

GRADIENT DESCENT

En este proyecto se va a usar el algoritmo del Gradient Descent para ajustar la pendiente y la ordenada en el origen de una recta de regresión lineal. Los datos que se van a usar en este proyecto son:

```
In [5]: import pandas as pd

df = pd.read_csv('Salary_Data.csv', sep = ',')
```

Los datos han sido sacados de <https://www.kaggle.com/udithkhan12/linear-regressionsalary-vs-experience>

```
In [6]: df
```

```
Out[6]:
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	YearsExperience	Salary
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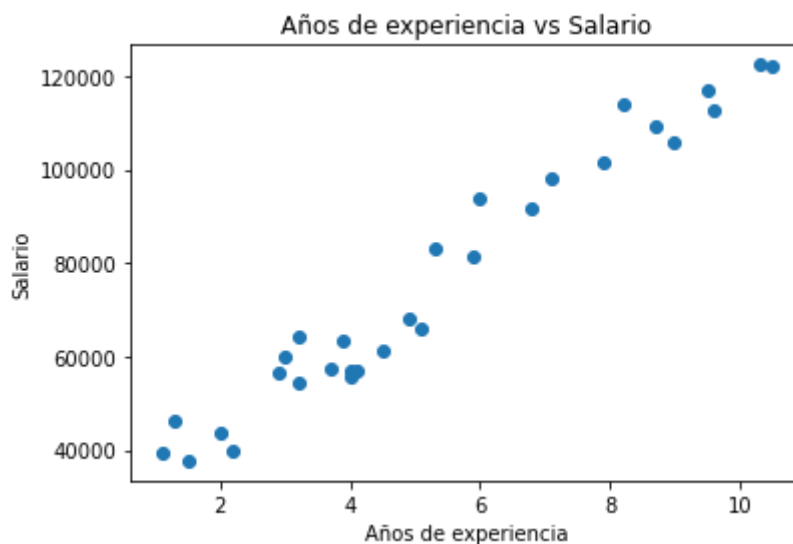
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4	2.2	39891.0
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6	3.0	60150.0
7	3.2	54445.0
8	3.2	64445.0
9	3.7	57189.0
10	3.9	63218.0
11	4.0	55794.0
12	4.0	56957.0
13	4.1	57081.0
14	4.5	61111.0
15	4.9	67938.0
16	5.1	66029.0
17	5.3	83088.0
18	5.9	81363.0
19	6.0	93940.0
20	6.8	91738.0
21	7.1	98273.0
22	7.9	101302.0
23	8.2	113812.0

	YearsExperience	Salary
24	8.7	109431.0
25	9.0	105582.0
26	9.5	116969.0
27	9.6	112635.0
28	10.3	122391.0
29	10.5	121872.0

```
In [7]: import matplotlib
from matplotlib import pyplot as plt
```

```
In [10]: plt.scatter(df['YearsExperience'], df['Salary'])

plt.title('Años de experiencia vs Salario')
plt.xlabel('Años de experiencia')
plt.ylabel('Salario');
```



```
In [11]: # para facilitar las operaciones con listas o vectores importamos numpy:
import numpy as np
```

```
In [18]: experiencia = np.array(df['YearsExperience'])
salario = np.array(df['Salary'])

#La expresión que queremos optimizar es la media de los residuos al cuadrado:
#    MRC = (1/n) * sum(salario - (b + m * experiencia))
#Cuyas derivadas son:
# con respecto a la ordenada en el origen (b):
#    dMRC/db = (-2/n) * sum(salario - (b + m * experiencia))
# con respecto a la pendiente (m):
#    dMRC/dm = (-2/n) * sum(experiencia * (salario - (b + m * experiencia)))
```

El algoritmo consiste en encontrar el óptimo de una función $f(p)$ dando pequeños pasos en dirección hacia él, guiándose por la derivada de la función. Se elige un p_1 discrecionalmente, y a partir de ahí:

- $p2 = p1 - \text{tasaAprendizaje} * f'(p1)$
- $p3 = p2 - \text{tasaAprendizaje} * f'(p2)$
- ...

In [71]:

```
#En nuestro caso:
n = len(experiencia)
b = m = 0
tasaAprendizaje = 0.026

for i in range(0, 400):
    #el algoritmo iterativo para b:
    b = b - tasaAprendizaje * (-2/n) * sum(salario - (b + m * experiencia))

    #el algoritmo iterativo para m:
    m = m - tasaAprendizaje * (-2/n) * sum(experiencia * (salario - (b + m * experi

    print('m = {}, b = {}, iteración = {}'.format(m, b, i))

x = np.array(range(11))
y = b + m * x

plt.scatter(df['YearsExperience'], df['Salary'])
plt.plot(x, y)

plt.title('Años de experiencia vs Salario')
plt.xlabel('Años de experiencia')
plt.ylabel('Salario');
```

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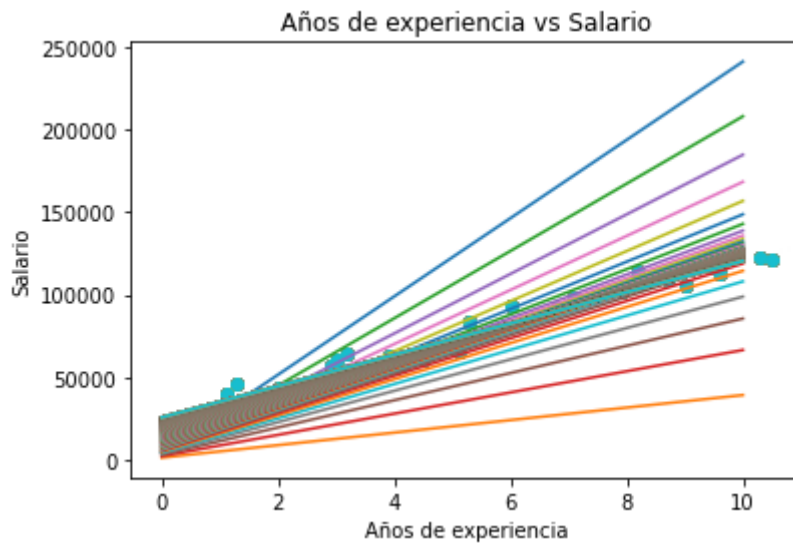
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```



En el gráfico de arriba se aprecia cómo se va ajustando la recta a la nube de puntos conforme las iteraciones avanzan

Vamos a comparar los valores de 'b' y 'm' con los que obtenemos al conseguir los coeficientes con el paquete de scikit learn:

```
In [41]: from sklearn import linear_model
```

```
In [43]: regression = linear_model.LinearRegression()
         regression.fit(df[['YearsExperience']], df[['Salary']])
```

```
Out[43]: LinearRegression()
```

```
In [44]: regression.intercept_
```

```
Out[44]: 25792.200198668717
```

```
In [45]: regression.coef_
```

```
Out[45]: array([9449.96232146])
```

Se ve que los valores del gradient descent convergen a los óptimos

```
In [ ]:
```