Linear Regression

- y=a + bx + b1 x1 + b2 x2.....
- y => dependent/target (1) [1D]
- x => independent/features (n) [2D]

```
from sklearn.linear_model import LinearRegression
import numpy as np
from sklearn.metrics import
r2_score,mean_absolute_error,mean_squared_error

#independent
time = np.array([5,7,12,16,20]).reshape(-1,1)

#dependent
mass = np.array([40,120,180,210,240])

mymodel = LinearRegression()
#model.fit(independent,dependent)
mymodel.fit(time,mass)
```

```
LinearRegression()
```

```
x = int(input("Enter the time in minutes :"))
result = mymodel.predict([[x]])  #passsing independent variable(time
in 2D)
print("If the time is ",x,"minutes the mass is ",result[0], " grams")
```

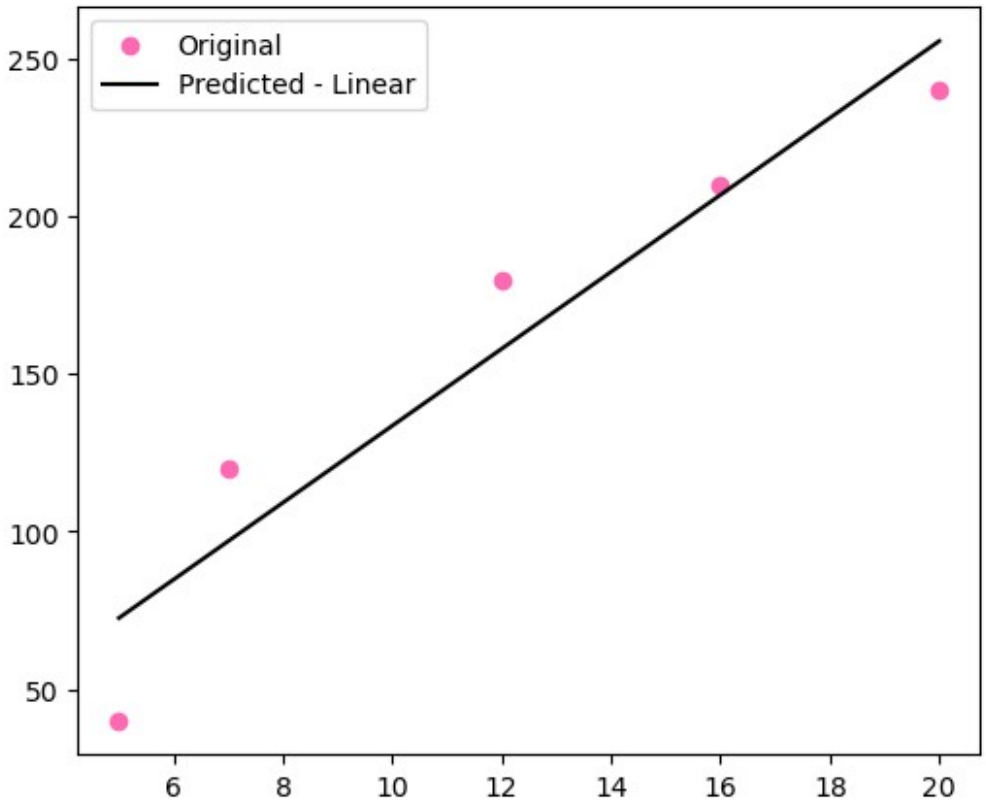
```
Enter the time in minutes : 13
```

```
If the time is  13 minutes the mass is  170.2077922077922  grams
```

```
mass_model = mymodel.predict(time)
print(mass_model)
```

```
[ 72.54545455  96.96103896 158.         206.83116883 255.66233766]
```

```
#plotting original values - scatter
import matplotlib.pyplot as plt
plt.figure(figsize=(6,5))
plt.scatter(time,mass,label="Original",color="hotpink")
#plotting mode valuea - Line
plt.plot(time,mass_model,label="Predicted - Linear",color='k')
plt.legend()
plt.show()
```



