```
pip install pandas-profiling

Requirement already satisfied: pandas-profiling in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (3.4.0)
Requirement already satisfied: missingno<0.6,>=0.4.2 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (0.5.1)
Requirement already satisfied: statsmodels<0.14,>=0.13.2 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (0.13.5)
Requirement already satisfied: tqdm<4.65,>=4.48.2 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (4.62.3)
Requirement already satisfied: PyYAML<6.1,>=5.0.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (5.4.1)
Requirement already satisfied: scipy<1.10,>=1.4.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (1.7.3)
Requirement already satisfied: jinja2<3.2,>=2.11.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (3.0.2)
Requirement already satisfied: matplotlib<3.6,>=3.2 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (3.5.0)
Requirement already satisfied: phik<0.13,>=0.11.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (0.12.2)
Requirement already satisfied: htmlmin==0.1.12 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (0.1.12)
Requirement already satisfied: pydantic<1.11,>=1.8.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (1.10.2)
Requirement already satisfied: requests<2.29,>=2.24.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (2.26.0)
Requirement already satisfied: visions[type_image_path]==0.7.5 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (0.7.5)
Requirement already satisfied: seaborn<0.13,>=0.10.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (0.11.2)
Requirement already satisfied: multimethod<1.10,>=1.4 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (1.9)
Requirement already satisfied: numpy<1.24,>=1.16.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (1.20.3)
Requirement already satisfied: pandas!=1.4.0,<1.6,>1.1 in
```

```
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas-
profiling) (1.3.4)
Requirement already satisfied: tangled-up-in-unicode>=0.0.4 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
visions[type_image_path]==0.7.5->pandas-profiling) (0.2.0)
Requirement already satisfied: networkx>=2.4 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
visions[type_image_path]==0.7.5->pandas-profiling) (2.6.3)
Requirement already satisfied: attrs>=19.3.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
visions[type_image_path]==0.7.5->pandas-profiling) (21.2.0)
Requirement already satisfied: Pillow in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
visions[type_image_path]==0.7.5->pandas-profiling) (9.0.1)
Requirement already satisfied: imagehash in /opt/conda/envs/Python-
3.9/lib/python3.9/site-packages (from visions[type_image_path]==0.7.5-
>pandas-profiling) (4.3.1)
Requirement already satisfied: MarkupSafe>=2.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
jinja2<3.2,>=2.11.1->pandas-profiling) (2.0.1)
Requirement already satisfied: fonttools>=4.22.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
matplotlib<3.6,>=3.2->pandas-profiling) (4.25.0)
Requirement already satisfied: python-dateutil>=2.7 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
matplotlib<3.6,>=3.2->pandas-profiling) (2.8.2)
Requirement already satisfied: pyparsing>=2.2.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
matplotlib<3.6,>=3.2->pandas-profiling) (3.0.4)
Requirement already satisfied: cycler>=0.10 in /opt/conda/envs/Python-
3.9/lib/python3.9/site-packages (from matplotlib<3.6,>=3.2->pandas-
profiling) (0.11.0)
Requirement already satisfied: packaging>=20.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
matplotlib<3.6,>=3.2->pandas-profiling) (21.3)
Requirement already satisfied: kiwisolver>=1.0.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
matplotlib<3.6,>=3.2->pandas-profiling) (1.3.1)
Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python-
3.9/lib/python3.9/site-packages (from pandas!=1.4.0,<1.6,>1.1->pandas-
profiling) (2021.3)
Requirement already satisfied: joblib>=0.14.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
phik<0.13,>=0.11.1->pandas-profiling) (0.17.0)
Requirement already satisfied: typing-extensions>=4.1.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
pydantic<1.11,>=1.8.1->pandas-profiling) (4.1.1)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-
3.9/lib/python3.9/site-packages (from python-dateutil>=2.7-
>matplotlib<3.6,>=3.2->pandas-profiling) (1.15.0)
```

```
Requirement already satisfied: charset-normalizer~=2.0.0 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
requests<2.29,>=2.24.0->pandas-profiling) (2.0.4)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
requests<2.29,>=2.24.0->pandas-profiling) (1.26.7)
Requirement already satisfied: certifi>=2017.4.17 in
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from
requests<2.29,>=2.24.0->pandas-profiling) (2022.9.24)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-
3.9/lib/python3.9/site-packages (from requests<2.29,>=2.24.0->pandas-
profiling) (3.3)
Requirement already satisfied: patsy>=0.5.2 in /opt/conda/envs/Python-
3.9/lib/python3.9/site-packages (from statsmodels<0.14,>=0.13.2-
>pandas-profiling) (0.5.2)
Requirement already satisfied: PyWavelets in /opt/conda/envs/Python-
3.9/lib/python3.9/site-packages (from imagehash-
>visions[type_image_path]==0.7.5->pandas-profiling) (1.1.1)
Note: you may need to restart the kernel to use updated packages.
```

```
import pandas as pd
import re
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from pandas_profiling import ProfileReport
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.ensemble import RandomForestRegressor
from sklearn.tree import DecisionTreeRegressor
```

```
import os, types
import pandas as pd
from botocore.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage.
It includes your credentials.
# You might want to remove those credentials before you share the
notebook.
cos_client = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='RybtIpezEc4Q3zGBYWS9v-rR5tvHuqdEiEsqrGH0vO4X',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-
```

```
storage.appdomain.cloud')

bucket = 'vehicleperformanceanalyzer-donotdelete-pr-apsgl4djhd1yss'
object_key = 'car performance.csv'

body = cos_client.get_object(Bucket=bucket,Key=object_key)['Body']
# add missing __iter__ method, so pandas accepts body as file-like
object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType(
__iter__, body )
car = pd.read_csv(body)
car.head()
```

```
    mpg  cylinders  displacement  horsepower  weight  acceleration  \
0  18.0          8         307.0         130    3504          12.0
1  15.0          8         350.0         165    3693          11.5
2  18.0          8         318.0         150    3436          11.0
3  16.0          8         304.0         150    3433          12.0
4  17.0          8         302.0         140    3449          10.5

   model year  origin                   car name
0          70       1  chevrolet chevelle malibu
1          70       1          buick skylark 320
2          70       1         plymouth satellite
3          70       1              amc rebel sst
4          70       1                ford torino
```

```
car
```

```
      mpg  cylinders  displacement  horsepower  weight
acceleration  \
0    18.0          8         307.0         130    3504          12.0

1    15.0          8         350.0         165    3693          11.5

2    18.0          8         318.0         150    3436          11.0

3    16.0          8         304.0         150    3433          12.0

4    17.0          8         302.0         140    3449          10.5

..    ...        ...           ...         ...     ...           ...

393  27.0          4         140.0          86    2790          15.6

394  44.0          4          97.0          52    2130          24.6

395  32.0          4         135.0          84    2295          11.6

396  28.0          4         120.0          79    2625          18.6
```

```
397  31.0          4         119.0          82    2720          19.4


     model year  origin                   car name
0            70       1  chevrolet chevelle malibu
1            70       1          buick skylark 320
2            70       1         plymouth satellite
3            70       1              amc rebel sst
4            70       1                ford torino
..          ...     ...                        ...
393          82       1            ford mustang gl
394          82       2                  vw pickup
395          82       1              dodge rampage
396          82       1                ford ranger
397          82       1                 chevy s-10

[398 rows x 9 columns]
```

```
Numeric_features = [x for x in car.columns if car[x].dtypes != "O"]
print("The number of Numeric_variable",len(Numeric_features))
car[Numeric_features].head()
```

```
The number of Numeric_variable 8

    mpg  cylinders  displacement  horsepower  weight  acceleration  \
0  18.0          8         307.0         130    3504          12.0
1  15.0          8         350.0         165    3693          11.5
2  18.0          8         318.0         150    3436          11.0
3  16.0          8         304.0         150    3433          12.0
4  17.0          8         302.0         140    3449          10.5

   model year  origin
0          70       1
1          70       1
2          70       1
3          70       1
4          70       1
```

```
Discrete_features = [x for x in car.columns if car[x].dtype == "O"]
print('Number of Discrete variables: ', len(Discrete_features))
car[Discrete_features].head()
```

```
Number of Discrete variables:  1

                   car name
0  chevrolet chevelle malibu
1          buick skylark 320
2         plymouth satellite
3              amc rebel sst
4                ford torino
```

```
continous_variable = [feature for feature in Numeric_features if
len(car[feature].unique()) > 25]
print("The number of Categorical_variable",len(continous_variable))
car[continous_variable].head()
```

```
The number of Categorical_variable 5
```

	mpg	displacement	horsepower	weight	acceleration
0	18.0	307.0	130	3504	12.0
1	15.0	350.0	165	3693	11.5
2	18.0	318.0	150	3436	11.0
3	16.0	304.0	150	3433	12.0
4	17.0	302.0	140	3449	10.5

```
discrete_variable = [feature for feature in Numeric_features if
len(car[feature].unique()) < 25]
print('Number of Continous variables: ', len(discrete_variable))
car[discrete_variable].head()
```

```
Number of Continous variables:  3
```

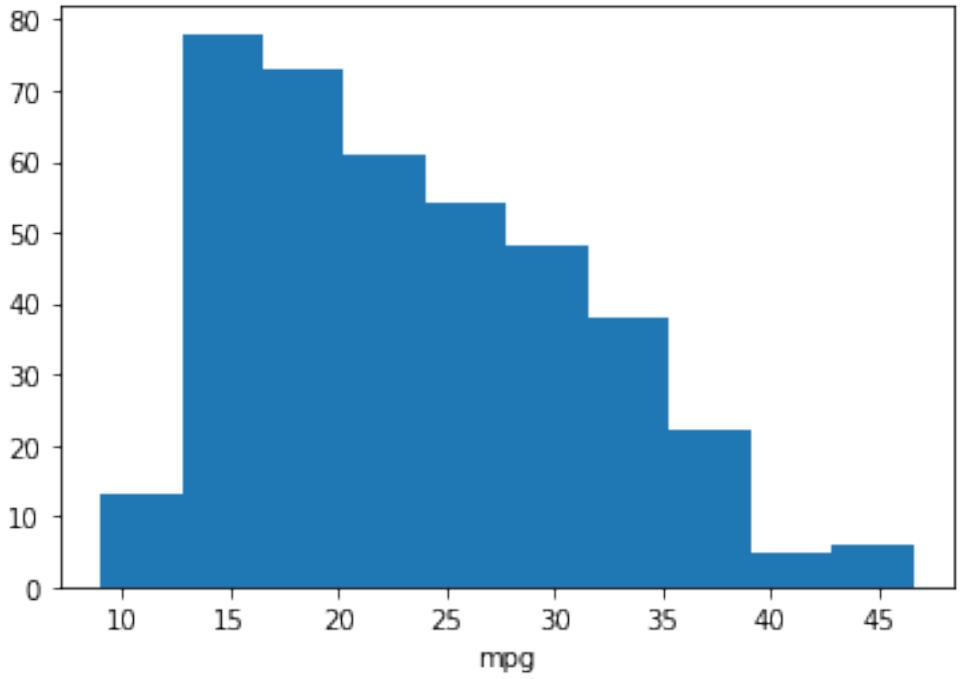
	cylinders	model year	origin
0	8	70	1
1	8	70	1
2	8	70	1
3	8	70	1
4	8	70	1

