Lab 3

September 19, 2021

In this lab we discuss some tools for data visualization in Python.

1 Import necessary Python libraries

matplotlib.pyplot: https://matplotlib.org/3.1.1/gallery/index.html

Seaborn: https://seaborn.pydata.org/examples/index.html

[1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from numpy import percentile
%matplotlib inline
```

2 Import the data

pd.read_csv: https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.read_csv.html

[2]:

```
# Read .csv data
possum = pd.read_csv("possum.csv")
# The possum dataset consists of morphometric measurements on 46 possums.
# The head() function is used to get the first 5 rows.
possum.head()
```

[2]:

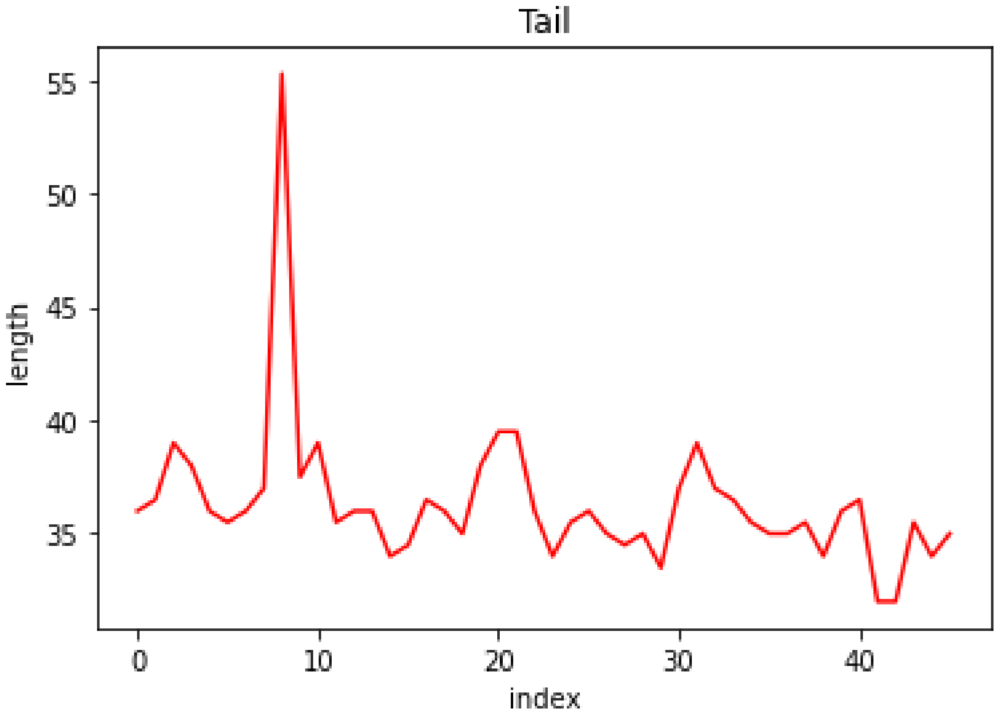
```
  sex  age  headL  skullW  totalL  tailL
0   m    8   94.1    60.4    89.0   36.0
1   f    6   92.5    57.6    91.5   36.5
2   f    6   94.0    60.0    95.5   39.0
3   f    6   93.2    57.1    92.0   38.0
4   f    2   91.5    56.3    85.5   36.0
```

3 Data visualization

3.1 Line plots

plt.plot: https://matplotlib.org/3.3.3/api/_as_gen/matplotlib.pyplot.plot.html

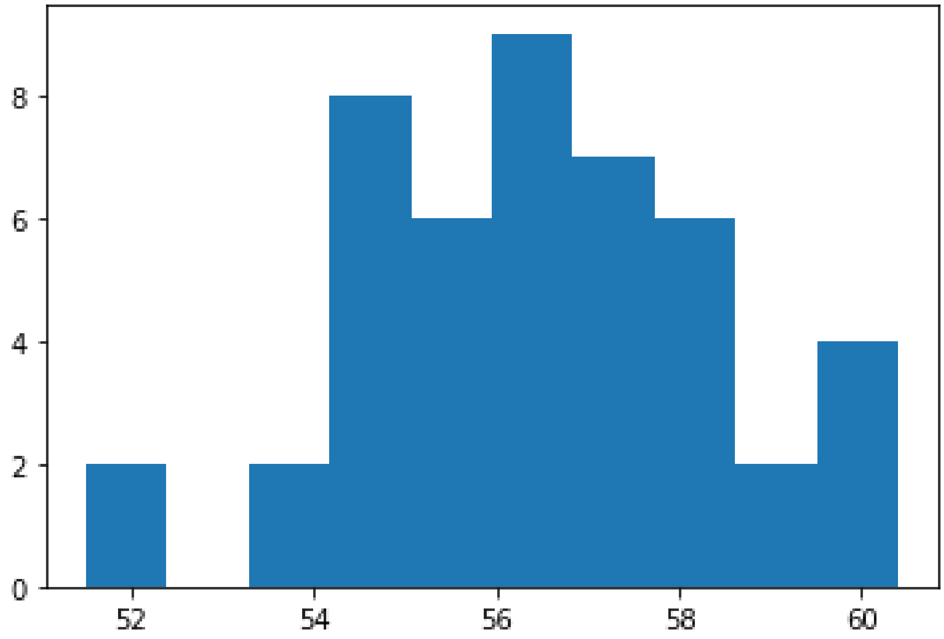
[3]:
```
# Plotting tailL (tail length) versus index
plt.plot(possum["tailL"], color = "red")

