Human Brain Mapping 2008

Print

Abstract Number: 1230 Submitted By: Blake Lucas
Last Modified: January 6 2008

MAPS: A Free Medical Image Processing Pipeline

Blake Lucas[1], Bennett Landman[1], Jerry Prince[1], Dzung Pham[2]

[1]Image Analysis and Communications Laboratory (IACL), The Johns Hopkins University, Baltimore, MD, United States/[2]Laboratory of Medical Image Computing (MedIC), The Johns Hopkins University, Baltimore, MD, United States

Introduction: The MedIC Automated Pipeline Scheduler (MAPS) is a free software package for designing and executing pipelines, which are multi-stage processing tasks. MAPS integrates with MIPAV (Medical Image Processing, Analysis, and Visualization) software, a free medical image analysis tool (http://mipav.cit.nih.gov). MAPS utilizes MIPAV plug-ins as modules in MAPS pipelines. To automate multiple executions of pipelines with variable inputs, MAPS includes a process manager that spools processing tasks over multiple processors. The MAPS software package is distributed as a platform-independent Java application, which is publicly available at http://medic.rad.jhu.edu.

Methods: MAPS consists of a Layout Tool, Process Manager, and Application Programming Interface (API). The base MIPAV package includes a Java programming interface for developing new plug-ins. The MAPS API extends this interface to automatically generate Graphical User Interfaces (GUIs) based on specified input and output arguments to each plug-in. Plug-ins developed within this framework are automatically registered as processing modules by the MAPS Layout Tool. Once a plug-in is MAPS-compatible, it can be executed manually through MIPAV or automatically through the MAPS Process Manager.

The MAPS Layout Tool provides a visual interface for composing pipelines from MIPAV plug-ins. The MAPS user interface is similar to existing visual pipeline tools, such as the LONI Pipeline (http://cms.loni.ucla.edu/pipeline/); however, because the tool was built to integrate with MIPAV, MAPS has several advantages over its competitors. First, algorithms can utilize any of MIPAV's functionality since MAPS executes each plug-in in a virtual MIPAV environment. Second, MAPS can automatically extract input/output argument information from plug-ins, so there is no need to manually specify this information when adding new plug-in modules to the MAPS registry. Third, all plug-ins can read or write data in any of MIPAV's supported formats, which eliminates compatibility problems usually encountered when forwarding information from one plug-in to another. Finally, MIPAV plug-ins can be easily distributed as platform independent JAR files.

The MAPS Layout Tool is accompanied by the MAPS Process Manager, which permits real-time monitoring and managing of processing tasks. MAPS automatically resolves dependencies between processing tasks so that tasks are executed in the appropriate order. In the event that more than one task can be run simultaneously, MAPS attempts to distribute tasks across multiple processors. The MAPS Process Manager displays real-time information about process status, computation time, memory usage, algorithm progress, task dependencies, and algorithm arguments.

Results: Figures 1-3 show MAPS controlling the CRUISE pipeline.

Conclusions: The MAPS package, which includes the API, Layout Tool, and Process

Manager, provides an environment for neuroscientists to develop, design, and automate sophisticated multi-stage processing tasks. We currently have over forty MAPS-compatible plug-ins, which include tools for cortical reconstruction, geometric deformable models, tissue classification, topology correction, deformable registration, surface inflation, data comparison, and many others. Future efforts will be devoted to incorporating additional plug-ins into the MAPS infrastructure and wrapping non-Java software packages to be compatible with MIPAV and MAPS.

References: X. Han, D. Pham, D. Tosun, M.E. Rettmann, C. Xu, and J.L. Prince, "CRUISE: Cortical Reconstructiong Using Implicit Surface Evolution," NeuroImage, 23: 997-1012, 2004.