



Data Science
Academy

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Machine Learning

```
mirror_mod = modifier ob  
set mirror_mod.select to mirror  
for_mod.mirror_object =  
operation == "MIRROR_X":  
mirror_mod.use_x = True  
mirror_mod.use_y = False  
mirror_mod.use_z = False  
operation == "MIRROR_Y":  
mirror_mod.use_x = False  
mirror_mod.use_y = True  
mirror_mod.use_z = False  
operation == "MIRROR_Z":  
mirror_mod.use_x = False  
mirror_mod.use_y = False  
mirror_mod.use_z = True
```

```
selection at the end -ad  
mirror_ob.select= 1  
mirror_ob.select=1  
context.scene.objects.active  
("Selected" + str(modifier  
mirror_ob.select = 0  
= bpy.context.selected_obj  
data.objects[one.name], sel  
print("please select exactl
```

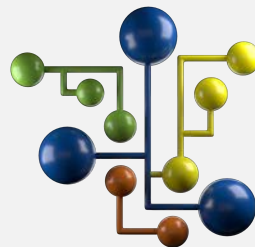
OPERATOR CLASSES

```
types.Operator):  
X mirror to the selected  
object.mirror = mirror_x"  
mirror X"
```

```
text):  
object is not
```



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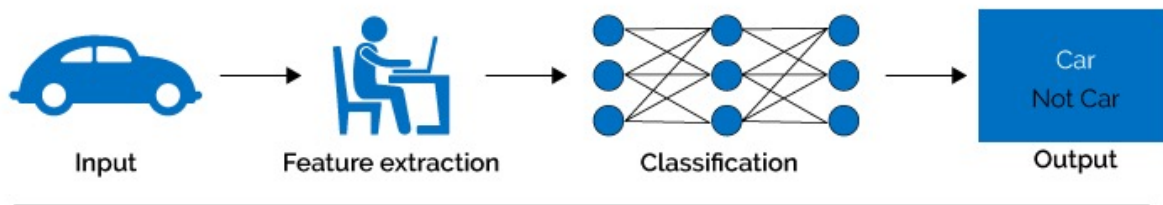


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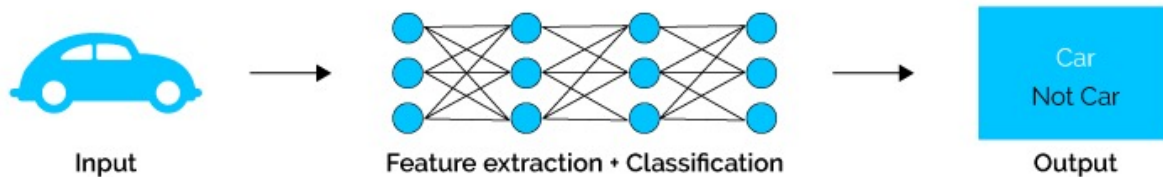
Redes Neurais Artificiais Profundas (Deep Learning)

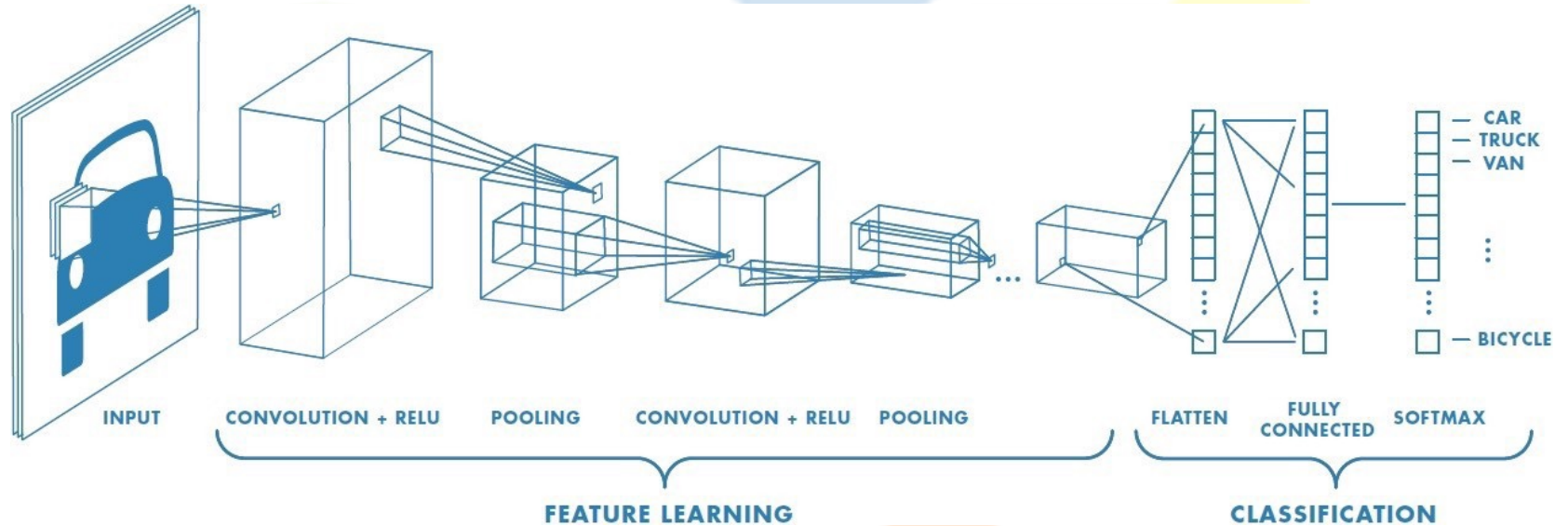


Machine Learning



Deep Learning



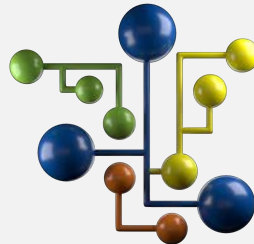




Este capítulo será uma introdução a Deep Learning, pois esse é um tema bastante extenso!



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O Que é Deep Learning?

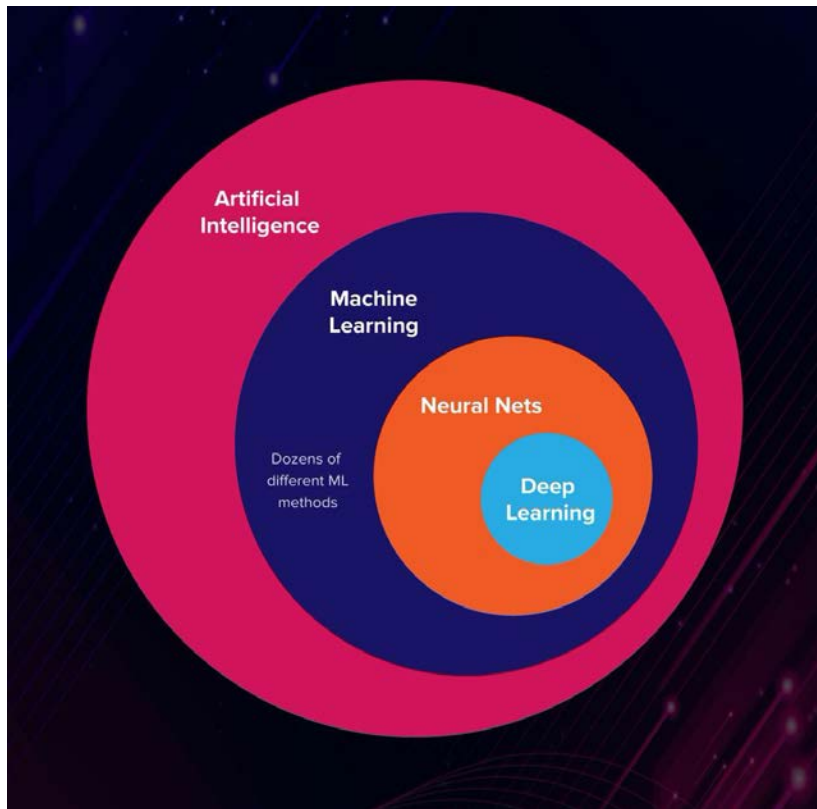


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Machine Learning

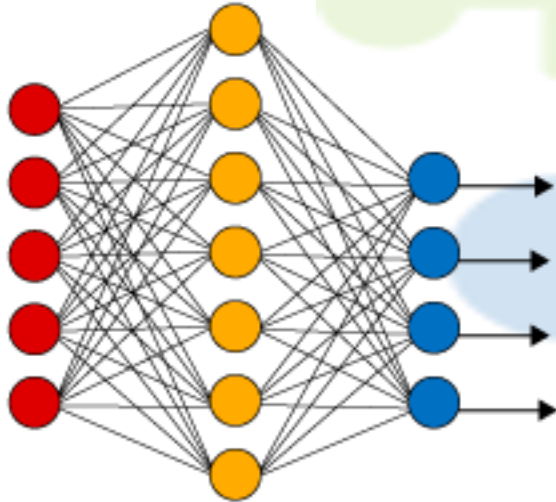
www.deeplearningbook.com.br



Deep Learning é uma sub-categoria de Machine Learning.



