Practicle:3 Linear Regression + Error Detection

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Use case : We have to predict the salary using experience by using linear regresion

Import libraries

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:

```
df=pd.read_csv("Salary_Data.csv")
```

In [3]:

```
df.head(2)
```

Out[3]:

	YearsExperience	Salary
0	1.1	39343.0
1	1.3	46205.0

In [4]:

```
df.tail(2)
```

Out[4]:

	YearsExperience	Salary
28	10.3	122391.0
29	10.5	121872.0

In [5]:

```
df.isnull().sum()
```

Out[5]:

```
YearsExperience    0
Salary             3
dtype: int64
```

In [6]:

```
df.notnull().sum()
```

Out[6]:

```
YearsExperience    30
Salary             27
dtype: int64
```

In [7]:

```
df.isnull().sum()
```

Out[7]:

```
YearsExperience    0
Salary             3
dtype: int64
```

In [8]:

```
df.dropna(inplace=True)
```

In [9]:

```
df.corr() # correlation
```

Out[9]:

	YearsExperience	Salary
YearsExperience	1.00000	0.98131
Salary	0.98131	1.00000

In [10]:

```
X=df.iloc[:,:-1].values # independent variable
y = df.iloc[:, -1].values # dependent variable
```

In [34]:

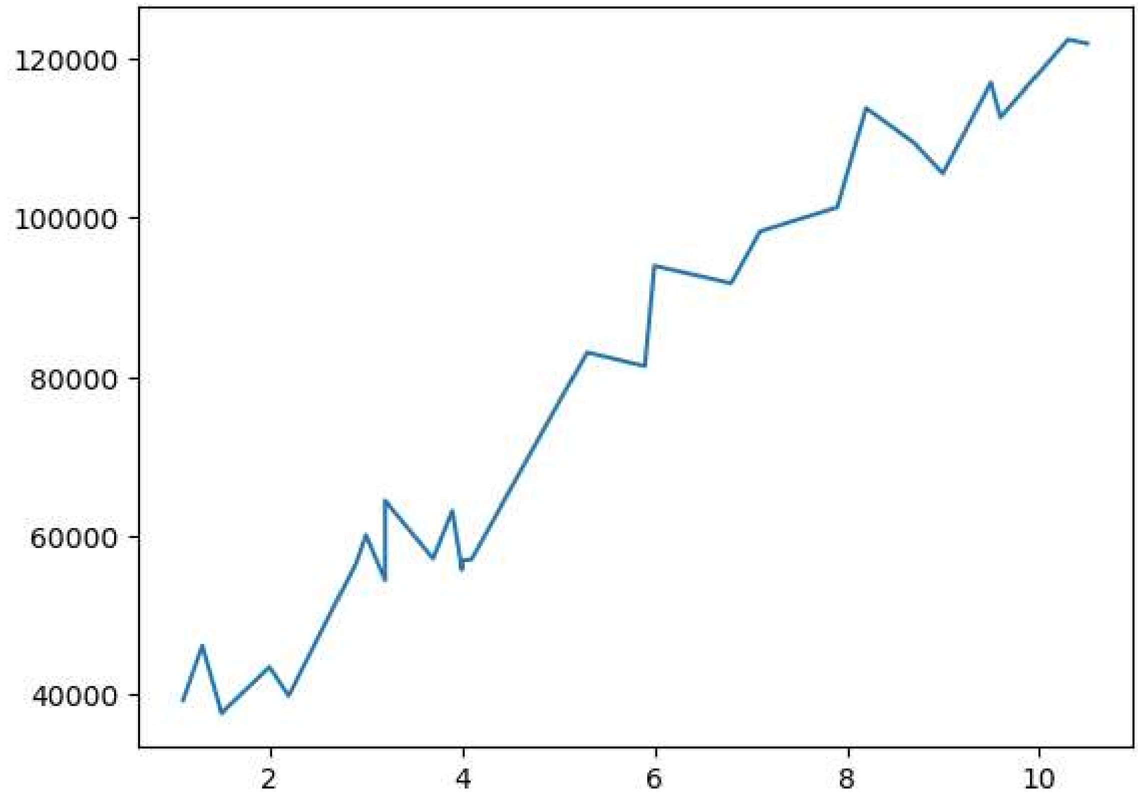
```
X
```

Out[34]:

```
array([[ 1.1],
       [ 1.3],
       [ 1.5],
       [ 2. ],
       [ 2.2],
       [ 2.9],
       [ 3. ],
       [ 3.2],
       [ 3.2],
       [ 3.7],
       [ 3.9],
       [ 4. ],
       [ 4. ],
       [ 4.1],
