Python_Seaborn-Copy1

March 31, 2023

1 Seaborn for Data visualisations

[3]:
```
# we always need these two packages when we do any type of data analysis
import numpy as np
import pandas as pd

# import the seaborn module
import seaborn as sns

# import "old" visualisation package, it provides supporting functions
import matplotlib.pyplot as plt

# jupyter notebok magic to ensure that visualisation is correctly placed in␣
 ↪notebook
%matplotlib inline
```

The main and "classical" package for data visualisation in Python is `matplotlib`. However, over time there were developed better packages with advanced functionality. So, we have `seaborn` - https://seaborn.pydata.org/index.html.

Package `seaborn` has a number of data sets embedded in the package and we can use them for presentation and testing.

[4]:
```
# full list of packages embedded
sns.get_dataset_names()
```

[4]:
```
['anagrams',
 'anscombe',
 'attention',
 'brain_networks',
 'car_crashes',
 'diamonds',
 'dots',
 'dowjones',
 'exercise',
 'flights',
 'fmri',
 'geyser',
```

```
 'glue',
 'healthexp',
 'iris',
 'mpg',
 'penguins',
 'planets',
 'seaice',
 'taxis',
 'tips',
 'titanic']
```

[5]:
```
# load a data set "Miles per gallon" - informations about cars and fuel␣
 ↪consumption
# it is a larger version of the data set we used before
mpg = sns.load_dataset("mpg")
mpg.head()
```

[5]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	model_year	origin	name
0	18.0	8	307.0	130.0	3504	12.0	70	usa	chevrolet chevelle malibu
1	15.0	8	350.0	165.0	3693	11.5	70	usa	buick skylark 320
2	18.0	8	318.0	150.0	3436	11.0	70	usa	plymouth satellite
3	16.0	8	304.0	150.0	3433	12.0	70	usa	amc rebel sst
4	17.0	8	302.0	140.0	3449	10.5	70	usa	ford torino

Before starting data analysis, we need to get a better understanding of the data.

[6]:
```
mpg.shape
```

[6]:
```
(398, 9)
```

[7]:
```
mpg.describe()
```

[7]:

	mpg	cylinders	displacement	horsepower	weight
count	398.000000	398.000000	398.000000	392.000000	398.000000
mean	23.514573	5.454774	193.425879	104.469388	2970.424623
std	7.815984	1.701004	104.269838	38.491160	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	93.500000	2803.500000
75%	29.000000	8.000000	262.000000	126.000000	3608.000000
max	46.600000	8.000000	455.000000	230.000000	5140.000000

```
       acceleration  model_year
count    398.000000  398.000000
mean      15.568090   76.010050
std        2.757689    3.697627
min        8.000000   70.000000
25%       13.825000   73.000000
50%       15.500000   76.000000
75%       17.175000   79.000000
max       24.800000   82.000000
```

1.0.1 Distribution plot

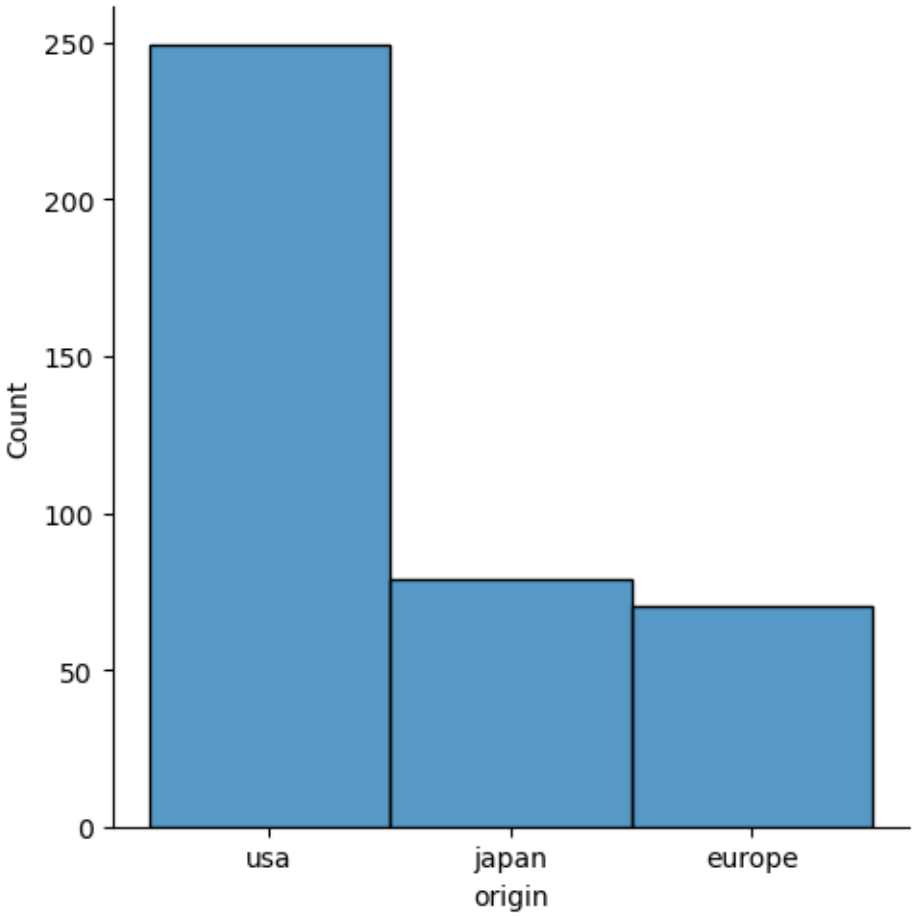
https://seaborn.pydata.org/generated/seaborn.displot.html

This is a "smart" function. It makes different charts depending on the data.

Try to re-call what are two types of data in statistical sense. Then re-call what are correct visualisations for each type of data.

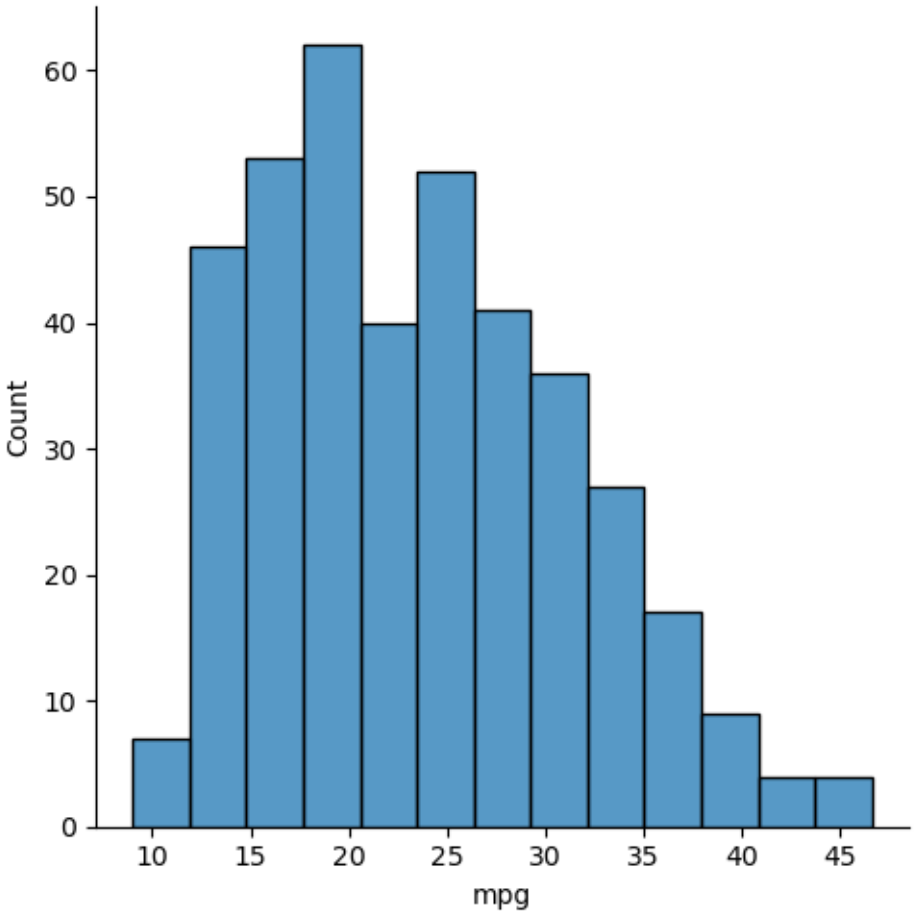
[8]:
```
sns.displot(mpg, x = "origin")
```