Simple Neural Network

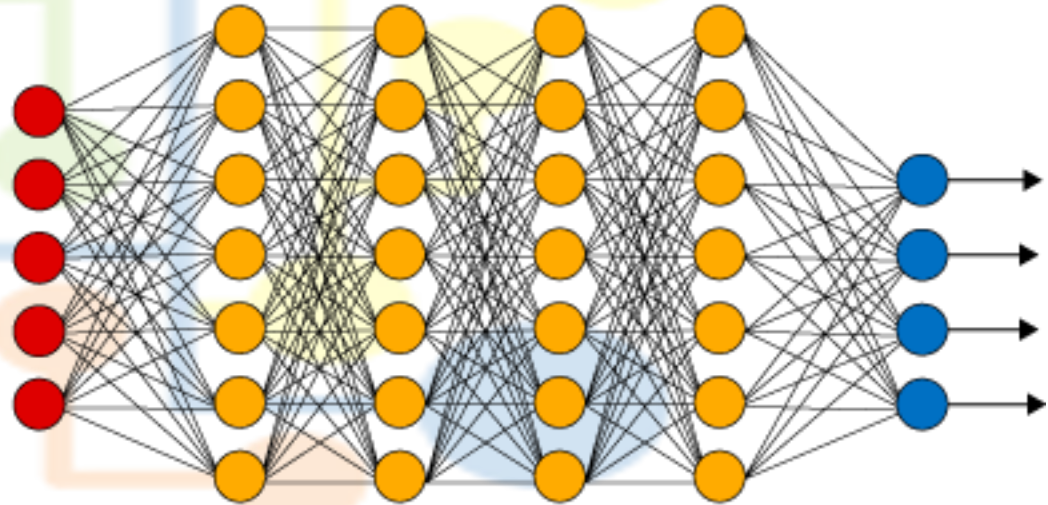


● Input Layer

● Hidden Layer

● Output Layer

Deep Learning Neural Network



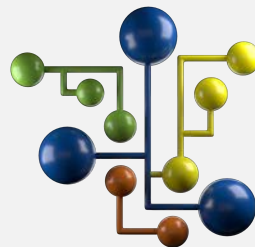
● Input Layer

● Hidden Layer

● Output Layer

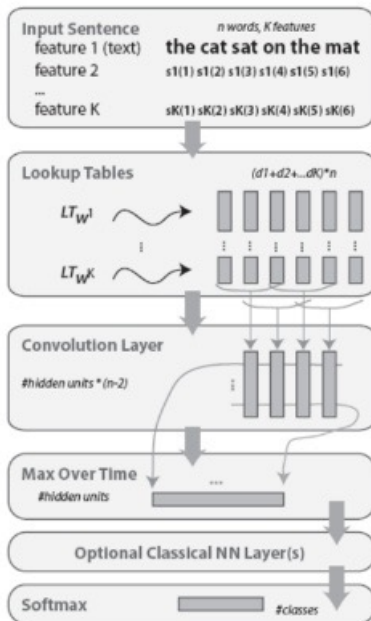


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O Processo de Aprendizagem de Modelos de Deep Learning



Basic features

Embeddings

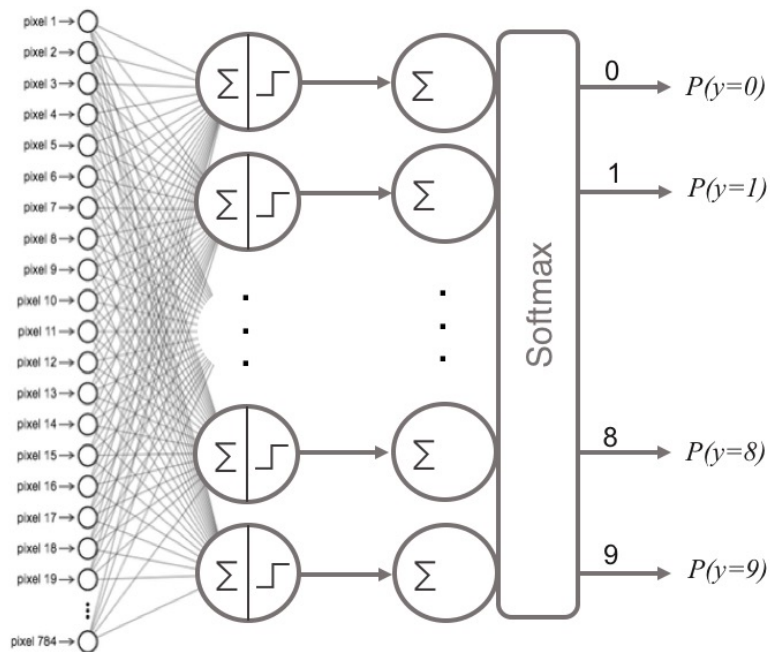
Convolution

Max pooling

“Supervised” learning

Em Deep Learning nosso trabalho é preparar as estruturas de dados.

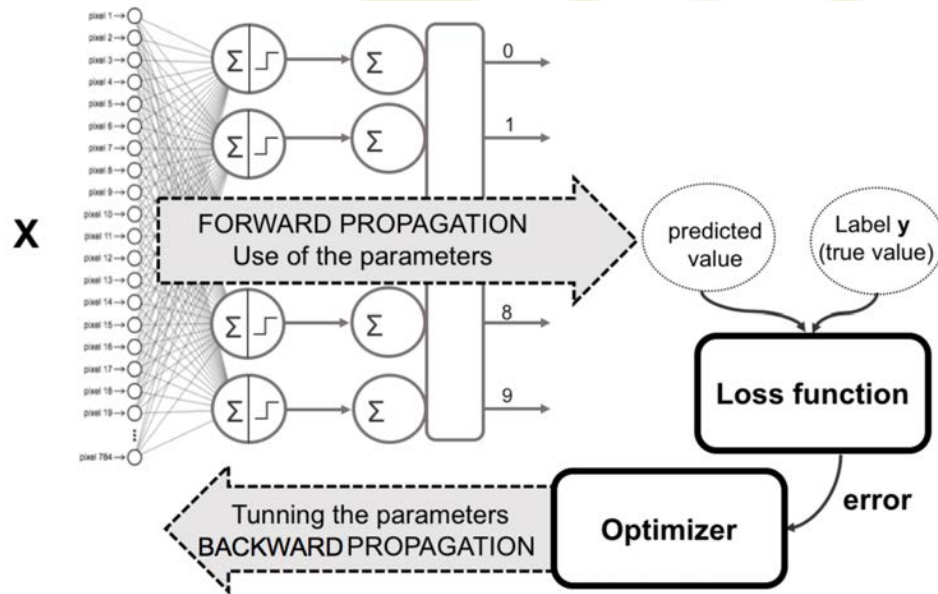
O aprendizado de recursos e a classificação/regressão são ambos feitos pelo modelo.



Em Visão Computacional, primeiro a rede realiza o processo de aprendizagem dos recursos e depois faz a classificação.

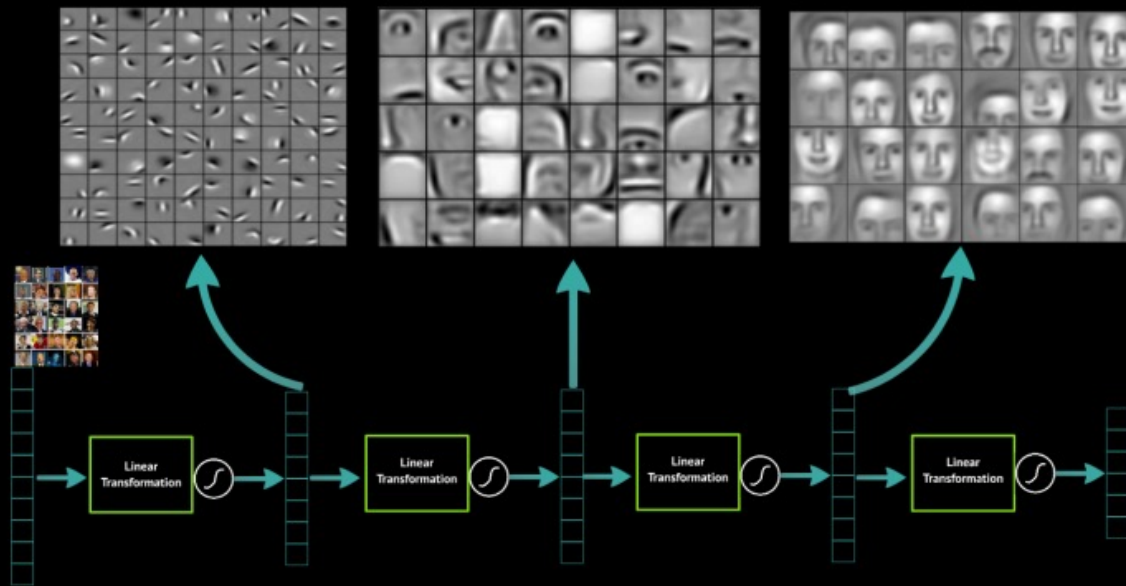


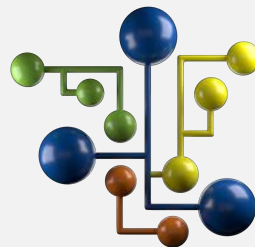
A aprendizagem ocorre em duas etapas: **Forward Propagation** e **Backward Propagation**!





Deep Learning learns layers of features



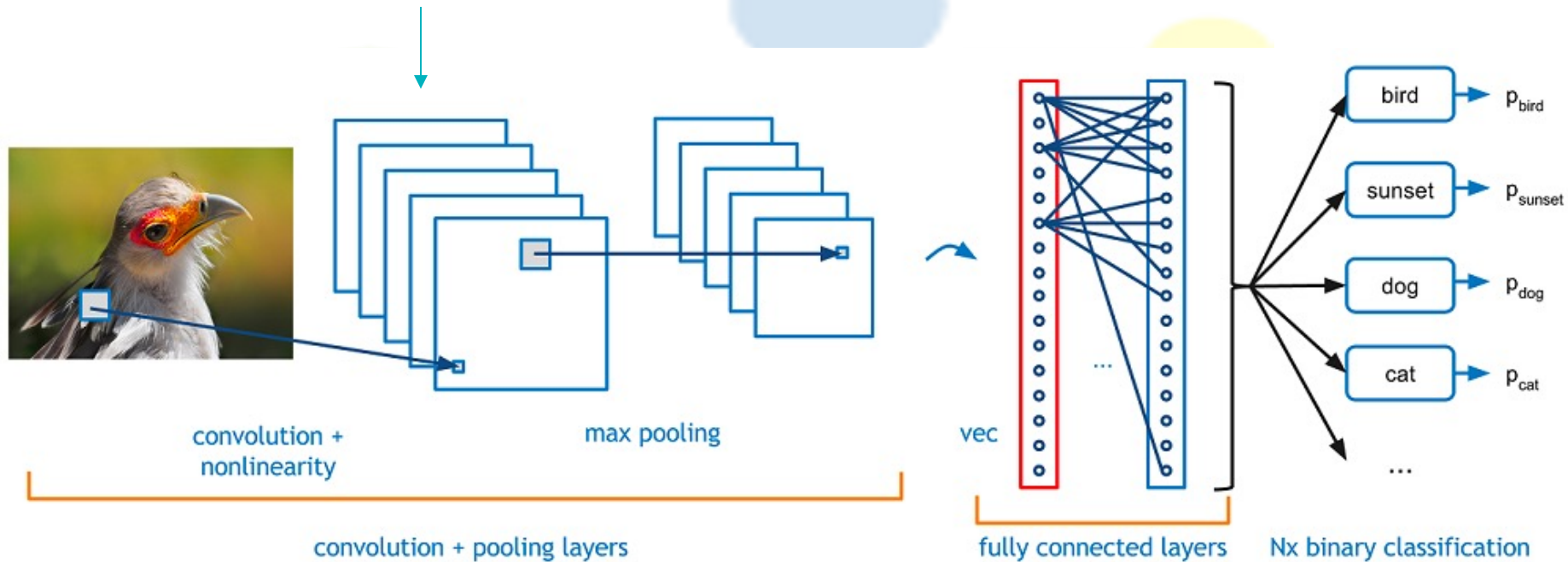


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Arquitetura de Redes Neurais Convolucionais

