Atlas-based Analysis of Hippocampal Subfield Atrophy in ADNI Data: A Preliminary Study

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Hippocampal Subfields

Photo and diagrams from Duvernoy, Atlas of the Human Hippocampus, 2005;
Hippocampus “Talairach” Atlas for Computational Anatomy

- A reference space for the hippocampus, in which to project results of cross-sectional and longitudinal morphometry
Atlas: Imaging
Atlas: Construction

Subfields manually traced in postmortem data

Atlas created using diffeomorphic image averaging and consensus STAPLE segmentation
Atlas: Mapping Subjects

Use medial representation (cm-rep) to establish geometric correspondences between ROIs
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Preliminary Analysis

• 3T MRI data from ADNI
• MCI vs. Control (subtle changes)
• Longitudinal and Cross-sectional
12 Month Atrophy Maps of 27 Subjects
Projected into Reference Space and
Integrated over Subfield Labels
12 Month Atrophy Maps of 27 Subjects Projected into Reference Space and Integrated over Subfield Labels
Cross-Sectional Analysis of Subfield Volume via Deformation-Based Morphometry and Atlas Projection
Cross-Sectional Thickness Analysis

- MCI[CSF~AD]-CTL
- MCI[CSF~CTL]-CTL
- MCI[CSF~CTL]-MCI[CSF~AD]
- MCI[CONV]-MCI[STABLE]
Cross-Sectional Thickness Analysis

MCI[CSF~AD]-CTL

MCI[CSF~CTL]-CTL

MCI[CSF~CTL]-MCI[CONV]

MCI[CSF~CTL]-MCI[STABLE]
Validation Efforts

We are using T2 data as ground truth for longitudinal atrophy estimation.
Acknowledgements & Resources

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- Specimens were provided by Dr. Gonatas and colleagues at the Penn Dept. of Pathology and Laboratory Medicine and the Harvard Brain Bank

- Available Resources:
  - Hippocampus atlas: google PennHippoAtlas NITRC
  - CM-Rep software: google CM-REP SourceForge