Introduction to Matplotlib using Python for Beginners

What is Matplotlib?

Matplotlib is a popular plotting library in Python used for creating high-quality visualizations and graphs. It offers various tools to generate diverse plots, facilitating data analysis, exploration, and presentation. Matplotlib is flexible, supporting multiple plot types and customization options, making it valuable for scientific research, data analysis, and visual communication. It can create different types of visualization reports like line plots, scatter plots, histograms, bar charts, pie charts, box plots, and many more different plots. This library also supports 3-dimensional plotting.

Installation of Matplotlib

Let's check how to set up Matplotlib in Google Colab. Colab Notebooks are similar to Jupyter Notebooks except they run on the cloud. It is also connected to our Google Drive, making it much easier to access our Colab notebooks anytime, anywhere, and on any system. You can install Matplotlib by using the PIP command:

```
!pip install matplotlib
```

To verify the installation, you would have to write the following code chunk:

```
import matplotlib
print(matplotlib.__version__)
```

Types of Plots in Matplotlib

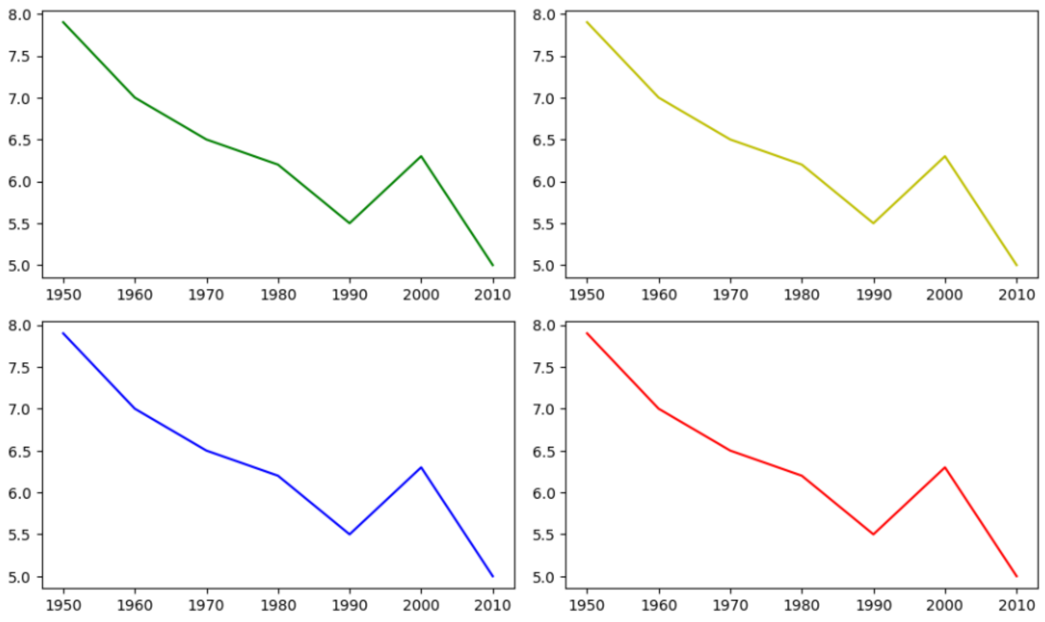
Now that you know what Matplotlib function is and how you can install it in your system, let's discuss different kinds of plots that you can draw to analyze your data or present your findings.

Sub Plots

`subplots()` is a Matplotlib function that displays multiple plots in one figure. It takes various arguments such as many rows, columns, or sharex, sharey axis.

```
# First create a grid of plots
fig, ax = plt.subplots(2,2,figsize=(10,6))
```

```
ax[0][0].plot(x1, np.sin(x1), 'g')
ax[0][1].plot(x1, np.cos(x1), 'y')
ax[1][0].plot(x1, np.sin(x1), 'b')
ax[1][1].plot(x1, np.cos(x1), 'red')
plt.tight_layout()
plt.show()
```



Now, let's check the different categories of plots that Matplotlib provides.