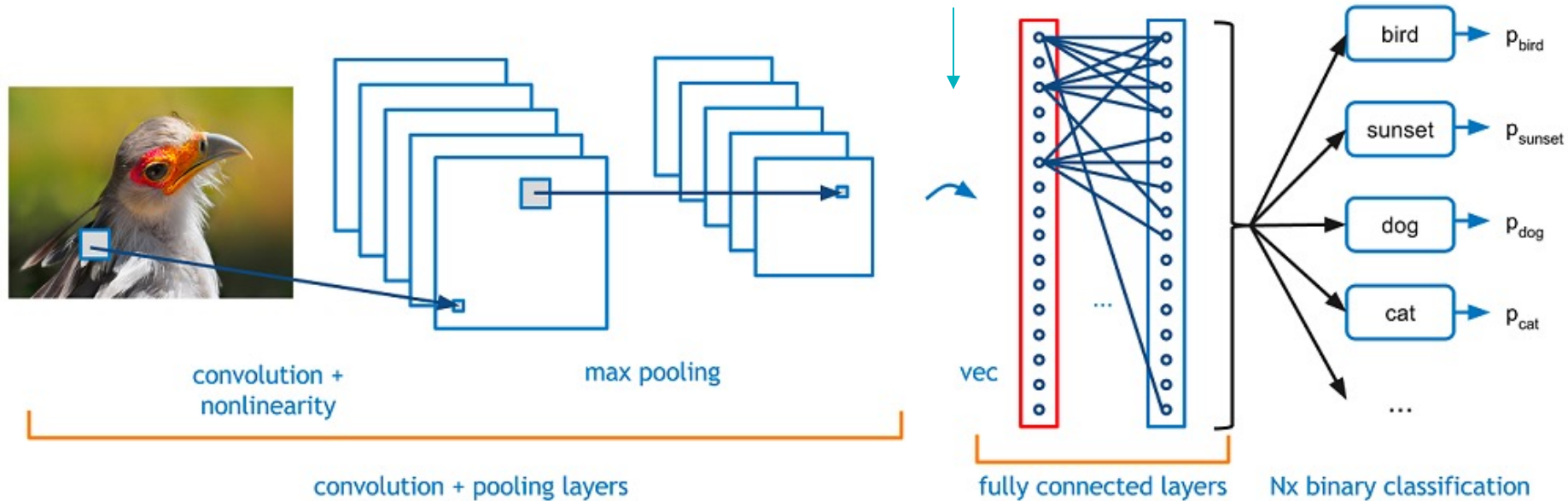


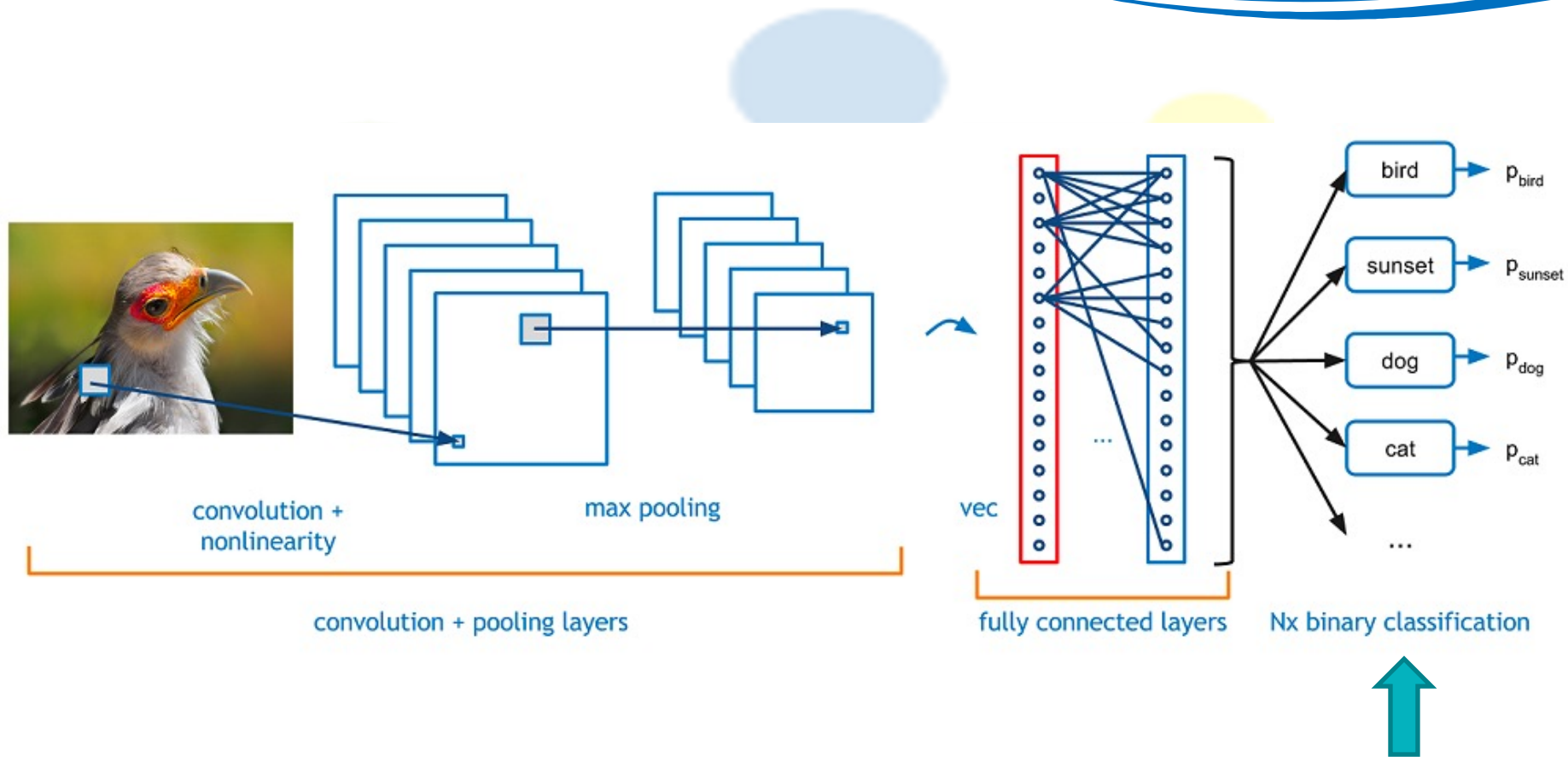
Mapas de Recursos





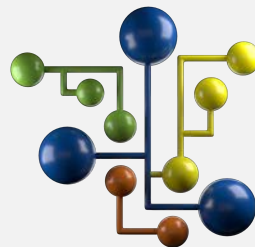
Transformamos a
Matriz em Vetor





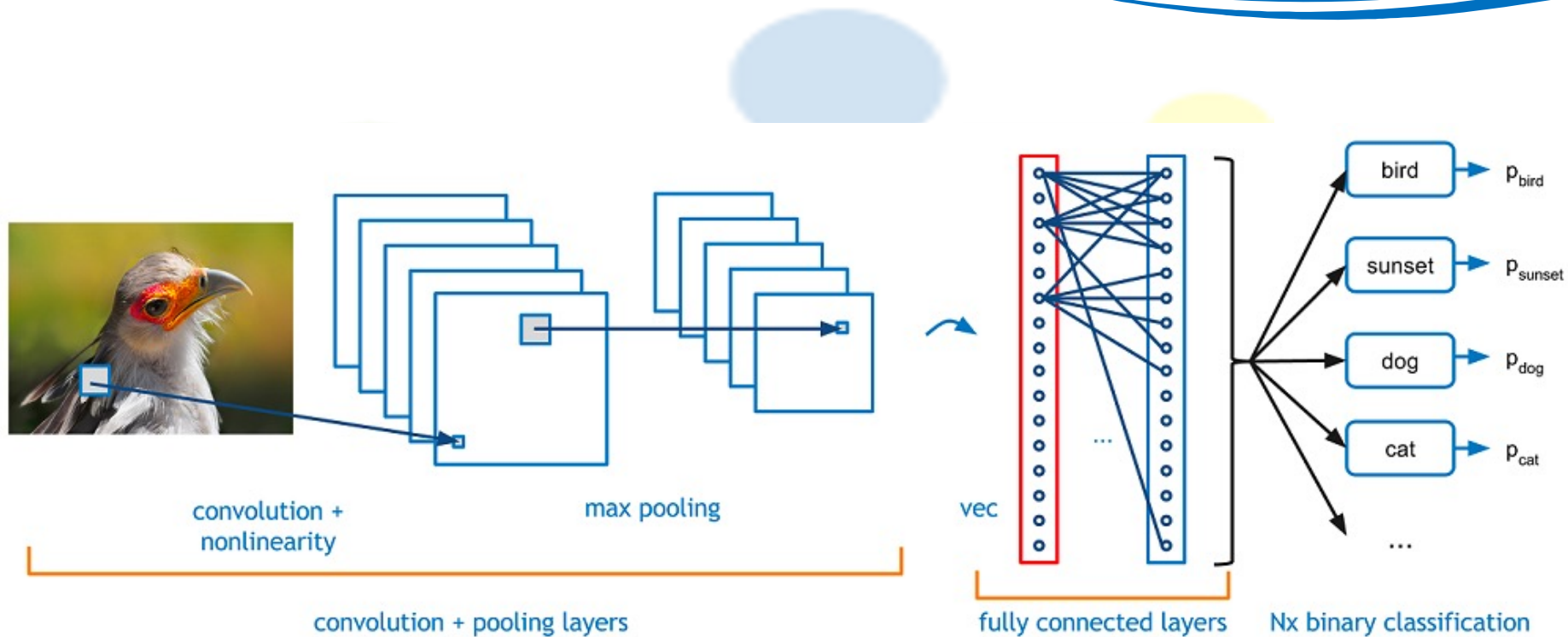


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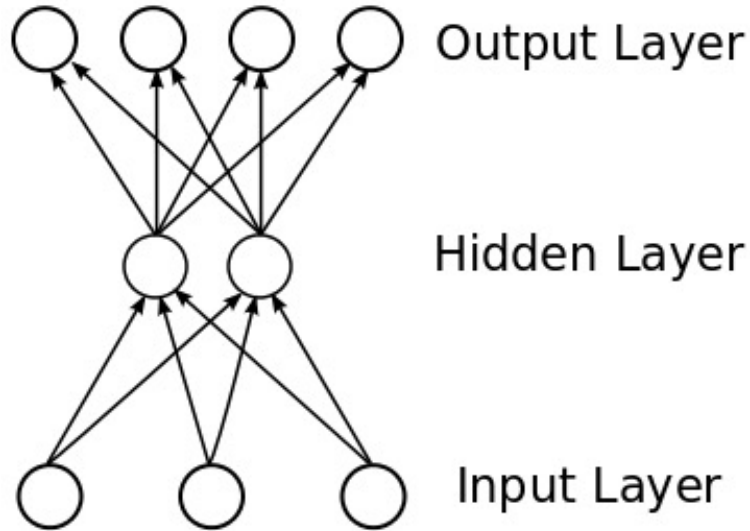
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Arquitetura de Redes Neurais Recorrentes

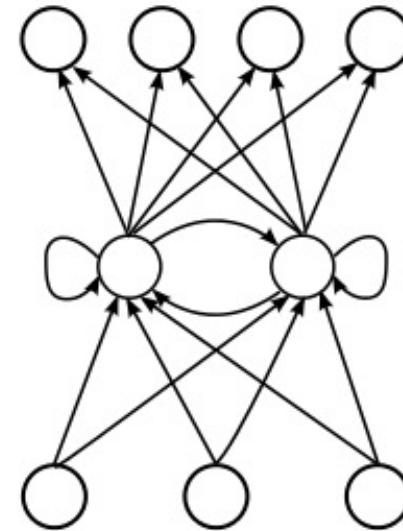


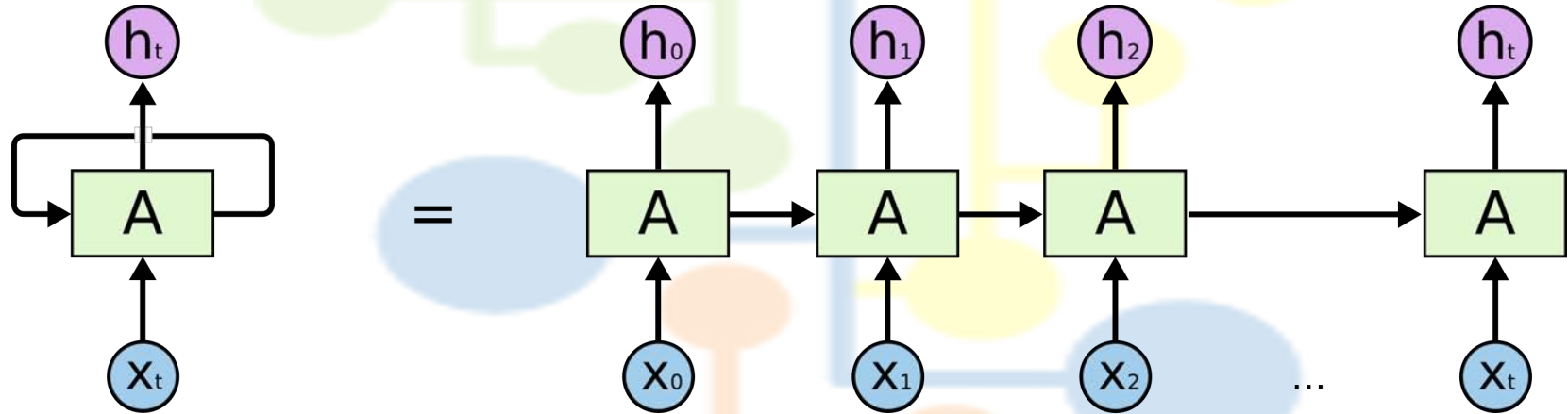


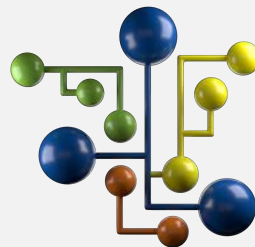
Feed Forward
Network



Recurrent Network



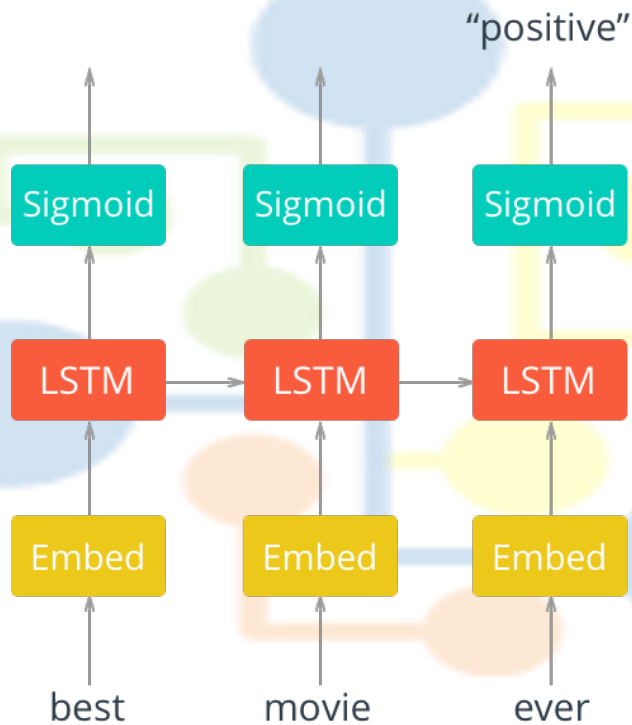


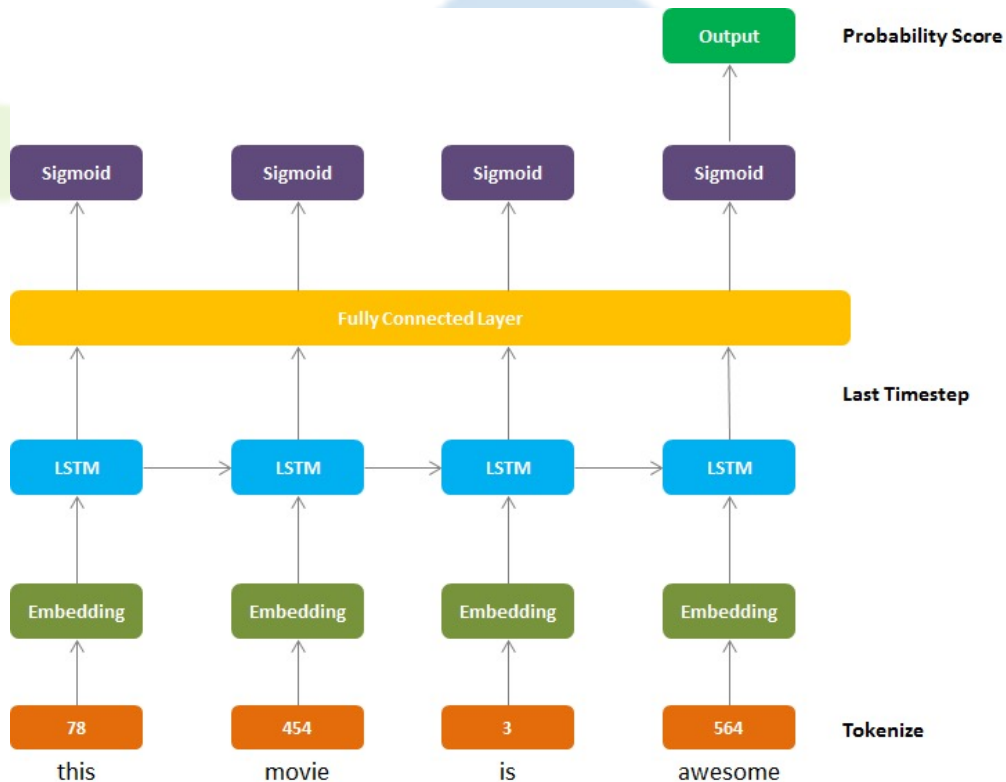


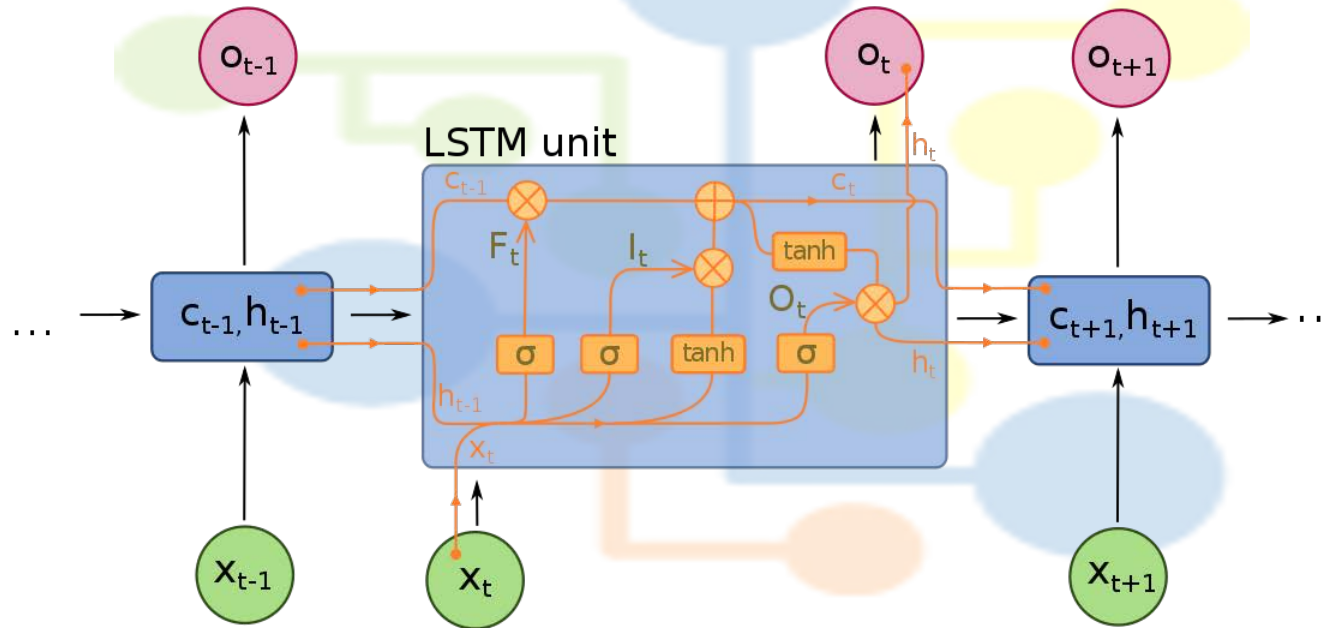
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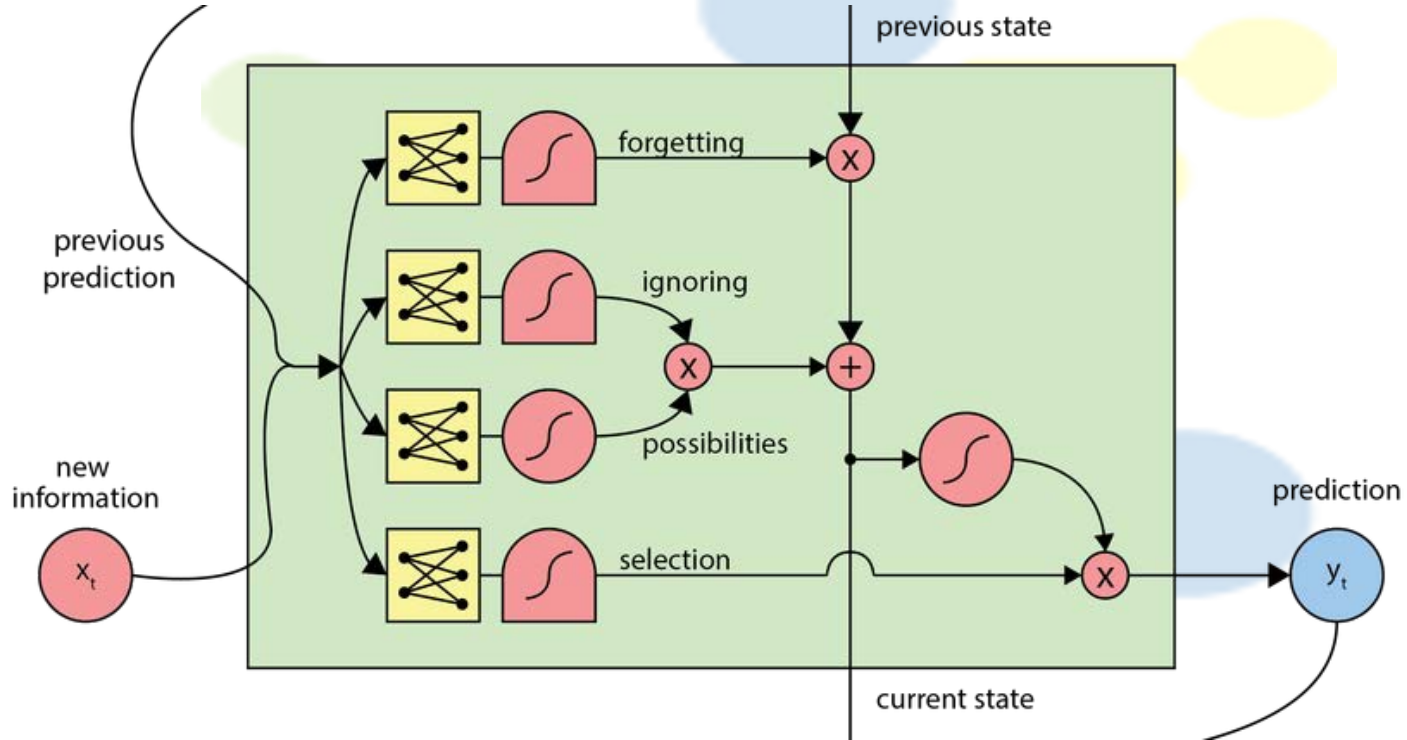
LSTM

Long Short-Term Memory



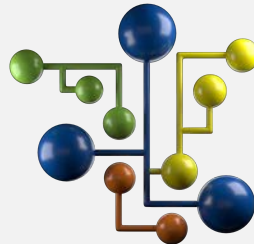






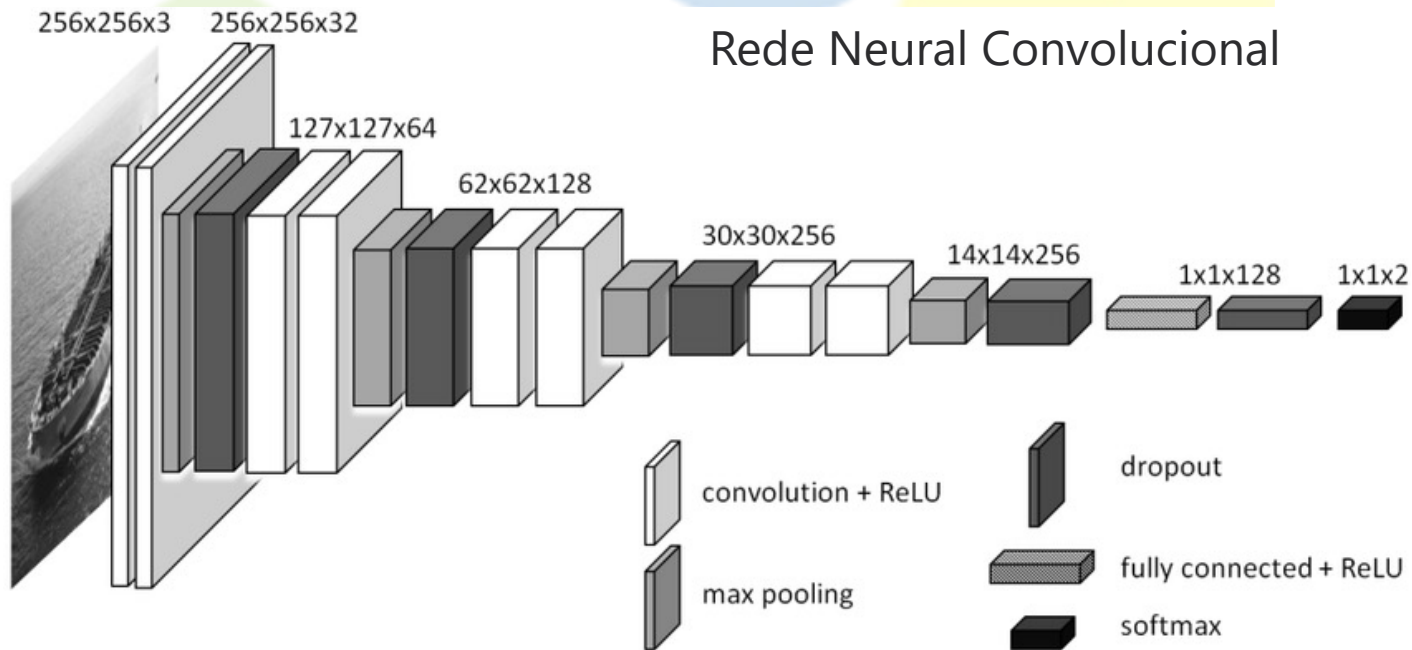


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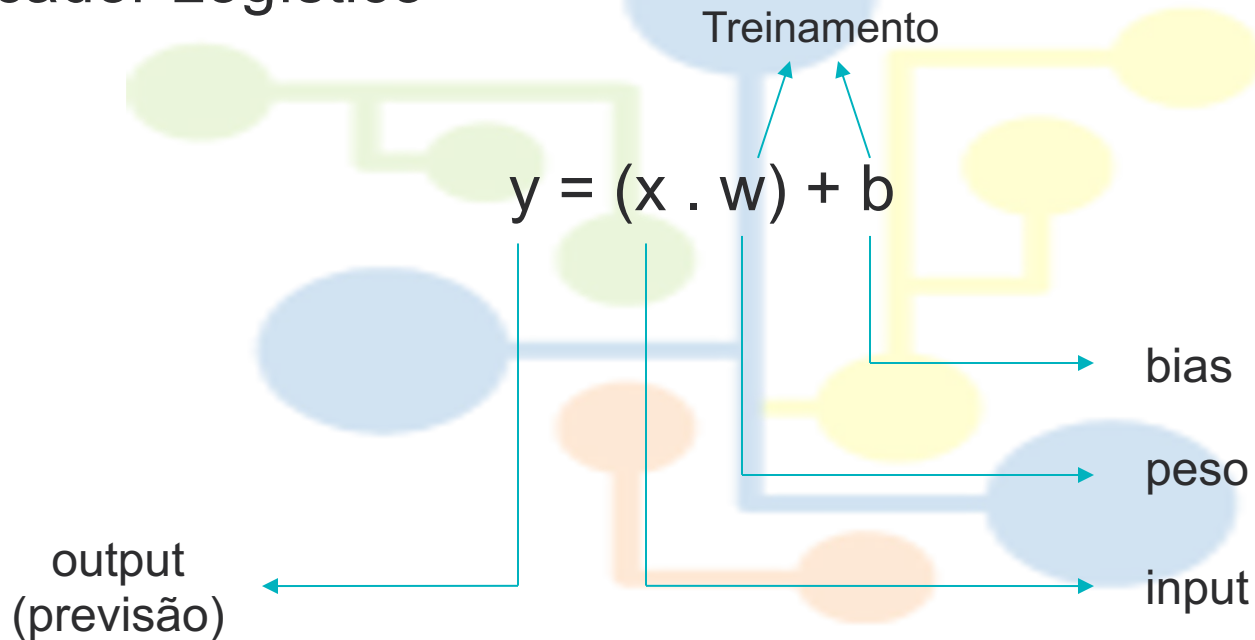
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Por Que Usamos a Função Softmax?



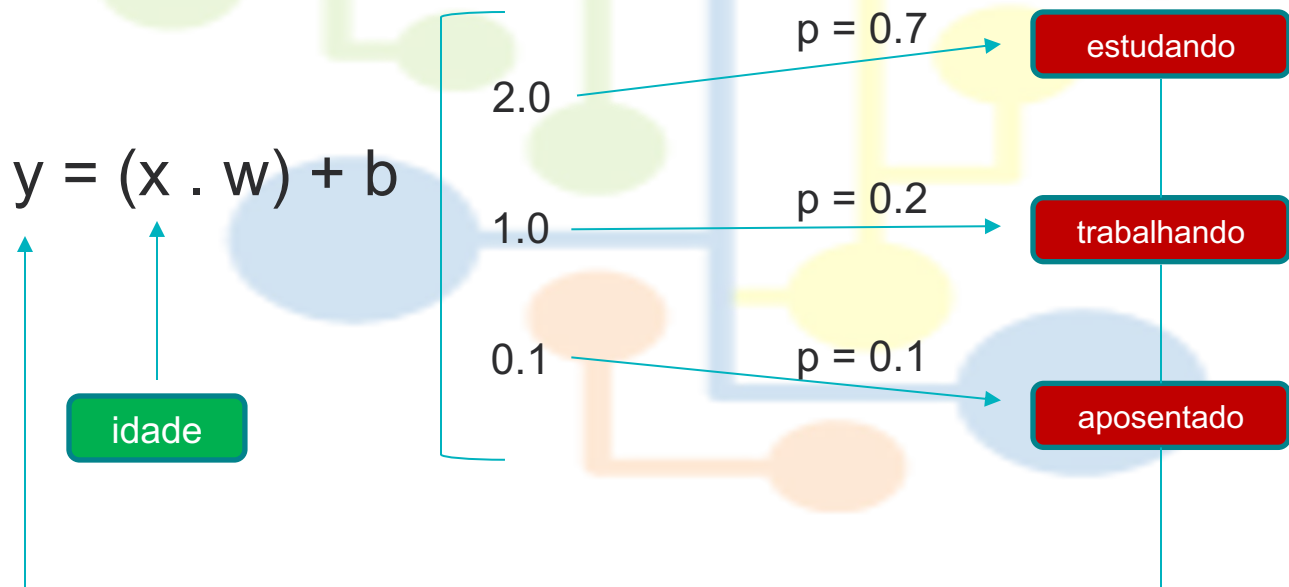


Classificador Logístico





Classificador Logístico





$$y = (x \cdot w) + b$$

2.0

$p = 0.7$

1.0

$p = 0.2$

0.1

$p = 0.1$



Função Softmax

$$y = (x \cdot w) + b$$

2.0

$p = 0.7$

1.0

$p = 0.2$

0.1

$p = 0.1$

Scores

Logits

Probabilidades



Função Softmax

```
import numpy as np

scores = [3.0, 1.0, 0.2]

def softmax(x):
    return np.exp(x) / np.sum(np.exp(x), axis = 0)

print(softmax(scores))
```

```
[ 0.8360188  0.11314284 0.05083836]
```



Função Softmax

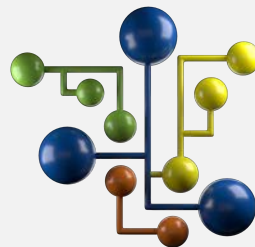
$$P(y=j \mid \theta^{(i)}) = \frac{e^{\theta^{(i)}}}{\sum_{j=0}^k e^{\theta_k^{(i)}}}$$

Softmax function

where $\theta = w_0x_0 + w_1x_1 + \dots + w_kx_k = \sum_{i=0}^k w_ix_i = w^T x$



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Afinal, O Que é Hot Encoding?



