

Non-invasive mapping of connections between human thalamus and cortex using diffusion imaging

Paper highlights:

- First connectivity based segmentation of grey matter.
- First quantitative demonstration of reliable inference of anatomical connectivity in grey matter.

My comments:

According to a later review by the same authors in 2007, they missed the projection from the *medial geniculate nucleus (mgn) of thalamus* to the primary auditory cortex which is notable in the biology of the brain. Why do you think that the algorithm missed this important tract, and potentially others? [Expected answer: because it assumes one fiber direction \(page 755 - bottom left\)](#)

Follow-up question: What impact does this have on the clinical applicability of the algorithm? More precisely, do you think it could still be used in the clinic if it misses out some important tracts?

Citations:

Google Scholar: 1116

Web of Science: 770

Impact factors:

Nature neuroscience: 14.976

Magnetic Resonance in Medicine (MAGN RESON MED): 3.27

Summary:

Streamline tracking has been investigated before in white matter but not in grey matter. Using streamlining algorithm they could follow tracts with high anisotropy which is the case in WM. The anisotropy in the GM is very low and therefore the algorithm cannot follow tracts through those regions. They use a probabilistic (Bayesian) approach so that they can use when there is no high anisotropy.

Before:

MR diffusion tensor spectroscopy and imaging (Basser PJ, 1994) -> pioneer (just WM)

After:

Characterization and propagation of uncertainty in diffusion-weighted MR imaging (T.E.J. Behrens) --> 1191 citations according to Google Scholar

A notable omission from the thalamic parcellation study presented in ([Behrens et al., 2003a](#)) is a projection from the medial geniculate nucleus (mgn) of thalamus to the primary auditory cortex. In [Rushworth et al. \(2005\)](#), the authors were able to find subcortical sites projecting to different portions of parietal lobe, but were unable to find the known parietal connections with premotor cortex and frontal eye fields that travel down the 1st and 2nd portions of the superior longitudinal fasciculus (SLF), despite several different attempted strategies.

Sentences:

- Catherine: Streamline tracking has been investigated before in white matter but not in grey matter (low anisotropy was a problem for previous tract following algorithms).
- Razvan: According to a later review they missed the projection from the medial geniculate nucleus (mgn) of thalamus to the primary auditory cortex which is notable in the biology of the brain.
- Luis: But the authors accounted for the missed projections enhancing their model and incorporating multiple fibers in a following paper (Behrens et al. 2003b) called Characterisation and Propagation of uncertainty in DWMRI.

Questions:

- Razvan: Why do you think the proposed probabilistic tracting algorithm missed a notable tract (projection from mgn inside thalamus to the primary auditory cortex)? Expected reply is because the bayesian approach proposed in the paper accounts only for a single direction.
- Catherine: Do you think is valid to compare first the monkey brain to histology of the monkey before going for humans?
- Luis: Apart from schizophrenia , what other disorders could be characterised by using techniques? In 2007 the authors extended the model to account for...