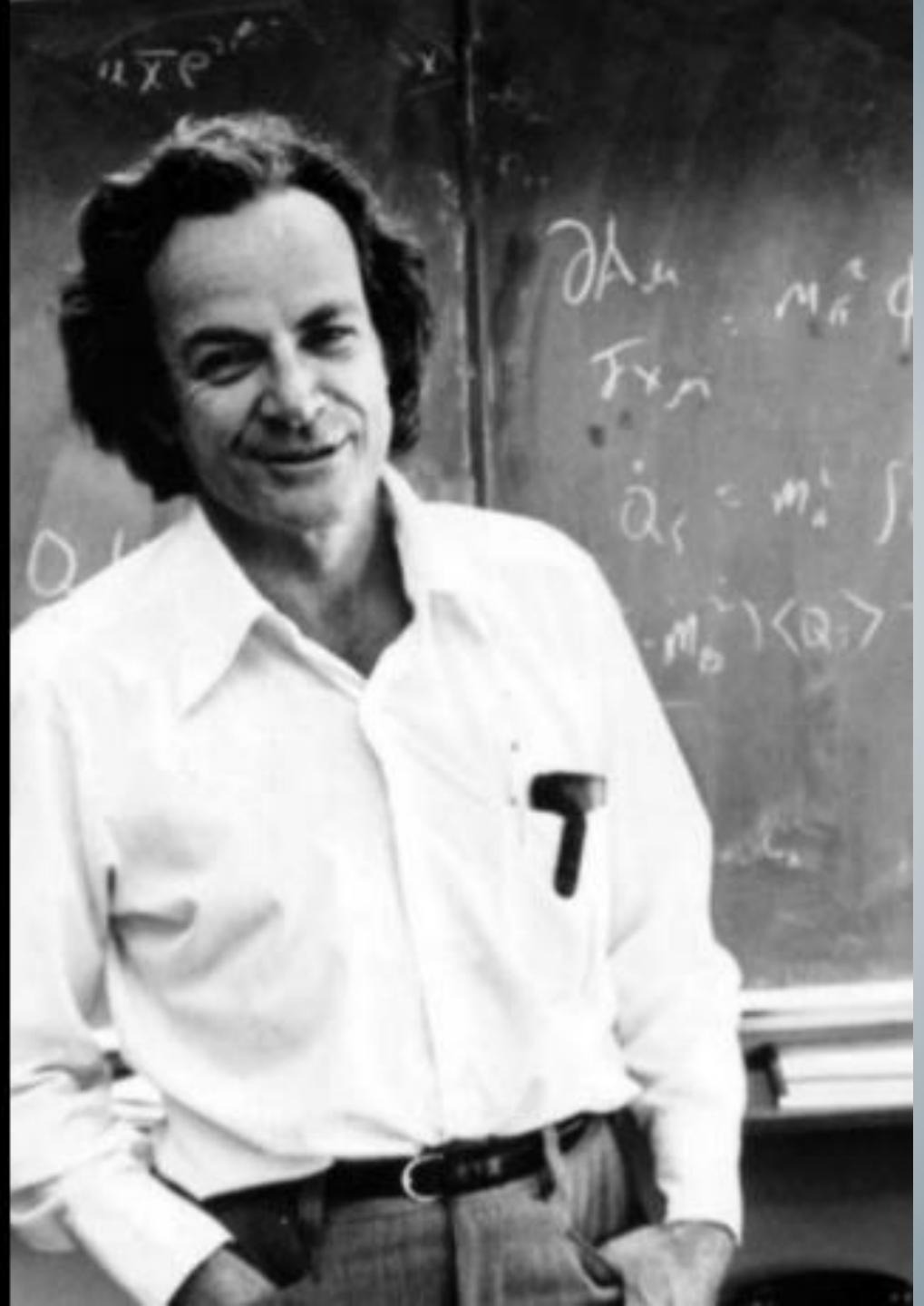
M. EN C. RUBÉN ALVAREZ

Código QR

https://github.com/bioruben/TalentLand2019

What I cannot build, I do not understand.

– Richard Feynmann



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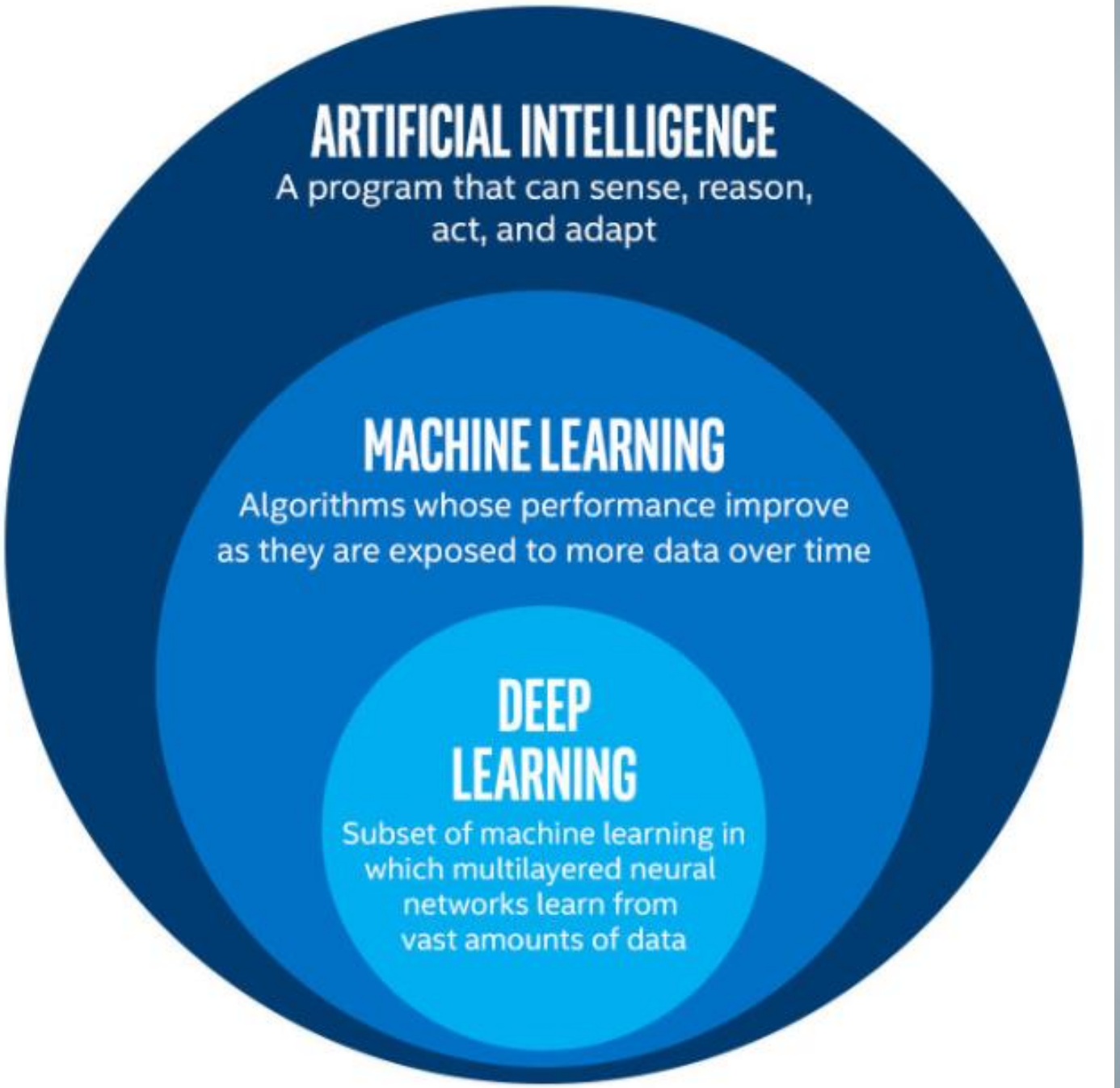

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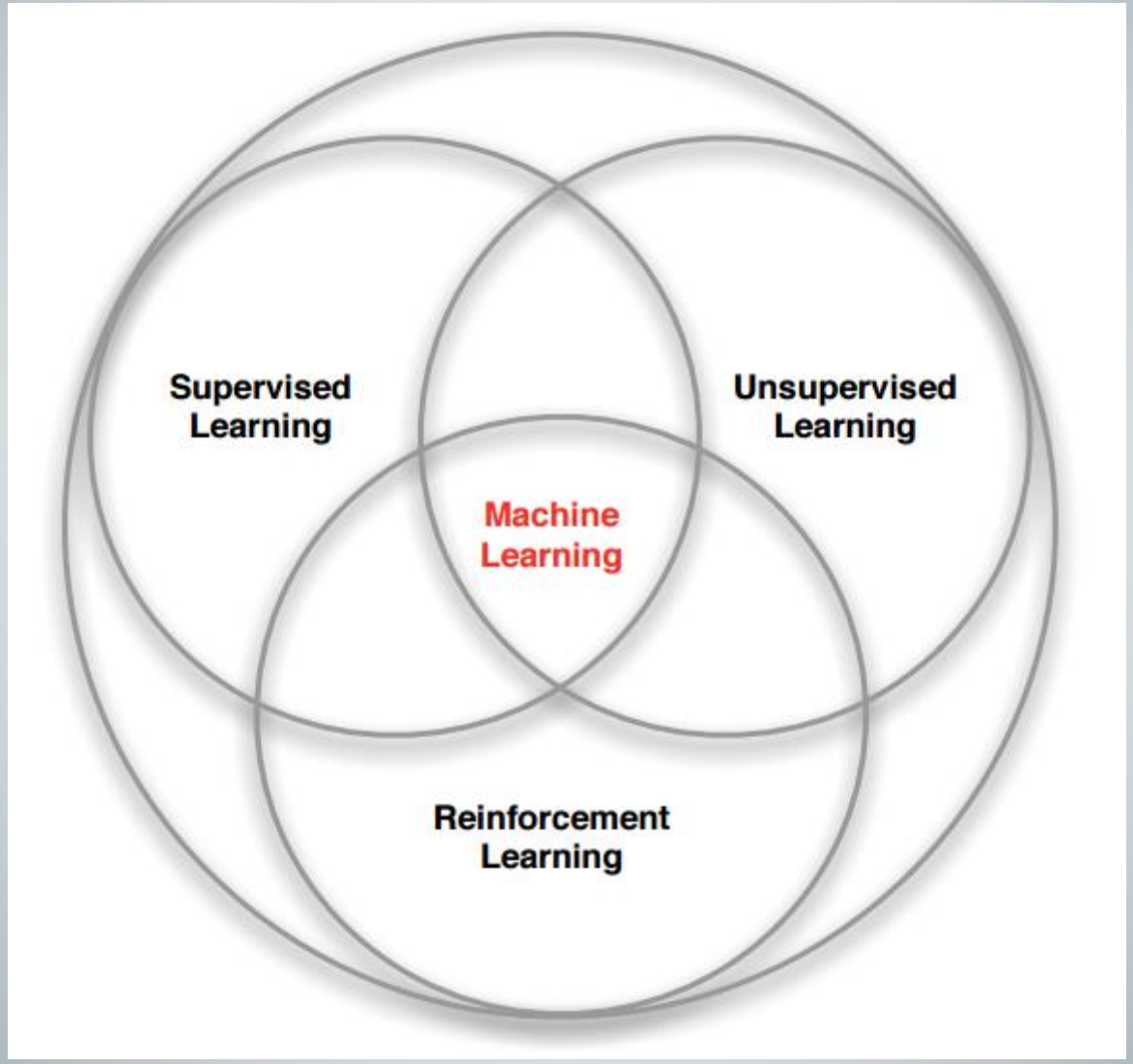