$$y = (x \cdot w) + b$$

good

2.0

$p = 0.7$

Good

1.0

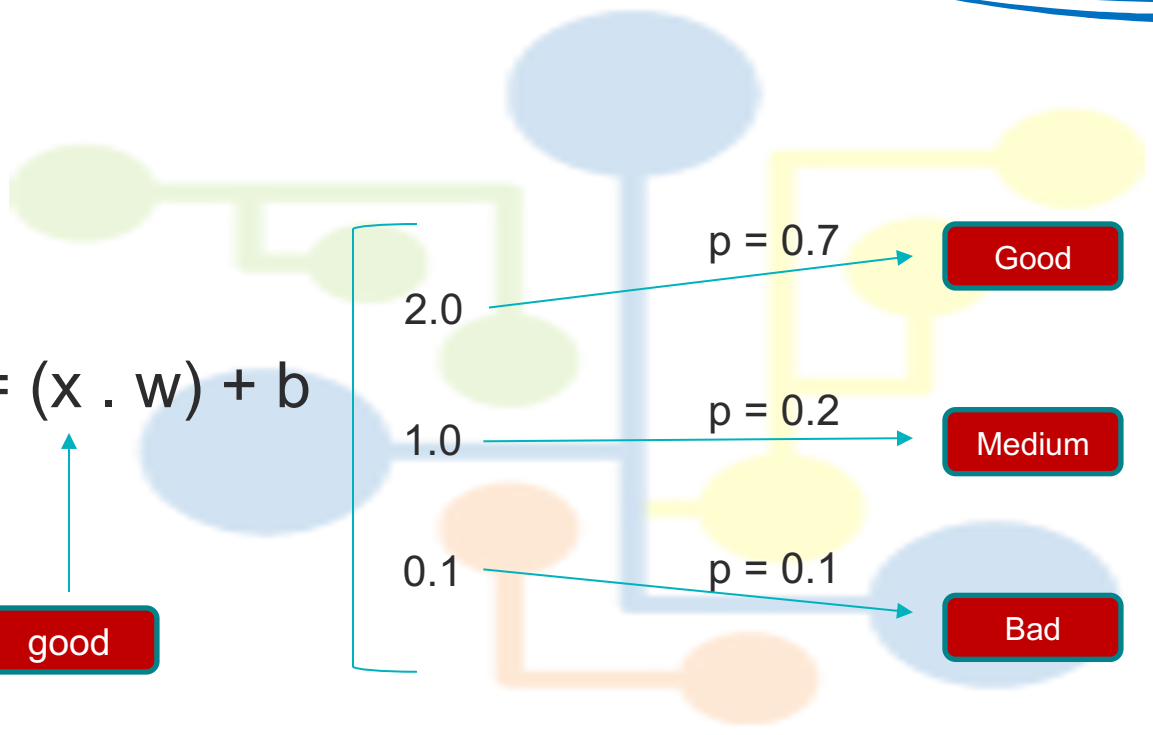
$p = 0.2$

Medium

0.1

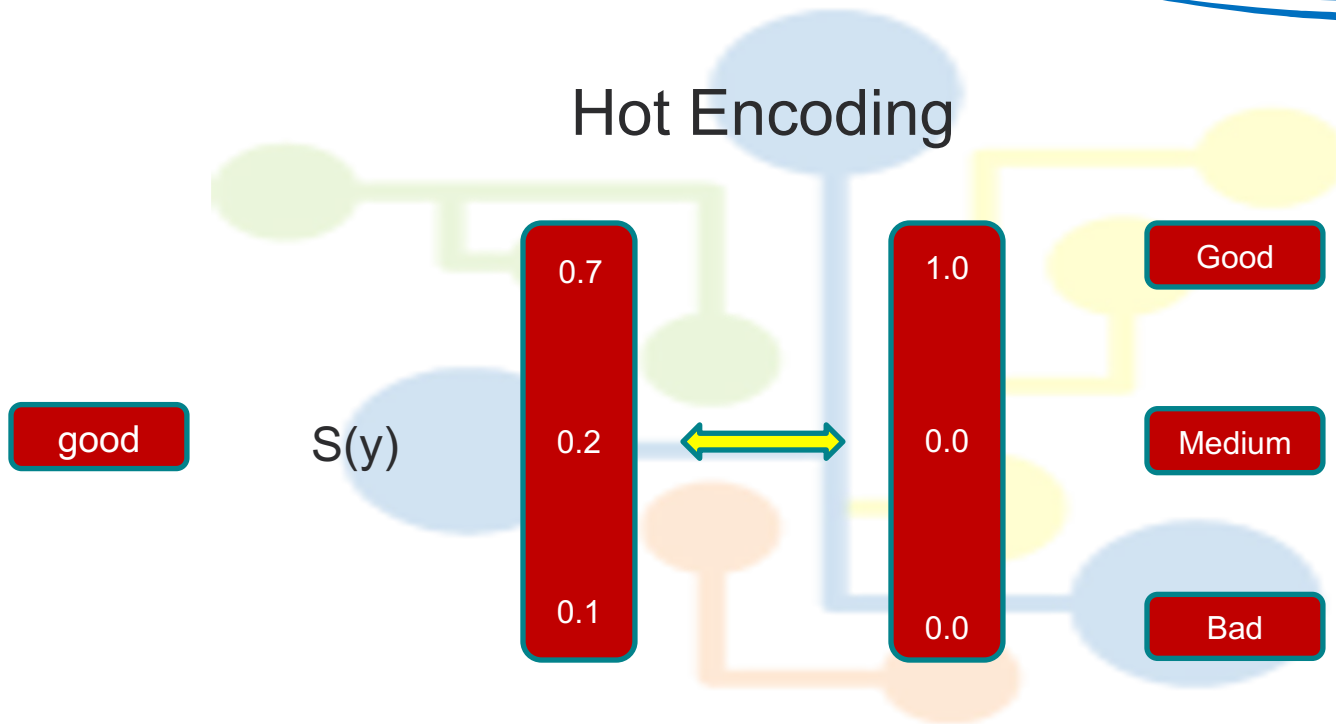
$p = 0.1$

Bad





Hot Encoding

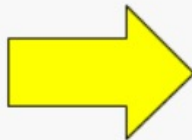


$S(y)$ = Função Softmax que converte os scores para probabilidades



Hot Encoding

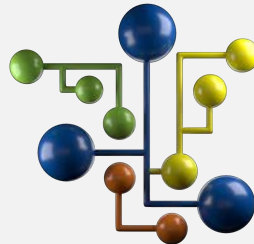
Color
Red
Red
Yellow
Green
Yellow



Red	Yellow	Green
1	0	0
1	0	0
0	1	0
0	0	1

