Computer Vision and Artificial Intelligence for robots by Carbon Robotics

M. EN C. RUBÉN ALVAREZ

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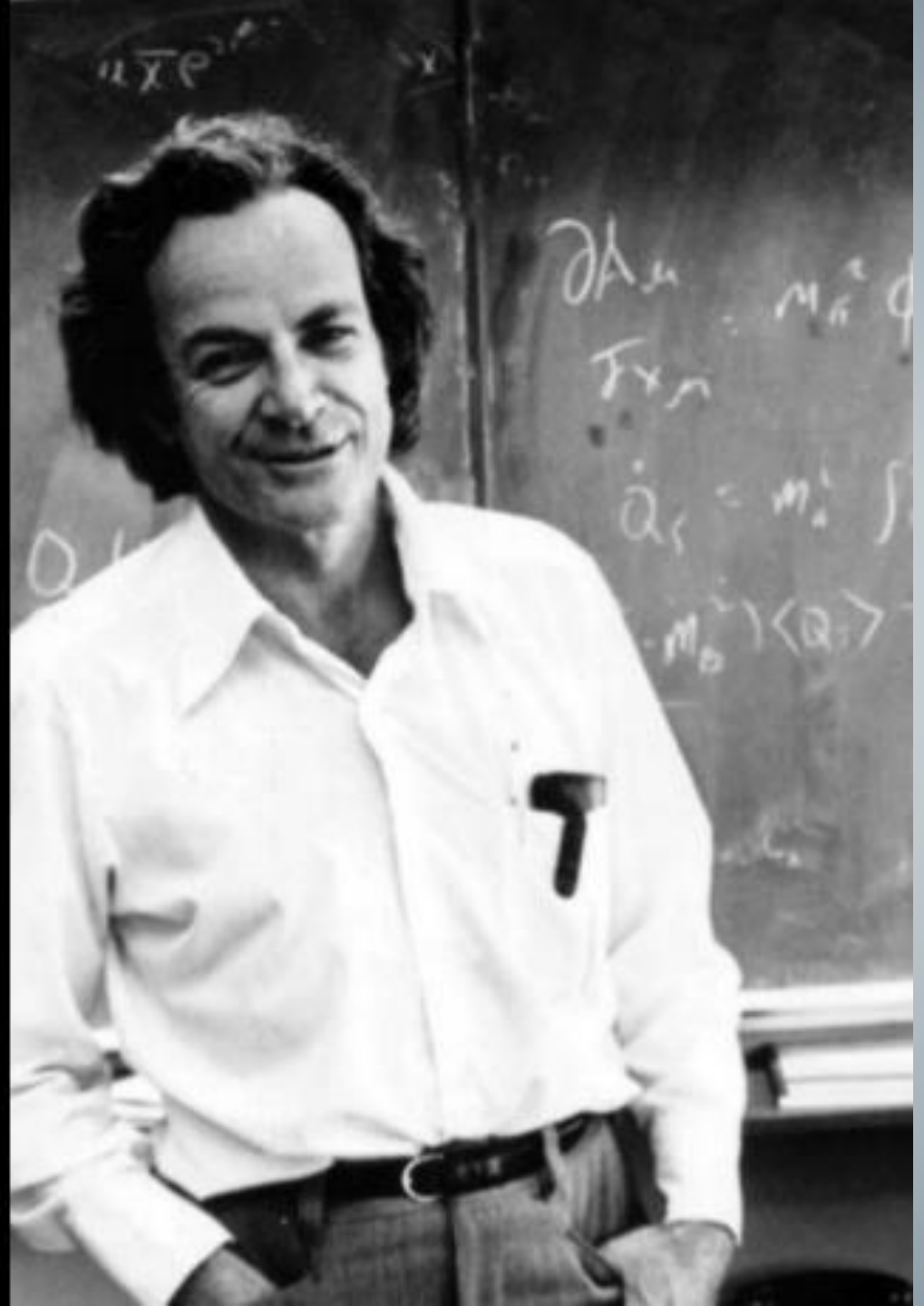
Código QR

https://github.com/bioruben/TalentLand2019

What I cannot build, I do not understand.

– Richard Feynmann



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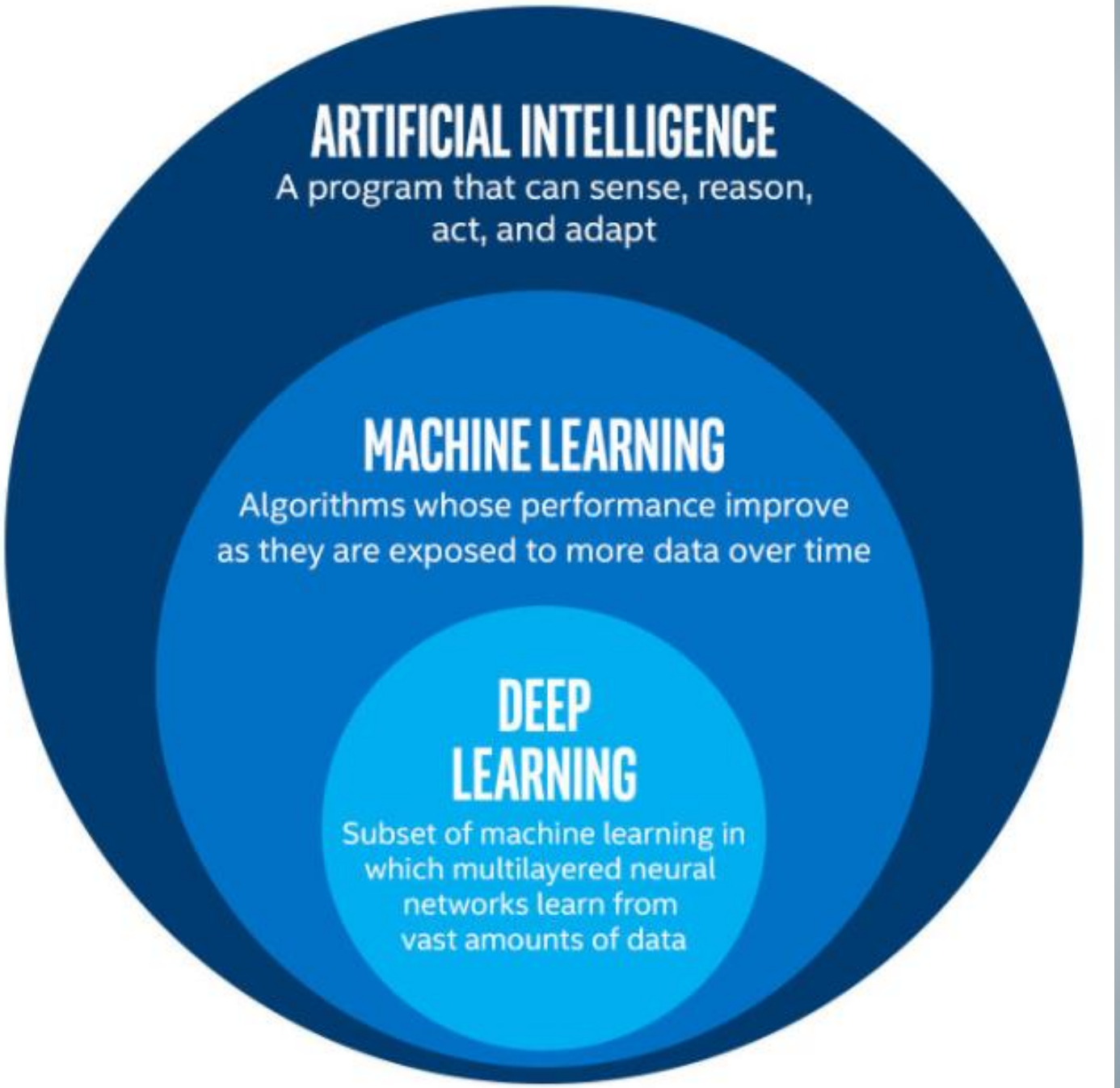

