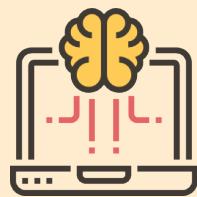
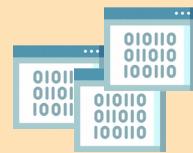


¿Qué es el
aprendizaje automático?



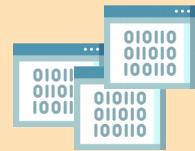
Inteligencia Artificial (IA)



Aprendizaje automático



Inteligencia Artificial (IA)

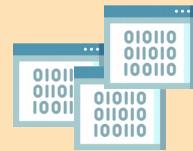


Aprendizaje automático

Aprendizaje **supervisado**



Inteligencia Artificial (IA)



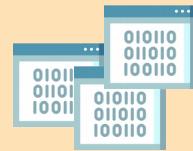
Aprendizaje automático

Aprendizaje **supervisado**

Aprendizaje **no supervisado**



Inteligencia Artificial (IA)



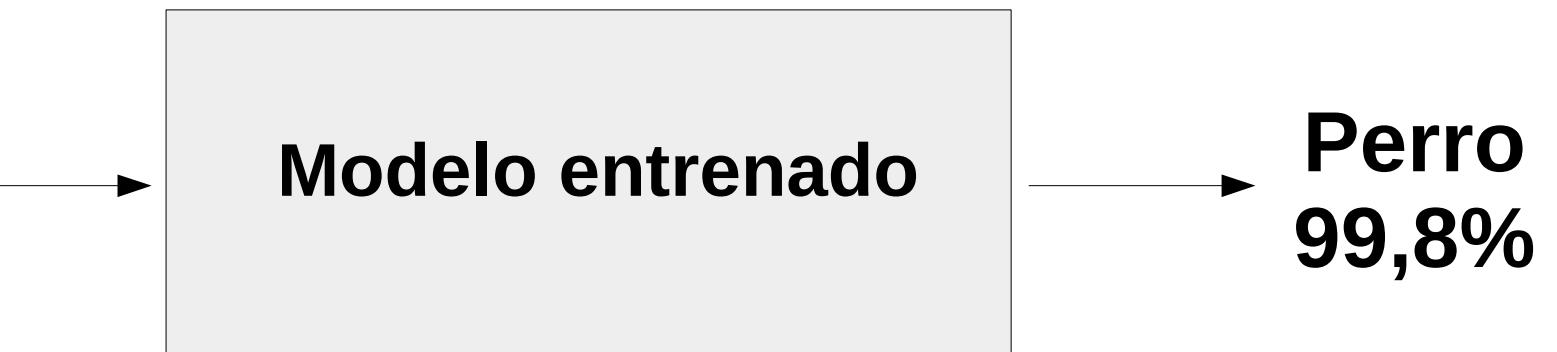
Aprendizaje automático

Aprendizaje **supervisado**

Aprendizaje **no supervisado**

Aprendizaje **por refuerzo**

Aprendizaje **supervisado**