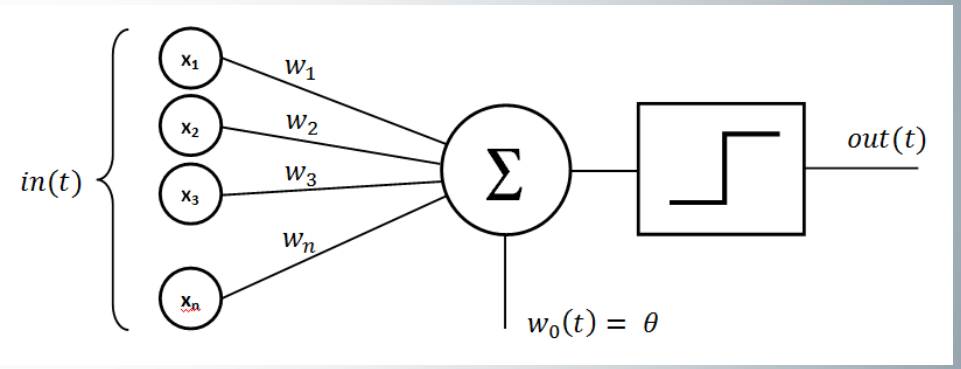

- Frank Rosenblatt (1928-1971)

Mark 1 Perceptron in 1960

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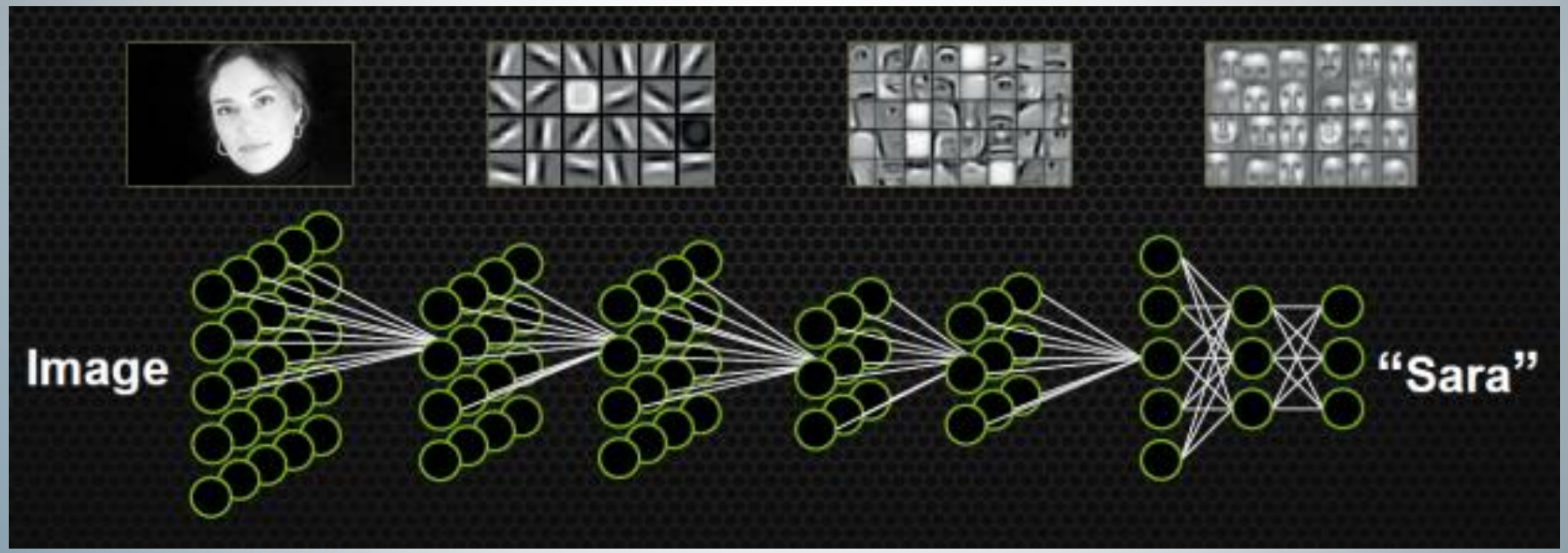

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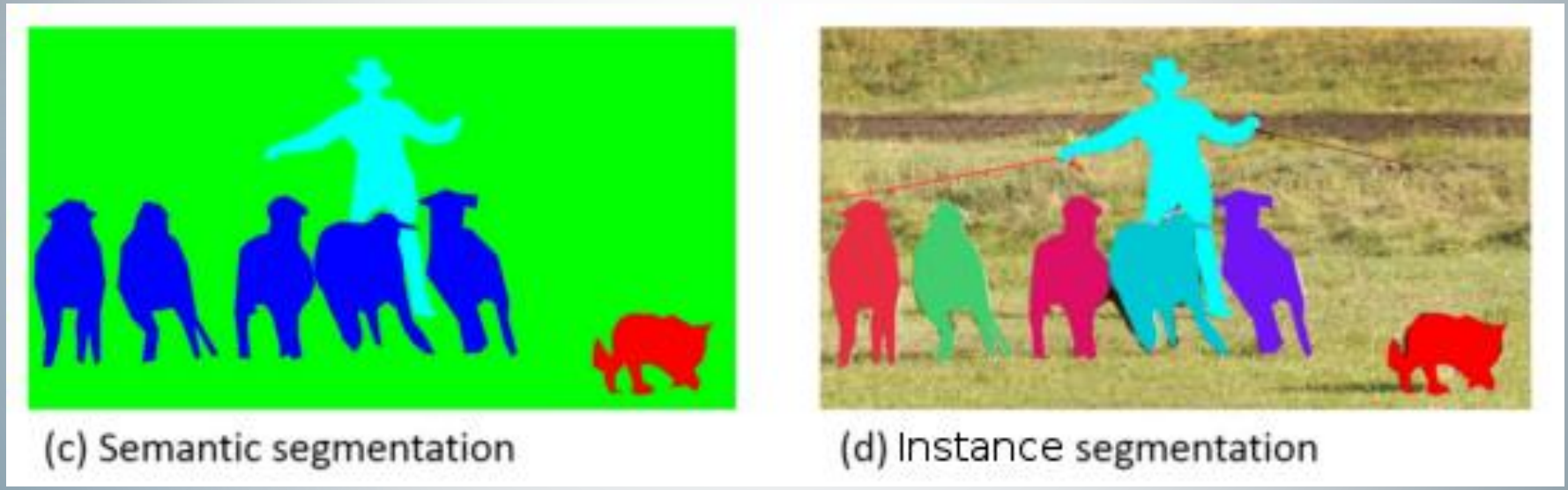
¿Porqué se necesitan grandes cantidades de datos para el entrenamiento?