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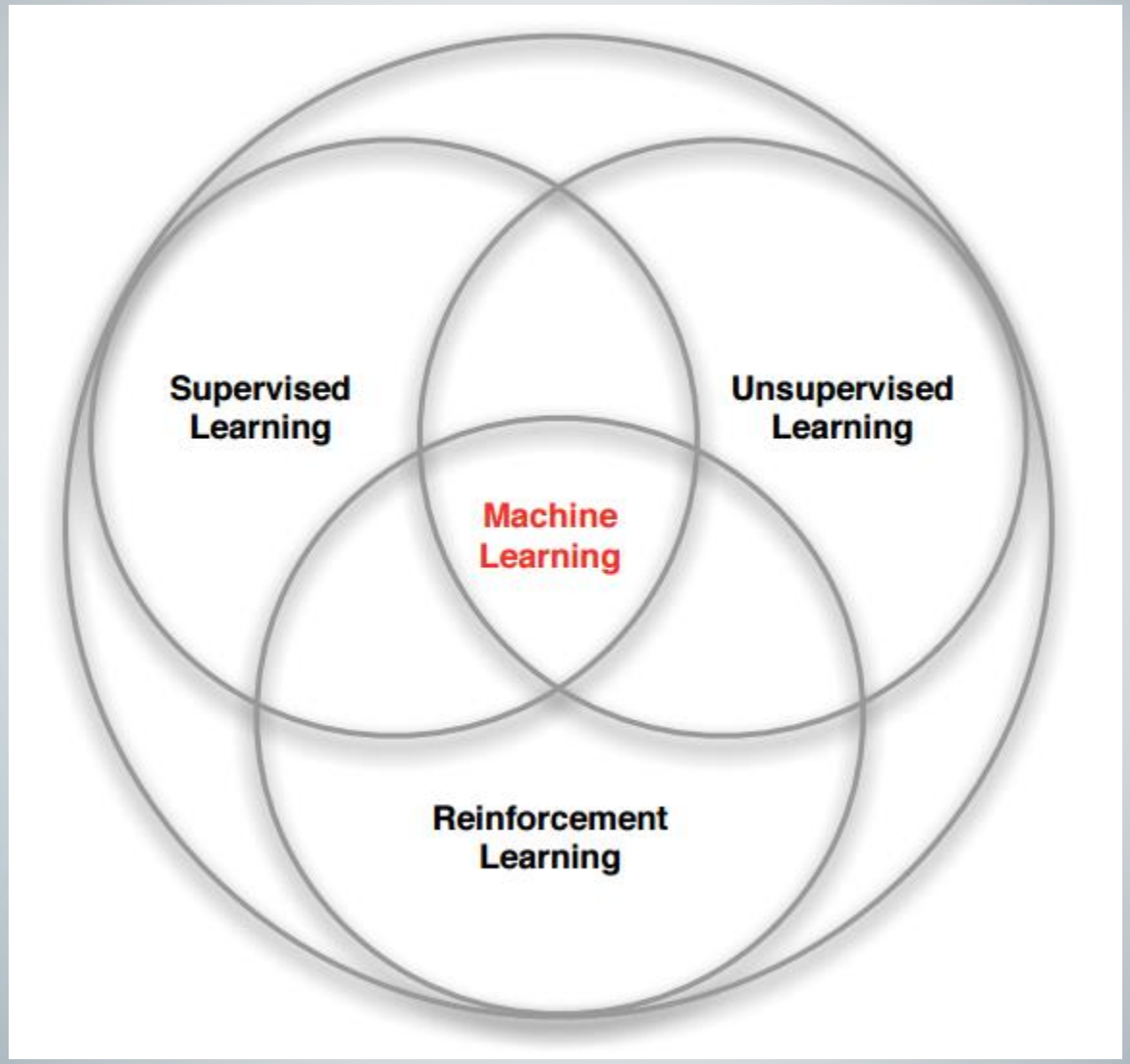

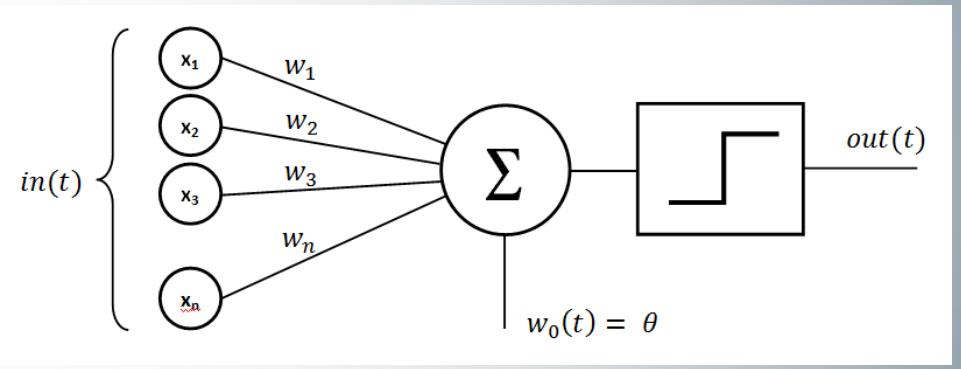

- Frank Rosenblatt (1928-1971) Mark 1 Perceptron in 1960

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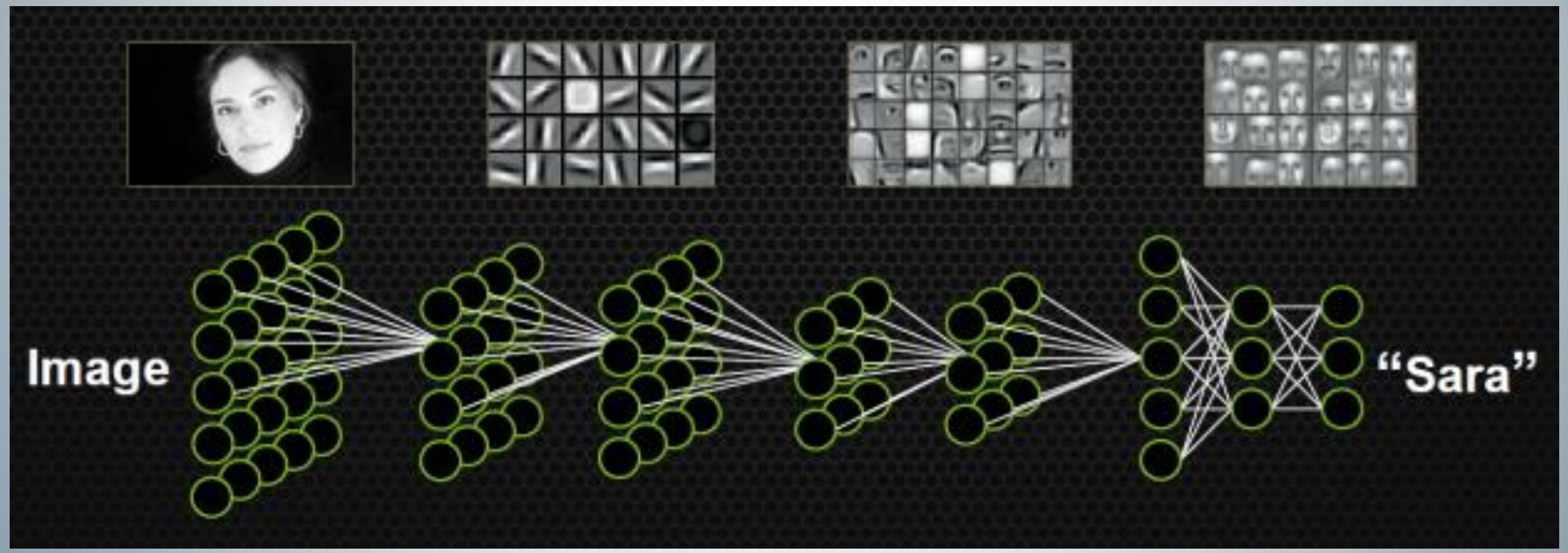

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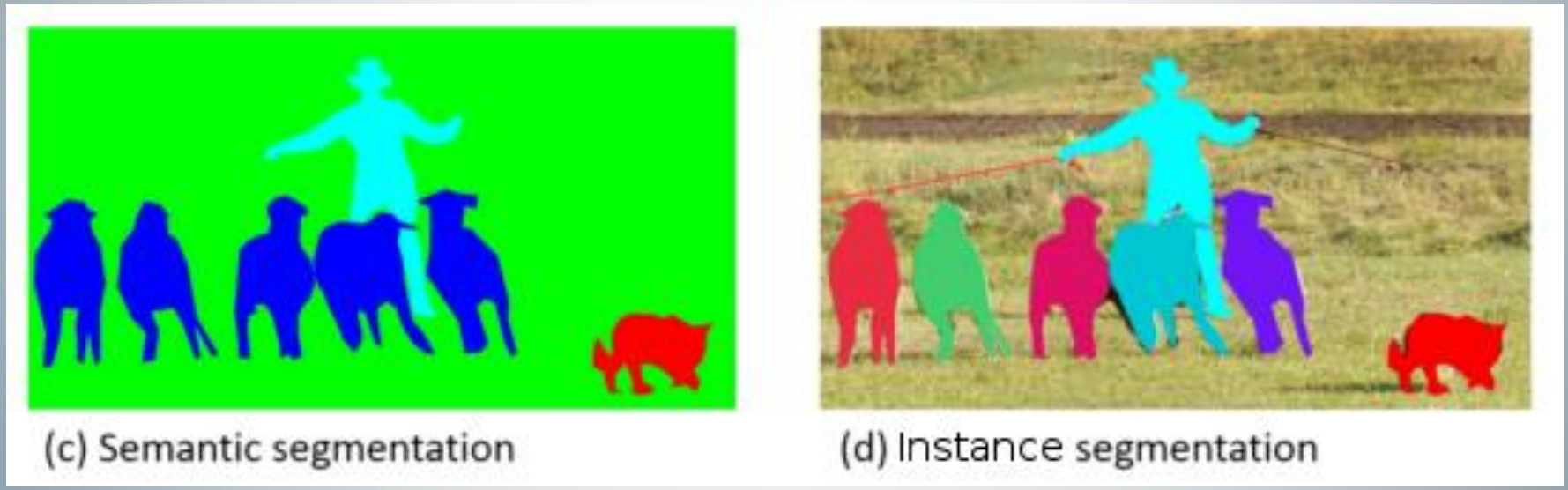
¿Porqué se necesitan grandes cantidades de datos para el entrenamiento?