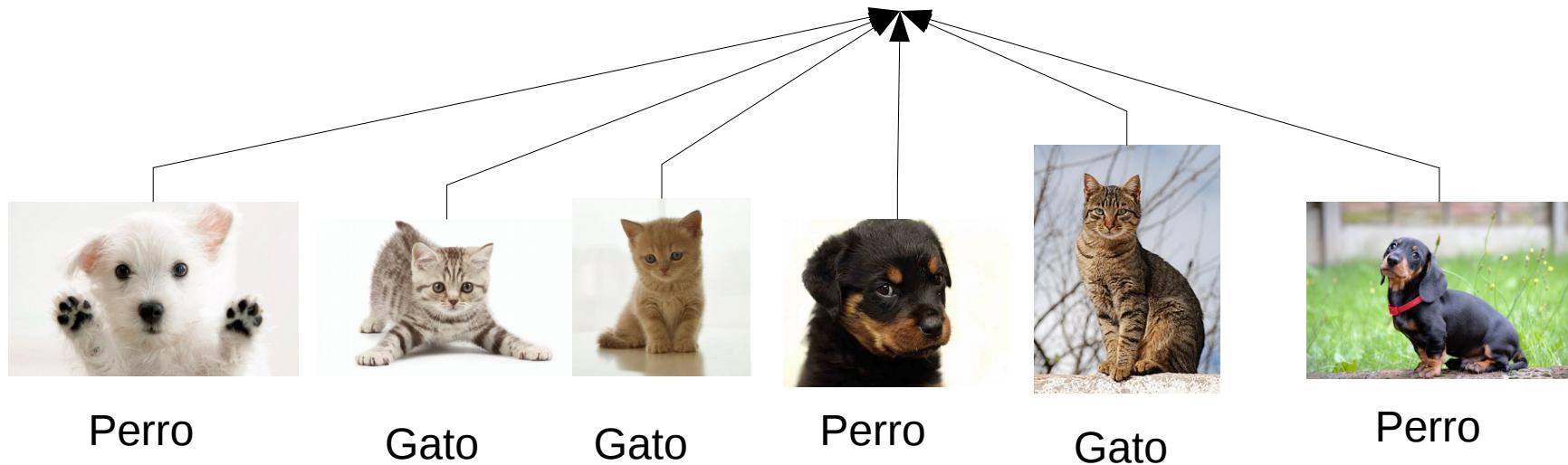


Aprendizaje **supervisado**

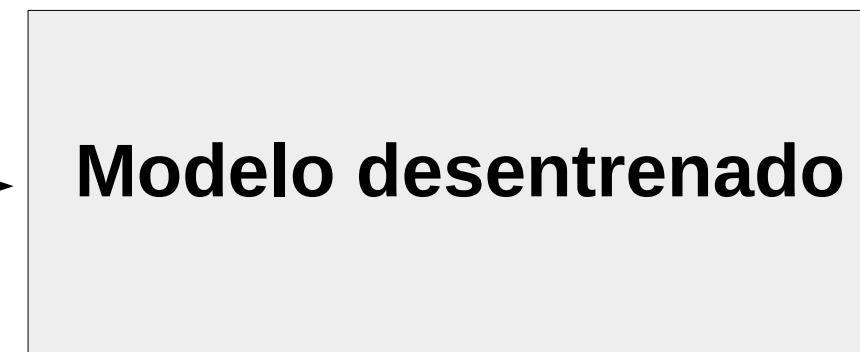


Aprendizaje supervisado

Modelo

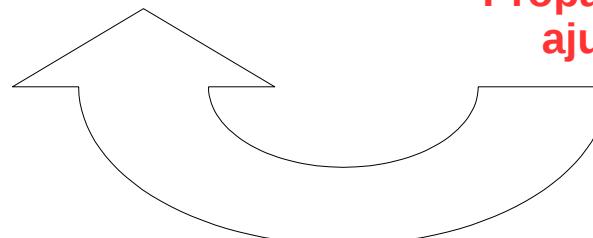


Aprendizaje supervisado

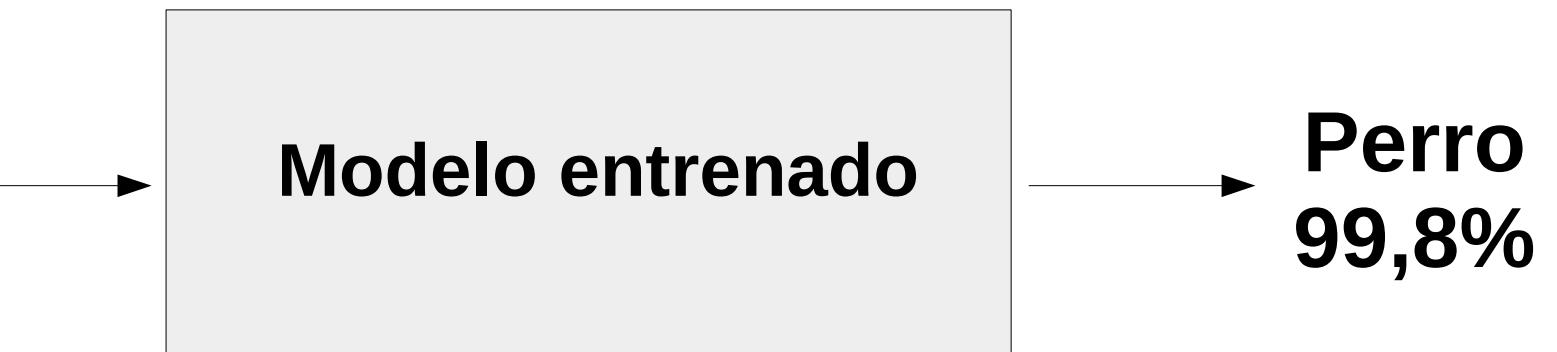


Gato

Propagación del error y
ajuste del modelo



Aprendizaje **supervisado**

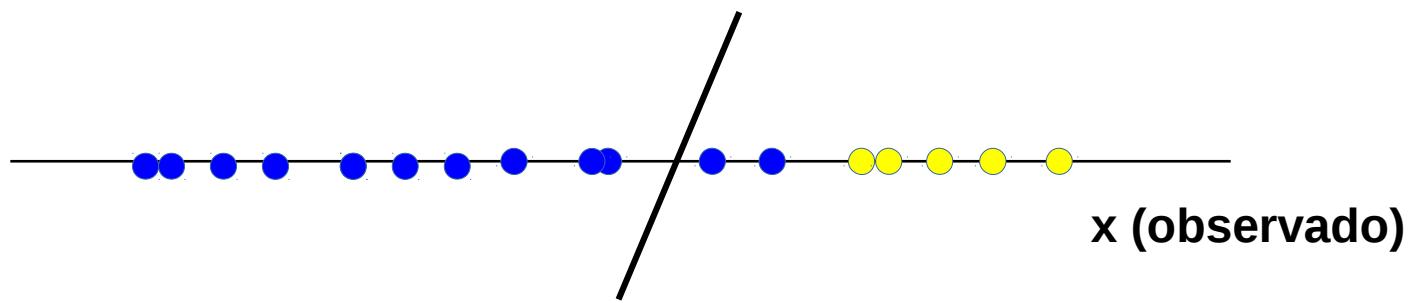


Clasificación binaria

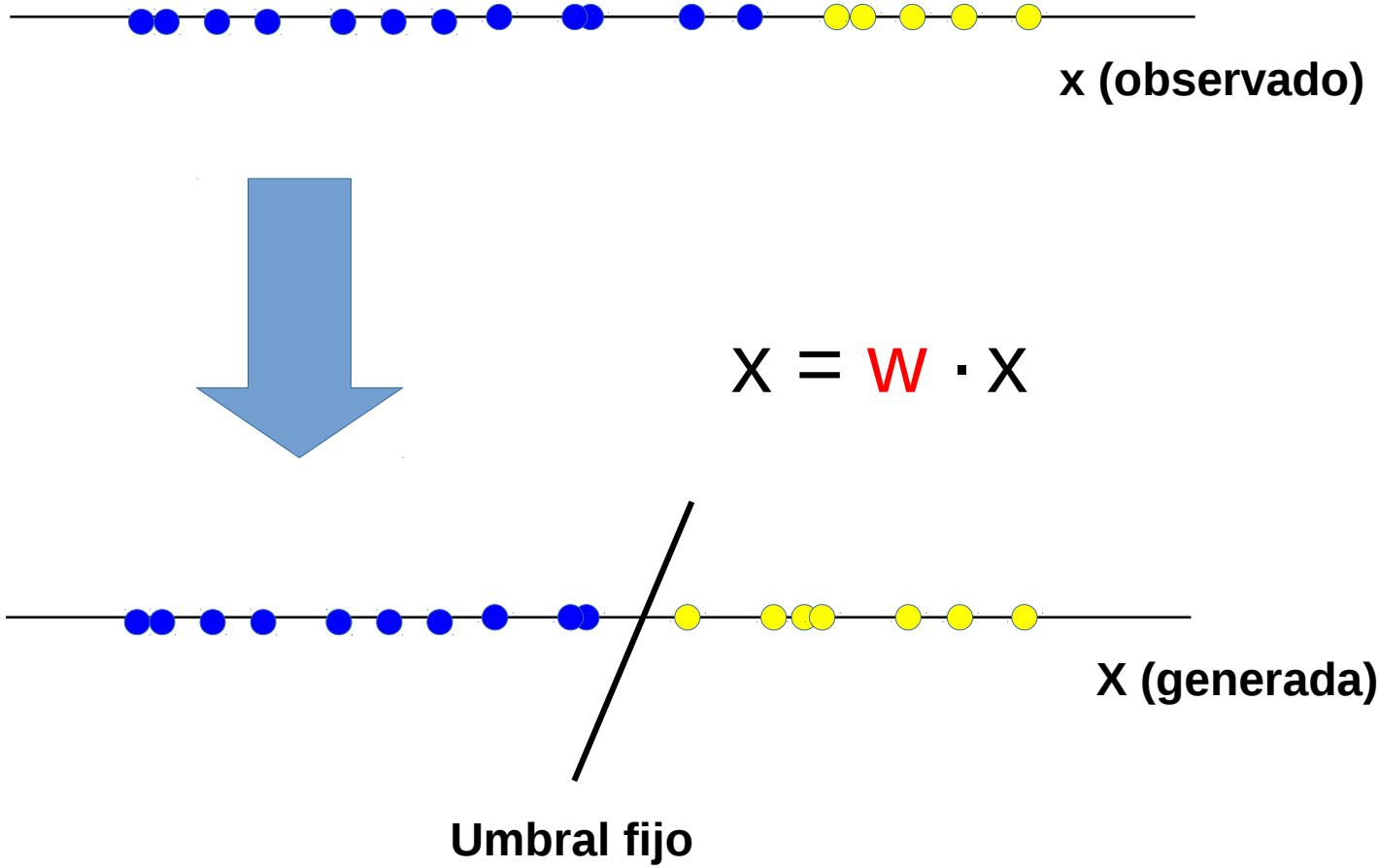


x (altura observada)

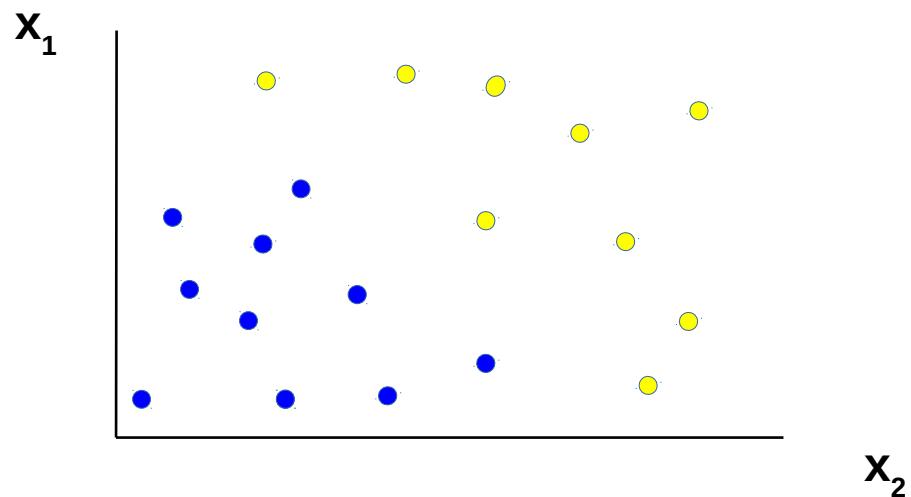
Clasificación binaria



Clasificación binaria

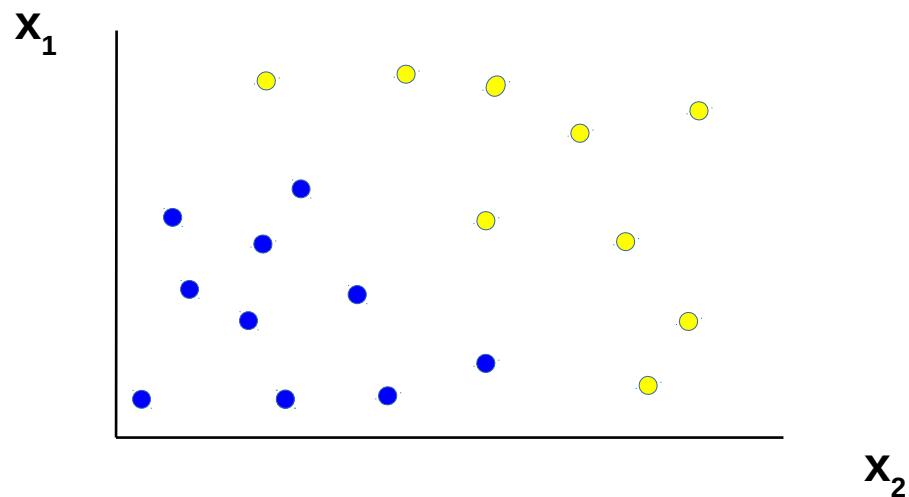


Clasificación binaria



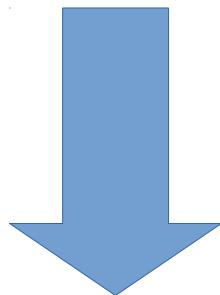
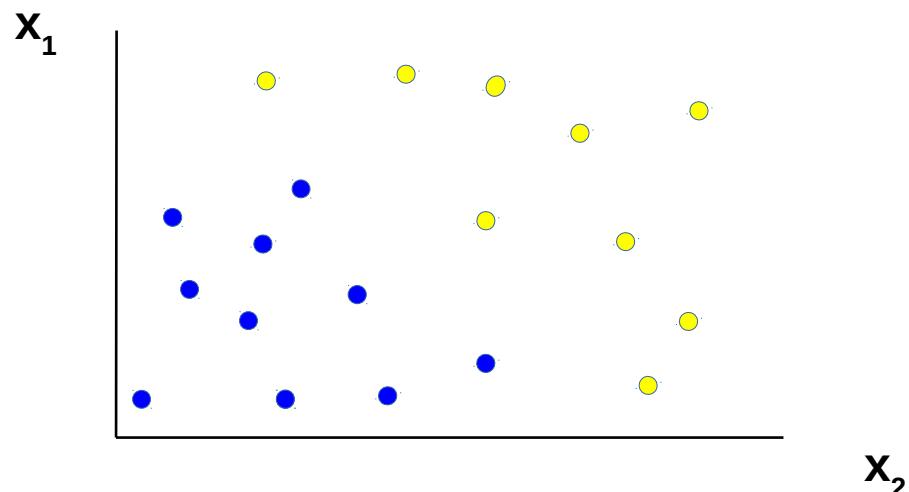
¿y con dos inputs?