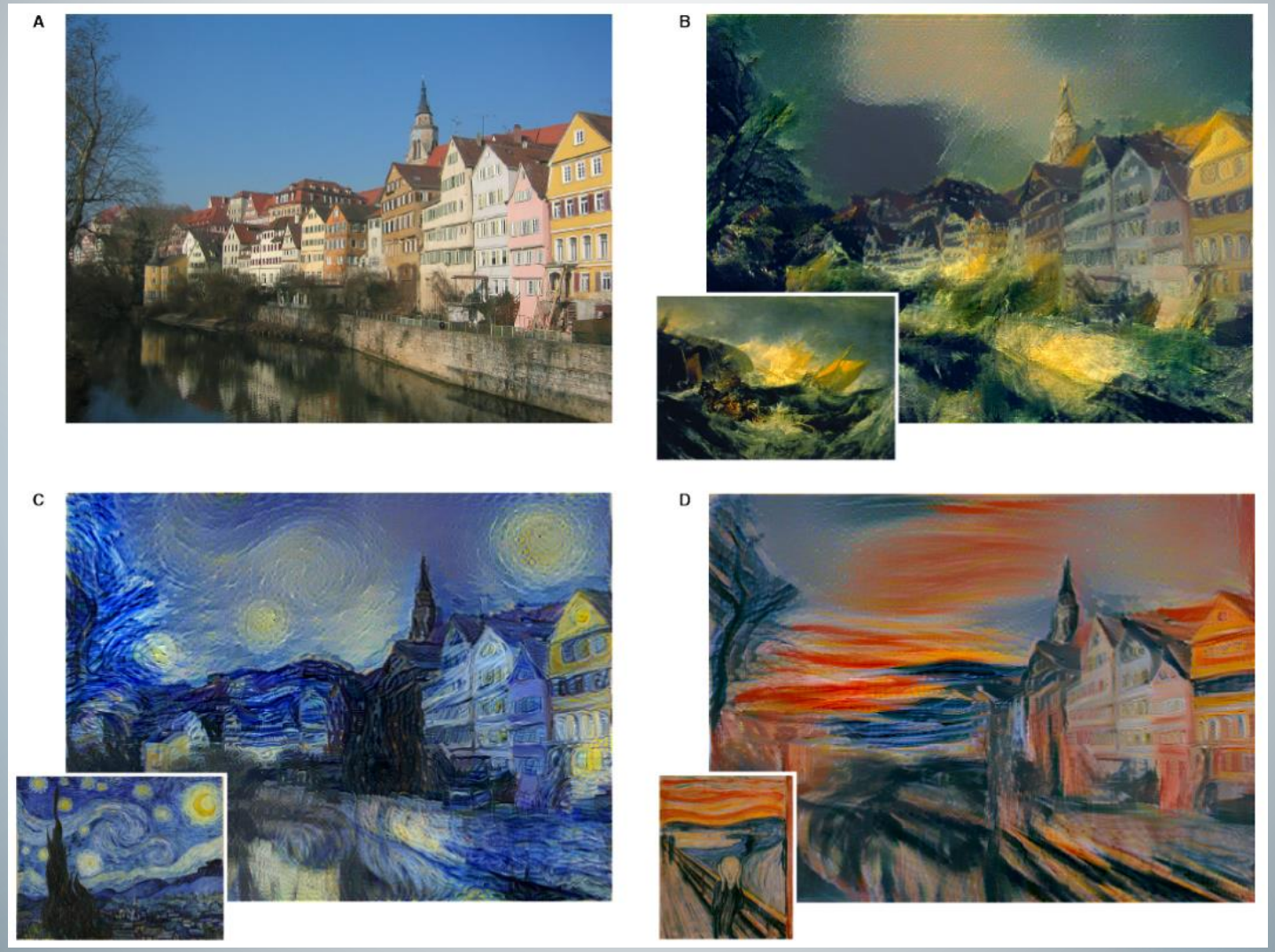
Aplicaciones



(c) Semantic segmentation

(d) Instance segmentation

Aplicaciones



Aplicaciones

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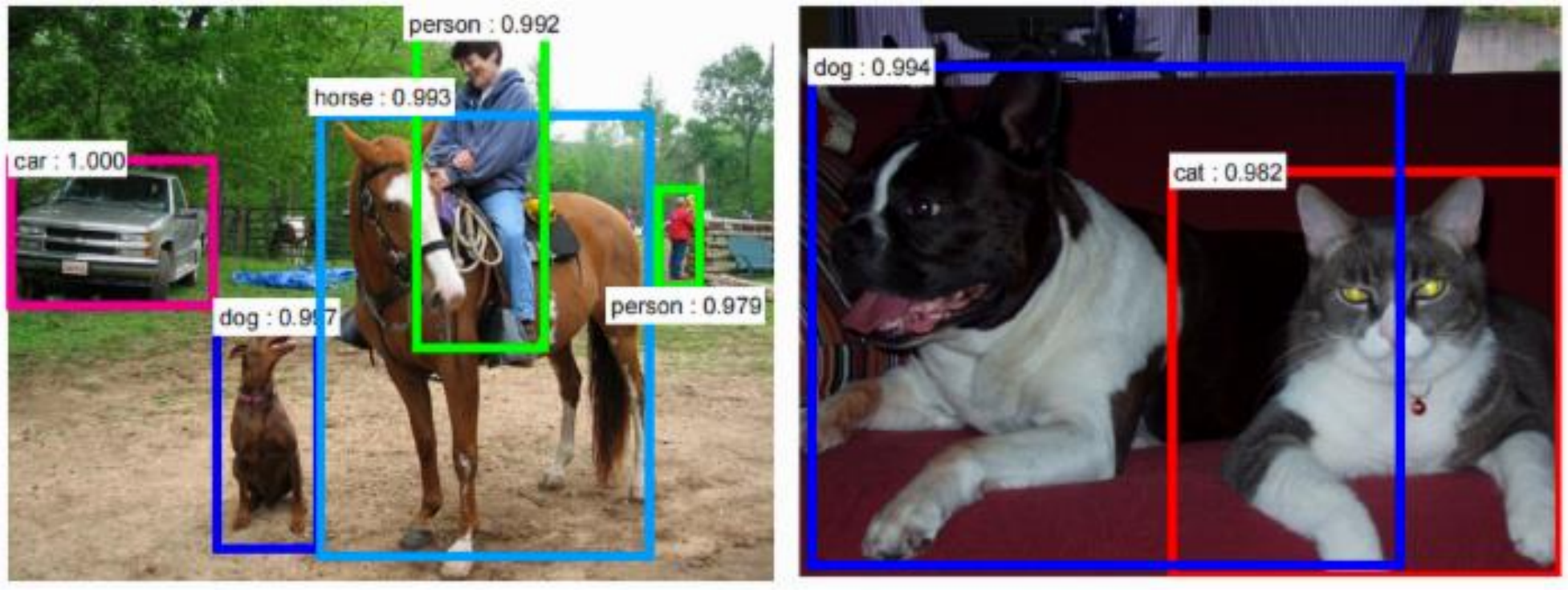
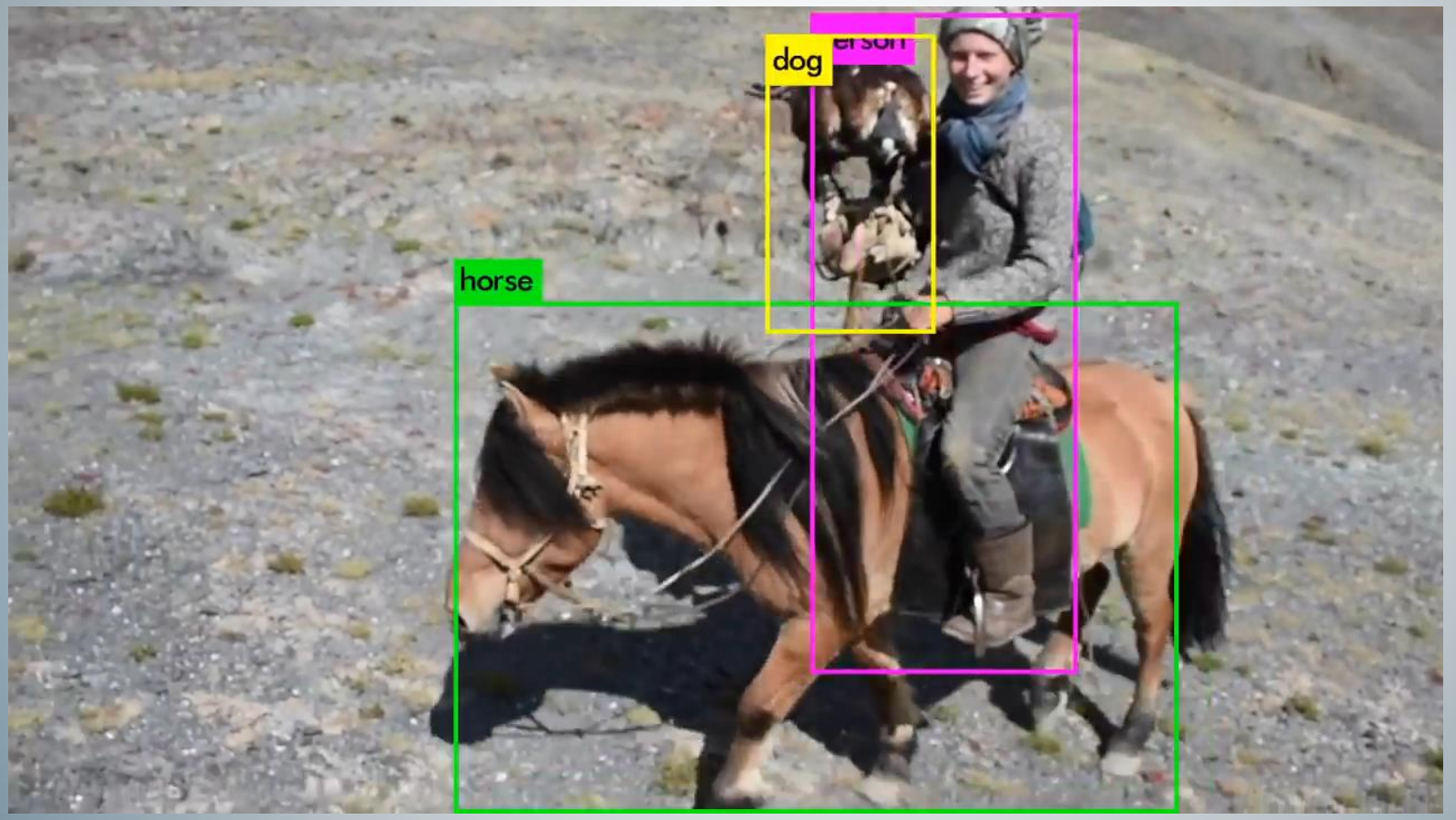
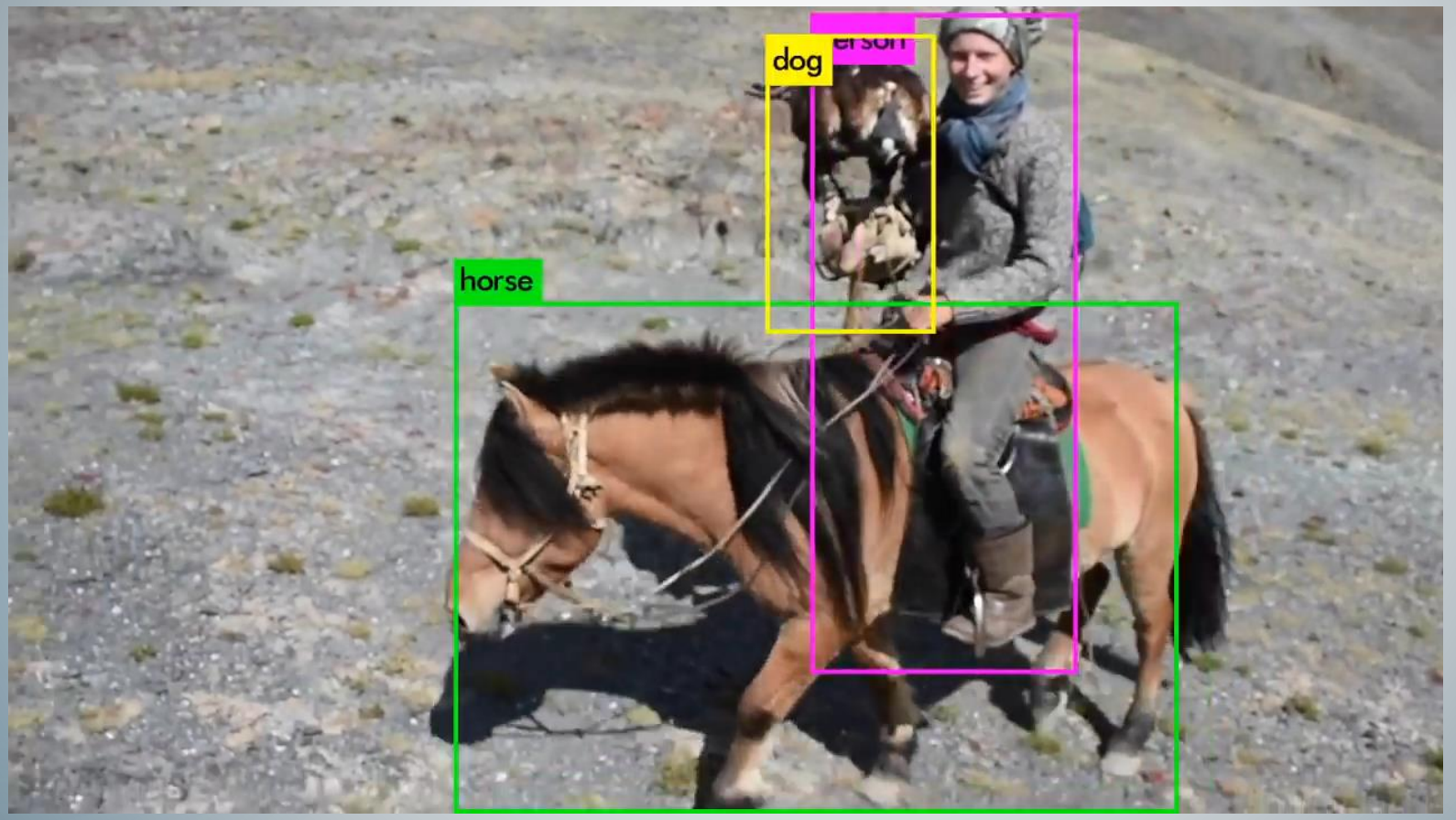



