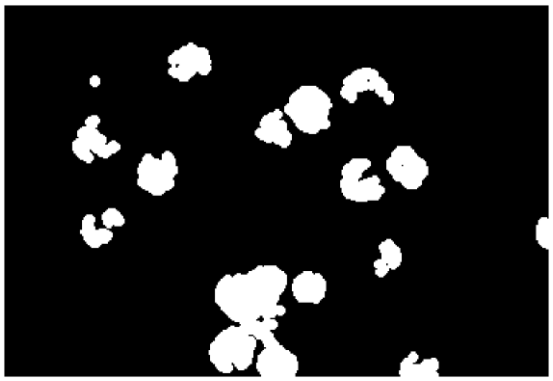
Activity 7- Feature Extraction From Labeled Blobs

Introduction

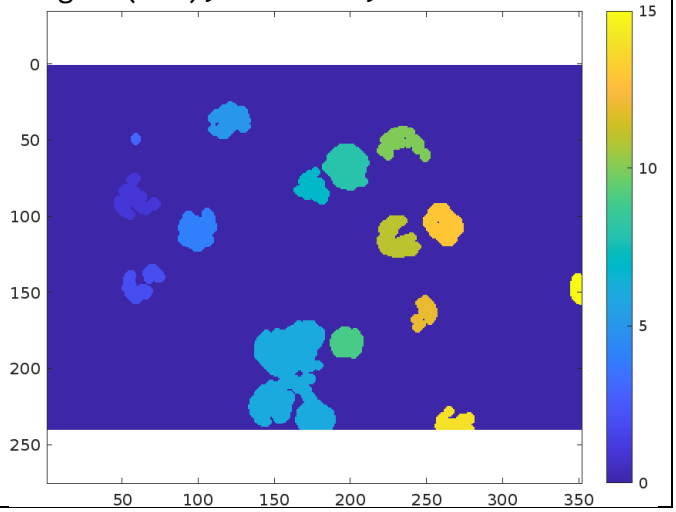
The past two activities taught you how to segment a region of interest according to grayscale or color, and how to clean up a thresholded image using morphological operations. Let us assume you have succeeded in getting a clean segmented binary image, where white blobs of connected pixels are the regions of interest and black pixels are the background. In this activity, we learn how to extract features from these blobs.

Suppose we have a nice clean segmented image shown below. Let the image variable be BW. The aim is to be able to automatically get features from each blob in BW. The features can include the size (in number of pixels), the centroid or even the bounding box enclosing the blob. It is good practice to give each blob a unique label. This is done by calling `bwlabel`.

```
imshow(BW);
```



```
BWL = bwlabel(BW);
Imagesc(BWL); colorbar;
```



We can then call the Matlab function `regionprops` to automatically measure the features of these blobs. To know more about the image features that can be obtained using regionprops, checkout this site:

[Regionprops documentation in MATLAB]

```
features = regionprops(BWL);
```

15×1 struct with 3 fields

Fields	Area	Centroid	BoundingBox
1	511	[57.8532,88.8552]	[44.5000,71.5000,31,31]
2	410	[62.8195,144.3537]	[49.5000,131.5000,29,26]
3	44	[59,49.5000]	[55.5000,45.5000,7,8]
4	559	[99.4794,109.2308]	[86.5000,94.5000,26,29]
5	499	[120.2846,37.2465]	[106.5000,24.5000,28,25]
6	2707	[160.8829,205.9760]	[132.5000,168.5000,58,72]
7	374	[175.0963,80.8957]	[162.5000,67.5000,24,25]
8	695	[197.7971,67.6647]	[181.5000,52.5000,31,31]
9	369	[197.6694,183.0298]	[186.5000,172.5000,22,21]
10	476	[234.2269,52.1513]	[217.5000,40.5000,35,24]
11	550	[230.5127,114.9236]	[217.5000,99.5000,29,28]
12	282	[248.5957,163.9433]	[239.5000,151.5000,18,25]
13	530	[261.0528,105.3019]	[247.5000,91.5000,27,28]
14	291	[268.4536,234.3780]	[255.5000,224.5000,26,16]
15	142	[348.8873,147.5352]	[344.5000,137.5000,8,21]

Calling regionprops alone will automatically measure Area, Centroid and Bounding Box of the blob. To measure other features use the syntax

```
features = regionprops(BWL, properties);
```

For example,

```
features = regionprops(BWL, “MajorAxisLength”);
```

Will only measure the major axis of the best fit ellipse on each of the blobs. The output of regionprops is a structure array and the elements of the structure can be called as follows:

```
Allarea = cat(1,features.Area );
```

will concatenate all Area values into an array. Calling features.Area by itself will just display all the area values

```
features(1).BoundingBox;
```

will output the rectangle defining the smallest founding box surrounding blob 1. The bounding box rectangle is a 4x1 vector which gives [X,Y, W,H], where X and Y are the upper right hand corner coordinates of the box and W,H are the width and height of the box in pixels.

Activity

We have done feature extraction using ImageJ. Now we will use MATLAB or python functions to integrate the feature extraction in our program. We may want to do this if we need to do experiments repeatedly.

1. Layout a single-colored cartolina or cloth on a table and spread out several objects with different shapes or sizes. In preparation for machine learning, choose objects that you would like to classify. For example, different coins, mixed nuts or grains, medicinal pills, electrical components, etc. Capture images of your spread out samples.

NOTE: For machine learning you will need a large set of examples for training data. This means you should take several non-overlapping images of your spread. Multiple images will also allow you to test out your program.

2. Segment your objects from the background. Clean the resulting image with morphological operations, as necessary.
3. Label and measure blob features using bwlabel and regionprops.