

# **Multi-atlas intensity and label fusion with supervised segmentation refinement for the automatic subparcellation of the hippocampus**

Nicholas J. Tustison<sup>1,2</sup>, Brian B. Avants<sup>3</sup>, ..., Hongzhi Wang<sup>4</sup>, ..., Michael A. Yassa<sup>2</sup>

<sup>1</sup>Department of Radiology and Medical Imaging, University of Virginia, Charlottesville, VA

<sup>2</sup>Department of Neurobiology and Behavior, University of California, Irvine, Irvine, CA

<sup>3</sup> Biogen, Cambridge, MA

<sup>4</sup> IBM Almaden Research Center

Corresponding author:

Nicholas J. Tustison

4173 Cardamon Circle

Corona, CA 92883

540-383-2719

[ntustison@virginia.edu](mailto:ntustison@virginia.edu)

## Abstract

### Contributions:

- joint fusion
  - NNLS
  - multi-threaded
  - remove directionality bias in search neighborhood
  - open-source implementation in ANTs (ITK-Style)
  - joint intensity fusion
- corrective learning
  - replace AdaBoost framework with random forest
  - binary labels correct classification vs. misclassification (old) vs. four labels (true, false)  $\times$  (positive, negative).
  - open source R implementation
    - \* `segmentationRefinement.train`
    - \* `segmentationRefinement.predict`
- remove study-specific “heuristics”
- T1/T2 evaluation on three publicly available data sets + 1 private data set (which will also be made publicly available?)
  - Yushkevich “PennData”
  - MniData
  - Winterburn data
  - Stark training set
- T1 only evaluation on the same data sets