

Identifying the human optic radiation using diffusion imaging and fiber tractography

Anthony J. Sherbondy et al., Journal of Vision (2008)

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Ahmed El-Rafei

Chair of Pattern Recognition (Computer Science 5)
Friedrich-Alexander-University Erlangen-Nuremberg

Outline



- Purpose
- Material and Methods
- Results
- Discussion

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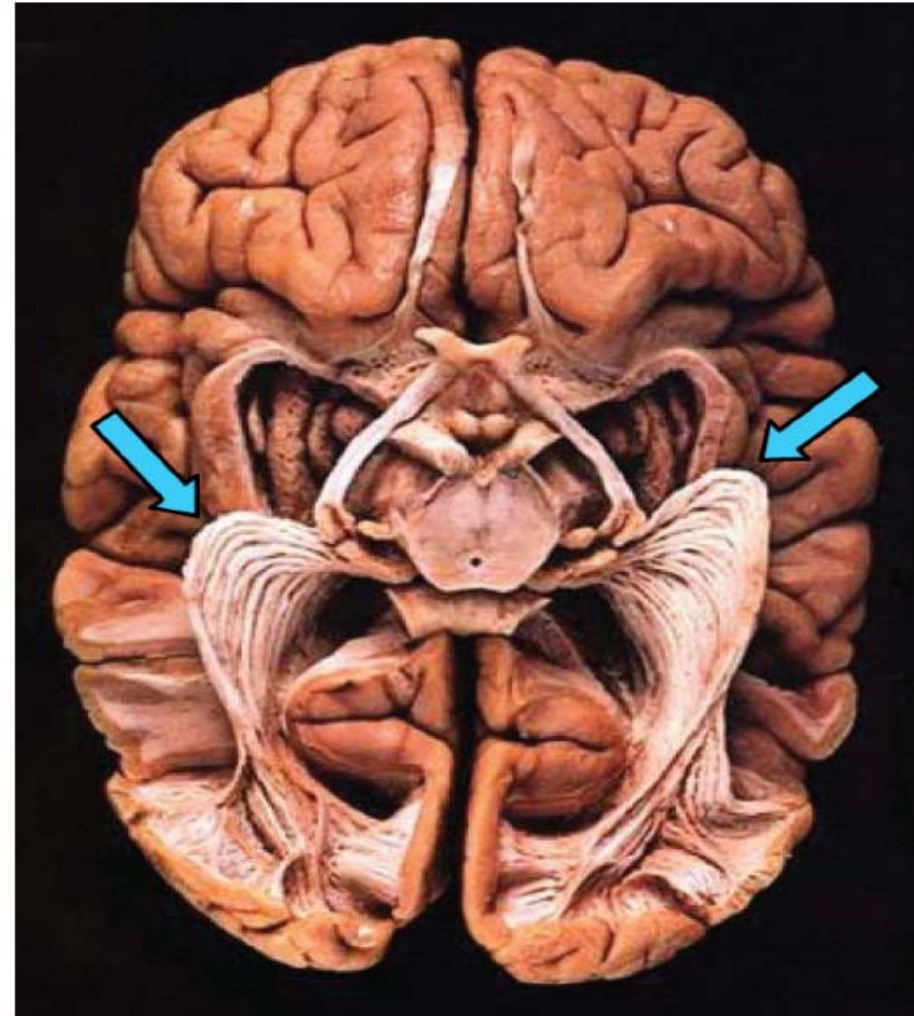


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Purpose



- Using diffusion tensor imaging (DTI) and fiber tractography to identify the most likely pathway lateral Geniculate Nucleus (LGN) to the visual cortex. i.e. Optic Radiation.



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Material



- 8 healthy volunteers with mean age 26.9 ± 8.1 years, one female, seven males were scanned.
- A scan contains
 - T1-weighted images
 - DTI data set
- Acquisition matrix size:
 - Field of view 260×260 mm² with 128×128 interslice resolution
 - 48-54 slices with thickness 2 mm (no spacing)

