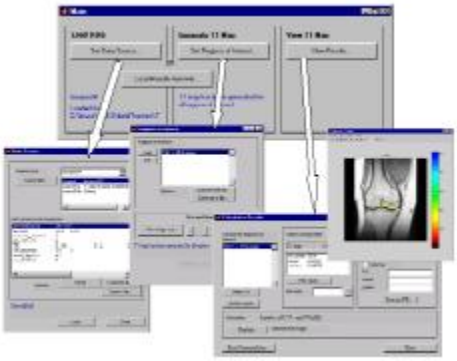
Overview



This software provides a graphical user interface for generating T1 and T2 maps of MRI images. Typical data flow:

1. Load MRI data from disk into memory.
2. User selects regions of interest (ROIs) in the MRI image.
3. Software executes the curve-fitting algorithm on pixels specified in the ROIs.
4. T1 (or T2) map is produced which is viewable as a false-color overlay on a background image (one of the images from the study).
5. Print or export the T1 (or T2)map image into a variety of file formats.

Requirements

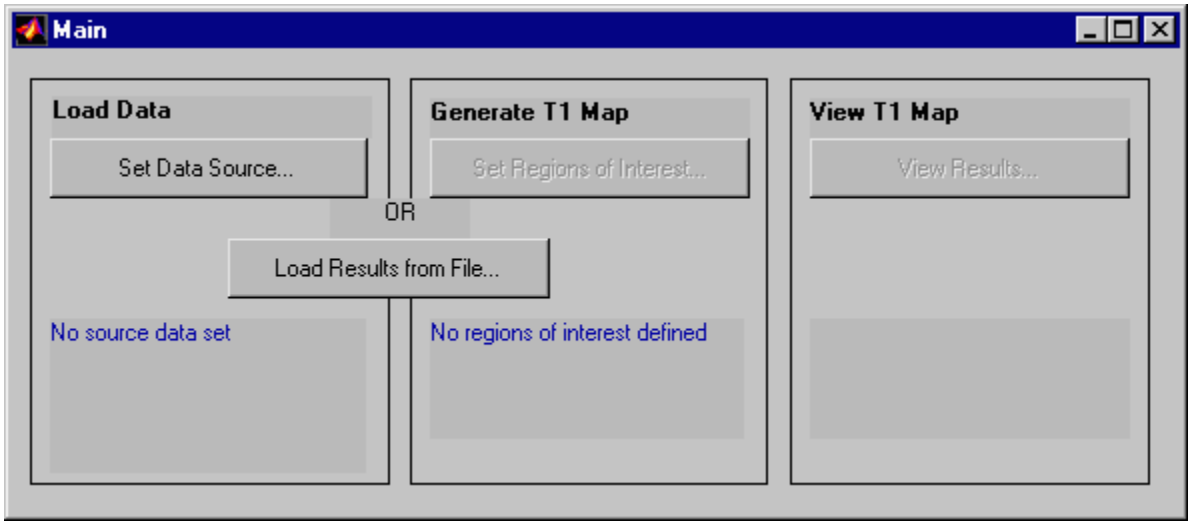
There are currently two versions of MRI Mapper software. One runs on Matlab version 5. Another runs on Matlab version 7. The software is a work in progress, and has been developed by Bruce Po and Meredith Gerber. Please contact Nitya Krishna with bug reports or questions.