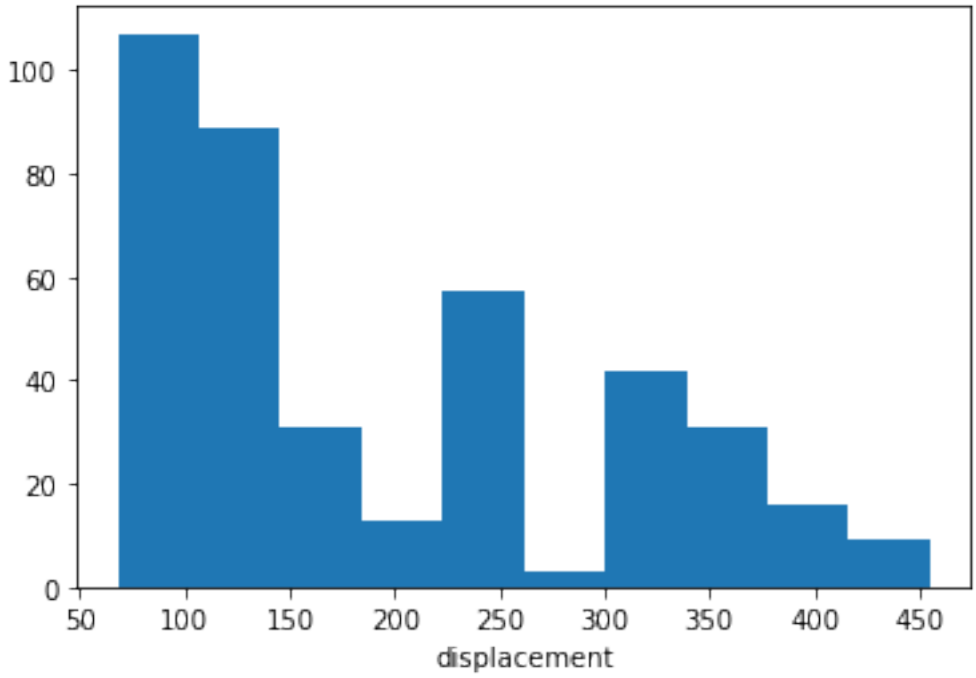
```
ProfileReport(car)
```

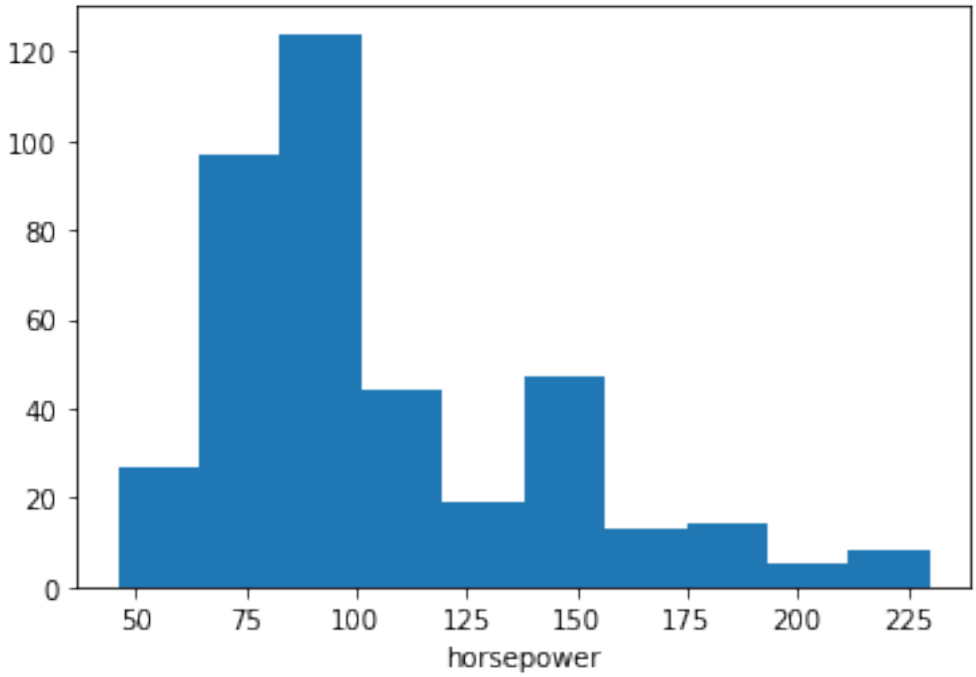

```
{"version_major":2,"version_minor":0,"model_id":"f388f98ca908409ea38da
3270e2f81f9"}

{"version_major":2,"version_minor":0,"model_id":"b5e8332304ef4785be2bd
ef5b7f15fb3"}

{"version_major":2,"version_minor":0,"model_id":"dd02b7b447d44b2abb561
28fedbd1682"}
```

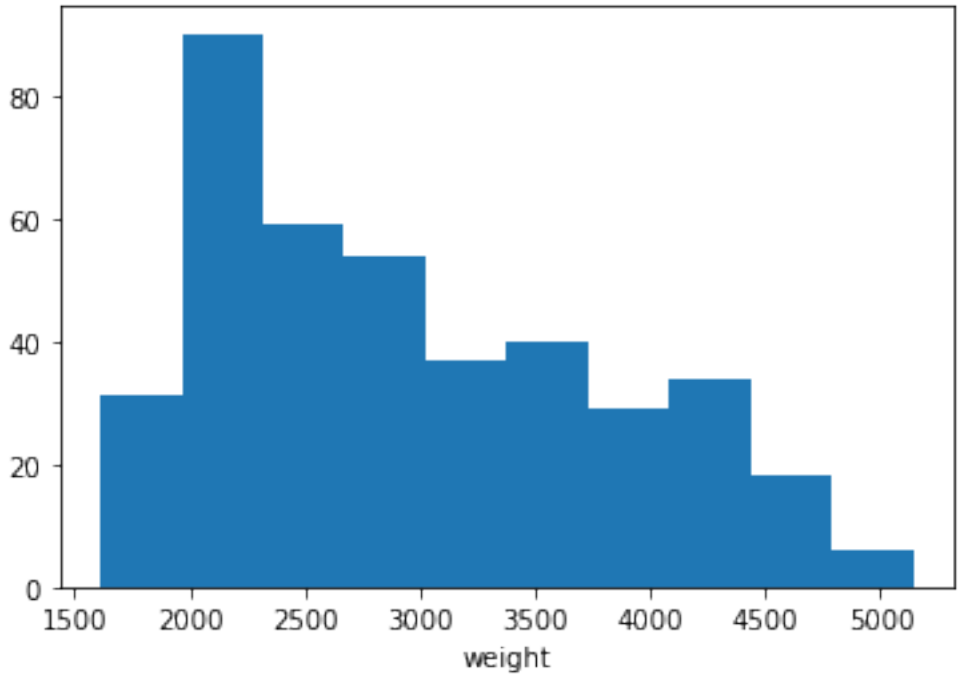

```
<IPython.core.display.HTML object>
```

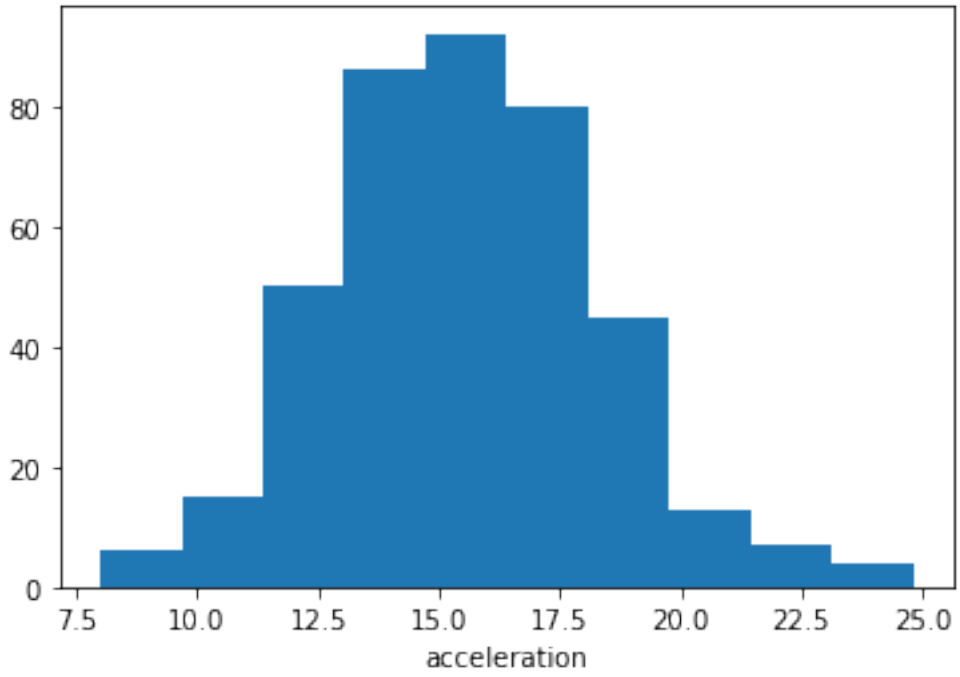
```
for feature in continous_variable:
    plt.hist(x=feature,data=car)
    plt.xlabel(feature)
    plt.show()
```