ConTrack Tractography

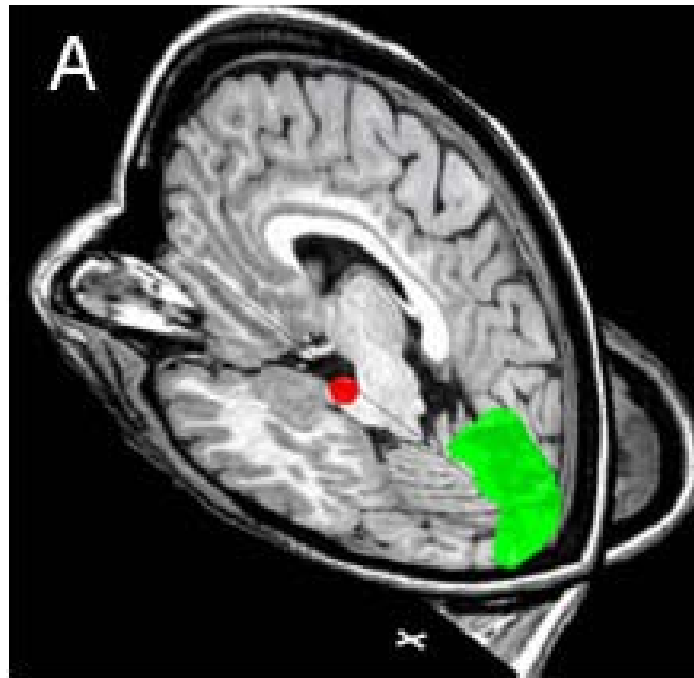


- ConTrack is a probabilistic tractography algorithm
- The method is comprised of
 - ROI specification
 - Pathway sampling: searches all possible pathways connecting two regions within the DTI data.
 - Pathway scoring: scores the sampled pathways with a function that evaluates the anatomical validity of the pathway.
 - Pathway Selection: the user sets a low score threshold for selecting a subset of the pathways that estimates the white matter anatomy of interest.



ROI Specification

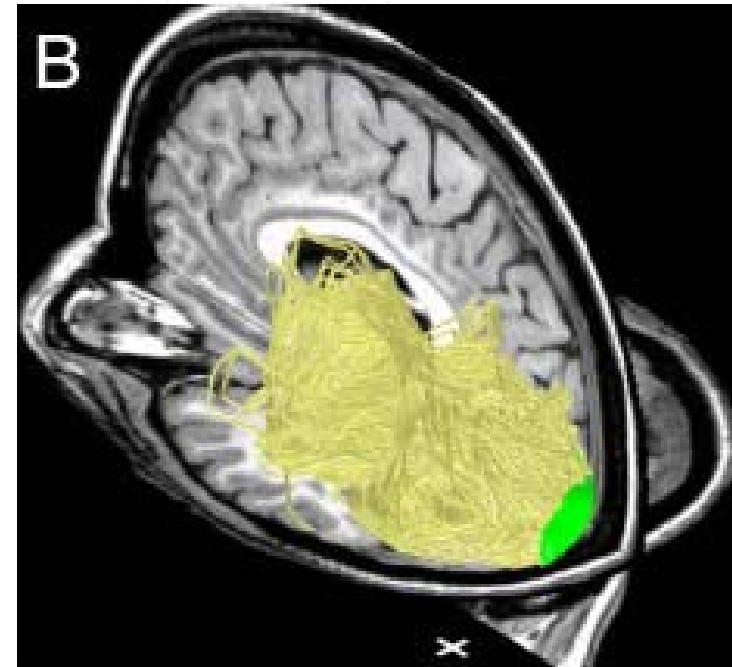
- The ROI consists of
 - Lateral Geniculate Nucleus (LGN)
 - Calcarine sulcus of the occipital lobe
- The ROI was manually segmented in each hemisphere





Pathway Sampling

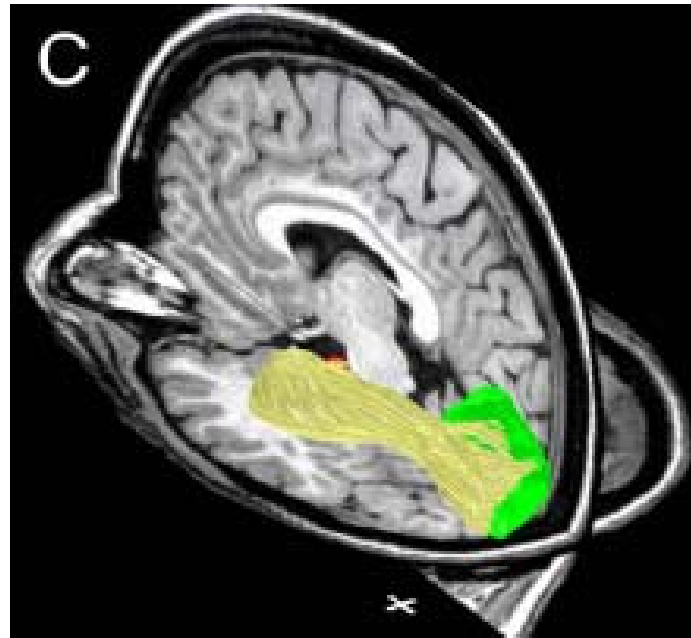
- ROIs are used as a boundary of the tracking
- Retain only pathway that satisfies the following criteria:
 - Pathway length $< 300\text{mm}$
 - Pathway bending angle for a single step not exceeding 130 degree
 - Pathway could not step through manually defined regions of gray matter
 - Pathways has both of its end points on ROIs
- Collecting 100,000 pathways samples





Pathway Scoring and Selection

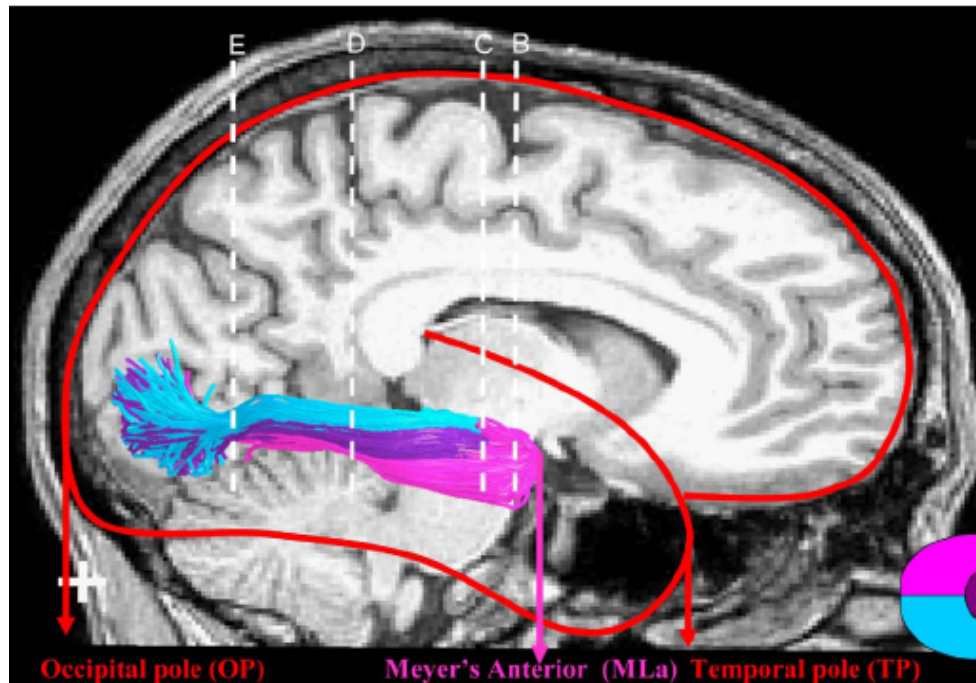
- A threshold is set manually for each subject and for each hemisphere to select a subset of the sampling pathways
- Manually eliminate pathways that intersects gray matter or cerebral spinal fluid
- A few pathways remained after the selection process





Evaluation of the estimated OR

- The evaluation was done by comparing the estimated OR with the results of dissection studies
- Anatomical landmarks were identified and distance between them and the estimated OR was calculated.



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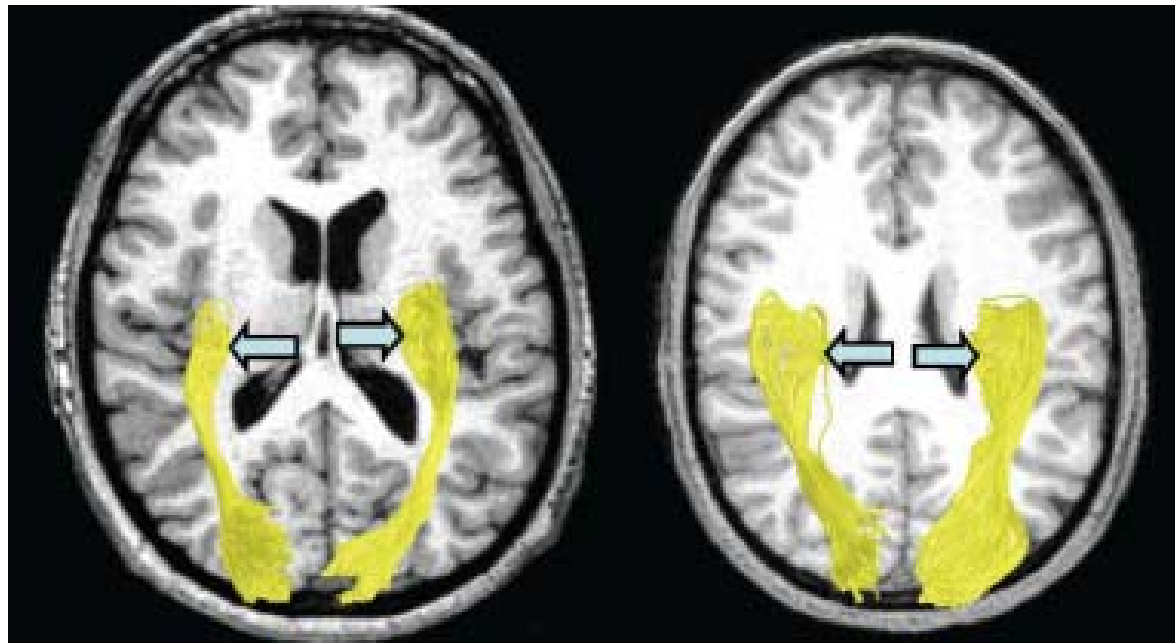


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Results



- OR was identified in all eight subjects
- Comparing the segmented OR with the landmarks, the results were found to be in agreement with the dissection results



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Discussion



- The data used is a high resolution DTI, which is typical when dealing with the visual system
- ROIs tractography
- Intensive medical experts interaction
 - ROI selection, Threshold selection, Extra pathways removal, Landmark identification
- Quantitative evaluation of the results using a comparison with landmark technique



Thank You !