```
import matplotlib.pyplot as plt
import pandas as pd
import pylab as pl
import numpy as np
%matplotlib inline
```

```
!wget -O FuelConsumption.csv https://s3-api.us-geo.objectstorage.softlayer.net/cf-courses-da
```

```
--2021-06-03 12:19:21--  https://s3-api.us-geo.objectstorage.softlayer.net/cf-courses-da
Resolving s3-api.us-geo.objectstorage.softlayer.net (s3-api.us-geo.objectstorage.softlay
Connecting to s3-api.us-geo.objectstorage.softlayer.net (s3-api.us-geo.objectstorage.sof
HTTP request sent, awaiting response... 200 OK
Length: 72629 (71K) [text/csv]
Saving to: 'FuelConsumption.csv'

FuelConsumption.csv 100%[===================>]  70.93K   151KB/s    in 0.5s

2021-06-03 12:19:22 (151 KB/s) - 'FuelConsumption.csv' saved [72629/72629]
```

```
df = pd.read_csv("FuelConsumption.csv")
# take a look at the dataset
df.head()
```

	MODELYEAR	MAKE	MODEL	VEHICLECLASS	ENGINESIZE	CYLINDERS	TRANSMISSION	FUELT
0	2014	ACURA	ILX	COMPACT	2.0	4	AS5	
1	2014	ACURA	ILX	COMPACT	2.4	4	M6	
2	2014	ACURA	ILX HYBRID	COMPACT	1.5	4	AV7	
3	2014	ACURA	MDX 4WD	SUV - SMALL	3.5	6	AS6	
4	2014	ACURA	RDX AWD	SUV - SMALL	3.5	6	AS6	

```
# summarize the data
df.describe()
```

	MODELYEAR	ENGINESIZE	CYLINDERS	FUELCONSUMPTION_CITY	FUELCONSUMPTION_HWY	F
count	1067.0	1067.000000	1067.000000	1067.000000	1067.000000	
mean	2014.0	3.346298	5.794752	13.296532	9.474602	
std	0.0	1.415895	1.797447	4.101253	2.794510	
min	2014.0	1.000000	3.000000	4.600000	4.900000	
25%	2014.0	2.000000	4.000000	10.250000	7.500000	
50%	2014.0	3.400000	6.000000	12.600000	8.800000	

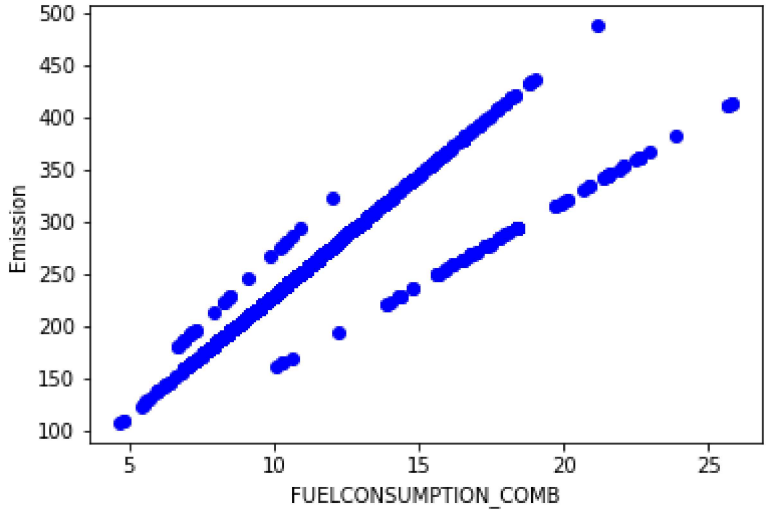
```
cdf = df[['ENGINESIZE','CYLINDERS','FUELCONSUMPTION_COMB','CO2EMISSIONS']]

cdf.head(9)
```

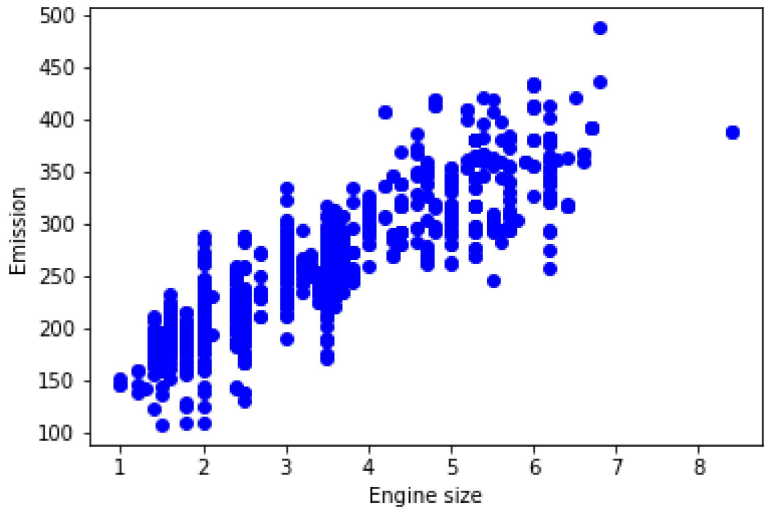
	ENGINESIZE	CYLINDERS	FUELCONSUMPTION_COMB	CO2EMISSIONS
0	2.0	4	8.5	196
1	2.4	4	9.6	221
2	1.5	4	5.9	136
3	3.5	6	11.1	255
4	3.5	6	10.6	244
5	3.5	6	10.0	230
6	3.5	6	10.1	232
7	3.7	6	11.1	255
8	3.7	6	11.6	267

```
viz = cdf[['CYLINDERS','ENGINESIZE','CO2EMISSIONS','FUELCONSUMPTION_COMB']]
viz.hist()
plt.show()
```


```
plt.scatter(cdf.FUELCONSUMPTION_COMB, cdf.CO2EMISSIONS, color='blue')
plt.xlabel("FUELCONSUMPTION_COMB")
plt.ylabel("Emission")
plt.show()
```

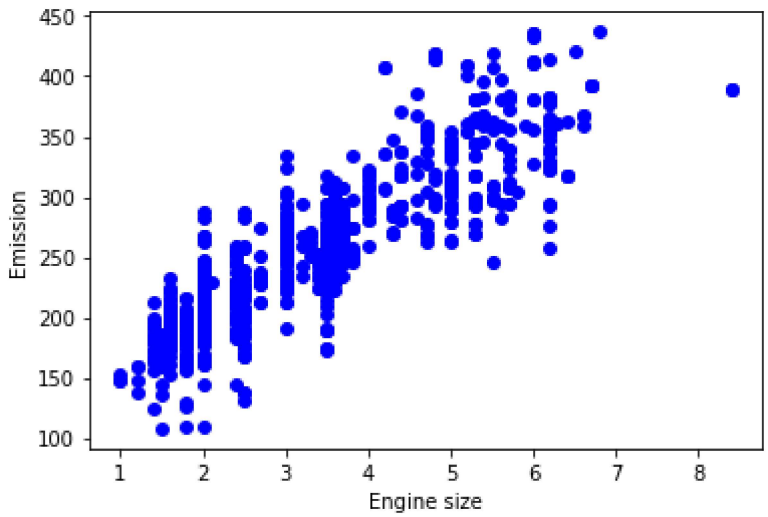



```
plt.scatter(cdf.ENGINESIZE, cdf.CO2EMISSIONS, color='blue')
plt.xlabel("Engine size")
plt.ylabel("Emission")
plt.show()
```




```
msk = np.random.rand(len(df))< 0.8
train = cdf[msk]
test = cdf[~msk]
```

```
plt.scatter(train.ENGINESIZE, train.CO2EMISSIONS,  color='blue')
plt.xlabel("Engine size")
plt.ylabel("Emission")
plt.show()
```

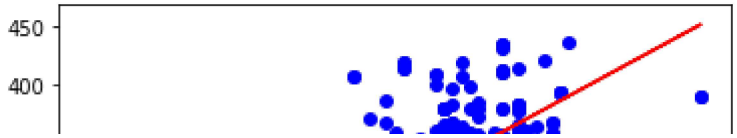



```
from sklearn import linear_model
regr = linear_model.LinearRegression()
train_x = np.asanyarray(train[['ENGINESIZE']])
train_y =np.asanyarray(train[['CO2EMISSIONS']])
regr.fit (train_x, train_y)
# The coefficients
print('Coefficients: ', regr.coef_)
print('Intercept: ', regr.intercept_)
```

```
Coefficients:  [[38.8095424]]
Intercept:  [126.02600476]
```

```
plt.scatter(train.ENGINESIZE, train.CO2EMISSIONS, color= 'blue')
plt.plot(train_x, regr.coef_[0][0]*train_x + regr.intercept_[0], '-r')
plt.xlabel("Engine size")
plt.ylabel("Emisson")
```

```
Text(0, 0.5, 'Emisson')
```




```
from sklearn.metrics import r2_score
test_x = np.asanyarray(test[['ENGINESIZE']])
test_y = np.asanyarray(test[['CO2EMISSIONS']])
test_y_hat= regr.predict(test_x)
print("Mean absolute error: %.2f" % np.mean(np.absolute(test_y_hat - test_y)))
print("Residual sum of squares (MSE): %.2f" % np.mean((test_y_hat - test_y) ** 2))
print("R2-score: %.2f" % r2_score(test_y_hat , test_y))
```

```
Mean absolute error: 21.63
Residual sum of squares (MSE): 805.77
R2-score: 0.72
```

✓ 0s completed at 19:03