December 2006

Edition: 7

Middlesex University

Tele-imaging in MEdicine

Overview

In the fifth newsletter of July 2006, the progress of work on a prototype tele-imaging system was reported. The GNU Image Finding Tool (GIFT) was proposed, which provided a framework that was built upon. Work continues on the attempt to co-register PET images with digital brain in real time.

The functional nature of PET images is expressed by a series of 2D slices which may be integrated to form a 3D representation in order to visualize PET images. Indeed effective co-registration is an important first-step for the correct visualization of PET images.

The processing of medical image data can be computationally intensive and data acquisition often require pixels of high quality leading to increased storage requirements. The complexity of medical image research also means that distributed collaborations such as remote visualizations are needed.

These led to the exploration of open-source software applications for Grid Computing and Visualization.

Grid Computing

An important distinction between the Internet and the Grid is that while the internet serves as a medium for sharing information, the Grid is a service for sharing computer power and data storage capacity over the internet. As such, the value of Grid Technology in building regional and national medical image archives is underlined. Globus Toolkit is one of the most popular software for making Grids.

OGSA-DAI web services can be deployed within the Globus Grid environment. It provides a data service framework for accessing and integrating files, relational and XML databases onto grids. An OGSA-DAI web service allows data to be queried, updated, transformed and delivered. It can be used to provide web services that offer data integration services to clients and therefore provides a means for users to Grid-enable their data resources.

Visualization of Medical Images

Four open-source software applications were explored within the context of two programming languages (C++ and Matlab).

3D Slicer and Osiris were both written in the C++ language and provide extensible functionalities for handling PET images. 3D Slicer is an open-source application that assists with the visualization, registration, segmentation, and quantification of medical image data. Osiris is a viewer for Papyrus / DICOM images (the actual standard for viewing, storing acquiring, communicating radiological and non-radiological medical images). Slicer is built on VTK, the Visualization Toolkit, hence modules have access to a wide range of visualization capabilities. The source code of Slicer can be divided into two main parts: Tcl/Tk modules and C++ code that extends VTK. Osiris viewer can enable the extension of Slicer for handling the PET image format more effectively.

SPM and Brede Toolbox are written in Matlab which conveniently has

visualization functions available in version 5.3 and above. SPM (Statistical Parametric Mapping) software is designed for the analysis of brain imaging data sequences. The sequences can be a series of images from different cohorts, or time-series from the same subject. It refers to the construction and assessment of spatially extended statistical processes used to test hypotheses about functional imaging data. The Brede Toolbox is a neuroinformatics toolbox whose primary purposes are handling, analyzing and visualizing data from functional neuroimaging experiments e.g. statistical parametric images and location data in stereotaxic space. It includes general purpose analysis algorithm for the visualization of multiple foci, volumes or surfaces in a 3-dimensional Corner Cube visualization or visualization with the VRML97 3-dimensional model language.

Future Directions

The Globus/OGSA-DAI solution can aid the exchange of valuable image data for the development of tele-imaging systems. For example, an image retrieval system may be able to query databases over a secure grid and the resulting data can be visualized without any breach of confidentiality. This is important for partners/collaborators in facilitating exchange of valuable medical data. There are other tools like OGSA-DAI that are used for managing security, collaboration, computation etc. The installation and configuration of the Globus and OGSA-DAI software on a Linux machine, although complicated, highlighted the need for further extensions to meet the requirements of the TIME project. It is unlikely that this extension can be achieved within the timeline of this project.

The lack of apparent anatomical information in PET images and the complexity of integrating 2D slices to form a complete 3D model have made it difficult to visualize PET images. There has been research into visualization methods which has led to a number of open-source software applications. Some of these applications have been explored. Matlab is a good platform for the development of computational algorithm, more so with the availability of visualization functions. The C++ solution is an area of expertise for the current researcher and is bolstered by the availability of the Visualization Toolkit. A review of visualization literature identified SPM as a popular modelling tool amongst researchers and as such Matlab may be the choice for future development.

It is envisaged that remote visualization of PET data will encourage more ideas between partners and lead to more fruitful research in this area.

Update of MIMI 2007 Website

The MIMI 2007 website has recently been updated with new information. Please check regularly for updates.

DIARY DATES	
JUNE 2007 EuroPACS June 20-23, 2007, Berlin, Germany. http://www.europacs.org	**AUGUST 2007** *August 14-16, 2007* MIMI2007, Beijing, China http://www.mitime.org/mimi2007.html

Project Web Page

www.mitime.org

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