# Adding title and labels
plt.title("Tail")
plt.xlabel("index")
plt.ylabel("length")
plt.show()
```



3.2 Histograms

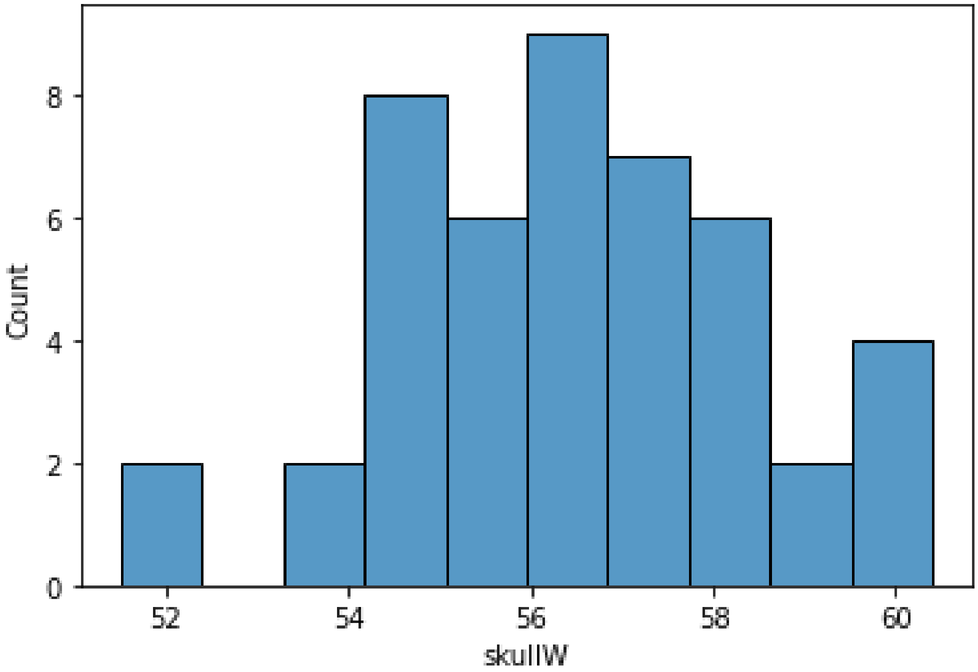
plt.hist: https://matplotlib.org/3.1.1/api/_as_gen/matplotlib.pyplot.hist.html

[4]:
```
# Plotting the histogram for skullW (skull width)
# A histogram represents a frequency distribution by means of rectangles whose␣
 ↪widths represent class intervals
# and whose areas are proportional to the corresponding frequencies.
plt.hist(possum['skullW'], bins = 10)
plt.show()
```



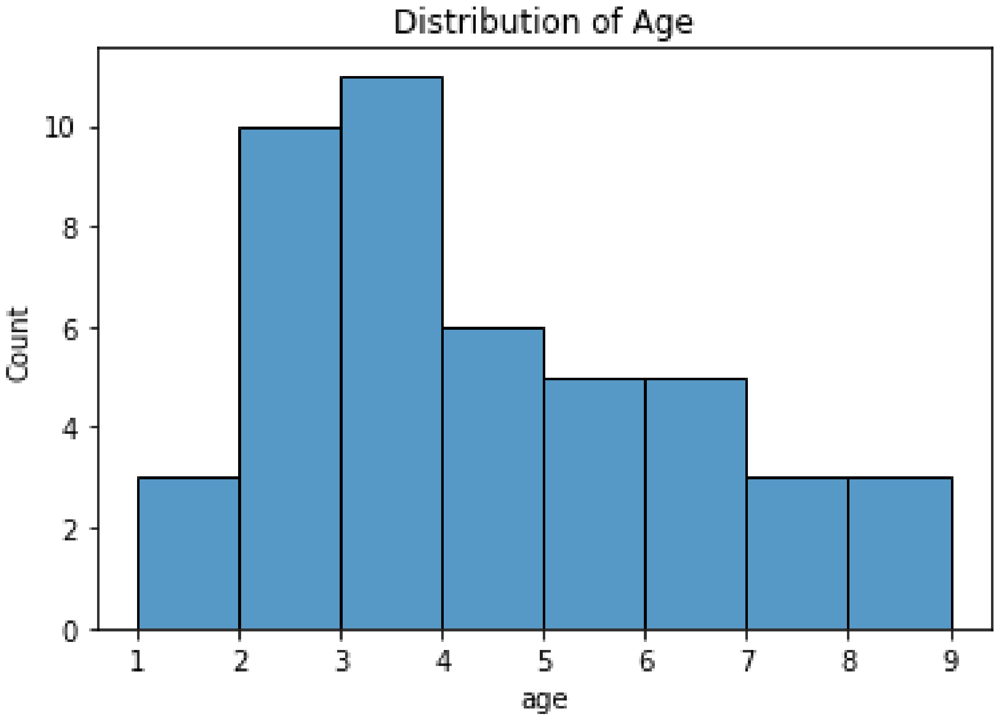
Doing the histogram using the library seaborn: sns.histplot: https://seaborn.pydata.org/generated/seaborn.histplot.html

