

Measuring Regional Diffusivity Dependency via Mutual Information

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Motivation & Background

Diffusion Magnetic Resonance Imaging (dMRI) has been extensively applied to depict local **intra-voxel microstructure** of white matter (WM).

These indices (i.e., FA and MD) have been extensively applied as markers for studying WM abnormality related to pathological conditions.

The aim of this study is to propose a new metric for measuring **inter-voxel coherence** of regional diffusivity (i.e., **RDD**) using mutual information (MI).

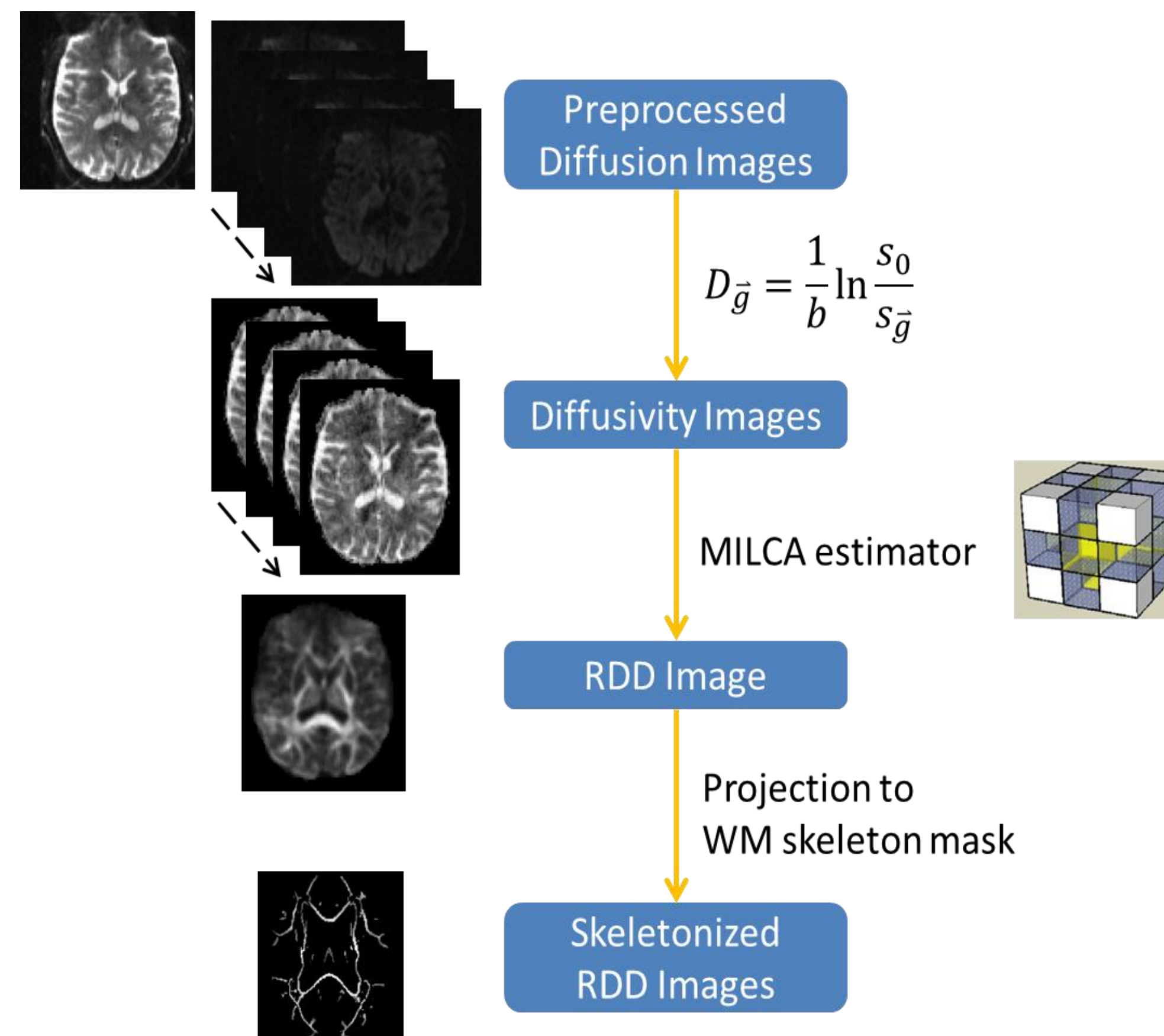
Dataset & Methods

The dMRI dataset (137 directions, 20 subjects, 34.3 ± 14.0 years) was from the NKI-RS Multiband Imaging Test-Retest Pilot Dataset.