Installation

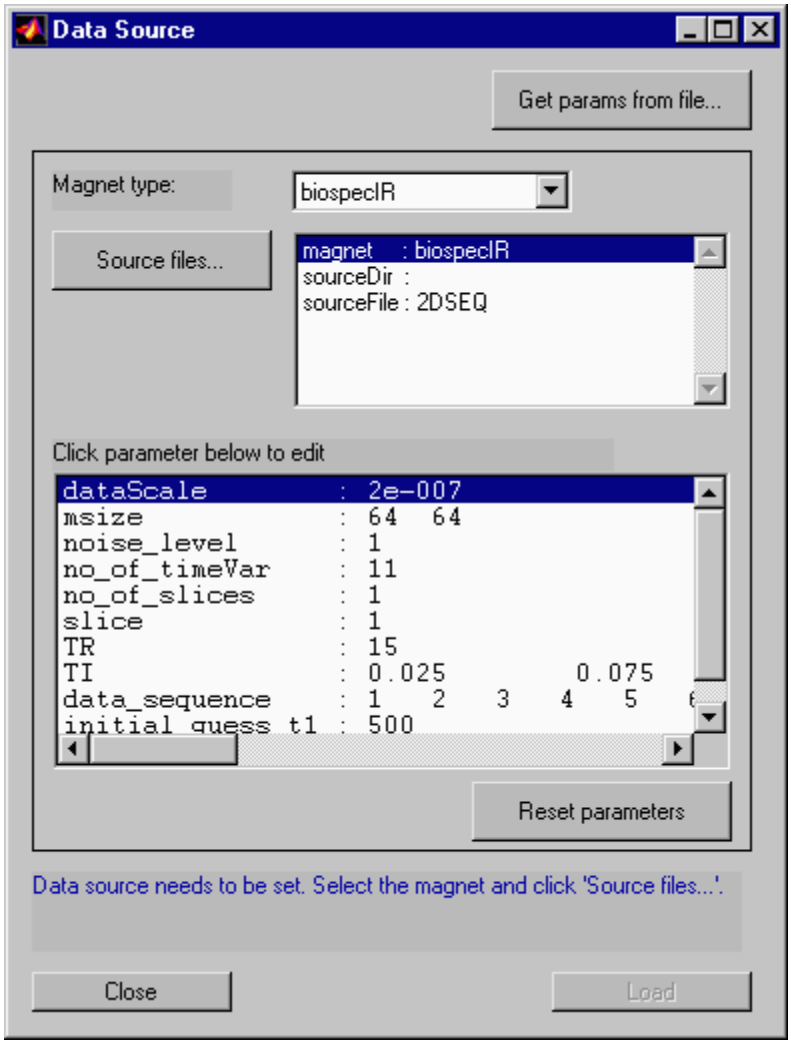
- Download the software for Matlab 5 or Matlab 7 in zip-compressed format.
- Unzip the zip file.
- Start Matlab.
- In Matlab, cd to the directory where this program was unzipped.
- Type "mrimapper" (no quotes) to start the program.

Getting Started

When you first run the program, the Main window appears. The Main window coordinates the operation of the major tasks involving user input: loading source data, specifying the regions of interest, and viewing the results. There are buttons associated with these tasks, and pushing the buttons opens up the user interface window responsible for that particular task. Multiple task windows may be opened concurrently. Closing the Main window exits the program.



Loading Source Data



MRI data from the MRI system is a sequence of images stored in one or more files. These files will be read by this Matlab program by pressing the "Set Data Source" button on the Main window and following these instructions:

1. Select the magnet type and scan type from the drop-down menu.
2. Click the "Source files" button to specify the location of the MRI file(s). The text box next to the button displays the file location information. The file information can be manually edited by clicking on the box.
3. Edit the scan parameters by clicking on the parameter you wish to modify.
4. Click "Load" at the bottom of the window. (If you click "Close", the MRI data will **not** be loaded.)

Once the data has been loaded, the program will display one of the MRI images in a figure window.

