



UNIVERSIDAD  
DE GRANADA



# Deep Learning para Multi-clasificación

Máster de Ingeniería Informática

Sistemas Inteligentes  
para la Gestión en la Empresa



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A decorative graphic on the left side of the slide. It features a large, light blue hexagon in the center. Surrounding it are several smaller hexagons in various shades of blue and teal. Some of these smaller hexagons contain white icons: a lightbulb, a thumbs-up, a smartphone, a magnifying glass, and a gear. There is also a network-like icon with a central node and several smaller nodes connected by lines.

1

¿Cuál es el objetivo?



# Trabajar con: Redes neuronales



Fundamentos  
teóricos

Red empleada

Discusión de  
resultados

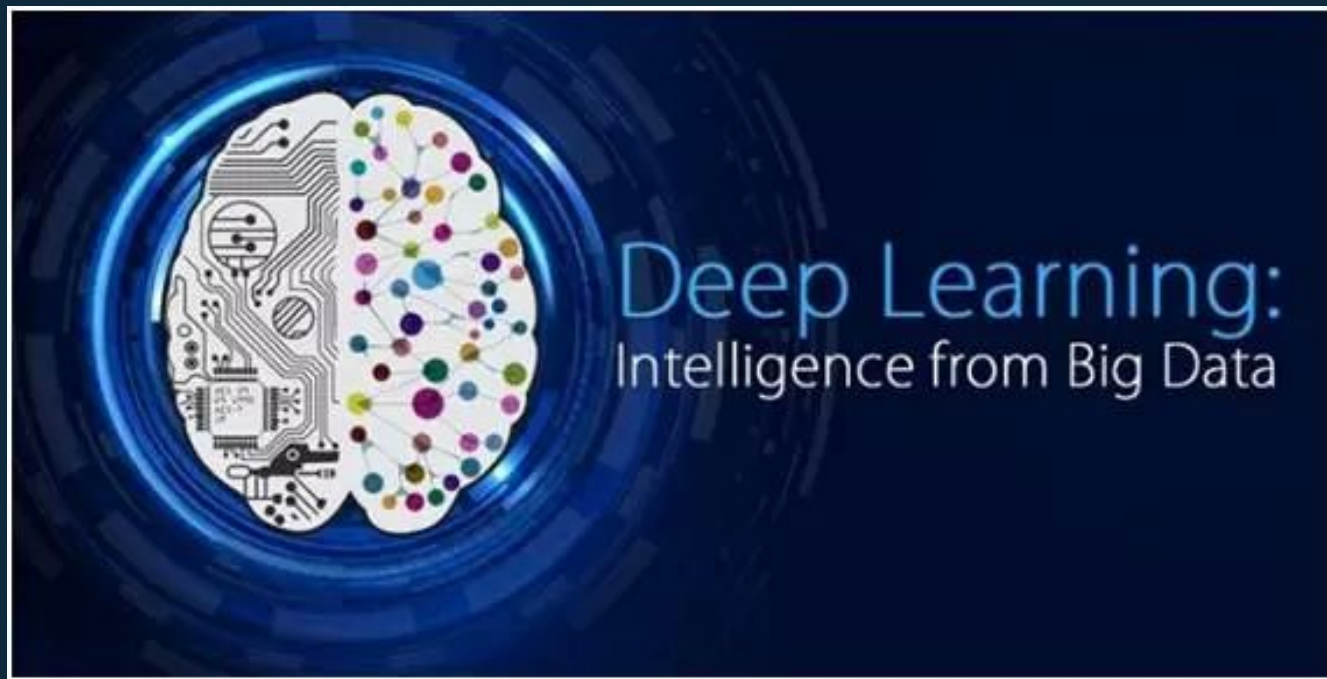


A decorative pattern of hexagons in various shades of blue and cyan on the left side of the slide. Some hexagons contain icons: a lightbulb, a thumbs up, a smartphone, a magnifying glass, and a gear. A network diagram with a central node and five peripheral nodes is also visible.

