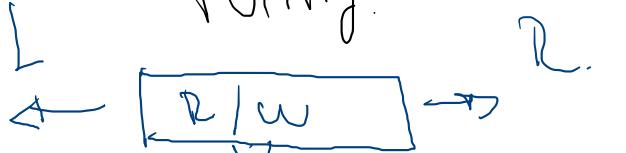


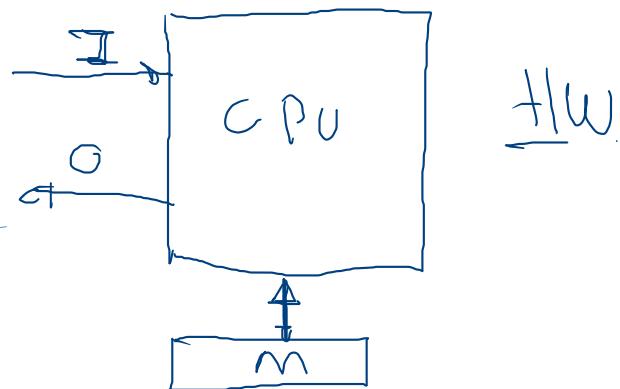
# Inteligencia Artificial

- Con máquinas intentar imitar la forma en la cual los Humanos aprenden, se enferman, comen, razonan, etc, para solucionar problemas
- Aprendizaje de Máquina

Máquina de Turing.



Arquitectura  
Von Neumann



ML (Machine Learning) → Algoritmos

- Procesamiento de Datos • Aprender de los datos
- 1. Predicción Ej: Regresión lineal, Precios de casas  
2. Clasificar Ej: Imágenes Perros/Gatos  
3. Agrupar Datos Ej: Sistema de Recomendación.  
\* 4. Generar información GAN.

→ Red Neuronal : Varias Neuronas (imitan las células neuronales).

- I.A → Lógica
- Sistemas Expertos (Sistemas basados en Reglas)
- Controladores Difusos
- Modelamiento basado en Agentes
- Técnicas de Búsqueda: No Informada  
    └ No informada: Búsqueda en Profundidad DFS
- └ Informada: Búsqueda en Anchura BFS
- └ Informada: USO de Heurísticas.
- Técnicas de optimización: Sistemas Bio-inspirados
- └ Algoritmos Genéticos \*