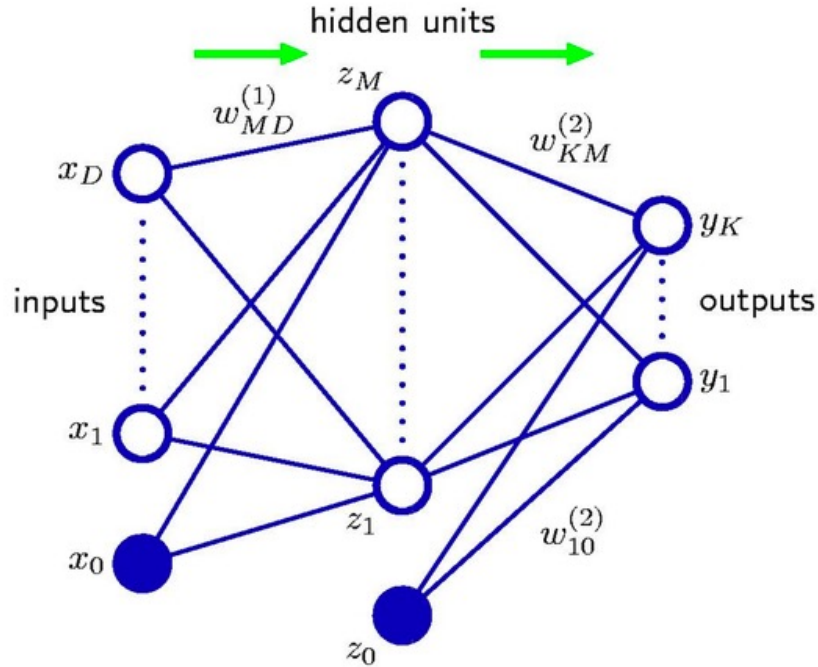


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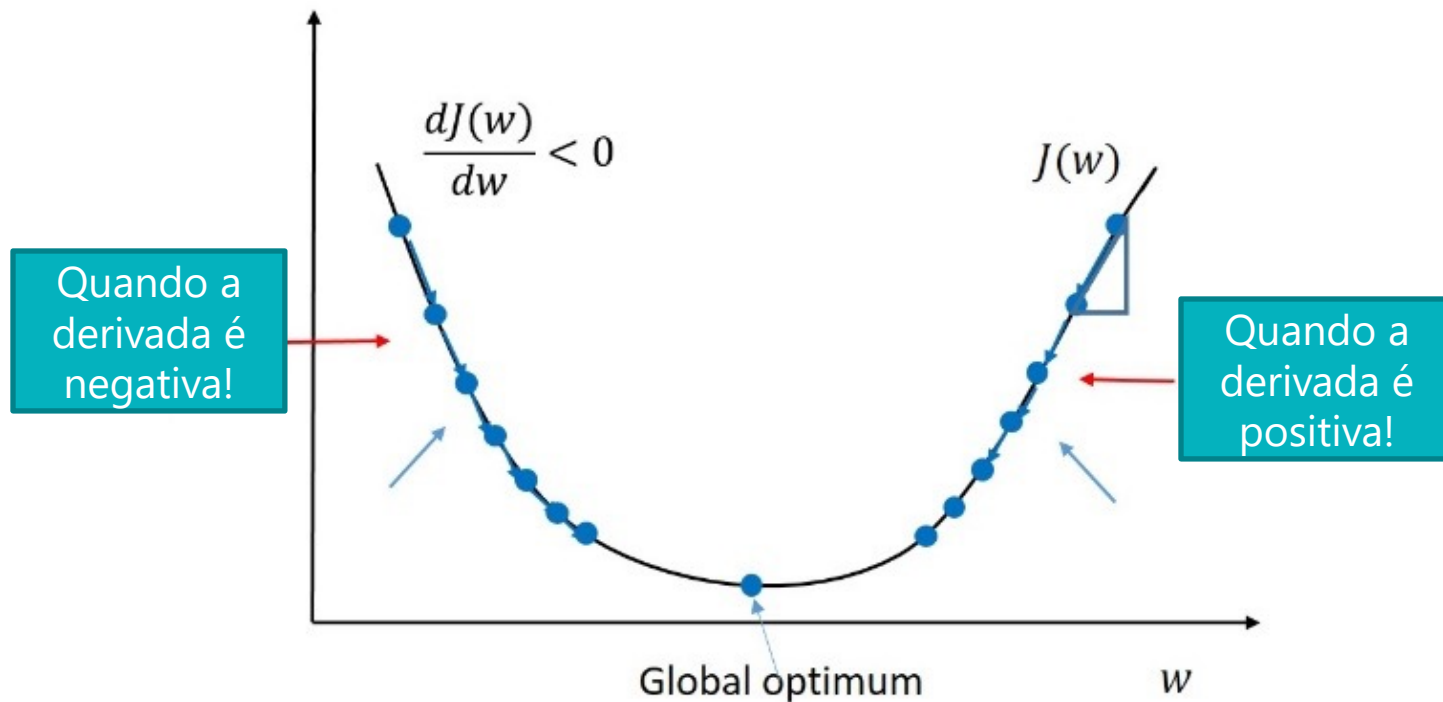


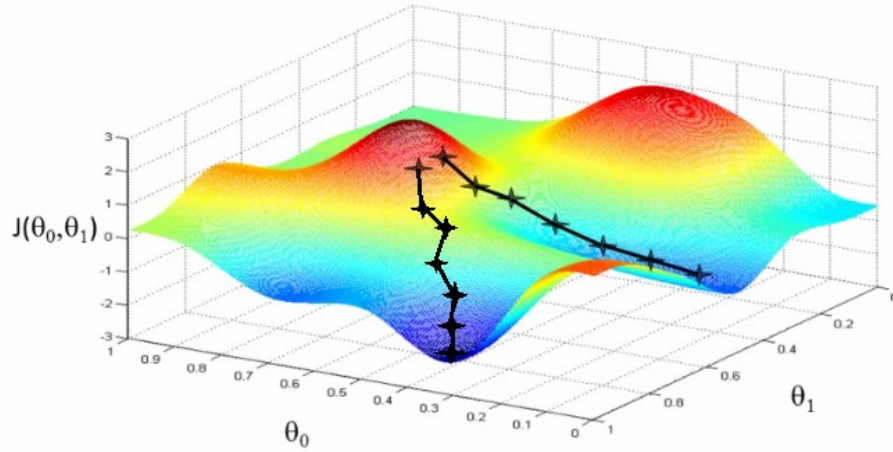
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Otimização com Stochastic Gradient Descent



O treinamento de uma rede neural é convertido em um problema de otimização, cujo objetivo é minimizar o erro cometido pela rede, quando considerados todos os exemplos de treinamento.

