

# Probabilistic Neighbourhood Tractography in the Developing Brain



**Title:** PROBABILISTIC NEIGHBOURHOOD TRACTOGRAPHY IN THE DEVELOPING BRAIN

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**Background:** Diffusion tensor imaging (DTI) may provide insights into the cerebral changes that accompany preterm birth by supplying biomarkers of white matter microstructure in tracts of interest (TOI).

**Objective:** Hypothesis: an automatic single seed point tractography-based segmentation method, probabilistic neighborhood tractography (PNT), can be used to the study the developing brain.

**Design/Methods:** 12 neonates underwent DTI (MAGNETOM Verio 3T): 11 T2-; 64 diffusion-weighted single-shot spin-echo EPI volumes; b=750s/mm$^2$;2mm isotropic voxels.
8 TOIs were identified using PNT (http://www.tractor-mri.org.uk). Using a neighborhood of seed voxels, the seed point that produced the best matched tract to the reference (MNI standard space) was determined. The resulting tract masks were applied to each subject's mean diffusivity (D) and fractional anisotropy (FA) volumes, which permitted TOI mean values, weighted by the connection probability, to be determined for each tract in every subject. The absolute goodness-of-fit of the best match tract to the reference (tract shape parameter, *R*) was calculated from the log-ratio between the matching likelihood of the chosen tract and that of the reference tract to itself.

**Results:** Group maps of (a) genu and (b) splenium generated by transforming the best match tract from each subject into standard space and overlaying them as

maximum intensity projections [figure 1].
Values of D range from 1139±70 for right corticospinal tract (CST) to 1707±209 $mm^2/s$ for left inferior longitudinal fasciculus (ILF), while FA ranges from 0.19±0.02 in left ILF to 0.31±0.03 in splenium. Values of $\lambda_{Axial}$ vary from 1512±76 for right CST to 2061±161 $mm^2/s$ for splenium, while $\lambda_{Rad}$ ranges from 952±87 for right CST to 1532±200 $mm^2/s$ for left ILF. Finally median (±IQR/2) values of R range from -3.68±0.79 for genu to -47.26±7.45 for left CST.

**Conclusions:** Quantitative DTI measures can be determined in tracts of interest in the developing brain using single seed point PNT.

[INSERT Fig1]