Técnicas Búsqueda

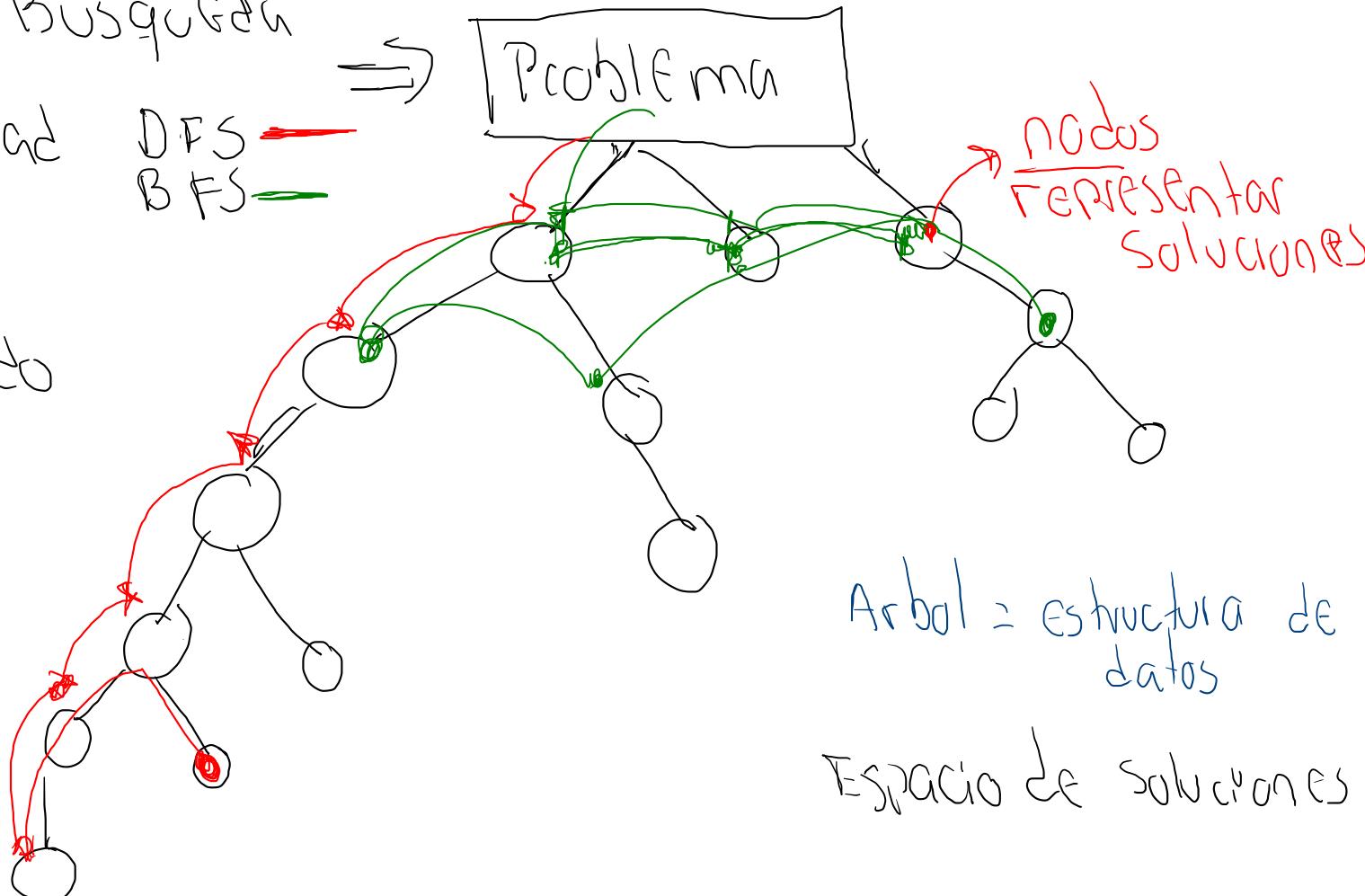
Profundidad  
Anchura

DFS  
BFS

Problema

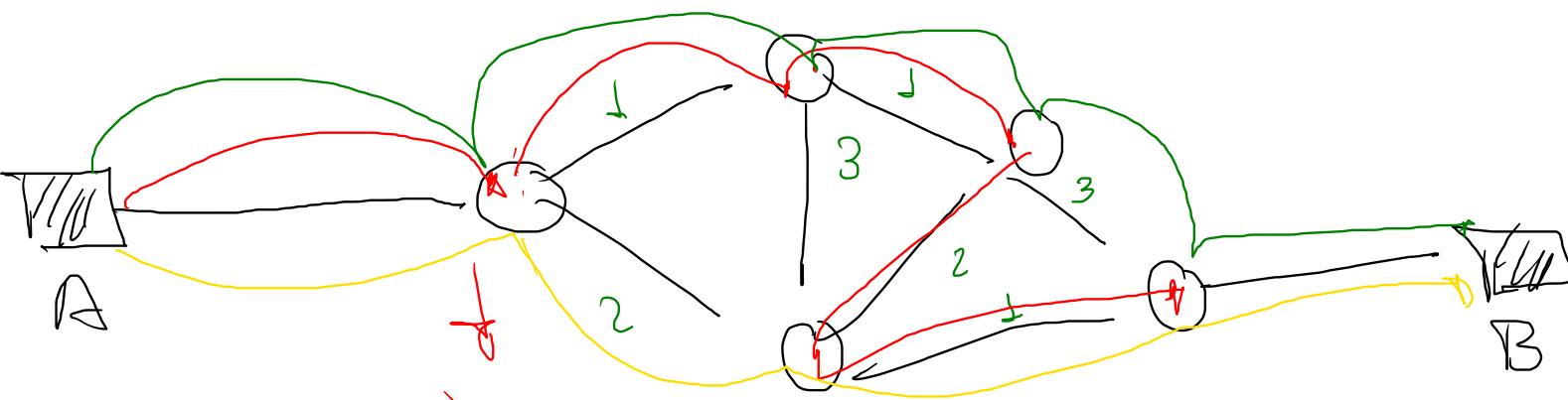
Nodos  
representar  
soluciones

No informado



# Technical Informatics

'Heuristica'  $A^*$ , Dijkstra,



Nodos  
Configuración de  
posibles soluciones

## Técnicas optimización

$f(x)$ : función objetivo

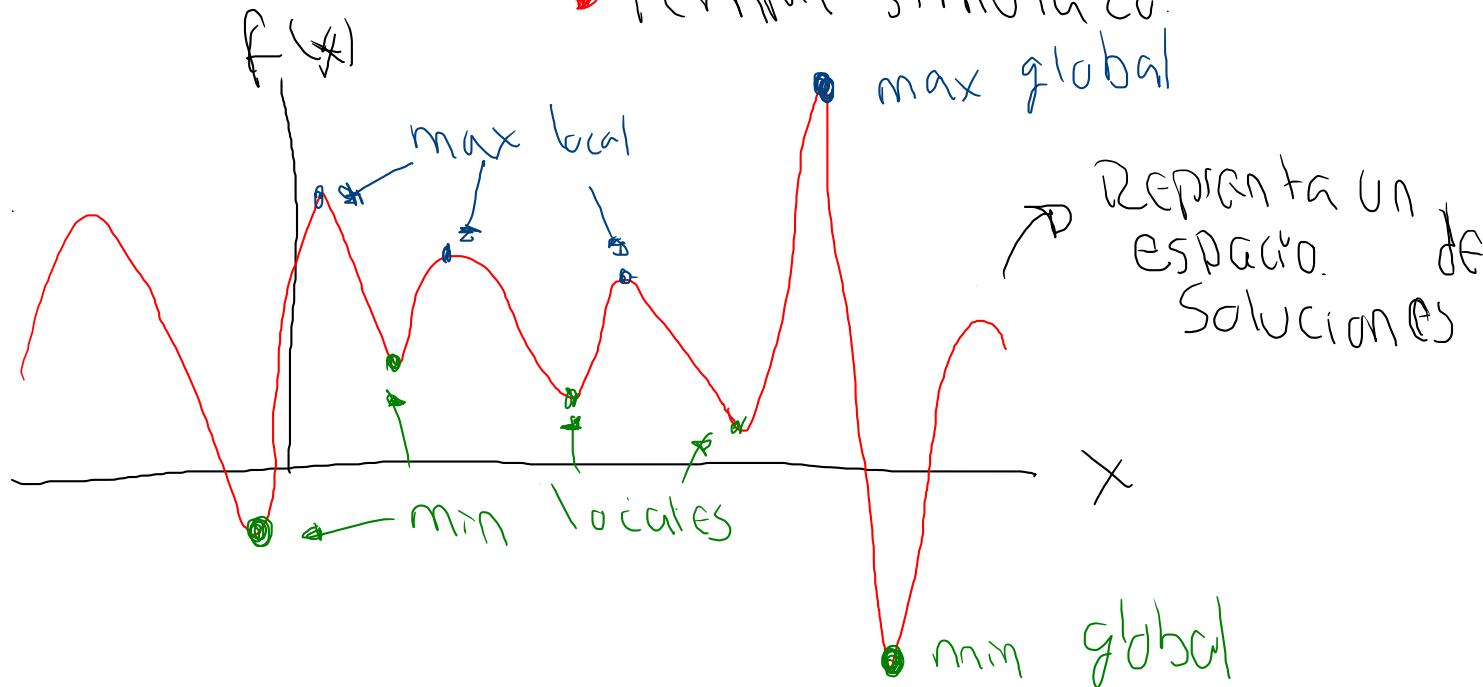
- max
- min

Restricciones.

→ Ascenso de Colina  
→ Temp Simulada

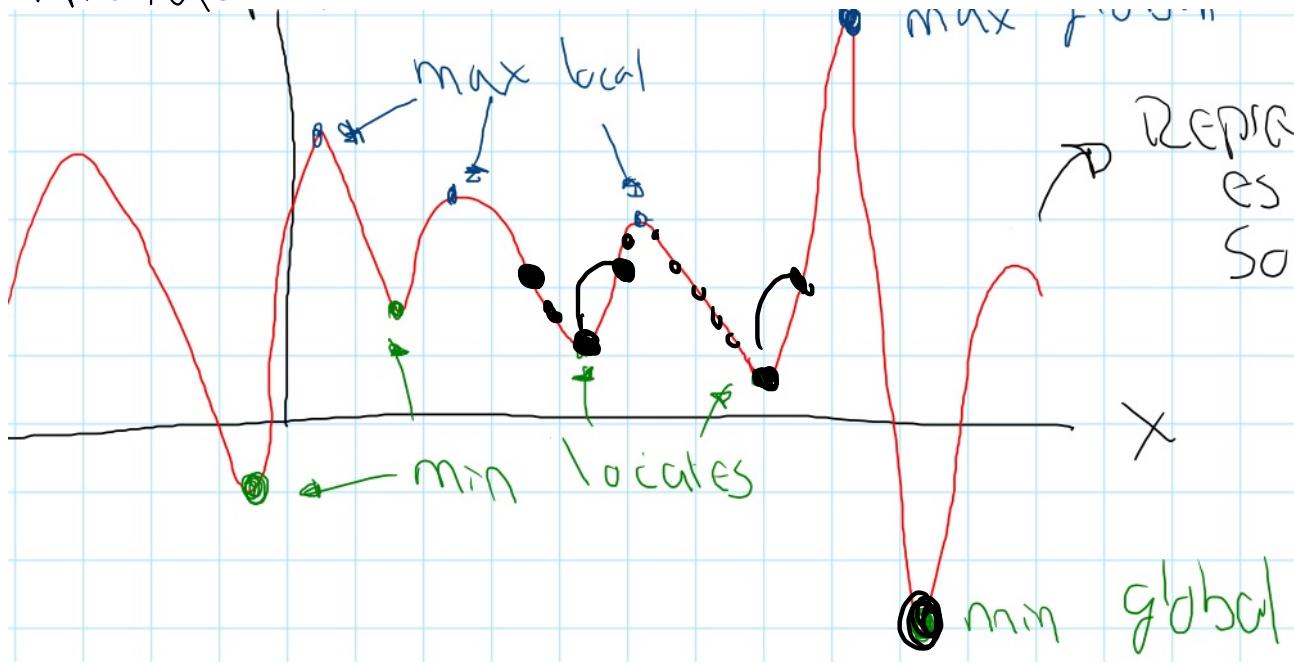
max global

→ Representa un espacio de soluciones



Típico Simulado

min



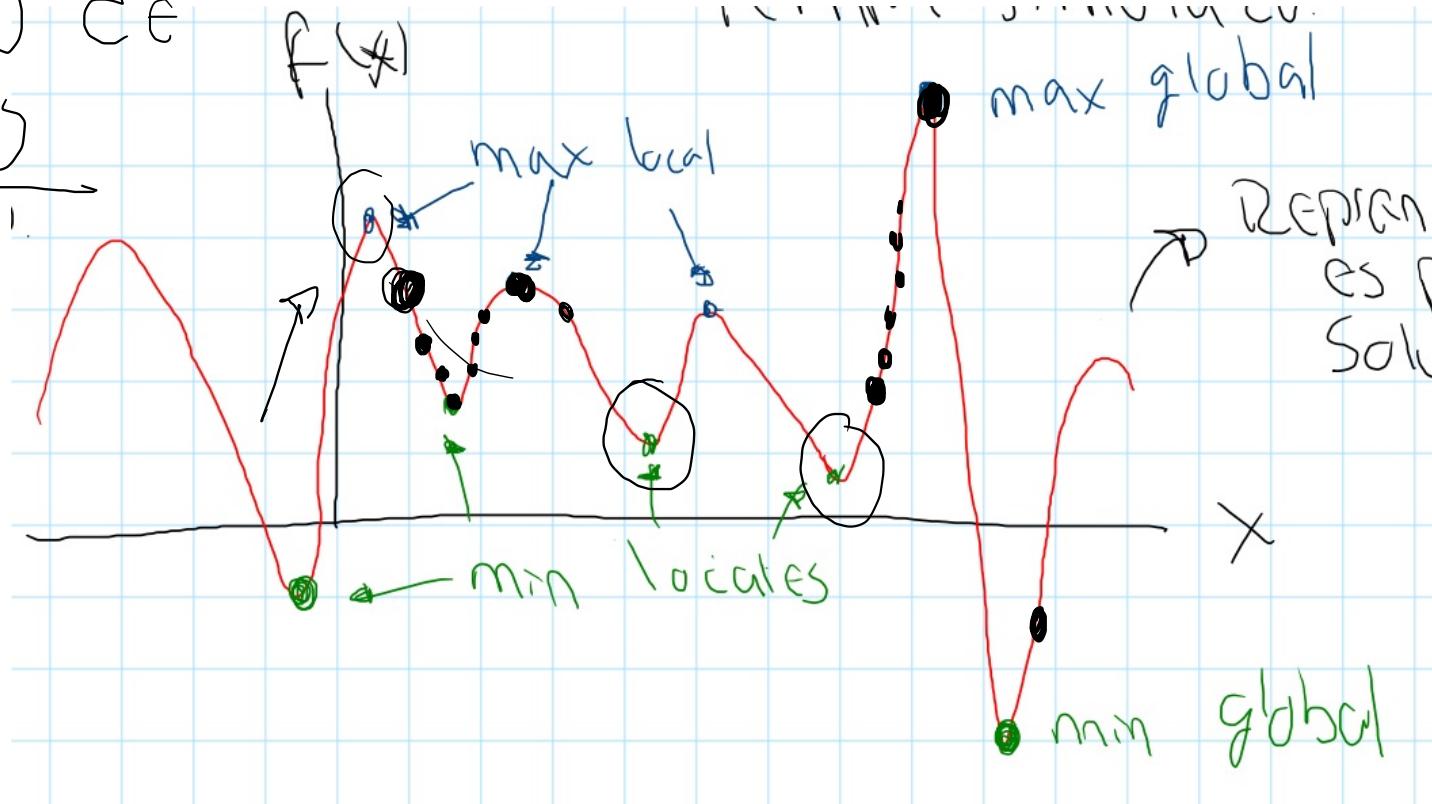
No se queda atrapado en min locales

ASCENSO IDE

(climbing)

