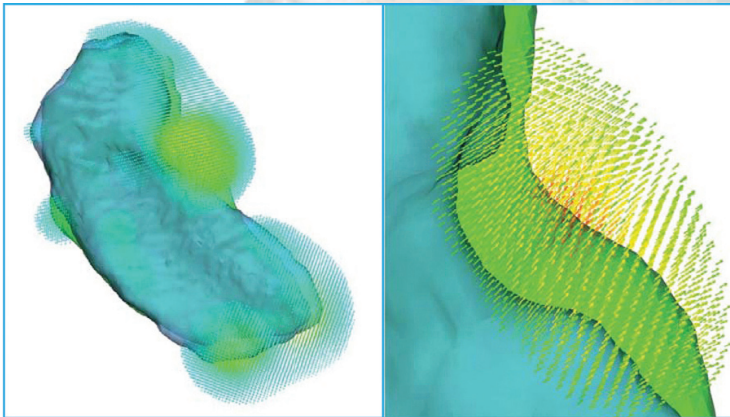Morphometry BIRN researchers are examing neuro-anatomical correlates of neurodegenerative disorders. These disorders include unipolar depression, Alzheimer's disease, and mild cognitive impairment. Ten groups currently participate.

By acquiring and pooling patient data across sites, scientists are analyzing data from a large group of subjects, in order to investigate what structural brain differences correlate to symptoms of memory dysfunction or depression. This line of research has already uncovered new diagnostic differences and is expected to lead to potential therapies.
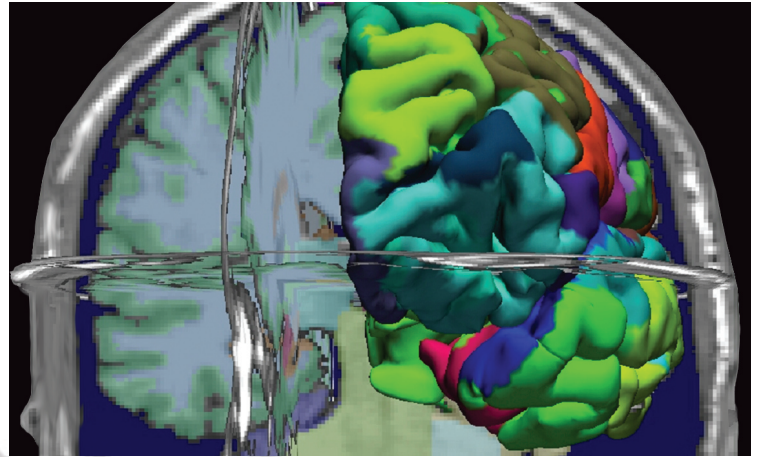
Morphometry BIRN *at work*

Shape analysis in Alzheimer's from the Morphometry BIRN test bed — Anatomical variation in the brain is a central issue in the study of magnetic resonance imagery (MRI). After correctly segmenting and labeling structures of interest, researchers can apply a variety of advanced techniques to study the morphometric properties of these structures. For example, researchers within the Morphometry-BIRN test bed are developing a Large Deformation Diffeomorphic Metric Mapping (LDDMM) application to assign metric distances onto anatomical images in support of computational anatomy. In this way the LDDMM software tool will provide for the direct comparison and quantization of changes in brain morphometrics.

MORPHOMETRY BIRN PARTICIPANTS INCLUDE:

❖ Center for Functional Neuroimaging Technologies, Massachusetts General Hospital

❖ Center for Image Science, Johns Hopkins University

❖ fMRI Research Center, University of California, San Diego

❖ Laboratory of Neuro Imaging, University of California, Los Angeles

❖ Brain Imaging Center, University of California, Irvine

❖ Brain Imaging and Analysis Center, Duke University

❖ Surgical Planning Lab, Brigham and Women's Hospital

❖ Neuroinformatics Research Group, Washington University, St Louis

❖ Computer Science & Artificial Intelligence Lab, Massachusetts Inst. of Technology

❖ Center for Brain Science, Harvard University

Caption: Left panel: two human hippocampi with the velocity vectors calculated by LDDMM. Right panel: the threshold of displayed velocities can be adjusted to display a narrow range of velocities—in this case the largest velocity vector, and hence primary deformation. (Images courtesy of The John Hopkin's Center for Imaging Science)

