ID: 190041220

Tasfia Tasneem Annesha

CSE'19

Importing Libraries

```
import numpy as np
from sklearn import datasets
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
import seaborn as sns
```

class

```
class LinearRegression:
    def __init__(self, lr = 0.001, n_iters = 100):
        self.lr = lr
        self.n_iters = n_iters
        self.weights = None
        self.bias = None

    def fit(self, X, y):
        # init parameters
        n_samples, n_features = X.shape
        self.weights = np.zeros(n_features)
        self.bias = 0
        self.mse_values = list([])

        for _ in range(self.n_iters):
            y_predicted = np.dot(X, self.weights) + self.bias
            self.mse_values.append(np.mean((y_predicted - y)**2))

            dw = (1/n_samples) * np.dot(X.T, (y_predicted - y))
            db = (1/n_samples) * np.sum(y_predicted - y)

            self.weights -= self.lr * dw
            self.bias -= self.lr * db

    def predict(self, X):
        y_predicted = np.dot(X, self.weights) + self.bias
        return y_predicted
```

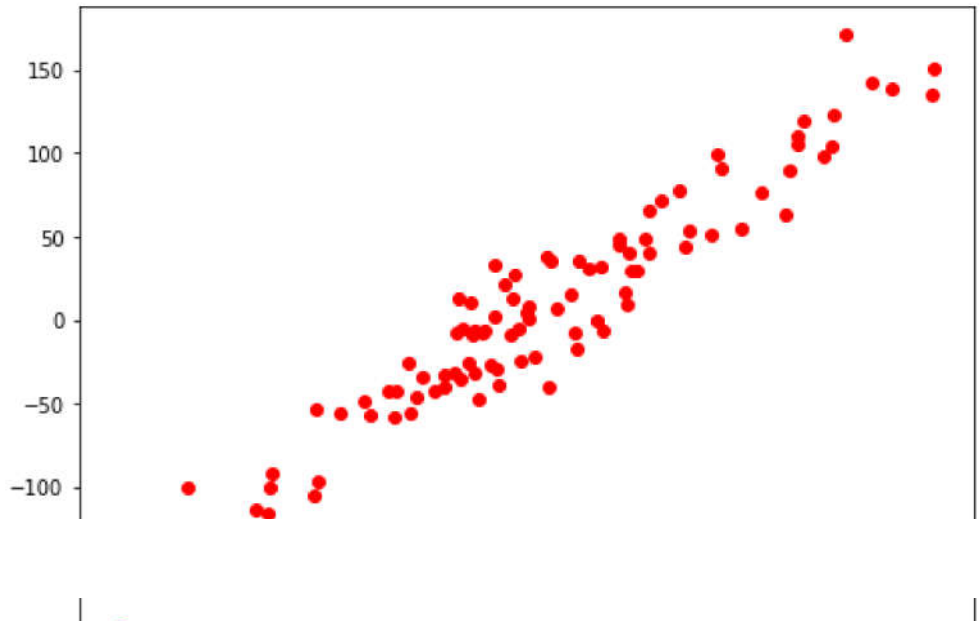
```
X, y = datasets.make_regression(n_samples = 100, n_features = 1, noise = 20, random_state = 7
print(X.shape,y.shape)
```

```
(100, 1) (100,)
```

```
y
```

```
array([   7.74874748,   48.30195813,  -99.86839046,  170.69731585,
         35.38423095,  -24.26065523,   53.38022553,   40.93769612,
        -58.37929858,  -40.00080755,   -5.72402446,  -32.41843535,
       -185.39492942,   16.10110541,   40.41032161,   65.57471889,
        -91.91302503,  109.79950356,   20.67535726,  -55.90394033,
        -31.48725571,  -34.18809808,   -7.62204079,    0.66585166,
          6.58245201, -137.86783118,   28.96765275,  -56.66561448,
        -27.38686869,    2.47905123,  119.3324661 ,  -25.36827924,
         37.61826504,   15.71208367,   35.29998191,  -47.8891707 ,
       -115.4023037 ,   -6.29475666,  -35.05780108,  135.50674081,
        -43.00213356,    4.5838433 ,   -9.24111836,   90.55005602,
        -42.13259317,   97.48433802,  138.54538857,  104.45930872,
         13.3261784 ,  -32.12098101,   51.52040062,  -99.90017385,
         10.88356439,  -22.16972415,  150.6949243 ,   29.52128207,
       -126.014095  ,   -5.93723276,   -5.30531644,   71.23691077,
        -42.3738208 ,  -46.50895613,  -39.68083805,  123.18508718,
         27.1377505 ,  -26.09127408, -140.0584903 ,   -8.19702745,
        -38.63819824,   76.11786241,   43.93083176,   31.19797233,
        142.43536845, -112.89329896,   -6.24848601,   -0.64742201,
         89.92333305,   32.37393853,   54.52190665,  -96.75561549,
        -48.10701677,   48.43826367,   78.08997587, -104.44462323,
          8.99421674,   62.78311716, -149.07075314, -130.92984266,
         -7.55831063,   99.78529963,  -29.35974516,  -55.73406339,
         12.65420352,  -52.89627393, -127.55160577,  105.3439611 ,
        -16.77527703,   44.58734207,   33.32282545,   -8.41288496])
```

```
fig =plt.figure(figsize=(8,6))
plt.scatter(X[:,0],y,color='r',marker ='o')
plt.show()
```




```
#test size 20%
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 7)
X_train.shape
```

```
(80, 1)
```

```
regressor =LinearRegression(lr =0.001,n_iters =10000)
regressor.fit(X_train,y_train)
```

```
predicted= regressor.predict(X_test)
```

```
y_test
```

```
array([  -6.29475666,   28.96765275,   54.52190665,  -55.73406339,
        -32.12098101,   65.57471889,  -52.89627393,   31.19797233,
       -149.07075314,   -7.62204079,   16.10110541,  -43.00213356,
         10.88356439, -185.39492942,   -7.55831063,   97.48433802,
        -32.41843535, -140.0584903 ,  -31.48725571,   20.67535726])
```

```
predicted
```

```
array([ -20.90190242,   41.38929807,   82.39416477,  -72.82028561,
        -28.98147773,   46.65724654,  -82.75515468,   22.80840514,
```

```
            -124.93077671,  -18.24788994,   36.8867518 ,  -51.54495826,
             -22.95720707, -158.5059681 ,   17.31446106,  114.05935271,
             -32.81857505, -143.01289179,  -20.9352896 ,   -9.32300296])
```

