Linear Regression

- y=a + bx + b1 X1+ b2 X2....
- y=>dependent/target (1) [1D]
- x=>independent/feature (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(ind,dep)
mymodel.fit(time,mass)
```

```
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")
```

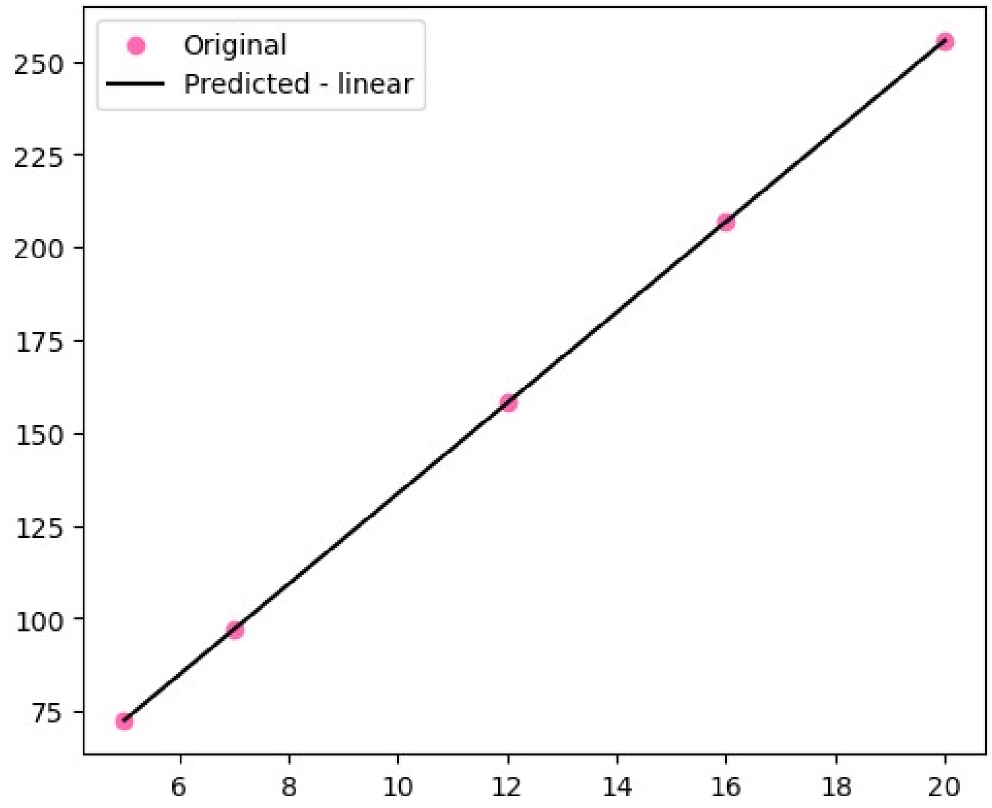
```
Enter the time in minutes: 45
```

```
if the time is 45 minutes the mass is 560.8571428571429 grams
```

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

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

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



linear Regression on large data

Evaluation:

R-square

- larger,the better

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

-816.6925282509699
```

MSE

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

25184.929870129872
```

MAE

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

146.0
```

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

- 1.import libraries
- 2.load data
- 3.split data
- 4.create the train model
- 5.test the model
- 6.evaluation

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import LabelEncoder
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

```
sdf=pd.read_csv("C:\mypythonfiles\Salary_EDA.csv")

sdf.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

```
sdf.isnull().sum()

Age                    2
Gender                 4
```

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

sdf.dropna(inplace=True)
sdf.isnull().sum()

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

Data preprocessing

```
g_e=LabelEncoder()
sdf['gender_encoded']=g_e.fit_transform(sdf['Gender'])
e_f=LabelEncoder()
sdf['Education_L_encoded']=e_f.fit_transform(sdf['Education Level'])
sdf.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  Education_L_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
```

split - ind,dep

```
X=sdf[['Age','gender_encoded','Education_L_encoded','Years of 
Experience']]
Y=sdf['Salary']
```

split -train and test

