
Matthew DiFrancesco, Emily Wible, Amanda Yung

Clients: Dr. James Gee and Dr. Lynne Schwartz
Abramson Pediatric Research Center

Background

- Software may induce neuronal apoptosis in neonatal brain
- Hippocampal-related cognition affected in behavioral tests (spatial working memory)
- Current methods are labor-intensive or practically unsuitable
- Manual segmentation—labor-intensive, prone to human error
- Traditional segmentation—requires creation of deformable atlas with data not readily available
- FTR-SNAP offers an ideal mix of automatic and manual segmentation components
- Easy-to-use for clinicians, researchers, and technicians, unsuitable for computer programming
- Design a protocol to reliably measure the volume of the rat hippocampus with the FTR-SCAP interface

Objective and Design Challenges

Objective: To develop a robust semi-automatic computer method that determines the volume of the rat hippocampus from a magnetic resonance image.

Specifications:
- Inter- and intra-rater reliability of at least 0.90, as measured by the intraclass correlation coefficient
- Detection of a rat hippocampal volume difference of less than 20% between image sets
- Segmentation of hippocampi in under 1 minute

Risks:
- Differential anatomical boundaries of the rat hippocampus
- Increased variability due to pre-existing knowledge of hippocampal shape affecting the ability to make final adjustments in the segmented hippocampus

Constraints:
- Inter-subject variability
- Small sample size (N=4)
- Scalability in software functionality

Results: Segmentation Parameters

| Parameter | Categorical Label | Inter-Rater Reliability (ICC) | Intra-Rater Reliability (ICC) | Data Coefficients (calculated through SRM-SNAP segmentation of 40 slices)
|------------|------------------|------------------------------|-------------------------------|------------------------------------------------------------|
| Volume     | Categorical Label | Inter-Rater Reliability (ICC) | Intra-Rater Reliability (ICC) | Data Coefficients (calculated through SRM-SNAP segmentation of 40 slices)
|            |                  |                              |                              |                                                 |
|            |                  | 0.94                         | 0.92                         | r = 0.82, p < 0.001                                        |
|            |                  | 0.86                         | 0.91                         | r = 0.80, p < 0.001                                        |

Conclusions and Recommendations

Conclusions:
- A segmentation protocol was developed for segmenting the rat hippocampus in MR images
- The protocol allowed for consistent volume measurements between raters, and between measurements from the same rater.

Recommendations:
- Modify FTR-SNAP interface to improve manual segmentation portion of the segmentation process
- Use segmentation protocol on MR images from isotropan-exposed rats

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