↓

maximo



## • Tipos de Aprendizaje en L

- Supervisado: Los datos tienen etiquetas
- No supervisado: los datos No tienen etiquetas

$$\text{Peso} = [w_1, \dots, w_n]$$

$$\text{Activación} = [a_1, \dots, a_n]$$

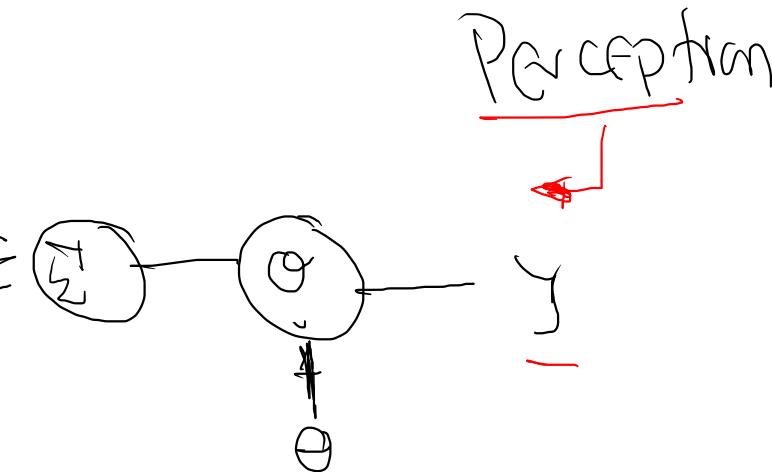
$$\text{Imc} = [x_1, \dots, x_n]$$

$$x_1 w_1$$

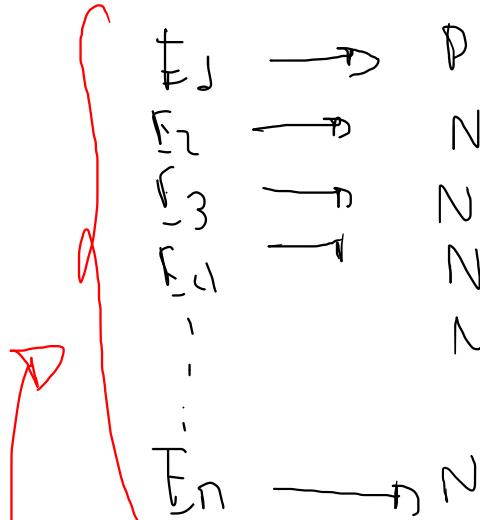
$$x_2 w_2$$

$$x_3 w_3$$

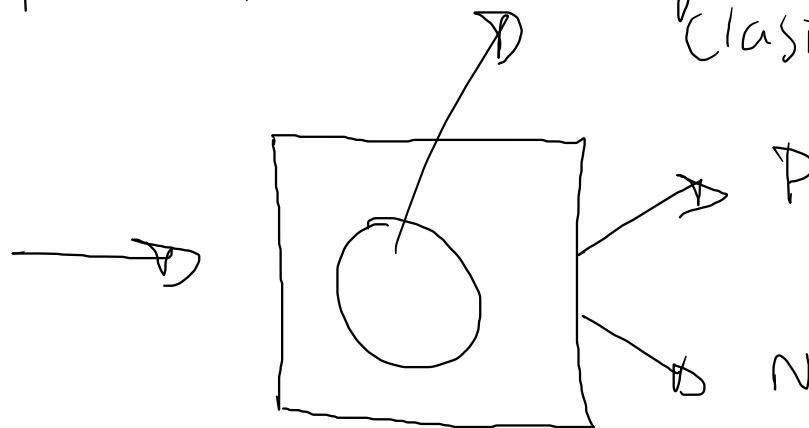
-



Ejemplo : Clasificación



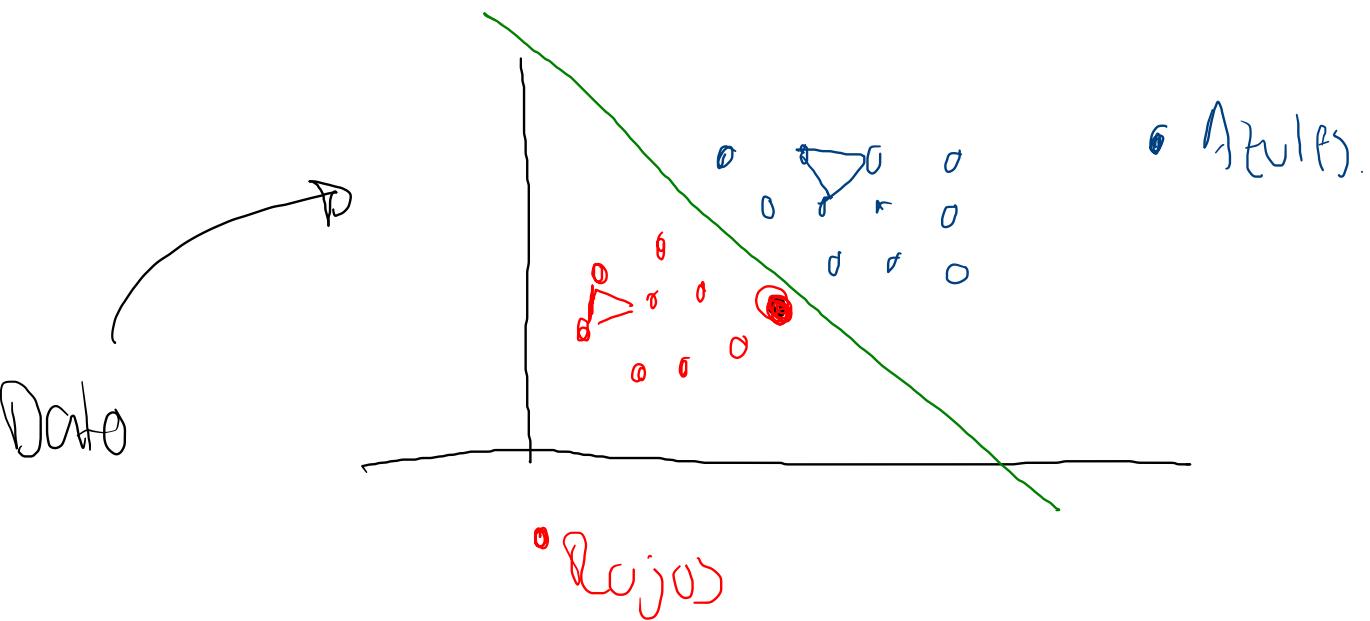
Algoritmo  
Clasificación



Datos  
Entrenamiento



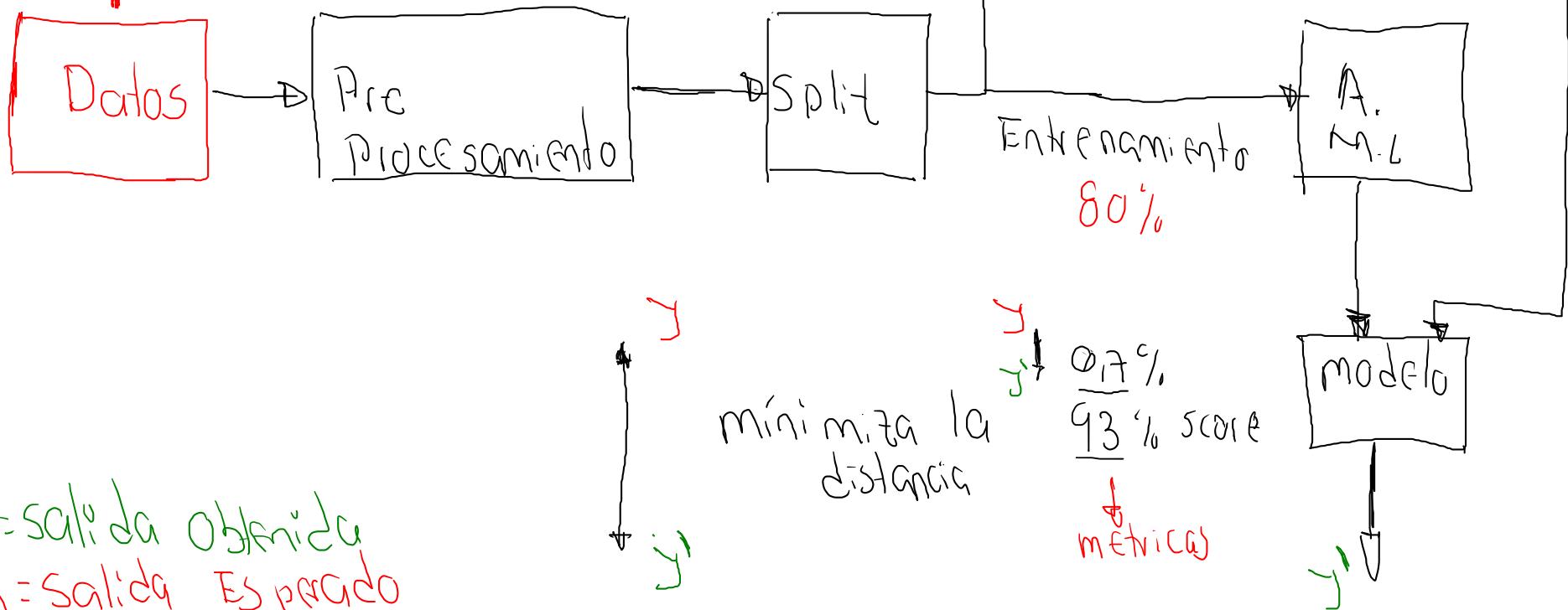
# Algoritmo de Agrupamiento



# Ciclo de vida del Dato (M.L)

Prueba 20%

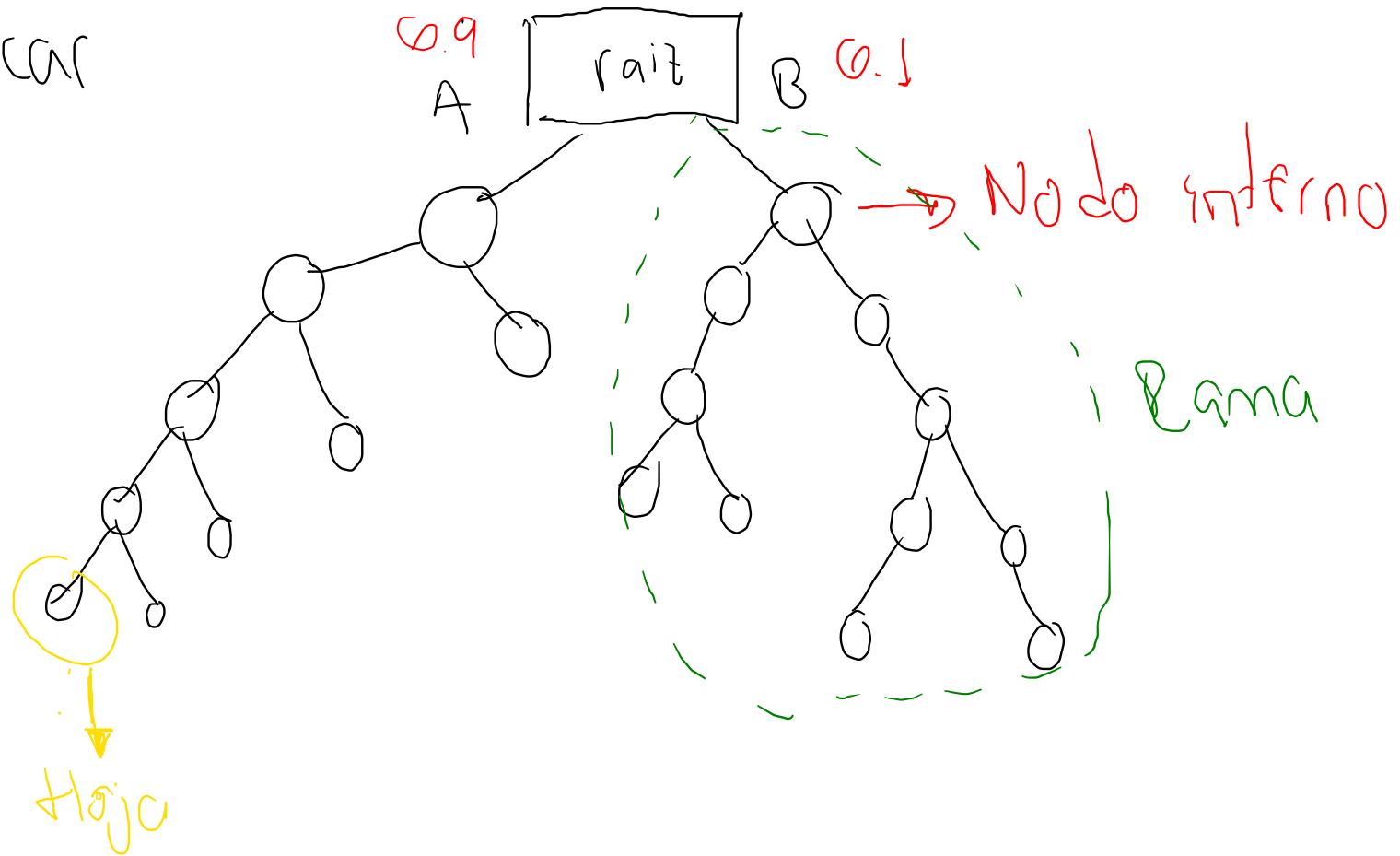
X = Dato in



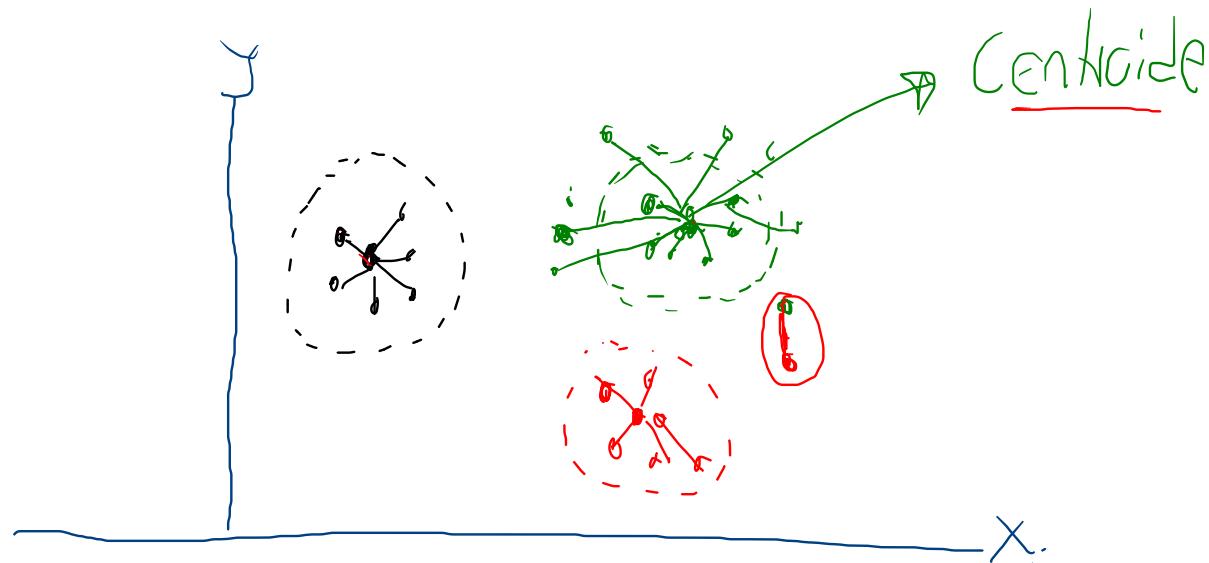
y = Salida obtenida  
y = Salida Esperado

# Árbol de decisión

Clasificar

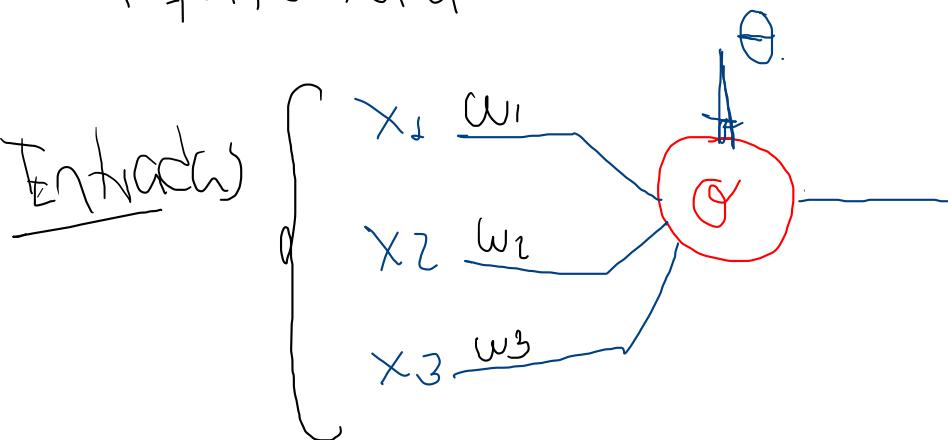


# Algoritmo de Agrupamiento k-means.



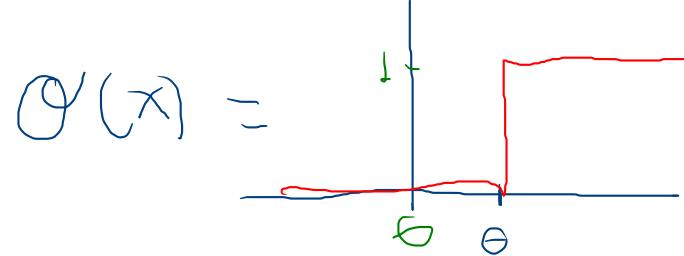
# Red Neuronal.

Arquitectura:



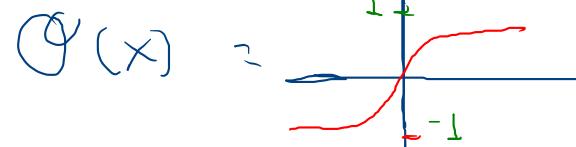
Perceptron  
Salida.

$$y = \Theta(x_1w_1 + x_2w_2 + x_3w_3 + \theta)$$



Función de paso

$$\Theta(x) =$$

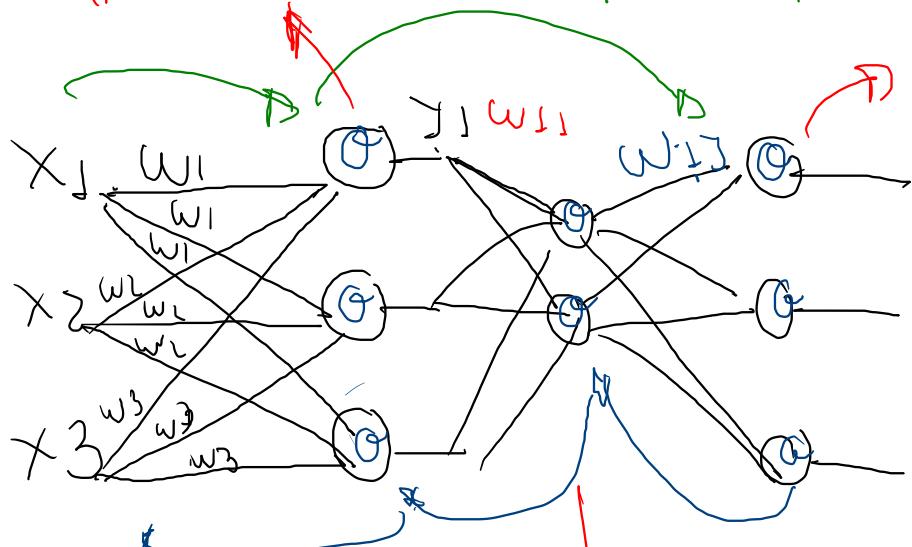


Función Sigmoidal

$$\Theta(x) =$$

Red Neuronales

CAPA ENTRADA



Hacia adelante

CAPA DE SALIDA.