Clasificación binaria

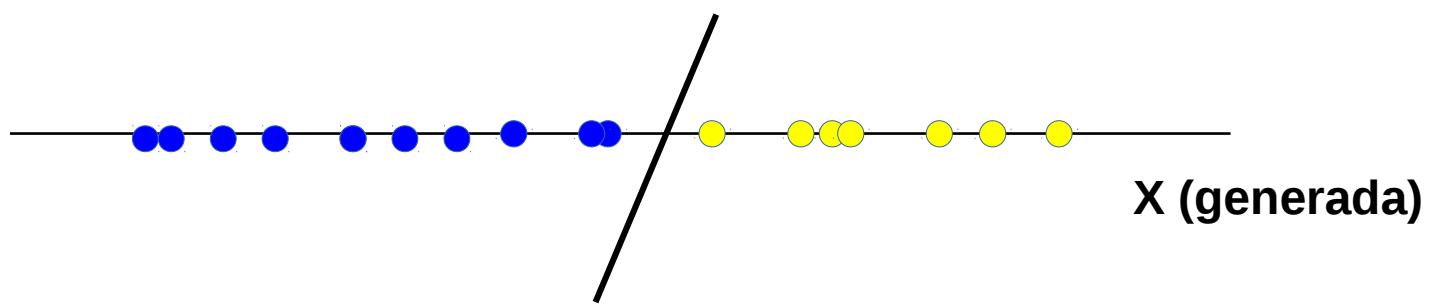


$$x = w_1 x_1 + w_2 x_2 + b$$

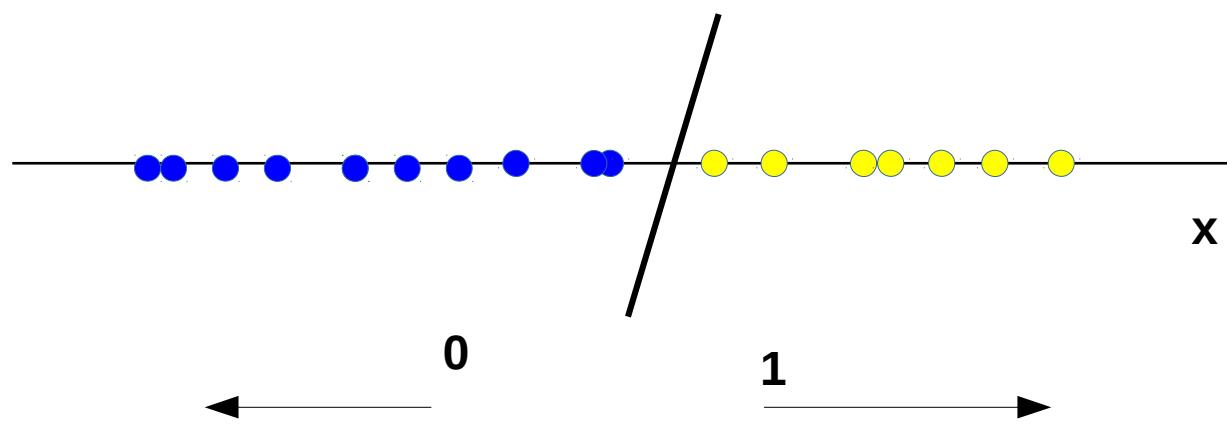
Clasificación binaria



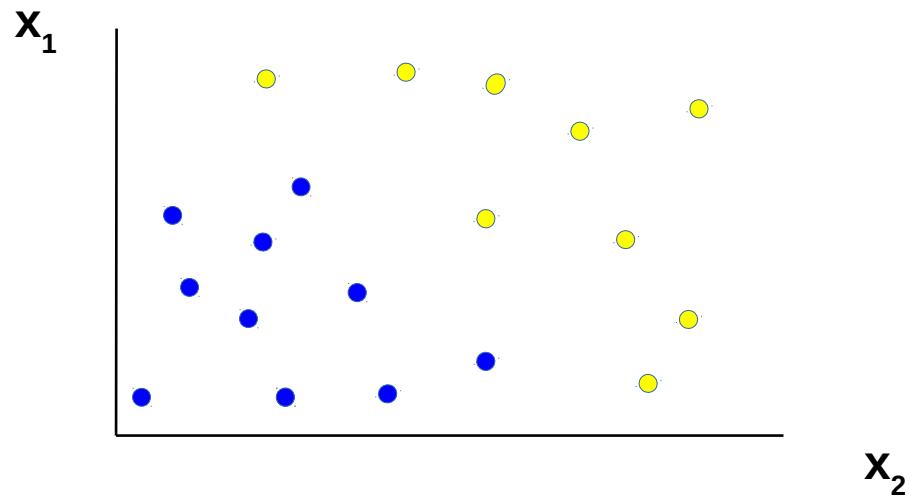
$$x = w_1 x_1 + w_2 x_2 + b$$



Clasificación binaria

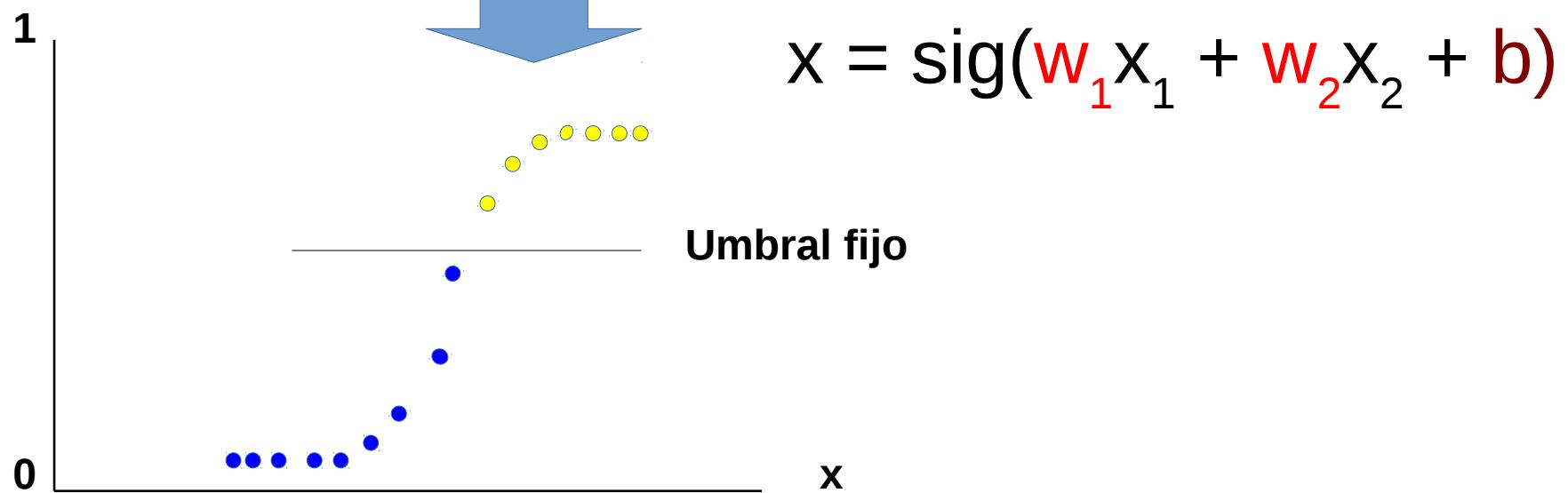
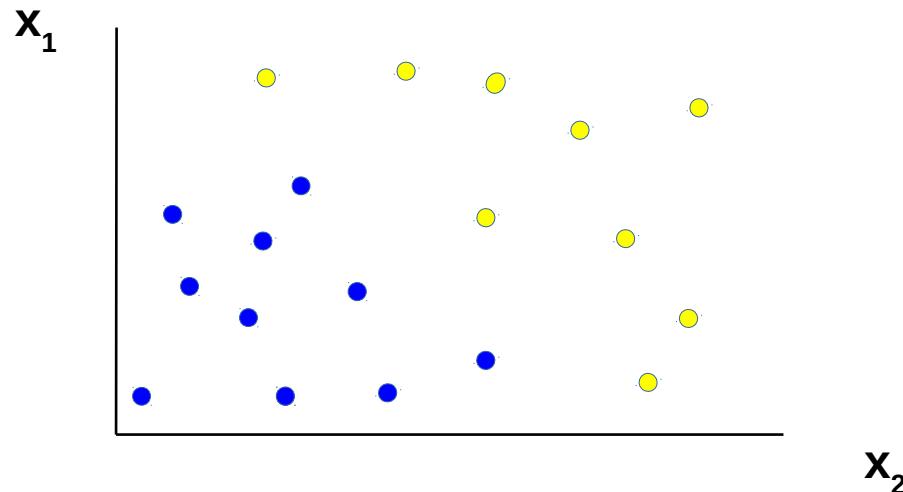


Clasificación binaria



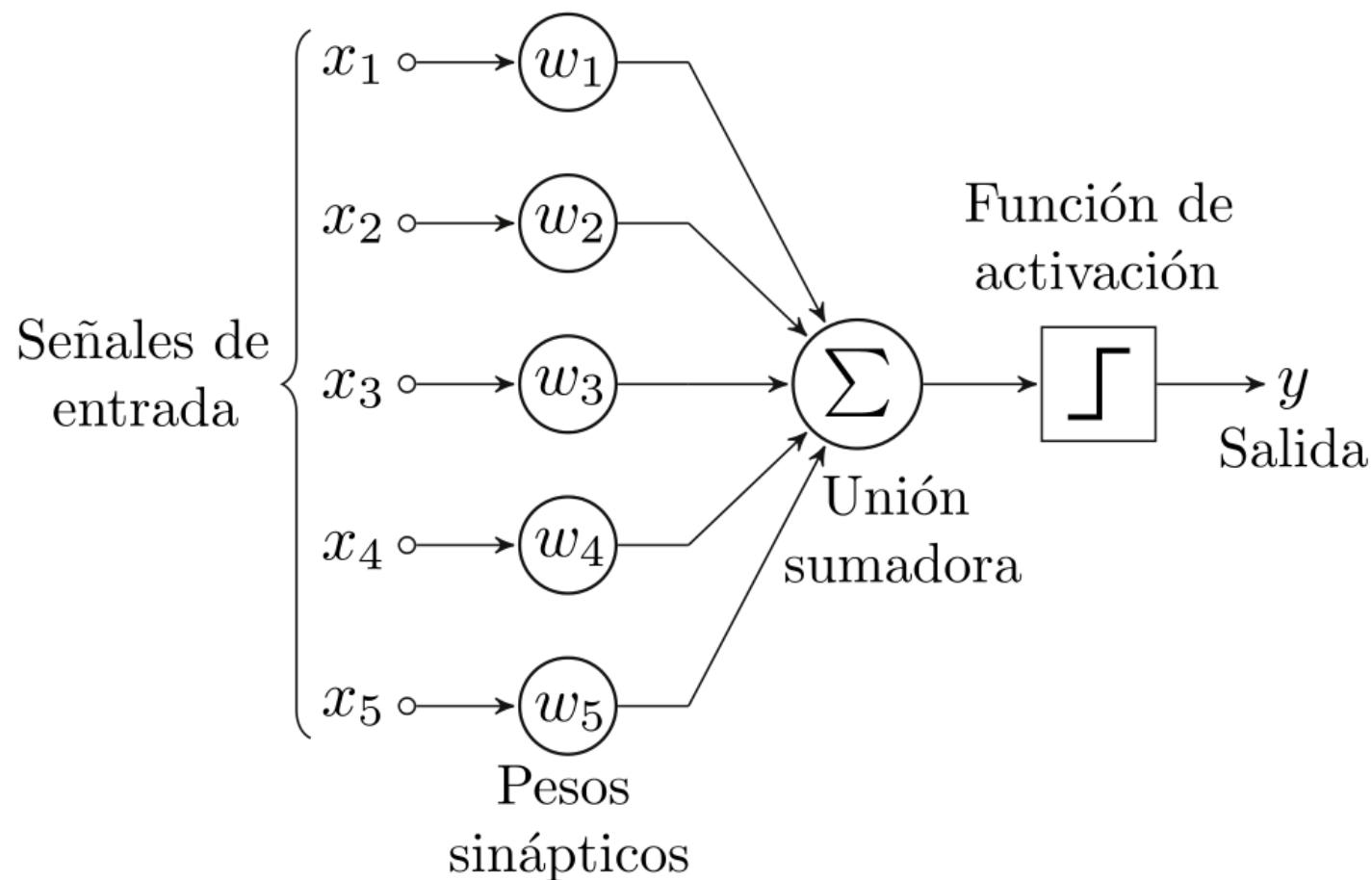
$$x = \text{sig}(w_1 x_1 + w_2 x_2 + b)$$

