Answers to questions in

Lab 3: Image segmentation

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**Instructions**: Complete the lab according to the instructions in the notes and respond to the questions stated below. Keep the answers short and focus on what is essential. Illustrate with figures only when explicitly requested.

Good luck!

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**Question 1**: How did you initialize the clustering process and why do you believe this was a good method of doing it?

Answers:

I randomly initialized the clusters with RGB from 0 – 255. It is possible to set this to the dominant colors of the image, but I kept it random since it was simpler. You might get a performance increase with the other option.

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**Question 2**: How many iterations L do you typically need to reach convergence, that is the point where no additional iterations will affect the end results?

Answers:

This is highly dependent on the definition of convergence in this case. I defined the convergence as when the algorithm has reached a point where the difference between old clusters and new ones is below a certain value. In other words, the algorithm has converged when the difference between clusters of different iterations is small.   
  
Another thing that might affect this is the complexity of the image in terms of colors and the number of clusters. Both of these factors increase the number of iterations needed.

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**Question 3**: What is the minimum value for K that you can use and still get no superpixel that covers parts from both halves of the orange? Illustrate with a figure.

Answers:

It is pretty hard to find an exact number but around

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**Question 4**: What needs to be changed in the parameters to get suitable superpixels for the tiger images as well?

Answers:

Well since it is more colors in this image, we can conclude that we are going to need more iterations, as I reasoned in question 2. Furthermore, there is a lot of color shift which means that we are going to need more clusters to compensate.

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**Question 5**: How do the results change depending on the bandwidths? What settings did you prefer for the different images? Illustrate with an example image with the parameter that you think are suitable for that image.

Answers:

If you increase the color bandwidth then that will correspond to a smoothing of the image. On the other hand, if you make the color bandwidth more narrow, it will correspond to a sharpening of colors.

If you increase the spatial bandwidth then you are going to increase the number of pixels that get included when doing the calculation. Thus, you will be able handle images where the modes are further separated. On the other hand, if you choose a narrow spatial bandwidth, then you will lose this ability but gain an increased precision in “pixel-mode” allocation.

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**Question 6**: What kind of similarities and differences do you see between K-means and mean-shift segmentation?

Answers:  
  
They both are algorithms that use mean calculation to step in the algorithm and they are used for similar things i.e., image segmentation. However, mean-shift looks at density whilst k-means looks at centroids. Also, k-means does not consider spatial information, only color information.

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**Question 7**: Does the ideal parameter setting vary depending on the images? If you look at the images, can you see a reason why the ideal settings might differ? Illustrate with an example image with the parameters you prefer for that image.

Answers:

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**Question 8**: Which parameter(s) was most effective for reducing the subdivision and still result in a satisfactory segmentation?

Answers:

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**Question 9**: Why does Normalized Cut prefer cuts of approximately equal size? Does this happen in practice?

Answers:

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**Question 10**: Did you manage to increase *radius* and how did it affect the results?

Answers:

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**Question 11**: Does the ideal choice of *alpha* and *sigma* vary a lot between different images? Illustrate with an example image with the parameters you prefer.

Answers:

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**Question 12**: How much can you lower K until the results get considerably worse?

Answers:

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**Question 13**: Unlike the earlier method Graph Cut segmentation relies on some input from a user for defining a rectangle. Is the benefit you get of this worth the effort? Motivate!

Answers:

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**Question 14**: What are the key differences and similarities between the segmentation methods (K-means, Mean-shift, Normalized Cut and energy-based segmentation with Graph Cuts) in this lab? Think carefully!!

Answers:

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