$$y_1 \longrightarrow j_1$$

$$y_2 \longrightarrow j_2$$

$$y_3 \longrightarrow j_3$$

Hacia atrás (Back propagation).  
CAPAS OCULTAS

$$\begin{bmatrix} w_1, w_2, w_3, \theta \\ w_{11}, w_{12}, w_{13}, w_{21}, w_{23}, w_{31}, w_{32} \\ w_{1j}, w_{2j}, w_{3j} \end{bmatrix}$$

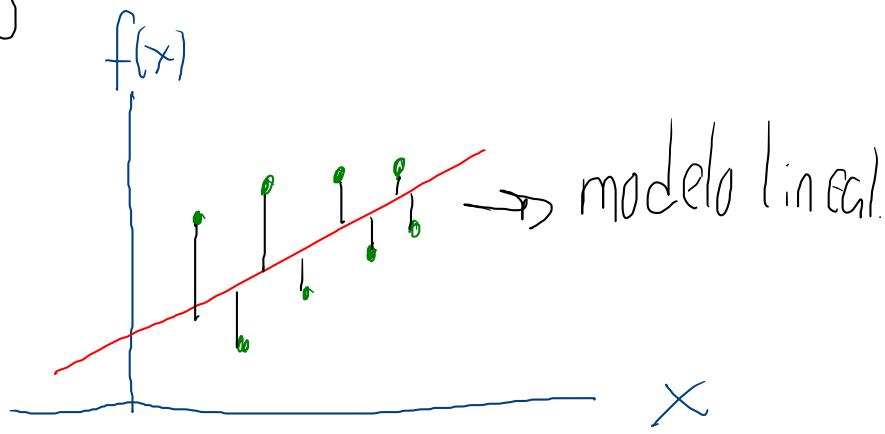
$j \rightarrow$  Salida obtenida

$\hat{j} \rightarrow$  Salida esperada

# Modelos de Entrenamiento

Regresión  $\rightarrow$   $y = mx + b$

$$MSE = \frac{1}{m} \sum_{i=1}^m (b^T x^i - y^i)^2$$



$$x = [100, 1]$$

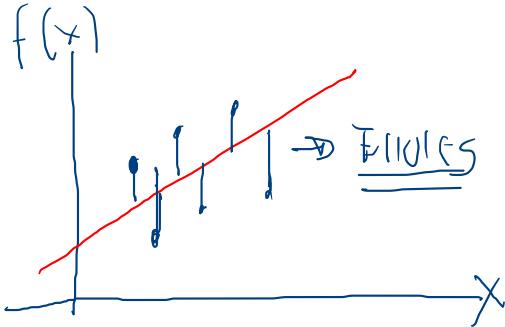
$$y = [100, 1] \rightarrow 3 + 3x + N$$

$$y = 3x + 3 + N$$

$$y = 3x + (3+N) \rightarrow \text{vector } b = (3+N)$$

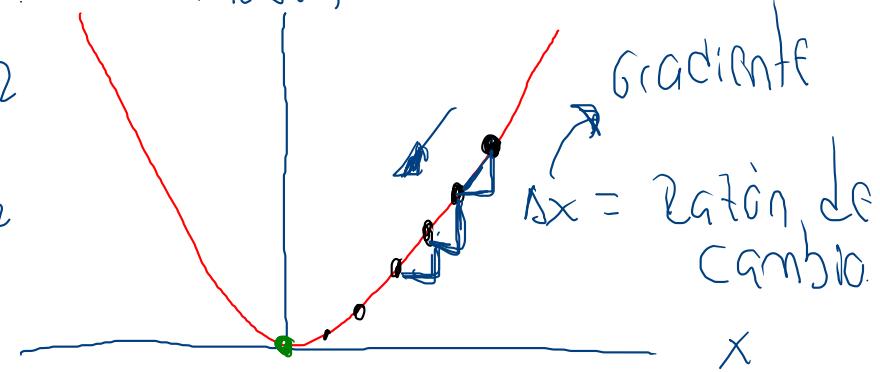
$N$  = ruido aleatorio.