Clasificación binaria

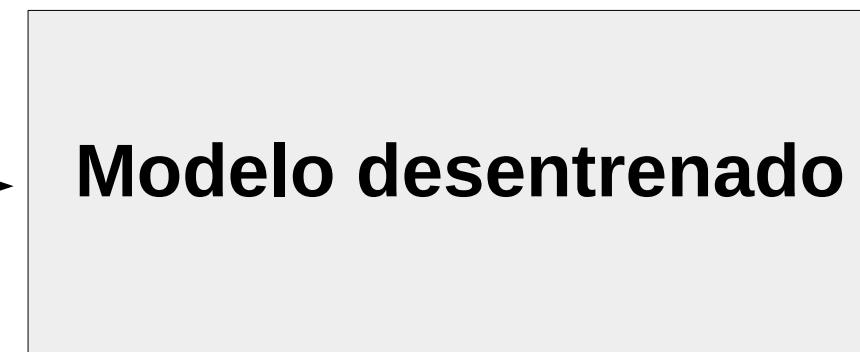


Redes neurales

Perceptrón

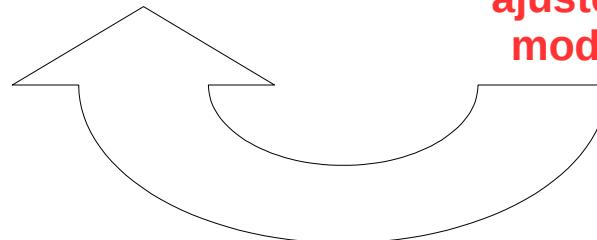


Aprendizaje supervisado



Gato

Propagación del error y
ajuste de los PESOS del
modelo discriminativo

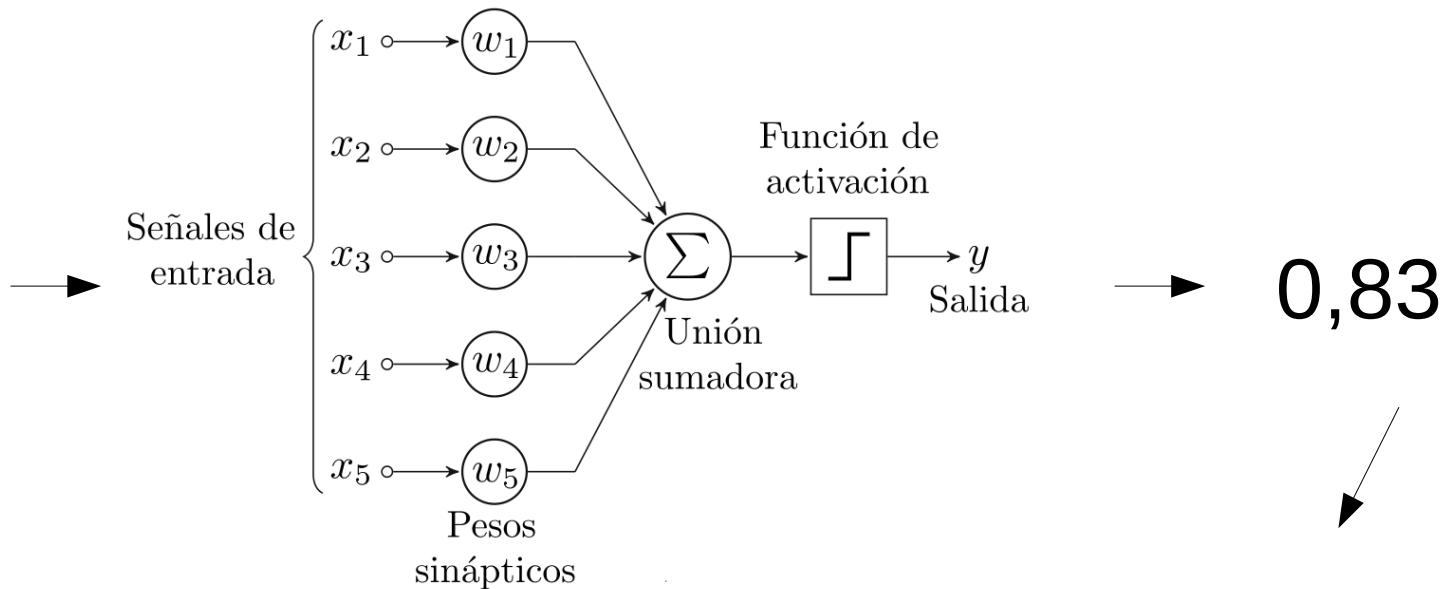


Redes neurales

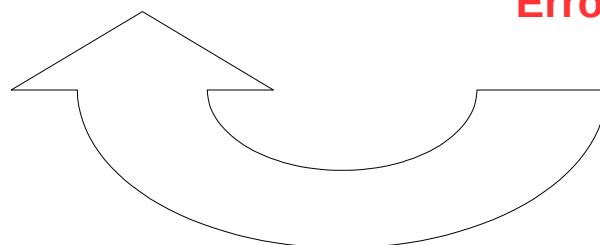
Perceptrón



(1)



$$\text{Error} = 1 - 0,83 = 0,17$$

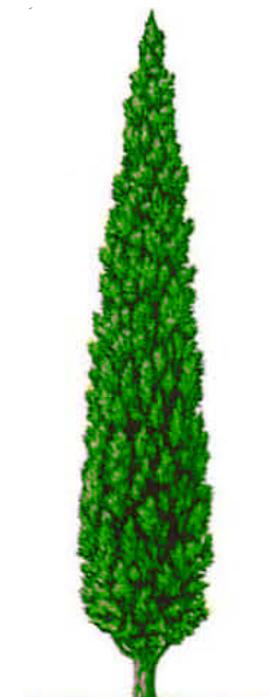


¡HORA DE CLASIFICARNOS!

<https://goo.gl/forms/OZ1fgTHP4jHbwdcE3>

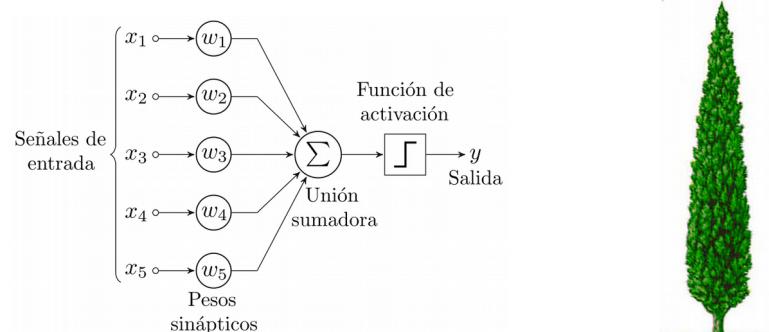
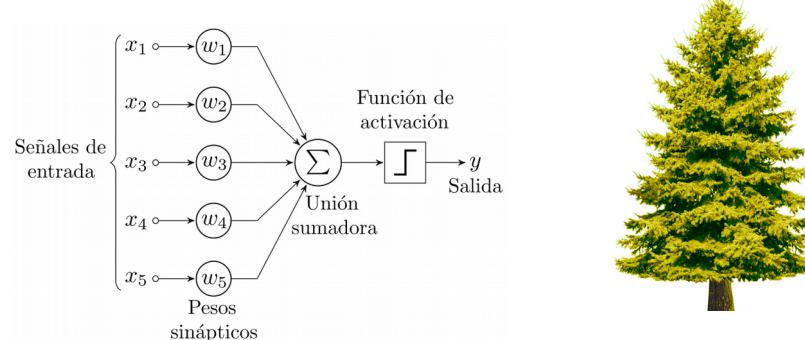
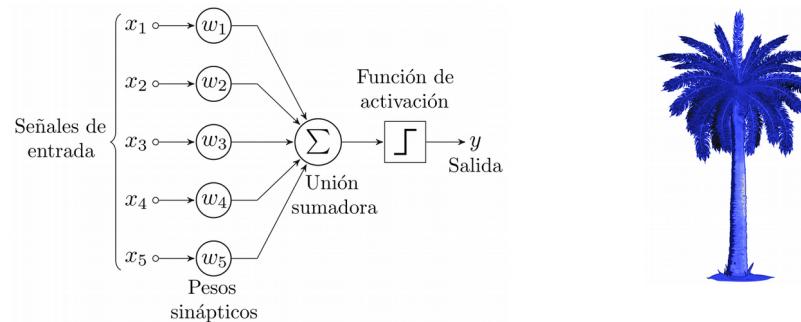
75% train set
25% test set

Clasificación multiclas



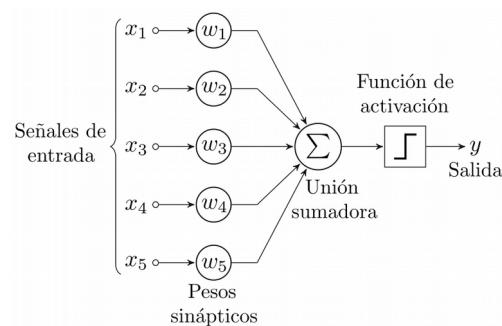
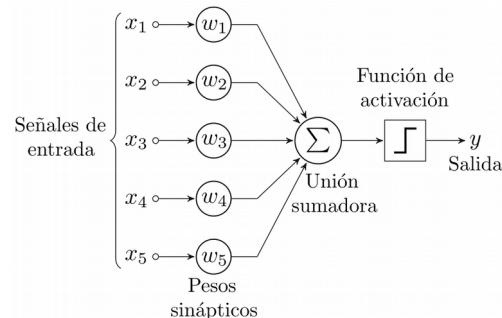
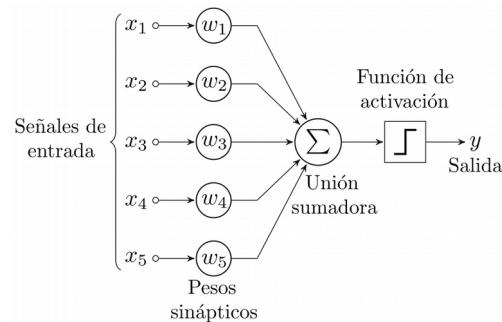
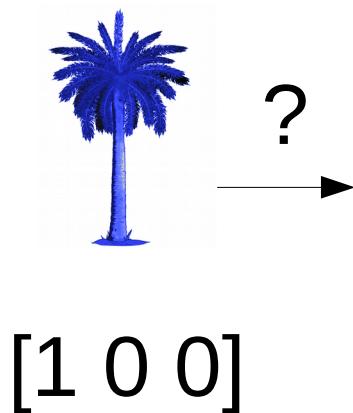
Redes neurales