1. Line plot
2. Histogram
3. Bar Chart
4. Scatter plot
5. Pie charts
6. Boxplot

Most of the time, we have to work with Pyplot as an interface for Matplotlib. So, we import Pyplot like this:

import matplotlib.pyplot

To make things easier, we can import it like this: import matplotlib. pyplot as plt

Line Plots

A line plot shows the relationship between the x and y-axis. The plot() function in the Matplotlib library's Pyplot module creates a 2D hexagonal plot of x and y coordinates. plot() will take various arguments like plot(x, y, scalex, scaley, data, **kwargs).

x, y are the horizontal and vertical axis coordinates where x values are optional, and its default value is range(len(y)).

scalex, scaley parameters are used to autoscale the x-axis or y-axis, and its default value is actual.

****kwargs** specify the property like line label, linewidth, marker, color, etc.

Code:

```
x1 = np.linspace(0, 10, 100)
plt.plot(x1, np.sin(x1), '-', color='orange')
plt.plot(x1, np.cos(x1), '--', color='blue')
plt.xlabel('x label')
plt.ylabel('y label')
plt.title('Title')
plt.show()
```

Histogram

The most common graph for displaying frequency distributions is a histogram. To create a histogram, the first step is to create a bin of ranges, then distribute the whole range of values into a series of intervals and count the value that will fall in the given interval. We can use plt.Hist () function plots the histograms, taking various arguments like data, bins, color, etc.

x: x-coordinate or sequence of the array

bins: integer value for the number of bins wanted in the graph

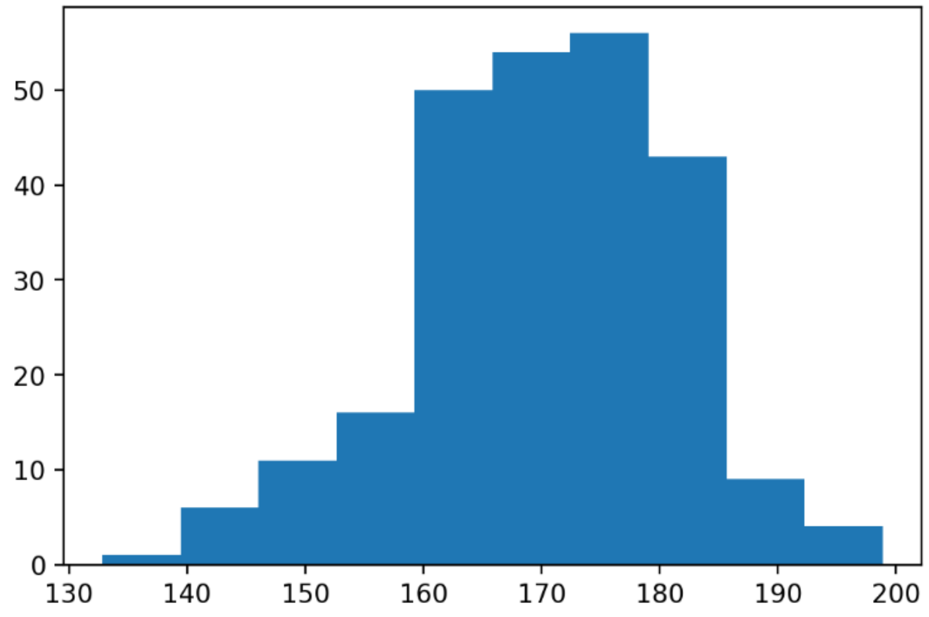
range: the lower and upper range of bins

density: optional parameter that contains boolean values

histtype: optional parameter used to create different types of histograms like:-bar bar stacked, step, step filled, and the default is a bar

Code:

```
#draw random samples from random distributions.
x = np.random.normal(170, 10, 250)
#plot histograms
plt.hist(x) plt.show()
```



