Overview:

HomER is a graphical user interface designed to help analyze functional Near-Infrared Spectroscopy (NIRS) data. HomER provides tools for filtering and signal processing, averaging and linear regression, and also contains image reconstruction capabilities. HomER is designed to work with NIRS data from most source and experimental set-ups, allowing the user full control of the measurement configuration and probe properties.

HomER is available for download to the research community at:
http://www.nmr.mgh.harvard.edu/PMI/resources/

System Requirements:

HomER is distributed as a stand-alone application for Windows®. It utilizes the MATLAB Run-time Component [Mathworks Inc. Natick, MA USA].

Operating System: Windows® XP (SP 1 or 2), Windows® 2000 (SP 3 or 4), Windows® NT (SP 5+)
Processor: Pentium III, IV, Xeon, Pentium M, AMD Athlon, Athlon MP, Athlon XP
Disc Space: Total = 190 Mb
RAM: 256 MB, 512 MB (recommended)
HomER Runtime Component: 175 Mb
Matlab Runtime Component: 15 Mb

Data Format:

HomER accepts raw data files saved in Matlab (.mat) format. This allows the user flexibility to analyze data from virtually any existing NIRS system with only minor pre-processing. Both the probe geometry and experimental design are specified by the user, allowing for greater versatility.

Input Variables:
- Data (d) - This variable contains raw light intensity versus time data for each NIRS source-detector channel.
- Measurement List (ml) - This lists all the combinations of source-detector pairs. The user can specify any number of measurements. The measurement list can be pruned within HomER to remove channels with low signal-to-noise ratios.
- Stimuli (s) - This allows the user to specify the timing for functional experiments. HomER allows both blocked and event-related experimental designs. Multiple stimulus types can be specified within a single data file.
- Source-Detector Geometry (SDG) - The user can describe any probe geometry by specifying the spatial positions of each optode in the probe.
- Lambda (SD-Lambda) - Any combination of wavelengths can be used in analysis (depending on the NIRS measurement hardware).

Data Export:

HomER allows export of analyzed data into both ASCII and Matlab (.mat) formats for further processing. This is done easily by pop-up menus on each plotted data window. Figures can also be created and saved to a variety of formats (JPEG, TIFF, etc.).

Data from HomER can also be saved into movie (.MPG) files for future presentations. Movies of either optical-density or hemoglobin concentration can be created for viewing the hemodynamic response changes over time.

Features:

Signal Processing:

HomER contains tools for filtering time-courses with band-pass filters. Principle component analysis can be applied for motion artifact correction and systemic fluctuation (physiology) removal.

Response Processing:

HomER contains a number of tools for analyzing functional hemodynamic responses. Both blocked design and event-related paradigms are supported, in addition to multiple condition (parametric) experimental designs. Responses are analyzed at the single experimental run and session level. Region-of-interest based analysis can be performed across subjects and sessions.

Image Reconstruction:

HomER offers a number of options for basic image reconstruction including back-projection and other regularized inversion techniques. HomER uses the PMI toolbox (also available to download at www.nmr.mgh.harvard.edu/PMI) to generate forward models using semi-infinite (homogeneous) slab geometries. Spectral priors can be used to reconstruct images of concentration [Li et al. 2005 Applied Optics 44(10)].

Region-of-Interest Analysis:

Region-of-interest analysis can also be carried out with HomER. ROI averages can be calculated for individual subjects or group averages. Either effects or ANOVA statistics can be used to define regions of interest. This can be done by source-detector channel or within the reconstructed images.

www.nmr.mgh.harvard.edu/PMI