[8]:
```
<seaborn.axisgrid.FacetGrid at 0x1da4a83e850>
```



[9]:
```
sns.displot(mpg, x = "mpg")
```

[9]:
```
<seaborn.axisgrid.FacetGrid at 0x1da4a985d30>
```

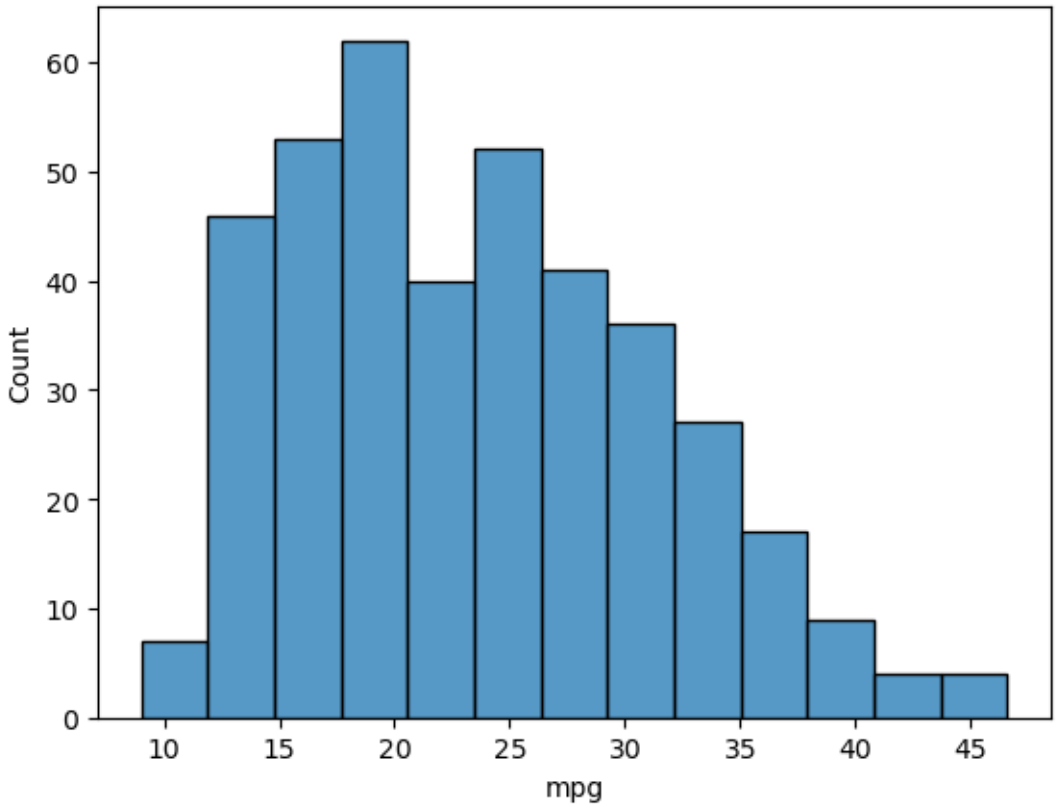


1.0.2 Histogram

https://seaborn.pydata.org/generated/seaborn.histplot.html

[10]:
```
sns.histplot(mpg, x = "mpg")
```

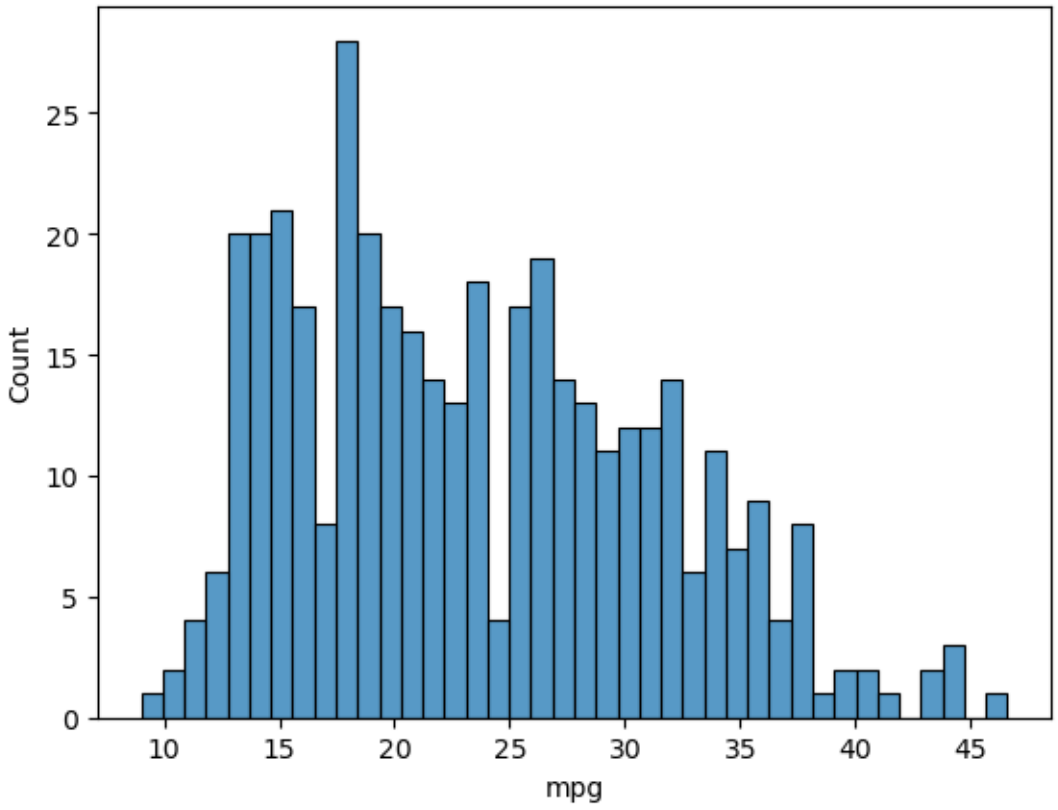
[10]:
```
<AxesSubplot:xlabel='mpg', ylabel='Count'>
```



It is important to select a "good" number for the number of bins in the histogram. Depending on that parameter, histogram might look quite different even for the same data.

[12]:
```
sns.histplot(mpg, x = "mpg", bins = 40)
```

[12]:
```
<AxesSubplot:xlabel='mpg', ylabel='Count'>
```

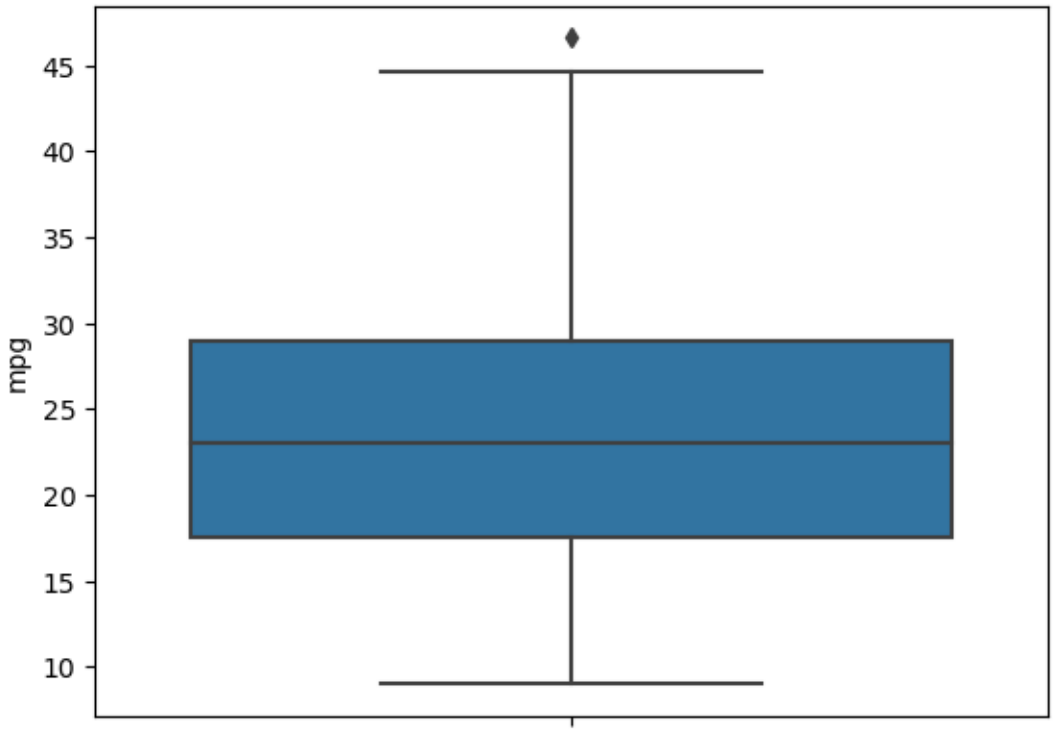


1.0.3 Box plot

https://seaborn.pydata.org/generated/seaborn.boxplot.html

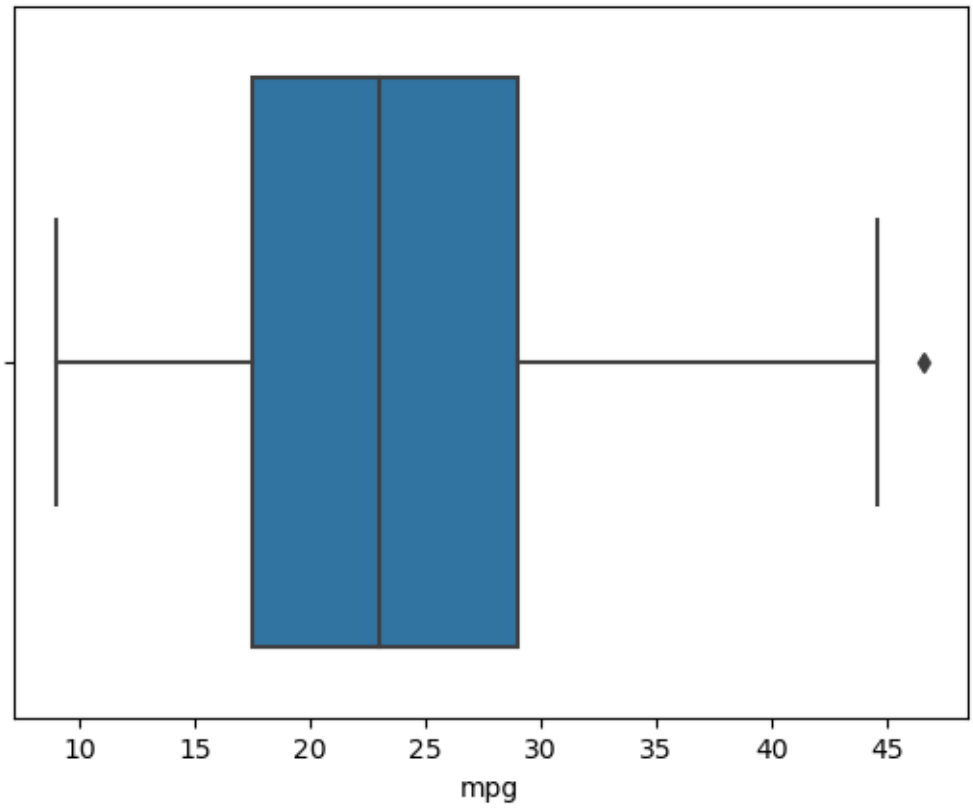
[13]:
```
sns.boxplot(data = mpg, y = "mpg")
```

[13]:
```
<AxesSubplot:ylabel='mpg'>
```



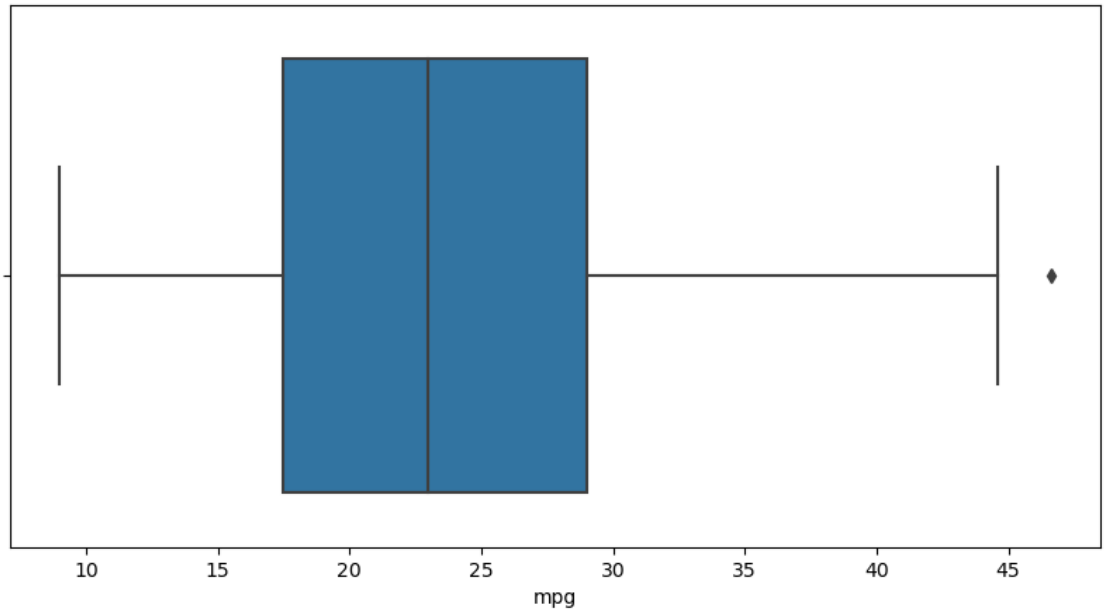
[14]:
```
sns.boxplot(data = mpg, x = "mpg")
```

[14]: <AxesSubplot:xlabel='mpg'>



[15]:
```
# adjust picture size
import matplotlib.pyplot as plt
plt.rcParams['figure.figsize'] = [10, 5]

sns.boxplot(data = mpg, x = "mpg")
```

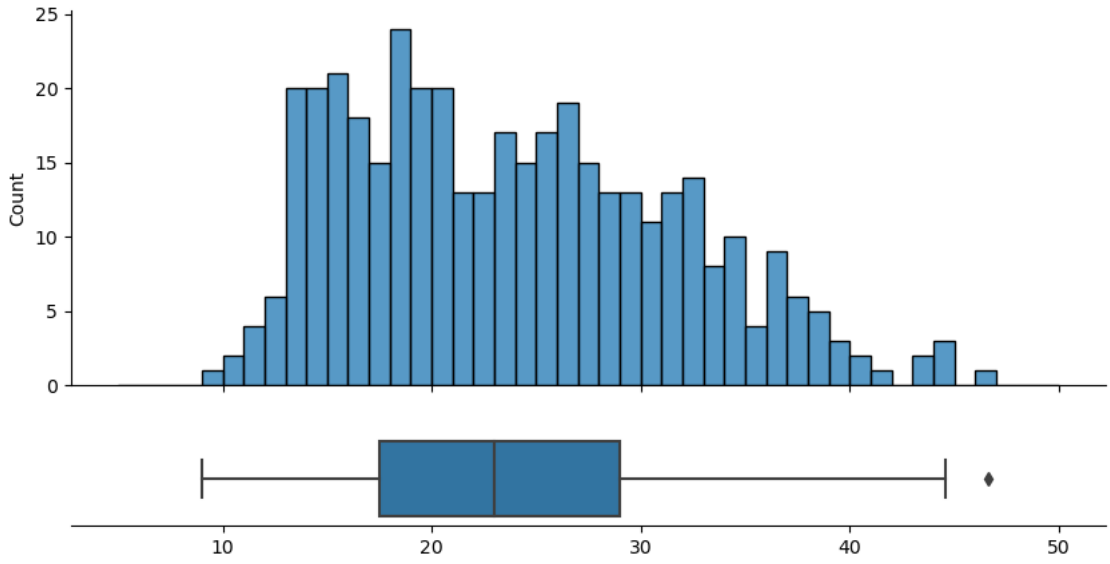
[15]:
```
<AxesSubplot:xlabel='mpg'>
```



1.0.4 Combined plot of histogram and box plot

https://www.python-graph-gallery.com/24-histogram-with-a-boxplot-on-top-seaborn

[25]:
```
# sns.set(style="darkgrid")

# creating a figure composed of two matplotlib.Axes objects (ax_box and ax_hist)
f, (ax_hist, ax_box) = plt.subplots(2, sharex=True,␣
 ↪gridspec_kw={"height_ratios": (.8, .2)})

# assigning a graph to each ax
sns.boxplot(data = mpg, x = "mpg", ax = ax_box)
sns.histplot(data = mpg, x = "mpg", ax = ax_hist, binwidth = 1, binrange =␣
 ↪[5,50])

# Remove x axis name for the boxplot
ax_box.set(xlabel='', yticks=[])

sns.despine(ax=ax_hist)
sns.despine(ax=ax_box, left=True)

plt.show()
```



1.0.5 Relationship between 'mpg' and 'origin'

[27]:
```
# remind ourselves the data structure
mpg.head()
```

[27]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	\
0	18.0	8	307.0	130.0	3504	12.0	
1	15.0	8	350.0	165.0	3693	11.5	
2	18.0	8	318.0	150.0	3436	11.0	
3	16.0	8	304.0	150.0	3433	12.0	
4	17.0	8	302.0	140.0	3449	10.5	

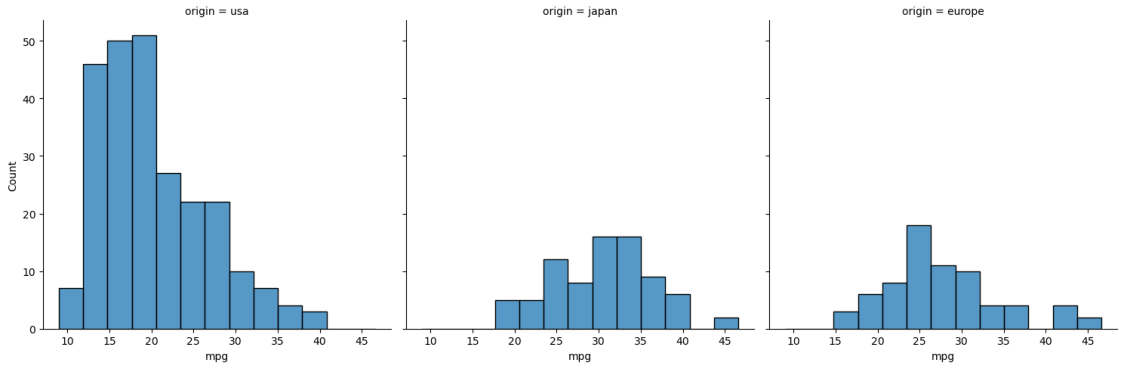
	model_year	origin	name
0	70	usa	chevrolet chevelle malibu
1	70	usa	buick skylark 320
2	70	usa	plymouth satellite
3	70	usa	amc rebel sst
4	70	usa	ford torino

[29]:
```
# get average fuel consumption per country of origin
mpg.groupby("origin").mpg.mean()
```

[29]:
```
origin
europe    27.891429
japan     30.450633
usa       20.083534
Name: mpg, dtype: float64
```

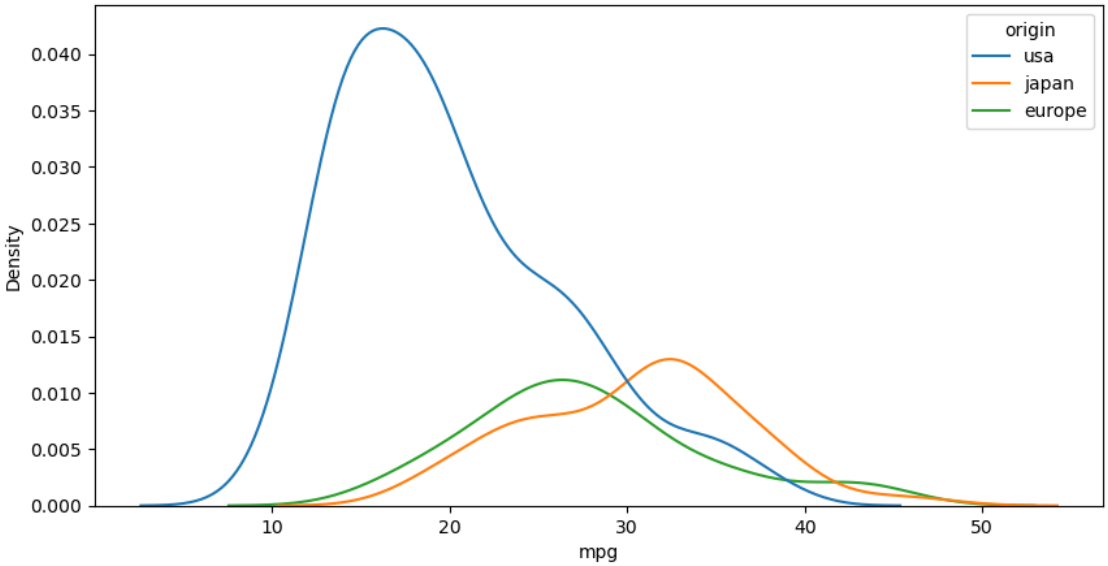
[30]:
```
sns.displot(mpg, x = "mpg", col = "origin")
```

