Enhanced visualization: assignment 8
Graphics in matplotlib

I. Matplotlib basic features

In this part we will study basic Matplotlib commands to generate graphics. This part is based on a tutorial which you can find at `https://www.labri.fr/perso/nrougier/teaching/matplotlib/`.

Download the notebook *assignment8.ipynb* from *moodle*.

A. Understanding the command lines. Read and run the code up to the indicated the cells and answer to the questions:

1. Cell #2: what does the *dpi* parameter control in *figure(.)*?

2. Cell #2: how can you save a graphic in png or pdf format?

3. Cell #4: where can we indicate the text to be displayed at the x tick labels?

4. Cell #5: what are the graphic spines?

5. Cell #5: why are the right and top spines set to *none*?

6. Cell #6: what do the parameters *loc* and *frameon* control?

7. Cell #7: how do you change the annotation text and annotation offset position?

8. Cell #7: how do you change the array style to a straight arrow?

9. Cell #9: what are the 4 first parameters of *fill_between(.)*?

10. Cell #10: how can you modify this graph to add annotations indicating the values of the lower bars?

11. Cell #11: uncomment the corresponding command line of the function *contour(.)*. What does it do?

12. Cell #11: how do you add labels to the contours?

13. Cell #11: how do you change the color map?

14. Cell #12: what are the parameters that have to be passed to *pie(.)* to do the following:

    (a) Display the numerical values of the fractions of each part in percent?

    (b) Display the labels of each part?

(c) Detach one of the slices so that it becomes emphasized?

15. Cell #13: what are the differences between versions 1 and 2 of the box plots?

B. ECG

1. How do you draw a major (bold) and minor (thin) grid in matplotlib?

2. Draw 1 second of ECG signal from the file *ecg.txt* given in the assignment 6 with the same drawing specifications as in that assignment. The graphic should display the R peak of the QRS complex in the center, see `https://en.wikipedia.org/wiki/QRS_complex`.

3. Add x ticks labels and y tick labels

4. Add annotations indicating the Q, R and S waves.

5. Include a graphical indication of the QRS interval time and add an annotation with its length in milliseconds.

II. Geographical displays and earthquakes

Download the notebook *earthquakes.ipynb* from *moodle*.

To run the code install the *folium* package. This can be done through the command *conda install -c conda-forge folium*.

1. After installation, run the notebook. You should see the geographical scatter plot displayed in Figure 1.

2. Read and explain the code.

3. Explore the website `https://earthquake.usgs.gov/earthquakes/feed/v1.0/csv.php` and change the notebook to generate different scatter plots to show the following earthquakes positions which occurred last month:

   • Earthquakes with magnitude greater than 4.5.
   • Earthquakes with magnitude greater than 2.5.
   • Earthquakes with magnitude greater than 1.0.

4. Generate a geographical scatter plot with earthquakes magnitudes being also indicated by a hot color colormap with higher magnitudes in red. Annotate the scatter plot with marker pop-ups indicating the place and the dates of the earthquakes.

5. Search for data on volcanic activity in the last week and add the corresponding geographical positions in the previous scatter plot with black markers.
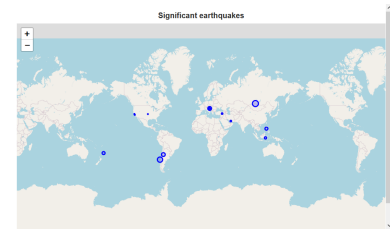

Figure 1: Geographical scatter plot.