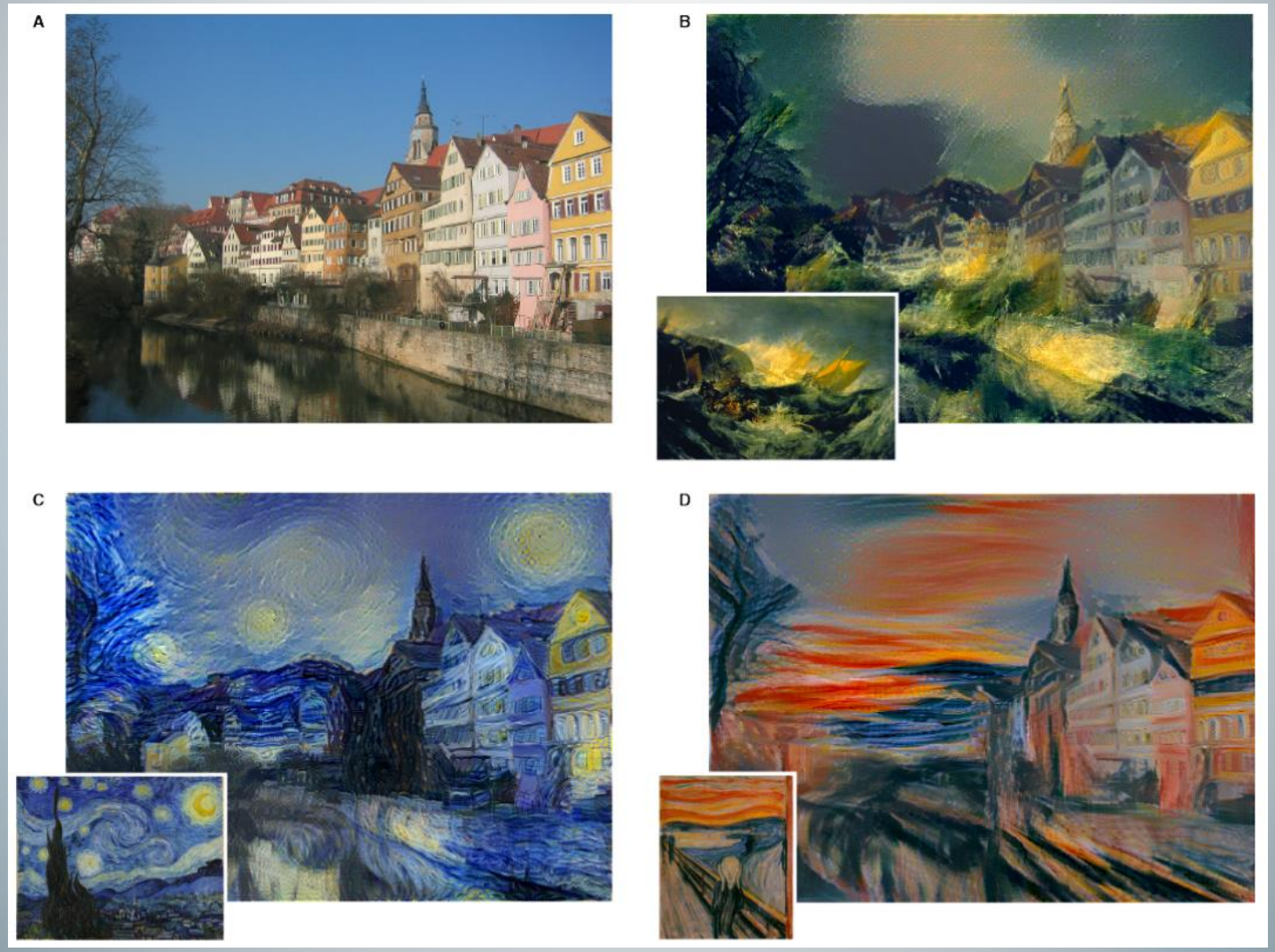
Aplicaciones



(c) Semantic segmentation

(d) Instance segmentation

Aplicaciones



Aplicaciones

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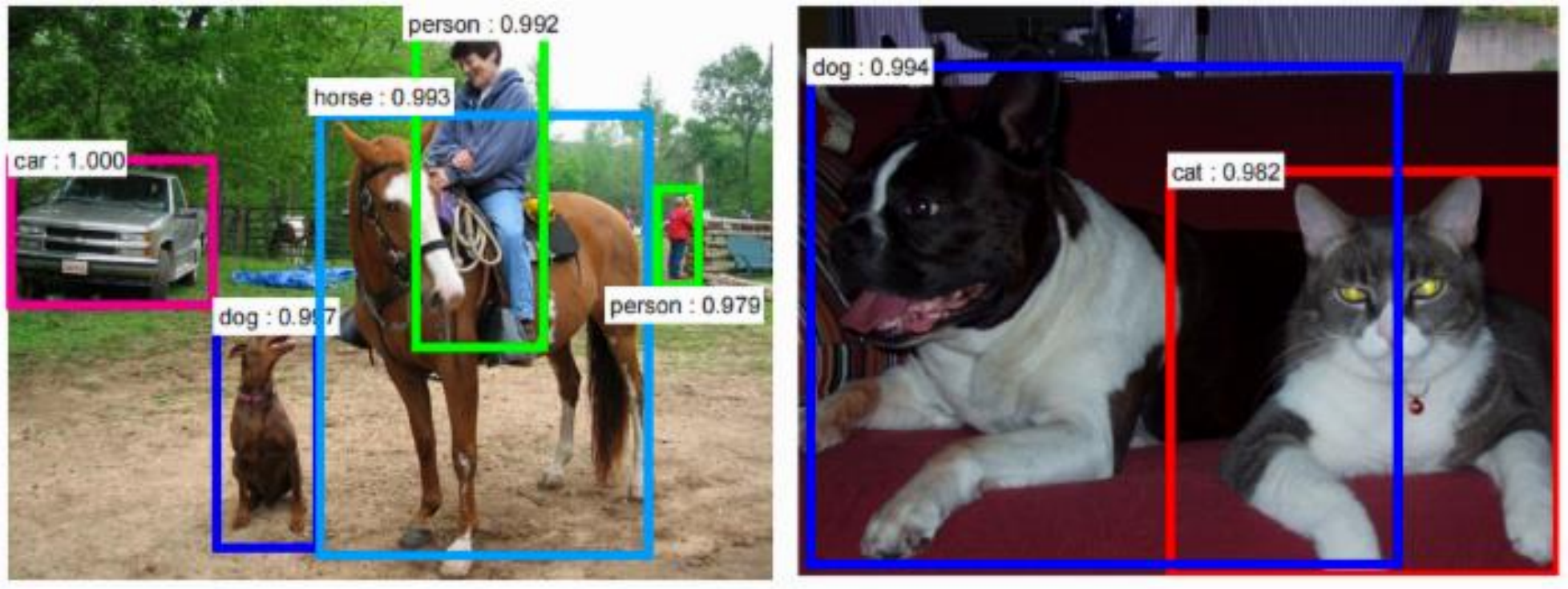
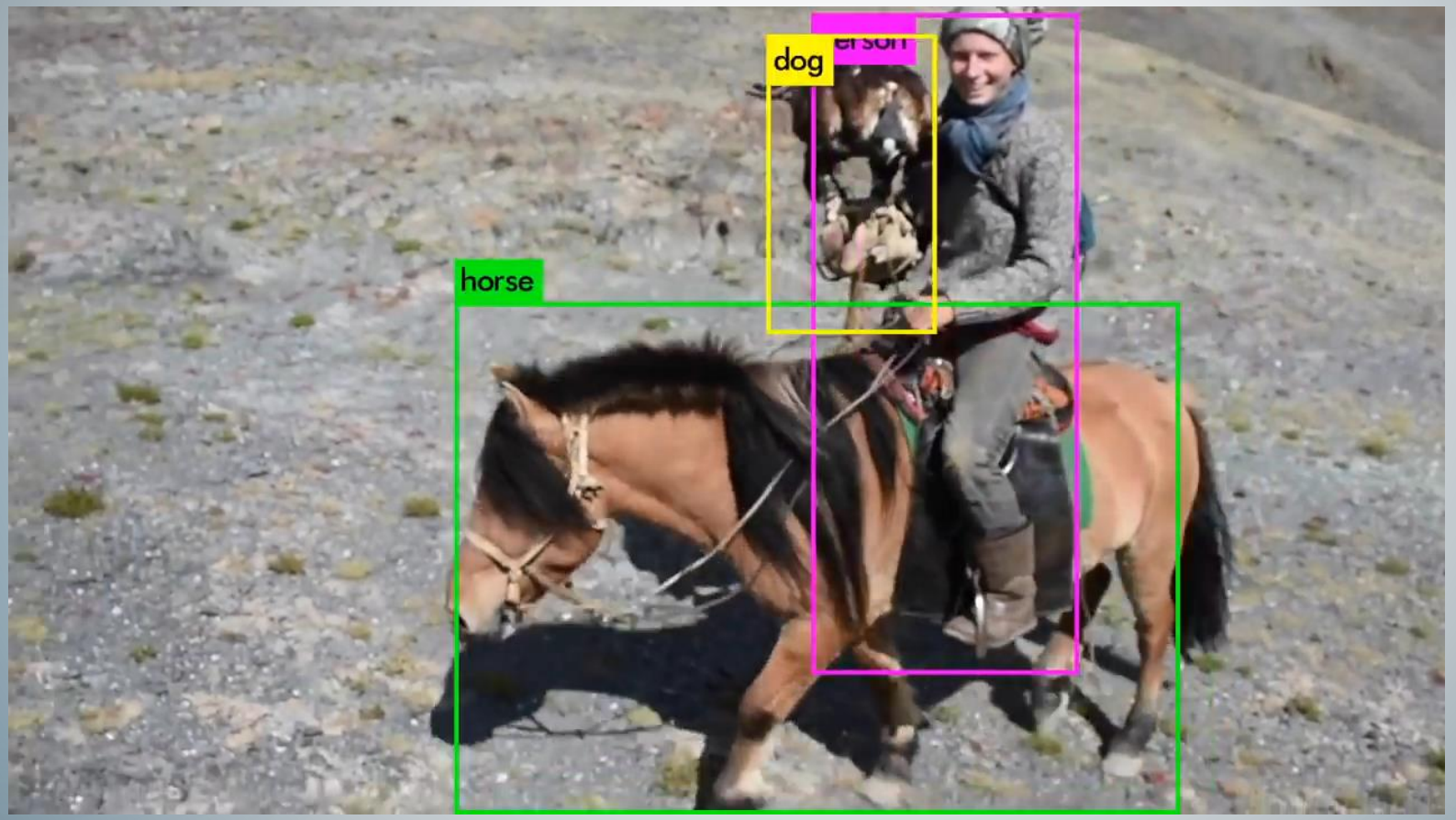
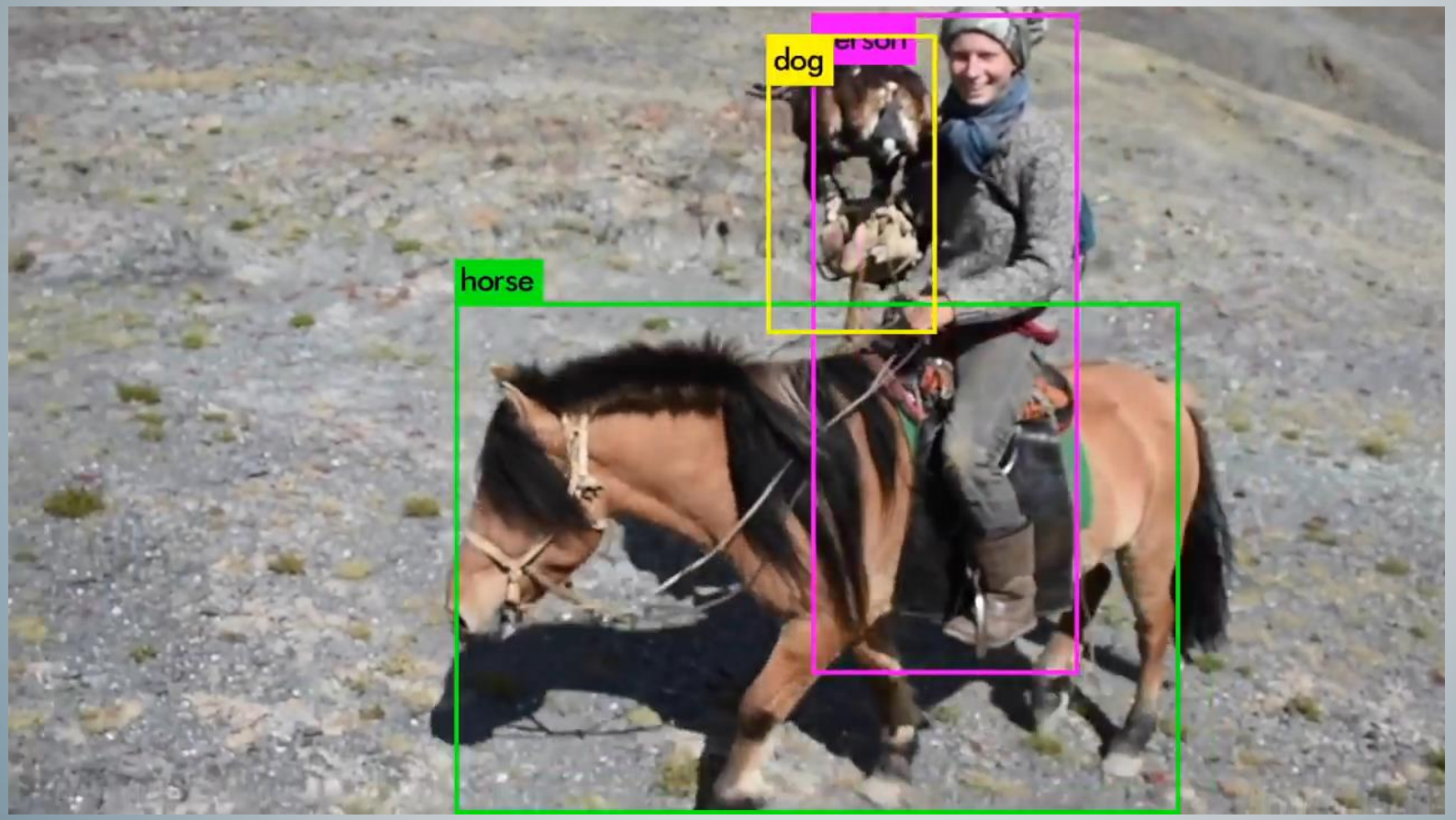