Función de costo. / Gradiente DESCENDENTE



$$MSE(x) = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$$

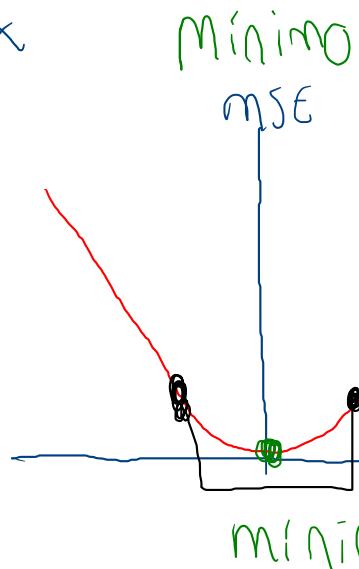
$MSE(x)$



modelo iterativo  
modelo Aproximado



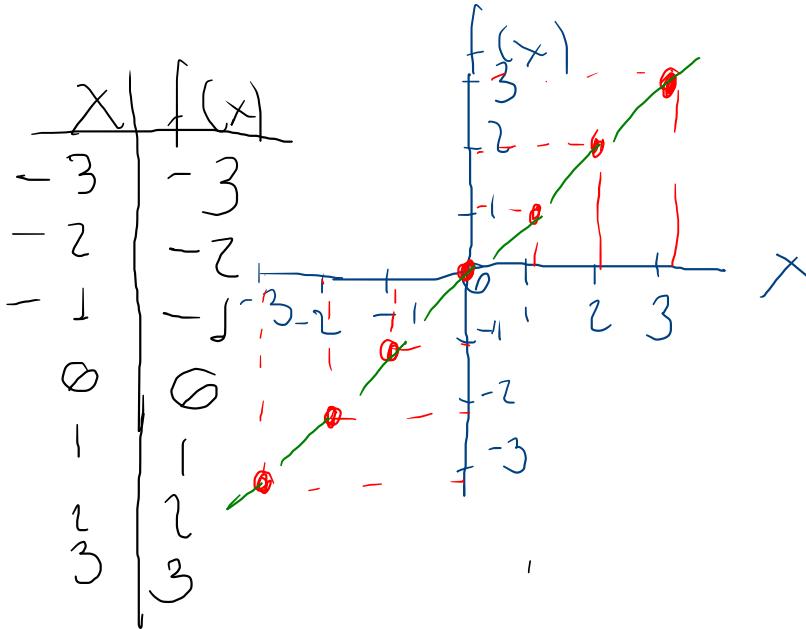
paso de  $\Delta x$   
PEQUEÑO



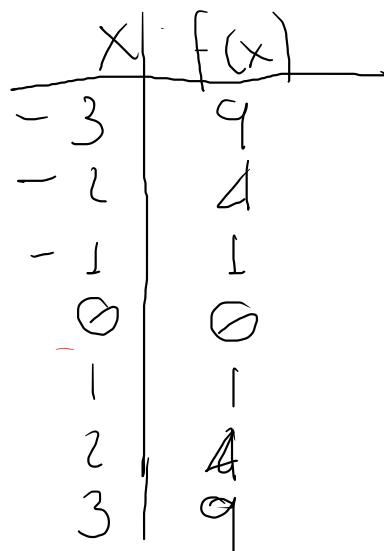
paso de  $\Delta x$   
GRANDE

# Ejemplo de funciones

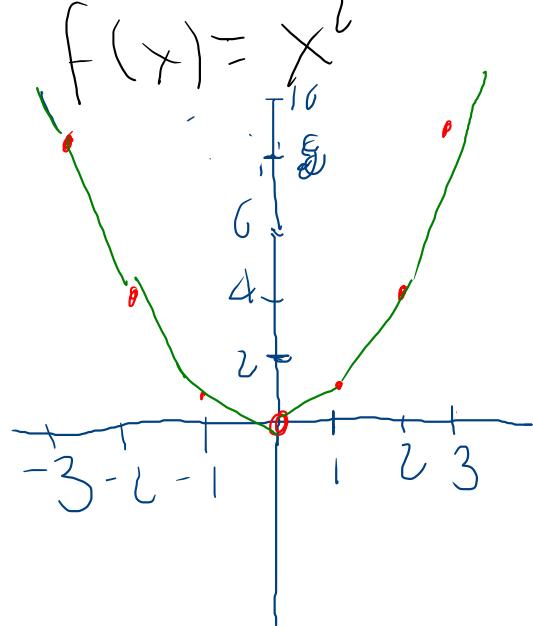
lineal  $f(x) = x$



cuadratica

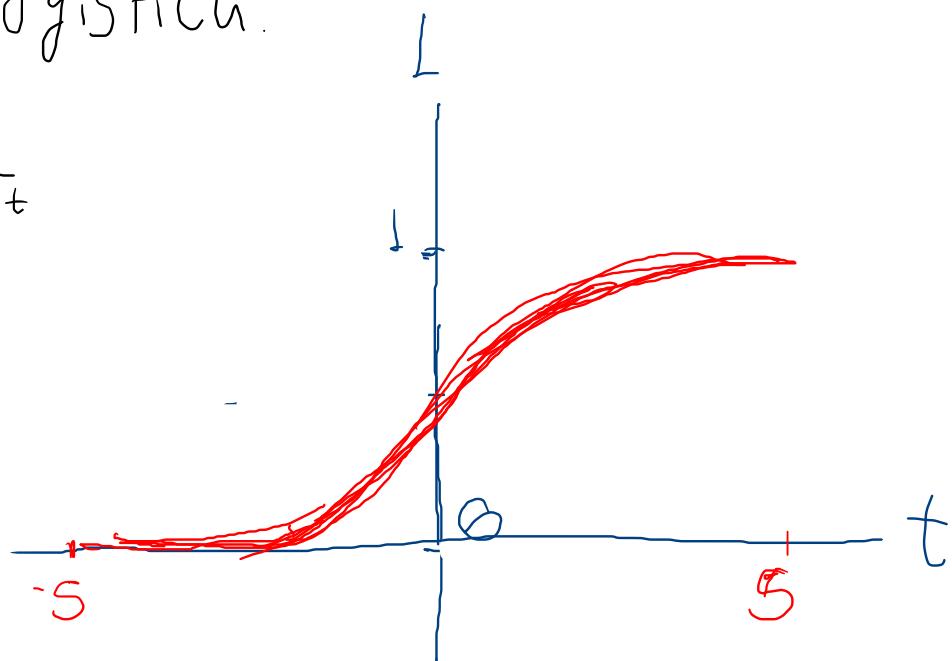


$f(x) = x^2$



Función logística:

$$L = \frac{1}{1 + e^{-t}}$$

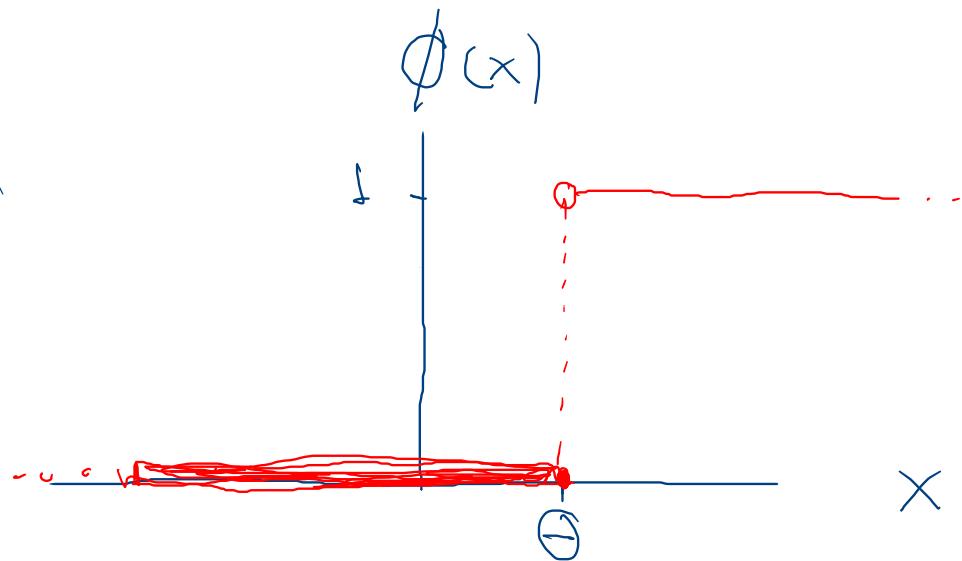


# Funciones de Activación.

## Función de Paso.

$$\phi(x) = \begin{cases} 0 & \text{Si } x \leq 0 \\ 1 & \text{Si } x > 0 \end{cases}$$

función a trozos



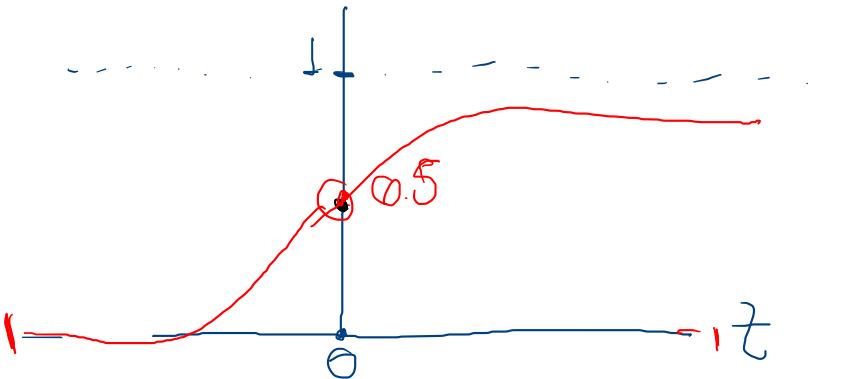
Si  $\underline{\theta} = 3$

$\phi(-1) = 0$	$\phi(3,1) = 1$
$\phi(0) = 0$	$\phi(4) = 1$
$\phi(1) = 0$	$\phi(5) = 1$
$\phi(2) = 0$	
$\phi(3) = 0$	

# Función Logística

$$\theta(t) = \frac{1}{1 + e^{-t}}$$

$$\theta'(t) = \frac{1}{(1 + e^{-t})^2}$$



$$e^{-t} = \frac{1}{1 + e^t}$$

$$\theta(t) = \frac{1}{1 + \frac{1}{e^t}}$$

$$\theta'(t) = \frac{e^t}{e^t - 1}$$

$$\theta(-3) = \frac{1}{1 - e^{-3}} =$$

$$\theta(t) = \frac{1/(1)}{e^t - 1} = \frac{e^t}{e^t - 1}$$

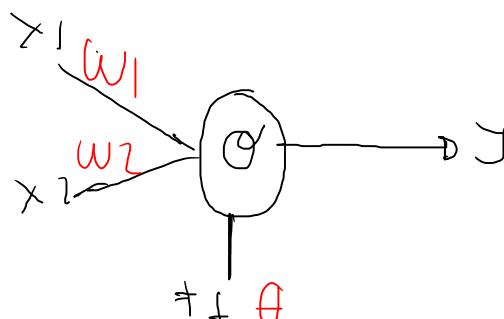
$$\theta(\phi) = \frac{e^\phi}{e^\phi - 1}$$

$$\theta(0) = \frac{1}{1 - 1}$$

$$\theta'(0) = \frac{1}{1 + e^{-0}} = \frac{1}{1+1} = \frac{1}{2} = 0.5$$

Función AND → Con Percepción

$x_1$	$x_2$	Out
0	0	0
0	1	0
1	0	0
1	1	1



$\theta$  = Función de paso.

$$\theta(x_1w_1 + x_2w_2)$$

$$w_1 = 2 \quad \theta = 0$$

$$w_2 = 2$$

$$\begin{aligned} w_1 &= 0.7 \\ w_2 &= -0.3 \\ \theta &= 1 \end{aligned}$$

Para  $x_1 = 0 \quad x_2 = 0$

$$\frac{0}{x_1} \cdot \underline{w_1} + 0 \cdot \underline{w_2} = 0 \quad \theta(0) = 0$$