dog
horse

Ejemplo

- Video


dog
horse

Pero, si vemos de cerca…

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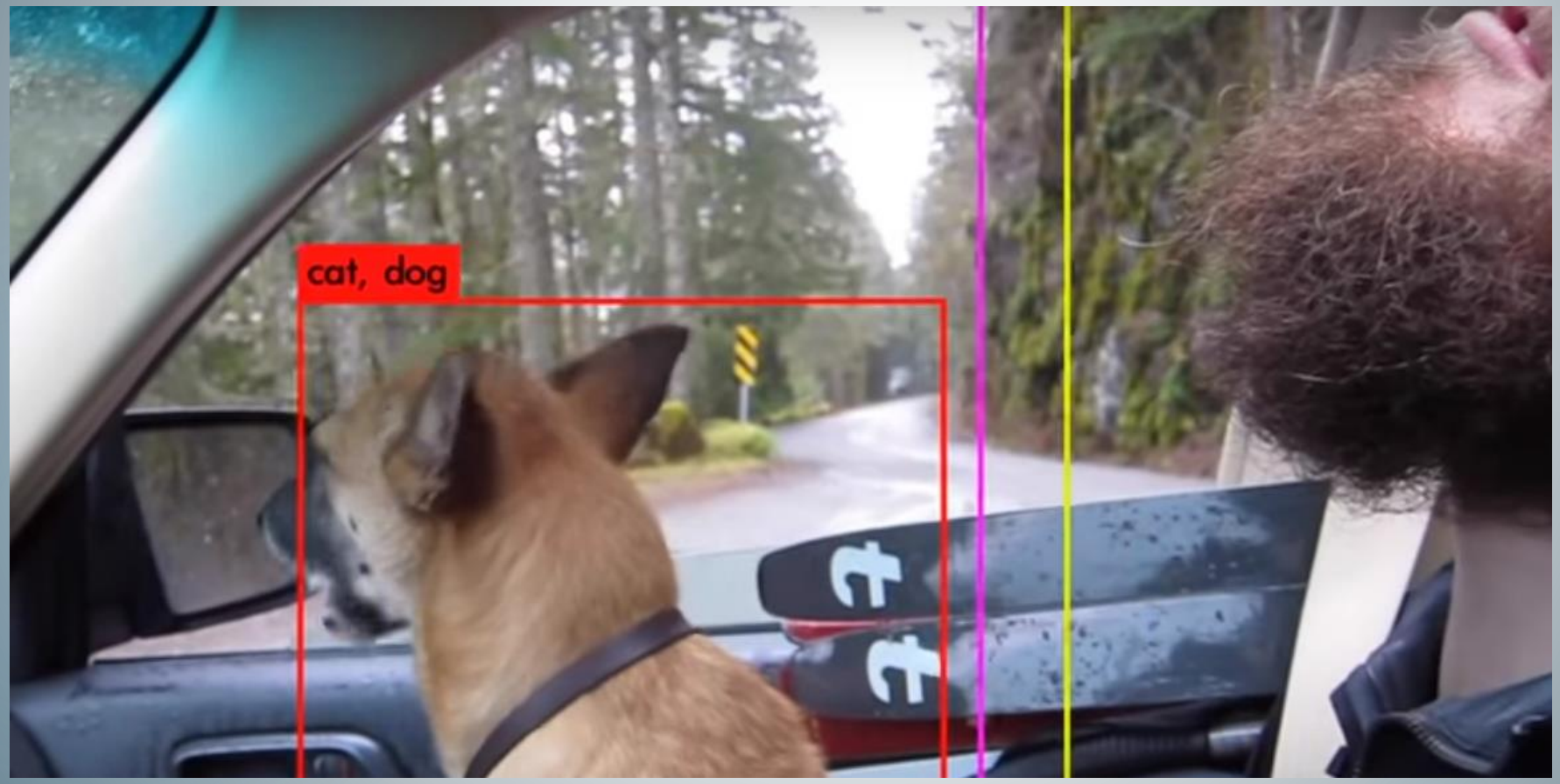

model: overfits on training data

world: new data

model:

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¿Por qué?

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Redes Neuronales Convolucionales (CNN)

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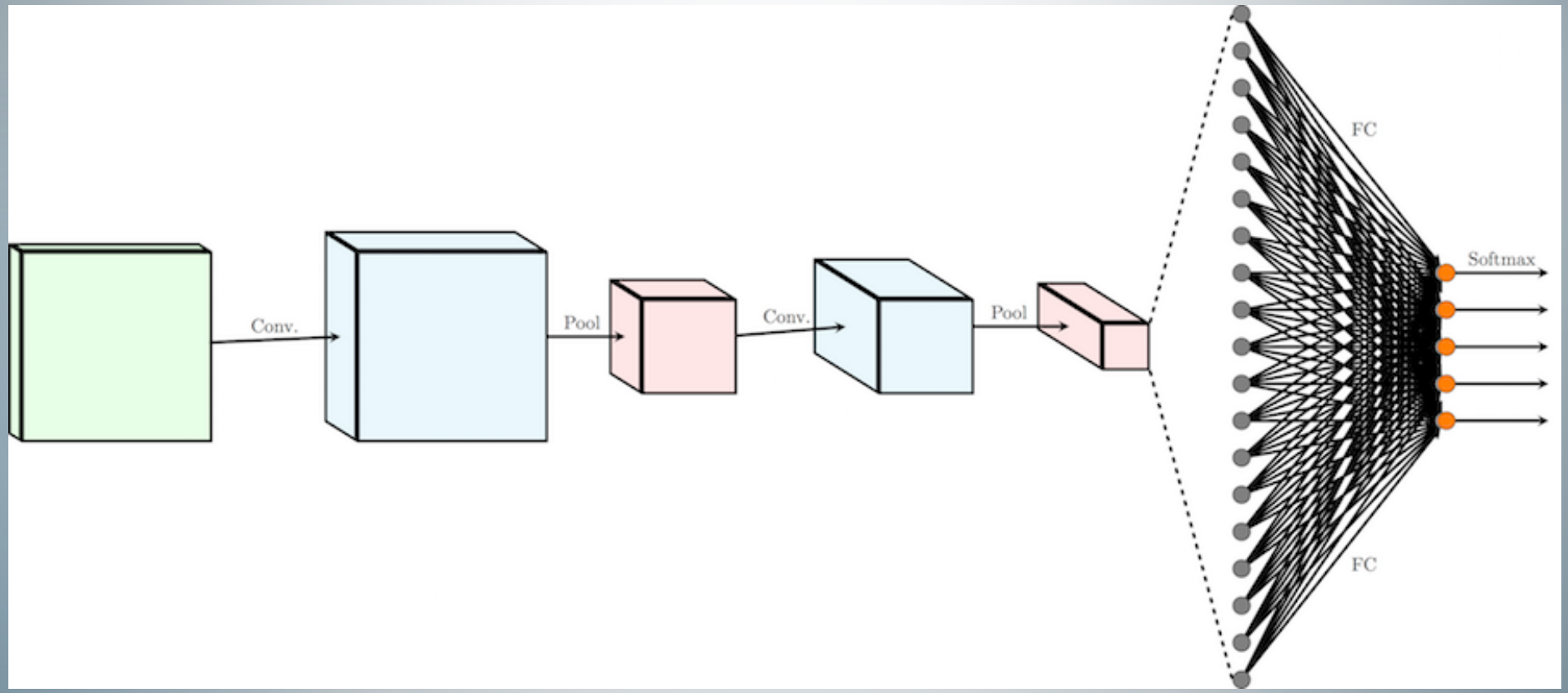
Redes Neuronales Convolucionales (CNN)



¿Qué es la convolución?

