**Exercise #4 - Data Visualization**

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The mail subject should be:  **'matlab intro 2021b exercise 4'**.

**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 3.
* 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 figure with 2\*2 subplots: use x and y values between -10 and 10 with the following intervals and attributes:
2. The surface with 0.4 intervals
3. The surface with 0.3 intervals
4. The surface with 0.2 intervals + no edges
5. Create a full contour (use *contourf* function) plot, use 0.1 intervals.
6. Repeat section 1 with x and y values between -5 and 5, and also with x, y values between -3 and 3 (you should use loops to create the same plots with the 3 different ranges, i.e. *merge* questions 1 and 2).  
   **Important**: make sure your code does not contain repeating lines of code (“copy+paste”) for the different conditions: arrange your code in such a way that the parts that are shared between conditions are written only once! Tips: You can use nested loops (loop inside loop) and a switch-case block. In addition, you should assign the parameters for the different conditions in an array, and run over this array with a for-loop.

**Question 2 - 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. Read the
4. In each iteration - read one image file and add the frame to the movie.
5. 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.
6. In order to read one image file at a time use the function ‘*imread’*, as follows:

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 3 – Visualizing your own data**

In this question, you are required to visualize your own experimental data. Choose a data suitable for two *different* plot types, (any data matrix can be used here). 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 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! The mat file should have the same name as the script (\*.m) file.**
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 to add appropriate titles, axis labels, axis limits, axis ticks, font size, legend (if needed), etc…
5. **Important notes:**
   1. If your data is not in .mat file format, you should convert your data to .mat format (in a separate MATLAB script than the script you are submitting. Don’t submit the converting script!). Make sure your script load the converted file and not the original data file.
   2. Name the .mat file similar to your script name: "hw4\_<your\_ID\_number>**.mat**".  
      Submissions with a different name will not be evaluated!