MILCA estimator [1], a robust MI estimator.

TBSS frame work for across-subject analysis.

Compare RDD with LDH [2], which is based on Kendell's coefficient concordance (KCC).

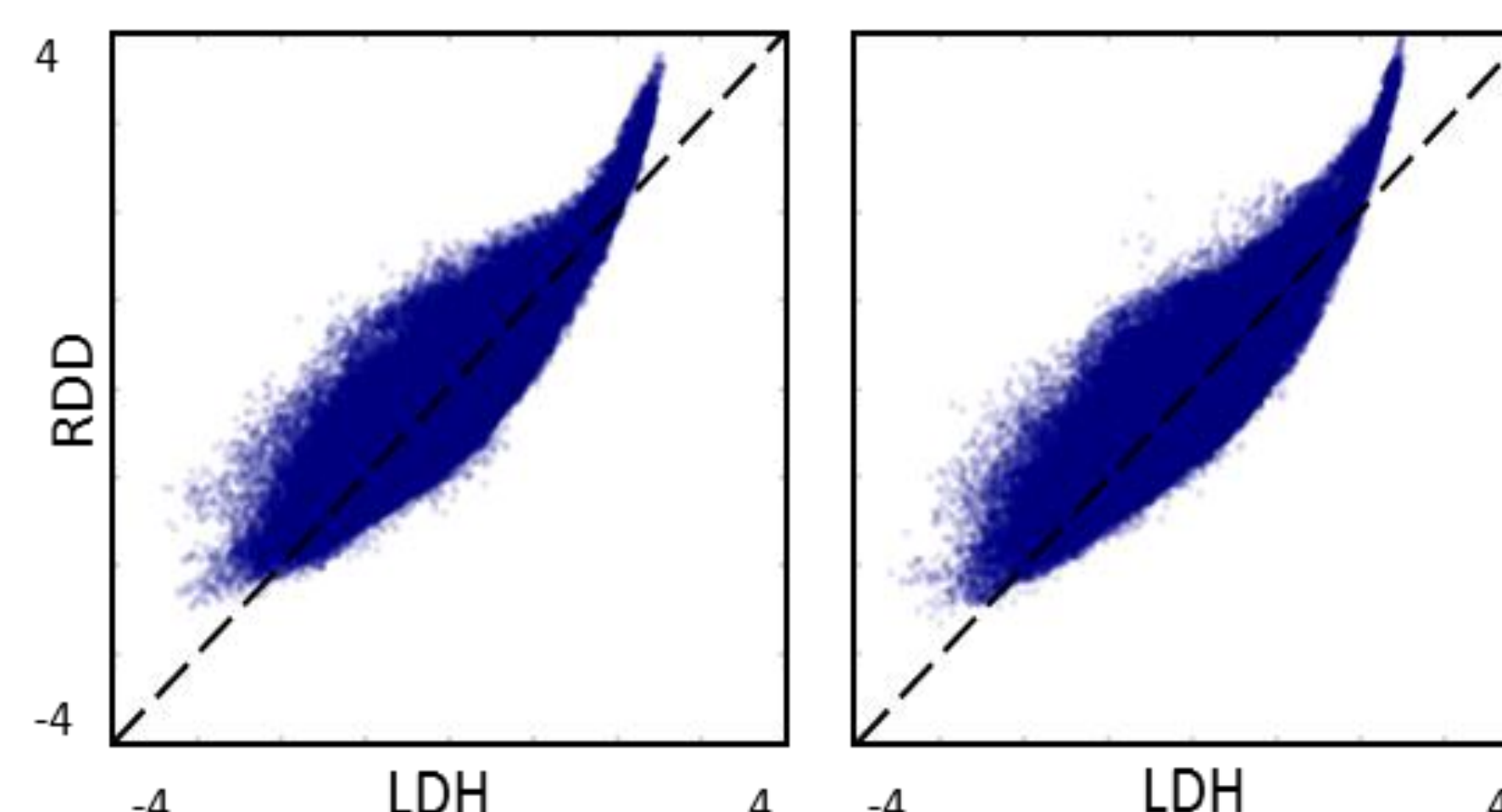


Results

1. Test-retest reliability

Metrics	Descriptive Statistics of ICC	
	Mean	SD
RDD	0.74	0.12
LDH	0.74	0.14
FA	0.71	0.16
MD	0.71	0.21