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¿Qué es la convolución?

$$(f * g)(t) = \int_{\infty}^{\infty} f(\eta) g(t - \eta)\, d\eta$$

Arquitectura de una CNN

- *Convolutional Layer*
- *Pooling Layer*
- *Flatten Layer*
- *Activation Layer*
- *Fully Connected Layer*
- *…*

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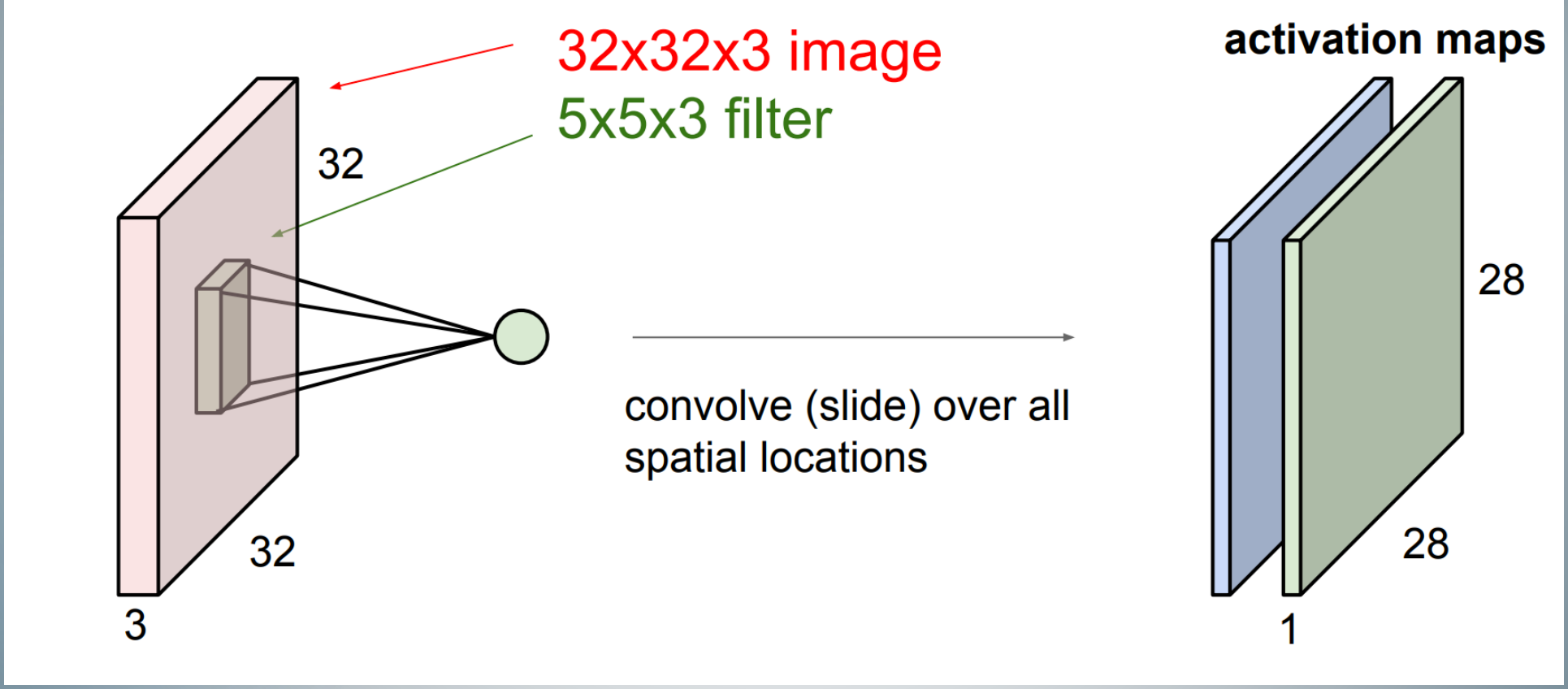
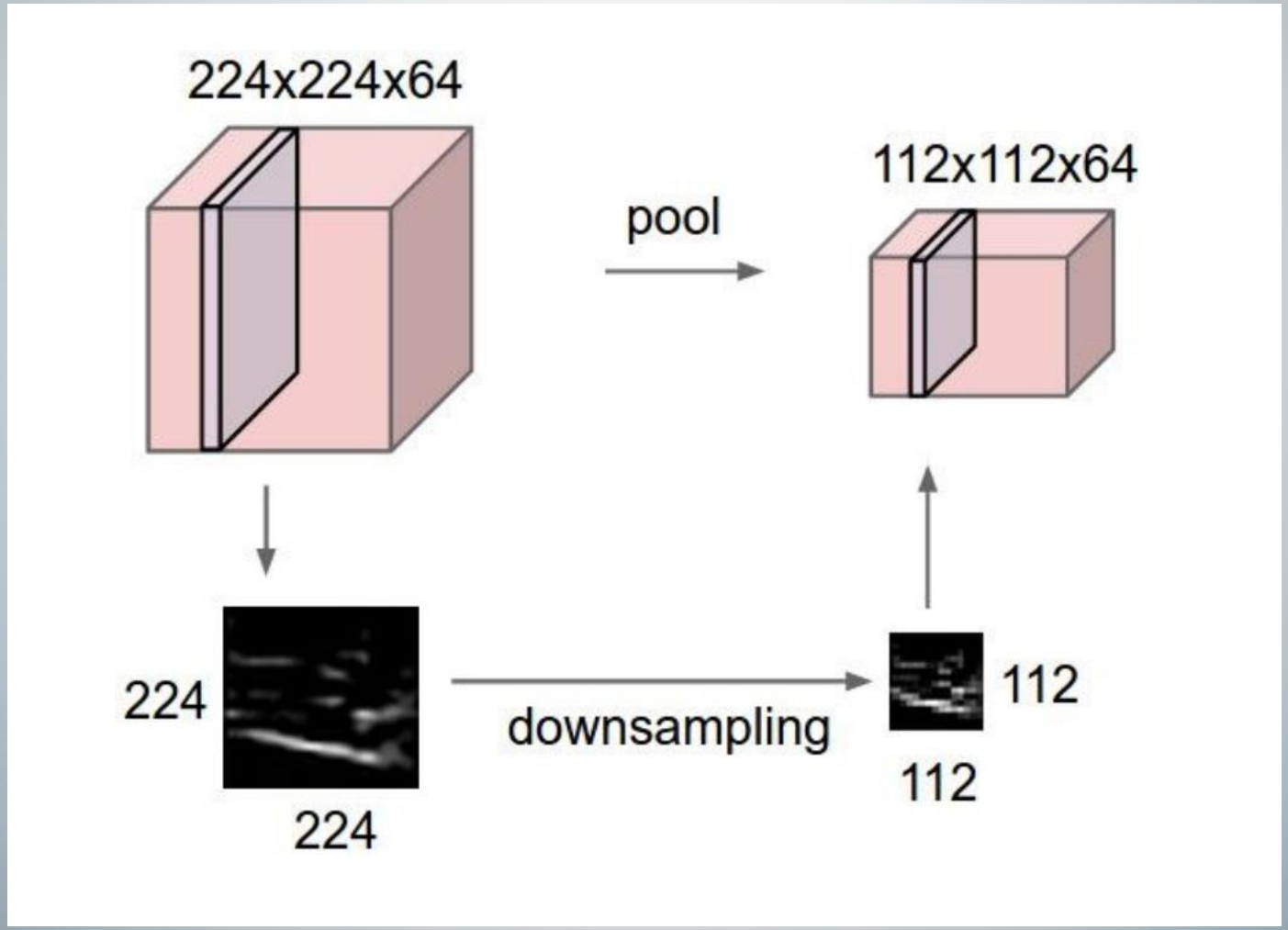
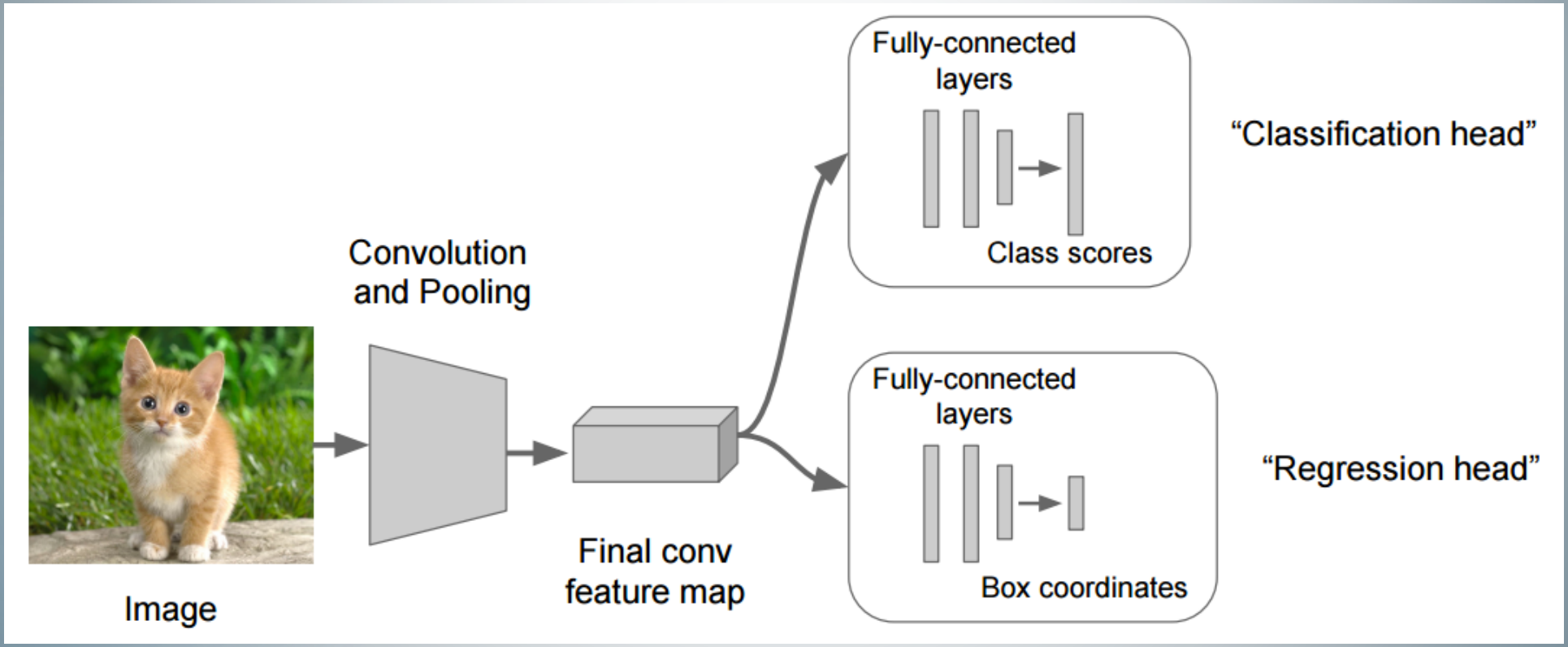
Activation Map CNN



