Linear Regression

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

```
from sklearn.linear_model import LinearRegression
import numpy as np
import pandas as pd
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(ind,dep)
mymodel.fit(time,mass) # train the model
```

```
LinearRegression()
```

```
x = int(input("Enter the time in minutes: "))
result = mymodel.predict([[x]]) #passing ind var(time in 2D)
print("if the time is ",x, "minutes the mass is ",result[0], " grams")
```

```
Enter the time in minutes:  14

if the time is  14 minutes the mass is  182.41558441558442  grams
```

```
x = int(input("Enter the time in minutes: "))
result = mymodel.predict([[x]]) #passing ind var(time in 2D)
print("if the time is ",x, "minutes the mass is ",result[0], " grams")
```

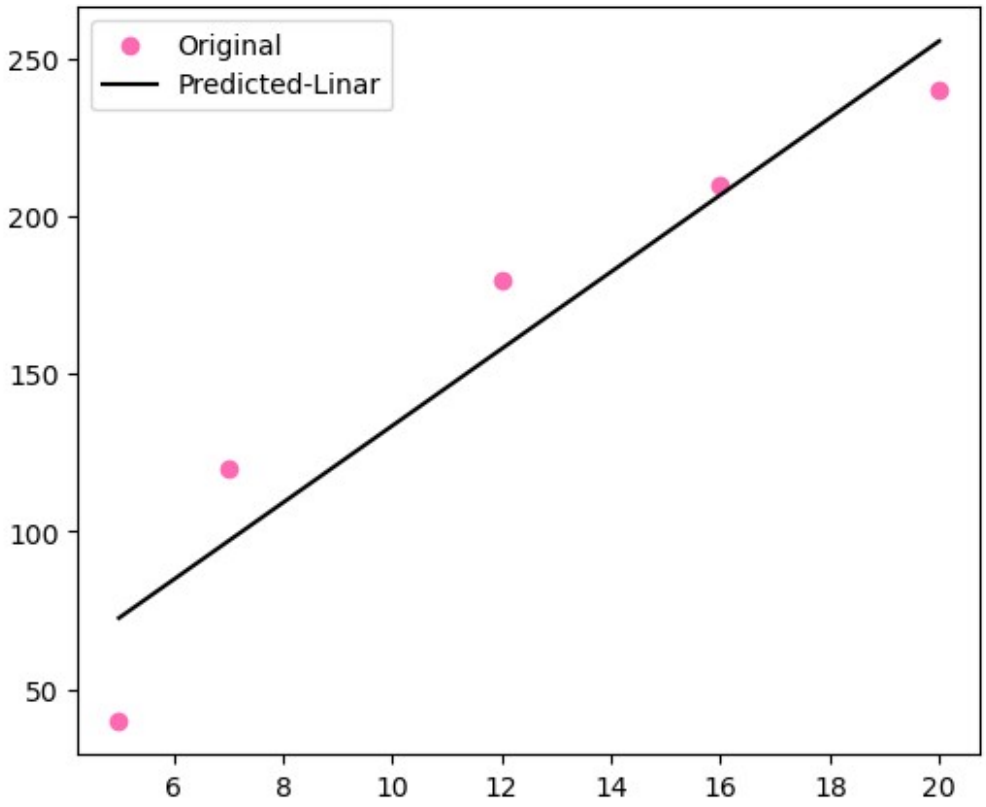
```
Enter the time in minutes:  29

if the time is  29 minutes the mass is  365.53246753246754  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 model values - line
plt.plot(time,mass_model,label = "Predicted-Linar",color = "k")
```

```
plt.legend()
plt.show()
```



EVALUTION

R-Square

- Lager the better

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

```
-816.6925282509699
```

MSE

- Lower the better

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

```
25184.929870129872
```

MAE

- Lower the better

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

```
146.0
```

linear regression 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 5) test the model 6) evaltion

importing libraries

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

loading data

```
df = pd.read_csv("C:\my files\Salary_EDA.csv")
df.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

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

```
Age                        2
Gender                     4
Education Level            3
Job Title                  5
Years of Experience        2
Salary                     3
Gender_encoder             0
Eduction_level_encoder     0
dtype: int64
```

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

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

data preprocessing

```
# encding gender
gen_en = LabelEncoder()
df["Gender_encoder"]=gen_en.fit_transform(df["Gender"])
# encoding education level
edu_en = LabelEncoder()
df["Eduction_level_encoder"]=edu_en.fit_transform(df["Education
Level"])

df.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_encoder  Eduction_level_encoder
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
```

split = ind,dep

```
x = df[["Age","Gender_encoder","Eduction_level_encoder","Years of
Experience"]]
y = df["Salary"]
```

split - train and test

```
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,ge,e)
#X_test- 140(age,ge,g)
#Y_train- 560(saL)
#y_test- 140(saL)
```

create and train

```
sal_model = LinearRegression()
sal_model.fit(x_train,y_train)
```

```
LinearRegression()
```

Test

```
a = float(input("Enter the age: "))
g_user = input("Enter your gender: ")
ed_user = input("Enter your education level: ")
exp = float(input("Enter your experience in years: "))
```

```
Enter the age:  39
Enter your gender:  Female
Enter your education level:  PhD
Enter your experience in years:  8
```

```
gen_en1 = gen_en.transform([g_user])[0]
ed_en1 = edu_en.transform([ed_user])[0]
print(gen_en1,ed_en1)
```

```
0 2
```

```
result = sal_model.predict([[a,gen_en1,ed_en1,exp]])
print("The predicated salary is: ",result[0])
```

```
The predicated salary is:  113372.21122018943
```

```
C:\ProgramData\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(
```

EVALUTION

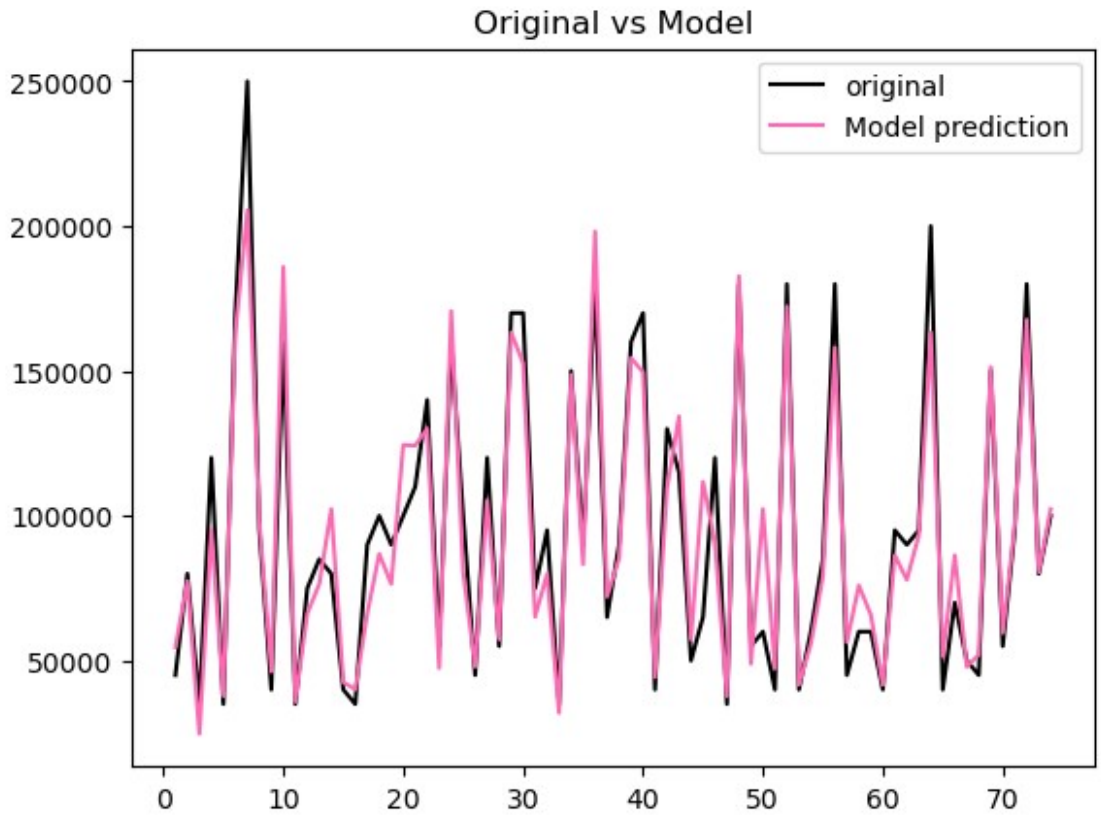
1) PREDICT TEST VALUES 2) VISULAZE 3) METRICS

```
model_predictions =sal_model.predict(x_test)
```

```
len(y_test) # x required
```

```
74
```

```
plt.plot(np.arange(1,75),y_test,color = "k",label = "original")
plt.plot(np.arange(1,75),model_predictions,color = "hotpink",label =
"Model prediction")
plt.title("Original vs Model")
plt.legend()
plt.show()
```




```
Evaltion
```

metrics

```
r2score = r2_score(y_test,model_predictions)
print(r2score)
```

```
0.908465830252362
```

```
mse = mean_squared_error(y_test,model_predictions)
print(mse)
```

```
235720545.72027326
```

```
mae = mean_absolute_error(y_test,model_predictions)
print(mae)
```

```
11362.212304880708
```