       [ 5.3],
       [ 5.9],
       [ 6. ],
       [ 6.8],
       [ 7.1],
       [ 7.9],
       [ 8.2],
       [ 8.7],
       [ 9. ],
       [ 9.5],
       [ 9.6],
       [10.3],
       [10.5]])
```

In [11]:

```
# graph
plt.plot(X,y)
plt.show()
```



In [13]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=
```

In [14]:
```
from sklearn.linear_model import LinearRegression
lm = LinearRegression()
lm.fit(X_train, y_train)
```

Out[14]:
```
▾ LinearRegression
LinearRegression()
```

In [15]:
```
pred = lm.predict(X_test)
```

In [16]:
```
print("y_test",y_test)
print("X_test",X_test)
```

```
y_test [ 37731. 112635.  83088.  91738.  56642.  55794.]
X_test [[1.5]
 [9.6]
 [5.3]
 [6.8]
 [2.9]
 [4. ]]
```

In [17]:
```
pred
```

Out[17]:
```
array([ 41144.69206511, 117316.34008101,  76879.53928245,  90985.40002613,
        54310.16209255,  64654.45997125])
```

y=mx+c
y=ax+c

In [18]:

```
print(lm.intercept())
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[18], line 1
----> 1 print(lm.intercept())

AttributeError: 'LinearRegression' object has no attribute 'intercept'
```

In [19]:

```
a=lm.intercept_
c=lm.coef_
```

In [20]:

```
print(a,c)
```

```
27038.831321426056 [9403.90716246]
```

In [21]:

```
my_sal_pred=a*10+c  # prediction of salary for 10 year exp
print(my_sal_pred)
```

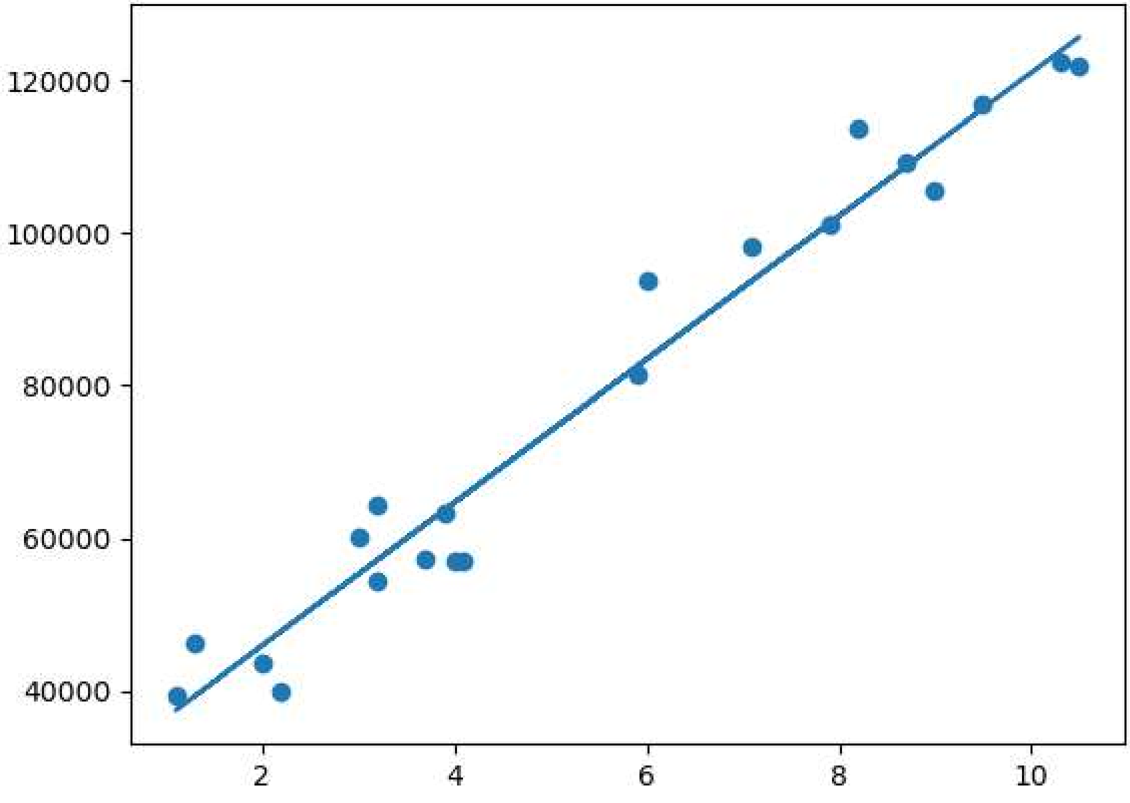
```
[279792.22037672]
```

In [22]:

```
# graph od train and test data
plt.scatter(X_train, y_train)
plt.plot(X_train, lm.predict(X_train))
```

Out[22]:

```
[<matplotlib.lines.Line2D at 0x17e1718e010>]
```



Model Evaluation Metrix

In [23]:
```
from sklearn import metrics
```

In [24]:
```
print('Mean Absolute Error is : ',metrics.mean_absolute_error(y_test,pred))
```

```
Mean Absolute Error is :  4374.731786040949
```

In [25]:
```
print('Mean Squared Error is :',metrics.mean_squared_error(y_test,pred))
```

```
Mean Squared Error is : 26104141.43339284
```

In [26]:
```
print('Root Mean Squared Error is: ',np.sqrt(metrics.mean_squared_error(y_test,pred)))
```

```
Root Mean Squared Error is:  5109.2212159381825
```

In [27]:
```
#root Mean Squared Error (RMSE)
```

In [28]:
```
train_score_lm = lm.score(X_train, y_train)
test_score_lm = lm.score(X_test, y_test)

print("Train score: ", train_score_lm)
print("Test score : ",test_score_lm)
```

```
Train score:  0.9633907320629322
Test score :  0.9591199103412812
```

In [ ]:
```
from sklearn.metrics import r2_score
print(" Root mean Squared error is:",r2_score(y_test,pred) )
r2=r2_score(y_test,pred)
```

Pracricle:4
Multiple Linear Regression

In [32]:
```
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder
col_transf = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [])], remair
X = np.array(col_transf.fit_transform(X))
```

In [ ]:

In [33]:
```
X
```

Out[33]:

```
array([[ 1.1],
       [ 1.3],
       [ 1.5],
       [ 2. ],
       [ 2.2],
       [ 2.9],
       [ 3. ],
       [ 3.2],
       [ 3.2],
       [ 3.7],
       [ 3.9],
       [ 4. ],
       [ 4. ],
       [ 4.1],
       [ 5.3],
       [ 5.9],
       [ 6. ],
       [ 6.8],
       [ 7.1],
       [ 7.9],
       [ 8.2],
       [ 8.7],
       [ 9. ],
       [ 9.5],
       [ 9.6],
       [10.3],
       [10.5]])
```

In [35]:

```
from sklearn.model_selection import train_test_split
Xm_train, Xm_test, ym_train, ym_test = train_test_split(X, y, test_size = 0.3, random_
```

In [36]:

```
from sklearn.linear_model import LinearRegression
lm1 = LinearRegression()
lm1.fit(Xm_train, ym_train)
```

Out[36]:

```
▾ LinearRegression i ?

LinearRegression()
```

In [37]:

```
ym = lm1.predict(Xm_test)
np.set_printoptions(precision=2)
print(np.concatenate((ym.reshape(len(ym),1), ym_test.reshape(len(ym_test),1)),1))
```

```
[[ 64179.34  63218.  ]
 [113452.36 105582.  ]
 [127944.42 121872.  ]
 [ 84468.23  93940.  ]
 [ 66111.61  57081.  ]
 [119249.19 112635.  ]
 [ 57416.37  54445.  ]
 [ 62247.06  57189.  ]
 [118283.05 116969.  ]]
```

In [ ]: