

Longitudinal stability of brain and spinal cord quantitative MRI measures

**Mathieu Boudreau¹, Agah Karakuzu¹, Arnaud Boré^{2,3}, Kiril Zelenkovski⁴, Basile Pinsard^{2,3},
Eva Alonso-Ortiz¹, Julie Boyle^{2,3}, Pierre Bellec^{2,3,5}, and Julien Cohen-Adad^{1,3,6,7}**

¹NeuroPoly, Polytechnique Montreal, Montreal, QC, Canada, ²Centre de Recherche de l'Institut Universitaire de Gériatrie de Montréal (CRIUGM), Montreal, QC, Canada, ³Unité de Neuroimagerie Fonctionnelle (UNF), Centre de Recherche de l'Institut Universitaire de Gériatrie de Montréal (CRIUGM), Montreal, QC, Canada, ⁴Faculty of Computer Science and Engineering (FINKI), Skopje, Macedonia, ⁵Psychology Department, Université de Montréal, Montreal, QC, Canada, ⁶Mila - Quebec AI Institute, Montreal, QC, Canada, ⁷Centre de recherche du CHU Sainte-Justine, Université de Montréal, Montreal, QC, Canada



Study Design

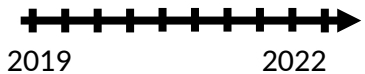


3T

6 participants



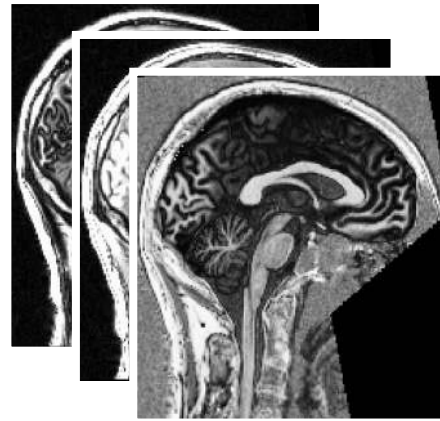
10 time points



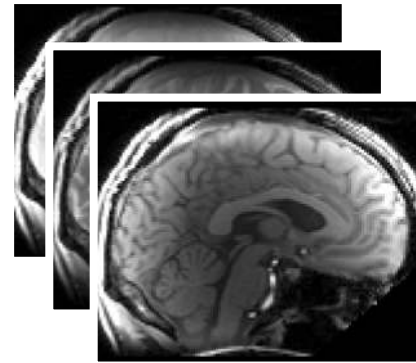
T1w (0.8mm)
Morphometry



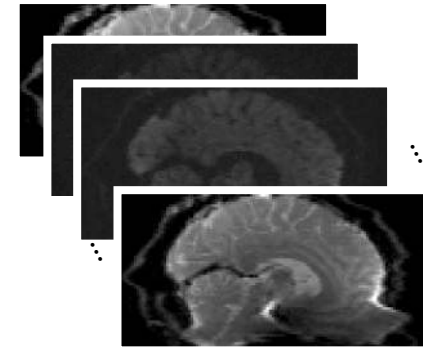
T2w (0.8mm)
Morphometry



MP2RAGE (1mm)
Demyelination



MT saturation (1.5mm)
Demyelination



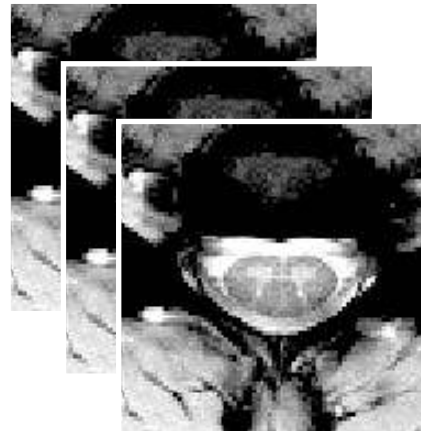
Diffusion (2mm)
Demyelination in WM
Axon degeneration