Perceptrón



Redes neurales

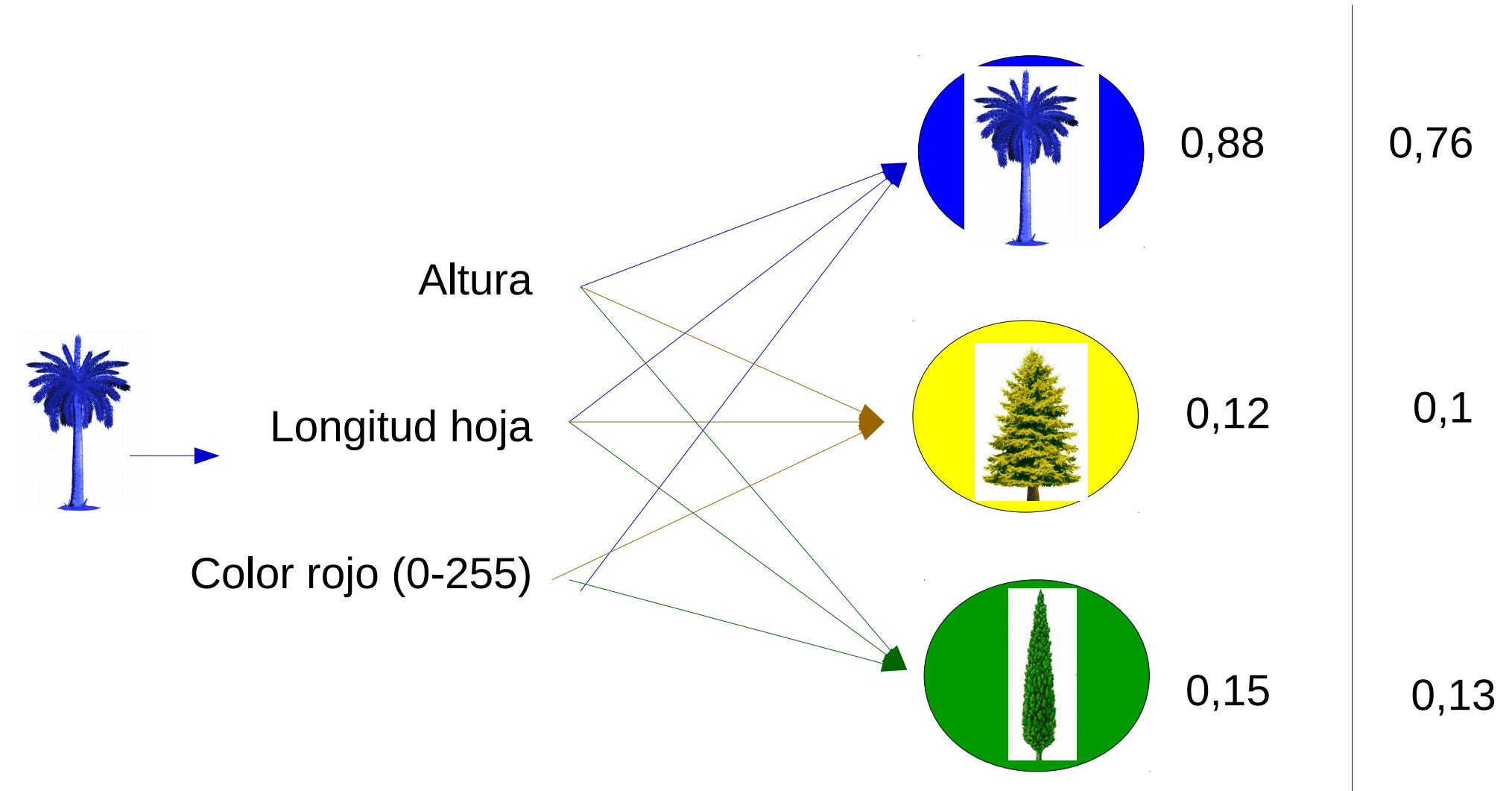
Perceptrón



Obs: [1 0 0]

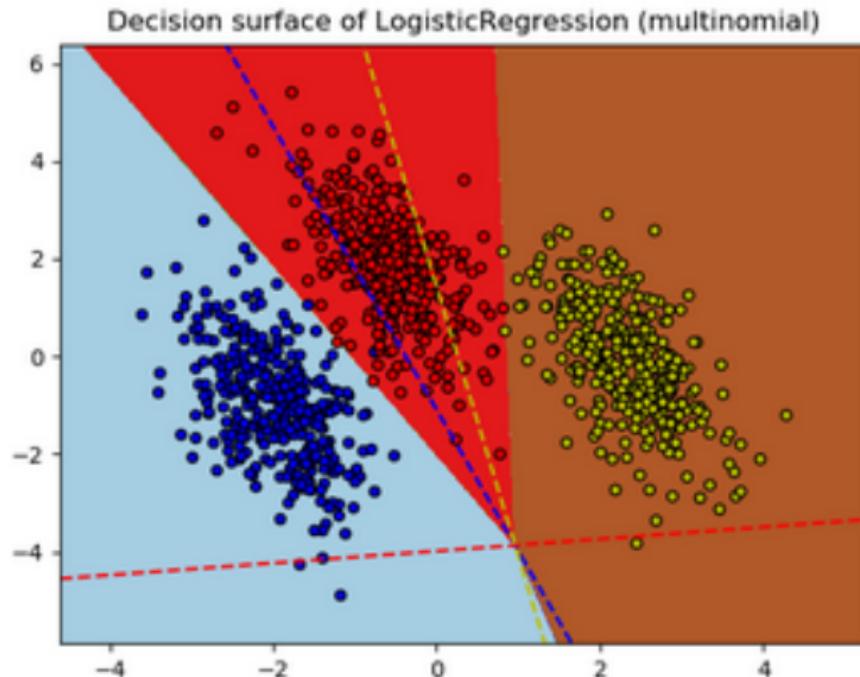
Pred: [0,83 0,1 0,2]
Error: = 0,17+0,1+0,2

Clasificación multiclas

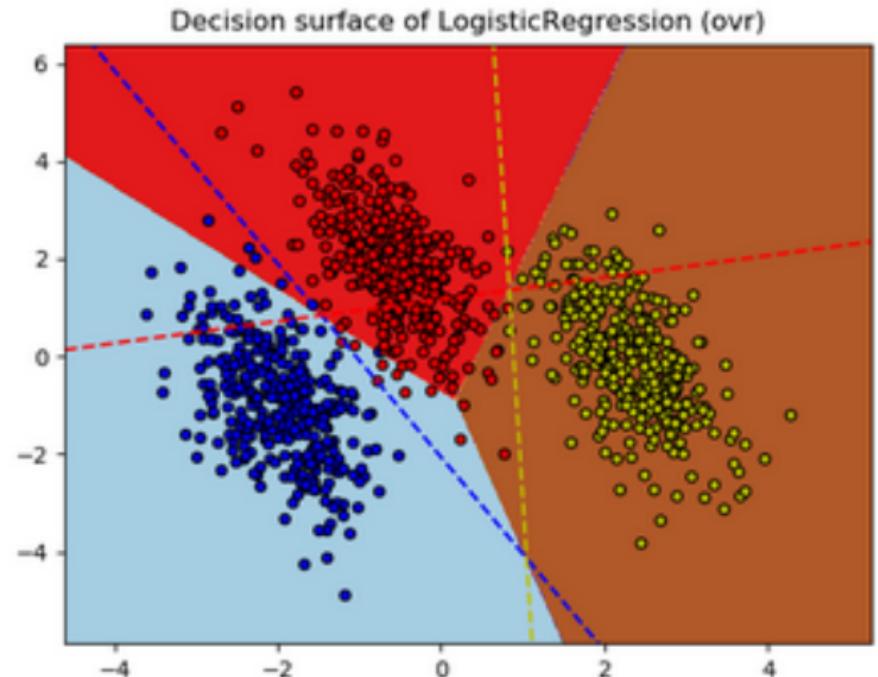


Clasificación multiclas

Multinomial



OvR



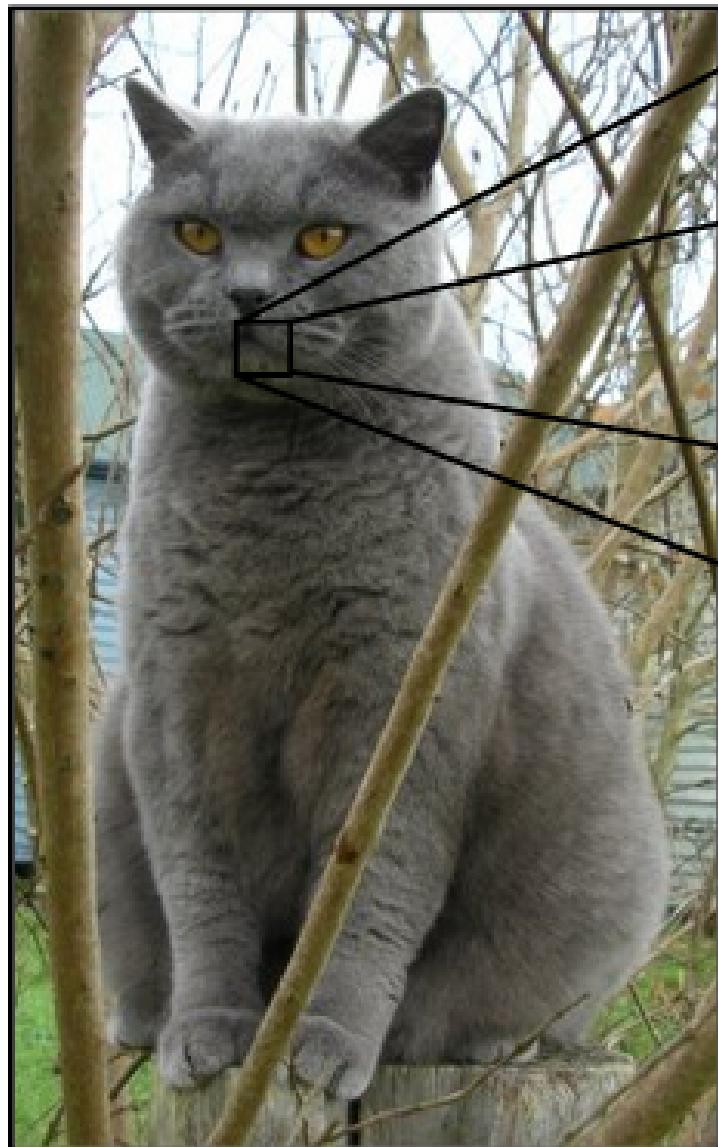
¡HORA DE CLASIFICARNOS!

<https://goo.gl/forms/OZ1fgTHP4jHbwdcE3>

75% train set
25% test set

¿Qué es una imagen para un ordenador?

Números



09	02	22	97	38	15	00	40	00	75	04	05	07	78	52	12	50	77	91	08
49	49	99	40	17	81	18	57	60	87	17	40	98	43	69	48	94	56	62	00
81	49	31	73	55	79	14	29	93	71	40	67	55	85	30	03	49	13	36	65
52	70	95	23	04	60	11	42	62	21	68	56	01	32	36	71	37	02	36	91
22	31	16	71	51	67	03	89	41	92	36	54	22	40	40	28	66	33	13	80
24	47	31	60	99	03	45	02	44	75	33	53	78	36	84	20	35	17	12	50
32	98	81	28	64	23	67	10	26	38	40	67	59	54	70	66	18	38	64	70
67	26	20	68	02	62	12	20	95	63	94	39	63	08	40	91	66	49	94	21
24	55	58	05	66	73	99	26	97	17	78	78	96	83	14	88	34	89	63	72
21	36	23	09	75	00	76	44	20	45	35	14	00	61	33	97	34	31	33	95
78	17	53	28	22	75	31	67	15	94	03	80	04	62	16	14	09	53	56	92
16	39	05	42	96	35	31	47	55	58	88	24	00	17	54	24	36	29	85	57
86	56	00	48	35	71	89	07	05	44	44	37	44	60	21	58	51	54	17	58
19	80	81	68	05	94	47	69	28	73	92	13	86	52	17	77	04	89	55	40
04	52	08	83	97	35	99	16	07	97	57	32	16	26	26	79	33	27	98	66
03	44	68	87	57	62	20	72	03	46	33	67	46	55	12	32	63	93	53	69
04	42	16	73	35	25	39	11	24	94	72	18	08	46	29	32	40	62	76	36
20	69	36	41	72	30	23	88	34	43	83	69	82	67	59	85	74	04	36	16
20	73	35	29	78	31	90	01	74	31	49	71	47	13	41	16	23	57	05	54
01	70	54	71	83	51	54	69	16	92	33	48	61	43	52	01	89	19	62	48