Evalution

R-Square

- Larger is better.

```
r2score=r2_score(time,mass_model)
print(r2score)

-816.6925282509699
```

Mean Squared Error [MSE]

- Lower is better.

```
mse=mean_squared_error(time,mass_model)
print(mse)

25184.929870129872
```

Mean Abosulte Error

- Lower is better.

```
mas=mean_absolute_error(time,mass_model)
print(mas)
```

```
146.0
```

Linear Regresssion on Large Data

Case : Predicting the salary from age,experience,gender,education

1.Import libraries 2.Load Data 3.Split Data 4.Create and Train Model

1. Test the model 6.Evalution

1.Importing Libraries

```
import pandas as pd
import numpy as np
from sklearn.linear_model import LinearRegression
from sklearn.metrics import
r2_score,mean_absolute_error,mean_squared_error
import matplotlib.pyplot as plt
from  sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
```

2.Data Loading

```
data=pd.read_csv(r"C:\My python Files\Salary_EDA.csv")
data.head()
```

```
    Age  Gender Education Level          Job Title  Years of
Experience  \
0  32.0    Male      Bachelor's  Software Engineer
5.0
1  28.0  Female        Master's       Data Analyst
3.0
2  45.0    Male             PhD     Senior Manager
15.0
3  36.0  Female      Bachelor's    Sales Associate
7.0
4  36.0  Female      Bachelor's    Sales Associate
7.0

     Salary
0   90000.0
1   65000.0
2  150000.0
3   60000.0
4   60000.0
```

Clean Data

```
data.isnull().sum()
```

```
Age                    2
Gender                 4
Education Level        3
Job Title              5
Years of Experience    2
Salary                 3
dtype: int64
```

Data Preprocessing

```
data.dropna(inplace=True)

data.isnull().sum()
```

```
Age                    0
Gender                 0
Education Level        0
Job Title              0
Years of Experience    0
Salary                 0
dtype: int64
```

Encode the Data

```
le=LabelEncoder()
data['Gender_Encoded']=le.fit_transform(data['Gender'])
le1=LabelEncoder()
data['Edu_Level_Encoded']=le1.fit_transform(data['Education Level'])

data.head()
```

```
    Age  Gender Education Level          Job Title  Years of
Experience  \
0  32.0    Male      Bachelor's  Software Engineer
5.0
1  28.0  Female        Master's       Data Analyst
3.0
2  45.0    Male             PhD     Senior Manager
15.0
3  36.0  Female      Bachelor's    Sales Associate
7.0
4  36.0  Female      Bachelor's    Sales Associate
7.0

     Salary  Gender_Encoded  Edu_Level_Encoded
0   90000.0               1                  0
1   65000.0               0                  1
2  150000.0               1                  2
3   60000.0               0                  0
4   60000.0               0                  0
```

3.Split Data

Split - independent , Dependent

```
X = data[['Age','Gender_Encoded','Edu_Level_Encoded','Years of
Experience']]
Y = data['Salary']

X_train,X_test,Y_train,Y_test =
train_test_split(X,Y,test_size=0.2,random_state=42)
#total 700 records
#X_train- 560(age,gender,Education,experience)
#X_test- 140(age,gender,Eduction,experience)
#Y_train- 560(Salary)
#Y_test- 140(Salary)
```

4.Create and train Model

```
sal_model=LinearRegression()
sal_model.fit(X_train,Y_train)

LinearRegression()
```

1. Test

```
a=float(input("Enter your age: "))
g_user=input("Enter your Gender: ")
ed_user=input("Enter your Education level: ")
Exp=float(input("Enter your experience in year: "))

Enter your age:  32
Enter your Gender:  Male
Enter your Education level:  PhD
Enter your experience in year:  7

gen_en=le.transform([g_user])[0]
edu_en=le1.transform([ed_user])[0]
print(gen_en,edu_en)

1 2

result = sal_model.predict([[a,gen_en,edu_en,Exp]])
print("The predicted Salary is: ",result[0])

The predicted Salary is:  98872.0492018653

C:\Users\DELL\anaconda3\Lib\site-packages\sklearn\base.py:439:
UserWarning: X does not have valid feature names, but LinearRegression
was fitted with feature names
  warnings.warn(
```

