

Winter term 2016/17

Bioinformatics II

Assignment Sheet 8

If you have questions concerning the exercises, please write to our mailing list:
vl-bioinf@lists.iai.uni-bonn.de.

We strongly encourage you to continuously work on the assignments and contact us with questions. However, you will only have to hand in your results (for all sheets of the second project) on January 31.

Exercise 1 (Markov Random Fields, 25 Points)

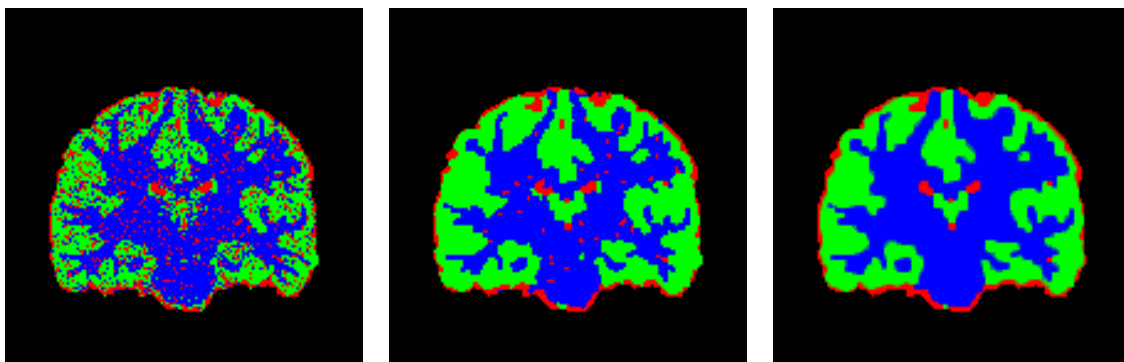


Figure 1: A discretized version of the segmentation result from sheet 7 (left), the result after repeated application of Iterated Conditional Modes with higher values of β (center), and the final probabilistic segmentation result with the MRF term (right).

- In order to do the following tasks please read the **explanation.pdf**, which is provided on the lecture homepage.
- Load the same noisy image **brain.png**, and download the **mask.png** from the lecture homepage. Based on your implementation of the EM algorithm from sheet 7, create a discrete (hard / non-probabilistic) label image that contains the most likely material for each pixel. Output it as an RGB image. For the segmentation use the **mask.png** in order to apply the algorithms only on the foreground pixels. (3P)
- Implement one iteration of the Iterated Conditional Modes (ICM) algorithm (for a Markov Random Field that uses the Potts model and $\beta = 0.5$) and use it to update the label image. Output the result as an RGB image. (5P)
- Apply your ICM iteration five times overall. Output the number of pixels whose label changes in each iteration, and output the final labels as an RGB image. (3P)
- Integrate your implementation of the ICM into the EM algorithm and run it until convergence. Output the final result as an RGB image. (6P)
- Increase the β parameter and repeat task e). At which value of β is the final segmentation almost noise-free similar to Fig. 1 right? Output the final result. (3P)

- g) Compare the output from task f) to the result of segmentation using GMM. How do the segmentation images differ and how would you explain the difference? (2P)
- h) So far, given the different methods for image segmentation, when would you choose a) Threshold based segmentation b) GMM c) MRF for segmenting a given image? (3P)

Good Luck!