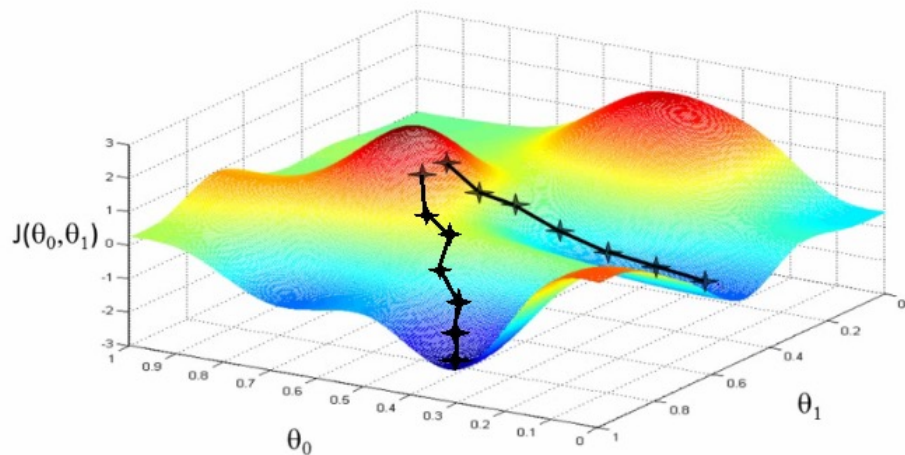




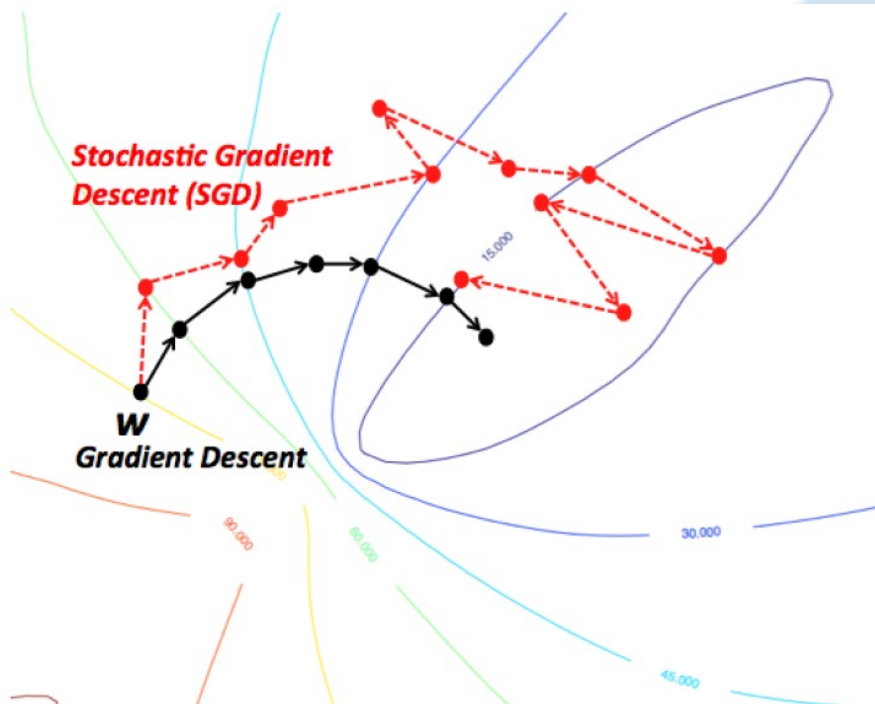
$$J(f(x(t) ; \theta), y(t))$$



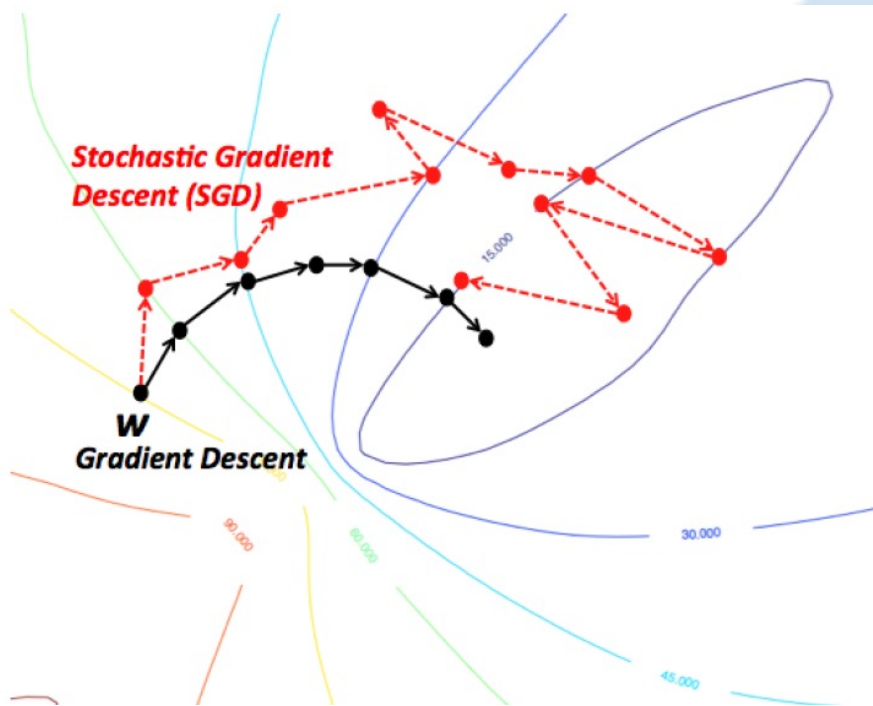
O gradiente de uma função f mede o quanto f varia uma vez que seus argumentos são alterados. Se f for uma função multivariada de n variáveis, então ∇f é um vetor n -dimensional cujas componentes são as derivadas parciais de f .



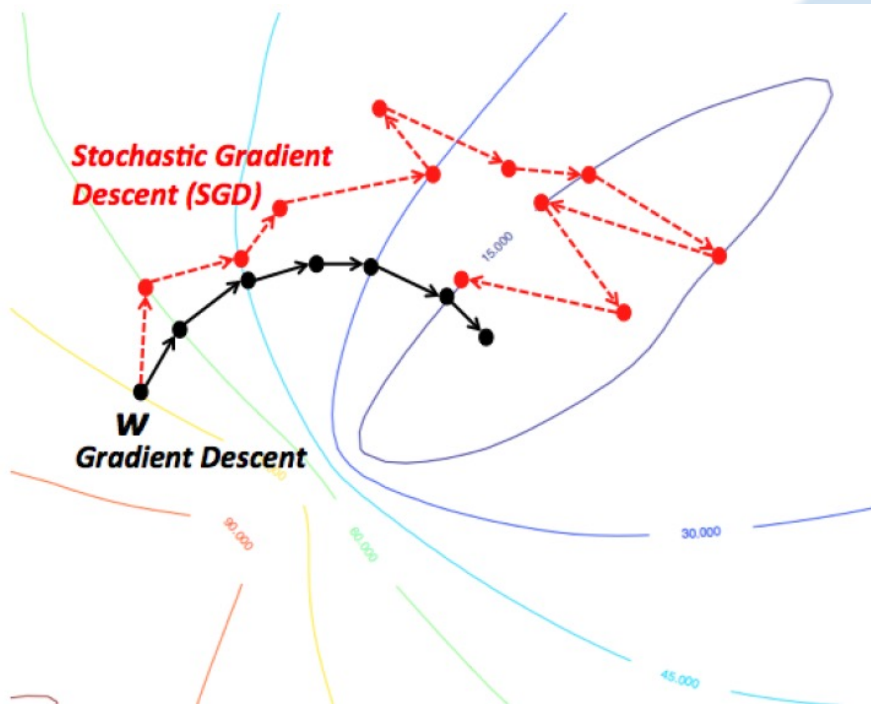
Além de ser computacionalmente intensivo, com Gradient Descent você precisa calcular o gradiente de cada elemento do seu conjunto de treinamento, o que pode levar muito tempo em grandes conjuntos de dados.



A solução encontrada para esse problema, foi o Stochastic Gradient Descent (SGD) que é uma versão do Gradient Descent, em que trabalhamos com amostras aleatórias.

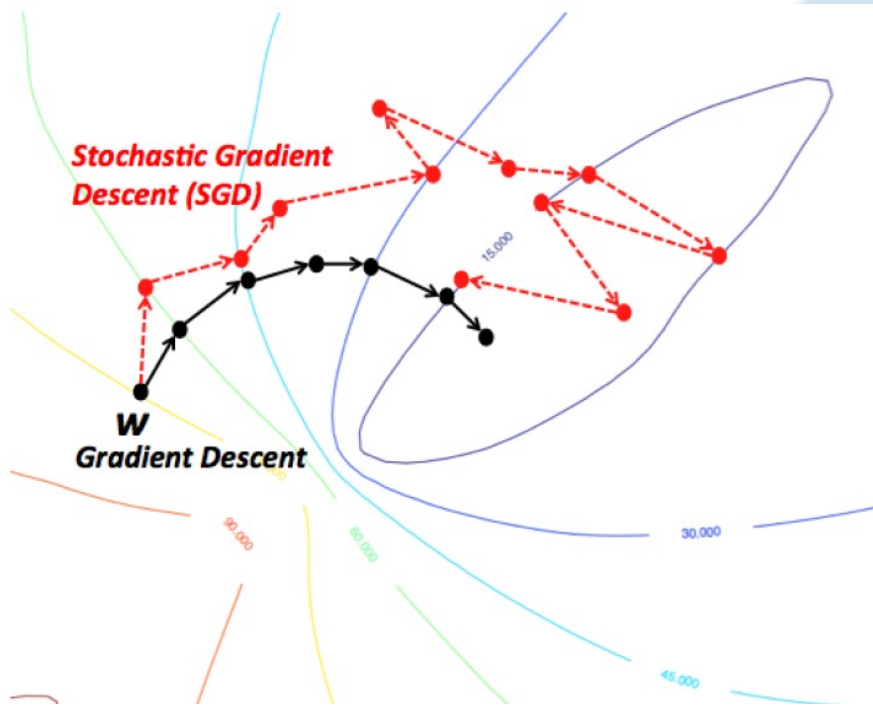


SGD é uma aproximação de Gradient Descent e quanto mais lotes processados pela rede neural (ou seja, mais amostra aleatórias), melhor a aproximação.



A implementação do SGD compreende:

1. Amostragem aleatória de um lote de dados do conjunto de dados total.
2. Executar a rede para frente e para trás para calcular o gradiente (com dados gerados no item 1).
3. Aplicar a atualização de descida de gradiente.
4. Repetir os passos 1 a 3 até que a convergência ou o ciclo seja interrompido por outro mecanismo, ou seja, o número de épocas (epochs).



A técnica de Stochastic Gradient Descent está no cerne do Deep Learning.

Isso ocorre porque o SGD se equilibra bem com os dados e o tamanho do modelo, e queremos trabalhar com Big Data e modelos com muitas camadas ocultas.



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Continue Trilhando uma Excelente Jornada de Aprendizagem!

Muito Obrigado!