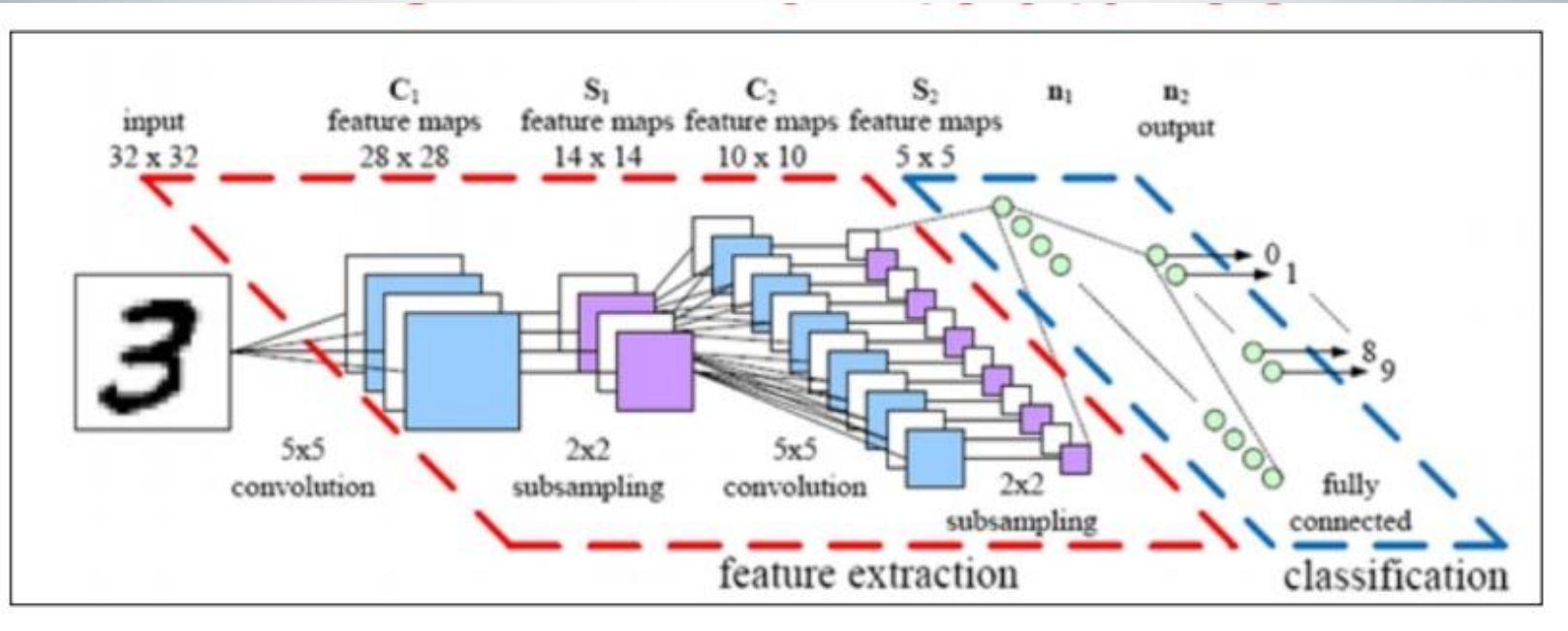
Pooling Layer



Fully Connected Layer



Deep Learning



¿Qué es la convolución?

$$C_p^1(i,j) = \sigma\left(\sum_{u=-2}^{2}\sum_{v=-2}^{2} I(i-u, j-v)k_{1,p}^1(u,v) + b_p^1\right)$$

Pero miremos de cerca la convolución

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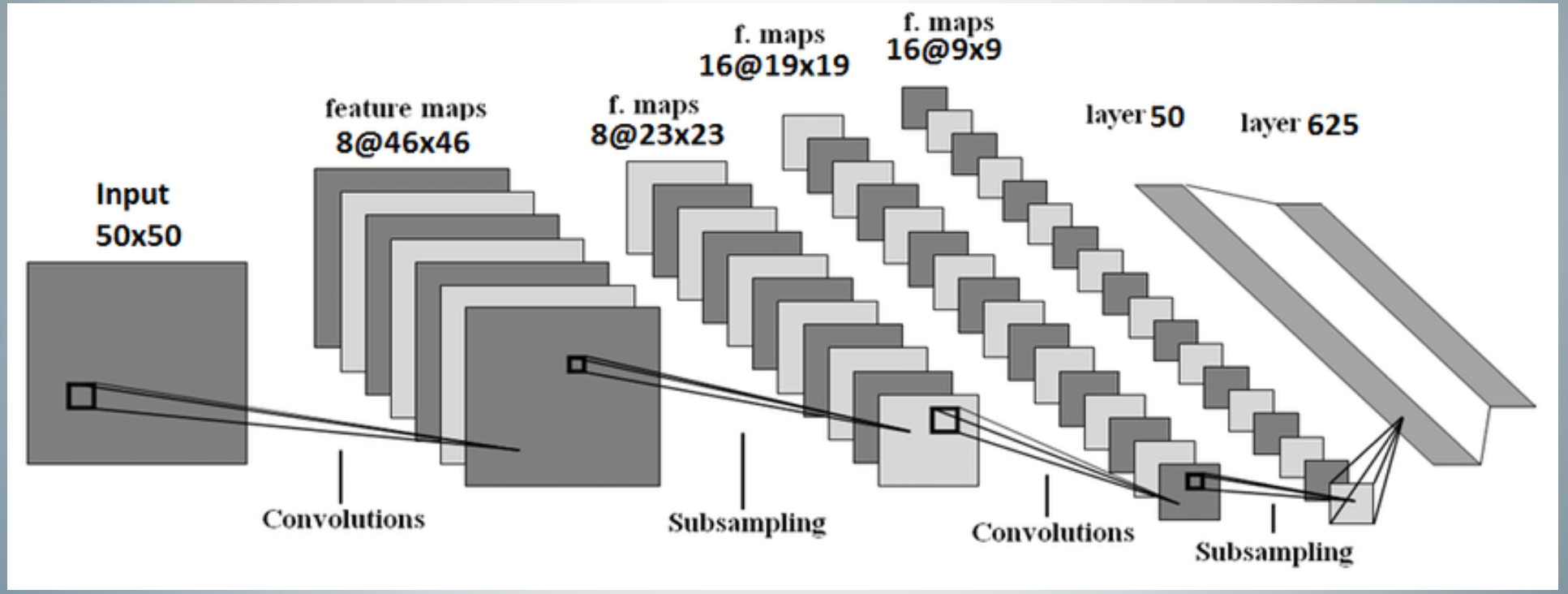
CNN


Input
50x50
feature maps
8@46x46
f. maps
8@23x23
f. maps
16@19x19
f. maps
16@9x9
layer 50
layer 625
Convolutions
Subsampling
Convolutions
Subsampling