```
[5]: sns.histplot(data=possum, x="skullW",bins=10) # it looks much better!
     plt.show()
```



[6]:

```
# Plotting the histogram/distribution for age
sns.histplot(data = possum["age"], binwidth = 1)
plt.title("Distribution of Age")
plt.xlabel("age")
plt.show()
```

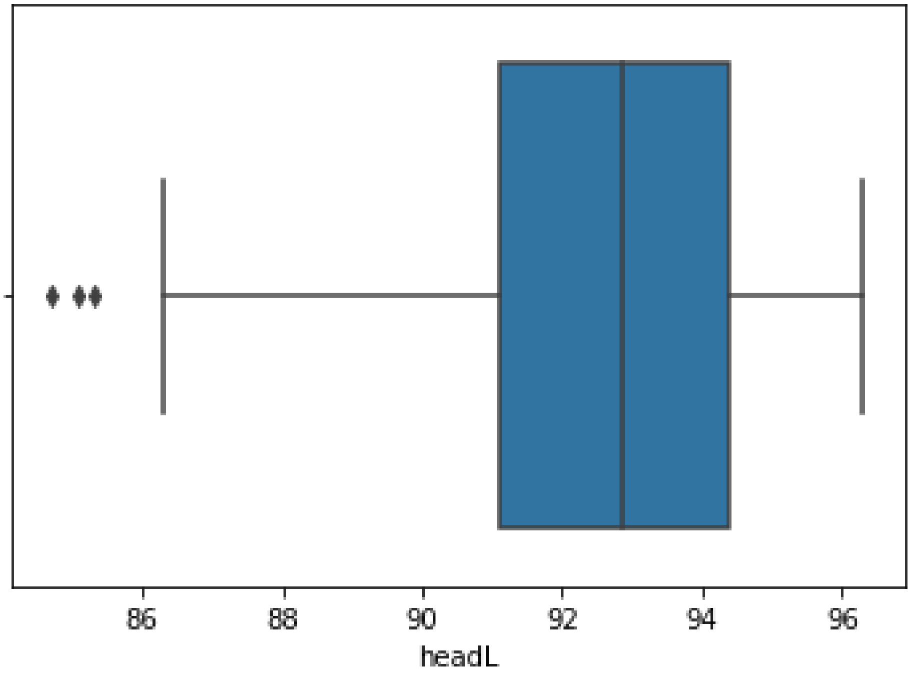


3.3 Boxplots

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

[7]:

```
# Plotting the boxplot for headL (head length)
# A boxplot is a graph that gives you a good indication of how the values in␣
 ↪the data are spread out.
sns.boxplot(x = possum["headL"])
plt.show()
```



4 Five-number Summary

[8]:
```
# Obtaining the 5-number summary for headL (head length)
# The five-number summary is a set of descriptive statistics that provides␣
↪information about a dataset.
# It consists of the five most important sample percentiles:
# 1. the sample minimum (smallest observation)
# 2. the lower quartile or first quartile
# 3. the median (the middle value)
# 4. the upper quartile or third quartile
# 5. the sample maximum (largest observation)
quartiles = percentile(possum["headL"], [25, 50, 75])
minimum = np.min(possum["headL"])
maximum = np.max(possum["headL"])
print('Min:', minimum)
print('Q1:', quartiles[0])
print('Median:', quartiles[1])
print('Q3:', quartiles[2])
print('Max:', maximum)
```

```
Min: 84.7
Q1: 91.1
Median: 92.85
Q3: 94.4
```

```
Max: 96.3
```

4.1 Mean and standard deviation

[9]:

```
# Obtaining the mean and standard deviation for headL (head length)
mean = np.mean(possum["headL"])
standard_devaiation = np.std(possum["headL"], ddof = 1)
print('Mean:', mean)
print('Standard Deviation', standard_devaiation)
```

```
Mean: 92.31086956521742
Standard Deviation 2.929332746234926
```

[10]:

```
# Alternative way to get those numbers for headL (head length)
possum["headL"].describe()
```

[10]:

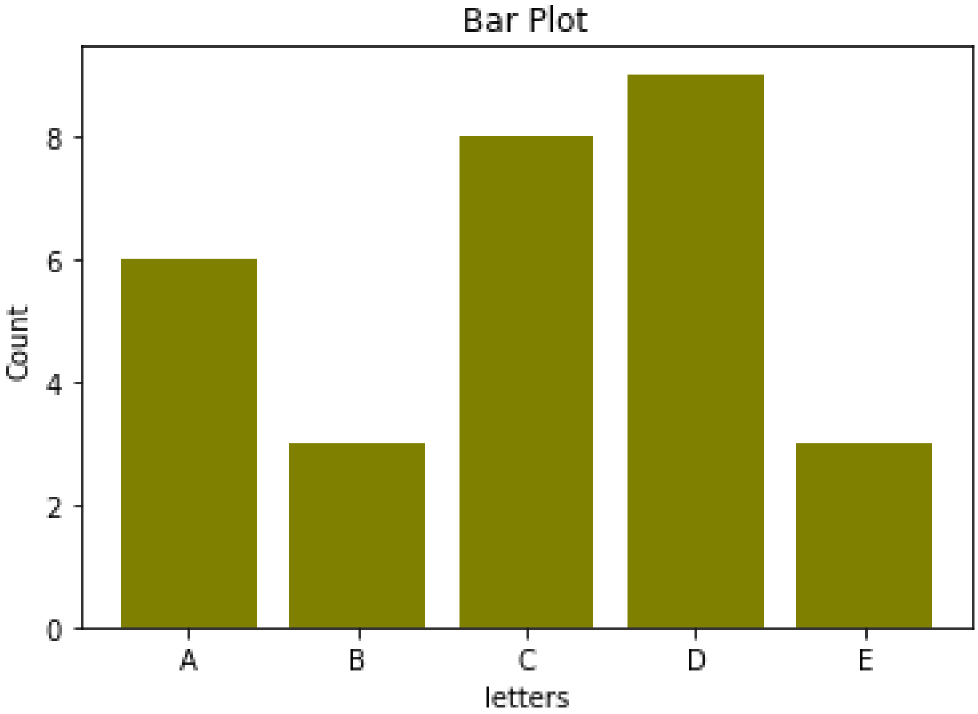
```
count    46.000000
mean     92.310870
std       2.929333
min      84.700000
25%      91.100000
50%      92.850000
75%      94.400000
max      96.300000
Name: headL, dtype: float64
```

5 Other Types of Plots - Bar Plots and Pie Charts

plt.bar : https://matplotlib.org/stable/api/_as_gen/matplotlib.pyplot.bar.html

[11]:

```
# Plotting a simple bar plot
# A bar plot is a plot that presents categorical data with rectangular bars
# with heights proportional to the values that they represent.
data = {'A':6, 'B':3, 'C':8, 'D':9, 'E':3}
letters = list(data.keys())
values = list(data.values())
plt.bar(letters, values, color = 'olive')
plt.xlabel('letters')
plt.ylabel('Count')
plt.title('Bar Plot')
plt.show()
```



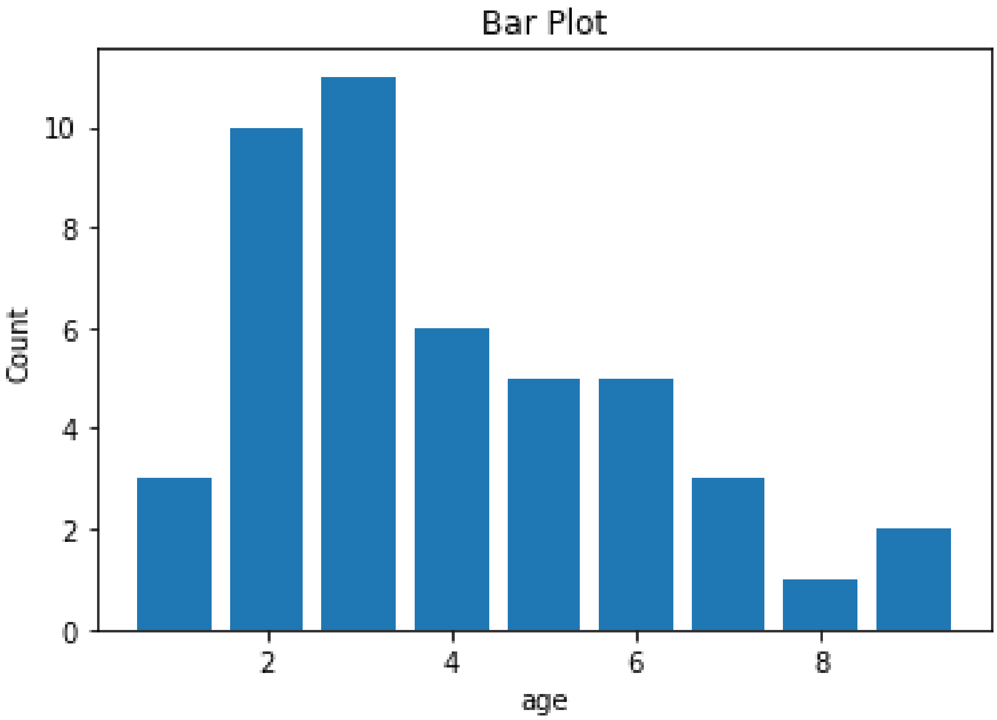
[12]:
```
# Getting back to the possum dataset
# The code below returns the unique values for age.
# unique() is used to find the unique elements of an array.
np.sort(possum["age"].unique())
```

[12]:
```
array([1, 2, 3, 4, 5, 6, 7, 8, 9])
```

[13]:
```
# The code below returns the counts for each value of age.
# value_counts() returns a Series containing counts of unique values.
possum["age"].value_counts(sort = False)
```

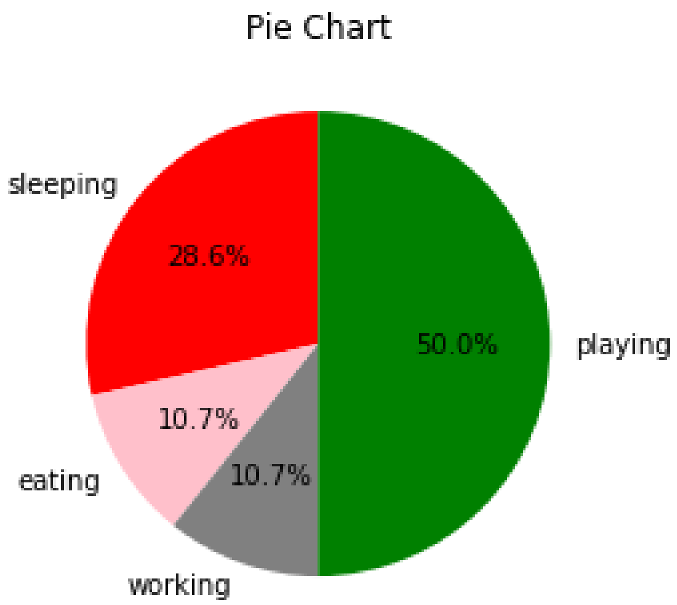
[13]:
```
1     3
2    10
3    11
4     6
5     5
6     5
7     3
8     1
9     2
Name: age, dtype: int64
```

```
[14]: # Plotting the bar plot for age
      plt.bar(np.sort(possum["age"].unique()), possum["age"].value_counts(sort =␣
       ↪False))
      plt.xlabel('age')
      plt.ylabel('Count')
      plt.title('Bar Plot')
      plt.show()
```



plt.pie : https://matplotlib.org/stable/api/_as_gen/matplotlib.pyplot.pie.html

```
[15]: # Plotting the pie chart for different activities
      # A pie chart is a circular statistical graphic which is divided into slices to␣
       ↪illustrate numerical proportion.
      sizes = [8, 3, 3, 14]
      activities = ['sleeping', 'eating', 'working', 'playing']
      colors = ['red', 'pink', 'gray', 'green']
      plt.pie(sizes, labels = activities, colors = colors, startangle = 90, autopct =␣
       ↪'%1.1f%%')
      plt.title('Pie Chart')
      plt.show()
```



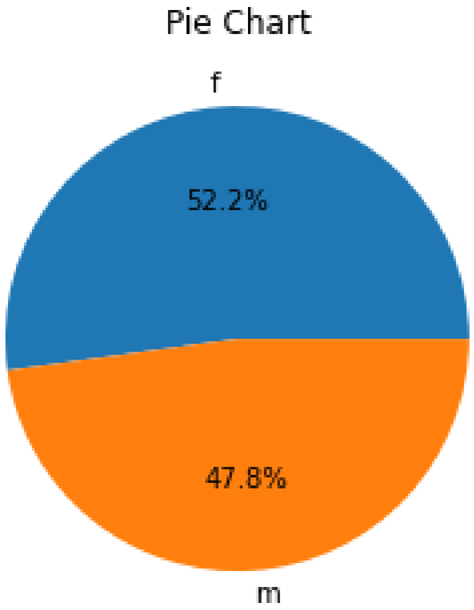
```
[16]: # Getting back to the possum dataset
      # The code below returns the unique values.
      # unique() is used to find the unique elements of an array.
      np.sort(possum["sex"].unique())
```

```
[16]: array(['f', 'm'], dtype=object)
```

```
[17]: # The code below returns the counts for each value.
      # value_counts() returns a Series containing counts of unique values.
      possum["sex"].value_counts(sort = True)
```

```
[17]: f    24
      m    22
      Name: sex, dtype: int64
```

```
[18]: # Plotting the pie chart
      plt.pie(possum["sex"].value_counts(sort = True), labels = np.sort(possum["sex"].
       ↪unique()), autopct = '%1.1f%%')
      plt.title('Pie Chart')
      plt.show()
```


Pie Chart
f
52.2%
47.8%
m