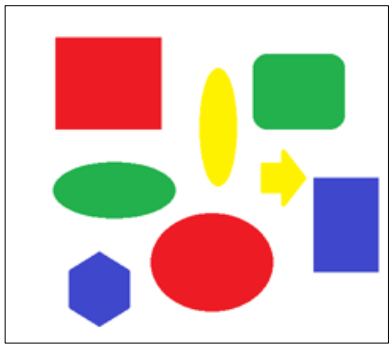
German University in Cairo
Faculty of Media Engineering and Technology
Spring 2019

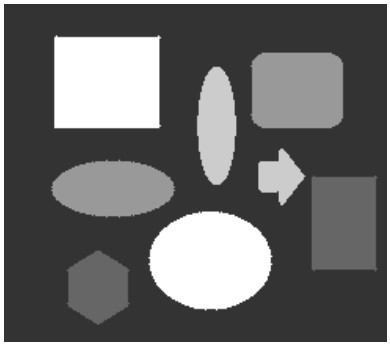
DMET 1002 – Advanced Media Lab

Lab 2 Procedure

K-means Segmentation of Colored Images

In all parts of this lab, you will process the image "Objects.bmp" shown below with an end goal to get the image shown on the right. You will be implementing each of the parts detailed below using MATLAB.





PART 1: Using MATLAB K-means Clustering

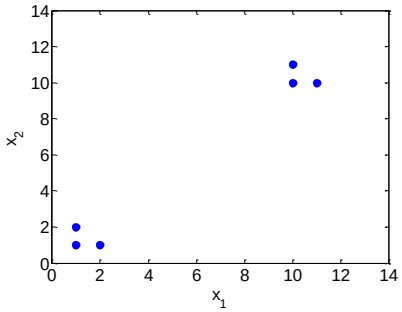
In this part, you are supposed to get familiar with the MATLAB `kmeans` function. The function is defined as follows

```
[IDX,C] = kmeans(X,k)
```

The function partitions the points in the n-by-p data matrix X into k clusters. Rows of X correspond to points, columns correspond to variables. `kmeans` returns an n-by-1 vector IDX containing the cluster index of each point and the k cluster centers in the k-by-p matrix C.

To try the function, use the 2-dimensional data given below with K = 2:

```
X=[1 1;1 2;2 1;10 10;10 11;11 10]
```



1. What is the output of the `kmeans` function using K = 2?
2. What is the output of the `kmeans` function using K = 3?

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K-means Segmentation of Colored Images

PART 2: Segmentation using K-means Clustering

Write a MATLAB function to apply K-means clustering to the "Objects.bmp" colored image. In your implementation, you can use the `kmeans` function already implemented in MATLAB examined in PART 1. The function should take the image and the number clusters as inputs and outputs a gray-scale image with different gray-levels corresponding to different clusters (colors).

Notes:

- When using the k-means MATLAB function, use the option `'emptyaction'` with the value `'singleton'` to overcome problems related to finding empty clusters.

- Every time you the k-means function, you might get different outputs as the random initialization results in different outputs on convergence.

3. Show the output segmented gray-scale image obtained using K = 2, 3, 4 and 5

PART 3: Determining the Best Value of K

Write a MATLAB function that can determine the best value of K as explained in the preparation document. The function should use the function implemented in PART 2 and based on the value of the measure Q, it should determine the best segmentation output that should be similar to the image given above.

4. Plot the value of Q for different values of K = 2:10

5. Show the output segmented gray-scale image corresponding to the value of K that gives the minimum value of K