

CURRENT SUBJECTS IN COMPUTER SCIENCE

PRACTICE SESSION 2: Segmentation

The main purpose of this practice is:

- To threshold some test images using Matlab Image Processing Toolbox
- To implement a segmentation procedure using Matlab Image Processing Toolbox

Exercise 1: Thresholding

The purpose of this exercise is to perform a basic segmentation over a set of images. Open a file and call it `threshold.m`. Then implement the following thresholding function:

```
function bw = threshold(I,T)
...
```

The resulting pixel value $bw(i,j)$ should be set to 0 when $I(i,j) < T$ and 255 when $I(i,j) \geq T$. We can test our function with the following commands:

```
I = imread('eight.tif');
figure, imshow(I);
T = 120;
bw = threshold(I, T);
figure,
imshow(bw)
```

We should obtain a result similar to the next figure. However, setting $T=120$ may not be a good idea when trying to threshold a different image. We should think on a procedure that best separates our image automatically into two groups.



Exercise 2: Automatic threshold selection (k-means)

The purpose of this exercise is to implement the k-means algorithm and test it with some images. Edit a file called `kmeans.m` and implement the function `kmeans`:

```
function T = kmeans(I)
....
```

The basic algorithm can be explained with the following steps:

- 1) Begin selecting $T^0 = B$, which separates the pixels into two groups.
- 2) Calculate the mean value in each group:

$$\mu_b^i(T^i) = \frac{\sum_{f(x,y) < T} f(x,y)}{\text{num.pixels } b} \quad \mu_o^i(T^i) = \frac{\sum_{f(x,y) \geq T} f(x,y)}{\text{num.pixels } o}$$

- 3) Select a new threshold T^{i+1} :

$$T^{i+1} = \frac{\mu_b^i + \mu_o^i}{2}$$

- 4) Goto 2).
- 5) Repeat until T stabilizes (i.e. $T^{i+1} - T^i < \epsilon$)

Finally we can test our results by calling the following commands:

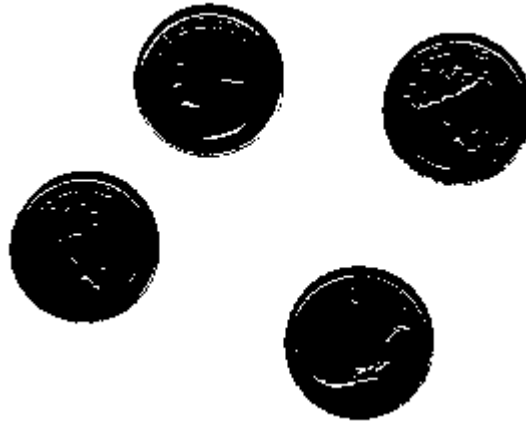
```
>> imshow(I)
>> T = kmeans(I);
>> T

T =

    169.4809

>> bw = threshold(I,T);
>> figure, imshow(bw)
```

The result should resemble the following figure:



You can try your functions with other test images.

To be included in your reports:

- Printed code of your Matlab functions.
- Place your result figures in your report.