Release Notes for MEDx version 3.44 (December, 2005)

This document describes new functionality added to MEDx and included in version 3.44 at NIH. Many of these features were developed as scripts at the National Institutes of Health and have proven to be robust and often are described by peer-reviewed journal publications.

These release notes contain a brief description for each feature as well as a reference to MEDx tutorials (http://www-medx.cc.nih.gov/MEDX_WWW/tutorials/tutslist.html) for a more full explanation. All new features our found under the *Volumetric* menu option in the MEDx toolbox.

❑ New Operating Systems Supported

MEDx v3.44 is now officially supported under the Mac OS X operating system. The list below shows the official list of multi-platform support for MEDx v3.44.

RedHat 7, 8, 9, Enterprise WS 3+
Solaris 7, 8, 9
Mac OS X

❑ Automated Lesion Detection

This semi-automated lesion detection program was designed to measure the volume of plexiform neurofibroma lesions seen on MRI of patients with Neurofibromatosis 1 (NF1). The algorithm uses histogram analysis, thresholding, edge enhancement and connected component analysis to detect the lesion. This detected lesion volume is used as a surrogate marker for several clinical drug trials held at NCI. This method was included in MEDx 3.44 for its potential use for segmentation of other enhancing lesions as well as for the detection of plexiform neurofibromas.

Documentation: Tutorial is found at http://www-medx.cc.nih.gov/MEDX_WWW/tutorials/ALDtut.pdf. A peer-reviewed journal article is: J. Solomon, K. Warren, E. Dombi, N. Patronas, B. Widemann, **"**Automated Detection and Volume Measurement of Plexiform Neurofibromas in Neurofibromatosis 1 Using Magnetic Resonance Imaging", *Computerized Medical Imaging and Graphics* 28(5), 2004.

Location of feature in the MEDx GUI: The Automated lesion detection module can be found under the Toolbox→Volumetric→Automated Body Lesion Detection menu.

❑ CT Brain Extraction

We developed this technique to automatically remove non-brain tissue from a CT brain scan. Previous methods developed to extract the brain in MR images (e.g. BET) do not perform effectively on CT images. These deskulled images are useful when automatically registering brain images. This CT Brain Extraction method is used as a

pre-processing step for the Analysis of Brain Lesion (ABLe) software included in MEDx.

Documentation: Tutorial is found at
http://www-medx.cc.nih.gov/MEDX_WWW/tutorials/CTstriptut.pdf

Location of feature in the MEDx GUI: The CT Brain Extraction module can be found under the Toolbox→Volumetric→CT Brain Extraction menu.

- **MS Brain Lesion Analysis**

This program was developed to monitor the volume load of MS lesions over time. A 3D connected component analysis plus a decoding algorithm is used to track each lesion over time and create a table listing the centroid of the lesion as well as its volume. The segmentation of the lesion is based on a simple thresholding technique. The true value of this program is the ability to track the lesions for an individual over time.

Documentation: Tutorial is found at
http://www-medx.cc.nih.gov/MEDX_WWW/tutorials/MSscripttut.pdf
A peer-reviewed journal article is: S Gupta, JM Solomon, TA Tasciyan, MM Cao, RD Stone, JL Ostuni, JM Ohayon, PA Muraro, JA Frank, ND Richert, HF McFarland, F Bagnato. **"**Interferon-beta-1b effects on re-enhancing lesions in patients with multiple sclerosis", *Multiple Sclerosis* 11:658-668 (2005).

Location of feature in the MEDx GUI: The MS Brain Lesion Analysis module can be found under the Toolbox→Volumetric→MS Brain Lesion Analysis menu.

- **Automated DSC MR Brain Perfusion Analysis**

To allow the user to conduct perfusion analysis at the click of a button on DICOM, AVW or any 4D data set. The arterial input function (AIF) is determined based on the arrival time (TA) and standard deviation calculations. Note**: AIF method is different than the one used in MEDx. The perfusion analysis is conducted by accessing the routines in MEDx using Mx scripting commands.

Documentation: Tutorial is found at
http://www-medx.cc.nih.gov/MEDX_WWW/tutorials/AUTOperfusiontut.pdf
An abstract describing this method is: Butman JA, Tasciyan T. "Automated Computation of the Arterial Input Function for Dynamic Susceptibility Bolus Tracking Brain Perfusion MRI" ISMRM 2005; 13:1126

Location of feature in the MEDx GUI: The Automated DSC MR Brain Perfusion Analysis module can be found under the Toolbox→Volumetric→DSC MR Brain Perfusion Analysis menu.

- **Subcut/Intra-abdominal Fat Measurement**

  We developed a semi-automated tool for Subcutaneous/IntraAbdominal contour delineation for the purpose of determining fat volume in CT images. Contours can be delineated with a single click with an edge detection tool. Corrections to contours can be made by editing vertices. Fat computation is displayed and written to an output file.

  Documentation: Tutorial is found at
  http://www-medx.cc.nih.gov/MEDX_WWW/tutorials/CTfattut.pdf
  A peer-reviewed journal article describing this method is: A. Sumner, N. Farmer, M.K. Tulloch-Reid et al, "Sex differences in visceral adipose tissue volume among African Americans". American Journal of Clinical Nutrition, Vol. 76, No. 5, 975-979, November 2002

  Location of feature in the MEDx GUI: The Subcut/Intra-abdominal Fat Measurement module can be found under the Toolbox→Volumetric→Subcut/Intra-abdominal Fat Measurement menu.

- **Analysis of Brain Lesions (ABLe) enhancements**

  The following features have been added to ABLE 2.2:

  - Calculation of Left and Right hemisphere lesion volume
  - Option to measure corpus collosal thickness
  - Option to load a lesion mask derived from 3rd party software (e.g. MRIcro) instead of manual outlining in MEDx
  - New html reporting mechanism allowing for hierarchical search of intersected structures
  - Text output for database or spreadsheet
  - Threshold option for Two Group Analysis (double dissociation)
  - Behavior Analysis includes Table of clusters listing where (stereotaxically) lesion patients have lower behavior scores
  - No longer a limit on number of patients to analyze

  Documentation: ABLe is described in Chapter 17 of MEDx user's guide. A peer-reviewed journal article describing ABLe 1.0 is: M. Makale & J. Solomon, N. Patronas, A. Danek, J. Butman, J. Grafman."Quantification of Brain Lesions Using Interactive Automated Software". *Behavior Research Methods, Instruments, and Computers*, February 2002.
  An updated paper describing current ABLe methods is in progress.

  Location of feature in the MEDx GUI: The ABLe module can be found under the Toolbox→Volumetric→Analysis of Brain Lesions menu