[30]: <seaborn.axisgrid.FacetGrid at 0x1da4d408460>



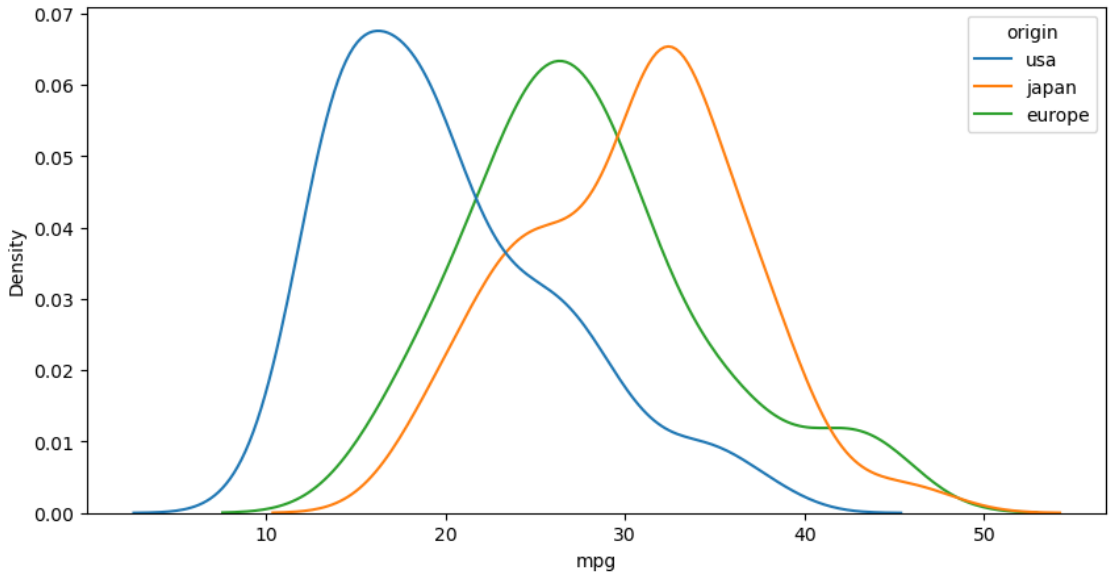
[35]:
```
sns.kdeplot(data = mpg, x = "mpg", hue = "origin")
```

[35]: <AxesSubplot:xlabel='mpg', ylabel='Density'>



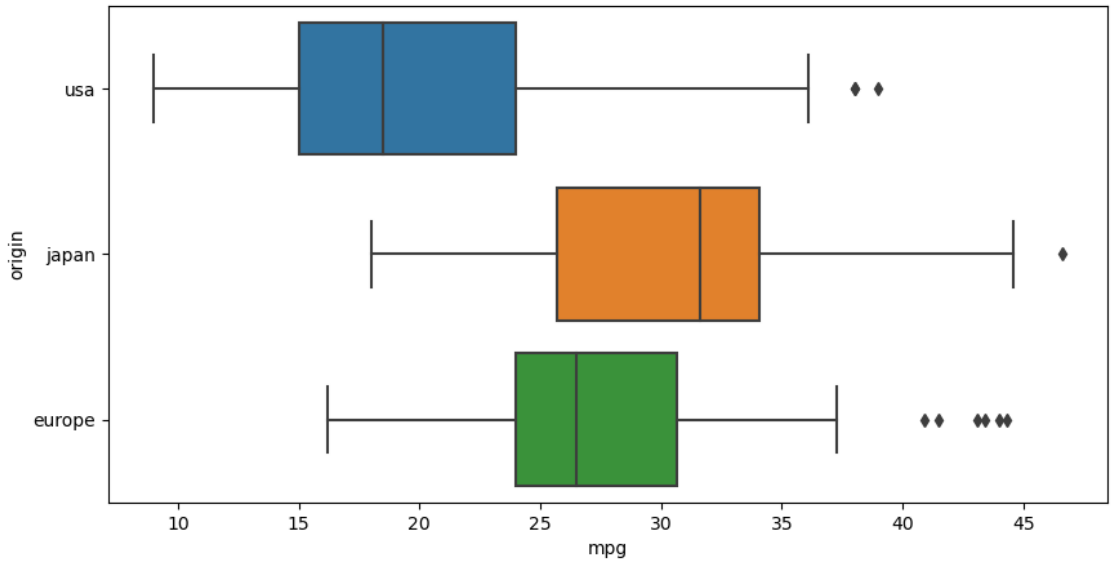
[36]:
```
sns.kdeplot(data = mpg, x = "mpg", hue = "origin", common_norm = False)
```

[36]: <AxesSubplot:xlabel='mpg', ylabel='Density'>



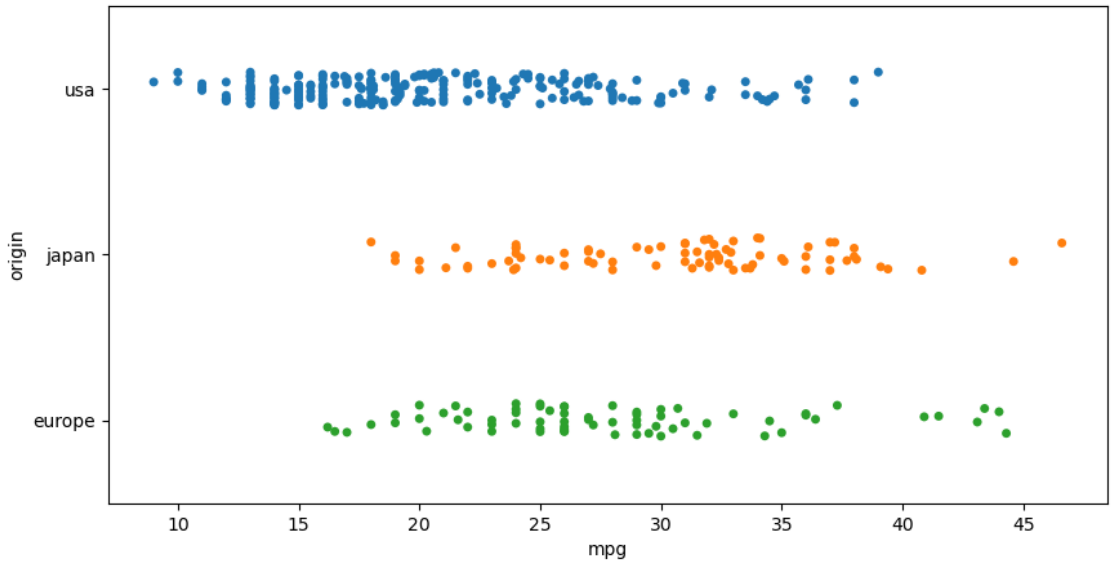
[37]:
```
sns.boxplot(data = mpg, x = "mpg", y = "origin")
```

[37]:
```
<AxesSubplot:xlabel='mpg', ylabel='origin'>
```



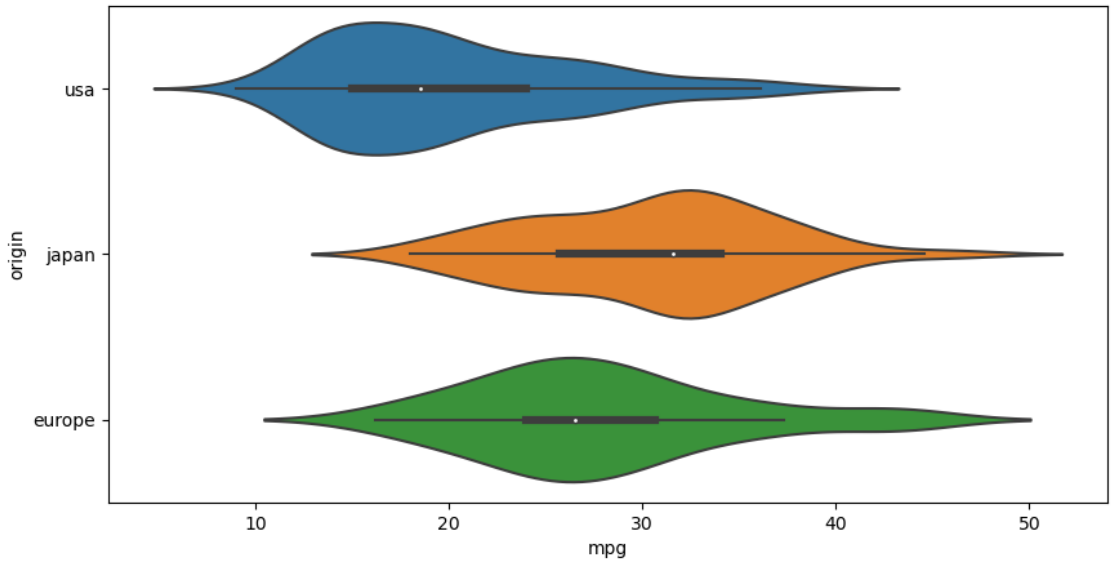
[38]:
```
sns.stripplot(data = mpg, x = "mpg", y = "origin")
```