6.Evalution 1.Predict test values 2.Visualize 3.Metrices

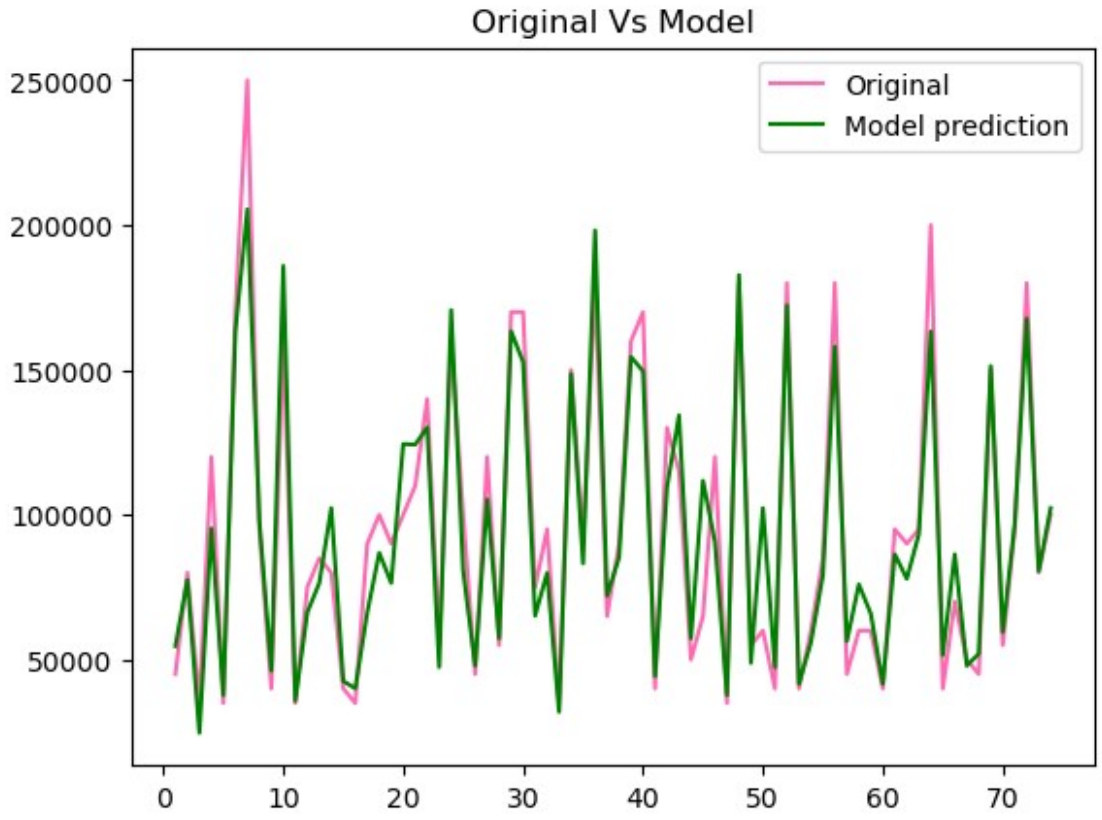
```
model_prediction=sal_model.predict(X_test)
```

2.Vistualize

```
len(Y_test)
```

```
74
```

```
plt.plot(np.arange(1,75),Y_test,color='hotpink',label="Original")
plt.plot(np.arange(1,75),model_prediction,color="green",label="Model
prediction")
plt.title("Original Vs Model")
plt.legend()
plt.show()
```



3.Metrices

```
r2score=r2_score(Y_test,model_prediction)
print(r2score)
if r2score>0.5:
    print("Model is good fit")
else:
    print("Model is not good fit")
```

```
0.908465830252362
Model is good fit

mae=mean_absolute_error(Y_test,model_prediction)
print(mae)

11362.212304880708

mse=mean_squared_error(Y_test,model_prediction)
print(mse)

235720545.72027326
```