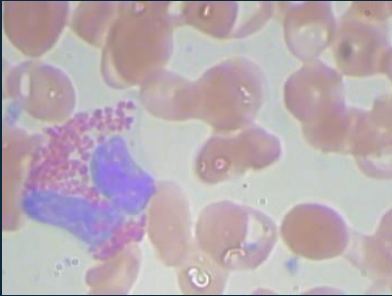
2

# Fundamentos teóricos

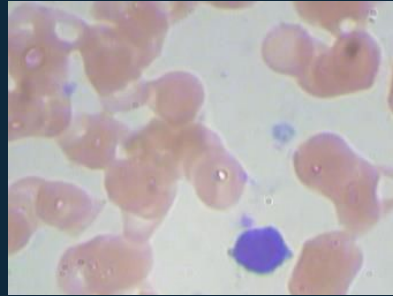
La idea...



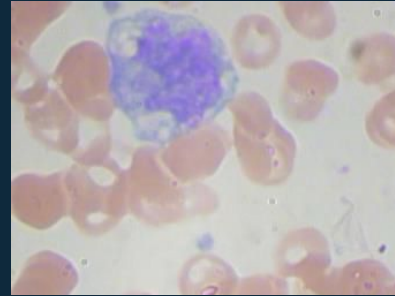
# Sobre qué se utiliza:



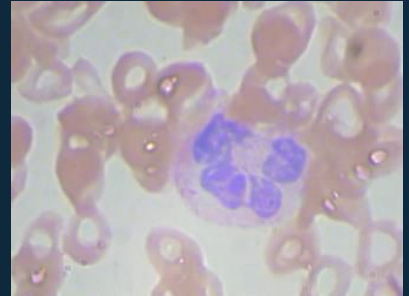
**Eosinófilos**



**Linfocitos**



**Monocitos**



**Neutrófilos**

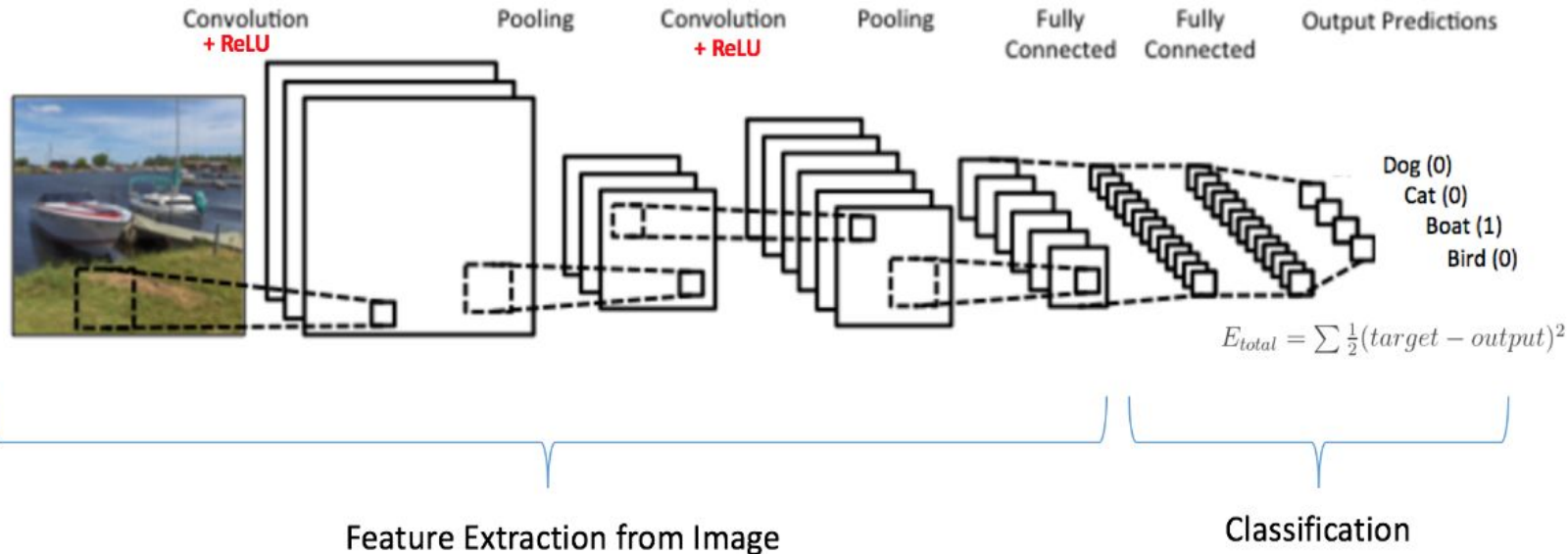


A decorative pattern of hexagons in various shades of blue and cyan. Some hexagons contain icons: a lightbulb, a thumbs-up, a network node, a smartphone, a magnifying glass, a gear, and a speech bubble. The number '3' is centered in a large cyan hexagon.

3

¿Cómo se crea la red?

# Un ejemplo de multi-clasificación





# Parámetros de la red



Filters

Sobre las capas convolutivas 2D, como parámetro de agrupamiento

Sobre las capas dense, como tamaño de salida

Units

Dropout


Grado de omisión de neuronas ocultas para que no se adapten entre sí

Cada iteración de la red por el lote de entradas en la que haya ajuste de variables

Epochs

Steps per epoch

Número de lotes que deben producir los generadores para completar una época



# Parámetros clave

Función de pérdida



Binary\_crossentropy

Categorical\_crossentropy

Mean\_squared\_logarithmic\_error

Algoritmos de optimización



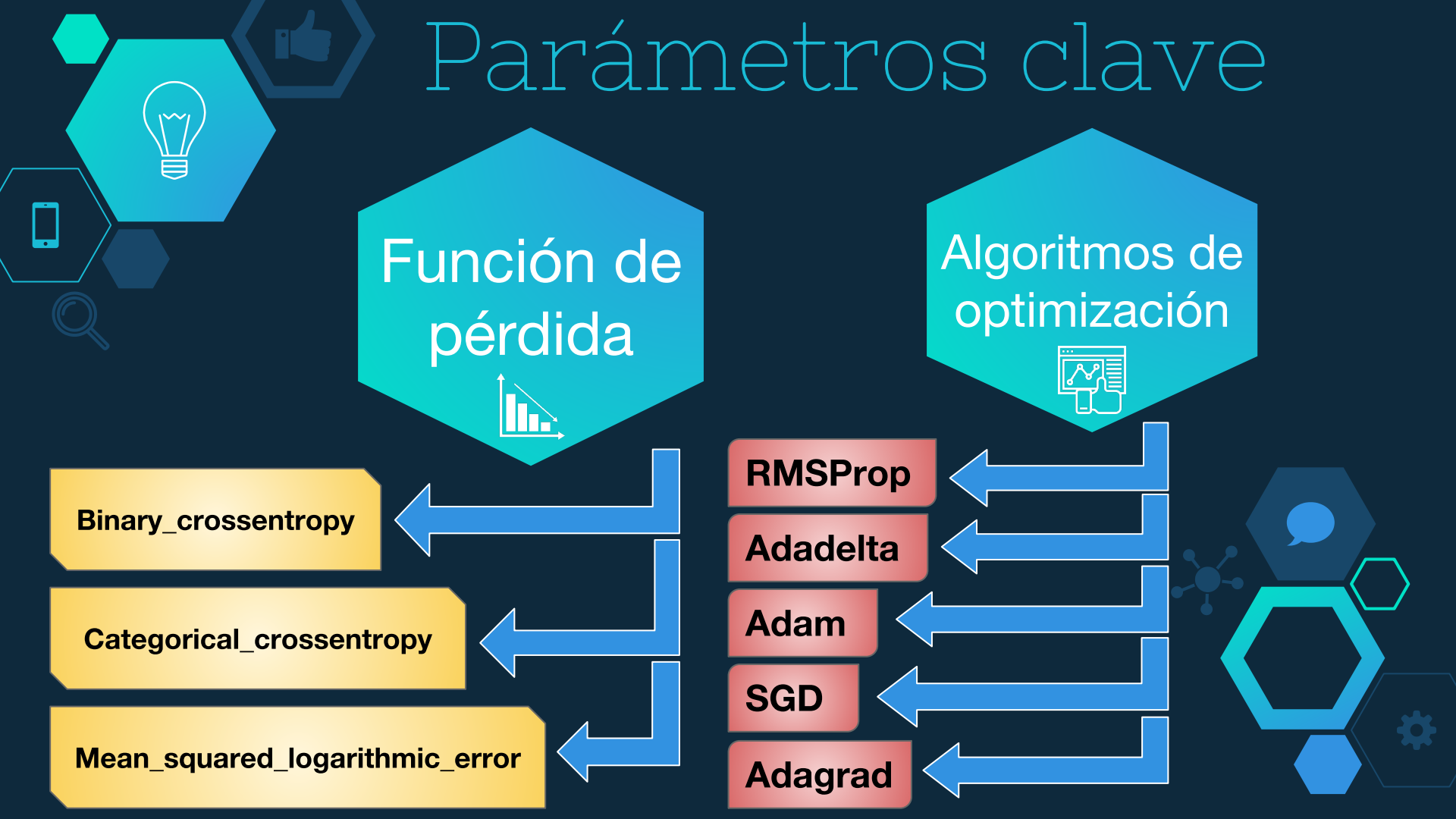
RMSProp

Adadelta

Adam

SGD

Adagrad



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4

# Construcción de la red

# Modelo

3



Conv2D

3



Activ(relu)

3



MaxPooling2D

1



Flatten

2



Dense

1



Dropout

```
model <- keras_model_sequential() %>%
```

```
  layer_conv_2d(filters = 32, kernel_size = c(3, 3), activation = "relu", input_shape = c(150,150,3)) %>% "Clasificación y segmentación de imágenes" "A,A,P"
```

```
  layer_activation('relu') %>% "Unidad lineal rectificada"
```

```
  layer_max_pooling_2d(pool_size = c(2, 2)) %>% "Reducir # de parametros"
```

```
  layer_conv_2d(filters = 32, kernel_size = c(3, 3), activation = "relu") %>%
```

```
  layer_activation('relu') %>%
```

```
  layer_max_pooling_2d(pool_size = c(2, 2)) %>%
```

```
  layer_conv_2d(filters = 64, kernel_size = c(3, 3), activation = "relu") %>%
```

```
  layer_activation('relu') %>%
```

```
  layer_max_pooling_2d(pool_size = c(2, 2)) %>%
```

```
  layer_flatten() %>% "Aplanar - 1 d"
```

```
  layer_dense(units = 256, activation = "relu") %>%
```

```
  layer_dropout(rate = 0.4) %>%
```

```
  layer_dense(units = 4, activation = "softmax") "Función Exp Normalizada - Redes Multiclase"
```

13 capas

# Compilación - Función de Pérdida

MIN. LOSS

ACCURACY MÁX.

0.102

Binary\_crossentropy

0.955

0.440

Categorical\_crossentropy

0.873

0.014

Mean\_squared\_logarithmic\_error

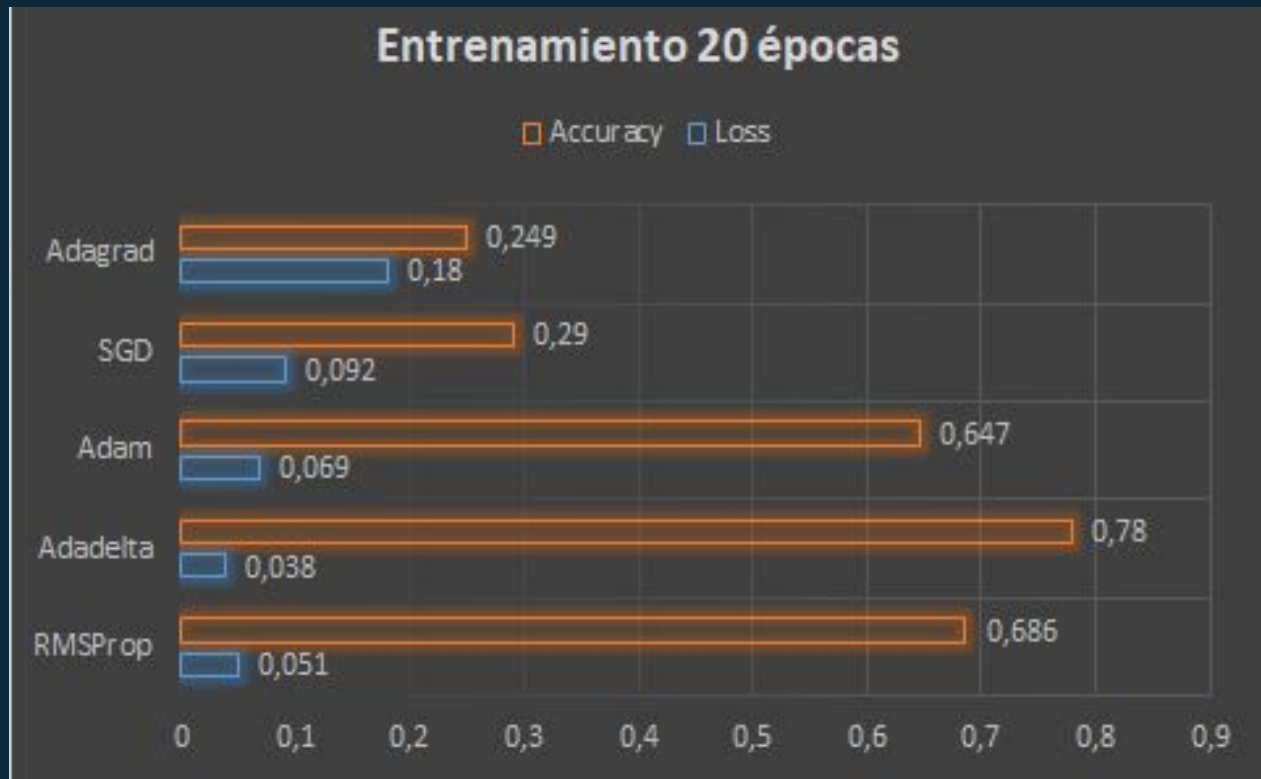
0.915

A decorative graphic on the left side of the slide. It features a large, solid cyan hexagon in the center, with the number '5' inside it. Surrounding this central hexagon are several smaller hexagons of varying shades of blue and cyan. Some of these smaller hexagons contain white icons: a lightbulb, a thumbs-up, a smartphone, a magnifying glass, and a gear. There is also a small network diagram icon and a speech bubble icon. The entire graphic is set against a dark blue background.

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¿Qué resultados  
se han obtenido?

