Forward Solutions

For the study, we assume that the bulk of detectable visual evoked potentials are generated by groups of pyramidal neurons located at the midpoint between the outer surfaces of the gray and the white matter. The orientation of the neurons is taken to be aligned perpendicular to the cortical surfaces. The discrete forward solutions in our boundary element models are produced in several steps. First, based on the individual MRI scans, 3-layer segmentation is generated that enclose of scalp, gray, and white matter. The initial segmentation results in approximately 150,000 triangulated mesh points per hemisphere at uniform density. Typically, this number is sufficient for producing accurate and smooth cortical representation. In the initial seeding of forward solution, 10,242 points are sampled uniformly from the 150,000 total mesh points per hemisphere. As For each of the subsampled populated, lead fields in the 3 Cartesian directions are calculated (Nunez, 1990). We have used the conductivity values ratio of (XX, XX, XX) for the scalp, gray, and white boundary layers (XXX, 1990). To give a measure of source densities, a 1 cm by 1 cm patch on the cortex contains approximately 170 mesh points but only 12 of these contain their own forward solutions. The lead field values are then interpolated to all of the remaining unpopulated high density mesh points. The interpolation is done with a simple nearest-neighbor sampling, which we believe is adequate since change in the lead field is sufficiently gradual. The reason we do not simply calculate forward solutions on all 300,000 physical mesh points is due to the taxing computational cost of lead field generation procedures. We believe the subsampling followed by the interpolation gives an acceptable method of optimizing computational versus modeling accuracy.

SIMULATION OF EXPERIMENTAL DATA

|  |  |
| --- | --- |
| Source response (time course) | Ales et al., 2009 |
| Source locations | Ales et al., 2010 |
| Conductivities | XXX |

The major goal of this simulation study is to test the validity of using principal component analysis for accurately predicting the V1 response. Incorporation of real experimental data and parameters from prior experiments bolsters the realism of the simulation. In particular, we suspect that the size and the geometry of the cortical activation is the crucial factor that determines the success or failure of PCA. We use retinotopic fMRI data to determine the expected location and orientation of visual sources that is expected to the simulated visual stimulus that correctly.

We simulate the EEG data in response to a check reversing 96-patch multifocal stimulus composed of 24 spokes and 4 rings. Save for their respective spatial locations, every Dpatch is assumed to be identical and are expected to produce response time courses that are identical. We have divided the 20 subjects into 2 groups consisting of 10 subjects each. The first group was presented with a stimulus with inner angle of 1.5 degrees and outer angle of 4 degrees. The latter was presented with 1.5 and 7 degrees inner and outer radius.

For the simulation of the data, we need (1) an assumption about the location of neural activation in response to the visual stimulus and (2) each subject’s forward solution. The location is