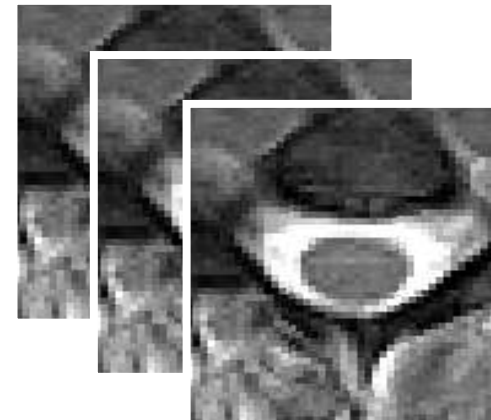
T1w (3D) 1mm
Morphometry



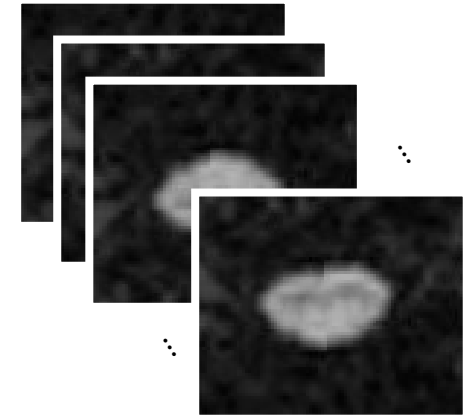
T2w (3D) 0.8mm
Morphometry



ME-GRE (2D)
GM Morphometry

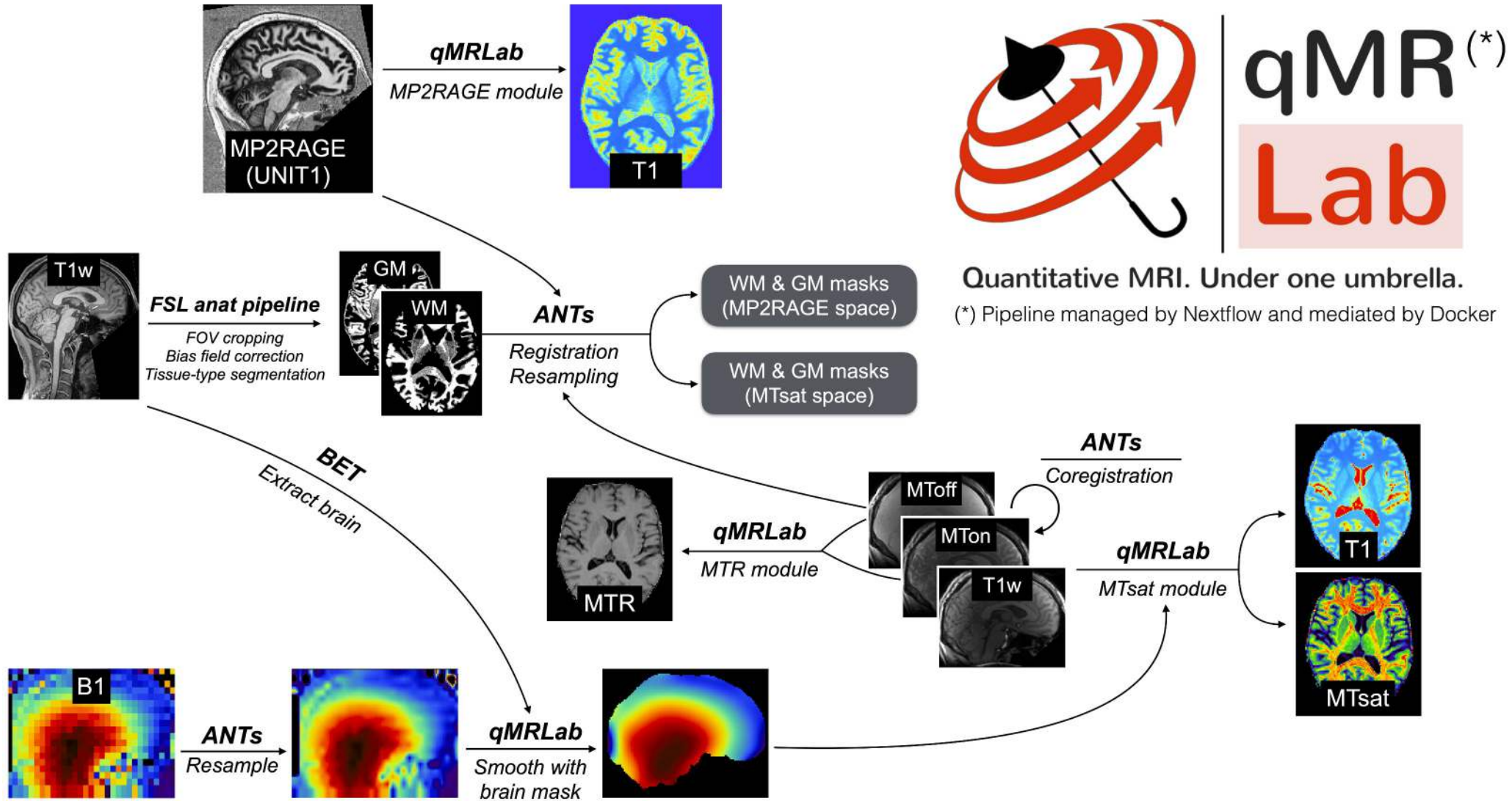