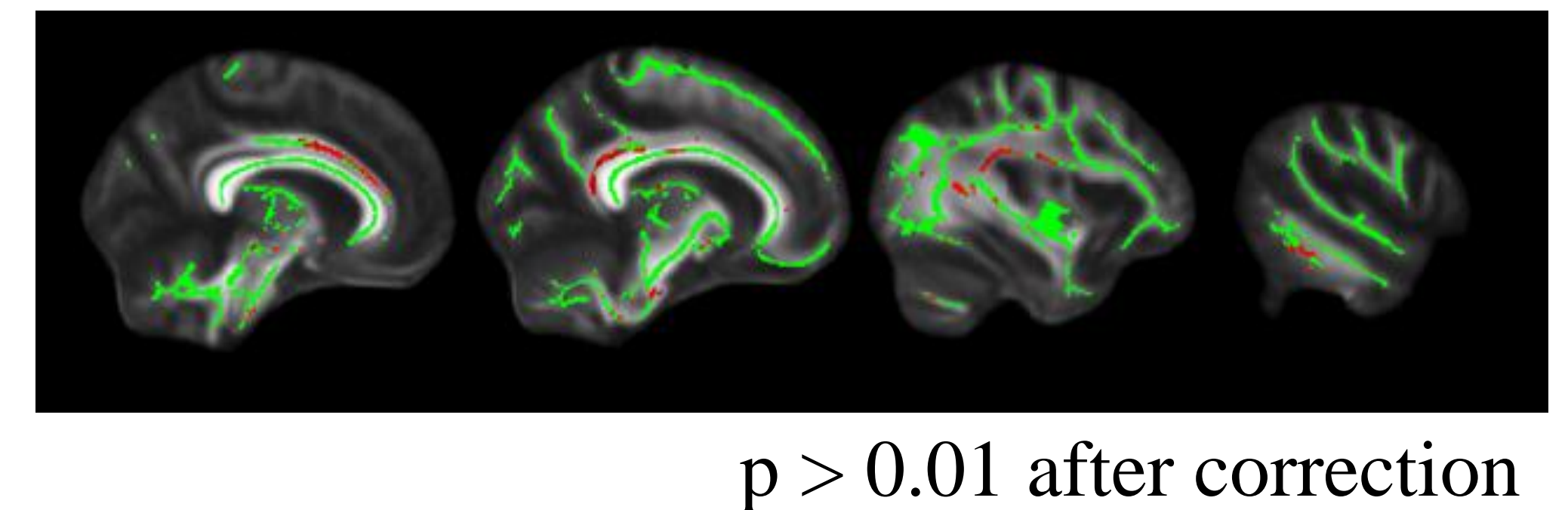
2. Spatial correlation with LDH



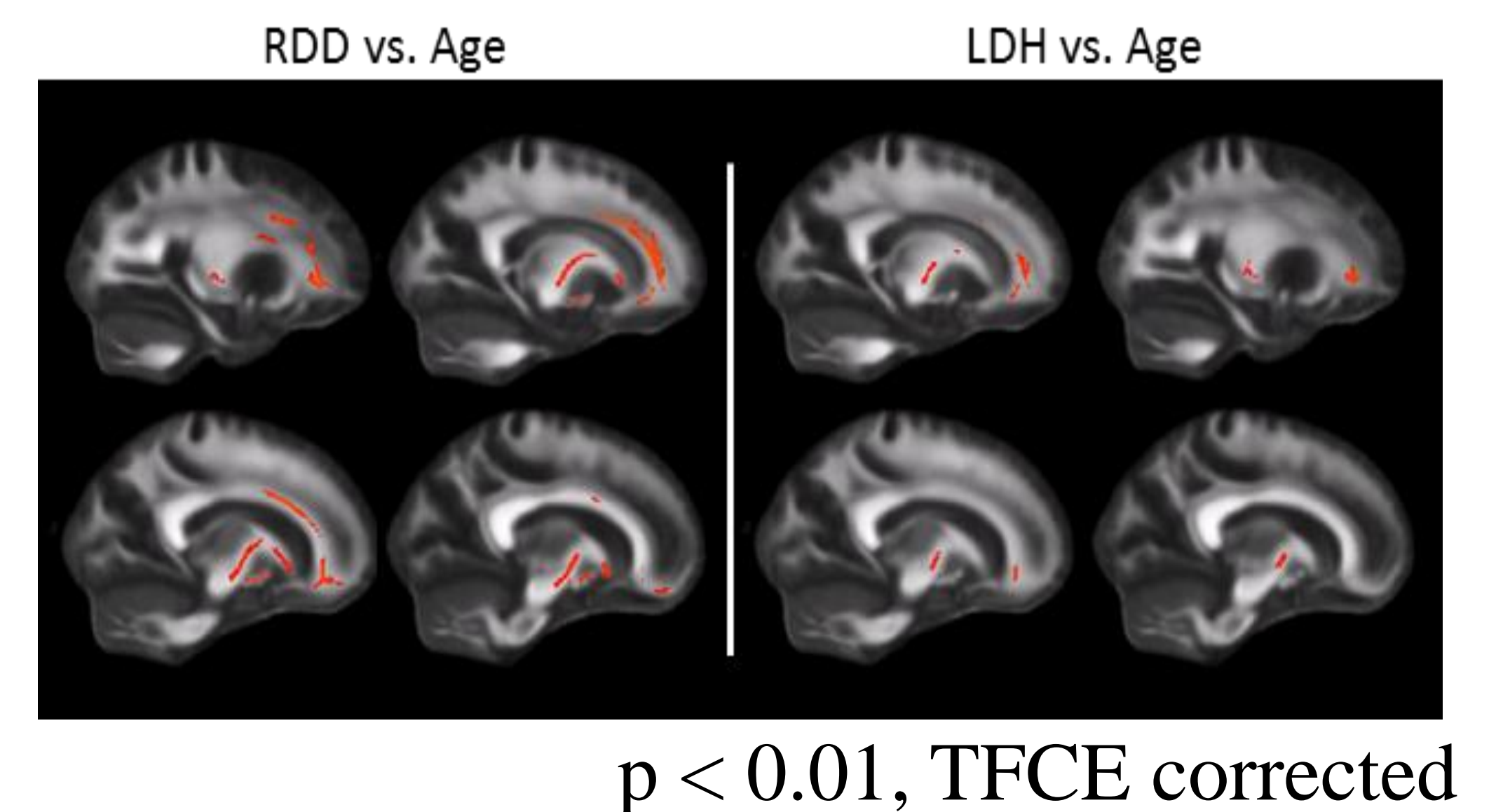
References

- [1] A. Kraskov, H. Stogbauer, P. Grassberger. Estimating mutual information. Physical review. E 69(6 pt. 2). 2004.
[2] G. Gong. Local Diffusion Homogeneity (LDH)... PLoS ONE 8(6): e66366. 2013.

3. Across-subject correlation



4. RDD and Aging



RDD: 4245 voxels; LDH: 1802 voxels

In sum, all results suggested that the RDD metric could detect the individual differences in WM more sensitively and act as an important marker about WM microstructure.

