In this issue of JAMIA, the focus section of papers on biomedical imaging/neuroscience is a sequel to the set of papers on bioinformatics/neuroinformatics that appeared in the January 2001 issue. Again, this issue collects three representative works by recipients of grants from the Human Brain Project*—works that focus, this time, on the tools and methodology to support the biomedical imaging aspects of neuroscience research.

Brain mapping and neuroimaging have recently witnessed an exponential rise in interest, output, and productivity similar to the rise in neuroscience research. Throughout the neuroscience community, however, there is a frustration with the volume of image data that are generated and their relative inaccessibility in forms other than textual narrative. To increase the efficiency of the biomedical imaging aspect of neuroscience research, a system to provide a logical and organized system for maintaining and distributing data is much needed. The paper “A Four-dimensional Probabilistic Atlas of the Human Brain,” by John Mazziotta, Arthur Toga, Alan Evans, and colleagues filled such a need. It describes the development of a four-dimensional atlas and reference system that includes both macroscopic and microscopic information on the structure and function of the human brain in subjects between the ages of 18 and 90 years. By means of the International Consortium for Brain Mapping (ICBM), they include 7,000 subjects in the initial phase of the database and atlas. In addition, 5,800 subjects will contribute DNA to enable genotype-phenotype-behavior correlations. This paper reports the process of developing the strategies, algorithms, data collection methods, validation approaches, database, and distribution of results and illustrates them with exemplary applications. The success of this project will provide new insights into the interrelationship between microscopic and macroscopic structure and function in the human brain and will have significant implications in basic and clinical neuroscience.

Working from a different perspective, the researchers at the Stanford Psychiatry Neuroimaging Laboratory (SPNL) are addressing the issue of sharing of neuroimaging informatics tools. The paper “BrainImageJ: A Java-based Framework for Interoperability in Neuroscience, with Specific Application to Neuroimaging,” reports a new software framework fully implemented in Java. The design of BrainImageJ serves two goals—to streamline the evolution and maintenance of neuroimaging tools in SPNL and to facilitate interoperability of tools and files through public computational data models. The framework consists of a set of programming interfaces for data modeling, file manipulation, algorithmic problem solving, and image visualization as well as an application front end. Such a framework, once it has matured, will have the potential to serve as an interlaboratory platform for designing, disseminating, and sharing informatics tools in the neuroimaging/neuroscience community.

The irregularity and variability of the cortex convolutions pose major challenges in analyzing and visualizing cortical structure, function, and development. Computational cortical cartography provides a pow-

erful approach these problems by using surface-based visualization and analysis methods. The work reported by David Van Essen and colleagues at the Washington University describes an integrated software framework for carrying out surface-based analysis of cerebral cortex. The first component of this integrated system, SureFit (Surface Reconstruction by Filtering and Intensity Transformations), is used for cortical segmentation, volume visualization, and initial surface generation. The second component, Caret (Computerized Anatomical Reconstruction and Editing Tool Kit), provides a wide range of surface visualization, surface manipulation, and analysis options. The third component, SuMS (Surface Management System), provides data archive and user interface facilities for surface-related data. Most important, the Results section of this paper emphasizes information that is helpful to users interested in using this software system to analyze their own experimental data or to view surface-based atlases.

Finally, we hope that the selected ideas and results represented in this second section of papers on Human Brain Program Research Progress will introduce new and better ways to develop tools to support brain imaging/neuroinformatics research and will lead us to the discoveries and realization of the next generation of biomedical imaging tools and database management systems for advancing neuroscience research.—STEPHEN T. C. WONG, PHD, STEVEN H. KOSLOW, PHD

References


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