# Department of Computer Engineering
# University of Peradeniya

## CO 544 Machine Learning and Data Mining

Lab 04

$28^{th}$ of May 2020

## 1. Objective

Provide students a hands on experience to *Matplotlib* Python module.

## 2. Introduction

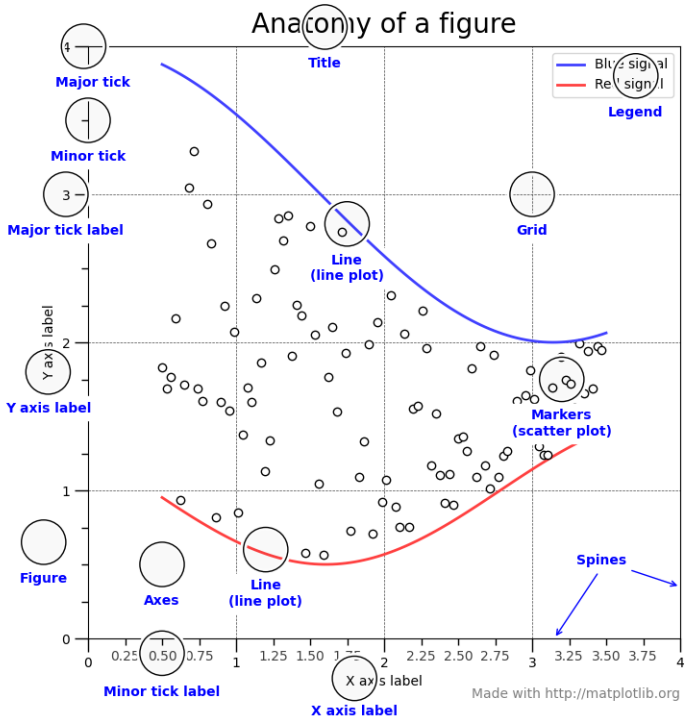
Making plots and visualizations are one of the most important tasks in data mining and machine learning. It may be a part of the exploratory process; for example, identify outliers, data transformations, or coming up with ideas for models. Matplotlib is a Python package which provides a wide variety of plot types such as lines, bars, pie charts and histograms.

## 3. Matplotlib

### (a) Importing Matplotlib

```
import matpltolib    #importing Matplotlib module
import matplotlib.pyplot as plt   #pyplot is a collection of command style functions
from mpl_toolkits import mplot3d  #importing modules for 3D plotting
```

### (b) Fundamendals of plotting



```
plt.plot([1,2,3,4,5],[1,4,9,16,25])     #sample scatter plot
plt.show()     #display the plot
```

(c) Figures and Subplots

```
t = np.arange(0., 5., 0.2)

fig = plt.figure(figsize =(10 , 10))    #creating a figure
fig.subplots_adjust(hspace =1.0)

axes_1 = plt.subplot (4,1, 1)    #first axes in the figure

plt.plot(t, t,'r^',markersize=8,label='line1')   #plotting with red marker '^'

legend = plt.legend(loc='upper right', shadow=True,fontsize='x-large') #adding the legend
plt.title('First Plot')    #adding the title
plt.xlabel('t')      #labeling x axis
plt.ylabel('t')      #labeling y axis
plt.xlim([0,10])     #limits of x axis

axes_2 = plt.subplot (4,1,2)     #second axes in the figure
plt.plot(t, t**2, 'b*',markersize=8)    #plotting
axes_2.set_title('Second Plot')      #adding the title
axes_2.set_xlabel('t')     #labeling x axis
axes_2.set_ylabel('t squred')     #labeling y axis
axes_2.set_ylim([0 ,40])    #limits of y axis
```

(d) Saving plots to file

```
plt.savefig('plot1.pdf')       #saving the plot as a pdf
plt.savefig('plot1.png',dpi =400,bbox_inches ='tight')
plt.savefig('plot1.jpg')       #saving the plot as a jpg file
plt.savefig('plot11.jpg', dpi=100, quality=50, optimize=True, progressive=True) #jpg options
```

(e) 3D plots

```
fig = plt.figure()      #creating a figure
ax = fig.add_subplot(311, projection='3d')      #creating 3D subplot

xs=([29, 24, 25, 23, 30 ,31, 26, 26, 30, 28])
ys=([ 7, 53 , 33 , 66,  1 ,11, 91, 51, 83,  6])
zs=([-25, -25, -19, -23,-6,  -9, -11 , -11,-5, 14])

ax.scatter(xs, ys, zs, c='r', marker='o')

ax.set_xlabel('X Label')
ax.set_ylabel('Y Label')
ax.set_zlabel('Z Label')
```

**TODO 1:** Explain the reason to set,

```
fig.subplots_adjust(hspace =1.0)
```

in part (c).

**TODO 2:** Visualize the 3D plot in part(e) in a different angle.

### Lab Excercise

(a) Import the **wine dataset** from **scikit learn** standard datasets.

(b) Perfrom a Principal Component Ananlysis with 3 components.Use the following code segment to import PCA from scikit learn.

```
from sklearn.decomposition import PCA
```

(c) Visualize the PCA in a 3D plot with well separated class (each class visualize with different colours). Your figure must contain a title, axis labels and a legend.

## 4. Submission

Submit a Python file with source code and a pdf file with answers to **TODOs** and the lab exercise. Name it as **e15xxxlab4** where **xxx** is your registration number.