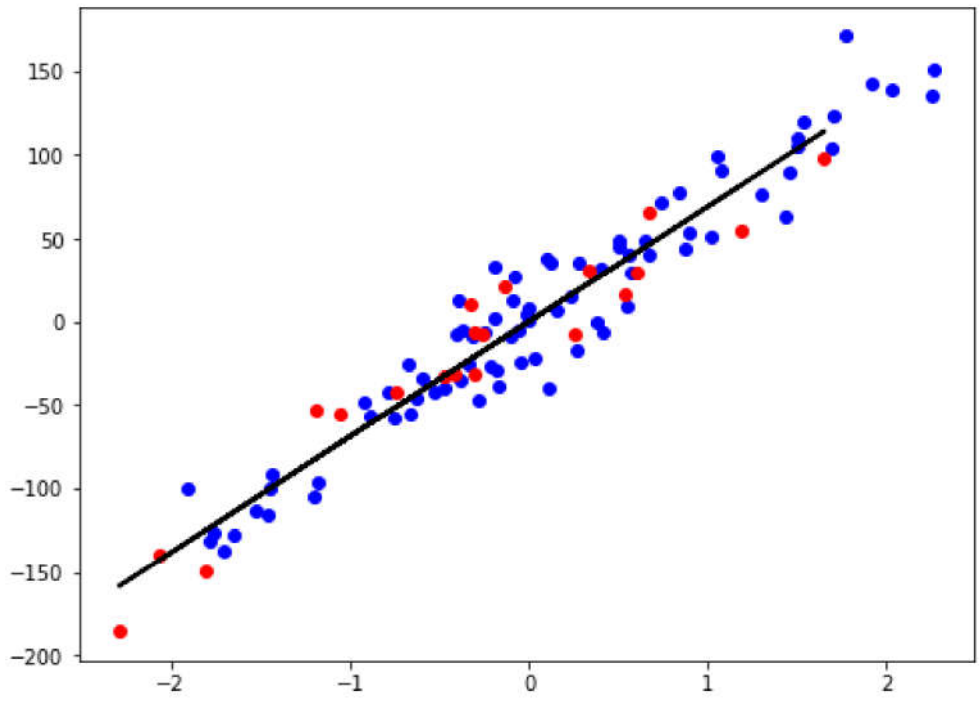
```
def mse(y_true, y_predicted):
    return np.mean((y_true - y_predicted)**2)
```

```
mse(predicted,y_test)
```

```
     387.4268402120403
```

