Practicum Computational Vision

Practicum 7: Image processing toolbox in Matlab

This session will practice the bottom-up segmentation by kmeans and meanshift in Matlab.

7.1 Obtain image segmentation by the kmeans algorithm

Read the image "animals.jpg" and apply the kmeans segmentation technique as shown in Fig.1 (See the help at the end of this text). Choose the optimal k value of the function. Is the result affected by rescaling the image size augmenting it or reducing it? Is the result changing when the image is rotated? Is the result always the same when running several times? Why? What does the numbers of the cluster mean? Is the algorithm deterministic i.e. always giving the same results?
Substitute the label of each cluster in the resulting image with the average color of the cluster.
Note: Check carefully the format of the parameters of the kmeans.

7.2 Adding spatial information to the kmeans segmentation (Optional):

Add as features the spatial position of the pixels and apply the kmeans. Is the result improved and when?

7.3 Mean-shift segmentation:

Apply the mean shift segmentation and compare it to the kmeans. You can find the meanshift in mathworks.com. Note that the format and order of the input and output parameters change! Discuss the results - advantages and limitations. Do you need to determine the number of clusters? Is the result changing when executing the algorithm several times? Why? What are the parameters of the algorithm? How do they change the final results? Implement a function to visualize the pixels of each cluster with the mean RGB value of the cluster. What does the numbers of the cluster mean? Is the algorithm deterministic i.e. always giving the same results? Compare the time execution of both algorithms and justify it.

Note: Check carefully the format of the parameters of the Meanshift operator.

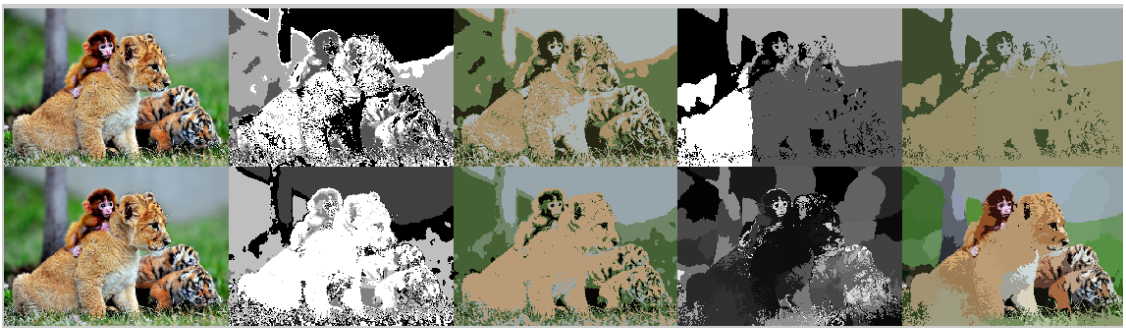

Fig.1 Original image (left), first row: kmeans segmentation, clusters of the kmeans - 2nd image, clusters substituted with the mean RGB value - 3rd image, clusters obtained with RGB+ spatial features - 4th image, the same clusters but substituted with the mean RGB value. Second row: analogous but using mean shift segmentation.

7.4 Adding spatial information to the kmeans segmentation (Optional):

Apply the mean shift segmentation adding to the RGB values the spatial position of the pixels.

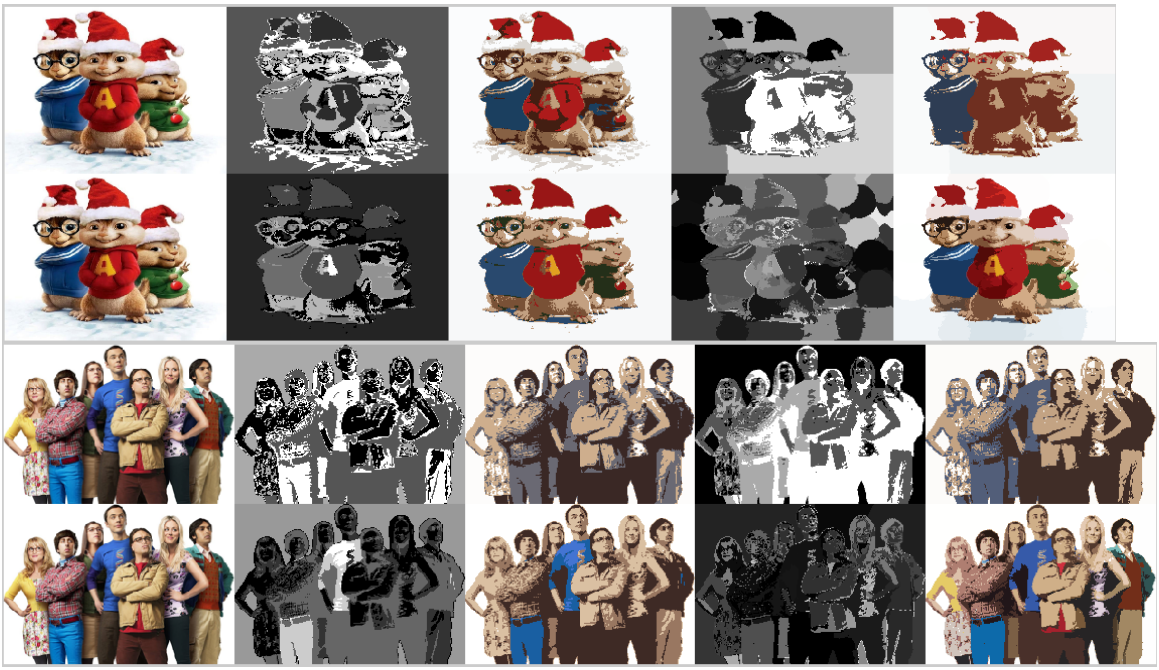

Fig.2. Some more examples

Repeat the tests on a pair of other images and discuss the results.

Help:

```
function [imres] = testKMeans(im)
% this is the classical kmeans algorithm

      im1d=reshape(im, size(im,1)*size(im,2),3);
```

```
        % Add here the spatial coordinates ….
        k=4; % cluster in 4 clusters

        idx=kmeans(double(im1d),k);

        im2d=reshape(idx, size(im,1),size(im,2));

        im2d=((double(im2d)-min(min(im2d)))/(max(max(im2d))-
        min(min(im2d)))*255.0);

        imres=cat(2,im,cat(3,im2d,im2d,im2d));

end
```

Practicum submission

You are requested to submit the exercises in this practicum with the exercises in the next session as a file "StudentName1+StudentName2_Lab7-8.zip" containing:

- A report entitled " Image segmentation" including the results of the problems posed in the lab 6 properly commented and all necessary images to fully understand your discussion. The report must provide answers for all questions.

-The matlab files with the implementation of the exercises.

Deadline: 26th of November, 23:55h by Campus Vitual.