**The Steiner Suite**

**Spin-Echo MRI Contrast Simulator**

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**Introduction**

The contrast simulator is a small GUI created with GUIDE in MATLAB 2017b, designed to generate synthetic images from Mo, T1 and T2 maps.

It is available as a function, to be run from the MATLAB IDE:

**pft\_ContrastSimulationGUI.m**

Also, as a standalone executable, which may be run on any PC, with or without a working installation of MATLAB (possibly after download of the appropriate MATLAB Compiler Run-Time):

**MRI\_SE\_Contrast\_Simulator.exe**

The inputs to the application are sample parameter maps acquired using the Siemens MR Fingerprinting WIP, stripped of all patient-identifying information using DicomCleaner and pickled into MATLAB data files (ABC.mat). Conceivably, other inputs could be used, with a simple adaptation of the code. In future, the interface might also be extended to create synthetic FLASH images with variable TR, TE and flip-angles.

The GUI has been written as a programming exercise, although it is already proving useful as a way to validate the MRF protocol. It could also be helpful to radiographers to plan their scans, working in either of two directions:

1. ***“Given these parameters (TR/TE), what should the images look like ?”***
2. ***“If I want my images to look like this, what parameters should I use ?”***

**Controls and Parameters**

1. The File menu.

* Open Data Set: Self-explanatory.
* Save Results: Options are set in the Export group box.

Individual slices or whole stacks may be saved.

DICOM stacks of the synthetic weighted images may be produced.

Results are written in a sub-folder matching the name of the i/p data.

Fresh outputs are numbered to avoid over-writing earlier ones.

* Import Parameters: From a numbered XLSX file.

Browsing will begin from a Results sub-folder matching the i/p data,

unless no parameters have yet been saved for that study,

in which case you will need to browse among other folders

from one or two levels up.

* Save Parameters: In a numbered XLSX file.

1. The main display area.

* 4 image panes: From left to right, the Mo, T1 and T2 maps,

and the synthetic weighted image.

* Display controls: Upper and lower window levels, and selectable colormaps.

A common slider control.

1. Image Weighting.

* Custom: Controlled from the TR and TE sliders.
* Proton Density: TR/TE = 5000/5 ms.
* T1W: TR/TE = 100/5 ms.
* T2W: TR/TE = 5000/50 ms.
* Mixed: TR/TE = 300/50 ms.

1. Sequence Parameters.

* TR: In ms.
* TE: In ms.
* Noise: In per cent of the peak magnitude time-domain signal.

The synthetic image is calculated immediately for the current slice,

and sliders can be dragged to produce a continuous and immediate

response.

* Reset Windowing: To program defaults.

1. Export.

* Map slices: Axes screenshots in PNG format.
* Map stacks: TIFF, generated by animating the slider through the image slices.
* WI slice: Axes screenshot in PNG format.
* WI stack: TIFF, generated by animating the slider through the image slices.
* WI DICOM stack: Generated by animating the slider through the image slices.

1. Captions.

These may be switched on or off, and the colour can be selected from a rainbow palette.