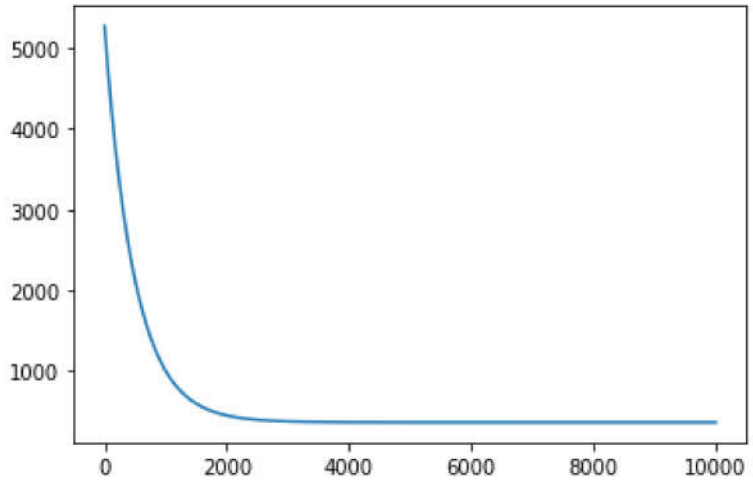
```
def draw_line (X_train, y_train, X_test, y_test, predicted):
  fig =plt.figure(figsize=(8,6))
  plt1 = plt.scatter(X_train, y_train, color = 'b')
  plt2 = plt.scatter(X_test, y_test, color = 'r')
  plt.plot(X_test,predicted,color='black',linewidth = 2)
```

```
draw_line(X_train, y_train, X_test, y_test, predicted)
```



```
plt.plot(regressor.mse_values)
```

```
[<matplotlib.lines.Line2D at 0x7fa281df0ca0>]
```




```
import pandas as pd
import seaborn as sns
!gdown 1m_uJkaKZvX24wdyAjXFIxTUY3SIawaCF
```

```
Downloading...
From: https://drive.google.com/uc?id=1m_uJkaKZvX24wdyAjXFIxTUY3SIawaCF
To: /content/CarPrice.csv
100% 26.7k/26.7k [00:00<00:00, 32.7MB/s]
```

Load Prices in pandas data frame from a csv (excel) file

Read data- read_csv()

In the following section the first 5 rows of the dataset are shown to give a brief overview of the

```
data = pd.read_csv('/content/CarPrice.csv')
data.head()
```

	car_ID	symboling	CarName	fueltype	aspiration	doornumber	carbody	dri
0	1	3	alfa-romero giulia	gas	std	two	convertible	
1	2	3	alfa-romero stelvio	gas	std	two	convertible	
2	3	1	alfa-romero Quadrifoglio	gas	std	two	hatchback	
3	4	2	audi 100 ls	gas	std	four	sedan	
4	5	2	audi 100ls	gas	std	four	sedan	

5 rows × 26 columns

wheelbase continuous

for some of the features list of possible values are fixed

shows the *columns and rows of the dataset*

```
data.shape
```

```
(205, 26)
```

numericL features

```
data.describe()
```

	car_ID	symboling	wheelbase	carlength	carwidth	carheight	curbw
count	205.000000	205.000000	205.000000	205.000000	205.000000	205.000000	205.0
mean	103.000000	0.834146	98.756585	174.049268	65.907805	53.724878	2555.5
std	59.322565	1.245307	6.021776	12.337289	2.145204	2.443522	520.6
min	1.000000	-2.000000	86.600000	141.100000	60.300000	47.800000	1488.0
25%	52.000000	0.000000	94.500000	166.300000	64.100000	52.000000	2145.0
50%	103.000000	1.000000	97.000000	173.200000	65.500000	54.100000	2414.0
75%	154.000000	2.000000	102.400000	183.100000	66.900000	55.500000	2935.0
max	205.000000	3.000000	120.900000	208.100000	72.300000	59.800000	4066.0

Here we can see the names of the columns, their data types and the non-Null values count.

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
RangeIndex: 205 entries, 0 to 204
Data columns (total 26 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   car_ID            205 non-null    int64  
 1   symboling         205 non-null    int64  
 2   CarName           205 non-null    object 
 3   fueltype          205 non-null    object 
 4   aspiration        205 non-null    object 
 5   doornumber        205 non-null    object 
 6   carbody           205 non-null    object 
 7   drivewheel        205 non-null    object 
 8   enginelocation    205 non-null    object 
 9   wheelbase         205 non-null    float64
 10  carlength         205 non-null    float64
 11  carwidth          205 non-null    float64
 12  carheight         205 non-null    float64
 13  curbweight        205 non-null    int64  
 14  enginetype        205 non-null    object 
 15  cylindernumber    205 non-null    object 
 16  enginesize        205 non-null    int64  
 17  fuelsystem        205 non-null    object 
 18  boreratio         205 non-null    float64
 19  stroke            205 non-null    float64
 20  compressionratio  205 non-null    float64
 21  horsepower        205 non-null    int64  
 22  peakrpm           205 non-null    int64  
 23  citympg           205 non-null    int64  
 24  highwaympg        205 non-null    int64  
 25  price             205 non-null    float64
dtypes: float64(8), int64(8), object(10)
memory usage: 41.8+ KB
```

```
data.columns
```

```
Index(['car_ID', 'symboling', 'CarName', 'fueltype', 'aspiration',
       'doornumber', 'carbody', 'drivewheel', 'enginelocation', 'wheelbase',
       'carlength', 'carwidth', 'carheight', 'curbweight', 'enginetype',
       'cylindernumber', 'enginesize', 'fuelsystem', 'boreratio', 'stroke',
       'compressionratio', 'horsepower', 'peakrpm', 'citympg', 'highwaympg',
       'price'],
      dtype='object')
```

Data Cleaning:

```
carnames = data['CarName']
CompanyNames = []

for carname in carnames:
    brand = carname.split(" ")[0]
    CompanyNames.append(brand)

data.drop(['CarName'], axis = 1, inplace = True)
data.insert(3, "CompanyName", CompanyNames)

data.head()
```

	car_ID	symboling	fueltype	CompanyName	aspiration	doornumber	carbody	dr
0	1	3	gas	alfa-romero	std	two	convertible	
1	2	3	gas	alfa-romero	std	two	convertible	
2	3	1	gas	alfa-romero	std	two	hatchback	
3	4	2	gas	audi	std	four	sedan	
4	5	2	gas	audi	std	four	sedan	

5 rows × 26 columns

```
data.CompanyName = data.CompanyName.str.lower()
```

```
data.CompanyName.unique()
```

```
array(['alfa-romero', 'audi', 'bmw', 'chevrolet', 'dodge', 'honda',
       'isuzu', 'jaguar', 'maxda', 'mazda', 'buick', 'mercury',
       'mitsubishi', 'nissan', 'peugeot', 'plymouth', 'porsche',
       'porcshce', 'renault', 'saab', 'subaru', 'toyota', 'toyouta',
       'vokswagen', 'volkswagen', 'vw', 'volvo'], dtype=object)
```

```
data.fueltype.unique()
```

```
array(['gas', 'diesel'], dtype=object)
```

split fueltype coloumn in two different colums gas and disel:

CREATE DUMMY VARIABLE COLUMNS

```
temp =pd.get_dummies(data['fueltype'])
```

```
temp.head()
```

	diesel	gas
0	0	1
1	0	1
2	0	1
3	0	1
4	0	1

drop original fueltype data column

```
data.drop(['fueltype'],axis=1,inplace=True)
```

CONCATINATE COLUMNS

axis=1 ->column

```
data=pd.concat([data,temp],axis=1)# as we are adding column we are concatinating coloum axis
```

```
data.head()
```

	car_ID	symboling	CompanyName	aspiration	doornumber	carbody	drivewheel
0	1	3	alfa-romero	std	two	convertible	rwd
1	2	3	alfa-romero	std	two	convertible	rwd
2	3	1	alfa-romero	std	two	hatchback	rwd
3	4	2	audi	std	four	sedan	fwd
4	5	2	audi	std	four	sedan	4wd

5 rows × 27 columns

Training model

Training data set size 0.8 as here test set size is 0.2

```
data_train, data_test = train_test_split(data, test_size = 0.2)
```

```
len(X_train)
```

```
164
```

```
len(X_test)
```

```
41
```

```
X_train
```

```
array([[ 99.1, 186.6, 110. ,   0. ,   1. ],
       [104.5, 187.8, 156. ,   0. ,   1. ],
       [ 95.7, 169.7,  62. ,   0. ,   1. ],
       [ 93.7, 157.3,  68. ,   0. ,   1. ],
       [ 97.2, 173.4,  97. ,   0. ,   1. ],
       [101.2, 176.8, 101. ,   0. ,   1. ],
       [ 98.4, 176.2, 116. ,   0. ,   1. ],
       [113. , 199.6, 176. ,   0. ,   1. ],
       [101.2, 176.8, 121. ,   0. ,   1. ],
```

