Supplementary Material for Applications of Epsilon Radial Networks in Neuroimage Analyses

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Data and Pre-processing

DTI data from 78 male subjects were used in this study: 42 high function subjects with ASD and 36 controls subjects group-matched for age, handedness and IQ as can be seen from group-comparisons using these variables shown in the table in Fig. 2. DTI data were acquired on a Siemens Trio 3.0 Tesla Scanner with an 8-channel, receive-only head coil. DTI was performed using a single-shot, spin-echo, EPI pulse sequence and SENSE parallel imaging (undersampling factor of 2). Diffusion-weighted images were acquired in twelve non-collinear diffusion encoding directions with diffusion weighting factor $b = 1000\texttt{s/mm}^2$ in addition to a single reference image (b=0). Data acquisition parameters included the following: contiguous (no-gap) fifty 2.5mm thick axial slices with an acquisition matrix of 128×128 over a field-of-view of 256mm, 4 averages, repetition time (TR) = 7000ms, and echo time (TE) = 84ms. The brain tissue was extracted using the brain extraction tool (BET [2]), part of the FSL software package [3]. The tensor elements were calculated using non-linear estimation using CAMINO [4]. State-of-the-art diffusion tensor image registration DTI-TK [1] was used for spatial normalization of the subjects. An average DTI template was constructed using a total of 112 subjects.

References

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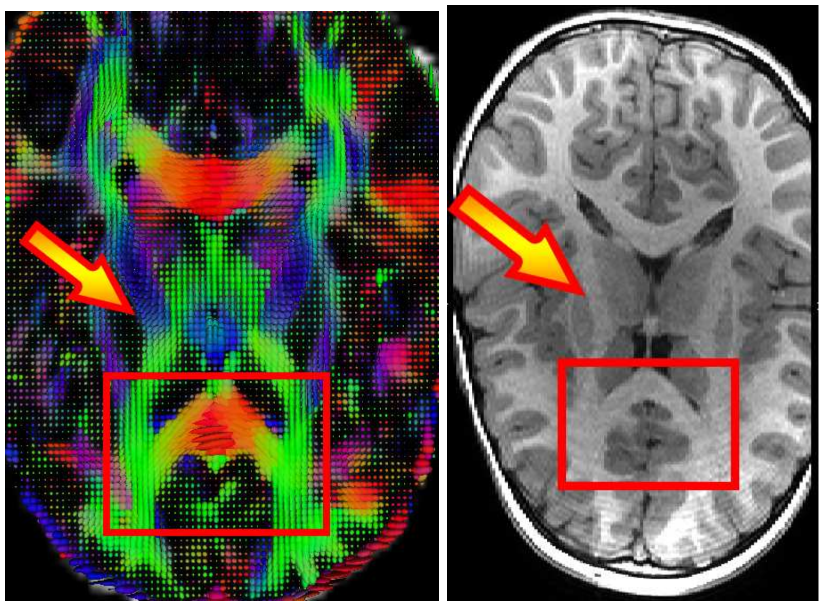

Fig. 1. A figure to demonstrate the difficulty of DTI to T1 co-registration. **Left:** An axial slice of DTI of a subject. The RGB color mapping shows the fiber orientations in XYZ directions respectively. **Right:** A roughly corresponding slice of T1-weighted image for the same subject. DTI to T1 co-registration is a hard problem since the white matter contrast is not specific enough in T1-weighted images: The arrow shows the region of internal capsule which has fibers going in two different directions (blue and green) as shown in the DTI image on left. That distinction is lost in the T1-weighted image as shown on right. Similarly, while the region enclosed in the box also has fibers going in three different directions, the T1-weighted image shows the same contrast for all the white matter. Utilizing contrast based on orientation information can be very helpful for accurate registration desired in white matter analyses [1].

Table I. Subject Characteristics

	TDCs (n=36)		ASDs (n=42)		Comparison	
	Mean (SD)	Range	Mean (SD)	Range	t-value	p-value
Age	15.25 (5.1)	8 - 26	15.38 (6.3)	6 - 30	0.0993	0.9212
Handedness	73.58 (32.8)	-60 - 100	70.98 (43.6)	-100 - 100	0.2943	0.7693
FIQ	113.75 (13.3)	85 - 136	108.00 (14.1)	85 - 137	1.8417	0.0694
PIQ	110.78 (12.8)	88 - 137	106.38 (14.1)	72 - 133	1.4174	0.1605
VIQ	112.17 (13.8)	81 - 140	108.05 (16.2)	71 - 145	1.2001	0.2338

Fig. 2. Table showing that the there are no significant differences between Age, Handedness, PIQ, VIQ between the two groups. Such a matching is important for finding group differences in white matter to minimize confounding effects. FIQ has a slight group difference but our other voxel based analyses show that the variable does not have a very significant effect.