dog
horse

Ejemplo

- Video


dog
horse

Pero, si vemos de cerca…

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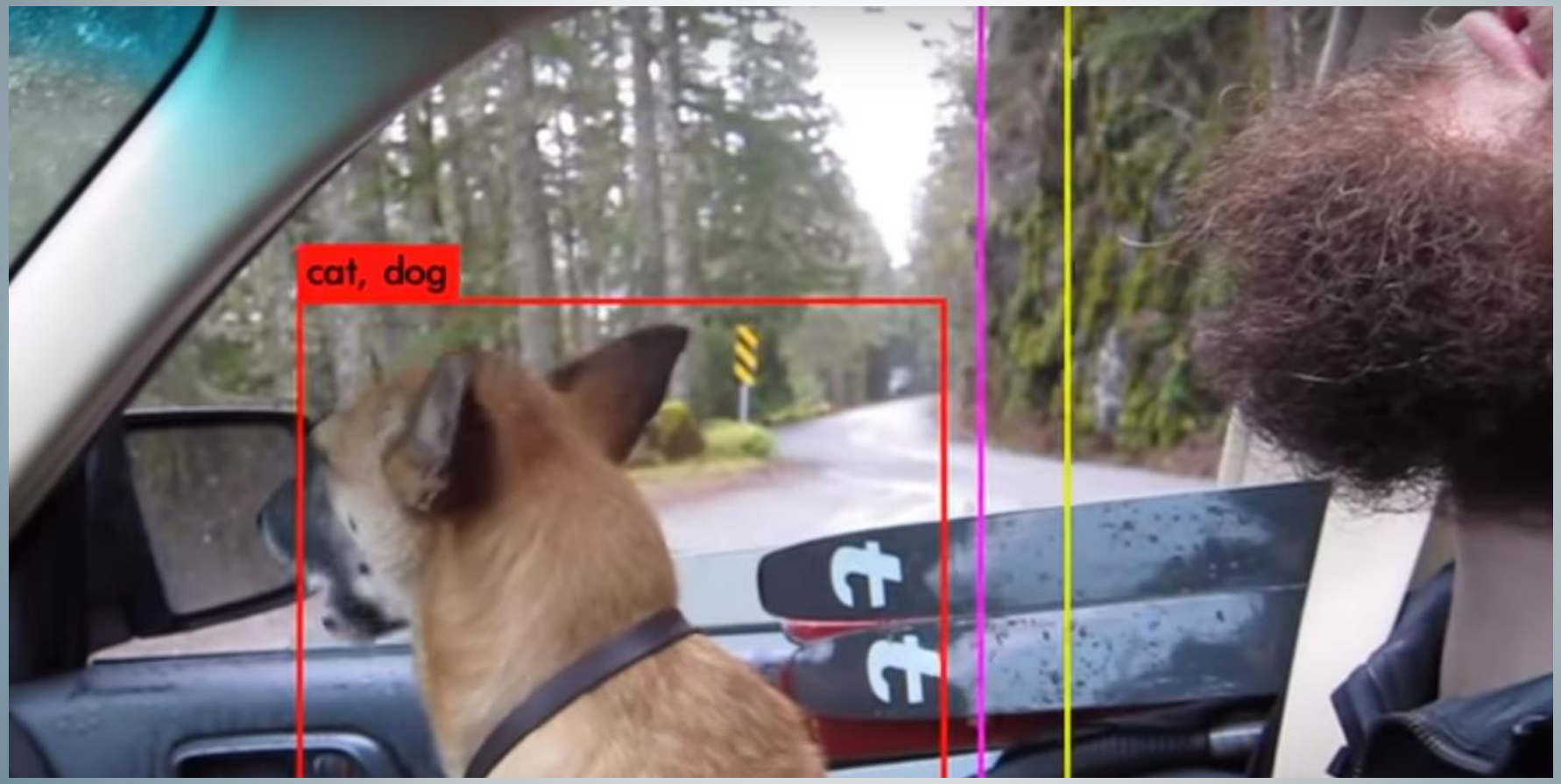

model: overfits on training data

world: new data

model:

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¿Por qué?

