Segmentation of Neuron Bundles from Diffusion MRI

SLT Course Project 2016

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Overview

Overview

- Model
- Optimization
- Implementation
- Results

Model

If you used an approach discussed in either lecture, tutorial or exercise, do not repeat the entire content. Only use what you need to put your extensions, modifications, etc. into context.

Similarity Matrix

Since in our setting we are not dealing with pairwise distances, rather with pairwise similarities of diffusion profiles, the similarity matrix D is calculated as follow

$$D_{ij} = \begin{cases} \|s_i - s_j\| & \text{if } v_i \text{ and } v_j \text{ are mutual neighbours} \\ 0 & \text{otherwise} \end{cases}$$

Inner Products for Measuring Diffusion Similarity

As another extension to the Blatt et al. [1] model we looked at inner products $\langle s_i, s_j \rangle$ between the vectors $s_{i,j}$ representing the diffusion profile of voxels v_i and v_j in order to get better insight in their similarity. This similarity measure further provides the opportunity to extend the model by applying a kernel.

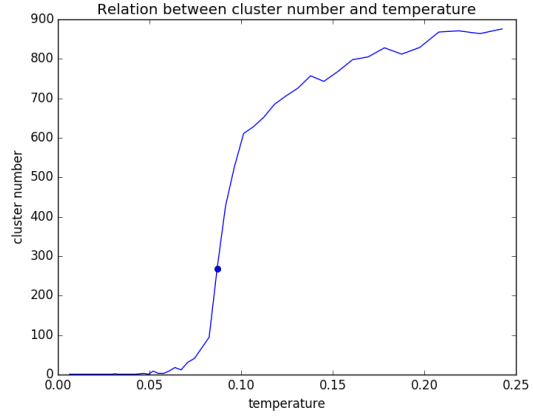
Optimization

Example: If you used Metropolis, mention it and maybe comment on your proposal distribution, but do not explain how it works in general. The same for deterministic annealing, etc. For any optimization strategy not discussed during the course, elaborate more.

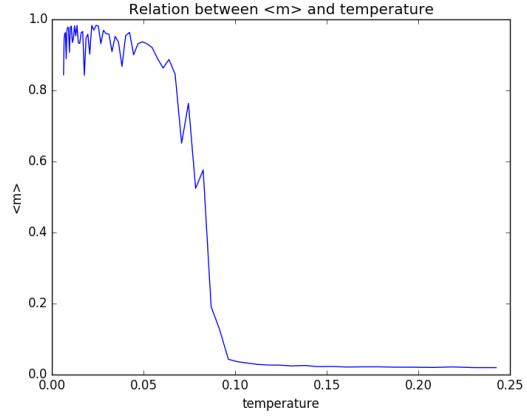
Implementation

State the software that you used. Did you use CPU, GPU, cluster, etc? Did you try to write efficient code? What performance differences did you observe? What were the most useful tricks that you applied? What else did you do to decrease runtime and memory usage?

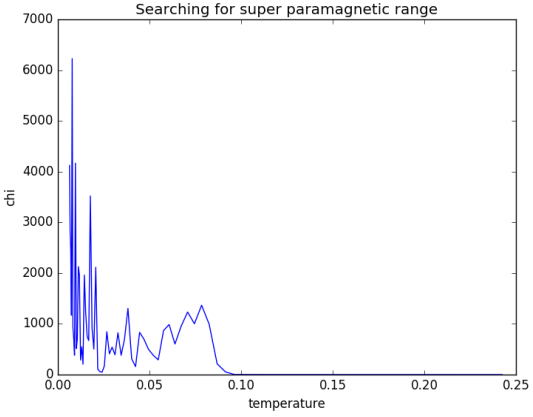
Implementation



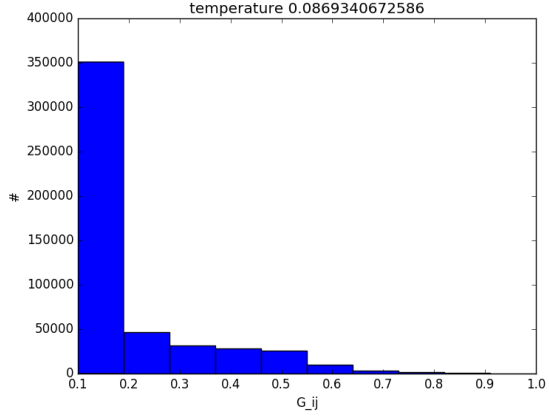
(a)