Bar Plot

Mainly, the barplot shows the relationship between the numeric and categoric values. In a bar chart, we have one axis representing a particular category of the columns and another axis representing the values or counts of the specific category. Barcharts are plotted both vertically and horizontally and are plotted using the following line of code:

plt.bar(x,height,width,bottom,align)

x: representing the coordinates of the x-axis

height: the height of the bars

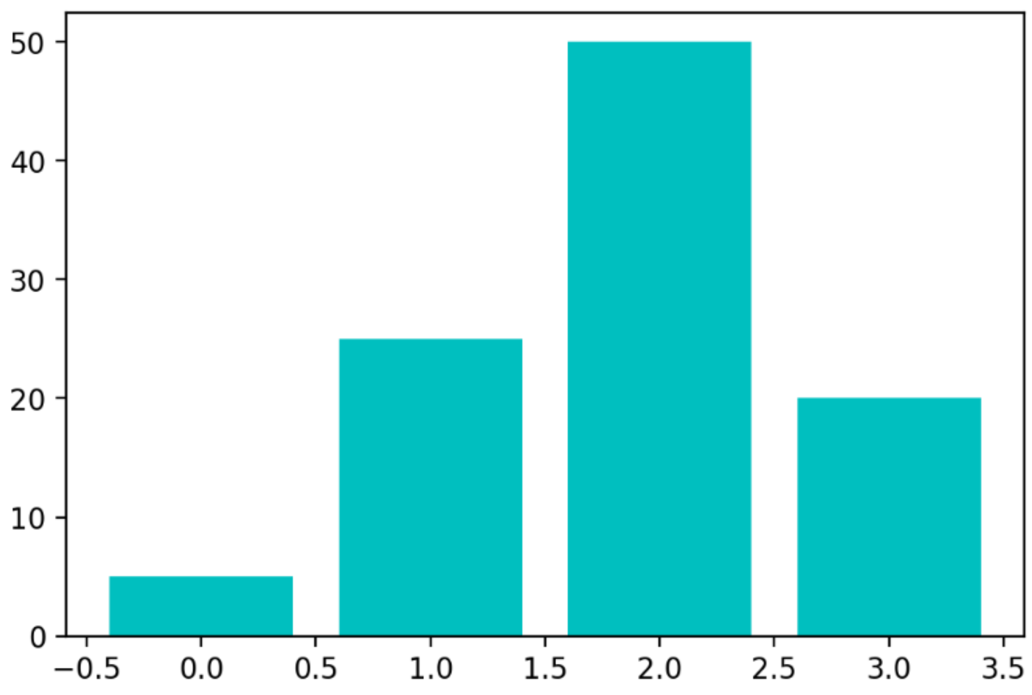
width: width of the bars. Its default value is 0.8

bottom: It's optional. It is a y-coordinate of the bar. Its default value is None

align: center, edge its default value is center

Code:

```
#define array
data= [5. , 25. , 50. , 20.]
plt.bar(range(len(data)), data,color='c')
plt.show()
```



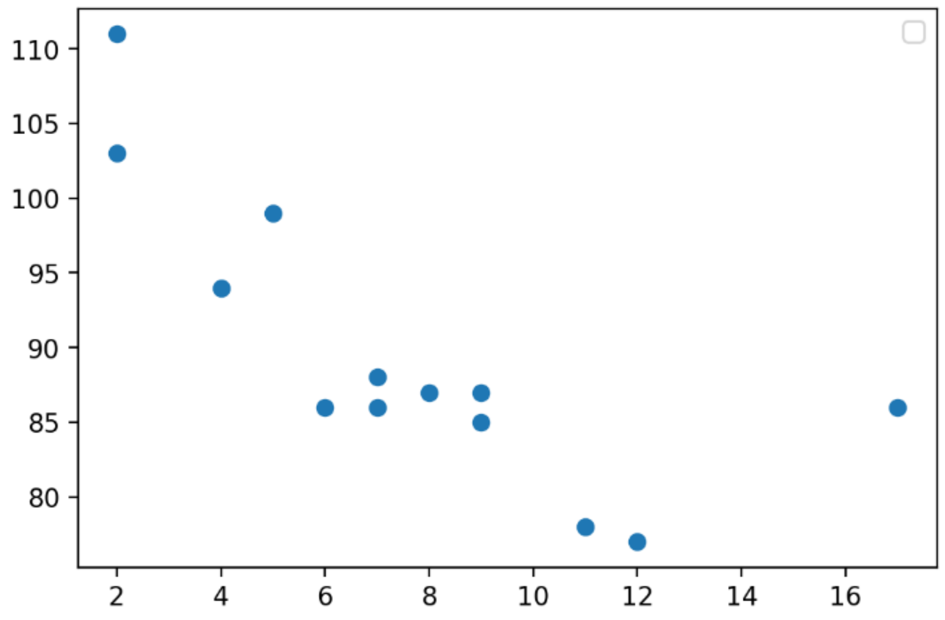
Scatter Plot

Scatter plots are used to show the relationships between the variables and use the dots for the plotting or to show the relationship between two numeric variables.

