**WHITE MATTER STRUCTURAL CONNECTIVITY WITHOUT DIFFUSION TENSOR IMAGING**

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**Introduction**

We present a novel computational framework for characterizing white matter (WM) structural connectivity. We do not use diffusion tensor imaging (DTI) but only T1-weighted magnetic resonance imaging (MRI). Structural connectivity via MRI has been proposed using cortical thickness before [1]. We propose to use the Jacobian determinant (JD) obtained from the tensor-based morphometry (TBM) [2]. By correlating JD in TBM, we can build a connectivity matrix based on the local volume.

The primary advantage of the proposed method is that it does not require DTI. Another advantage is that it uses JD that is defined over the whole brain including WM unlike cortical thickness.

The proposed framework is applied to the brain networks of the children who experienced early maltreatment and had been post-institutionalized in orphanages (PI; n=32) and age matched normal control subjects (NC; n=33).

**Results**

**Permutation test on the degree distributions**

<table>
<thead>
<tr>
<th>Degrees</th>
<th>NC</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0</td>
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1000 permutations, Bonferroni correction. (a) *p < 0.05, (b) null distribution Significant differences:

- PI > NC at low degrees (1 and 3)
- NC > PI at high degrees (15, 18, 20, 21)

**Simplified ε-neighbor graphs**

The thickness of edge codes the strength of connection Connections within the corpus callosum:

- Disjointed in PI when ε ≥ 12 mm
- Intact in NCs even for ε = 18 mm

**Discussion**

We have presented a novel structural connectivity mapping technique that uses only T1-weighted MRI. The global difference in degree distribution is significant. Visually, there seems to be a local network difference in the mid-body of the corpus callosum, which is known to be reduced due to the early stress [5].

**References**