Redes Neuronales Convolucionales (CNN)

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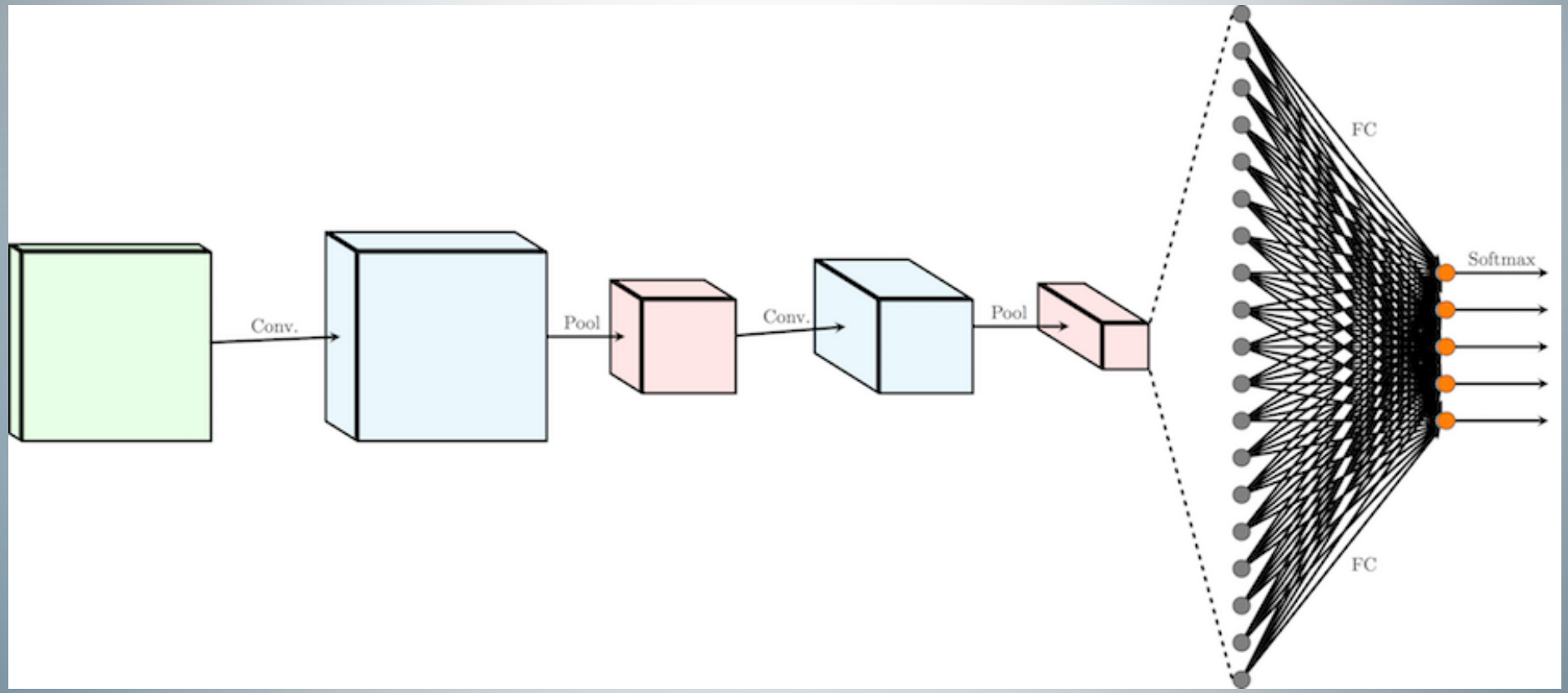
Redes Neuronales Convolucionales (CNN)



¿Qué es la convolución?

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¿Qué es la convolución?

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

Arquitectura de una CNN

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

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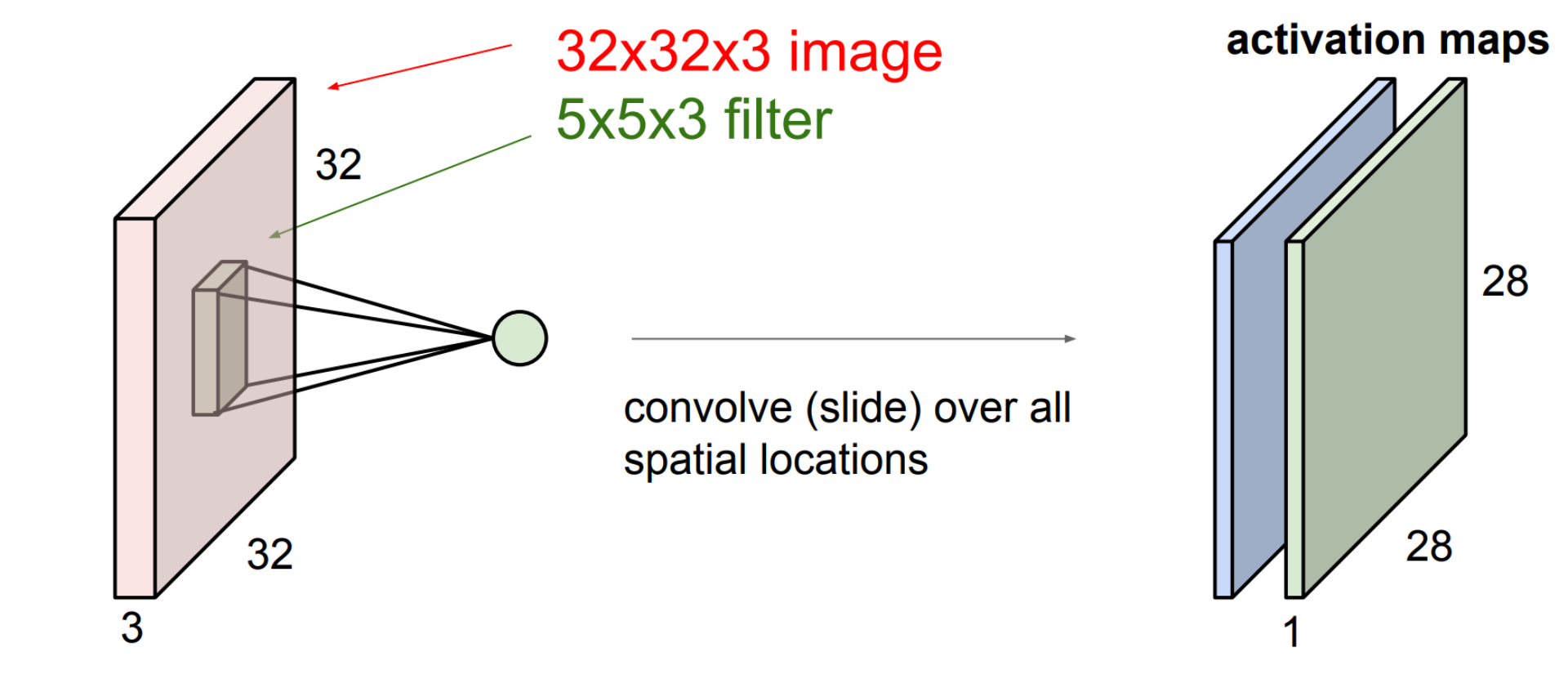
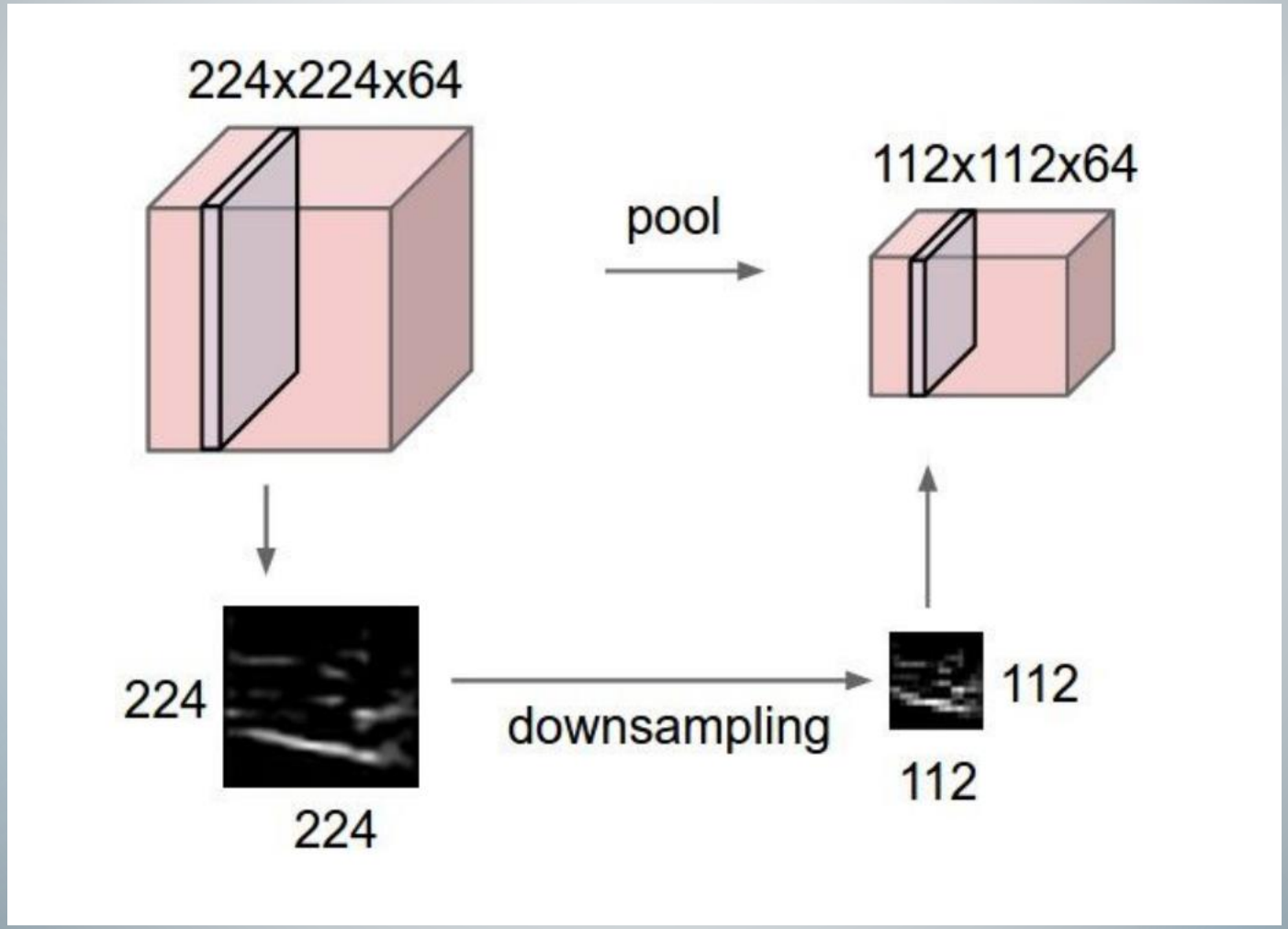
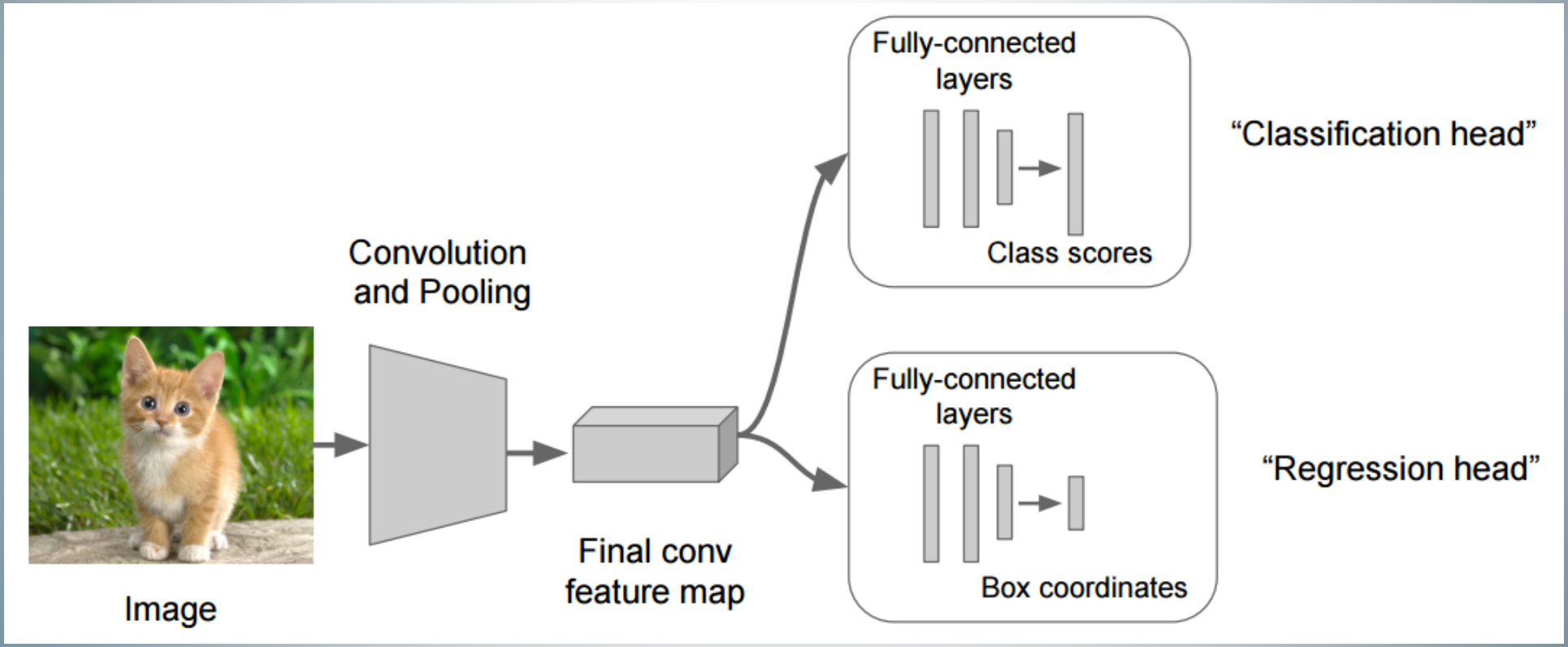
Activation Map CNN