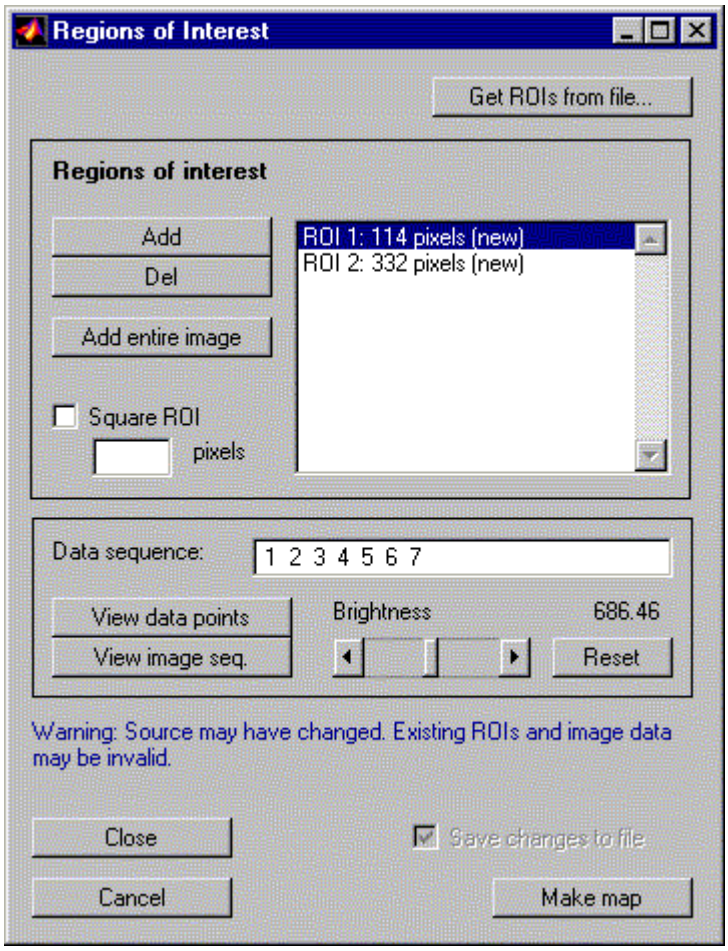
The button "Get params from file" allows you load the parameters in this window from a file rather than entering it in the manner described above. The MRI data itself is not loaded until the "Load" button is pushed.

Set Regions of Interest

Once the source MRI data has been loaded, click the button labeled "Set Regions of Interest" in the main window. This will bring up the Regions of Interest window. Quick instructions for specifying regions of interst (ROIs):

- Click "Add" and draw out a ROI on the figure.
- Repeat to create more ROIs if needed.
- Click "Make map" at the bottom of the window to start the calcutions.

More detailed description of specifying ROIs: The ROI list displays the ROIs you've created and how large they are. It will initially be blank. You may click on a particular ROI and it will be highlighted in the figure window.



- Click "Add" to add a new ROI on the image. However, before doing so you may wish to zoom into an area on the image by clicking the zoom icon on the image window and clicking somewhere in the image. Drawing is complete when you double-click.
  Note: ROIs are allowed to overlap, and in fact ROIs may be drawn *inside* existing ROIs.
- Repeat to create more ROIs if needed.
- Clicking "Del" will delete the highlighted ROI.
- The button "Add entire image" creates a ROI that covers the entire image.
- If the check box "Square ROI" is checked off, then new ROIs are squares rather than shapes that you draw.

