**Exercise #4 - Data Visualization**

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**HW instructions:**

* Name your script "hw4\_IDnum1\_IDnum2.m".
* In this exercise you should submit only the Matlab script and the data file for question 4.
* Your data file should be in “.mat” format **with the same name as the script name**!).

**Question 1**

The surface z is defined as a function of x,y:

z = -y .\* (x.^2 - y.^2) ./ (x.^2 + y.^2 + eps);

Use the *meshgrid* function and the *surf* plot. *meshgrid* creates x and y arrays where in x the coordinates change across columns and in y the coordinates change across rows. This provides an easy way to evaluate the function z over the desired range of x and y. You can print the values of arrays x and y in workspace just to get a feeling of how this works.

Important note: In new MATLAB versions, you can calculate the matrix z, using x as a row vector and y as a column vector (or vice versa). If you choose to use this method, be extra careful with the dimensions of the variables!!

1. Prepare a 2\*2 subplots use x and y values between -10 and 10 with the following intervals and attributes:
2. The surface with 0.2 intervals
3. The surface with 0.4 intervals
4. The surface with 0.02 intervals + no edges
5. Create a full contour (use *contourf* function) plot, use 0.05 intervals.
6. Repeat section 1 with x and y values between -3 and 3, and with x, y values between -5 and 5 (use loops to create the same plots with the 3 different ranges, i.e. merge questions 1 and 2).

**Question 2**

Visualize the data shown in the lecture (you can copy the data to your script to create this variable).

Data - Kaplan, Bren et al. Mol Cell. 2008

ara\_bad = [

0.003 0.026 0.104 0.26 0.38 0.464 0.565 0.73 0.858 0.883 0.925 1

0.003 0.007 0.026 0.104 0.26 0.38 0.464 0.507 0.571 0.609 0.609 0.783

0.002 0.002 0.007 0.023 0.063 0.168 0.329 0.418 0.446 0.482 0.496 0.503

0.002 0.002 0.002 0.002 0.003 0.021 0.075 0.147 0.231 0.269 0.275 0.294

0.002 0.002 0.002 0.002 0.002 0.002 0.009 0.054 0.136 0.164 0.198 0.203

0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.004 0.037 0.079 0.124 0.137

0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.03 0.077 0.099

0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.004 0.03 0.077];

1. Create 4 subplots presenting “ara\_bad” using *surf, surfc, bar*3 and *contour*:

* Add appropriate axis labels and titles.
* Do not include x and y ticks for subplots 3 & 4.
* All titles should be bold with font size 12.
* Use *view* to rotate the plots the following way: The first plot should have azimuth of 49.5 degrees, and the second subplot -42.1. The first subplot should have a 23 degrees elevation, and the second 35.
* The figure should be opened in full screen size.

1. What do the colors represent in each of the graphs? Are they all the same?
2. Do you need to create a meshgrid in this question? Why?

**Question 3 - Create a movie from a set of images**

Download the zip file 'images\_dir.zip', and extract it to a folder in your current directory. The zip file contains 50 images. The images were taken in time laps microscopy, every 30 minutes. These are images of human cancer cells responding to chemotherapy drug – added at time point 0.

We would like to create from the series of images a movie.

1. Download the zip file. Extract the image files from the zip file into a new directory. Name the directory “images\_dir”, and put it in your current directory.
2. You'll need to create a loop as shown in class.
3. In each iteration - read one image file and add the frame to the movie.
4. Use the function *dir* to get a list of files in the “images\_dir” directory. Read the documentation of the *dir* function! Use it appropriately so you will get only the images ('tif' files) in your list.
5. In order to read one image file at a time use the following line:

Im=imread(['images\_dir\',dir\_list(ii\_image).name]);

Here we read the i’th image (we use “ii\_image” and not 'i' because i is a complex number in Matlab) file from the list, using the file name and path. We use the function *imread* to read the image into a matrix called “Im”.

1. Insert the following line: Im=imadjust(Im);

This function rescales the image according to the lowest and highest values.

Answer in your code: why do we need to use this function?

1. Use the function *imshow*, to create the image figure in matlab.
2. Use the function *getframe* as shown in class.
3. Outside the loop use the function “movie” as shown in class.
4. Do not use the function *movie2avi*, and do not save the movie you created from your script. You can use *movie2avi* in order to debug your script, but erase/comment-out those lines before submission.

**Question 4 – Visualizing your own data**

In this question you are required to visualize your own experimental data. Choose a data suitable for 2 **different** plot types, (any data matrix can be used here). The plots need to be offer different views of data – not just different graphics (e.g. don’t do a line plot and a scatter plot of the same data). If you don't have appropriate data from your own research you can use any data you wish from the internet or from your friends/lab.

1. Write shortly in a few sentences (not more than 5), explaining the data you chose.
2. Load the data from a file. **You have to submit the data file in \*.mat format with your script!**
3. Create 2 subplots containing the two types of plots that you chose. Choose the type of plot that you think will visualize the data in the most suitable way. Explain in your documentation (up to 2 sentences per subplot) why you think this is the best way to present the data.
4. Make sure you enter appropriate titles, axis labels, axis limits, axis ticks, font size, legend (if needed), etc…
5. Notes:
   1. If your data is not in .mat file format, you should convert your data to .mat format (in a different MATLAB script than the script you are submitting!).
   2. Name the .mat file similar to your script name: "hw4\_<your\_ID\_number>\_**data.mat**".