

XNAT: A Software Framework for Managing Neuroimaging Laboratory Data.

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Laboratories that collect large and diverse data types, such as those using imaging techniques, require substantial within-laboratory data management resources in order to facilitate local usability and to prepare data for between-laboratory sharing and analysis. The eXtensible Neuroimaging Archive Toolkit (XNAT) has been developed to support this need. Experimental data types are defined in XNAT using XML Schema. The XML Schema document is also used by XNAT to automatically generate the data store, modules for retrieving and storing data, and custom web pages. Laboratories preparing to use XNAT can utilize predefined data types in XNAT's standard schema or extend the schema to include their own data types. The schema document also defines relationships between data types, allowing XNAT to run complex queries and searches of the data store. XNAT provides a number of features for interacting with the data store, including: (1) web-based data entry, exploration, and visualization tools; (2) a data validation service; (3) services to share data as html, PDF, spreadsheets, and XML; (4) command-line tools for retrieving data from the archive; (5) administrative tools for managing security and user privileges; and (6) services to run local processing routines. XNAT currently services a multi-center neuroimaging data repository at Washington University, and includes data from the Alzheimer's Disease Research Center and Conte Center. Data includes over 5000 T1- and T2-weighted and diffusion tensor MRI images from over 700 subjects, as well as a range of derived (e.g. manual and automatic brain segmentations), clinical (e.g. CDR, MMSE), demographic, and psychometric data. A genetics module is under development. XNAT enables the quality control, data integrity, and security measures that are required for such multi-center research programs.