Matlab: Arrays, and array operations

IMPORTANT: DO NOT USE FOLLOWING COMMANDS WHILE WORKING ON THIS PROJECT
for loops, while loops, if, else if,

Background

For this project you will have to load the data from the file 'zzp3100.txt'. This file represents the AFM topographic image like the one shown in Figure 1 below. Each pixel in this Matlab surface image plot represents the value of the topography of the particular point on the surface imaged by AFM. The image data are organized in square matrix with m x m dimensions where each pixel is defined by its position in the matrix (row and column) and by its value of the surface height.

Figure 1.

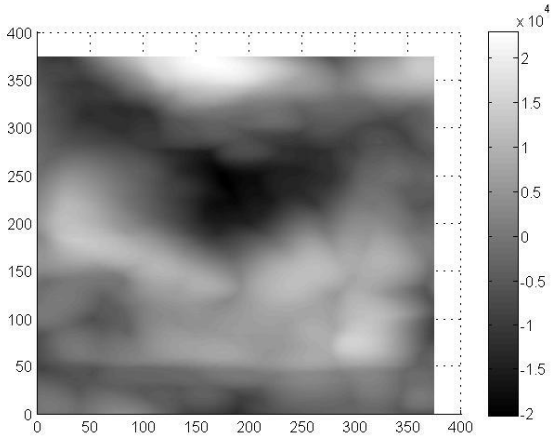


Figure 2.

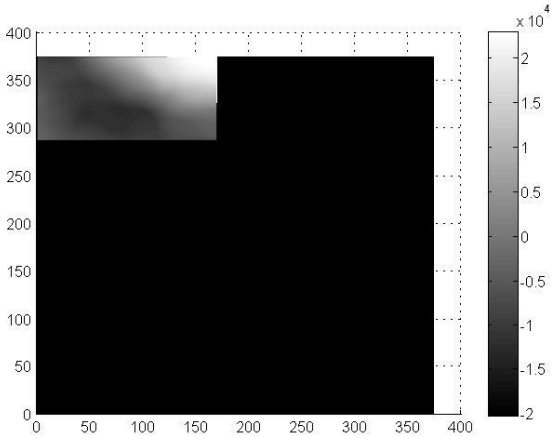
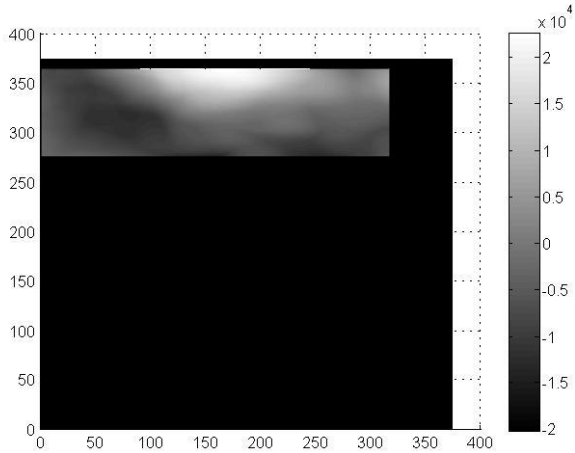


Figure 3



Procedure

Question: What amount of "collaboration" with fellow students is allowed?

Answer: You are encouraged to discuss verbally the project with other students. You can brainstorm together solution approaches, and you can teach each other how to do things with MATLAB. However, allowed collaboration ends with this verbal discussion. At no time can you

copy work others have done, or have someone else do any of the work for you, or do any of the work for someone else. "Copying" includes obtaining an electronic copy, or simply looking over someone's shoulder and writing down the MATLAB commands. Everything in the MATLAB script file itself must be your work, and your work alone. If you need more help, ask your proctor or instructor for assistance.

Create a directory entitled **uuuuup3**, where **uuuuu** is your cougarnet username. As you work on this project, save all of the specified files in this directory. This should be set as your current working directory. When finished, you will turn in the complete directory using the dropfolders method.

Inside this directory, create a script file named **main.**m. As you work on your solution, save the file often so that you will not lose work previously done if there is a system failure.

The file should begin with a "title" comment that includes your name, email address, and proctor number. This information should also be displayed in the command window when your script is run. The clc, close all, and clear commands should be given once at the start of the file. For example your script file could begin:

```
% your name – your email – your proctor
clc; close all; clear;
disp('ECE 1331 Project 3 – your name – your email-your proctor');
```

Additional comments should briefly describe the project and the important parameters . The computations will be divided into the tasks described below. Preceding each task, provide the task number, e.g., "**Task 1**", followed by suitable explanatory comments. The task number and explanations should also be displayed in the command window when your script file is run. For example:

```
% Task 1 – Import the data
disp('Task 1 Import the data');
code
```

This documentation is required! In other words, both your script and your output must be easy to read with each section well delineated

On the ECE 1331 website, in the Projects/Project3 folder you will find the plain text file, zzp3100.txt . Copy the file to your p3 directory. However, your solution must be kept sufficiently general so that when these values are changed the script will still execute correctly--without anybody making additional changes. We will execute your script with a different set of values containing a different size matrix! We will not provide any interactive input!

Task 1: In your **main,** use the load function to store the values in zzp3100.txt in a matrix named IMAGE. For the work in this project the first and last six rows and columns on this image should be excluded. Such modified image should be used in the following calculations. Display the size (number of rows & number of columns) of the modified image, clearly labeled as well as the total number of pixels this represents..

Task 2: Plot the working image as a surface plot in gray scale. Designate this as figure 1.Use Matlab help to find out how to use the surf function to produce a shaded 3-D plot similar to figure 1 above. Be sure to include appropriate legends.

Grid – puts grid lines on the plot
Gtext('text') – enables placement of text with the mouse
Plot(x,y) – generates a plot of the array y versus the array x on rectilinear axes
Title('text') – puts text in a title at the top of the plot
Xlabel('text') – adds a text label to the horizontal axis
Ylabel('text') - adds a text label to the vertical axis
Legend('leg1', 'leg2',…) – creates a legend using the strings leg1, leg2 and so on and specifies its placement with the mouse.(25,27,275,280)

Use surf and surfc to view mathematical functions over a rectangular region. surf and surfc create colored parametric surfaces specified by X, Y, and Z, with color specified by Z or C.

surf(Z) creates a a three-dimensional shaded surface from the *z* components in matrix Z, using x = 1:n and y = 1:m, where [m,n] = size(Z). The height, Z, is a single-valued function defined over a geometrically rectangular grid(to'rtburchak katakchalar). Z specifies the color data as well as surface height, so color is proportional to surface height.

http://www.mathworks.com/access/helpdesk/help/techdoc/index.html?/access/helpdesk/help/techdoc/ref/surf.html&http://www.google.com/search?q=surf+matlab&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a

```
colormap(jet)
```

Task 3: In analyzing data, the "standard deviation" is an important descriptive statistic. Matlab has a built-in function, `std( )` that will calculate the standard deviation of a vector or a rwo vector containing the standard deviations of each of the columns in a matrix. Find and display the standard deviation of the modified image, treated as a single vector.

Task 4: Find % of the modified image that has the topography values greater than the std of the image . Display, clearly labeled.

Contour - A **contour line** (level set) of a function of two variables is a curve along which the function has a constant value.
Topography - topography specifically involves the recording of terrain, the three-dimensional quality of the surface, and the identification of specific landforms. In modern usage, this involves generation of elevation data in electronic form. It is often considered to include the graphic representation of the landform on a map by a variety of techniques, including contour lines.

Task 5: Find % of the modified image that has the topography values smaller than the std of the image? Display, clearly labeled.

Task 6: Find the maximum and the minimum of the stds of the columns, and which columns they correspond to, displaying the values, clearly labeled.
[x,k]=max(A) – stores the maximum values of A in a row vector and their indices in the row vector k.
Length(A) – computes either the number of elements of A if A is a vector or the largest value of m or n if A is an mxn matrix

Task 7: Find the maximum and the minimum of the stds of the rows, and which rows they correspond to, displaying the values, clearly labeled.

Task 8: Find what is the % of the area of the image confined in-between the rows and columns with maximum and minimum values of std?

Task 9: Find the std of that area of the image (area of the image confined in-between the rows and columns with maximum and minimum values of std)?

Task 10: Find what is the % of the area of the image confined in-between the rows and columns with maximum and minimum averages?

Task 11: Find the std of that area of the image (area of the image confined in-between the rows and columns with maximum and minimum averages)?

Task 12: Plot the working images a) where all values of the pixels will be equal to the value of the minimum one on this image, except for the areas of the image that is confined in-between

the rows and columns with maximum and minimum averages (see example of Fig.3) and b) in-between the rows and columns with maximum and minimum values of std (see the example shown in Fig. 2.)

Turn In Your Project

Use the DropFolders method to turn in your project. Copy your entire uuuuup3 directory into the proper dropfolder. Remember that projects up to 24 hours late receive a 25 point penalty; projects later than 24 hours are not accepted.

No matter what problems you are having with your project, always turn in whatever you have completed by the due date. If you have strange last minute problems, you can send email to your professor explaining it. But don't miss the due date! Read the section in the Course Guide on Turning in your Projects—the part about protection problems with dropfolders! Turn in whatever you have by the due date!!!