

BrainMOD: 4-dimensional multimodal medical image analysis software

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Purpose of the software

Within the Central Nervous System Imaging project (<http://www.eniac-csi.org/>) of the ENIAC consortium, the need has emerged for a general multimodal visualization platform which facilitates the evaluation of data produced by new enhanced devices developed in the project. Taking advantage of multi-source post-processed data, this software aims to help interpreting complex intra-modal relationships. The modalities involved are PET, MRI, EEG, EIT.

According to the project proposal, our purpose was to develop a software for interactive user-friendly 2D and 3D visualization of post-processed multi-modal medical imaging data. Important requirements were to manage dynamic image data and explicitly support the use of various enhanced brain imaging techniques.

Methods / Implementation

The input of the software are MR structural data, fMRI and PET dynamic data and activation maps (GLM, ICA), EEG/EIT based static functional maps and dynamic data, other EEG and fMRI related time series (eg. hemodynamic response functions, independent component analysis time courses), volumes-of-interests of segmentation data and EEG/EIT marker positions. Besides conventional 2D image fusion features, the software provides numerous ways to reveal intra-modal dynamic relationships. Volumes-of-interests can be delineated manually or automatically aided by various segmentation algorithms or brain atlases [1]. Time series curves can be generated from the image data and on these various operations can be performed (eg. resampling, filters, correlation, convolution).

Three dimensional surfaces can be reconstructed, visualized and colored by multiple parameters (eg. dynamic functional information).

The program is built upon the MultiModal Medical Imaging software library system (www.minipetct.com/m3i) and runs on Windows 7 and Windows Xp operation systems and various Linux distributions. The hardware requirements of the application match the current average PC configurations used in medical image analysis.

The software system was implemented in C++.

Features illustrated at the exhibit

At the exhibit the features of the software are illustrated by performing a comparison analysis of EEG-fMRI activation maps vs. resected area and evaluating the overlap between fMRI parametric maps computed by Independent Component Analysis and standard resting-state network templates [2].

References

- [1] T. Spisák, M. Koselák, G. Opposits, S. A. Kis, L. Trón, A. Jakab, E. Berényi, M. Emri, Region management toolkit for atlas-space image processing, *MAGMA* 24 (S1):543, 2011.
- [2] Shirer, WR and Ryali, S. and Rykhlevskaia, E. and Menon, V. and Greicius, MD, Decoding subject-driven cognitive states with whole-brain connectivity patterns, *Cerebral Cortex*, 22(1):158-162, 2012.