# Algoritmos de optimización

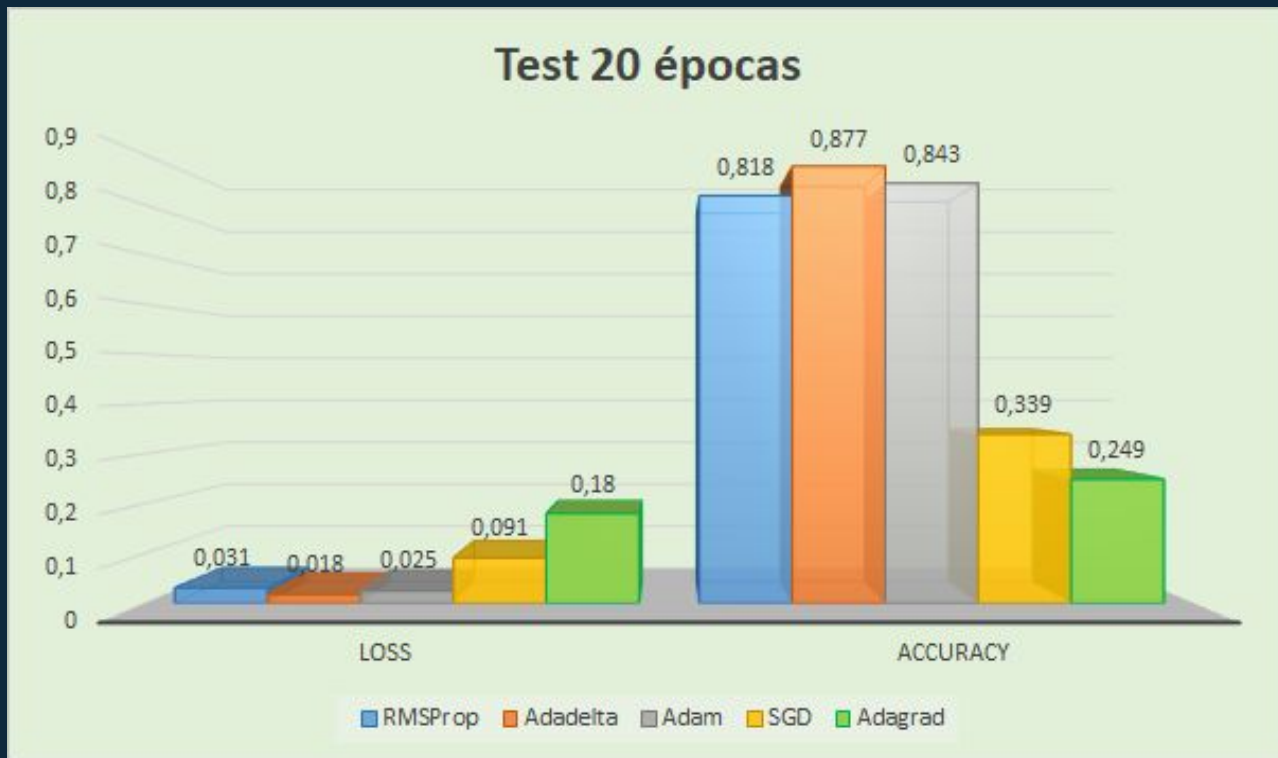


# Algoritmos de optimización

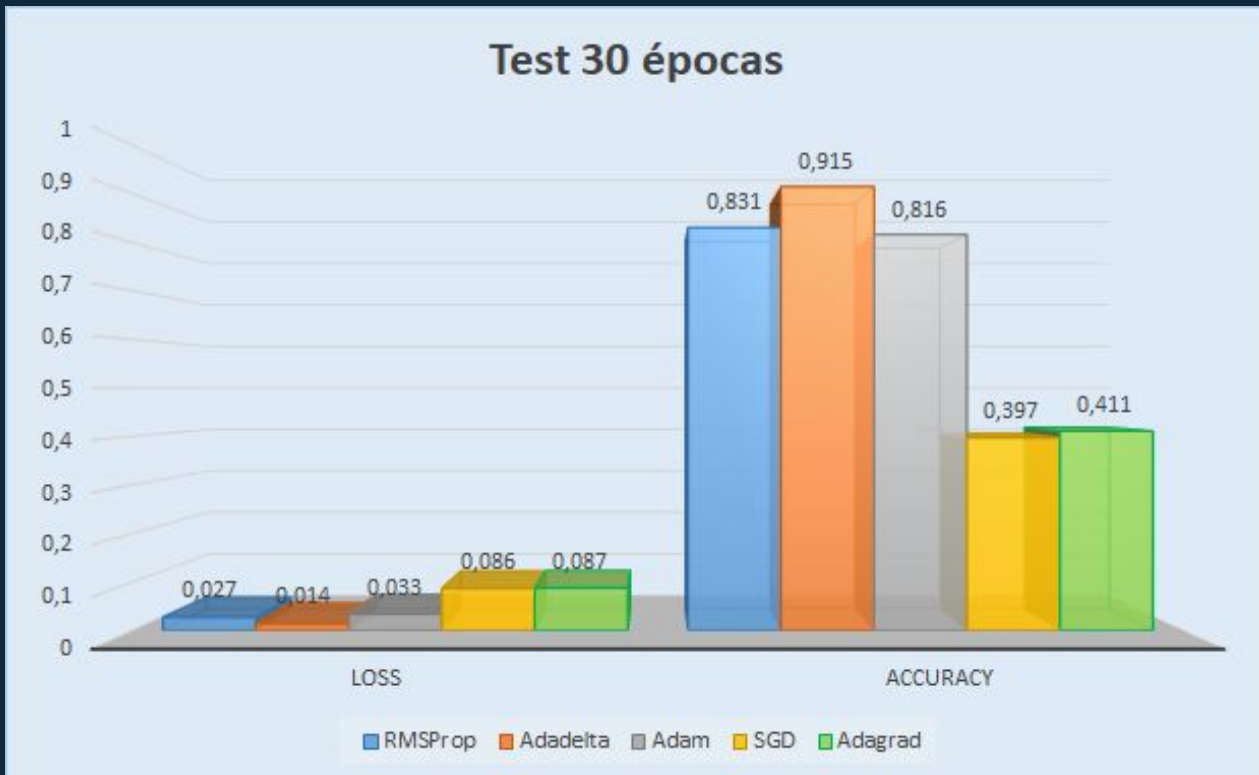




# Algoritmos de optimización



# Algoritmos de optimización

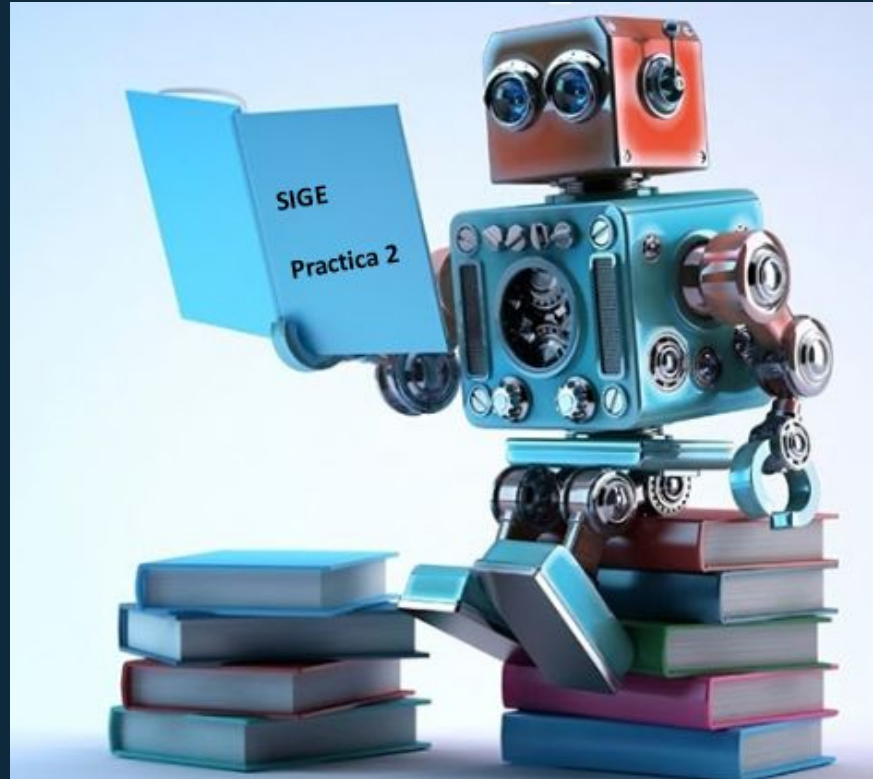


A decorative graphic on the left side of the slide. It features a large, light blue hexagon in the center containing the number '6'. Surrounding this central hexagon are several smaller hexagons of varying shades of blue and teal. Some of these smaller hexagons contain white icons: a lightbulb, a thumbs-up, a smartphone, a magnifying glass, and a gear. There is also a network-like icon with a central node and radiating lines, and a speech bubble icon.

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¿Qué conclusiones  
se pueden extraer?

# Conclusiones





¡Gracias!

¿Alguna pregunta?

