Automatic brain tissue segmentation in MR images using Random Forests and Conditional Random Fields

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***Abstract*—The abstract goes here.**

***Index Terms*—IEEE, IEEEtran, journal, LaTeX, paper, template.**

I. Introduction

PROGRESSION of neurodegenerative diseases can be tracked by the atrophy of brain tissues. Manual segmentation / measurement is very time consuming - not a viable option in clinical practice.
In this paper the goal is the segmentation of grey matter, white matter, hippocampus, amygdala and thalamus. Grey matter mostly consist of neuronal cell bodies which are unmyelinated. White matter consist mostly myelinated axons. These are connecting the GM areas. Hippocampus is the brain part where the learning and memory occurs. Amygdala is for emotions and aggressions and the thalamus is the the relay center for sensory informations. These parts are crucial for a good neurosurgeon to plan and simulate the procedure accurate and preciecly.

II. Materials and Methods

Detailed Outline:

A. Material

- 30 unrelated healthy subjects from the Human Connectome Project data set
- 3 tesla MR T1- and T2-weighted images with ground truth
- Images with skull are defaced for anonymization

B. Methods

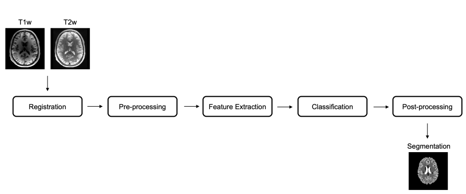

Fig. 1. Pipeline.

Registration
Alignment of the images to a common reference space named atlas
Preprocessing
Alignment of the images to a common reference space named atlas
Feature Extraction
Finding of representing features for brain tissues
Classification
Predicts to which label or class a voxel belongs
Postprocessing
Improvement the segmentation accuracy after the classification (Main focus of our group)
Approach I: Probabilistic Keyhole Filling
In this section we explain the basic concept and the procedure of the Probabilistic Keyhole filling (PKF). The Goal of the PFK is to incorporate prior knowledge into the post-processing. We know that we are segmenting connected structures within the brain, therefore the obtained labels also have to be connected. The structures to be segmented are also uniform in themselves. This means that within the local neighbourhood (26-connected) of one voxel, all voxels should carry the same label (unless it is a boundary voxel).

*Goal: incorporate prior knowledge (connected structure and spatial coherence)

*Use probability information from segmentation to reassign labels
*Reassign all labels not connected to the largest connected label

In the following we present the individual steps of the PKF.

III. Results

Results go here

IV. Discussion

Discussion goes here

V. Conclusion

The conclusion goes here.

Appendix A
Proof of...

Appendix one text goes here.

Appendix B

Appendix two text goes here.

Acknowledgment

The authors would like to thank...

References

[1] H. Kopka and P. W. Daly, *A Guide to LaTeX*, 3rd ed. Harlow, England: Addison-Wesley, 1999.