The **scatter()** method in the **Matplotlib** library is used for plotting.

Code:

```
#create the x and y axis coordinates

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])

y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])

plt.scatter(x, y)

plt.legend()

plt.show()
```



Pie Chart

A pie chart (or circular chart) is used to show the percentage of the whole. Hence, it is used to compare the individual categories with the whole. Pie() will take the different parameters such as:

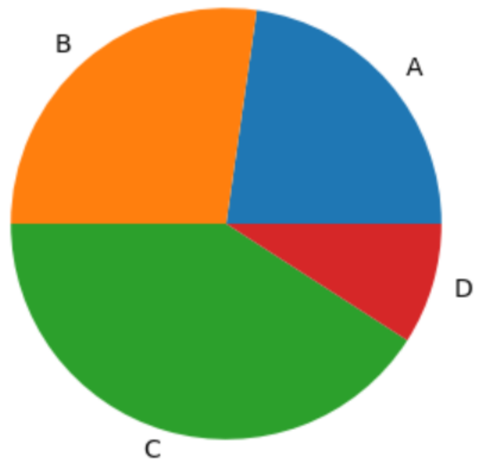
x: Sequence of an array

labels: List of strings which will be the name of each slice in the pie chart

Autopct: It is used to label the wedges with numeric values. The labels will be placed inside the wedges. Its format is %1.2f%

Code:

```
 #define the figure size

plt.figure(figsize=(7,7))

x = [25,30,45,10]

#labels of the pie chart

labels = ['A','B','C','D']

plt.pie(x, labels=labels)

plt.show()
```



Box Plot

A Box plot in Python Matplotlib showcases the dataset's summary, encompassing all numeric values. It highlights the minimum, first quartile, median, third quartile, and maximum. The median lies between the first and third quartiles. On the x-axis, you'll find the data values, while the y-coordinates represent the frequency distribution.

Parameters used in box plots are as follows:

data: NumPy array

vert: It will take boolean values, i.e., true or false, for the vertical and horizontal plot. The default is True

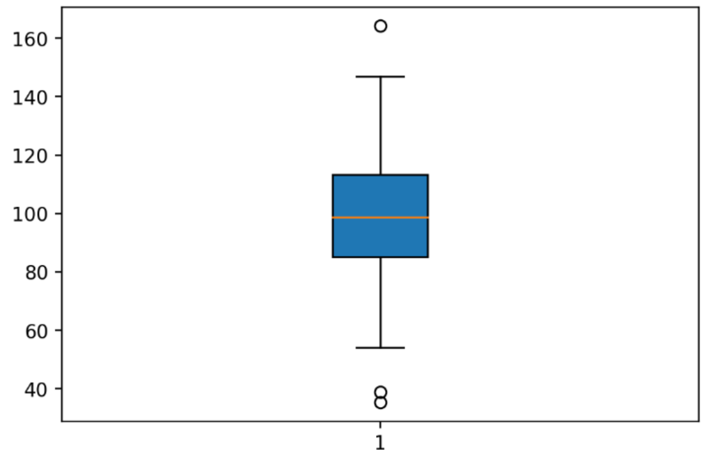
width: This will take an array and sets of the width of boxes. Optional parameters

Patch_artist: It is used to fill the boxes with color, and its default value is false

labels: Array of strings which is used to set the labels of the dataset

Code:

```
#create the random values by using numpy
values= np.random.normal(100, 20, 300)
#creating the plot by boxplot() function which is avilable in matplotlib
plt.boxplot(values,patch_artist=True,vert=True)
plt.show()
```



Area Chart

An area chart or plot is used to visualize the quantitative data graphically based on the line plot. **fill_between()** function is used to plot the area chart.