DGIA  $x_1 = 0 \quad x_2 = 1$

$$0 \cdot 0.7 + 1 \cdot (-0.3) = -0.3 \quad \theta(-0.3) = 0$$

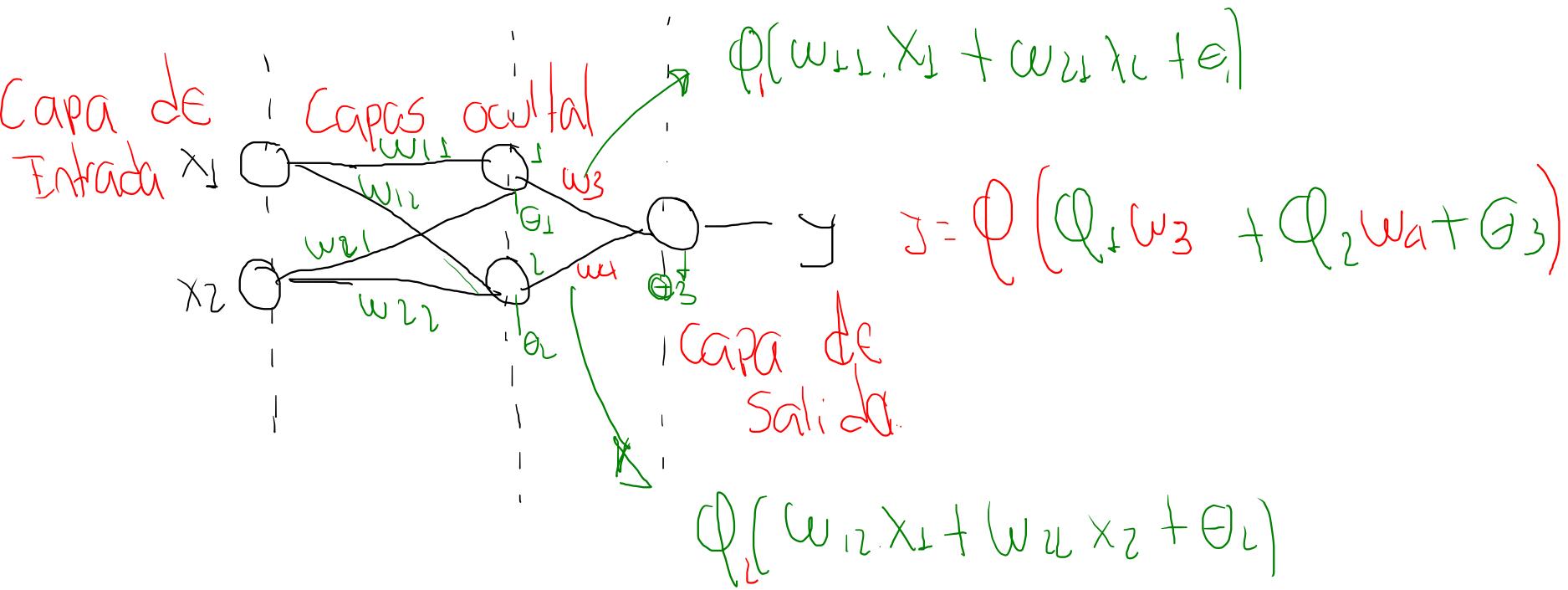
DGA  $x_1 = 1 \quad x_2 = 0$

$$1 \cdot (0.7) + 0 \cdot (-0.3) = 0.7 \quad \theta(0.7) = 0$$

DGA  $x_1 = 1 \quad x_2 = 1$

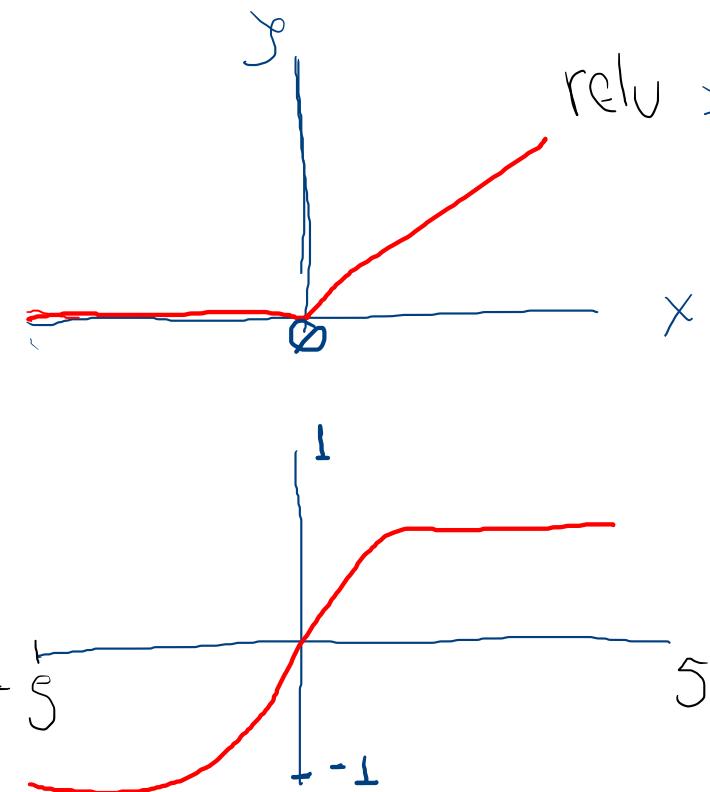
$$1 \cdot (0.7) + 1 \cdot (-0.3) = 0.4 \quad \theta(0.4) = 0$$

# Percepción multicapa.



# Funciones de activación

- Peso ✓
- Logistica ✓
- relu →
- tanh
- identidad

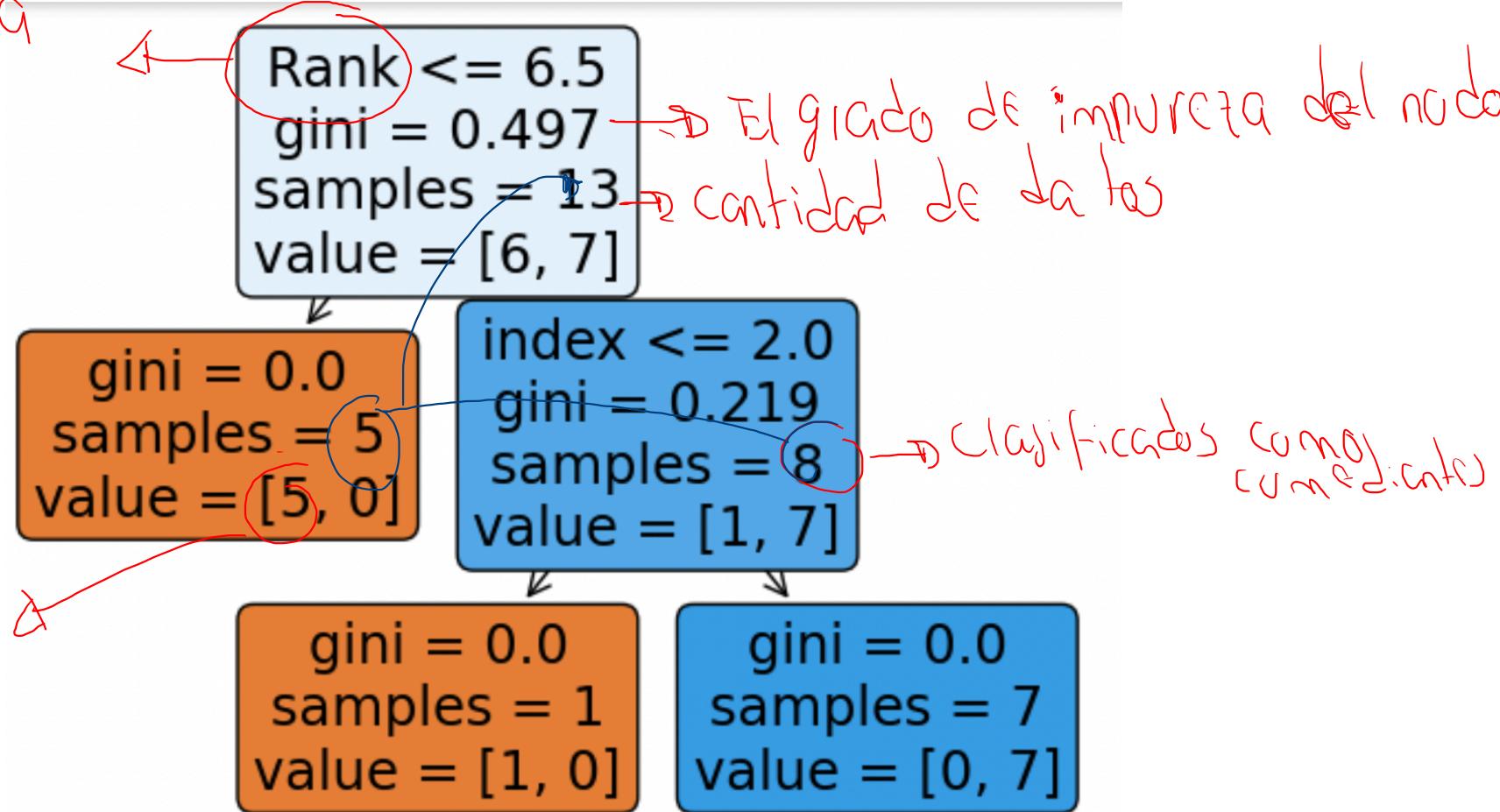


$$\text{relu} = \begin{cases} 0, & x \leq 0 \\ x, & x > 0 \end{cases}$$

$$\tanh(x) = \frac{1 - e^{-2x}}{1 + e^{-2x}}$$

El Algoritmo de Árbol de decisión se sobre ajusta,  
hay que tener cuidado de colocar los parámetros  
indicados.

Variable para  
tomar la  
decisión

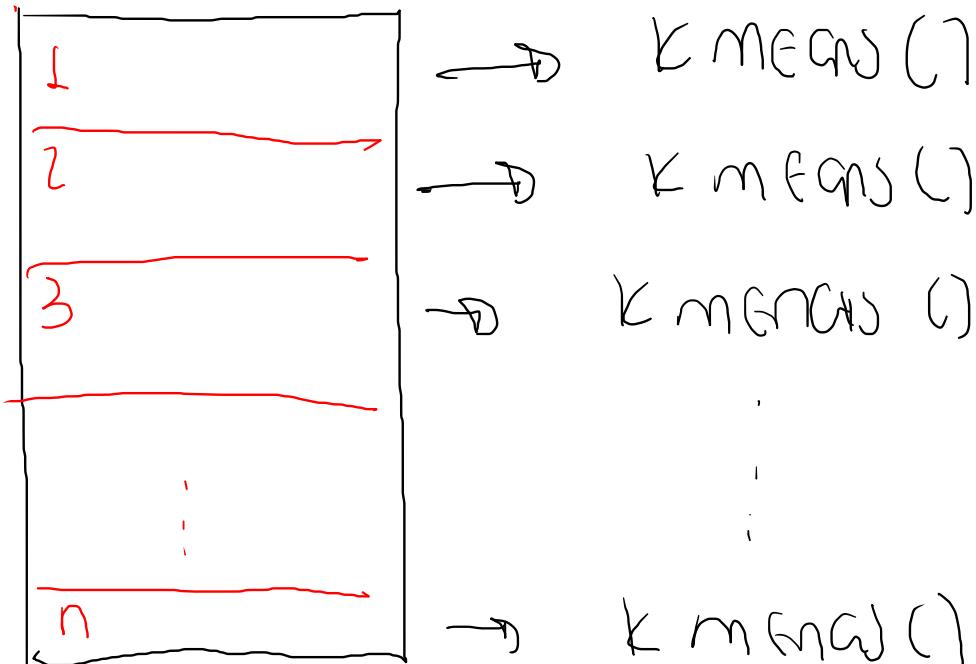


K-means mini Batch:

Dataset — grandes

$\boxed{km(na) = K \text{MEANS}().}$

modelo.