(b)

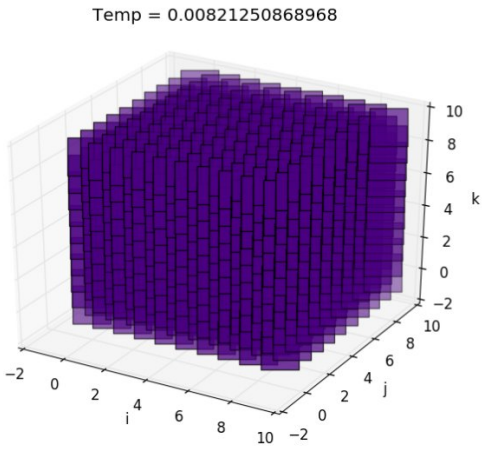


(c)

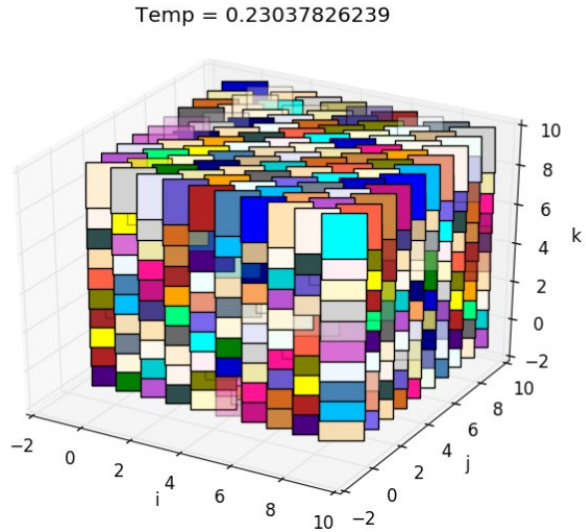


(d)

Results



(a)



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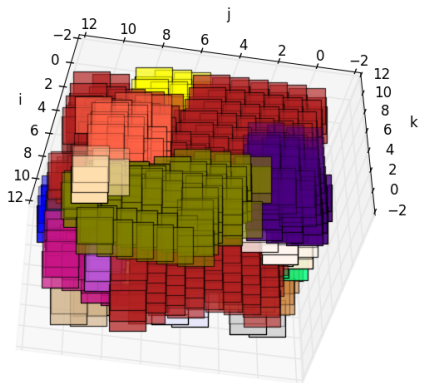
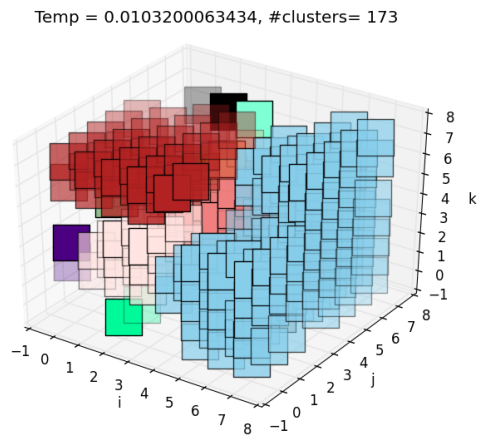


(c)



(d)

References

[1] Marcelo Blatt, Shai Wiseman, and Eytan Domany. "Data clustering using a model granular magnet". In: *Neural Computation* 9.8 (1997), pp. 1805–1842.