[38]:
```
<AxesSubplot:xlabel='mpg', ylabel='origin'>
```



[39]:
```
sns.violinplot(data = mpg, x = "mpg", y = "origin")
```

[39]:
```
<AxesSubplot:xlabel='mpg', ylabel='origin'>
```



1.0.6 Categorical data

[40]:
```
mpg.head()
```

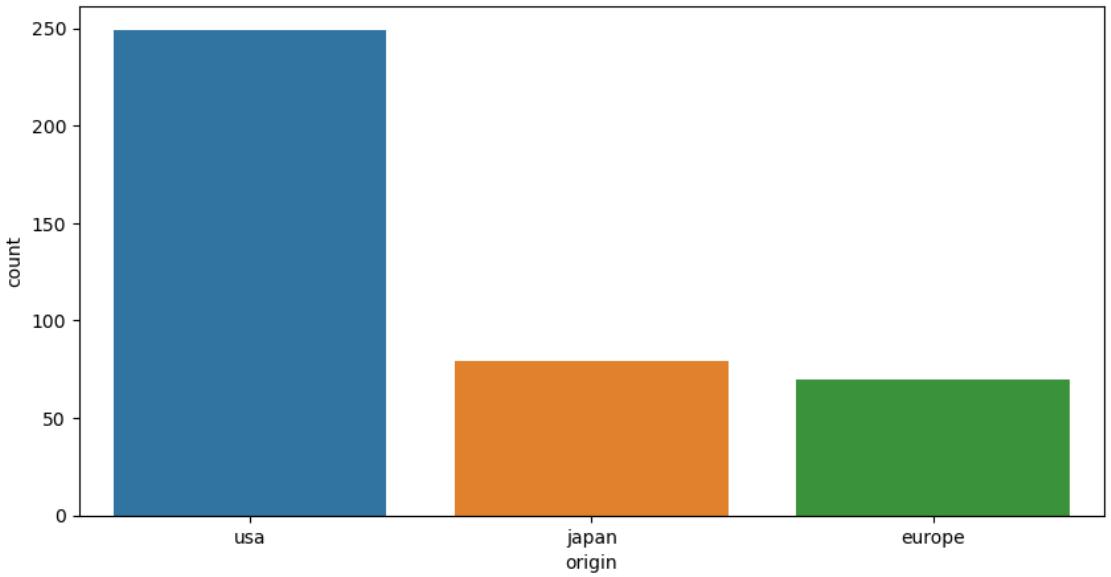
[40]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	\
0	18.0	8	307.0	130.0	3504	12.0	
1	15.0	8	350.0	165.0	3693	11.5	
2	18.0	8	318.0	150.0	3436	11.0	
3	16.0	8	304.0	150.0	3433	12.0	
4	17.0	8	302.0	140.0	3449	10.5	

	model_year	origin	name
0	70	usa	chevrolet chevelle malibu
1	70	usa	buick skylark 320
2	70	usa	plymouth satellite
3	70	usa	amc rebel sst
4	70	usa	ford torino

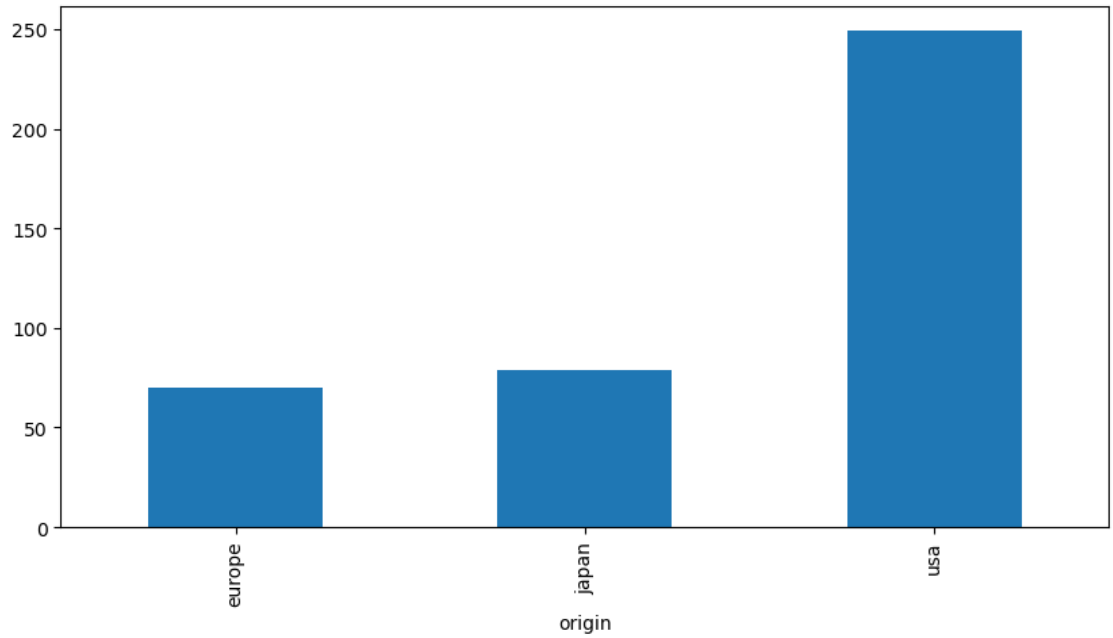
[41]:
```
sns.countplot(data = mpg, x = "origin")
```

[41]: <AxesSubplot:xlabel='origin', ylabel='count'>



[42]:
```
origin_counts = mpg.groupby("origin").origin.count()
origin_counts.plot(kind='bar')
```

[42]: <AxesSubplot:xlabel='origin'>



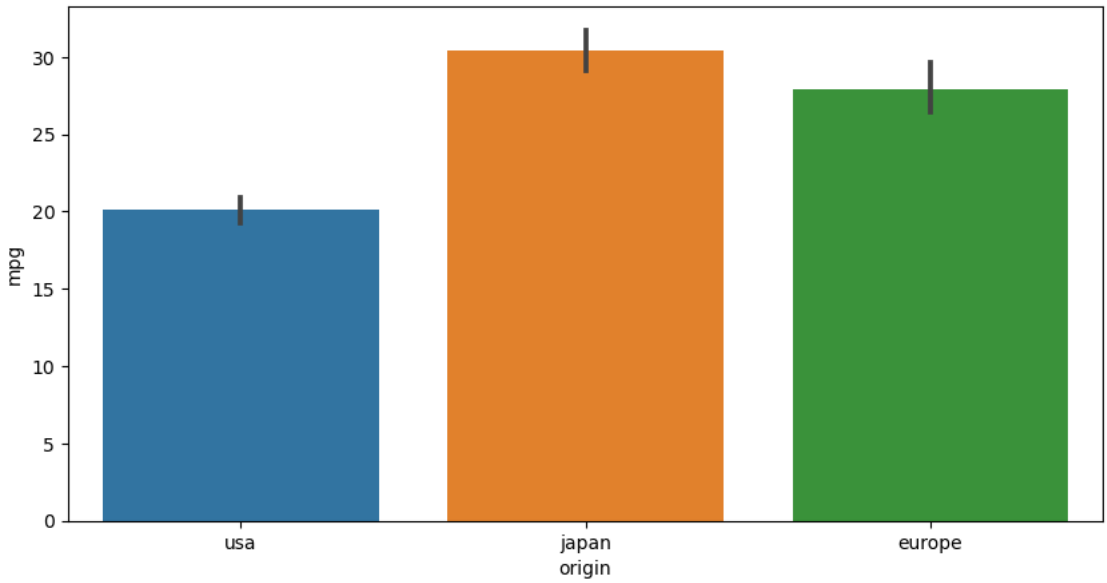
[43]:
```
origin_counts
```

[43]:
```
origin
europe     70
japan      79
usa       249
Name: origin, dtype: int64
```

1.0.7 Relationship between 'origin' and 'mpg'

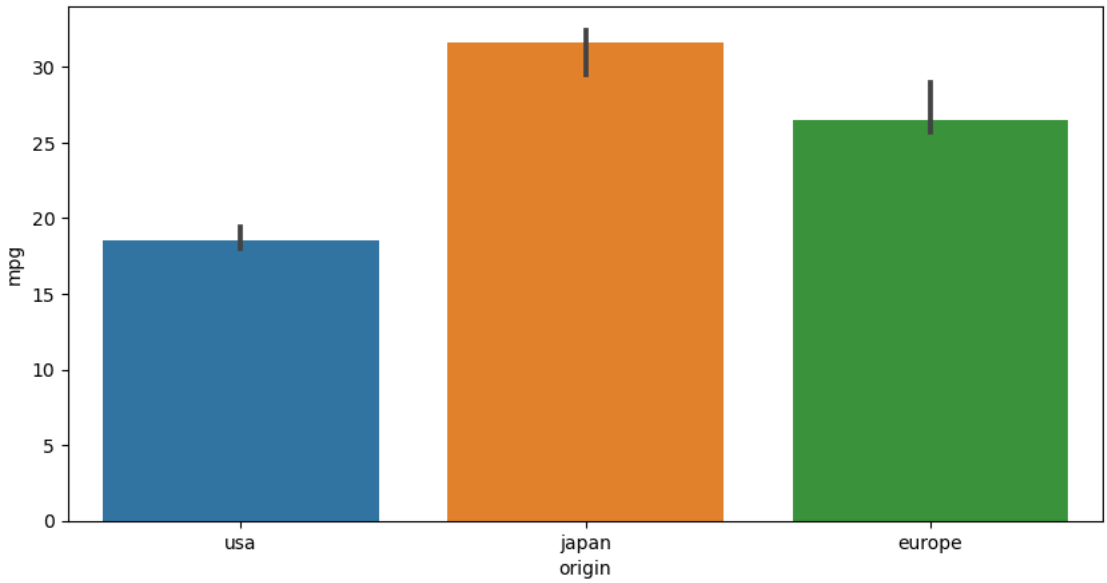
[44]:
```
sns.barplot(x = "origin", y = "mpg", data = mpg)
```

[44]:
```
<AxesSubplot:xlabel='origin', ylabel='mpg'>
```



[45]:
```
sns.barplot(x = "origin", y = "mpg", data = mpg, estimator = np.median)
```