80
70
60
50
40
30
20
10
0
10
15
20
25
30
35
40
45
mpg

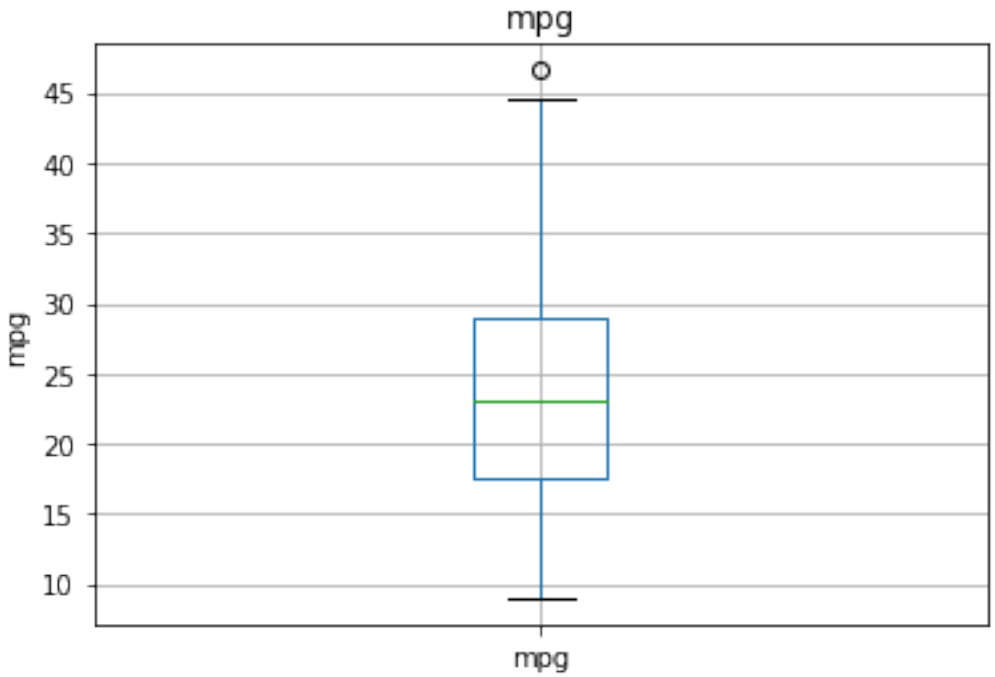

100
80
60
40
20
0
50
100
150
200
250
300
350
400
450
displacement

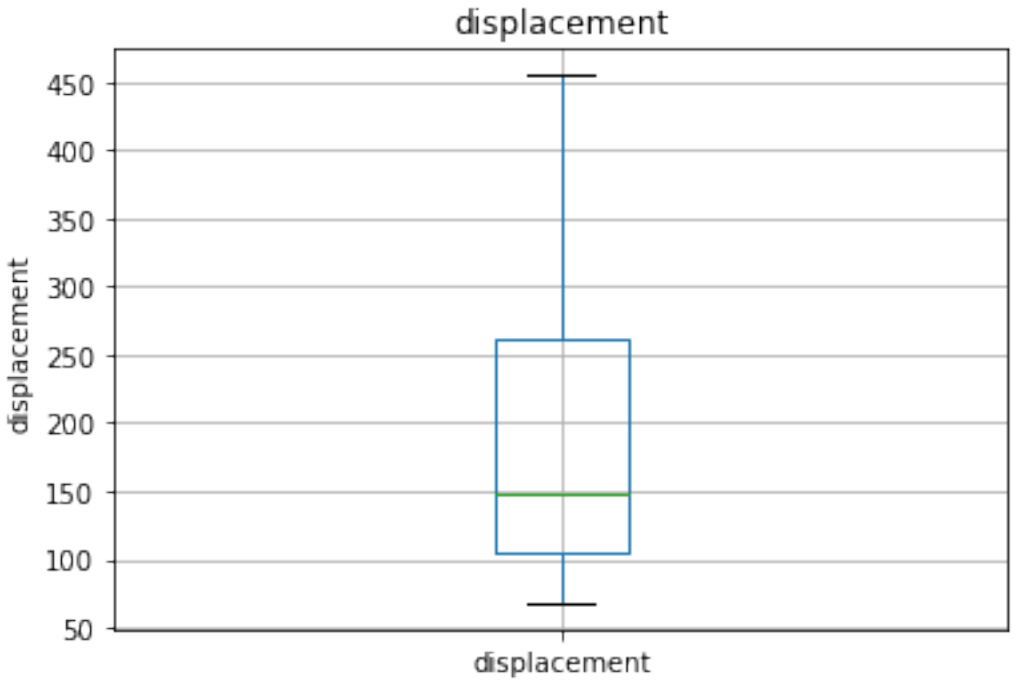

120
100
80
60
40
20
0
50
75
100
125
150
175
200
225
horsepower

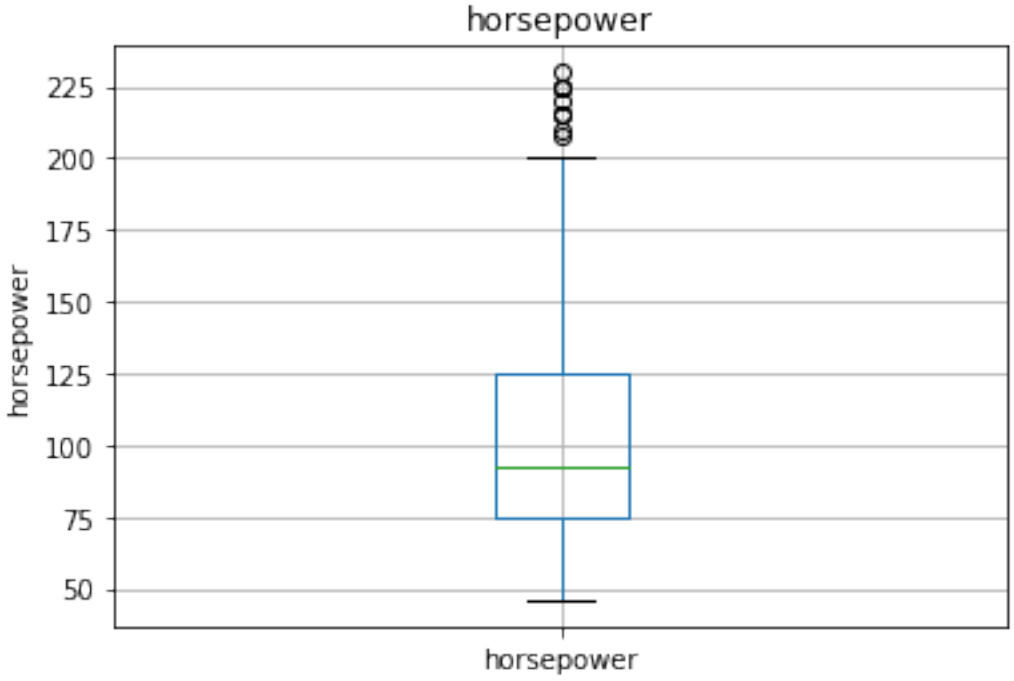

80
60
40
20
0
1500
2000
2500
3000
3500
4000
4500
5000
weight

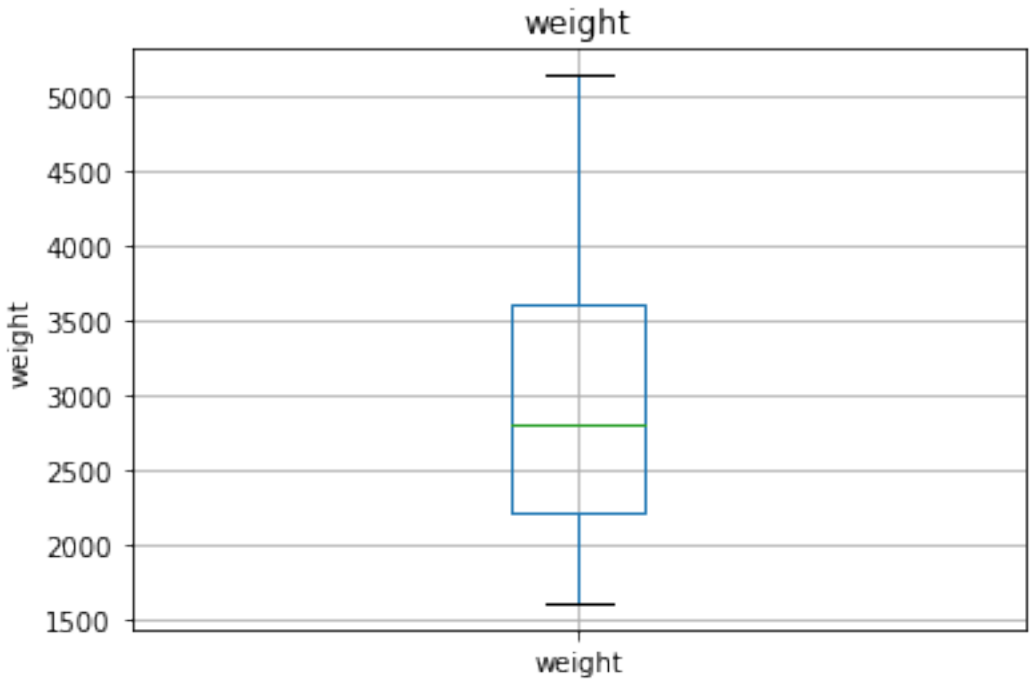


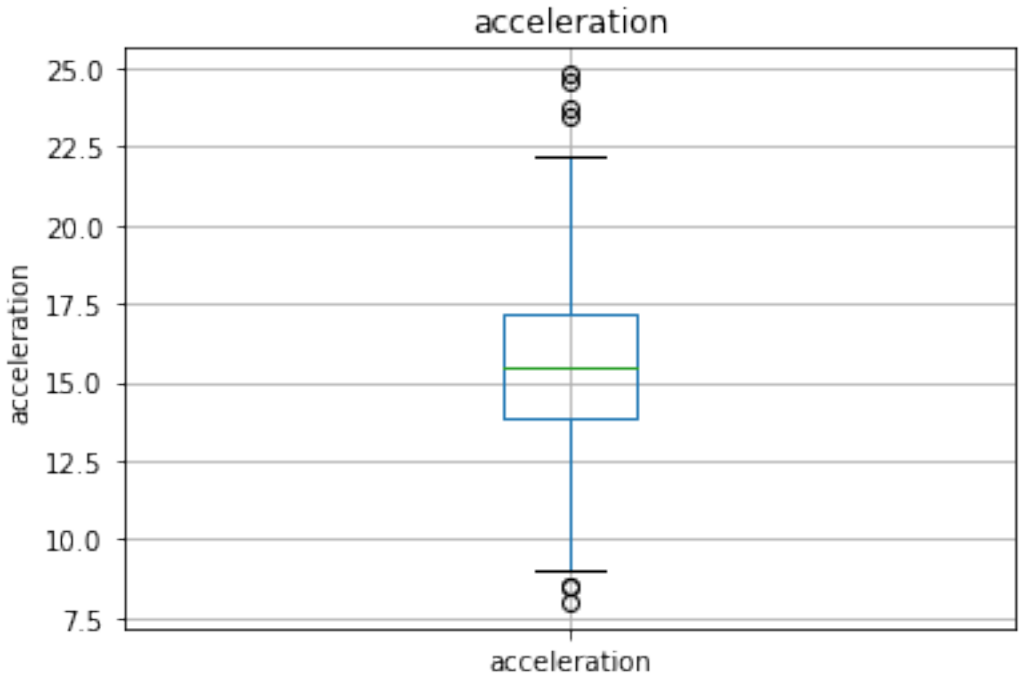

```
for feature in continous_variable:
    car.boxplot(column=feature)
    plt.ylabel(feature)
    plt.title(feature)
    plt.show()
```