Parameter:

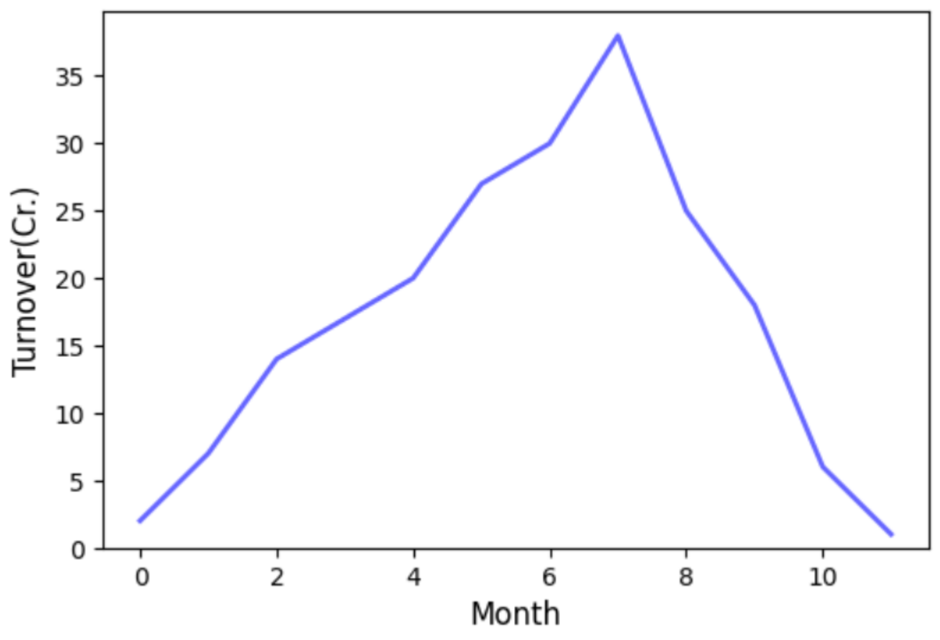
x,y represent the x and y coordinates of the plot. This will take an array of length n.

Interpolate is a boolean value and is optional. If true, interpolate between the two lines to find the precise point of intersection.