Magnetization Transfer
Demyelination in WM

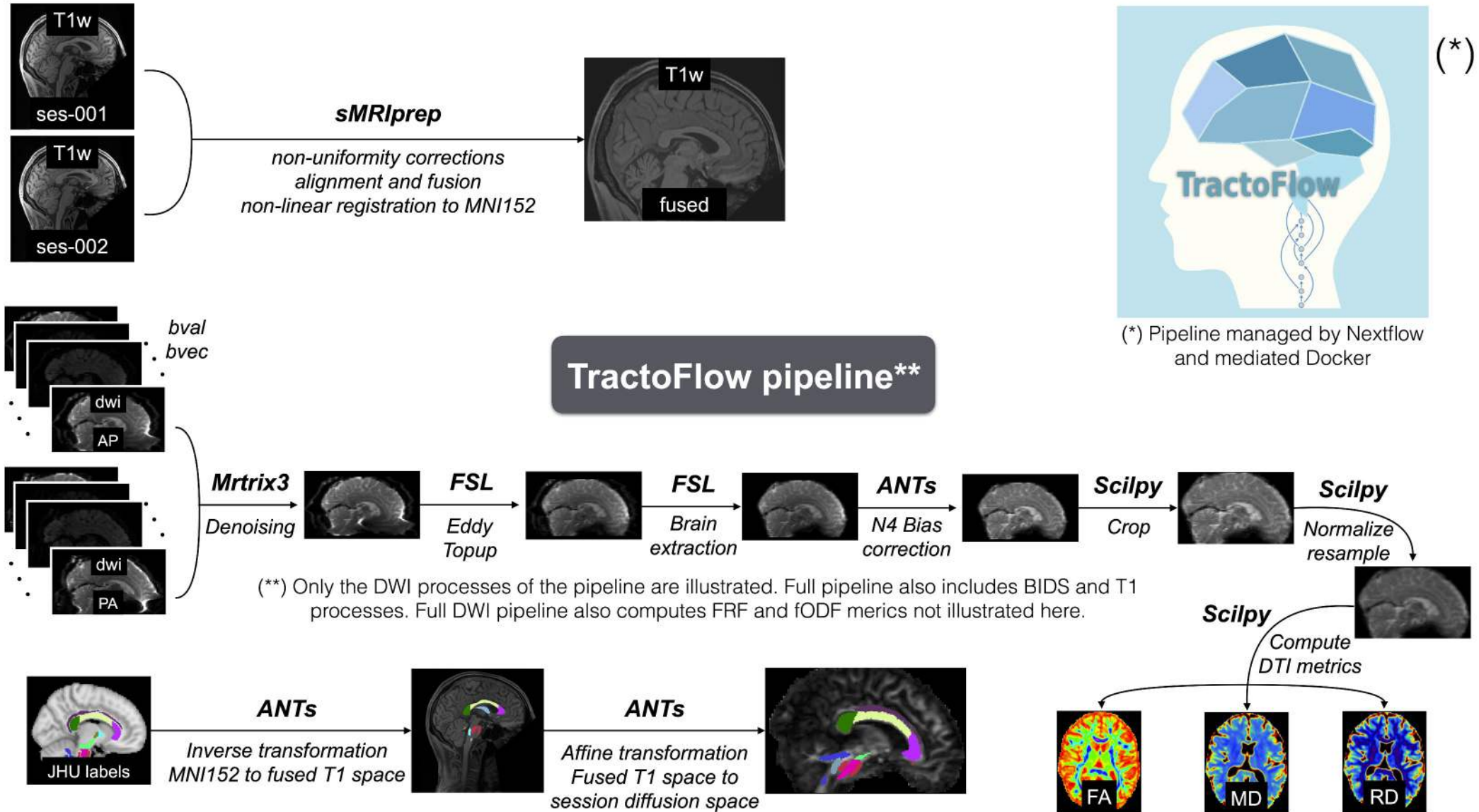


Diffusion Weighted Imaging
Demyelination in WM
Axon degeneration

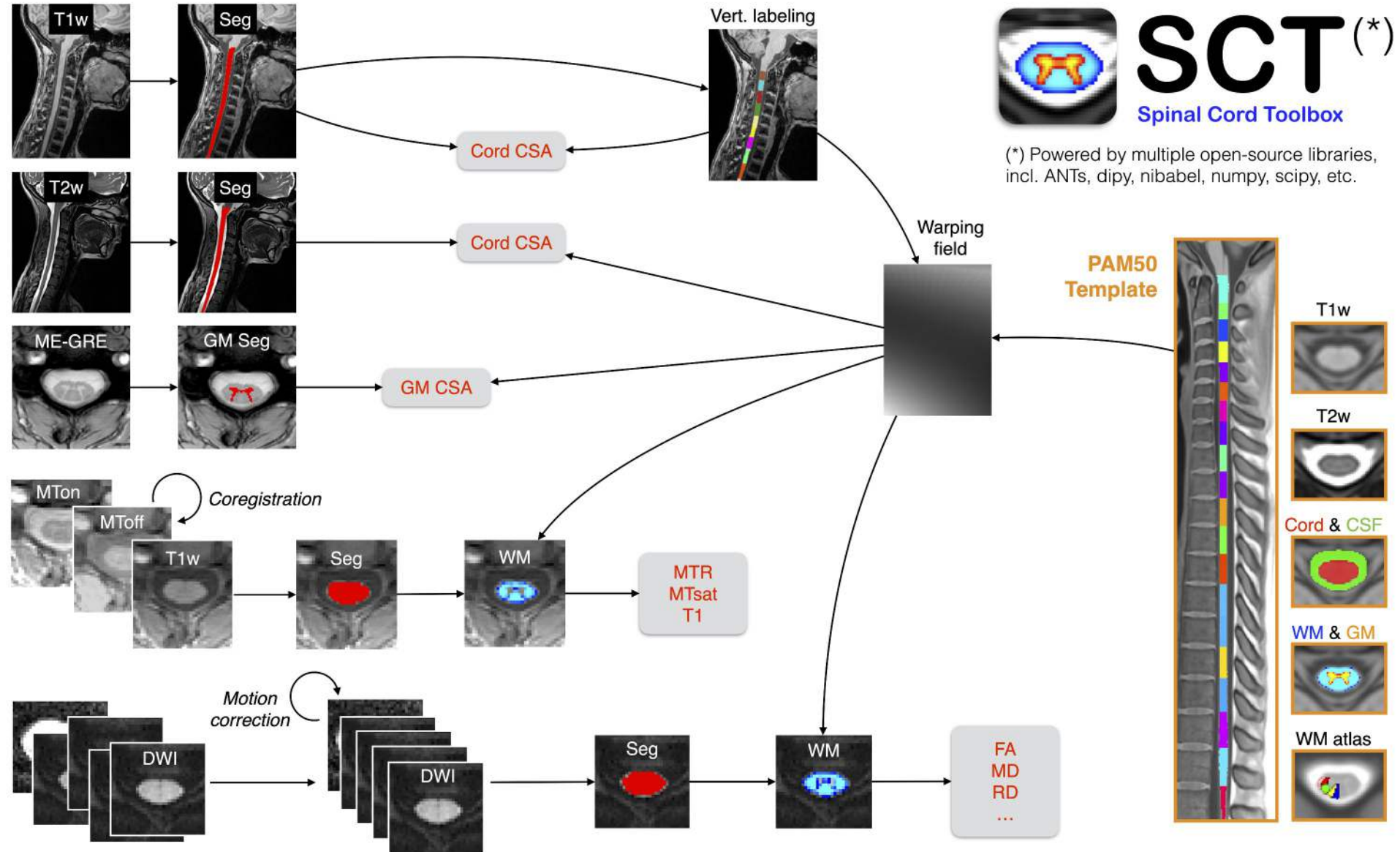