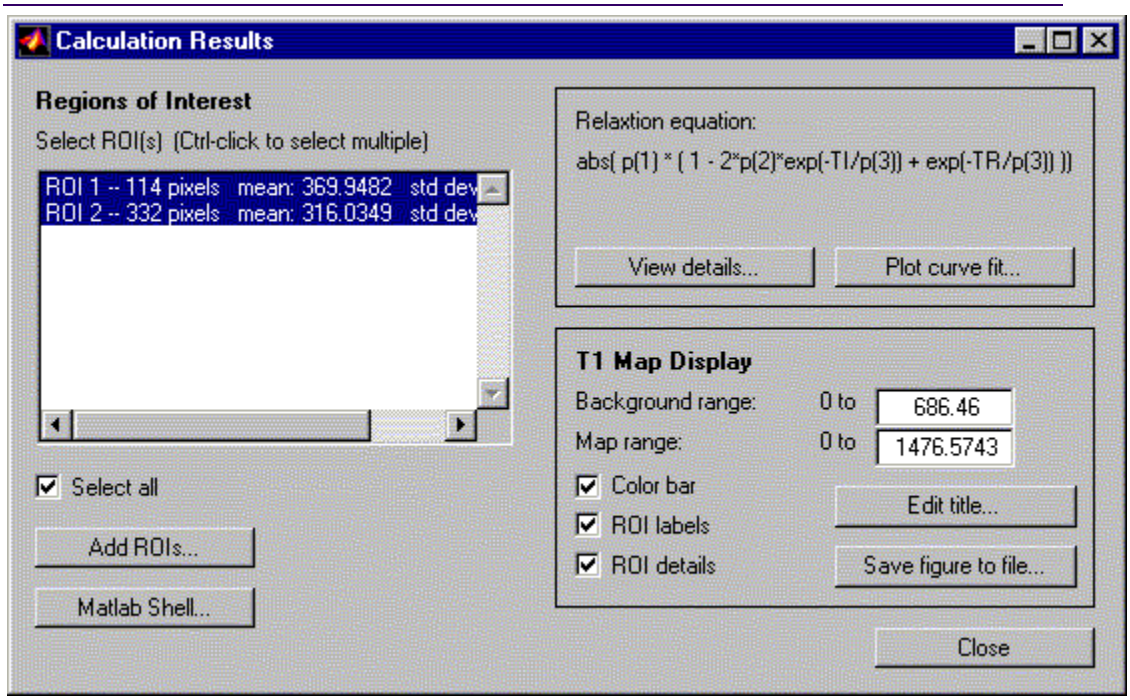
- Click "Make map" to begin the T1/T2 calculations. The amount of time to do the calculations is proportional to the number of pixels to calculate.

The Regions of Interest window has other controls for setting what data to be analyzed.

- The box labeled "Data sequence" allows you specify which time-sampled (and in what order) data is used in the T1/T2 mapping. For example, a T2 estimate with 32 echos may use only the even TE times, so you would enter 2:2:32 (which gets expanded to [2 4 6 ... 32]) in that box.
- Pressing "View data points" allows you to select a pixel from the image and plot the values for all the time points.
- Pressing "View Image seq" displays all the MRI data as a sequence of images.
- The brightness slider scales the intensity of the image and has no effect on T1/T2 calculations. The number displayed is the pixel intensity value to be rendered as white.

The button on the top labeled "Get ROIs from file" allows you to retrieve ROIs stored in an external file.

Viewing Results



Clicking the "View Results" button on the Main window opens up the Calculation Results window and an image window displaying the MRI image with a T1 or T2 map overlay. The Calculation Results window has numerous tools for analyzing the calculated map.

- The ROI list displays all the ROIs along with the number of pixels, mean, and standard deviation. The image window displays only the ROIs that are highlighted in the window. The "Select all" checkbox selects all the ROIs.
- Clicking the "Add ROIs" button brings up the ROI list user interface window described in the previous section. This allows you to add new ROIs and even delete ROIs.
- Relaxation equation frame
    - The relaxation equation text displays the curve that the fitting algorithm used in fitting the MRI data.
    - Clicking "View details" brings up a window for analyzing the estimated parameters, plotting their values, and displaying them as a map. Only the ROIs selected are analyzed.
    - Clicking "Plot curve fit" brings up a window for plotting the MRI data values and estimate curve verses time. This is useful for visually evaluating the performance of the estimator. Only the ROIs selected are analyzed.
- T1 Map Display frame
    - The Background range edit box sets the pixel intensity value that gets rendered as white. This is useful for adjusting the brightness of the background image. Normally, this does not need to be adjusted. Typing "auto" into this box sets it to a suitable, calculated valued.
    - The Map range edit box sets the T1/T2 map's maximum value on its color scale. T1/T2 values that exceed the set maximum are clipped and rendered as the maximum value's color (blue). Typing "auto" into this box calculates a value where at least 98% of the T1/T2 values in the *selected ROIs* are displayed. However, if you have multiple scans, it is very useful to enter your own value so that the color scales remain consistent across scans.
- The "Matlab Shell" button pauses the program and temporarily returns control to the Matlab Command Window, specifically, the Matlab keyboard command is called. To resume the program, type "return" at the Matlab prompt.