[45]: <AxesSubplot:xlabel='origin', ylabel='mpg'>



1.0.8 Relationship between numerical variables

[46]:
```
mpg.head()
```

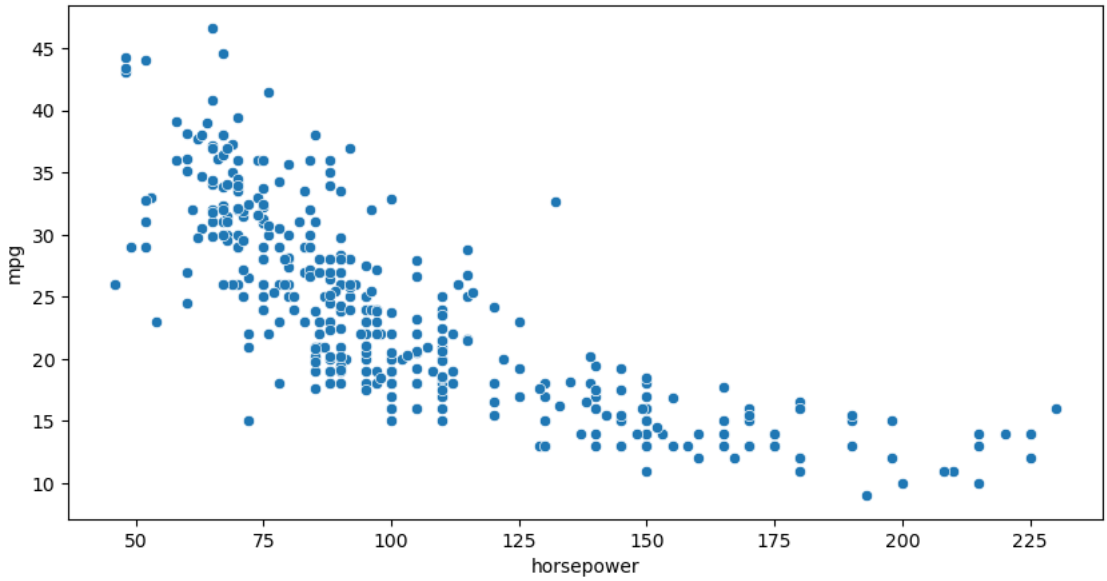
[46]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	\
0	18.0	8	307.0	130.0	3504	12.0	
1	15.0	8	350.0	165.0	3693	11.5	
2	18.0	8	318.0	150.0	3436	11.0	
3	16.0	8	304.0	150.0	3433	12.0	
4	17.0	8	302.0	140.0	3449	10.5	

	model_year	origin	name
0	70	usa	chevrolet chevelle malibu
1	70	usa	buick skylark 320
2	70	usa	plymouth satellite
3	70	usa	amc rebel sst
4	70	usa	ford torino

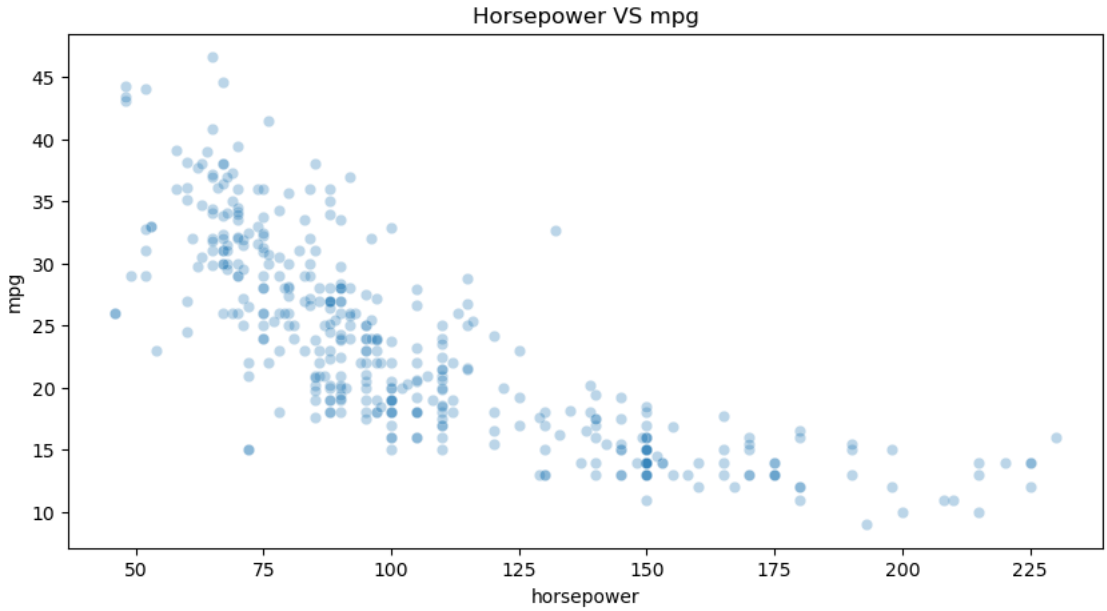
[47]:
```
sns.scatterplot(data = mpg, x = "horsepower", y = "mpg")
```

[47]: <AxesSubplot:xlabel='horsepower', ylabel='mpg'>



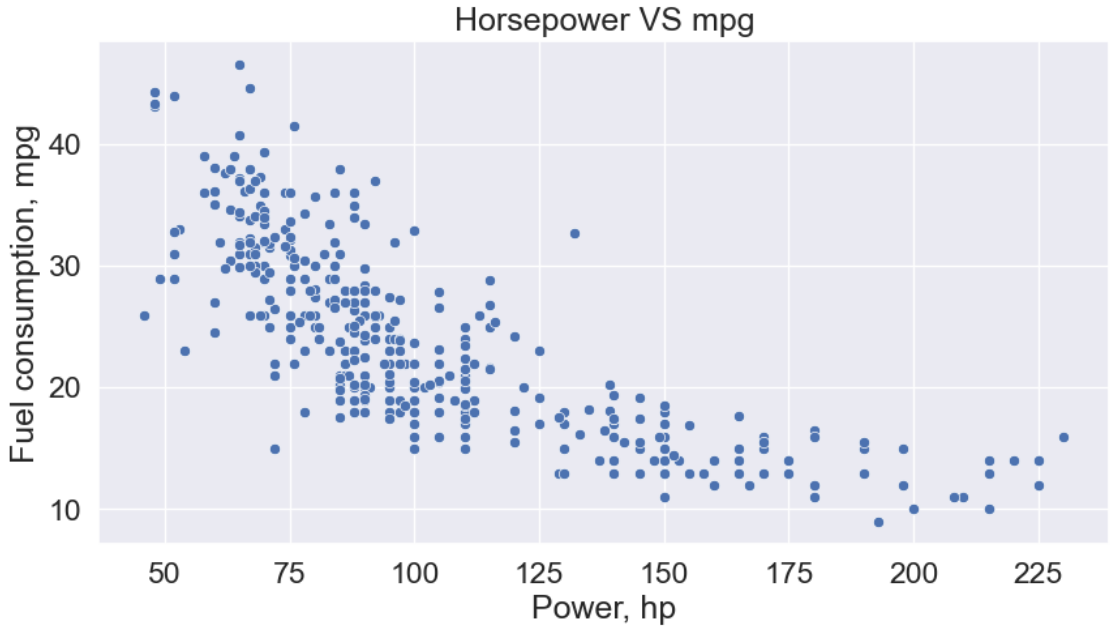
[48]:
```
sns.scatterplot(data = mpg, x = "horsepower", y = "mpg", alpha = 0.3).
↪set(title='Horsepower VS mpg')
```

[48]: [Text(0.5, 1.0, 'Horsepower VS mpg')]



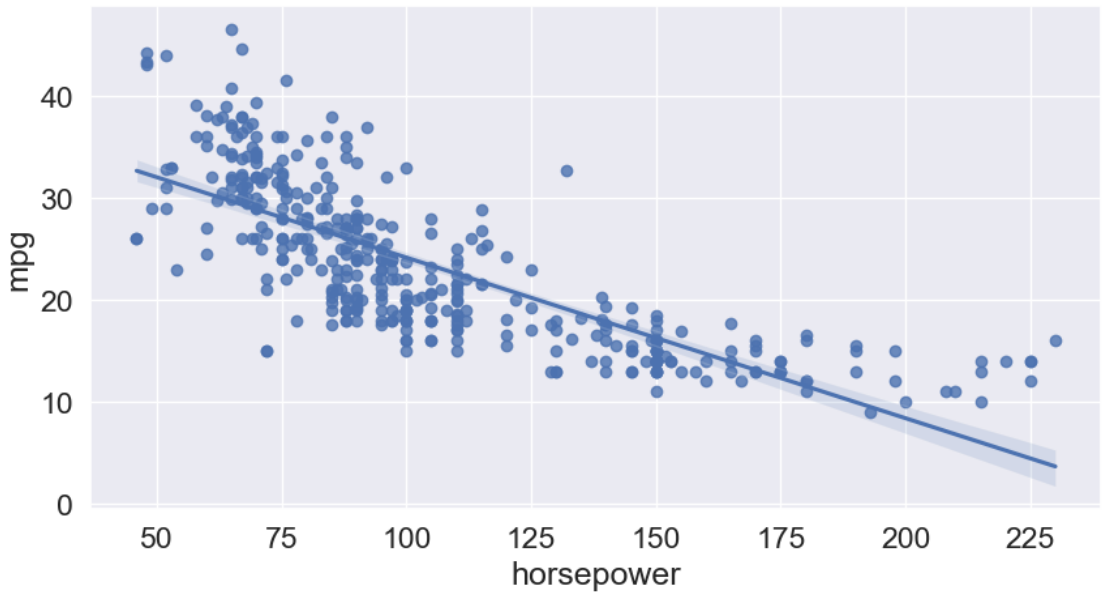
[49]:
```
sns.set(font_scale=1.5)
my_graph = sns.scatterplot(data = mpg, x = "horsepower", y = "mpg")
my_graph.set(xlabel = "Power, hp", ylabel = "Fuel consumption, mpg", title =␣
 ↪"Horsepower VS mpg")
```