Ejercicio

- Setup Yolo

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Y Reinforcement Learning

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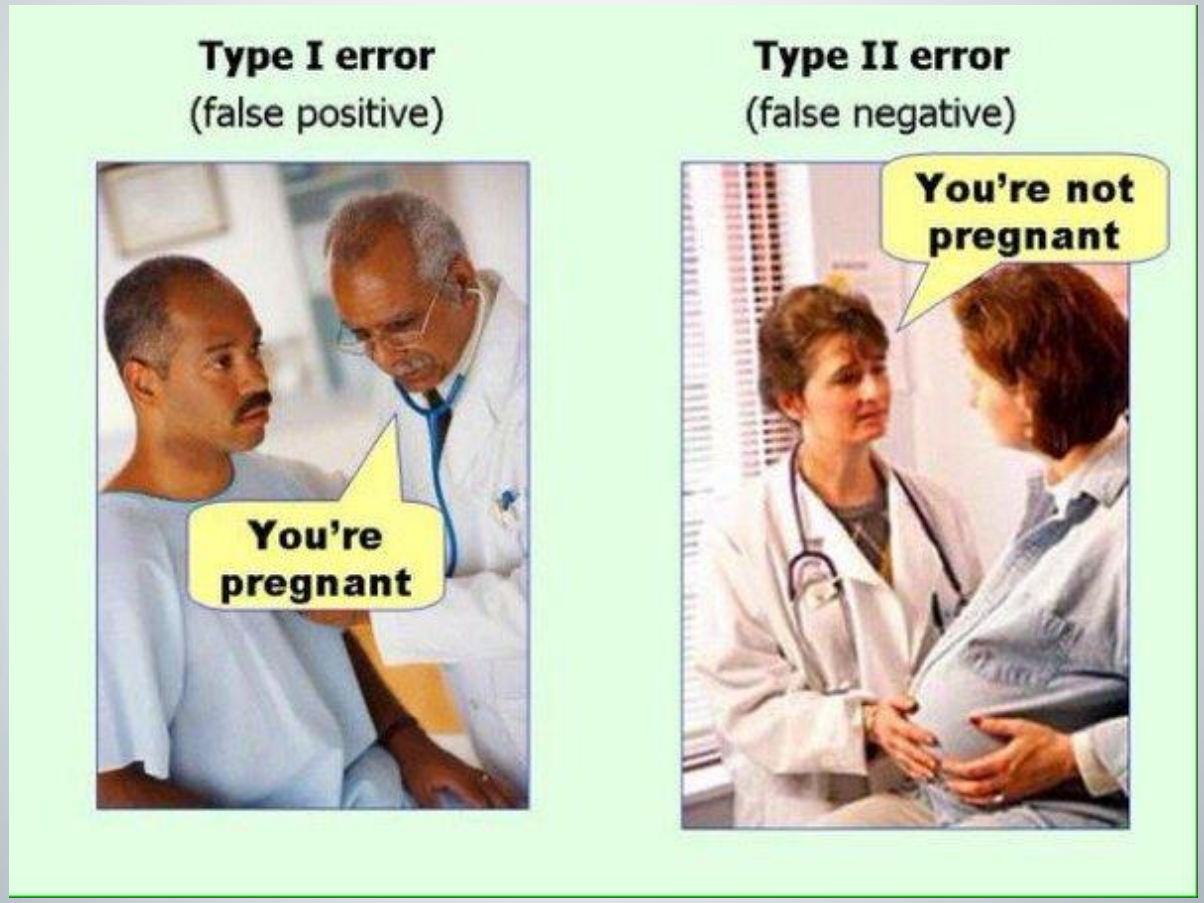
The Bellman Equation

$$V(s) = \max_a \left(R(s,a) + \gamma \sum_{s'} P(s,a,s')V(s') \right)$$

Entonces…

Accuracy


Type I error
(false positive)
You're pregnant
Type II error
(false negative)
You're not pregnant

Accuracy

	Predicción del Modelo: Positivo	Predicción del Modelo: Negativo
Verdad: Positivo	TP	FN
Verdad: Negativo	FP	TN

Accuracy

$$\text{Precision} = \frac{tp}{tp + fp}$$

$$\text{Accuracy} = \frac{tp + tn}{tp + tn + fp + fn}$$

$$\text{Recall} = \frac{tp}{tp + fn}$$

$$\text{F1} = 2 * \frac{\text{precision} * \text{recall}}{\text{precision} + \text{recall}}$$

Cuál es la base de todos los sistemas de Machine Learning

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Cuál es la base de todos los sistemas de Machine Learning

Ejercicio

- Clasificación

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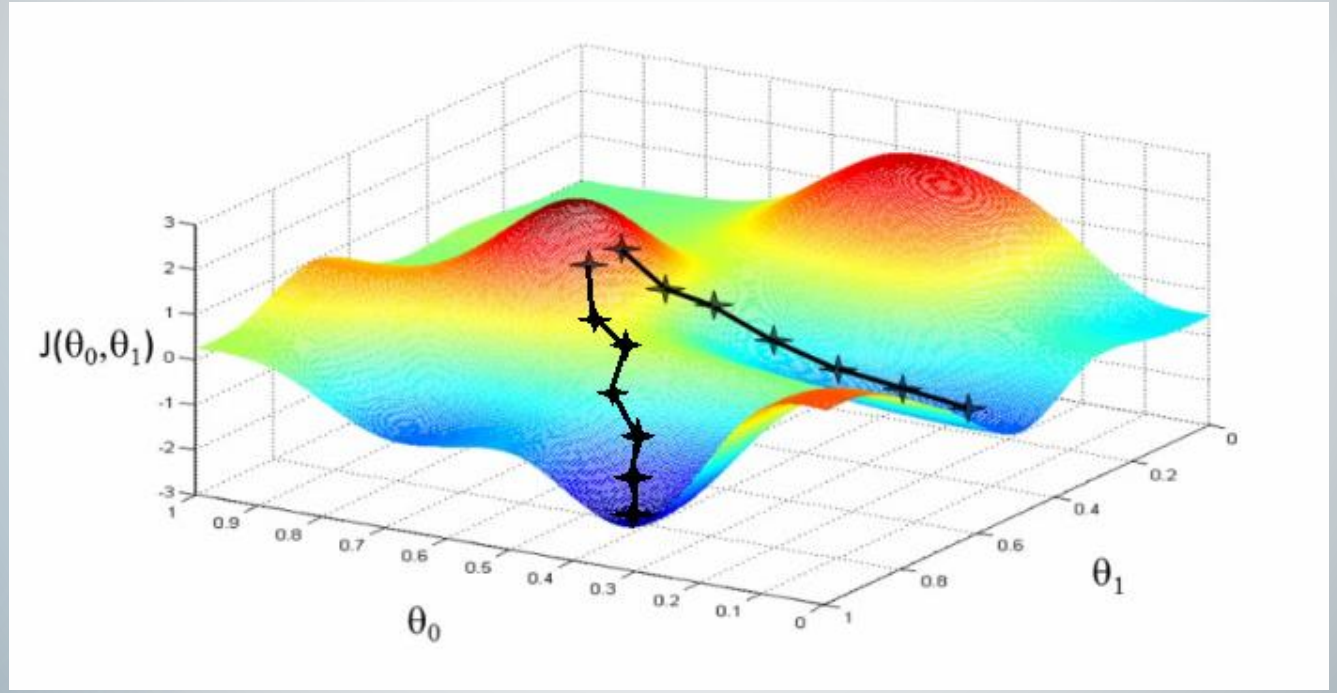
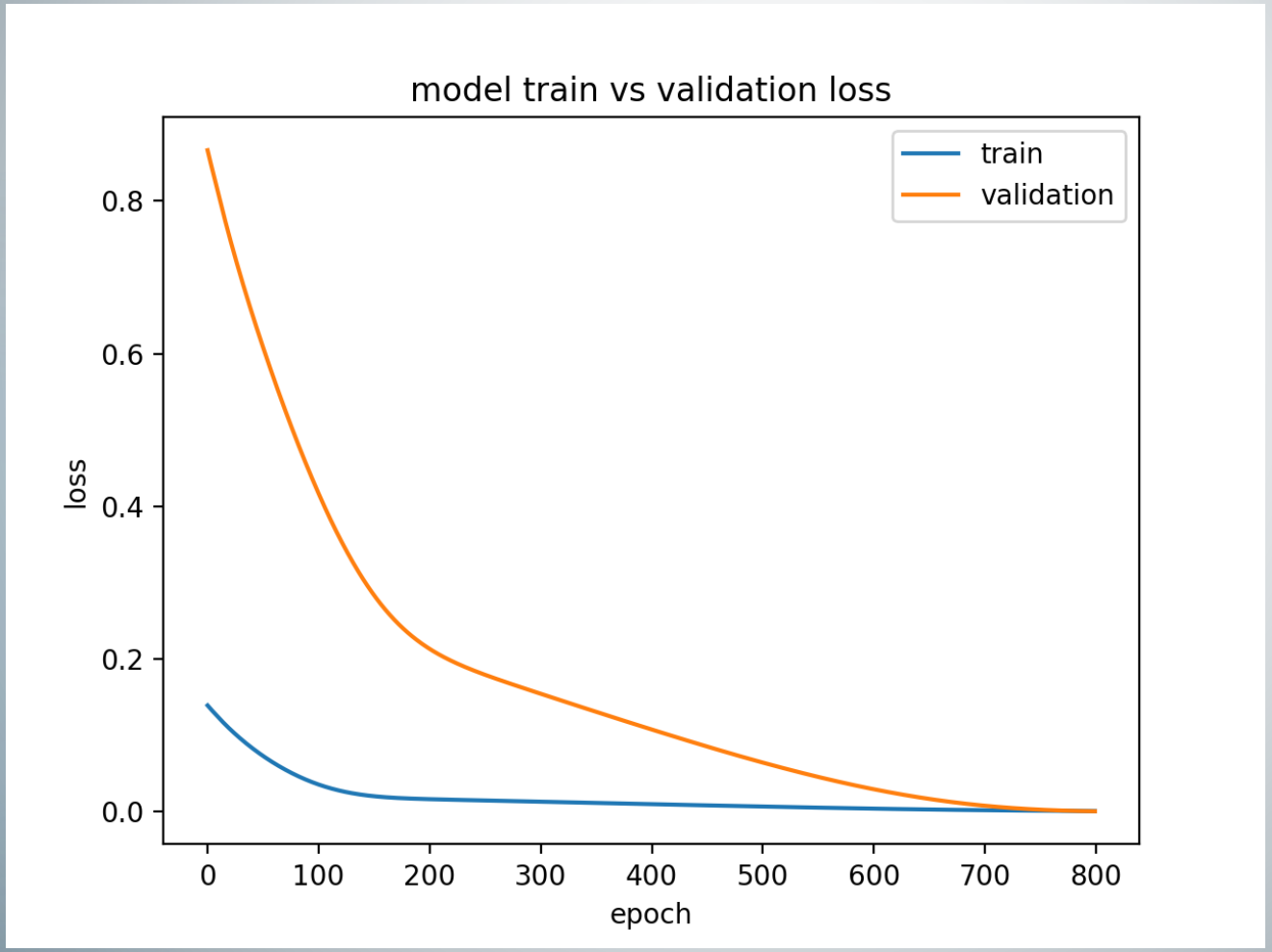
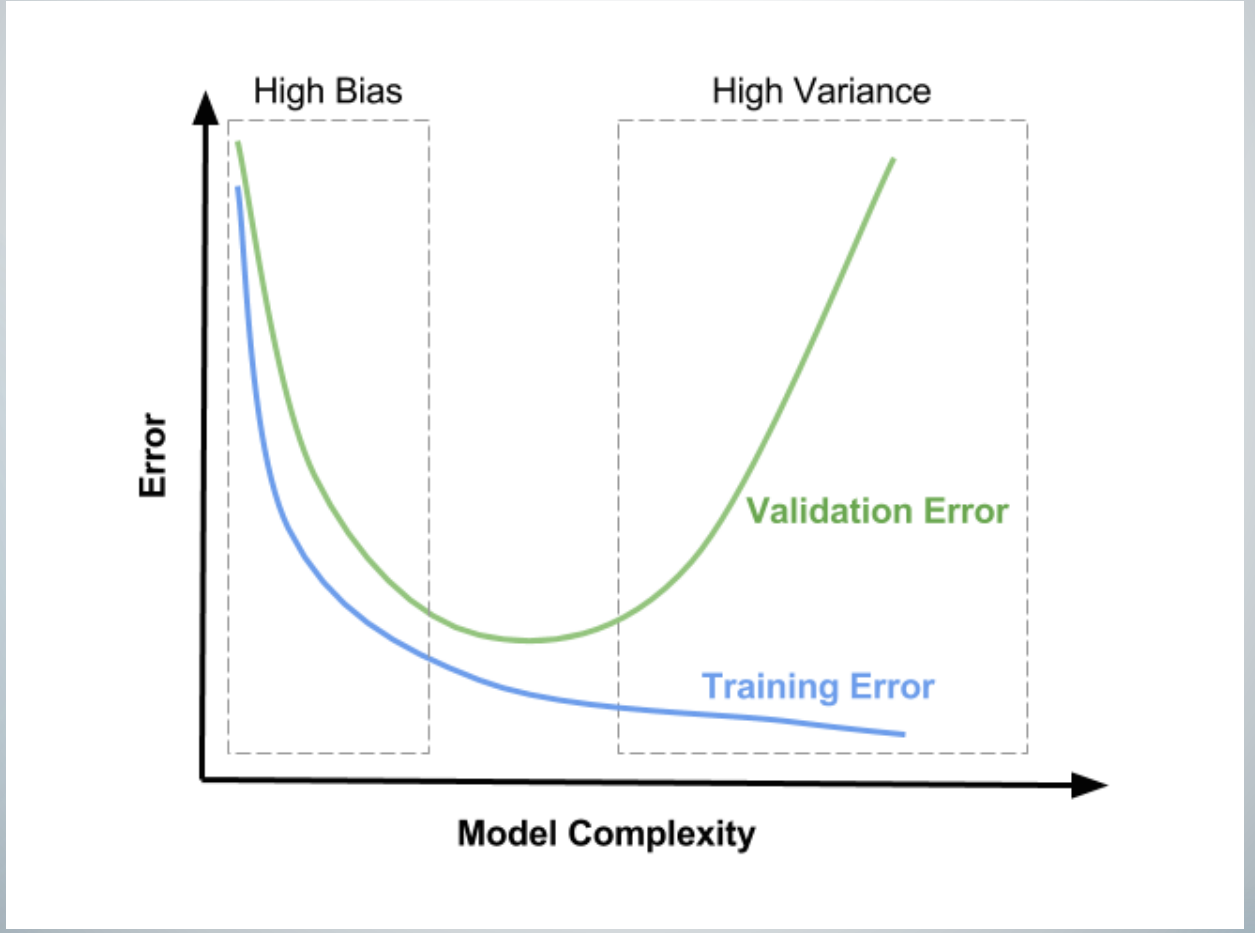
Cuál es la base de todos los sistemas de Machine Learning