Brain Analysis Pipeline: T_1 , MTR, & MTsat



Brain Analysis Pipeline: Diffusion

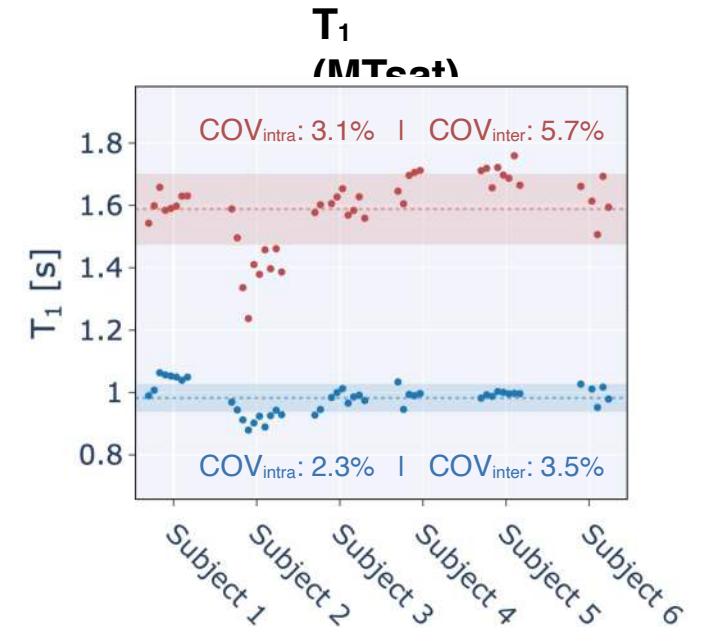
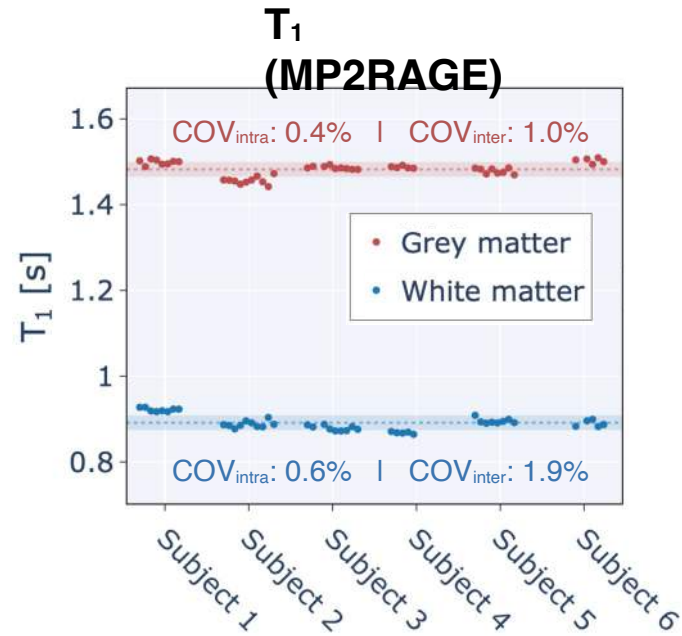
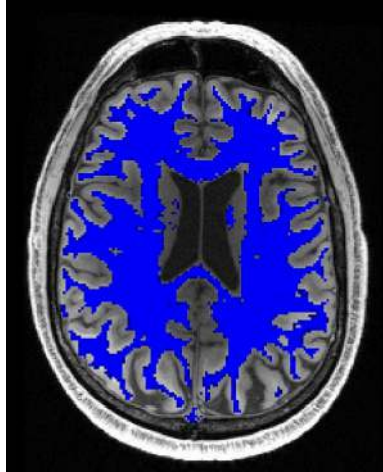