****kwargs**: alpha, color, face color, edge color, linewidth.

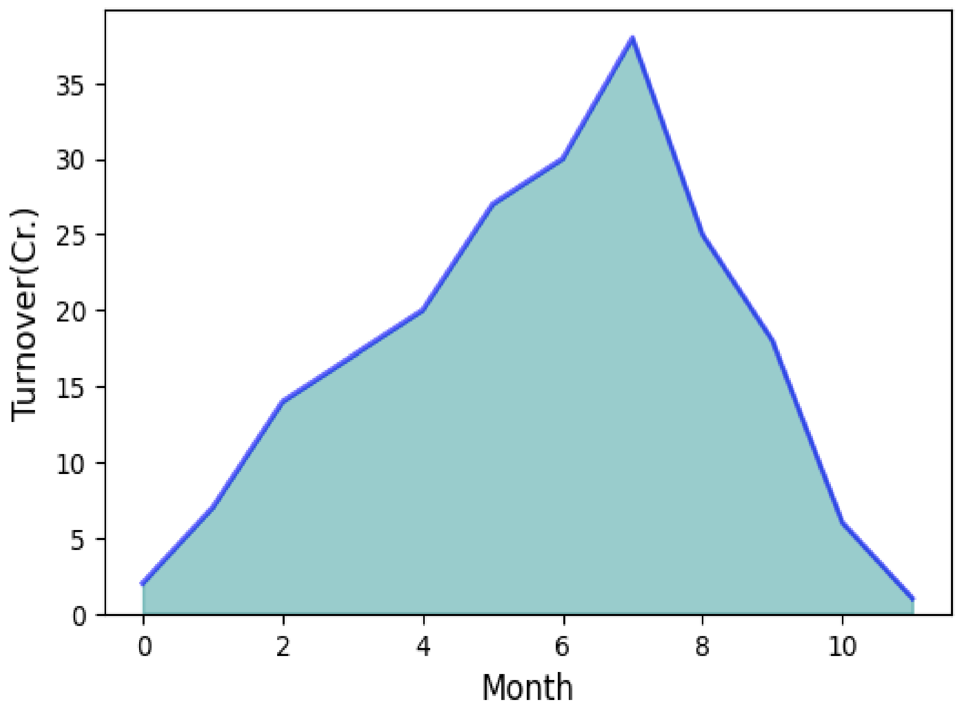
Code:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
y = [2, 7, 14, 17, 20, 27, 30, 38, 25, 18, 6, 1]
#plot the line of the given data
plt.plot(np.arange(12),y, color="blue", alpha=0.6, linewidth=2)
#decorate thw plot by giving the labels
plt.xlabel('Month', size=12)
plt.ylabel('Turnover(Cr.)', size=12) #set y axis start with zero
plt.ylim(bottom=0)
plt.show()
```



Fill the area in a line plot using fill_between() for the area chart.

plt.fill_between(np.arange(12), turnover, color="teal", alpha=0.4)



Word Cloud

Wordcloud is the visual representation of the text data. Words are usually single, and the font size or color shows the importance of each word. The word cloud () function is used to create a word cloud in Python.

The word cloud**()** will take various arguments like:

width: set the width of the canvas .default 400

height: set the height of the canvas .default 400

max_words: number of words allowed. Its default value is 200.

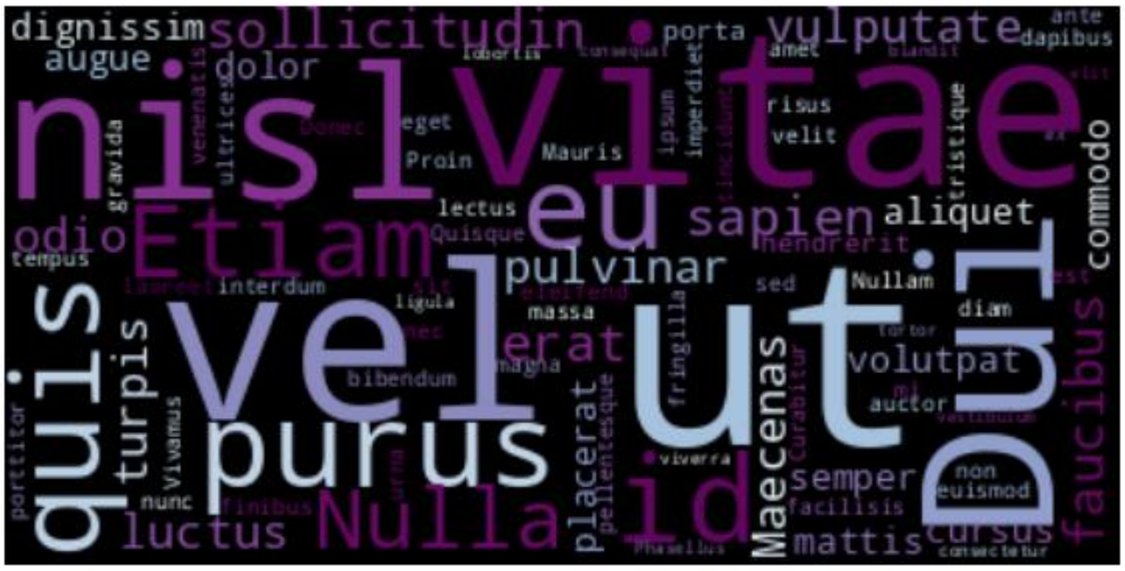
background_color: background color for the word-cloud image. The default color is black.

Once the word cloud object is created, you can call the generate function to generate the word cloud and pass the text data.

Code:

```
#import the libraries

from wordcloud import WordCloud

import matplotlib.pyplot as plt

from PIL import Image

import numpy as np

#set the figure size .

plt.figure(figsize=(10,15))

#dummy text.

text = '''Nulla laoreet bibendum purus, vitae sollicitudin sapien facilisis at.

        ----.'''

wordcloud = WordCloud( margin=0,colormap='BuPu').generate(text)
```

```
#imshow() function in pyplot module of matplotlib library is used to display data as an image.

plt.imshow(wordcloud, interpolation='bilinear')

plt.axis('off')

plt.margins(x=0, y=0)

plt.show()
```


nisl
vitae
vel
ut
Dui
purus
quis
Etiam
eu
id
Nulla
sollicitudin
vulputate
dignissim
augue
dolor
sapien
aliquet
pulvinar
odio
turpis
erat
Maecenas
volutpat
faucibus
commodo
placerat
luctus
mattis
cursus
semper