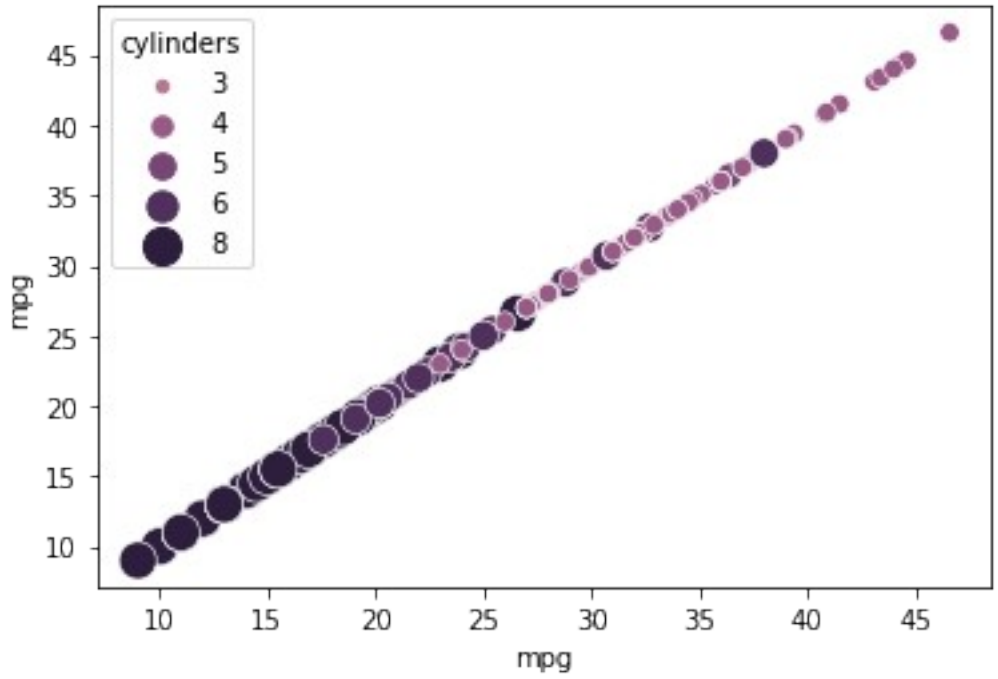

displacement
450
400
350
300
250
200
150
100
50
displacement
displacement

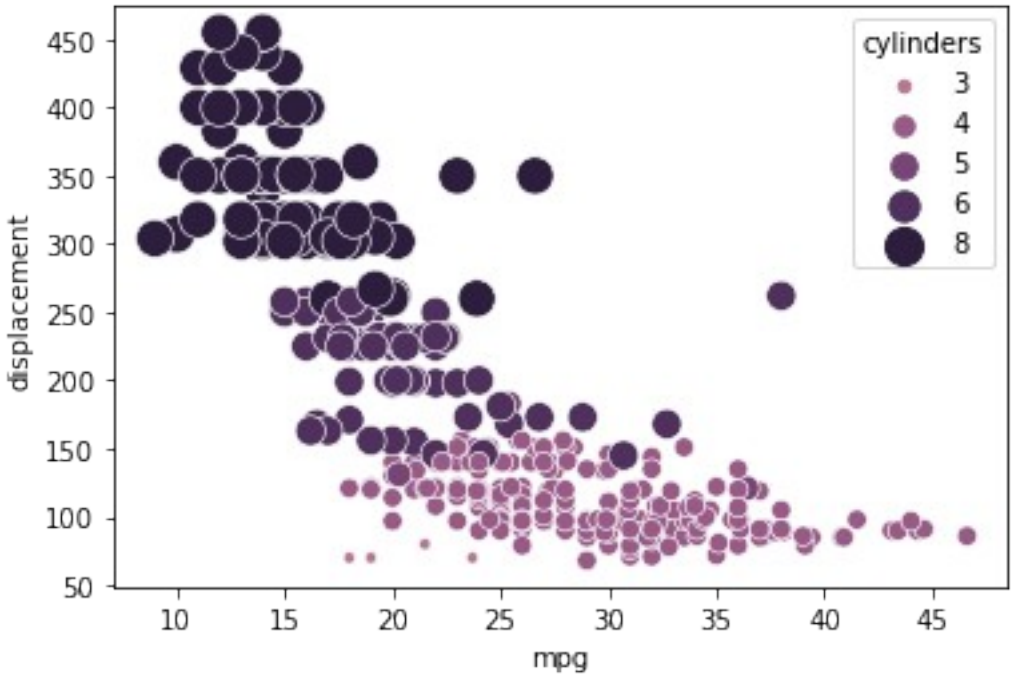

horsepower
225
200
175
150
125
100
75
50
horsepower
horsepower

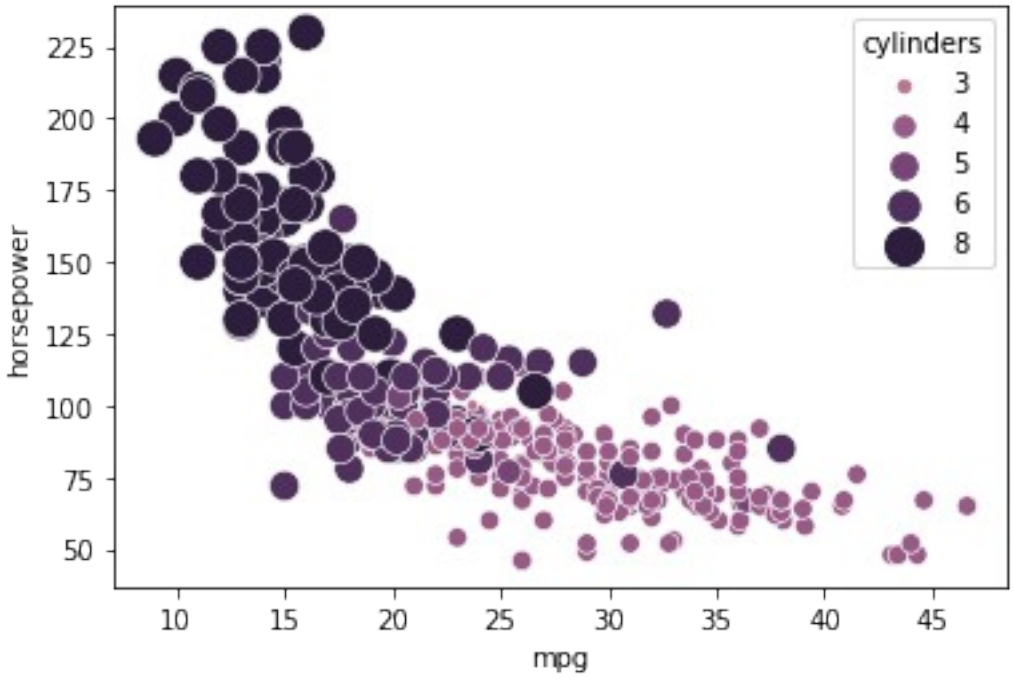


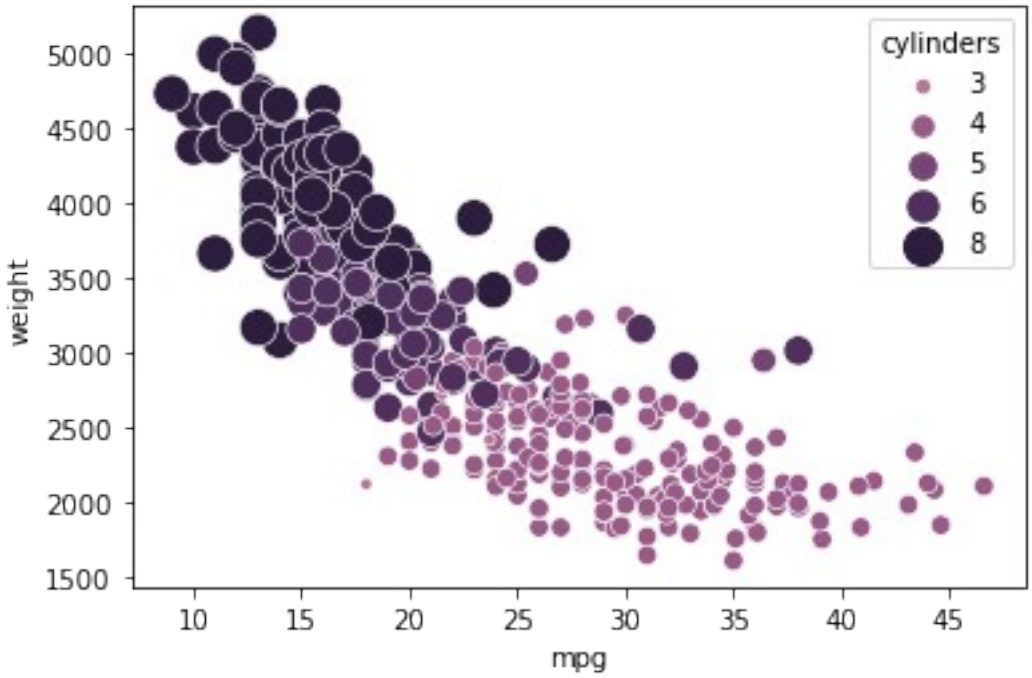


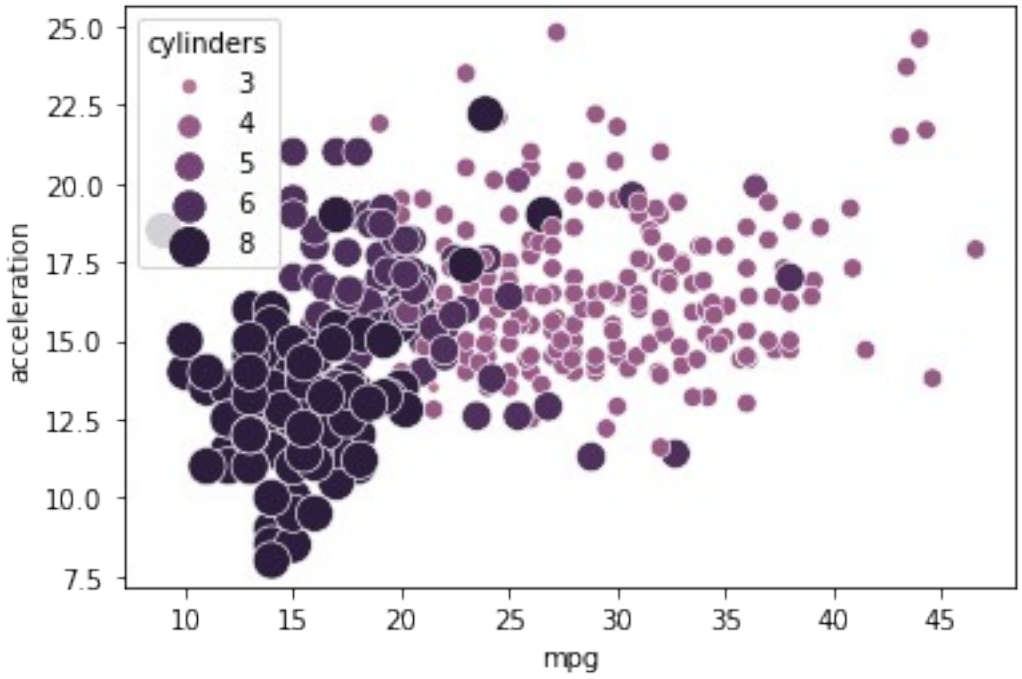

```
for feature in continous_variable:
    sns.scatterplot(data=car, x="mpg",
y=feature,hue="cylinders",size='cylinders',sizes=(20, 200),
hue_norm=(0, 7), legend="full")
    plt.show()
```