```
[102.4, 175.6,  73. ,   1. ,   0. ],
[ 93.7, 150. ,  76. ,   0. ,   1. ],
[ 96.6, 180.3, 155. ,   0. ,   1. ],
[ 94.5, 155.9,  70. ,   0. ,   1. ],
[ 98.4, 175.7, 288. ,   0. ,   1. ],
[ 98.8, 177.8,  84. ,   0. ,   1. ],
[ 99.1, 186.6, 110. ,   0. ,   1. ],
[ 88.6, 168.8, 111. ,   0. ,   1. ],
[ 95.7, 158.7,  62. ,   0. ,   1. ],
[ 96.5, 175.4, 101. ,   0. ,   1. ],
[ 94.5, 168.7, 112. ,   0. ,   1. ],
[ 93.7, 150. ,  76. ,   0. ,   1. ],
[ 93.7, 167.3,  68. ,   0. ,   1. ],
[ 95.9, 173.2, 145. ,   0. ,   1. ],
[ 96.3, 172.4, 116. ,   0. ,   1. ],
[106.7, 187.5, 123. ,   1. ,   0. ],
[ 93.1, 159.1,  68. ,   0. ,   1. ],
[102.4, 175.6,  92. ,   0. ,   1. ],
[102.7, 178.4, 175. ,   0. ,   1. ],
[ 98.4, 176.2, 116. ,   0. ,   1. ],
[105.8, 192.7, 140. ,   0. ,   1. ],
[102.4, 175.6,  92. ,   0. ,   1. ],
[ 93.7, 157.3,  68. ,   0. ,   1. ],
[107.9, 186.7,  97. ,   0. ,   1. ],
[102.4, 175.6,  92. ,   0. ,   1. ],
[ 93.7, 157.9,  73. ,   0. ,   1. ],
[114.2, 198.9,  97. ,   0. ,   1. ],
[ 94.5, 165.3,  69. ,   0. ,   1. ],
[ 95.3, 169. , 101. ,   0. ,   1. ],
[ 95.7, 158.7,  62. ,   0. ,   1. ],
[112. , 199.2, 184. ,   0. ,   1. ],
[115.6, 202.6, 155. ,   0. ,   1. ],
[ 93.7, 157.3,  68. ,   0. ,   1. ],
[ 93.1, 166.8,  68. ,   0. ,   1. ],
[ 99.8, 177.3, 110. ,   0. ,   1. ],
[ 98.4, 176.2, 116. ,   0. ,   1. ],
[ 94.5, 165.3,  69. ,   0. ,   1. ],
[109.1, 188.8, 106. ,   1. ,   0. ],
[ 98.8, 177.8,  84. ,   0. ,   1. ],
[ 98.4, 176.2, 116. ,   0. ,   1. ],
[ 95.7, 166.3,  70. ,   0. ,   1. ],
[109.1, 188.8, 134. ,   0. ,   1. ],
[102.4, 175.6,  92. ,   0. ,   1. ],
[ 94.5, 168.7,  70. ,   0. ,   1. ],
[114.2, 198.9,  95. ,   1. ,   0. ],
[ 94.5, 168.7, 112. ,   0. ,   1. ],
[ 94.5, 165.6,  69. ,   0. ,   1. ],
[ 97.3, 171.7, 100. ,   0. ,   1. ],
[ 96.3, 172.4,  88. ,   0. ,   1. ],
```

```
data_train.head()
```

	car_ID	symboling	CompanyName	aspiration	doornumber	carbody	drivewheel
132	133	3	saab	std	two	hatchback	fwd
181	182	-1	toyouta	std	four	wagon	rwd
155	156	0	toyota	std	four	wagon	4wd
25	26	1	dodge	std	four	sedan	fwd
99	100	0	nissan	std	four	hatchback	fwd

5 rows × 27 columns

```
faeture_columns = ['wheelbase', 'carlength', 'horsepower', 'diesel', 'gas']
X_train = data_train[faeture_columns].values
X_test = data_test[faeture_columns].values
y_train = data_train['price'].values
y_test = data_test['price'].values
X_train.shape
```

```
(164, 5)
```

creating linear regression object-'regressor'

object creation for linear regression from sklearn linear_model

then fitting data->training model

1st arg- 2d array

2nd arg- y axis

then predicting prices

```
regressor = LinearRegression(lr = 0.000000000000001, n_iters = 1000)
regressor.fit(X_train, y_train)
predicted = regressor.predict(X_test)
```

```
regressor.predict(330)
```

```
array([4.45858266e-04, 7.90347644e-04, 5.40027085e-04, 5.80231247e-07,
       3.85184042e-06])
```

```
mse(predicted  y test)
```

```
mse(predicted, y_test)
```

```
222716164.80540848
```