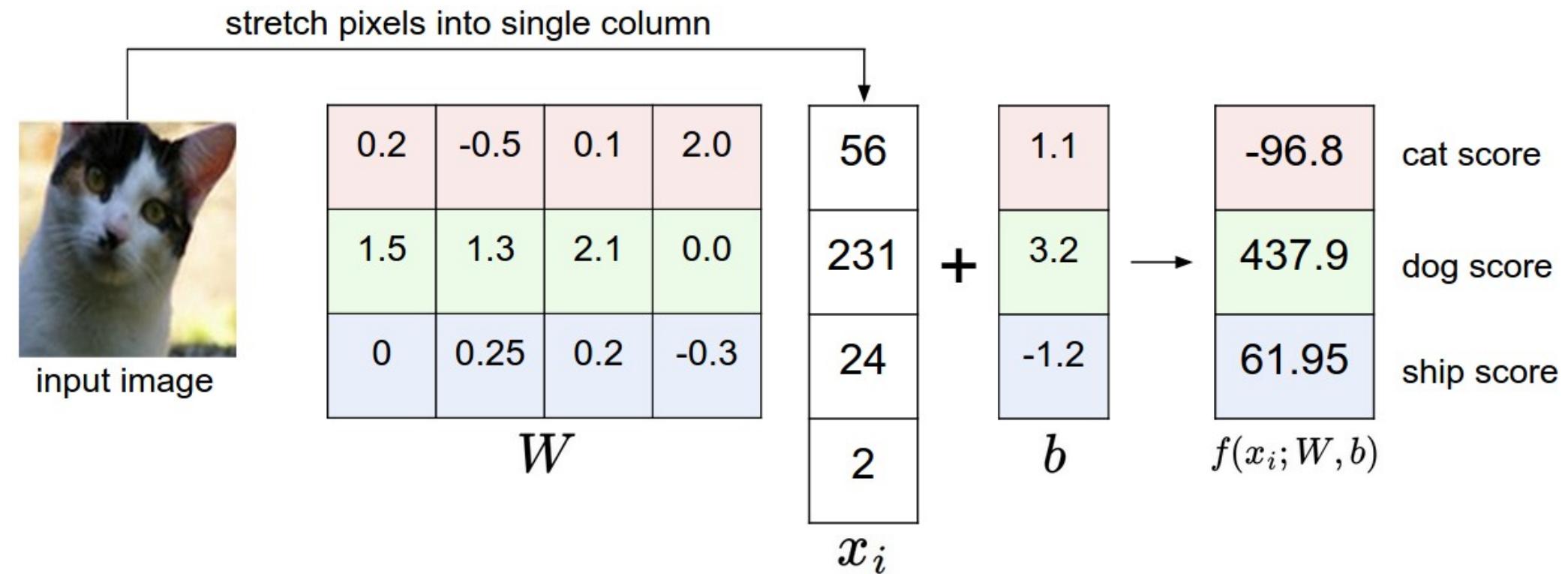
What the computer sees

image classification

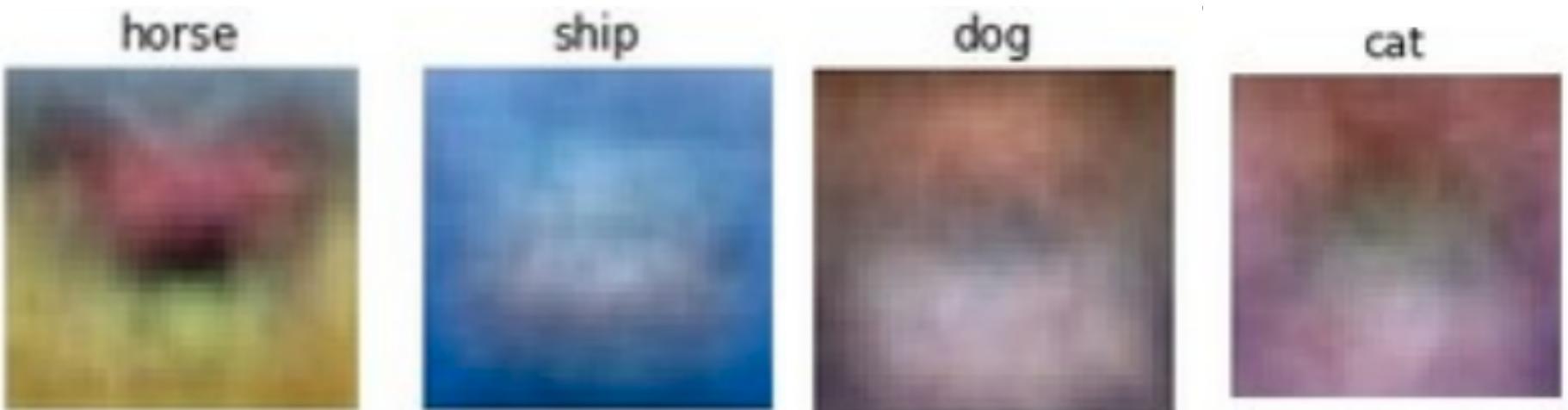
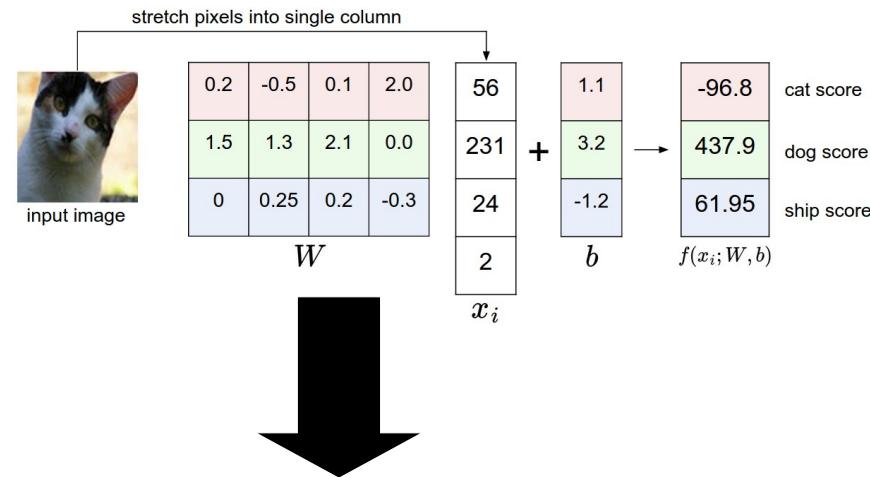
82% cat
15% dog
2% hat
1% mug

Redes neurales

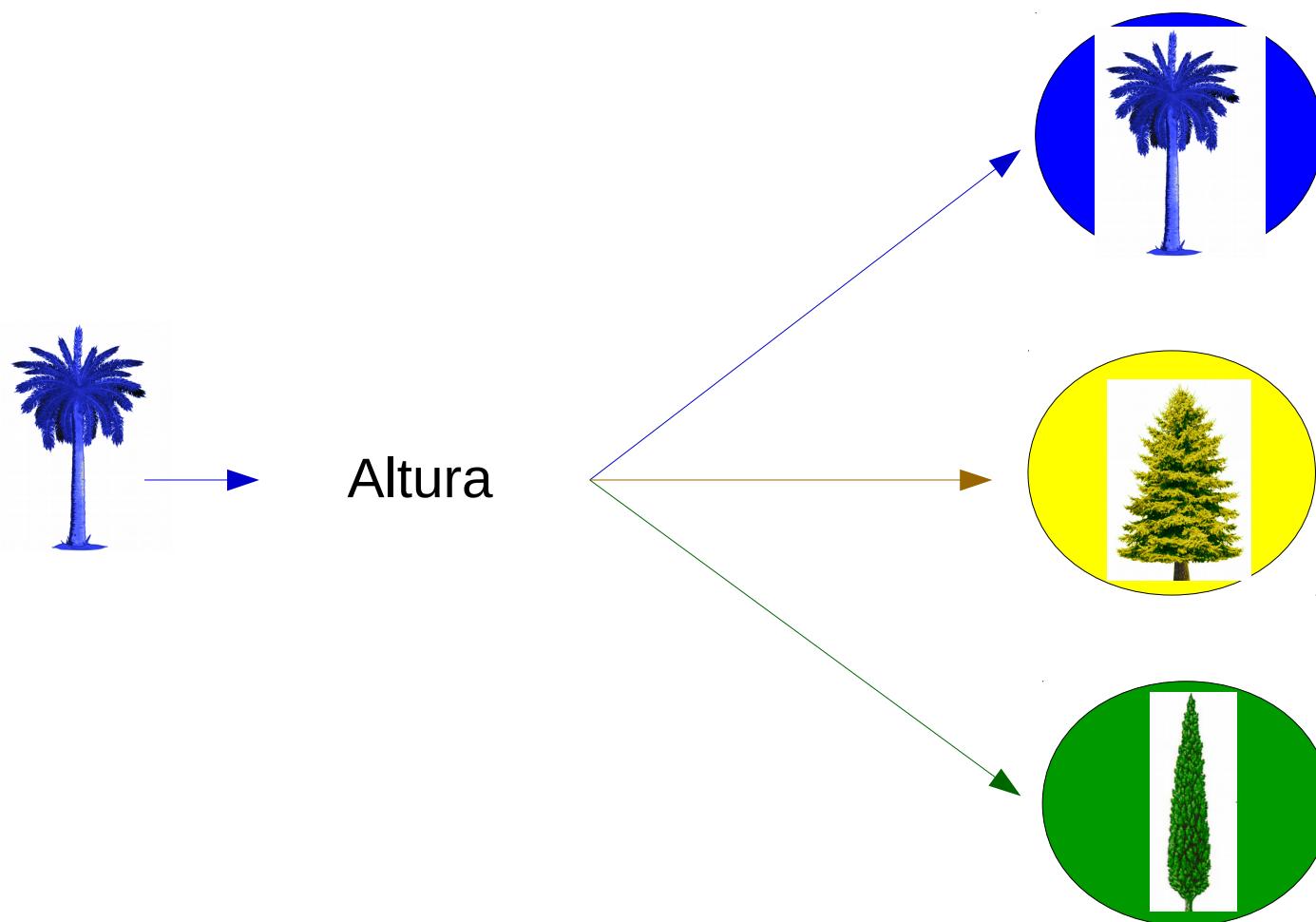
Perceptrón



Perceptrón Pesos



Clasificación multiclas



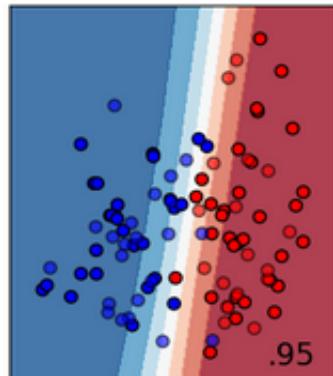
Dinámicas no lineales

Para ser lineal, se tiene que poder separar del resto de datos proyectados en un solo eje con una linea recta