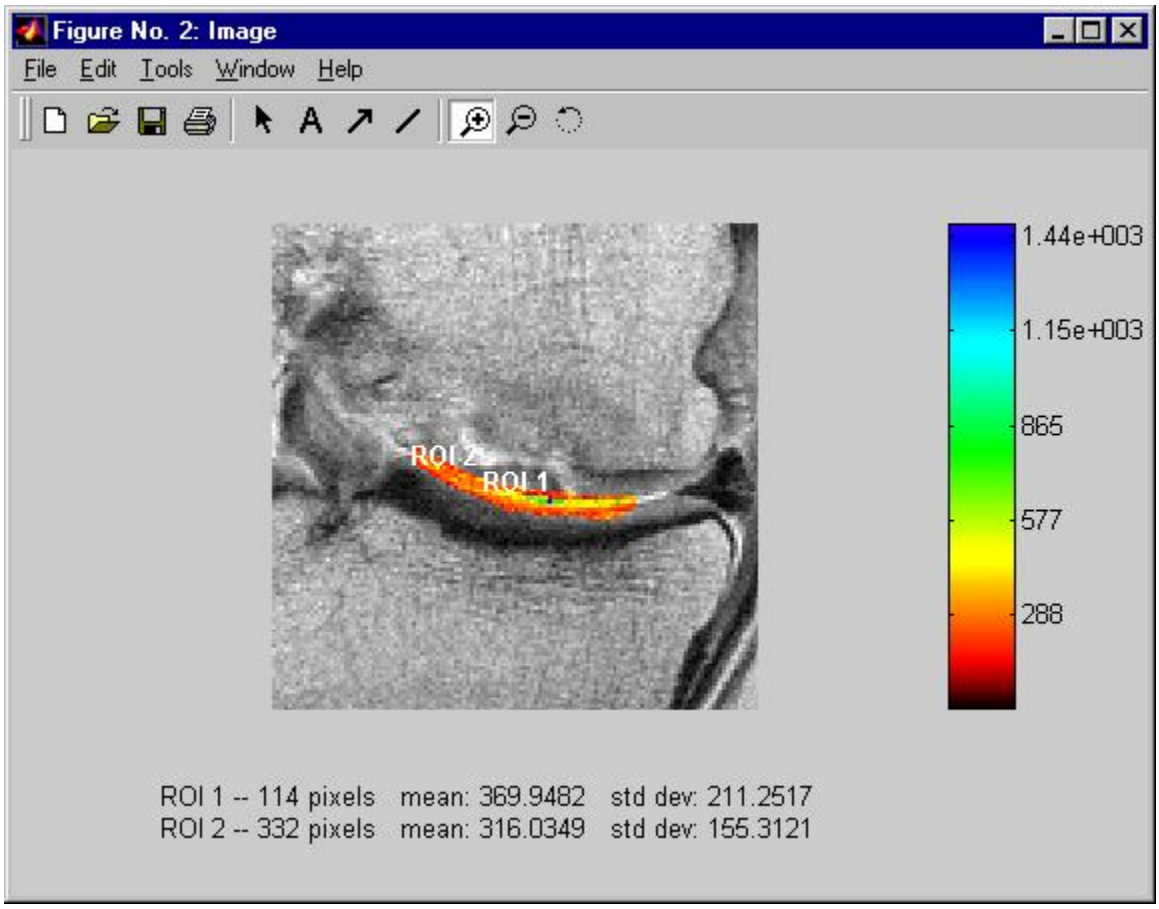


Figure No. 2: Image
File Edit Tools Window Help
ROI 2
ROI 1
1.44e+003
1.15e+003
865
577
288
ROI 1 -- 114 pixels mean: 369.9482 std dev: 211.2517
ROI 2 -- 332 pixels mean: 316.0349 std dev: 155.3121