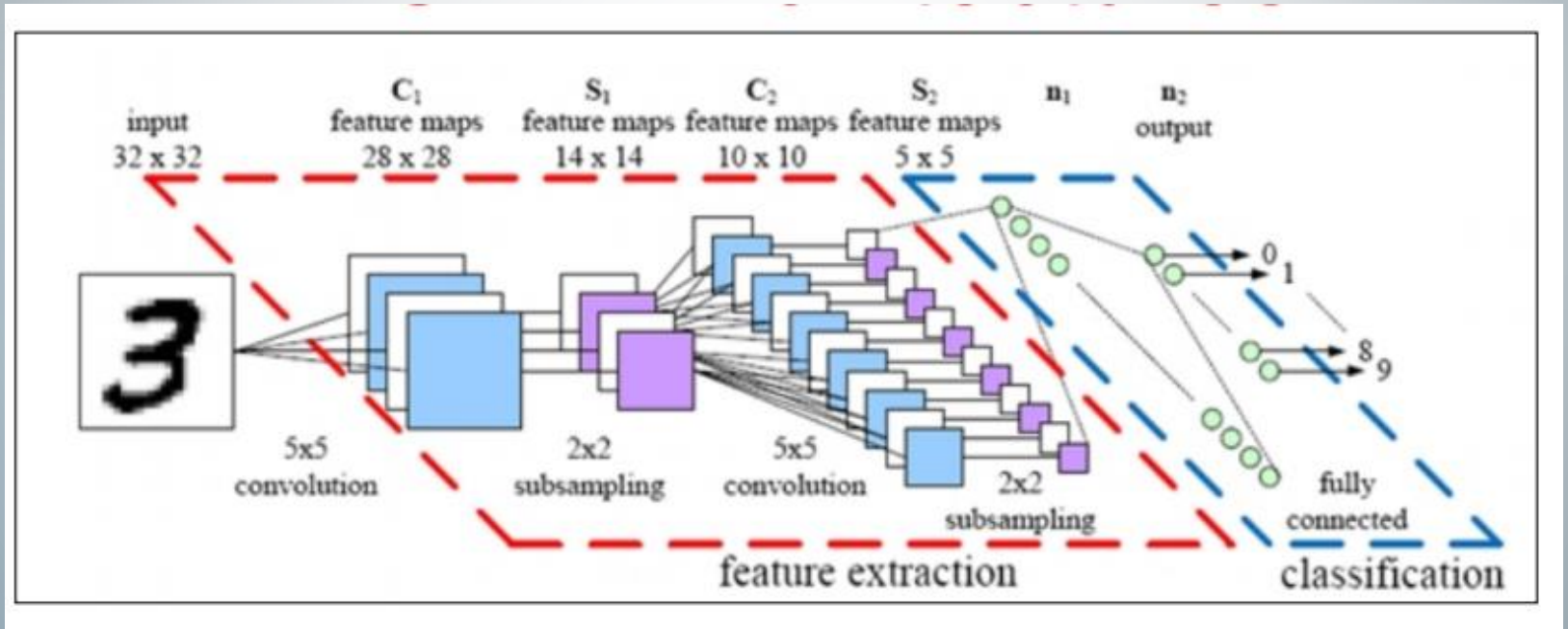
Pooling Layer



Fully Connected Layer



Deep Learning



¿Y cómo se aplica la convolución dentro de una CNN?

¿?

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

¿Cuántas veces se repetirá este proceso?

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CNN

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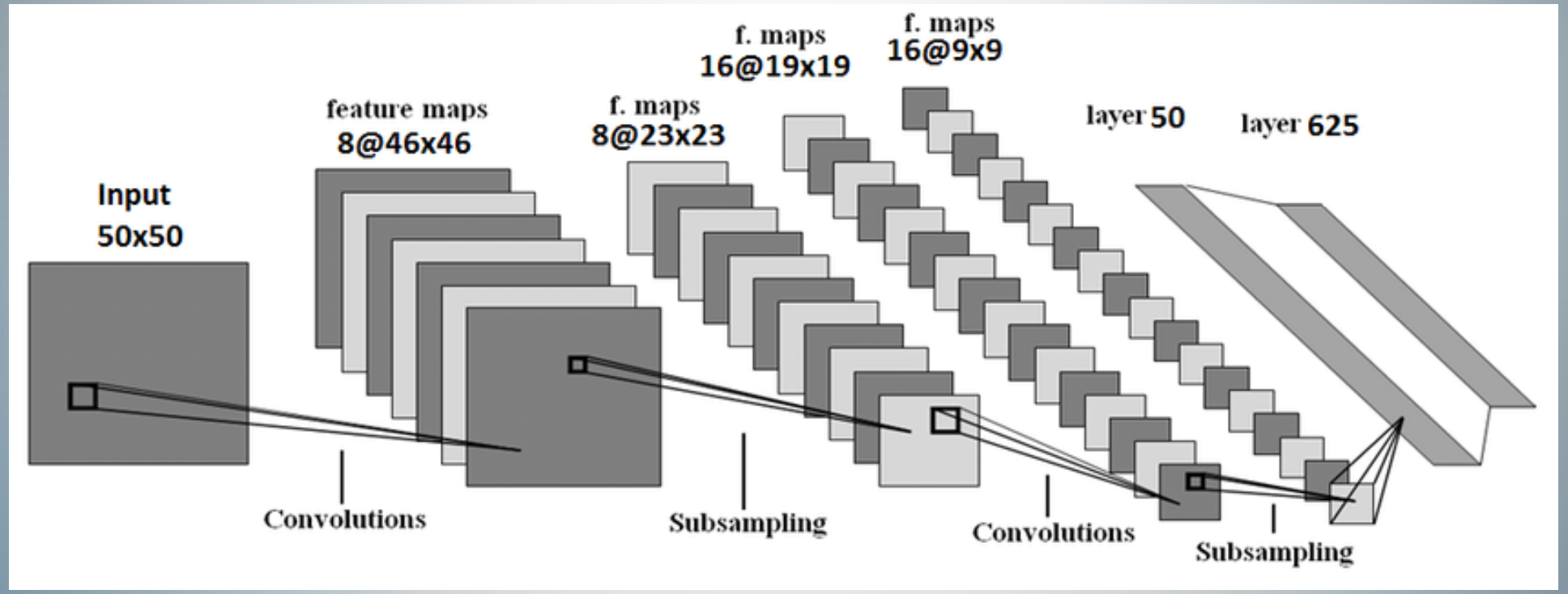

Ejercicio

- Setup Yolo

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Y Reinforcement Learning

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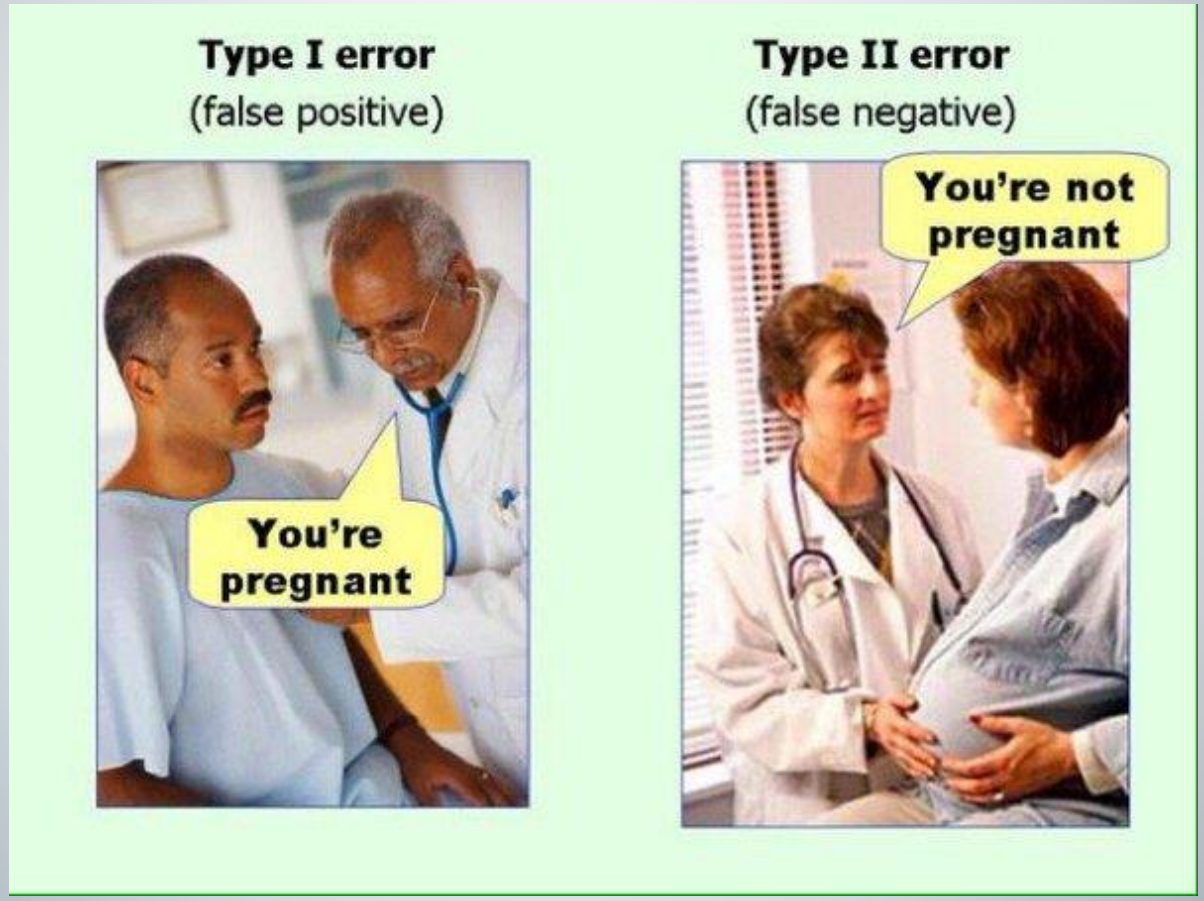
The Bellman Equation

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

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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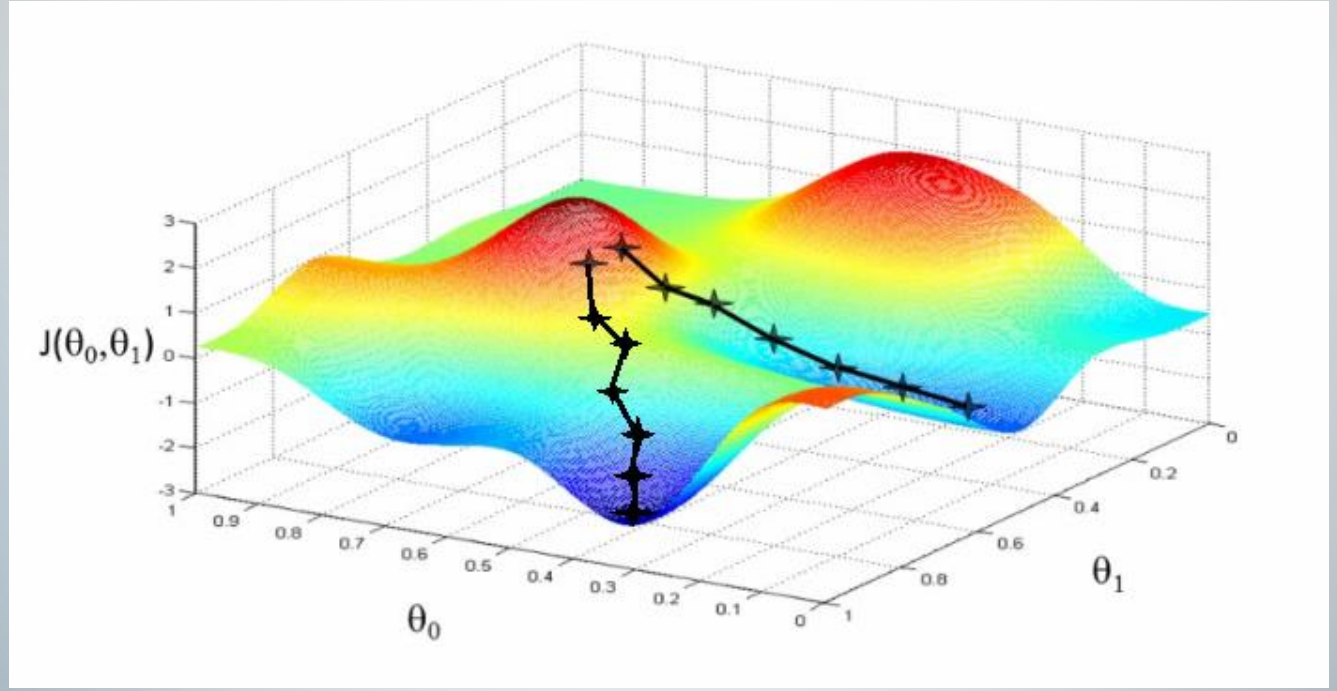
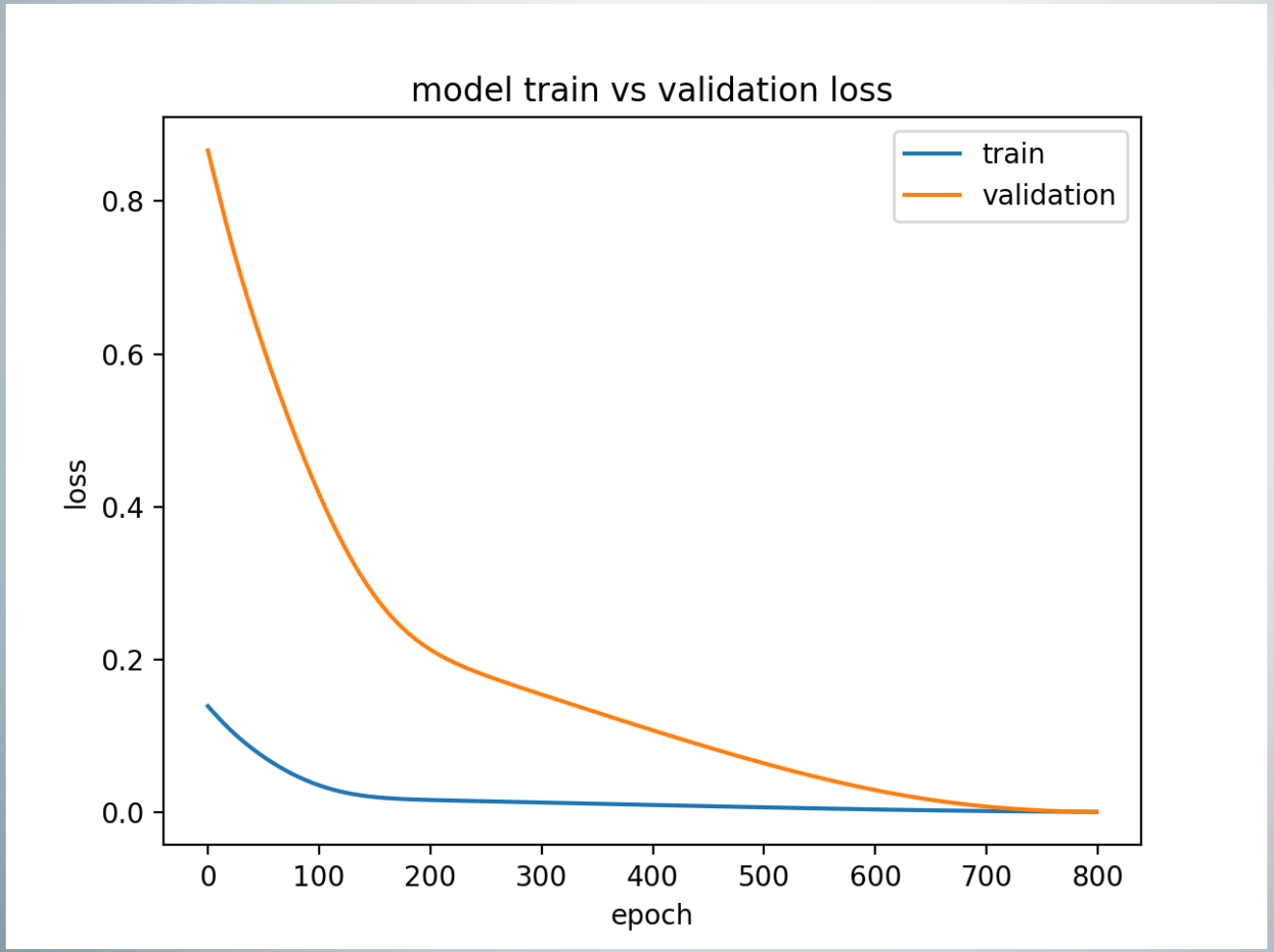
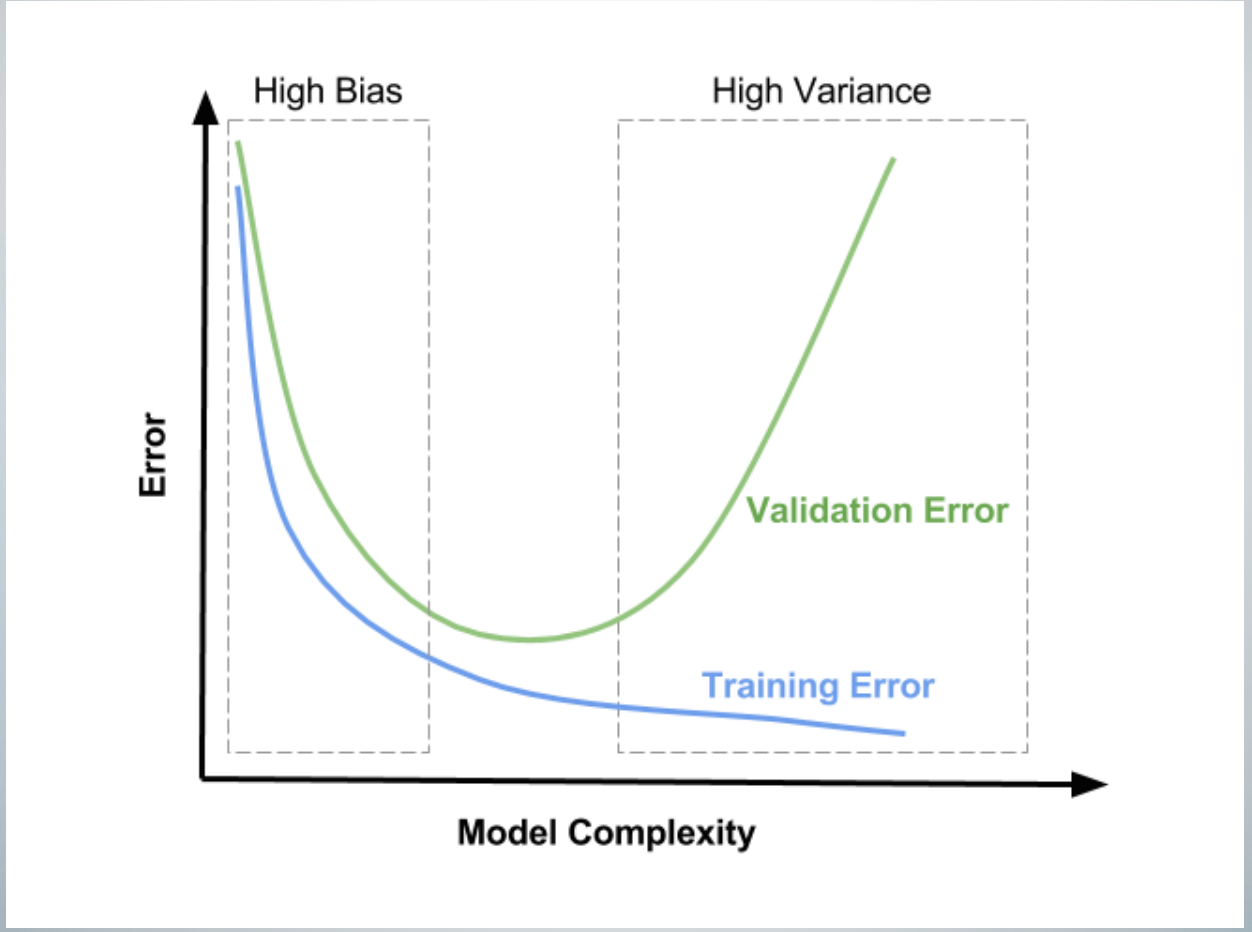
¿Porqué es necesario saber de optimización?



Cross Validation



Cross Validation



¿Es infalible?

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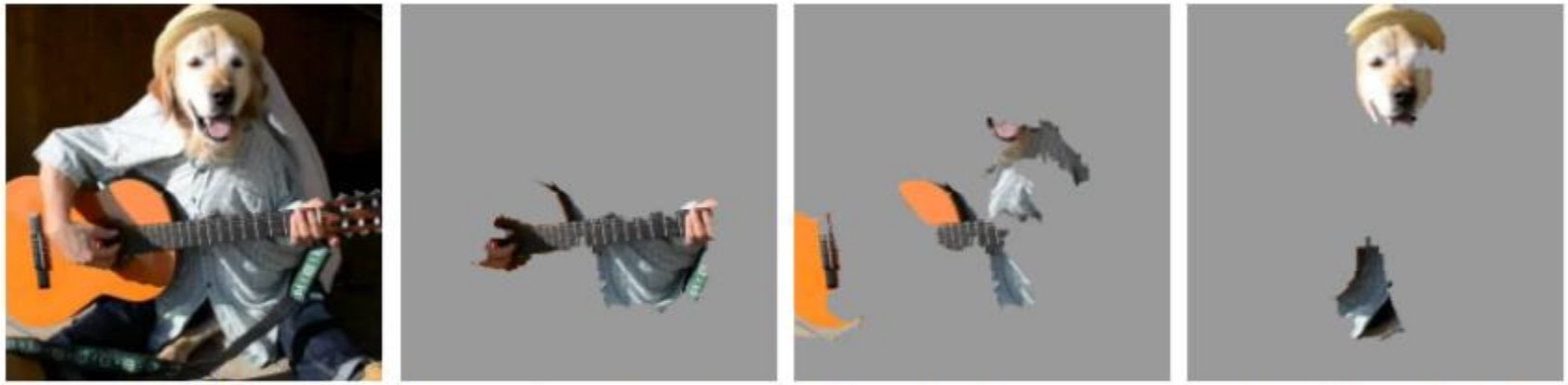
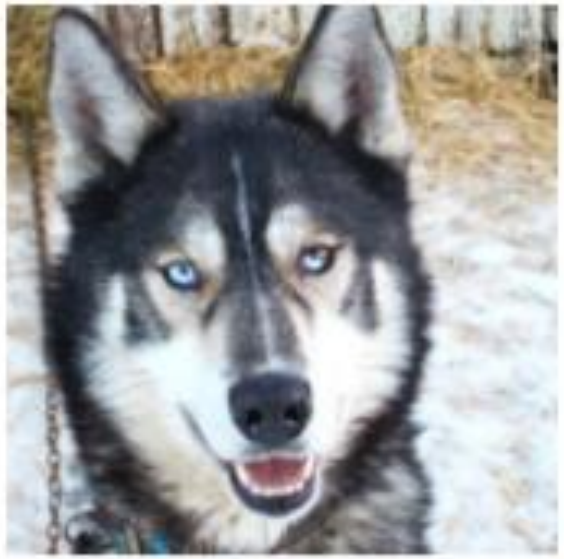


(a) Original Image (b) Explaining *Electric guitar* (c) Explaining *Acoustic guitar* (d) Explaining *Labrador*

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.

Some say Loki is best MCU villian till date

Some say its Ultron

But deep down we all know that

deep learning won't lead us to AGI

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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

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¿Preguntas?

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https://carbon.ai/talentland/

¡Gracias por su atención!

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