Image Processing Guideline for TMU 7T MRI

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Section 1: Installation of ImageJ software

Section 2: Import and adjustment of image sequence

- ✓ Import image sequence
- ✓ Zoom in/out and crop images
- ✓ Background removal

Section 3: Measurements in region of interest (ROI)

Section 4: Export processed images

Section 5: 3D Viewer for MR angiography

< Section 1: Installation of ImageJ software >

✓ Download ImageJ software and demanded Java version from the official website and install on your PC.

http://imagej.nih.gov/ij/ (Support Windows 7/8, Max OS X, and Linux)



< Section 2: Import and adjustment of image sequence >

- ✓ Once MRI scan is done, a disc containing separated directories for each image sequence is given (Sequences of T2-SE and MRA are demonstrated in this guideline).
- ✓ Imaging data are saved as DICOM format and located at SequenceName\pdata\1\dicom.

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- ✓ Execute ImageJ and import image sequence by selecting [File] → [Import] → [Image
 Sequence...] on the menu bar. Please load the first image within a dicom folder.
- ✓ A window of Sequence Options will pop out. Number of images is automatically set as the file number within the selected dicom folder. Normally, keep the original value will be fine. Press [OK] to proceed.

Sequence Options	×			
Number of images:	2			
Starting image:	1			
Increment:	1			
Scale images:	100 %			
File name contains:				
(enclose regex in parens)				
Convert to RGB				
Sort names numerically				
Use virtual stack				
256 x 256 x 9 (2.2MB)				
ок	Cancel Help			

✓ Scroll the mouse wheel or use the slider bar beneath the Image to switch different image slices. Use [Image] → [Zoom] → [In] or [Image] → [Zoom] → [out] on the menu bar to zoom in or out the image.



✓ To crop images, use the Selection Tools to select a region on the image slice. Use [Image]
 → [Crop] to crop whole image series.

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Rectangular or rounded rectangular selections (right click to switch)					
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Selection Tools



✓ To adjust image contrast, press [Image] → [Adjust] → [Brightness/Contrast...] to open the B&C window for the contrast adjustment.



- ✓ To clean up the background intensity, two steps are recommended though the first step is optional but helpful.
 - Step 1: Perform thresholding on images as the following procedure:
 - Duplicate image by [Image] → [Duplicate...], ensure the Duplicate stack is checked, and then press [OK];
 - 2) Select [Image] → [Adjust] → [Threshold...], adjust lower and higher threshold values, ensure Dark background and Stack histogram are both checked, and press [Apply] and [OK];
 - 3) Use [Process] → [Image Calculator...] to multiply Image1 by Image2;



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	Result of dicom (300%)): 32-bit 448K
🛓 Image Calculator		
Image1: dicom 💌	1 ×	2
Operation: Multiply		Carl I
Image2: dicom-1 💌	A I have	
Create new window		
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4) Use **[Process]** \rightarrow **[Math]** \rightarrow **[Divide...]** to correct the image intensity of the resultant image from procedure 3). Set the value as 255.

🛓 Divide	X
Value:	255.000
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OK	Cancel

Step 2: Clean up the background slice by slice. Use either Freehand or Polygon selection tool to create the region of interest (ROI) and then select [Edit] → [Clean Outside] to eliminate the intensity outside the ROI. This process must be repeated slice by slice.



< Section 3: Measurements in ROI >

✓ Open ROI Manager window by selecting [Analyze] \rightarrow [Tools] \rightarrow [ROI Manager...].



- To measure the intensity, area, length, and angle of ROIs, create an ROI using one of the Selections Tools (rectangular, oval, polygon, freehand selection, straight line, or angle) and press [Add] on the ROI manager window to add it into the measurement list.
- ✓ Select the ROIs and press [Measure] on the ROI manager window to view the measurements in ROI(s). The unit of measurements is mm or mm².



The target volume (such as the tumor volume) can be calculated as the area (in mm²) of ROI multiplied by the slice thickness (in mm). The value of slice thickness can be found in the SequenceName\pdata\method file (open with Word or WordPad).

##\$PVM_SliceThick=0.8

< Section 4: Export processed images >

- ✓ To save the image sequence as the specified format,
 - ➢ Press [File] → [Save As] → [Image Sequences...], select the image format (BMP, GIF, JPEG, PNG,...), and press [OK] to create the consecutive slice images.

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OK Cancel	9個項目			

 ✓ Instead, you can select [File] → [Save As] → [Animated GIF] to export image sequence as an animated GIF file.

< Section 5: 3D Viewer for MR angiography >

- ✓ For the image sequence of MR angiography (MRA), **3D Viewer** Plugin has to be installed for once (download from <u>http://3dviewer.neurofly.de/</u>, and copy the downloaded file into the ImageJ\plugins\3D folder).
- ✓ Import MRA image sequence and press [Plugins] → [3D] → [3D Viewer] to open the ImageJ 3D Viewer window.
- ✓ Select [Edit] → [adjust threshold] to adjust threshold for displaying vessel structures.