Spinal Cord Analysis Pipeline

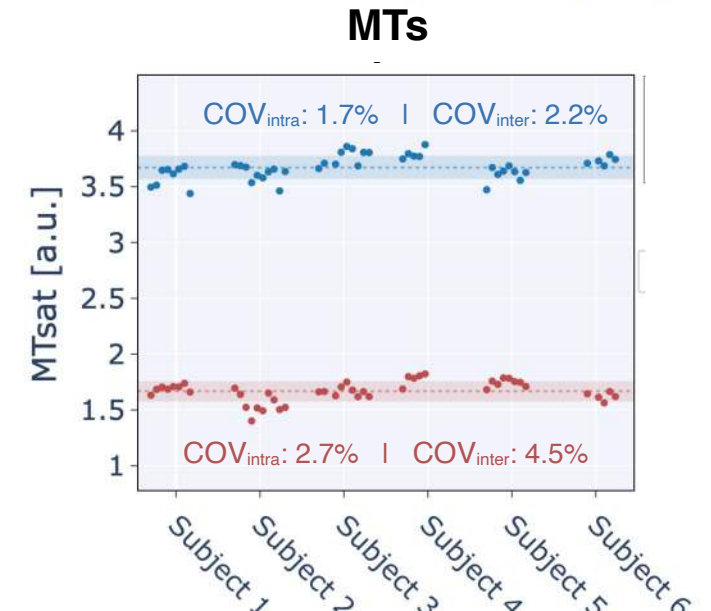
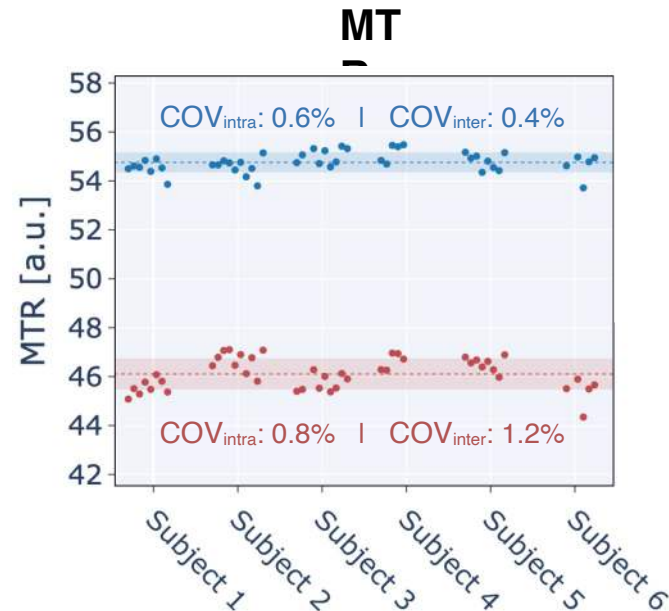
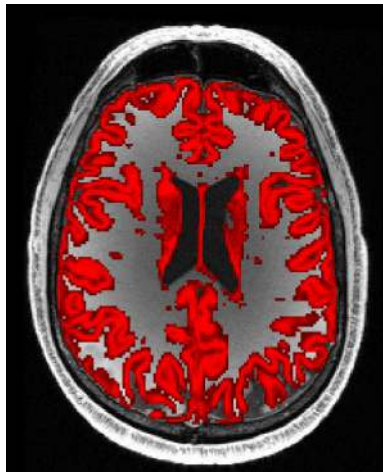


Results: Brain (T_1 , MTR, & MTsat)