[49]:
```
[Text(0.5, 0, 'Power, hp'),
 Text(0, 0.5, 'Fuel consumption, mpg'),
 Text(0.5, 1.0, 'Horsepower VS mpg')]
```



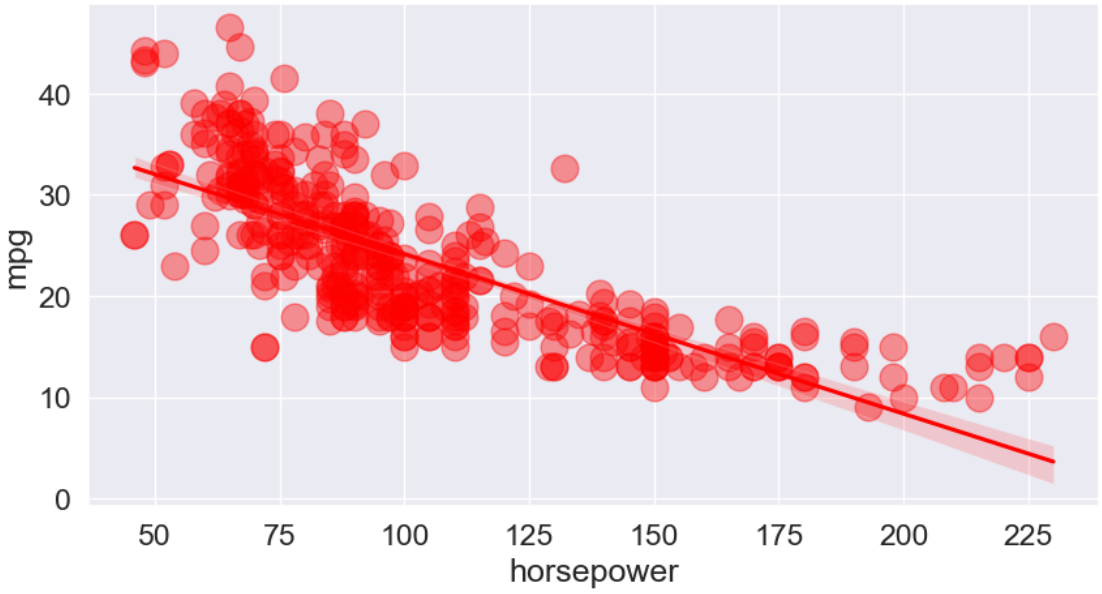
[50]:
```
sns.regplot(data = mpg, x = "horsepower", y = "mpg")
```

[50]: <AxesSubplot:xlabel='horsepower', ylabel='mpg'>



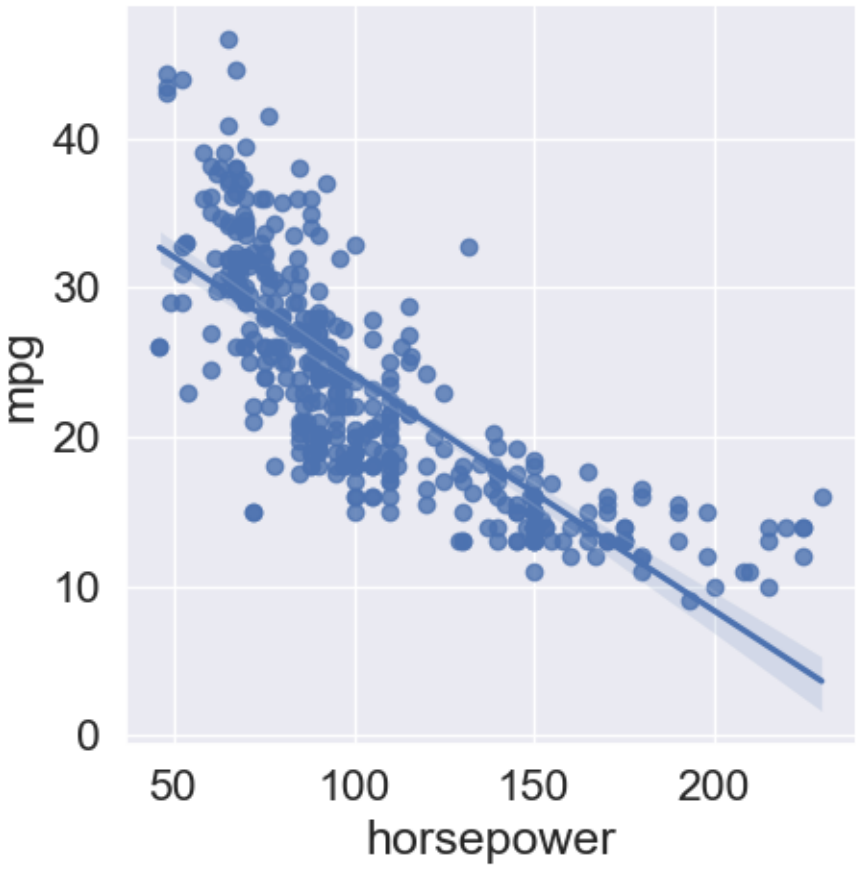
[51]:
```
sns.regplot(data = mpg, x = "horsepower", y = "mpg", marker='o', color='red',␣
↪scatter_kws={'s':222, 'alpha':0.4})
```

[51]: <AxesSubplot:xlabel='horsepower', ylabel='mpg'>



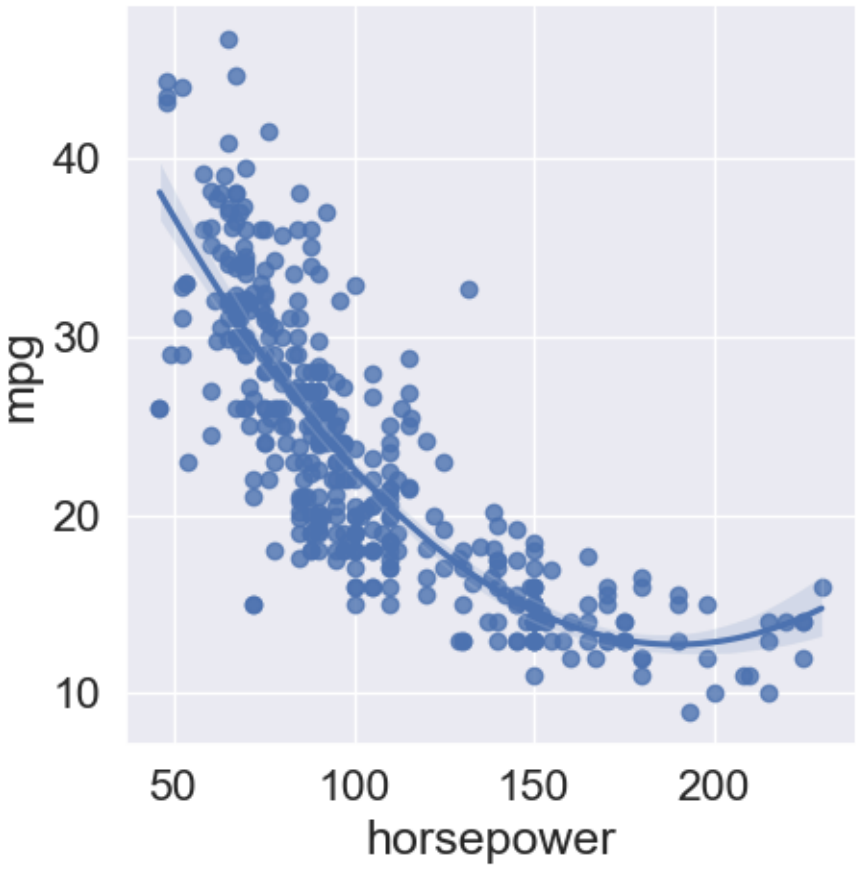
[52]:
```
sns.lmplot(data = mpg, x = "horsepower", y = "mpg")
```

[52]:
```
<seaborn.axisgrid.FacetGrid at 0x1da4e8385b0>
```



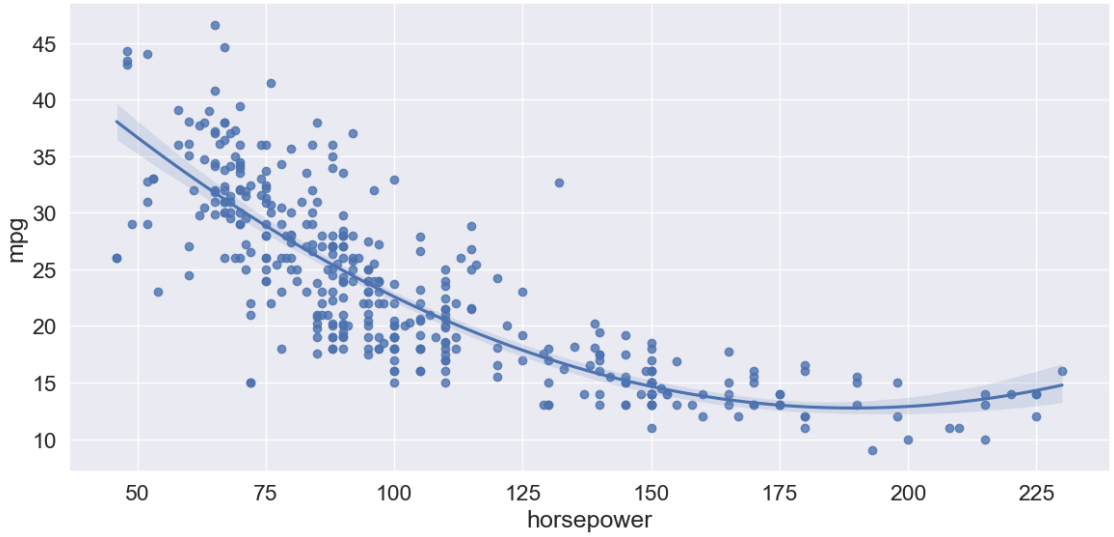
[53]:
```
sns.lmplot(data = mpg, x = "horsepower", y = "mpg", order = 2)
```