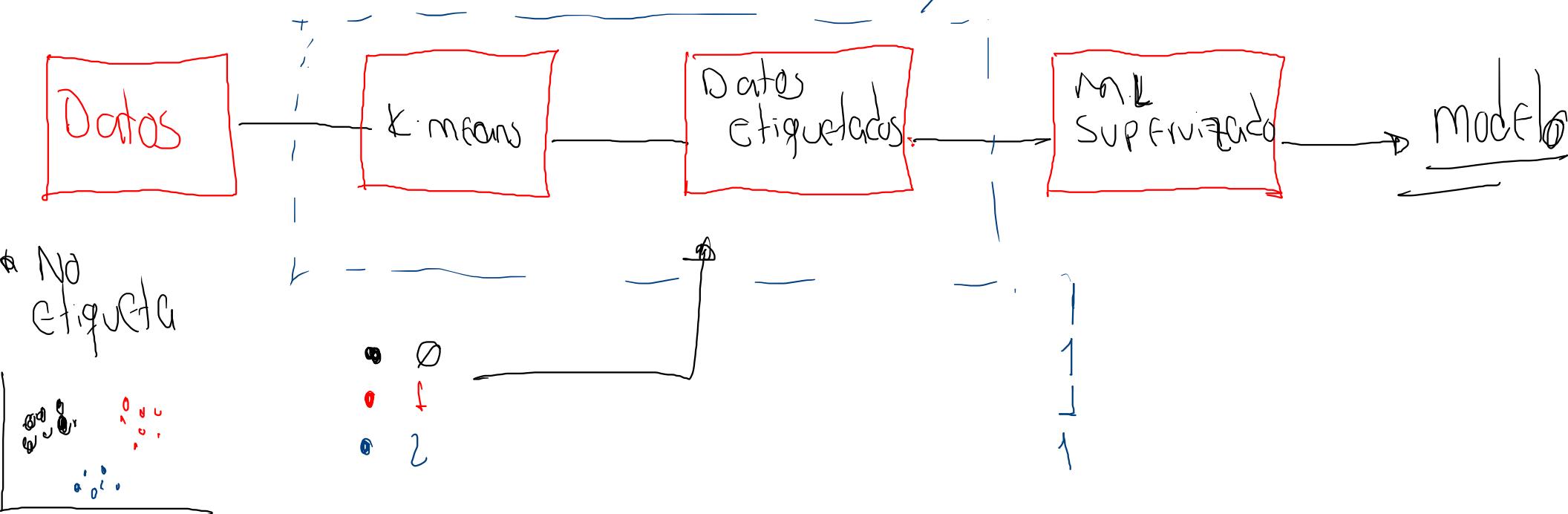


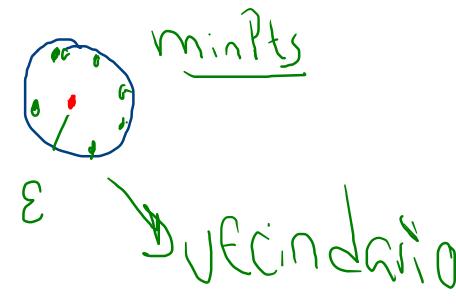
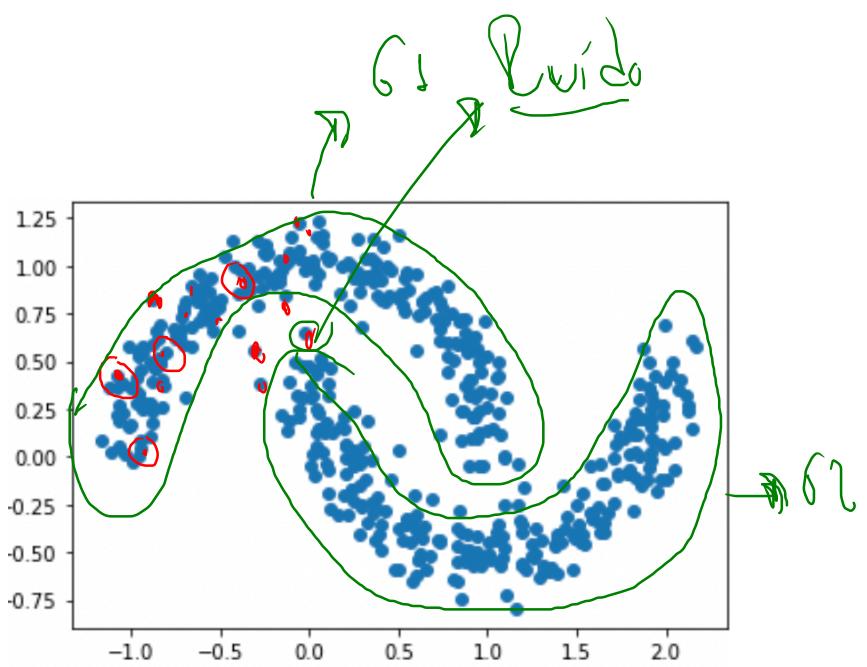
# Agrupamiento para Pre - Procesamiento

A. Supervisado = Etiqueta

No. Supervisado = No etiqueta

Pre - Procesamiento





## Actividad\_ II

→ Convertiendo los datos de entrada.

Col1  
Col2  
Col3  
Col4.

Salida = [ ]

Fila = [ ]

Salida [ fila1, fila2, ..., fila7 ]

X = np.array (Salida)

Datos de agrupamiento

Internet móvil abonados por proveedor

AÑO Trimestre # abonados

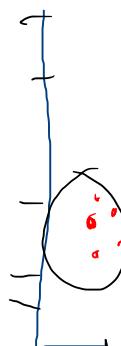
AÑO	Trimestre	# abonados
2021	1	XJZ
	2	JX+
	3	;

AÑO	Trimestre	# abonados
2021	3	222

Proveedor  $\Rightarrow$  # abonados  $\Rightarrow$  trimestre

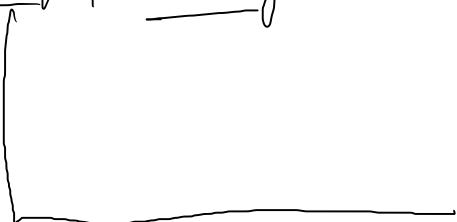
DBSCAN

\* Proveedor



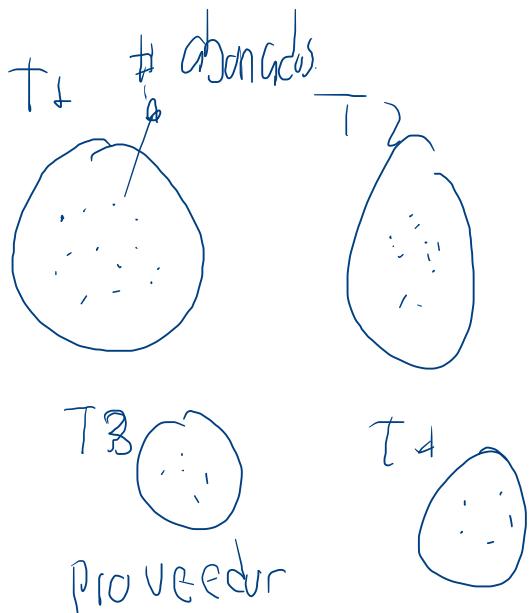
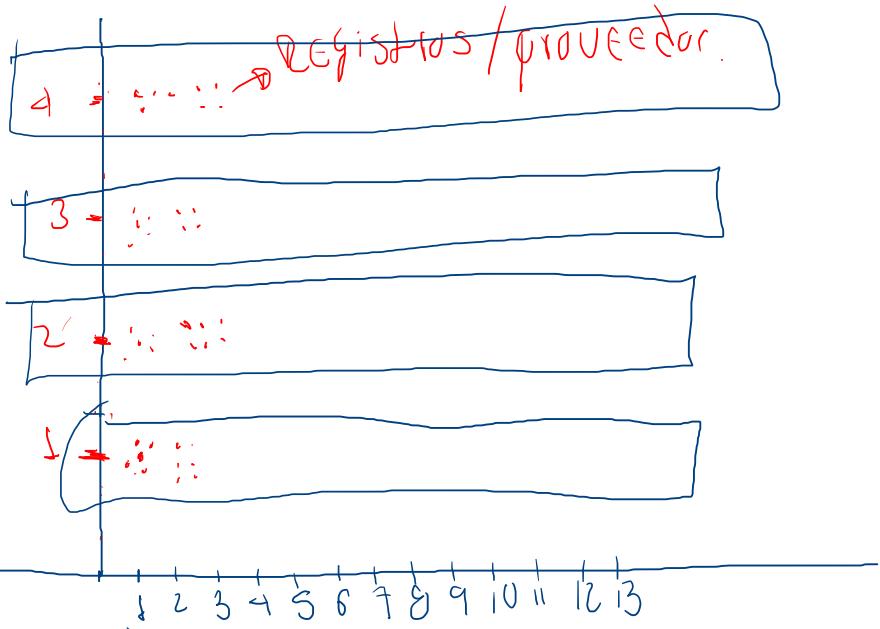
trimestre

PRE PAGO / Post-Pago.



trimestre

# Trimestres



# Algoritmos de ML

$$X = \begin{bmatrix} \cdot \\ \vdots \\ \cdot \\ \cdot \\ \cdot \\ \cdot \end{bmatrix} \rightarrow \boxed{(\cdot)} \rightarrow Y = \begin{bmatrix} \cdot \\ \vdots \\ \cdot \\ \cdot \end{bmatrix}$$

Numericos

- K VECINOS
- K MEAN.

↳ NUMERICOS