Linear Regression

🔶 Linear regression predicts a real value output based on the input value.

- Simple linear regression only has one input/variable and we try to fit a line to best describe the output and input relationship
- Multiple linear regression has multiple variables as input and we try to fit a hyperplane instead.

🔶 A example of simple linear regression is salary prediction, with the salary as output, and years of working experience as input variable.

🔶 The algorithm can be used for simple linear regression or multiple linear regression, and in this notebook, it will be implemented for simple linear regression using sklearn linear regression algorithm

Import libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
from sklearn.linear_model import LinearRegression
```

Read data

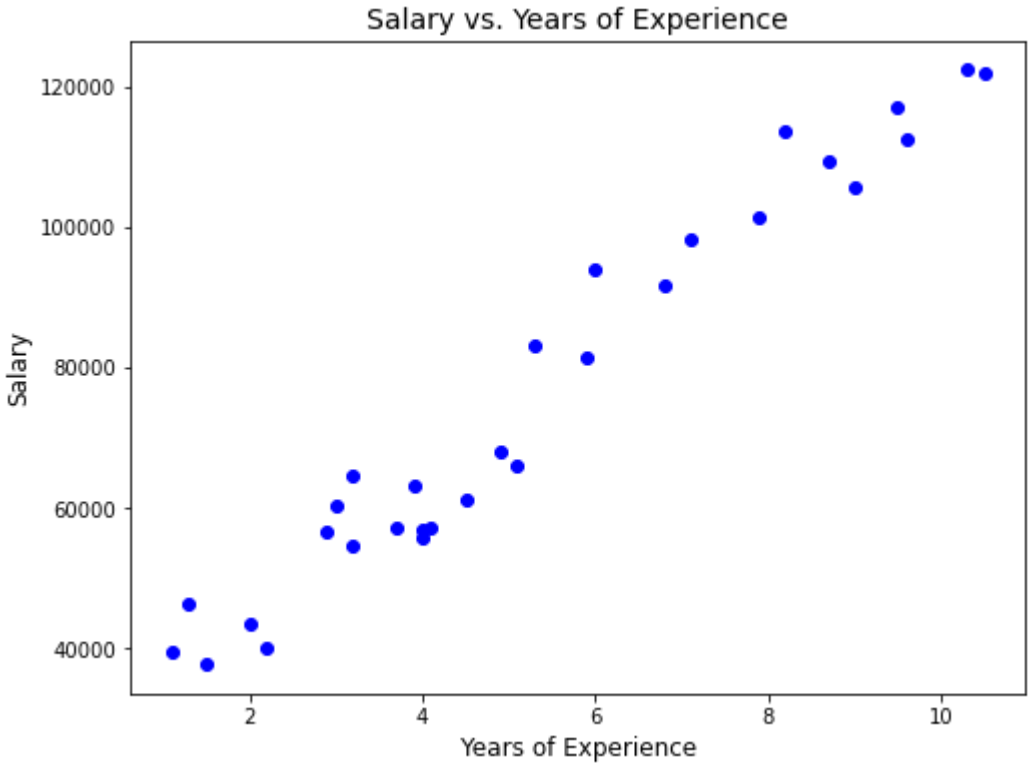
In [2]:
```
df = pd.read_csv('Salary_Data.csv')
# shuffle data
df = df.sample(frac=1, random_state=42).reset_index(drop=True)
```

In [3]:
```
df.head()
```

Out[3]:

	YearsExperience	Salary
0	9.6	112635.0
1	4.9	67938.0
2	8.2	113812.0
3	5.3	83088.0
4	3.2	64445.0

In [4]:
```
# visualize data
fig = plt.figure(figsize=(8,6))
plt.scatter(df.iloc[:,0], df.iloc[:,1], c='b')
plt.title('Salary vs. Years of Experience', fontsize=14)
plt.xlabel('Years of Experience', fontsize=12)
plt.ylabel('Salary', fontsize=12)
plt.show()
```



Split data to train and test dataset

In [5]:
```
x = np.array(df.iloc[:,0:1])
y = np.array(df.iloc[:,1])
```

In [6]:
```
train_frac = 0.7
train_size = int(df.shape[0] * train_frac)
x_train = x[0:train_size,:]
y_train = y[0:train_size]
x_test = x[train_size:,:]
y_test = y[train_size:]
```

In [7]:
```
print ('training size is {}\ntest size is {}'.format(x_train.shape[0], x_test.shape[0
```

```
training size is 21
test size is 9
```

Initialize the model

In [8]:
```
lr = LinearRegression()
lr.fit(x_train, y_train)
train_accuracy = lr.score(x_train, y_train)*100
```

Predict the test data output

In [9]:
```
y_pred_train = lr.predict(x_train)
y_pred_test = lr.predict(x_test)
```

```
coef = lr.coef_
intercept = lr.intercept_
test_accuracy = lr.score(x_test, y_test)*100
```

In [10]:

```
# print the test data, predicted test data and the error
np.set_printoptions(formatter={'float': lambda x: "{0:0.01f}".format(x)})
print('y_test\n {}\n\ny_pred_test\n {}\n\ntest accuracy (%) {}\n\ncoef {} intercept {
      .format(y_test, y_pred_test, test_accuracy, coef, intercept))
```

```
y_test
 [116969.0 81363.0 121872.0 91738.0 54445.0 63218.0 61111.0 93940.0 60150.0]

y_pred_test
 [115224.5 81135.1 124693.7 89657.4 55568.1 62196.6 67878.1 82082.0 53674.2]

test accuracy (%) 95.1483199421986

coef [9469.3] intercept 25266.40502593999
```

Visulize fitted results

In [11]:

```
fig = plt.figure(figsize=(8,6))
plt.scatter(df.iloc[:,0], df.iloc[:,1], c='b')
plt.plot(x_train, y_pred_train, c='r', lw=2)
plt.title('', fontsize=14)
plt.xlabel('Years of Experience', fontsize=12)
plt.ylabel('Salary', fontsize=12)
plt.legend(['fitted line using sklearn LinearRegression'], fontsize=12)
plt.show()
```