[53]:
```
<seaborn.axisgrid.FacetGrid at 0x1da4ef40550>
```



[54]:
```
sns.lmplot(data = mpg, x = "horsepower", y = "mpg", order = 2, height=6,␣
↪aspect=2)
```

[54]: <seaborn.axisgrid.FacetGrid at 0x1da4e78c190>



1.0.9 Multiple relationships

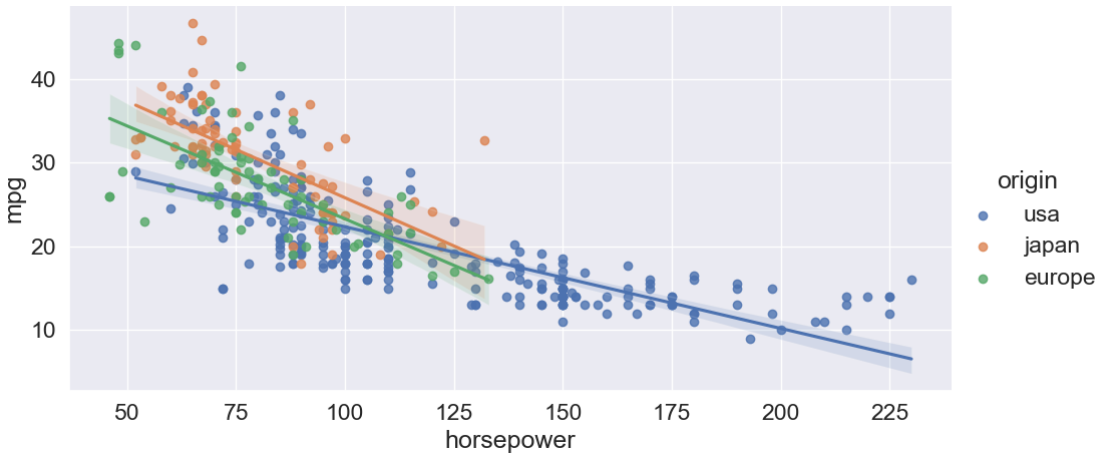
[55]:
```
mpg.head()
```

[55]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	model_year	origin	name
0	18.0	8	307.0	130.0	3504	12.0	70	usa	chevrolet chevelle malibu
1	15.0	8	350.0	165.0	3693	11.5	70	usa	buick skylark 320
2	18.0	8	318.0	150.0	3436	11.0	70	usa	plymouth satellite
3	16.0	8	304.0	150.0	3433	12.0	70	usa	amc rebel sst
4	17.0	8	302.0	140.0	3449	10.5	70	usa	ford torino

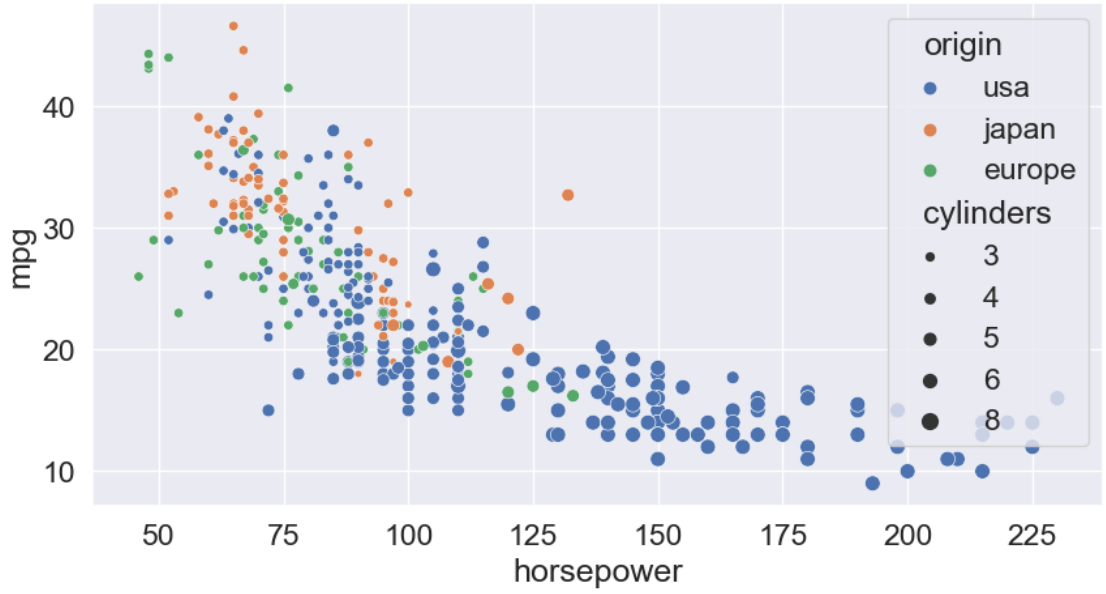
[56]:
```
sns.lmplot(data = mpg, x = "horsepower", y = "mpg", hue = "origin", height=5,␣
↪aspect=2)
```

[56]:
```
<seaborn.axisgrid.FacetGrid at 0x1da4fc77250>
```



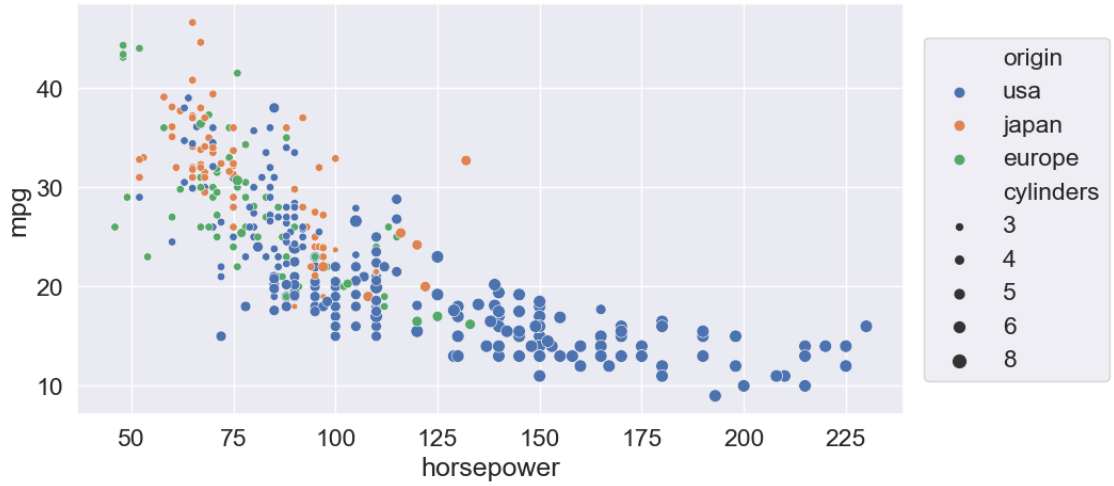
[57]:
```
sns.scatterplot(data = mpg, x = "horsepower", y = "mpg", hue = "origin", size =␣
↪"cylinders")
```

[57]: <AxesSubplot:xlabel='horsepower', ylabel='mpg'>



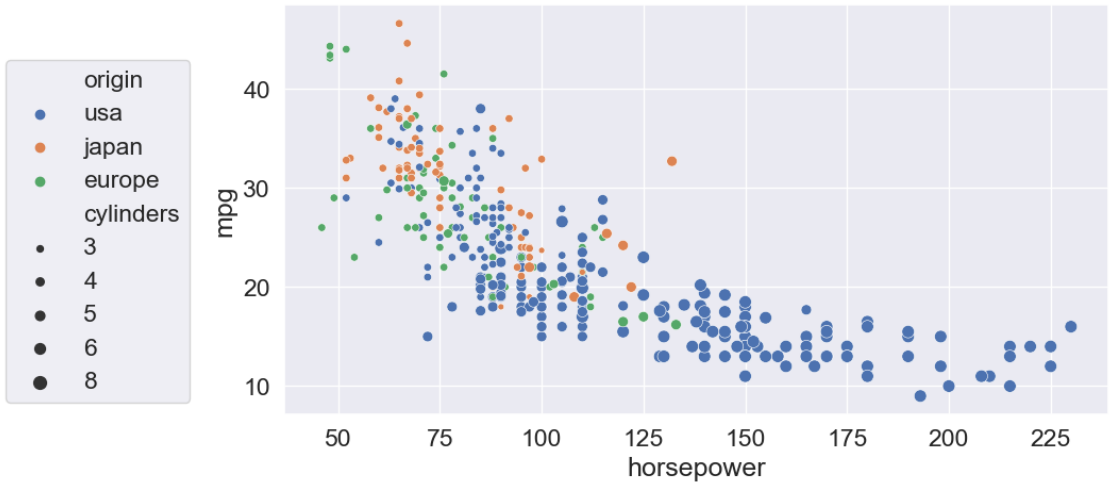
[58]:
```
sns.scatterplot(data = mpg, x = "horsepower", y = "mpg", hue = "origin", size =␣
↪"cylinders")
plt.legend(loc='center left', bbox_to_anchor=(1.01, 0.5), ncol=1)
```

[58]: <matplotlib.legend.Legend at 0x1da4fd17310>



[59]:
```
my_graph = sns.scatterplot(data = mpg, x = "horsepower", y = "mpg", hue =␣
↪"origin", size = "cylinders")
my_graph.legend(loc='lower right', bbox_to_anchor=(-0.1, 0.0), ncol=1)
```

[59]: <matplotlib.legend.Legend at 0x1da51857280>



[ ]: