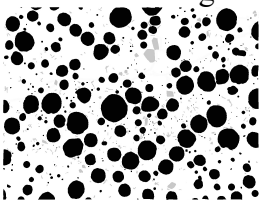
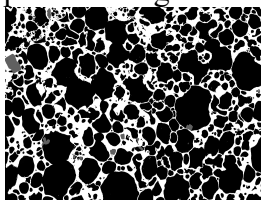
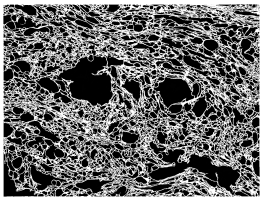
Homework Assignment #12

Image Processing

*This homework is based on the computer lab exercise and has two main parts. Please cut and paste some results into this Word file and submit it to bCourses along with some *.m files that we ask you to write.*

Part 1 – More Bubbles in Pumice

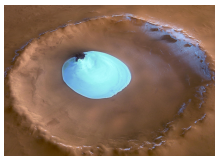
Download the following three pumice images from bCourses:

Compute the how many bubbles are in each image and determine the 2D porosity (ratio of voids and total area). **Enter your results** for each image here:

Now analyze the shape of the bubbles. Select three properties from the results of the *regionprop* function that best illustrate the differences between the three images. **Insert the results** for the three images **in numerical or graphical form** (e.g. table, histogram, or plot) and give a brief **explanation**:

Part 2 – Ice Deposits on Mars

ESA's Mars Express spacecraft took this picture  that shows ice deposits inside a crater in the northern plains on Mars. More details can be found at here. Download the image and start writing a new Matlab script file to analyze it. We want to determine the area of the ice deposits with three different methods:

a) First we want to use a grey scale threshold so that the ice deposit stands out as isolated grain. Read the image and convert it to a grey scale image, G. Use `imshow(G); impixelinfo;` and scan the resulting image with your cursor to determine a good grey scale threshold. Then use the command `bw=im2bw(I,threshold)` to obtain a black&white image. Decide if you need to add `bw=1-bw` before you use `bwconncomp` and `regionprops` to determine the size of the biggest grain in pixels.

b) Now we want to repeat the exercise in part a, but after having performed some smoothing. Pick a reasonable size for your neighborhood and smooth using a median filter:

```
fSize = ???;
```

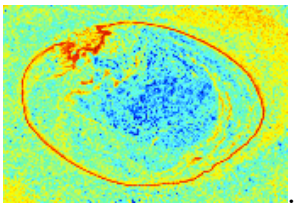
```
Sm = medfilt2(G, [fSize fSize]);
figure; imshow(Sm);
title('median smoothing');
```

As before, use the command `bw=im2bw(I,threshold)` to obtain a black&white image. You will need to fiddle with the threshold for a while to obtain a b&w image that matches the ice deposits reasonably well.

Insert your best b&w image here:

c) Now we want to use an *entropy threshold* to the ice-rock boundary. Pick a reasonable size for your neighborhood and analyze the entropy landscape using

```
fSize = ???;
nhood = true(fSize,fSize);
E = entropyfilt(G,nhood);
figure; imagesc(E); impixelinfo
```

You should obtain an image where the ice boundary stands out  . Again hover over the image with your cursor to determine an entropy threshold so that the ice boundary stands out as one *connected* ring.

```
thresh = ???;
L = E>thresh;
figure; imshow(L);
```

Insert your best resulting b&w image here:

d) Pick the method (a, b, or c) that results in a b&w image that best matches the ice deposits, and compute the ice area in pixels using the *bwconncomp* and *regionprops* functions.

What is the approximate area of the ice deposits in pixels?

Submit the Matlab script that displays a black and white image where the ice stands out and prints the area of the ice deposit in pixels.