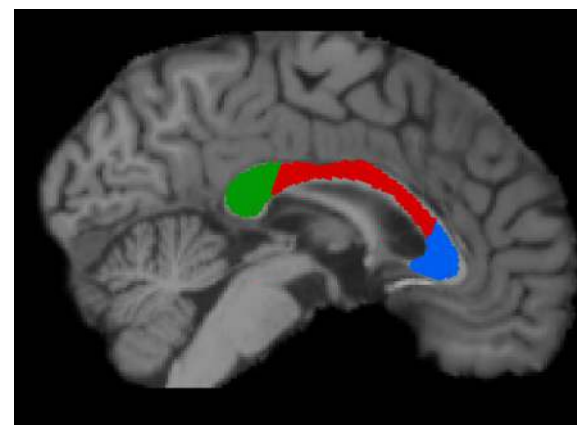
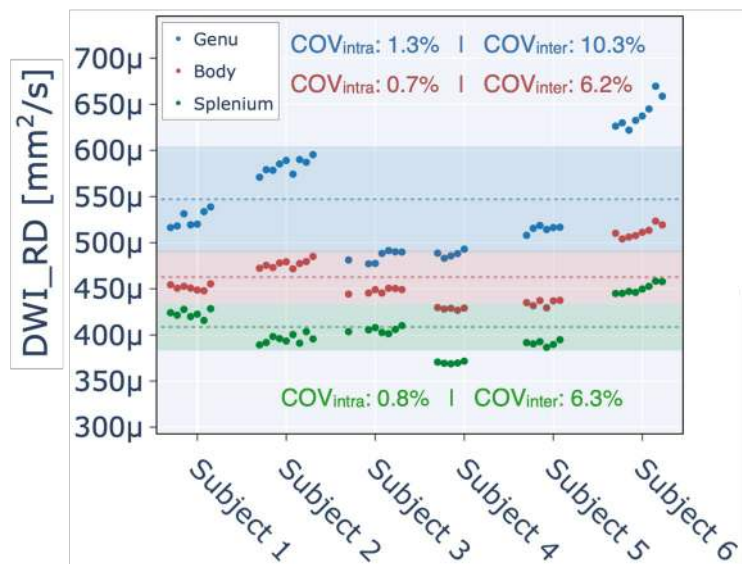
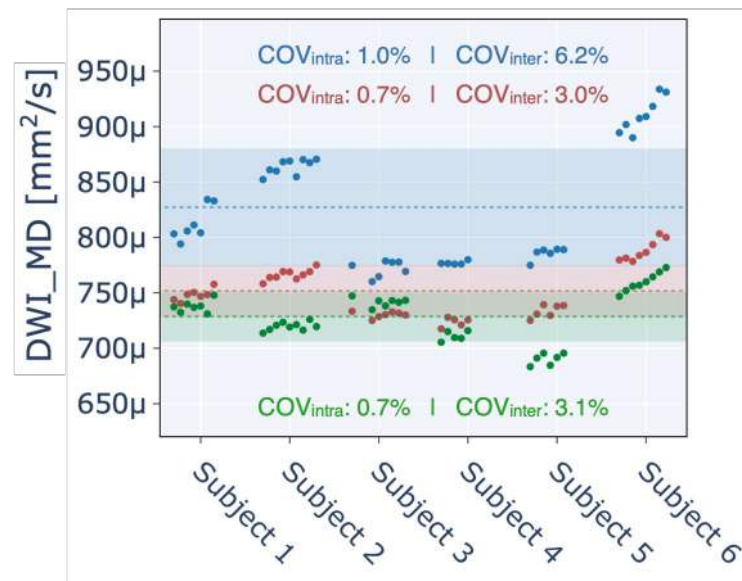
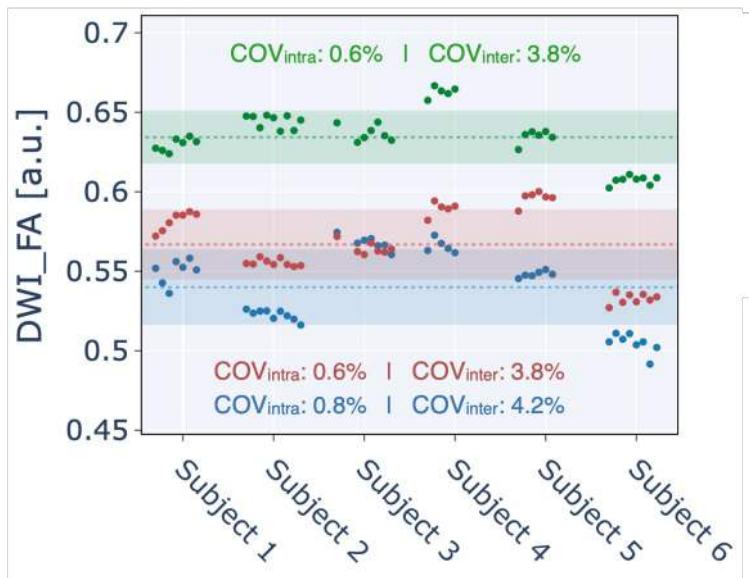
White Matter



Grey Matter



Results: Brain (diffusion)

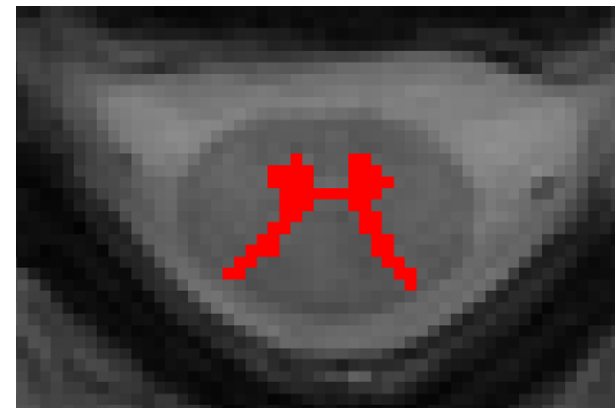
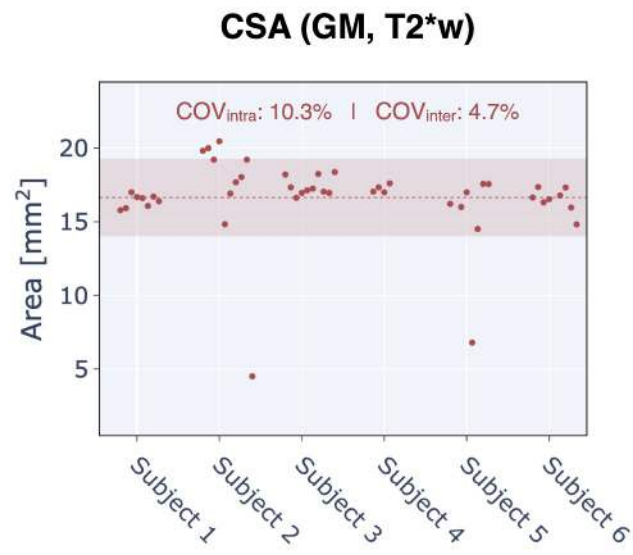
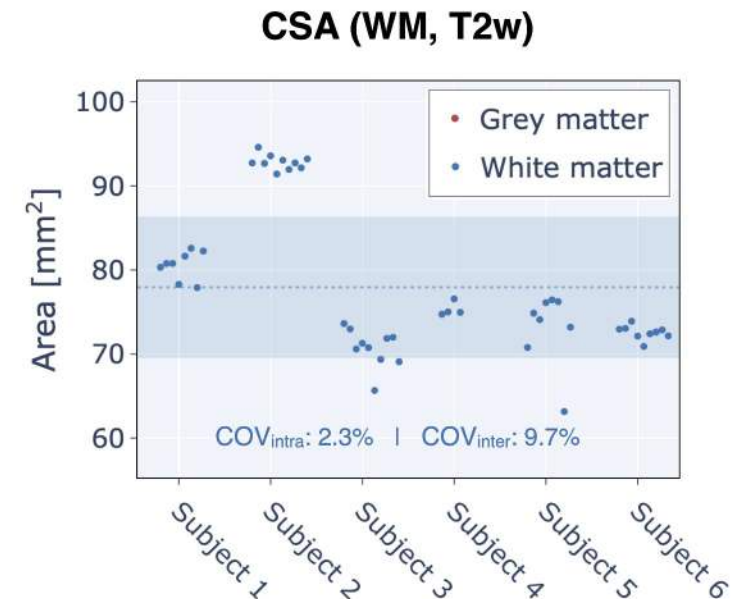
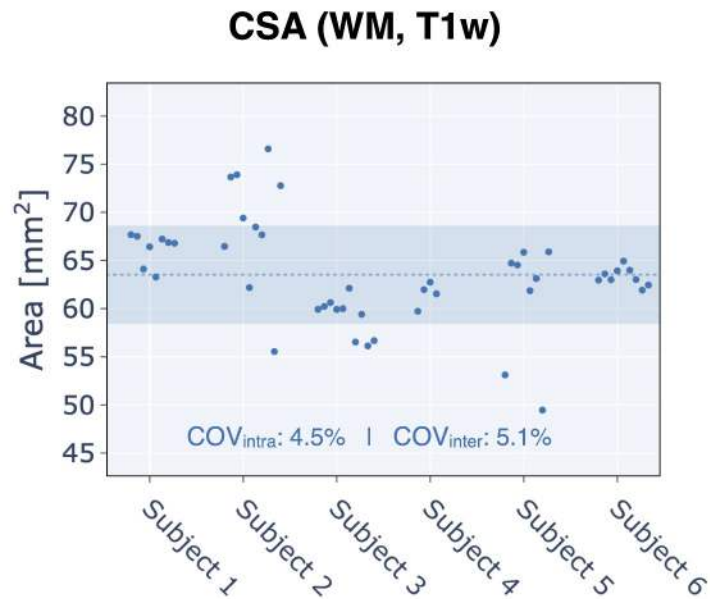