cylinders
3
4
5
6
8
mpg
mpg
10
15
20
25
30
35
40
45

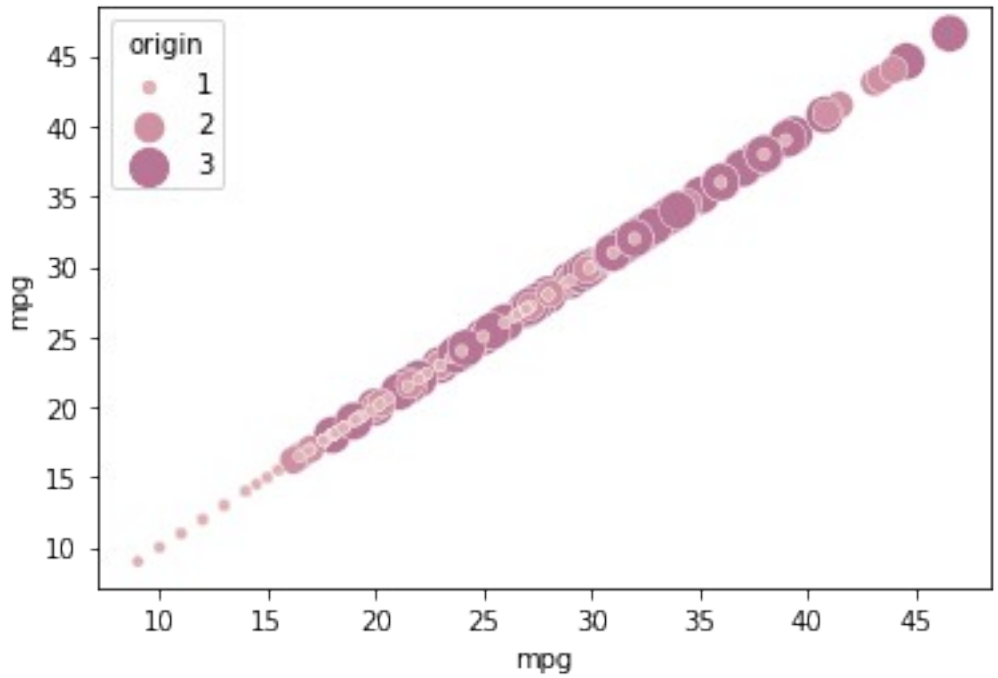

cylinders
3
4
5
6
8
displacement
mpg
50
100
150
200
250
300
350
400
450
10
15
20
25
30
35
40
45

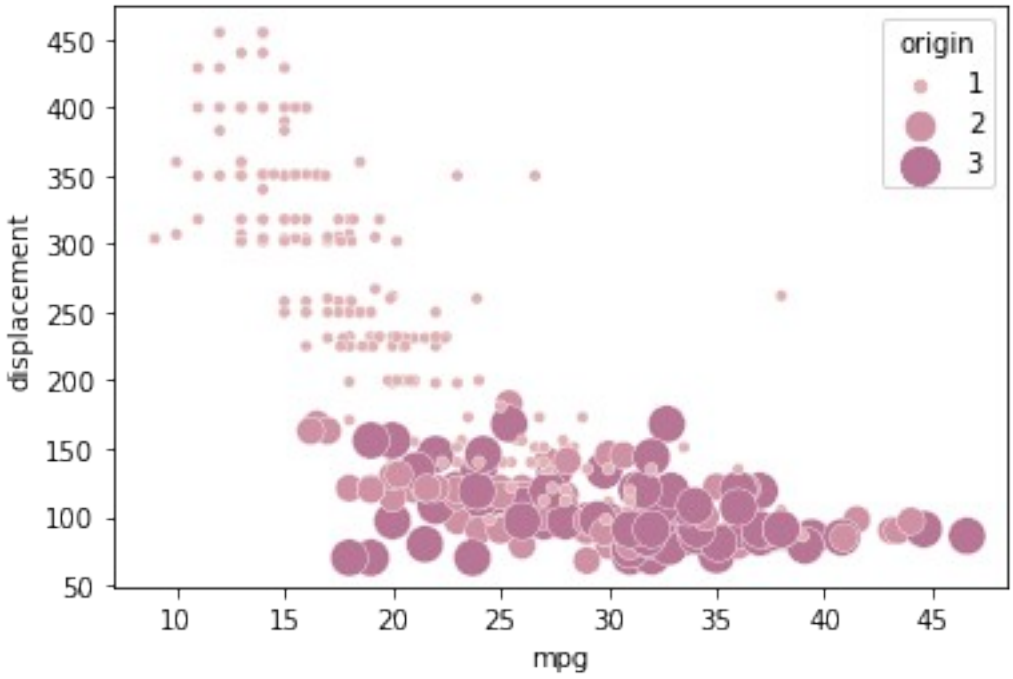

cylinders
3
4
5
6
8
horsepower
225
200
175
150
125
100
75
50
10
15
20
25
30
35
40
45
mpg

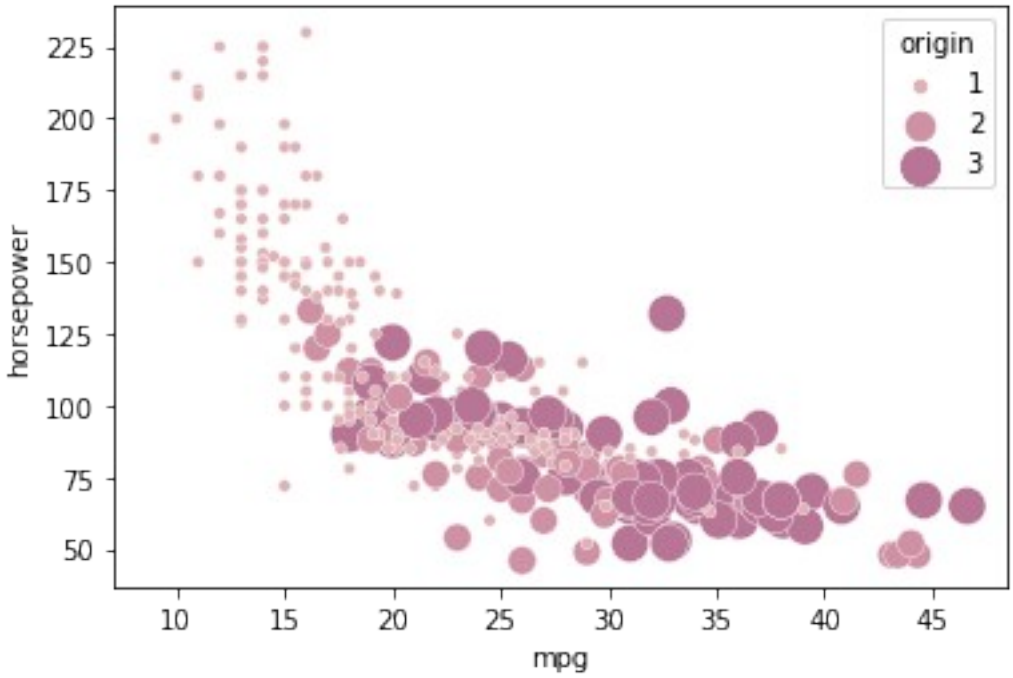

cylinders
3
4
5
6
8
weight
5000
4500
4000
3500
3000
2500
2000
1500
10
15
20
25
30
35
40
45
mpg

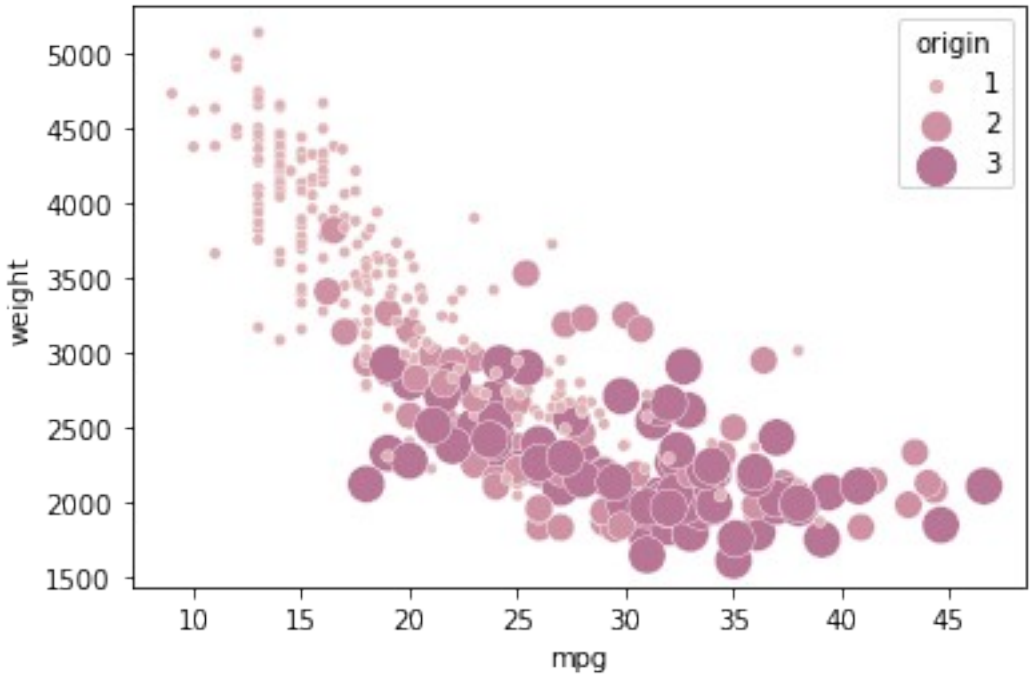


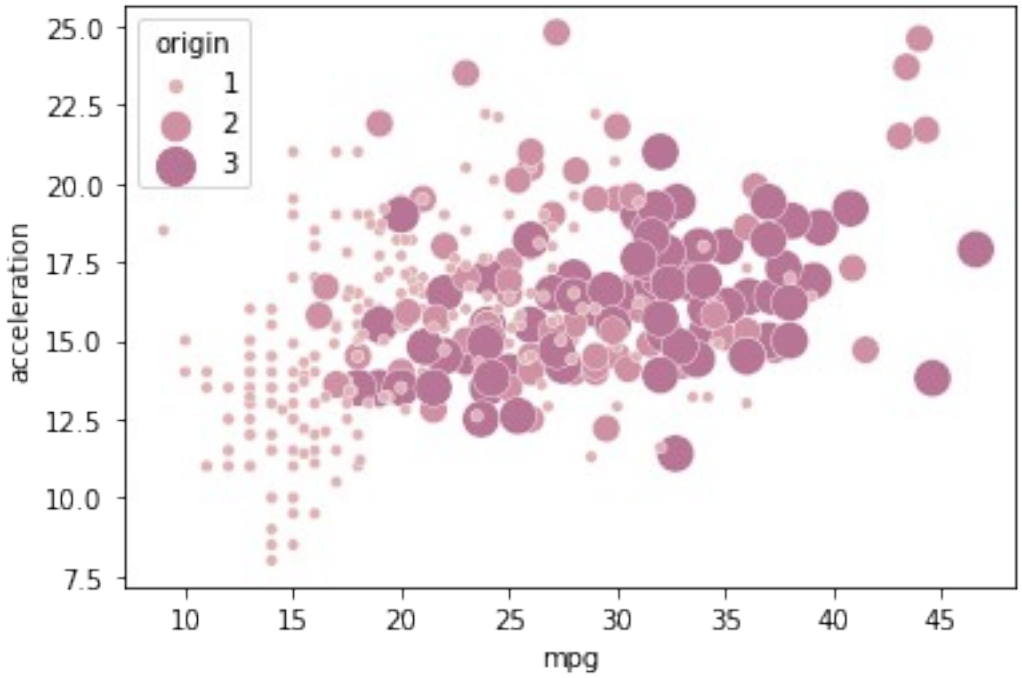

```
for feature in continous_variable:
    sns.scatterplot(data=car, x="mpg",
y=feature,hue="origin",size='origin',
    sizes=(20, 200), hue_norm=(0, 7), legend="full")
    plt.show()
```