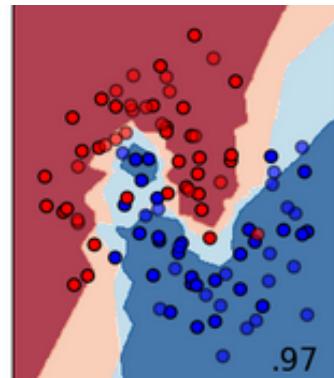


x (altura observada)

Es muy importante interpretar los datos: Reconocimiento del problema

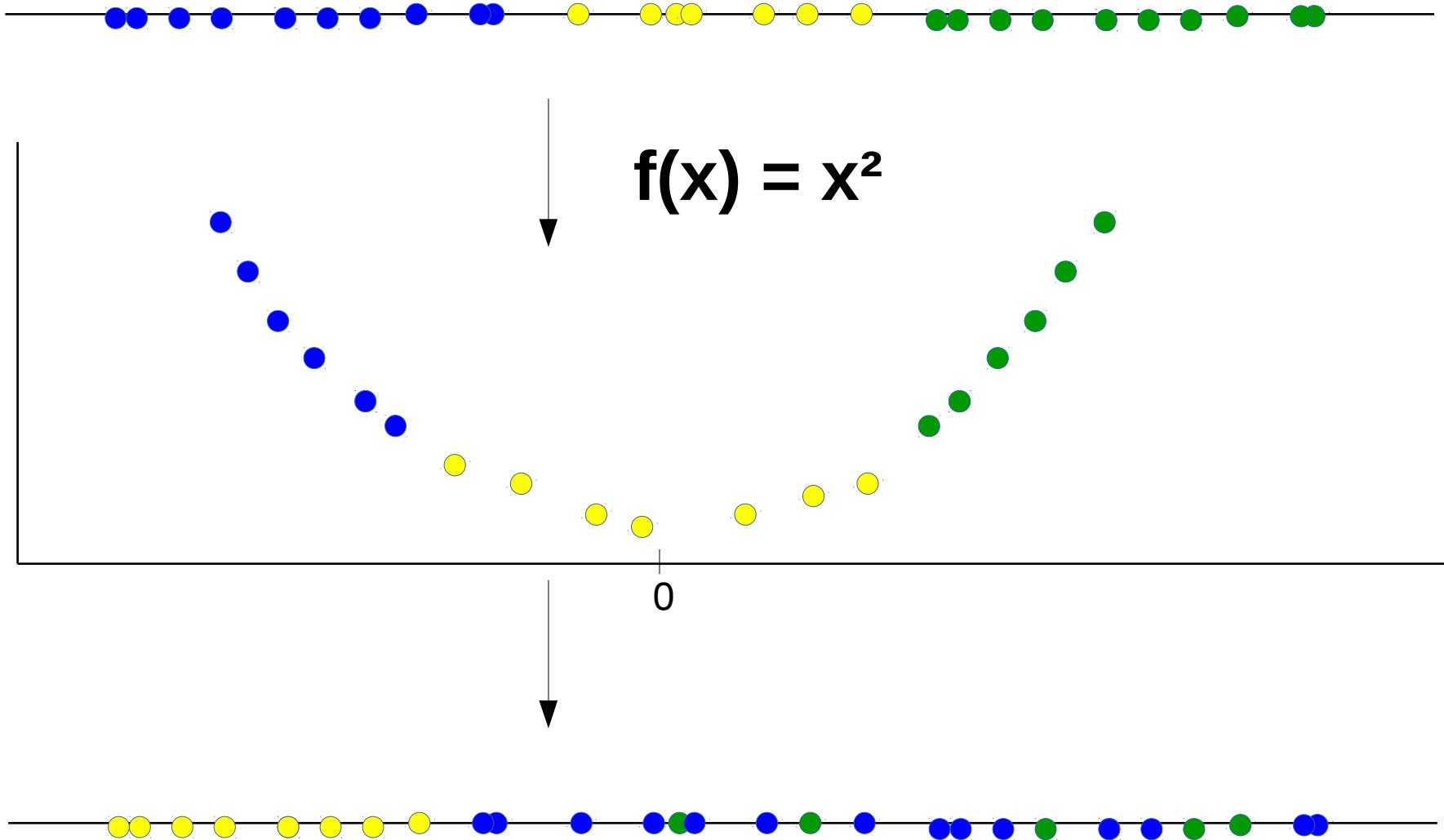


Linealmente separable

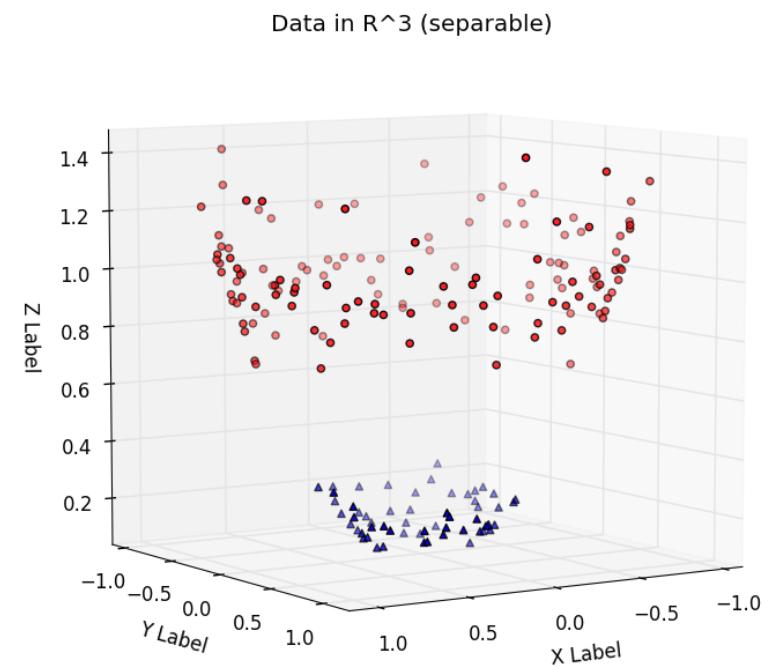
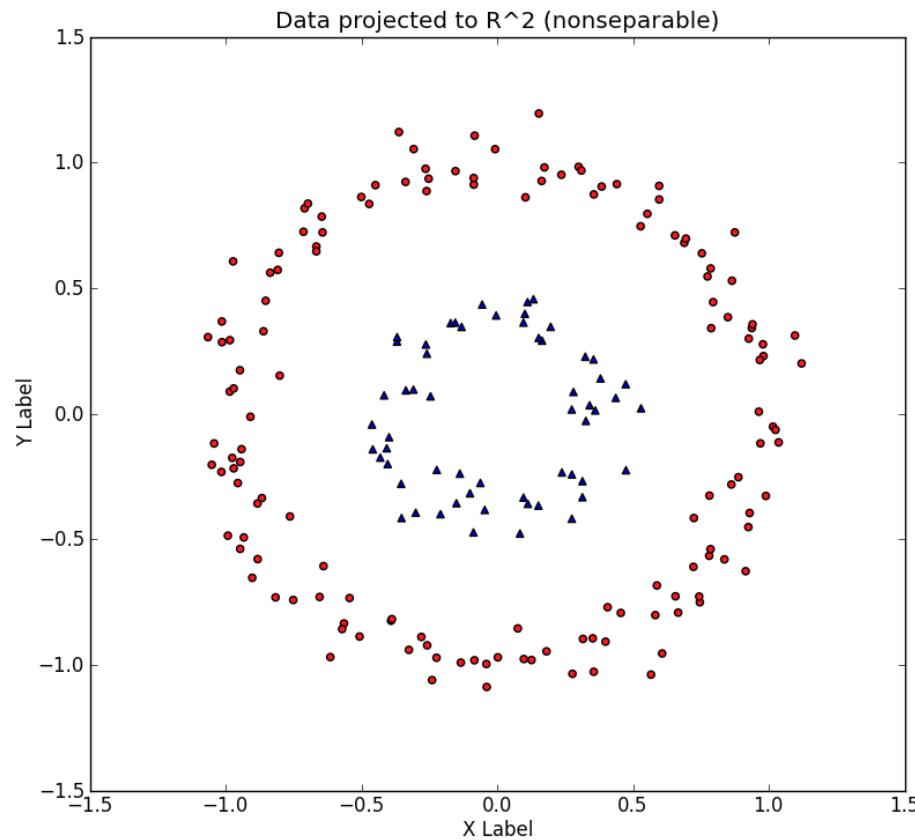


No linealmente separable

Afrontar un problema no lineal: Transformar los datos: Kernel trick



Afrontar un problema no lineal: Transformar los datos: Kernel trick



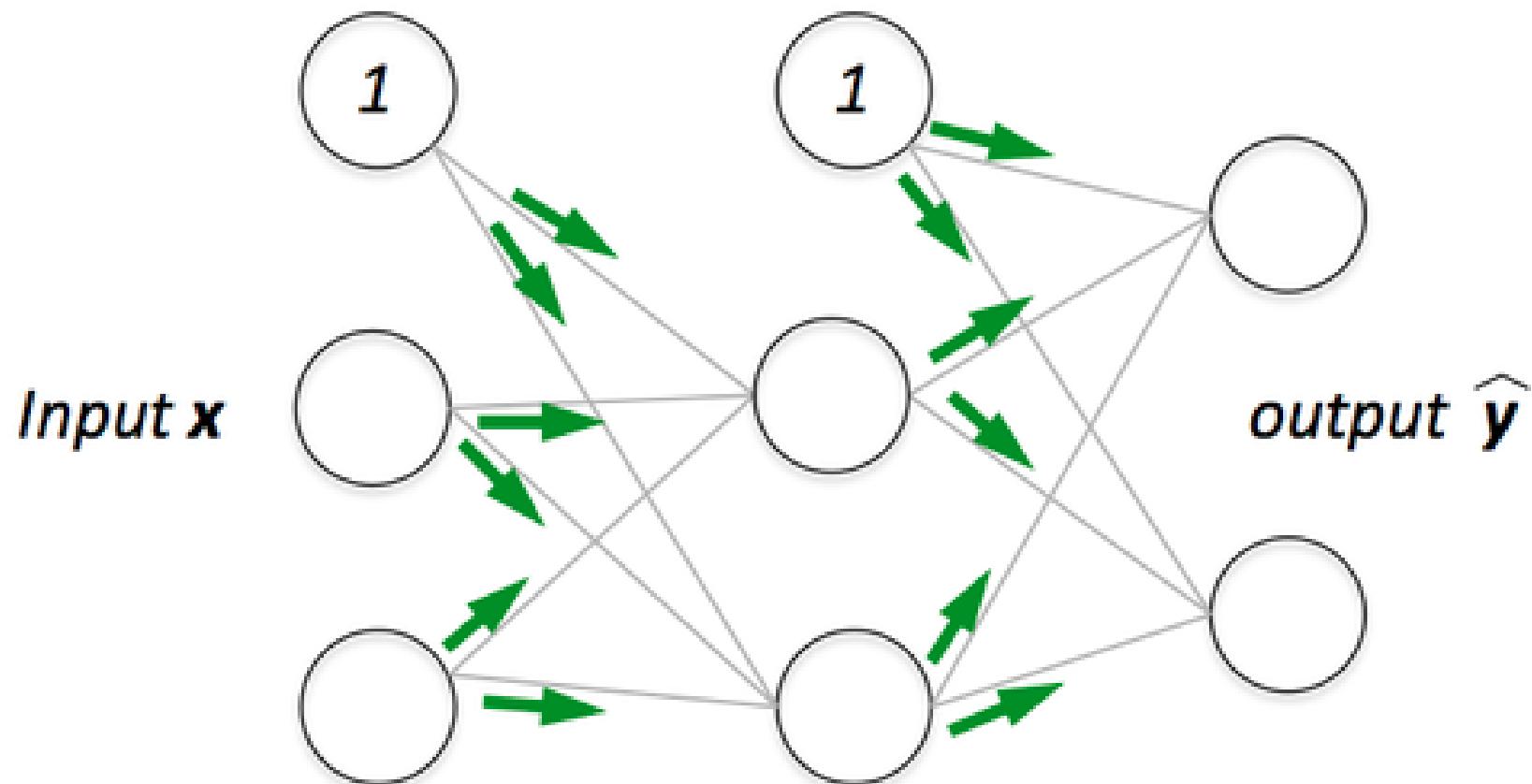
¿Puede un modelo averiguar por su naturaleza cómo hay que transformar los datos?