Genu

Body

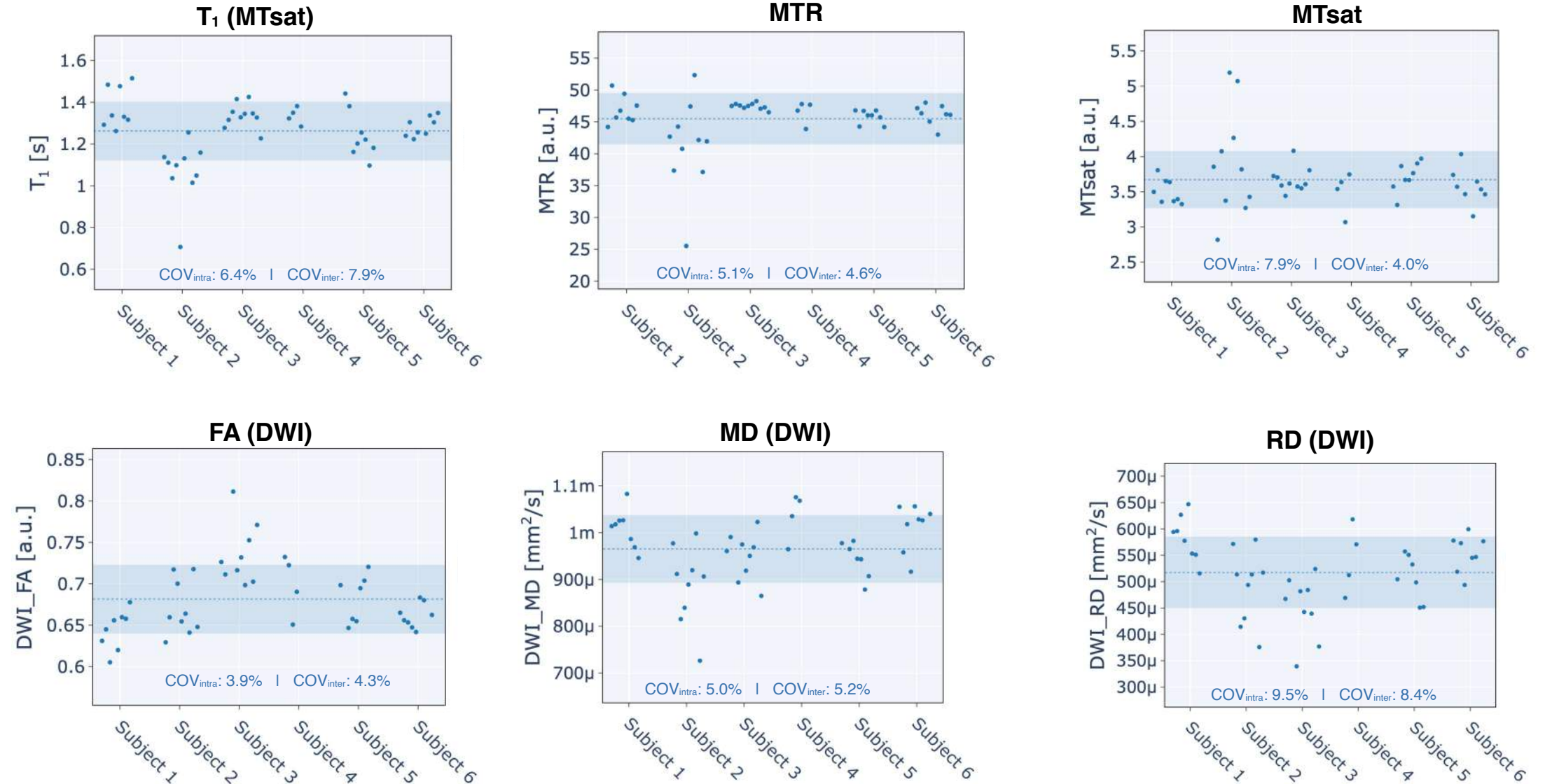
Splenium

Results: Spinal cord (cross-sectional area)



Grey Matter
(T2*w image)

Results: Spinal cord (T_1 , MTR, MTsat, & diffusion)



Key Takeaways



Brain T_1 (MP2RAGE), MTR, and diffusion demonstrated the best stability

Fill In details



Spine CSA demonstrated better stability than T_1 /MTR/Msat/diffusion

Good long-term stability of the cross-sectional area (CSA) quantitative metric in the spinal cord, and that T2w is the better choice for CSA quantification stability.



NEUROMOD
THE COURTOIS PROJECT
ON NEURONAL MODELLING

First anatomical data release of the ongoing CNeuromod Project

This long-term database of quantitative MRI measurements may be valuable information to incorporate in deep learning training models of other longitudinal measurements (eg, fMRI, MEG) to account for confounding changes in the brains of these subjects.

Interactive Preprint: courtois-neuromod.github.io/anat-processing-paper