origin
1
2
3
displacement
mpg
450
400
350
300
250
200
150
100
50
10
15
20
25
30
35
40
45

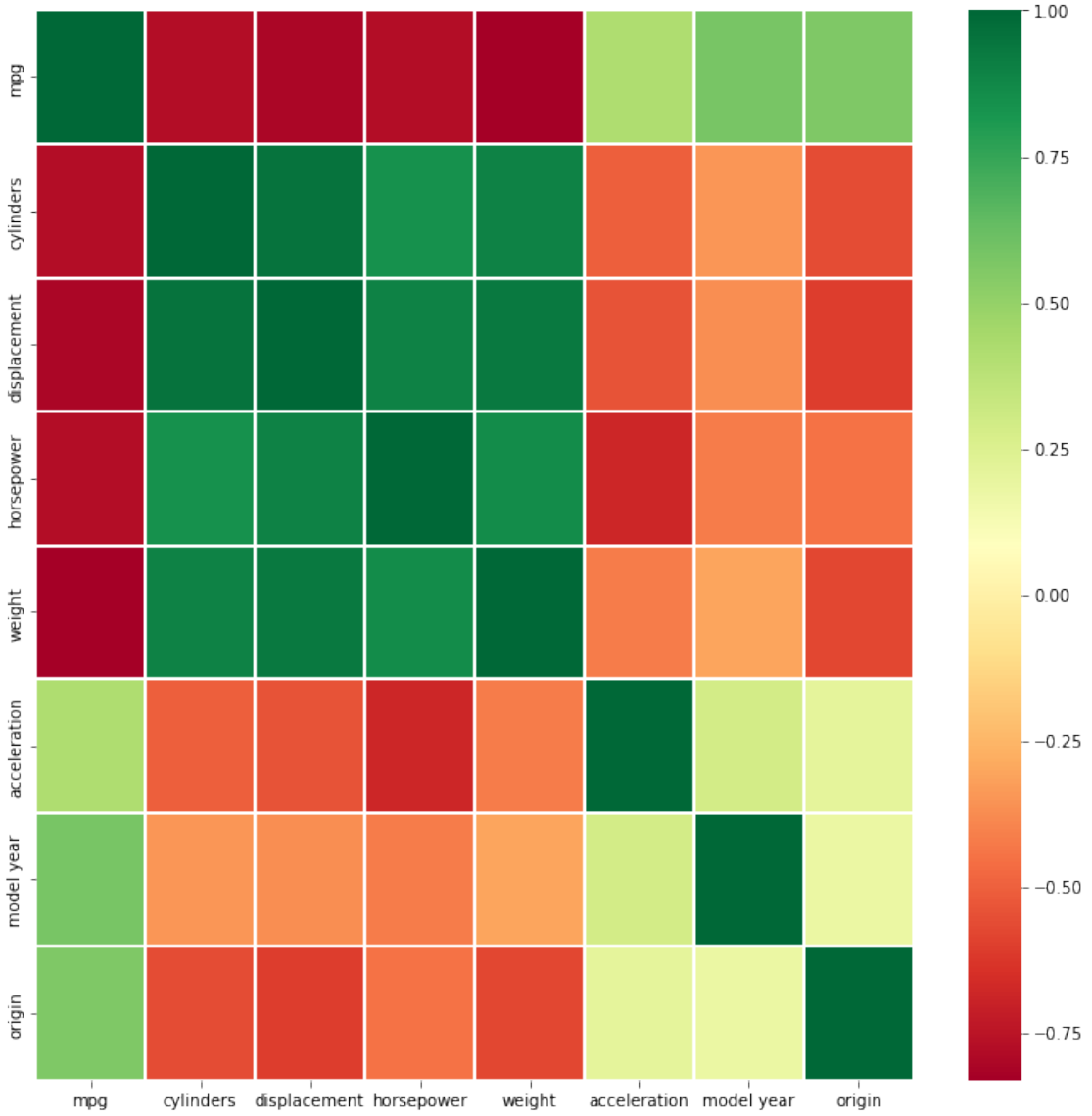

origin
1
2
3
horsepower
mpg
225
200
175
150
125
100
75
50
10
15
20
25
30
35
40
45






```
plt.figure(figsize=(12,12))
sns.heatmap(car.corr(),fmt="",cmap='RdYlGn',linewidths=0.30)
```

```
<AxesSubplot:>
```



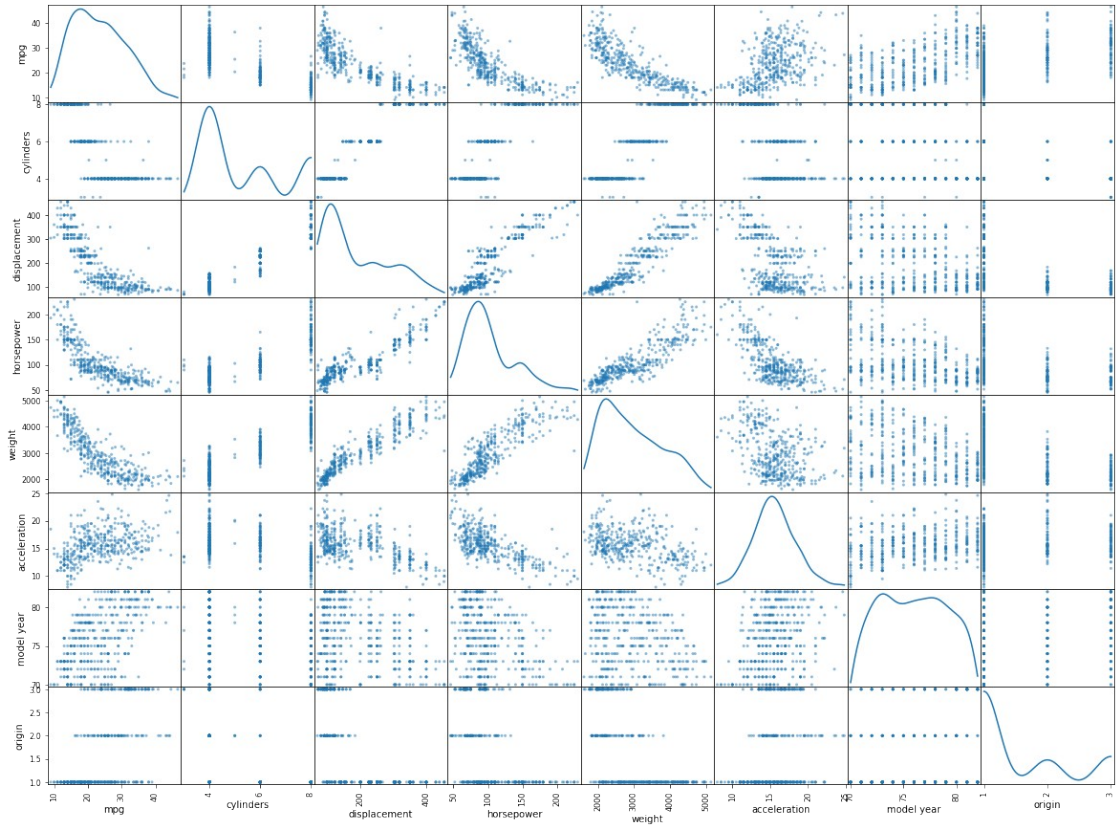

```
car.corr()
```

	mpg	cylinders	displacement	horsepower	weight
mpg	1.000000	-0.775396	-0.804203	-0.777501	-0.831741
cylinders	-0.775396	1.000000	0.950721	0.842437	0.896017
displacement	-0.804203	0.950721	1.000000	0.897082	0.932824
horsepower	-0.777501	0.842437	0.897082	1.000000	0.863990
weight	-0.831741	0.896017	0.932824	0.863990	1.000000
acceleration	0.420289	-0.505419	-0.543684	-0.686436	-0.417457

```
model year    0.579267  -0.348746     -0.370164   -0.417081 -0.306564

origin        0.563450  -0.562543     -0.609409   -0.452386 -0.581024
```

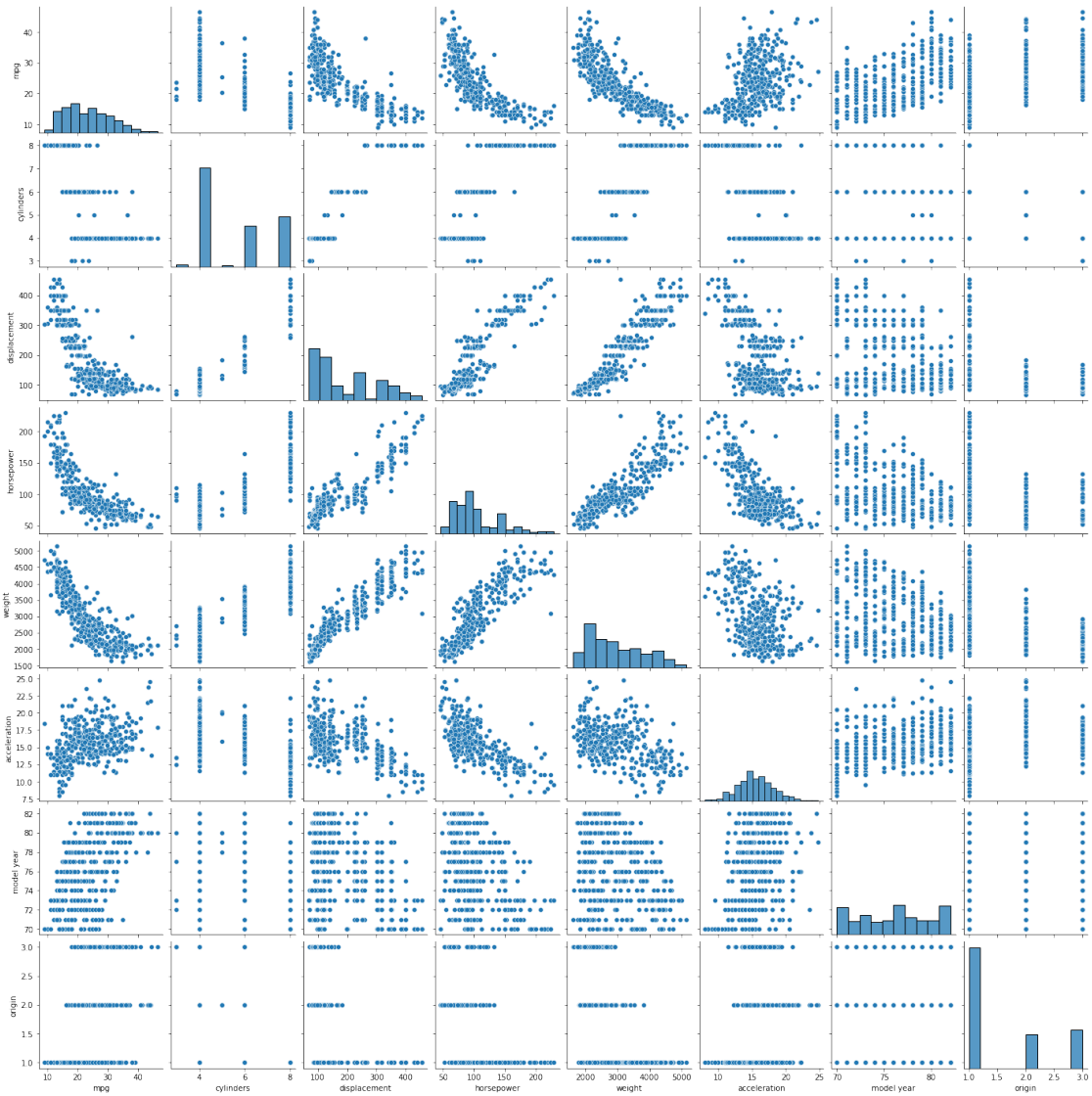
```
              acceleration  model year    origin
mpg               0.420289    0.579267  0.563450
cylinders        -0.505419   -0.348746 -0.562543
displacement     -0.543684   -0.370164 -0.609409
horsepower       -0.686436   -0.417081 -0.452386
weight           -0.417457   -0.306564 -0.581024
acceleration      1.000000    0.288137  0.205873
model year        0.288137    1.000000  0.180662
origin            0.205873    0.180662  1.000000
```

```
pd.plotting.scatter_matrix(car, diagonal="kde",figsize=(20,15))
plt.show()
```




```
sns.pairplot(car)
```

```
<seaborn.axisgrid.PairGrid at 0x7fb1fe3ac9d0>
```




```
car.describe()
```

	mpg	cylinders	displacement	horsepower	weight
count	398.000000	398.000000	398.000000	398.000000	398.000000
mean	23.514573	5.454774	193.425879	104.165829	2970.424623
std	7.815984	1.701004	104.269838	38.298676	846.841774
min	9.000000	3.000000	68.000000	46.000000	1613.000000
25%	17.500000	4.000000	104.250000	75.000000	2223.750000
50%	23.000000	4.000000	148.500000	92.000000	2803.500000

```
75%     29.000000    8.000000    262.000000  125.000000  3608.000000

max     46.600000    8.000000    455.000000  230.000000  5140.000000
```

```
       acceleration  model year      origin
count    398.000000  398.000000  398.000000
mean      15.568090   76.010050    1.572864
std        2.757689    3.697627    0.802055
min        8.000000   70.000000    1.000000
25%       13.825000   73.000000    1.000000
50%       15.500000   76.000000    1.000000
75%       17.175000   79.000000    2.000000
max       24.800000   82.000000    3.000000
```

```
car.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 398 entries, 0 to 397
Data columns (total 9 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   mpg           398 non-null    float64
 1   cylinders     398 non-null    int64  
 2   displacement  398 non-null    float64
 3   horsepower    398 non-null    int64  
 4   weight        398 non-null    int64  
 5   acceleration  398 non-null    float64
 6   model year    398 non-null    int64  
 7   origin        398 non-null    int64  
 8   car name      398 non-null    object 
dtypes: float64(3), int64(5), object(1)
memory usage: 28.1+ KB
```

```
car.mean()
```

```
/tmp/wsuser/ipykernel_375/1170622532.py:1: FutureWarning: Dropping of
nuisance columns in DataFrame reductions (with 'numeric_only=None') is
deprecated; in a future version this will raise TypeError.  Select
only valid columns before calling the reduction.
  car.mean()
```

```
mpg              23.514573
cylinders         5.454774
displacement    193.425879
horsepower      104.165829
weight         2970.424623
acceleration     15.568090
model year       76.010050
origin            1.572864
dtype: float64
```

```
car.median()
```

```
/tmp/wsuser/ipykernel_375/961299306.py:1: FutureWarning: Dropping of
nuisance columns in DataFrame reductions (with 'numeric_only=None') is
deprecated; in a future version this will raise TypeError.  Select
only valid columns before calling the reduction.
  car.median()
```

```
mpg              23.0
cylinders         4.0
displacement     148.5
horsepower        92.0
weight          2803.5
acceleration      15.5
model year        76.0
origin             1.0
dtype: float64
```

```
car.mode()
```

```
    mpg  cylinders  displacement  horsepower  weight  acceleration  \
0  13.0        4.0          97.0       150.0    1985          14.5
1   NaN        NaN           NaN         NaN    2130           NaN

   model year  origin    car name
0        73.0     1.0  ford pinto
1         NaN     NaN         NaN
```

```
# Measure of dispersed
for feature in continous_variable:
    data1 = max(car[feature]) - min(car[feature])
    print(data1)
```

```
37.6
387.0
184
3527
16.8
```

```
car.var()
```

```
/tmp/wsuser/ipykernel_375/1087542622.py:1: FutureWarning: Dropping of
nuisance columns in DataFrame reductions (with 'numeric_only=None') is
deprecated; in a future version this will raise TypeError.  Select
only valid columns before calling the reduction.
  car.var()
```

```
mpg                61.089611
cylinders           2.893415
displacement     10872.199152
horsepower        1466.788552
weight          717140.990526
```

```
acceleration         7.604848
model year          13.672443
origin               0.643292
dtype: float64
```

```
car.std()
```

```
/tmp/wsuser/ipykernel_375/2098329851.py:1: FutureWarning: Dropping of
nuisance columns in DataFrame reductions (with 'numeric_only=None') is
deprecated; in a future version this will raise TypeError.  Select
only valid columns before calling the reduction.
  car.std()
```

```
mpg               7.815984
cylinders         1.701004
displacement    104.269838
horsepower       38.298676
weight          846.841774
acceleration      2.757689
model year        3.697627
origin            0.802055
dtype: float64
```

```
car.skew()
```

```
/tmp/wsuser/ipykernel_375/2526934436.py:1: FutureWarning: Dropping of
nuisance columns in DataFrame reductions (with 'numeric_only=None') is
deprecated; in a future version this will raise TypeError.  Select
only valid columns before calling the reduction.
  car.skew()
```

```
mpg             0.457066
cylinders       0.526922
displacement    0.719645
horsepower      1.106827
weight          0.531063
acceleration    0.278777
model year      0.011535
origin          0.923776
dtype: float64
```

```
car.kurt()
```

```
/tmp/wsuser/ipykernel_375/2577377318.py:1: FutureWarning: Dropping of
nuisance columns in DataFrame reductions (with 'numeric_only=None') is
deprecated; in a future version this will raise TypeError.  Select
only valid columns before calling the reduction.
  car.kurt()
```

```
mpg            -0.510781
cylinders      -1.376662
displacement   -0.746597
```

```
horsepower      0.753032
weight         -0.785529
acceleration    0.419497
model year     -1.181232
origin         -0.817597
dtype: float64
```

```
car.isnull().sum()
```

```
mpg             0
cylinders       0
displacement    0
horsepower      0
weight          0
acceleration    0
model year      0
origin          0
car name        0
dtype: int64
```

Preprocessing

Create make features

```
import re

car["make"] = car["car name"].apply(lambda x: re.search(r'^\w+',
x).group(0))

car = car.drop("car name",axis=1)

car
```

```
      mpg  cylinders  displacement  horsepower  weight
acceleration  \
0    18.0          8         307.0         130    3504          12.0

1    15.0          8         350.0         165    3693          11.5

2    18.0          8         318.0         150    3436          11.0

3    16.0          8         304.0         150    3433          12.0

4    17.0          8         302.0         140    3449          10.5

..    ...        ...           ...         ...     ...           ...

393  27.0          4         140.0          86    2790          15.6
```

```
394  44.0          4          97.0          52    2130          24.6

395  32.0          4         135.0          84    2295          11.6

396  28.0          4         120.0          79    2625          18.6

397  31.0          4         119.0          82    2720          19.4


     model year  origin       make
0            70       1  chevrolet
1            70       1      buick
2            70       1   plymouth
3            70       1        amc
4            70       1       ford
..          ...     ...        ...
393          82       1       ford
394          82       2         vw
395          82       1      dodge
396          82       1       ford
397          82       1      chevy

[398 rows x 9 columns]
```

Fix typos in make names

```
make_typo_correction = {
        'vw': 'volkswagen',
        'chevy': 'chevrolet',
        'maxda': 'mazda',
        'vokswagen': 'volkswagen',
        'toyouta': 'toyota',
        'chevroelt': 'chevrolet'
    }
car['make'] = car['make'].replace(make_typo_correction)

car
```

```
      mpg  cylinders  displacement  horsepower  weight
acceleration  \
0    18.0          8         307.0         130    3504          12.0

1    15.0          8         350.0         165    3693          11.5

2    18.0          8         318.0         150    3436          11.0

3    16.0          8         304.0         150    3433          12.0

4    17.0          8         302.0         140    3449          10.5
```

```
..    ...        ...           ...         ...     ...           ...

393  27.0          4         140.0          86    2790          15.6

394  44.0          4          97.0          52    2130          24.6

395  32.0          4         135.0          84    2295          11.6

396  28.0          4         120.0          79    2625          18.6

397  31.0          4         119.0          82    2720          19.4
```

```
     model year  origin        make
0            70       1   chevrolet
1            70       1       buick
2            70       1    plymouth
3            70       1         amc
4            70       1        ford
..          ...     ...         ...
393          82       1        ford
394          82       2  volkswagen
395          82       1       dodge
396          82       1        ford
397          82       1   chevrolet

[398 rows x 9 columns]
```

```
from sklearn import preprocessing
label_encoder = preprocessing.LabelEncoder()
car['make']= label_encoder.fit_transform(car['make'])
```