```
X_train,X_test,Y_train,Y_test=train_test_split(X,Y,test_size=0.2,rando
m_state=42)
```

create and train

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

LinearRegression()
```

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 year of Experience:"))

Enter your age: 34
Enter your Gender: Male
Enter your Education level: PhD
Enter your year of Experience: 4

gen_enc=g_e.transform([g_user])[0]
edu_enc=e_f.transform([ed_user])[0]
print(gen_enc,edu_enc)

1 2

result=sal_model.predict([[a,gen_enc,edu_enc,exp]])
print("the predict salary is : ",result[0])

the predict salary is :  94747.06303601456

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(
```

Evaluation:

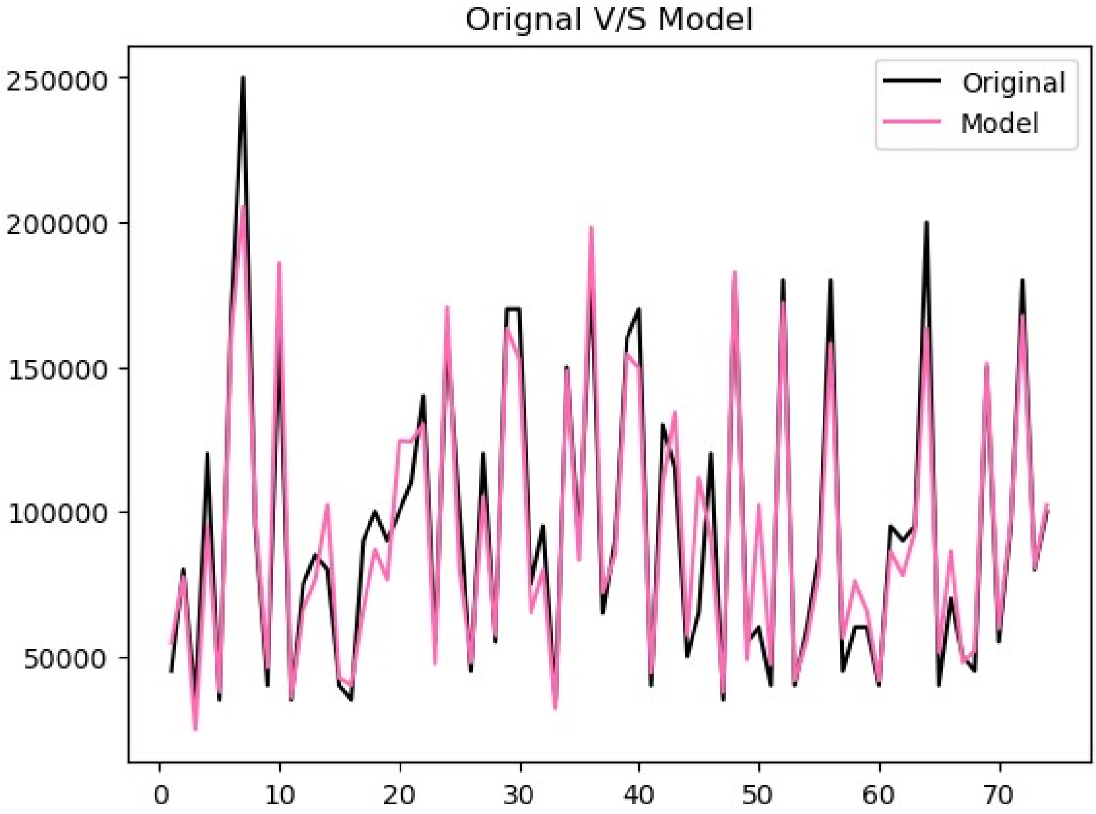
- Predict test values
- visualize
- metrics

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

```
len(Y_test)
```

```
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")
plt.title('Orignal V/S Model')
plt.legend()
plt.show()
```



Evalution

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

```
0.908465830252362
Model is Good fit
```

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

```
235720545.72027326
```

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

```
11362.212304880708
```