The Brain Morphometry test bed develops and shares collaborative methods, data, tools, and tutorials from participating institutions and other groups that share their data through our infrastructure. We continuously update our Web site with new versions and resources. See the BIRN site (http://nbirn.net/downloads/) to access the complete and diverse set of Morphometry BIRN shared resources. The following highlights describe some of our recent accomplishments.
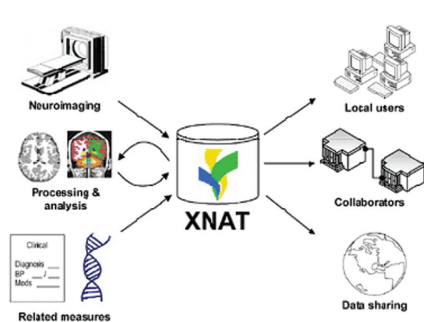
TOOLS

3D-Slicer/FreeSurfer integration — a new module is available for the visualization tool 3D-Slicer called vtkFreeSurferReaders. This module allows results generated from FreeSurfer to be loaded and manipulated with the 3D-Slicer environment. The user can view segmentation results as an overlay, build 3D models of brain structures, view white matter parcellations, and perform group statistics on cortical surface measurements. More information can be found on the NA-MIC Wiki: http://www.na-mic.org/Wiki/index.php/Slicer:Workshops:User_Training_101
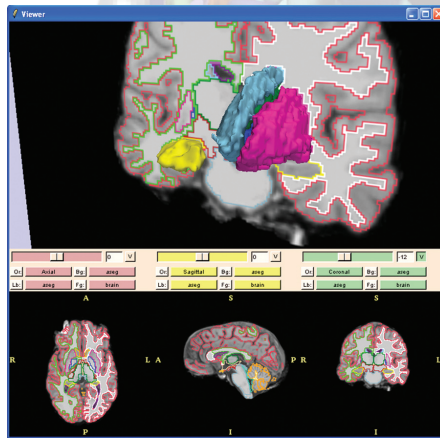
XNAT — the new Web-based database tool, the Extensible Neuroimaging Archive Toolkit (XNAT) is an open source software tool for organizing and querying both imaging data sets and meta-data, such as health history and genetic information.

XNAT provides database tools for securing, organizing and maintaining the data as well as informatics tools that enhance data mining. An extensible XML schema is used by XNAT to define the data structure, and tags are provided to represent common imaging data. The software is a collaborative effort involving Washington University St. Louis, Harvard University, Howard Hughes Medical Center, and BIRN. More information on XNAT can be found at **http://xnat.nmr.mgh.harvard.edu/home.jsp**

DATA SETS

Structural MRI Calibration Data — from 5 healthy volunteers scanned multiple times on multiple sites having different 1.5T systems (manufactured by Siemens, GE, and Picker) was collected in order to investigate various metrics of within-site and across-site reproducibility. For each subject, four multi-spectral structural scans were obtained in a single scan session, from which tissue proton density and T1 maps can be derived.
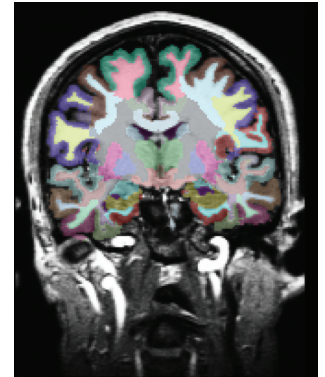
Diffusion MRI Calibration Data — was acquired as part of a study to investigate reproducibility of diffusion-derived metrics, such as fractional anisotropy maps. The dataset details the effects of the following parameters on the reproducibility of DTI derived data: signal-to-noise ratio (SNR), number of gradient orientation, b-value, and echo time. This first database is designed to assess the impact of SNR and gradient orientation.

The data consists of DTI datasets with b=1000 s/mm^2 and 30 gradient orientations. With 5 b=0 images, one complete dataset has 35 images. The measurement was repeated 7-15 times. From this dataset, DTI-based contrast can be generated using from 1-15 datasets (lowest-highest SNR). Also, by using only a subset of the 30 orientations, the impact of changing the number of gradient orientations can be studied. To measure the reproducibility of various analysis results, the entire study was repeated 3 times at different occasions using the same subject.