Cross Validation



Cross Validation



¿Es infalible?

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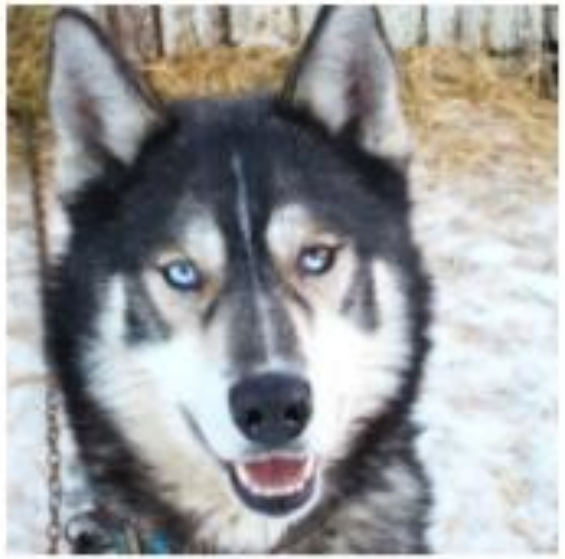
(a) Original Image (b) Explaining *Electric guitar* (c) Explaining *Acoustic guitar* (d) Explaining *Labrador*

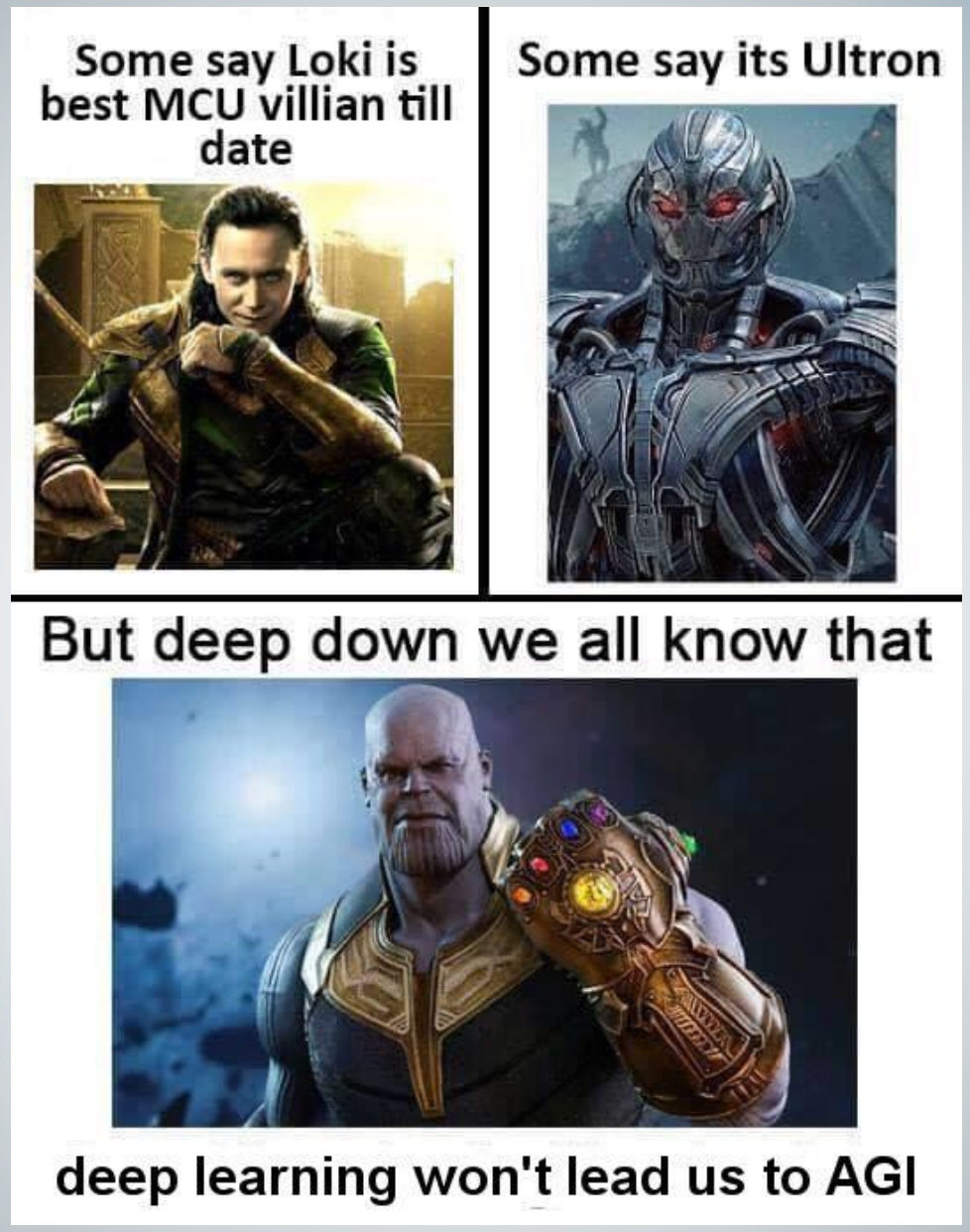
Figure 4: Explaining an image classification prediction made by Google's Inception neural network. The top 3 classes predicted are "Electric Guitar" ($p = 0.32$), "Acoustic guitar" ($p = 0.24$) and "Labrador" ($p = 0.21$)



(a) Husky classified as wolf

(b) Explanation

Figure 11: Raw data and explanation of a bad model's prediction in the "Husky vs Wolf" task.



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Entonces… ¿Las ventajas?…

En mi opinión personal

1. Percepción y reconstrucción 3D.
2. Procesamiento de imágenes.
3. Machine-Deep Learning en Computer Vision

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¿Qué necesito saber?

- Signal Processing
- Image Processing
- Óptica Geométrica
- Óptica Electromagnética
- Background matemático
- Data Science
- …

Y Modelos 3D

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"Those who can imagine anything, can create the impossible."

-Alan Turing

¿Preguntas?

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https://carbon.ai/talentland/

¡Gracias por su atención!

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