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 took some random sample points and sorted them by colour then I divided that into K segments and took the average colour of those. I think this method worked pretty well but there is room for improvement. Problem occurs when there are few pixels of a very different

colour.

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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: The orange and tiger 3 converged after around 50 iterations, while tiger 1 & 2 converged around 100 iterations.

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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:

At K=6 there is no superpixel that covers both of them.

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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:

For the tiger images it was important to increase the pre-blurring to get a good result.

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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:

Increasing the spatial bandwidth seems to be make the superpixels larger, in some cases making areas overlap objects. Also creates more squigily lines. Higer colour bandwith on the other hand smoothed the edges of the lines and make the area more circular around the center.

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

Answers:

Both of them move iteratively towards a local density maximum. K-means has a fixed amount of clusters while mean-shift does not and it also take position of pixels into consideration.

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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:

Yes the ideal parameters vary depending on the image. Depending on the size of objects min\_area should be adjusted. Colour scheme in the image can effect what colour bandwidth you want to use etc.

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

Answers:

I would say that it is radius which can reduce subdivision while not compromising much on the result. Cut threshold and especially max depth can cause bad segmentation while trying to reduce subdivision.

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

Answers:

Because it tries to balance the partitioning of the graph, it is made by design for robustness. You can see that this also happens in practice to a certain extent, in some cases you can see areas which are larger than other ones but generally they are similar size.

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

Answers:

Increasing the radius gave a substantial positive effect to the result.

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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:

Yes it varies between images. I have illustrated an example with tiger 1 & 3

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

Answers:

For the tiger 1 image the results started becoming considerably worse around K=10

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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:

I think it is worth the effort because in previous methods we could only group similar looking areas together but not make any distinctions what is what. This simple rectangle makes it possible to separate areas part of fore- and back-ground, which becomes valuable information.

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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:

All except N\_cut uses clustering of RGB values and iterate toward a local density max.

All except K-means take the position of pixels into consideration.

Graph- and N-cut try to separate areas while K-means and mean-shift group pixels together.

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