Split df into x and y

```
y = car['mpg'].copy()
x = car.drop('mpg', axis=1).copy()

x_train, x_test, y_train, y_test = train_test_split(x, y,
train_size=0.7, random_state=123)
```

Using a simple linear model

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

linear_r2 = linear_model.score(x_test, y_test)
print("Linear Regression R^2: {:.1f}".format(linear_r2))
```

```
Linear Regression R^2: 0.8
```

Using a decision tree model

```
tree_model = DecisionTreeRegressor()
tree_model.fit(x_train, y_train)

tree_r2 = tree_model.score(x_test, y_test)
print("Decision Tree R^2: {:.5f}".format(tree_r2))
```

```
Decision Tree R^2: 0.73206
```

Using ranadom forest regression model

```
rf_model = RandomForestRegressor()
rf_model.fit(x_train, y_train)

rf_r2 = rf_model.score(x_test, y_test)
print("Random Forest R^2: {:.5f}".format(rf_r2))
```

```
Random Forest R^2: 0.83855
```

```
x_test
```

```
     cylinders  displacement  horsepower  weight  acceleration  model
year  \
150          4         108.0          93    2391          15.5
74
42           8         383.0         180    4955          11.5
71
120          4         121.0         112    2868          15.5
73
102          4          97.0          46    1950          21.0
73
293          4          89.0          71    1925          14.0
79
..         ...           ...         ...     ...           ...
...
327          5         121.0          67    2950          19.9
80
223          8         318.0         145    4140          13.7
77
283          6         232.0          90    3265          18.2
79
273          4         119.0          97    2405          14.9
78
377          4          91.0          68    1970          17.6
82

     origin  make
```

```
150       3    25
42        1     9
120       2    29
102       2    28
293       2    28
..      ...   ...
327       2     1
223       1     9
283       1     0
273       3     8
377       3    14

[120 rows x 8 columns]
```

```
rf_model.predict(x_test)
```

```
array([24.551, 12.23 , 21.142, 28.389, 36.816, 18.993, 30.458, 29.012,
       33.396, 13.295, 28.304, 35.627, 20.554, 19.924, 18.141, 20.107,
       15.262, 21.497, 14.89 , 14.15 , 37.797, 16.327, 28.233, 30.427,
       19.422, 17.751, 15.79 , 31.024, 29.601, 26.154, 23.239, 19.147,
       25.795, 15.019, 27.408, 29.457, 23.837, 37.019, 14.78 , 33.23 ,
       15.672, 37.202, 31.988, 35.726, 28.315, 17.704, 14.709, 23.955,
       28.938, 36.173, 12.825, 31.172, 27.627, 27.046, 32.743, 19.721,
       16.055, 25.221, 15.498, 22.57 , 24.576, 23.15 , 28.32 , 37.568,
       28.275, 23.833, 19.245, 33.273, 18.66 , 25.642, 14.755, 19.127,
       24.742, 27.99 , 18.941, 29.342, 17.822, 20.124, 16.362, 17.966,
       15.372, 29.645, 13.775, 31.862, 26.248, 31.971, 17.634, 24.362,
       12.03 , 24.134, 17.129, 18.574, 25.022, 31.658, 15.841, 16.698,
       24.319, 34.642, 13.5  , 35.327, 18.152, 15.212, 23.931, 14.73 ,
       19.115, 14.963, 28.708, 23.173, 17.17 , 23.192, 18.468, 19.289,
       16.618, 30.024, 14.63 , 29.946, 15.92 , 19.915, 25.93 ,
36.774])
```

```
from ibm_watson_machine_learning import APIClient
wml_credentials={
    "url": "https://us-south.ml.cloud.ibm.com",
    "apikey": "McA0cABIxbmWF-itHuc3Tat6XJ0FtvRJHwgQjLDcZI5R"
}
client=APIClient(wml_credentials)
```

```
def guid_from_space_name(client, space_name):
    space = client.spaces.get_details()
    #print(space)
    return(next(item for item in space['resources'] if item['entity']
["name"] == space_name)['metadata']['id'])
```

```
space_uid = guid_from_space_name(client, 'models')
print("Space UID = " + space_uid)
```

```
Space UID = f07214d2-ef23-4551-a74a-98004974c9aa
```

```
client.set.default_space(space_uid)
```

```
'SUCCESS'

client.software_specifications.list()

------------------------------  ------------------------------------
----
NAME                            ASSET_ID
TYPE
default_py3.6                   0062b8c9-8b7d-44a0-a9b9-46c416adcbd9
base
kernel-spark3.2-scala2.12       020d69ce-7ac1-5e68-ac1a-31189867356a
base
pytorch-onnx_1.3-py3.7-edt      069ea134-3346-5748-b513-49120e15d288
base
scikit-learn_0.20-py3.6         09c5a1d0-9c1e-4473-a344-eb7b665ff687
base
spark-mllib_3.0-scala_2.12      09f4cff0-90a7-5899-b9ed-1ef348aebdee
base
pytorch-onnx_rt22.1-py3.9       0b848dd4-e681-5599-be41-b5f6fccc6471
base
ai-function_0.1-py3.6           0cdb0f1e-5376-4f4d-92dd-da3b69aa9bda
base
shiny-r3.6                      0e6e79df-875e-4f24-8ae9-62dcc2148306
base
tensorflow_2.4-py3.7-horovod    1092590a-307d-563d-9b62-4eb7d64b3f22
base
pytorch_1.1-py3.6               10ac12d6-6b30-4ccd-8392-3e922c096a92
base
tensorflow_1.15-py3.6-ddl       111e41b3-de2d-5422-a4d6-bf776828c4b7
base
autoai-kb_rt22.2-py3.10         125b6d9a-5b1f-5e8d-972a-b251688ccf40
base
runtime-22.1-py3.9              12b83a17-24d8-5082-900f-0ab31fbfd3cb
base
scikit-learn_0.22-py3.6         154010fa-5b3b-4ac1-82af-4d5ee5abbc85
base
default_r3.6                    1b70aec3-ab34-4b87-8aa0-a4a3c8296a36
base
pytorch-onnx_1.3-py3.6          1bc6029a-cc97-56da-b8e0-39c3880dbbe7
base
kernel-spark3.3-r3.6            1c9e5454-f216-59dd-a20e-474a5cdf5988
base
pytorch-onnx_rt22.1-py3.9-edt   1d362186-7ad5-5b59-8b6c-9d0880bde37f
base
tensorflow_2.1-py3.6            1eb25b84-d6ed-5dde-b6a5-3fbdf1665666
base
spark-mllib_3.2                 20047f72-0a98-58c7-9ff5-a77b012eb8f5
base
tensorflow_2.4-py3.8-horovod    217c16f6-178f-56bf-824a-b19f20564c49
base
runtime-22.1-py3.9-cuda         26215f05-08c3-5a41-a1b0-da66306ce658
```

```
base
do_py3.8                        295addb5-9ef9-547e-9bf4-92ae3563e720
base
autoai-ts_3.8-py3.8             2aa0c932-798f-5ae9-abd6-15e0c2402fb5
base
tensorflow_1.15-py3.6           2b73a275-7cbf-420b-a912-eae7f436e0bc
base
kernel-spark3.3-py3.9           2b7961e2-e3b1-5a8c-a491-482c8368839a
base
pytorch_1.2-py3.6               2c8ef57d-2687-4b7d-acce-01f94976dac1
base
spark-mllib_2.3                 2e51f700-bca0-4b0d-88dc-5c6791338875
base
pytorch-onnx_1.1-py3.6-edt      32983cea-3f32-4400-8965-dde874a8d67e
base
spark-mllib_3.0-py37            36507ebe-8770-55ba-ab2a-eafe787600e9
base
spark-mllib_2.4                 390d21f8-e58b-4fac-9c55-d7ceda621326
base
autoai-ts_rt22.2-py3.10         396b2e83-0953-5b86-9a55-7ce1628a406f
base
xgboost_0.82-py3.6              39e31acd-5f30-41dc-ae44-60233c80306e
base
pytorch-onnx_1.2-py3.6-edt      40589d0e-7019-4e28-8daa-fb03b6f4fe12
base
pytorch-onnx_rt22.2-py3.10      40e73f55-783a-5535-b3fa-0c8b94291431
base
default_r36py38                 41c247d3-45f8-5a71-b065-8580229facf0
base
autoai-ts_rt22.1-py3.9          4269d26e-07ba-5d40-8f66-2d495b0c71f7
base
autoai-obm_3.0                  42b92e18-d9ab-567f-988a-4240ba1ed5f7
base
pmml-3.0_4.3                    493bcb95-16f1-5bc5-bee8-81b8af80e9c7
base
spark-mllib_2.4-r_3.6           49403dff-92e9-4c87-a3d7-a42d0021c095
base
xgboost_0.90-py3.6              4ff8d6c2-1343-4c18-85e1-689c965304d3
base
pytorch-onnx_1.1-py3.6          50f95b2a-bc16-43bb-bc94-b0bed208c60b
base
autoai-ts_3.9-py3.8             52c57136-80fa-572e-8728-a5e7cbb42cde
base
spark-mllib_2.4-scala_2.11      55a70f99-7320-4be5-9fb9-9edb5a443af5
base
spark-mllib_3.0                 5c1b0ca2-4977-5c2e-9439-ffd44ea8ffe9
base
autoai-obm_2.0                  5c2e37fa-80b8-5e77-840f-d912469614ee
base
spss-modeler_18.1               5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b
```

```
base
cuda-py3.8                    5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e
base
runtime-22.2-py3.10-xc        5e8cddff-db4a-5a6a-b8aa-2d4af9864dab
base
autoai-kb_3.1-py3.7           632d4b22-10aa-5180-88f0-f52dfb6444d7
base
------------------------------  ------------------------------------
----
Note: Only first 50 records were displayed. To display more use
'limit' parameter.
```

```
software_spec_uid =
client.software_specifications.get_uid_by_name("runtime-22.1-py3.9")
software_spec_uid
```

```
'12b83a17-24d8-5082-900f-0ab31fbfd3cb'
```

```
model_details = client.repository.store_model(
    model=rf_model,meta_props={
        client.repository.ModelMetaNames.NAME:"RandomForest_modeling",
        client.repository.ModelMetaNames.TYPE:"scikit-learn_1.0",

client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_spec_uid,
    }
)
model_id = client.repository.get_model_uid(model_details)
```

```
This method is deprecated, please use get_model_id()
```

```
/opt/conda/envs/Python-3.9/lib/python3.9/site-packages/
ibm_watson_machine_learning/repository.py:1453: UserWarning: This
method is deprecated, please use get_model_id()
  warn("This method is deprecated, please use get_model_id()")
```

```
model_id
```

```
'fa491e42-cc7a-4451-93e5-0f37cb7219fa'
```