

Brain Visualization in Java3D

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BrainJ3D is a cross-platform Java/Java3D software toolkit for processing and visualizing brain imaging data, which 1) contains general purpose tools for reconstructing, mapping and visualizing integrated structural and functional images and 2) leverages Java's Remote Method Invocation to provide both a standalone and a client/server mode.

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BrainJ3D is a next-generation 3-D visualization package we are developing as a follow-on to the successful use of our custom but non-portable software by neuroscience researchers¹ (see also the companion poster by Poliakov et al). BrainJ3D provides two major pieces of functionality: 1) 3-D reconstruction, mapping, and visualization of integrated data, and 2) client-server operation. Given appropriate image volumes as input, BrainJ3D can generate and render in real-time (on the local workstation in standalone mode) an anatomically correct 3-D model of the brain. Using this surface model the user can map functional data onto the brain – such as cortical stimulation mapping (CSM) sites from a surgical photo [Fig 1] – or fMRI overlays [Fig 2].

Client-server mode, on the other hand, is designed to make it easier to share and view MRI and fMRI data over the Internet, thereby facilitating collaboration between labs, and improving the usefulness of central data repositories.

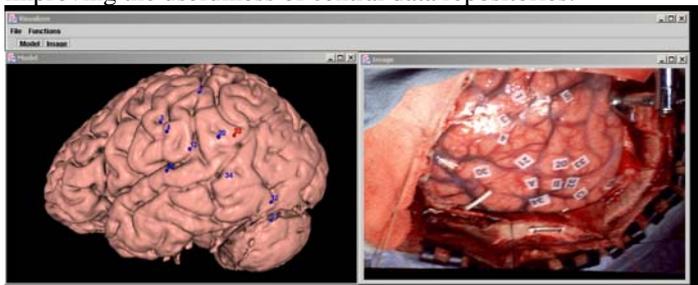


Figure 1. Mapping CSM sites from a photograph.

Sharing data is crucial to collaboration, but there are several roadblocks for sharing of neuroimaging data, including a sense of ownership over the studies, the physical difficulty in sharing and transferring extremely large studies, and a desire to maintain control of the data. BrainJ3D addresses these roadblocks in several ways. To reduce the need to transmit large studies client/server mode is designed using the off screen rendering feature of Java3D, so that renderings are

computed on the server, and only snapshots are exported to the client. Such an approach means the clients do not need overly fast network connections, nor expensive hardware or complicated software installations.

In addition, client-server operation permits fine-tuned control over data sharing. Because BrainJ3D supports various levels of security on the user level, the sharing lab can set up restrictions on which datasets can be viewed by certain individuals. This feature allows labs to share more data with trusted collaborators and to add restrictions to the general public or less trusted collaborators. The lab maintains control of the data because only snapshots of the models or slices are exported to other computers, whereas the data stay local.

Although initially designed as a follow-on to existing tools within our own group, BrainJ3D was also designed to be flexible, expandable and interoperable with popular software tools (including SPM). We believe that current and future versions will provide an increasingly valuable visualization and data sharing tool for users, fMRI data repositories and individual labs.

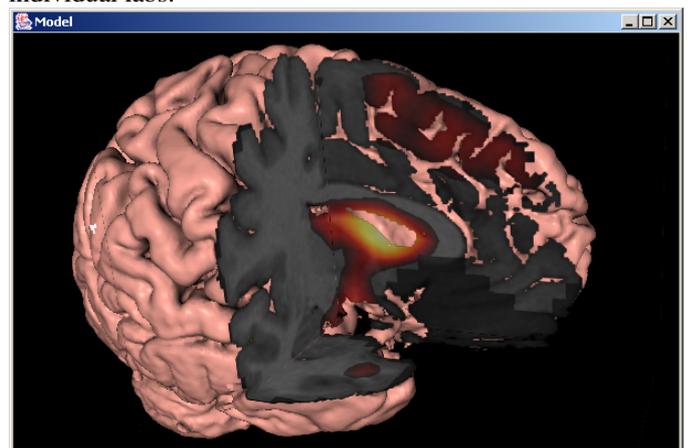


Figure 2. Cutaway of surface model with fMRI activation.

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1. Poliakov, A.V., Albright, E., Corina, D., Ojemann, G., Martin, R.F. and Brinkley, J.F. 2001 Server-based approach to web visualization of integrated 3-D medical image data. Proc AMIA Symposium 2001, pp 533-537.