Sí: DEEP LEARNING

¡Añadir una capa más a la red neuronal!

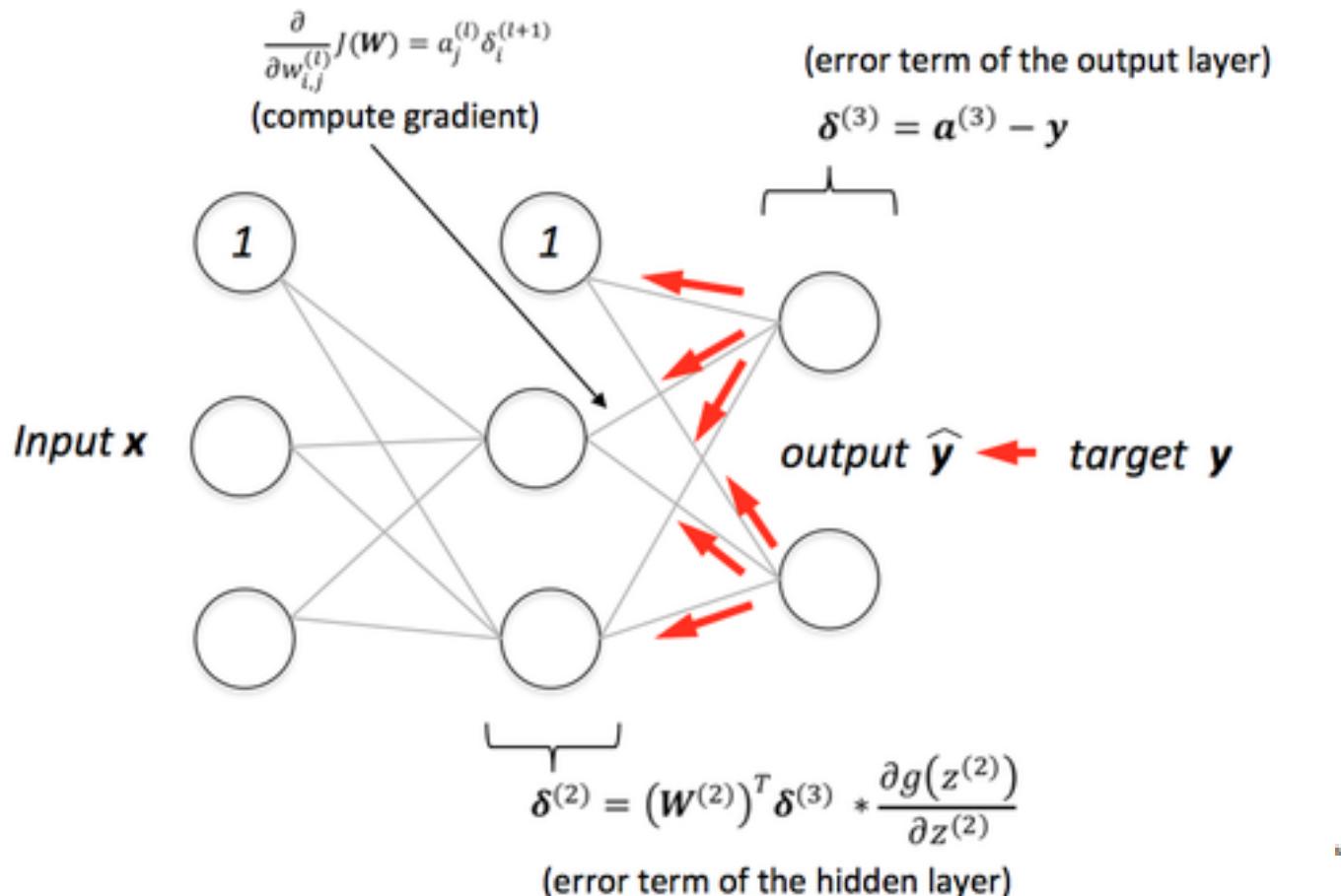
Redes neuronales MULTICAPA

Forward propagation



Redes neuronales MULTICAPA

Backward propagation



$$\frac{\partial y}{\partial x} = \frac{\partial f}{\partial g} \frac{\partial g}{\partial x}$$

Problemas para afrontar imágenes como datos de entrada

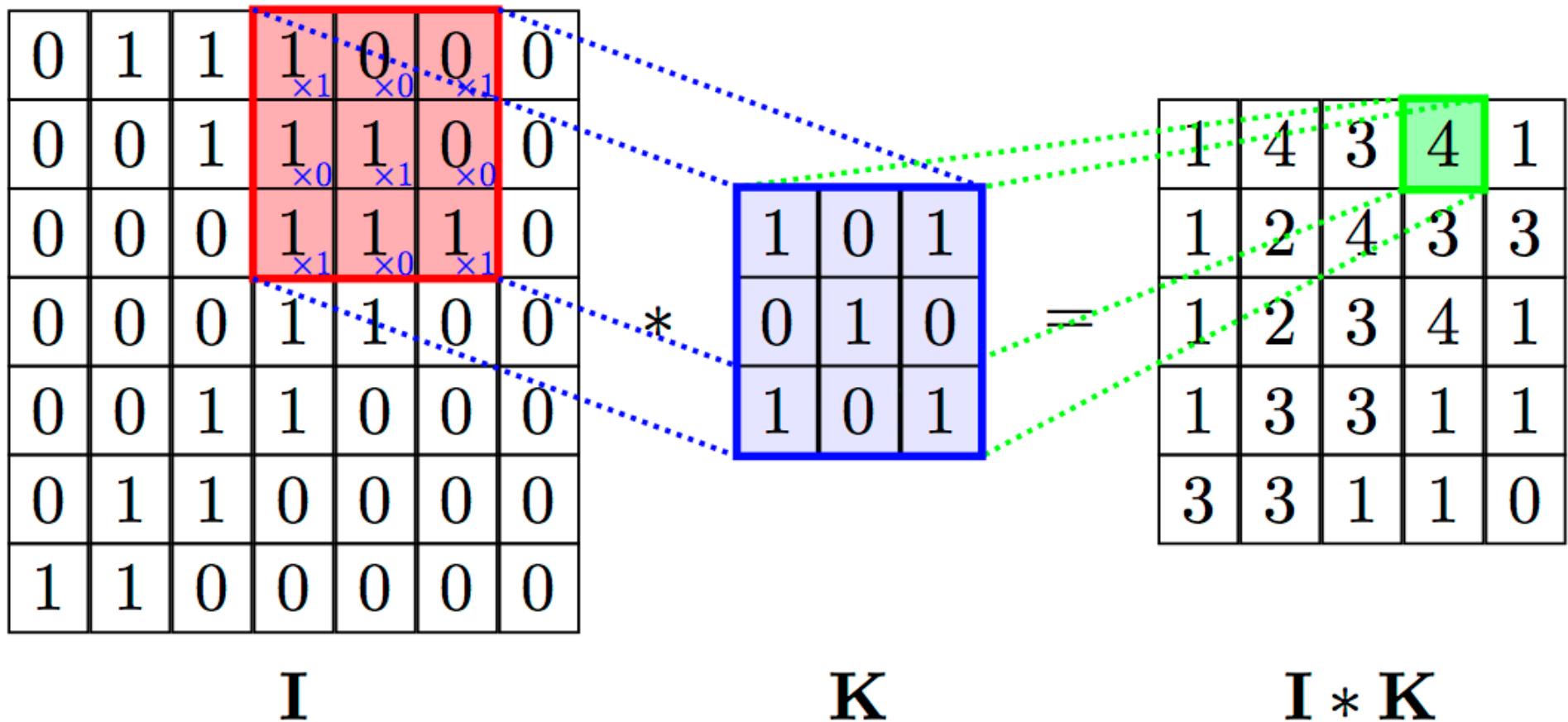
- Una pantalla de ordenador a 1024x768 muestra imágenes con 3,145,728 números
- El modelo se ajusta demasiado a imágenes concretas, y no generaliza en casos donde los píxeles se mueven

Una buena solución

Analizar el problema, y **reutilizar** una red neuronal por **distintas partes de la imagen** (inspirado en la retina del ojo).

Esto es, incluir en el modelo **capas convolucionales**

La capa convolucional es “igual”



Clasificación de imágenes



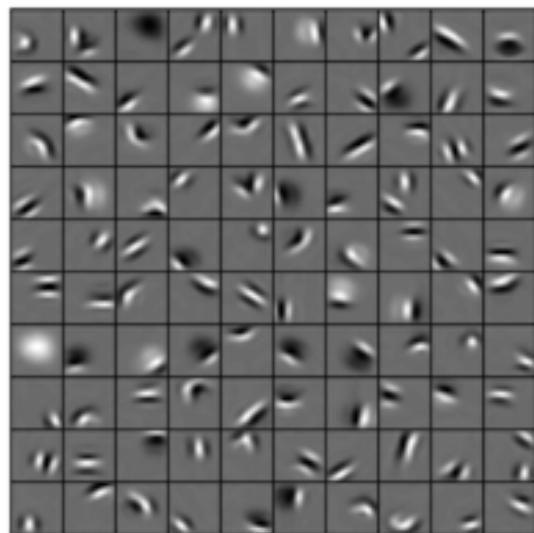
*

1	0	-1
2	0	-2
1	0	-1



Clasificación de imágenes

Variante de MLP: Red neural convolucional (CNN)



HORA DE SER NEURONAS

Clasificación de imágenes

Variante de MLP: Red neural convolucional (CNN)

