Blood flow (Perfusion): Hints

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In this case study, you are expected to process and analyze an in-vivo breast dynamic contrast-enhanced (DCE-MRI) data. Given a T1-weighted DCE- MRI data set, a multi-flip data set, and an arterial input function (AIF), you should produce the kinetic parameter maps using Standard Tofts and Extended Tofts model.

1. The first step in understanding the case study will be to look out for the meaning of the scanning parameters (TR, TE, flip angles, etc.) given in the first part of the exercise.

2. Spend some time on understanding the graph of the arterial input function AIF. Can you explain why the slope at the various time points?

3. Investigate what Signal to Noise Ratio (SNR) and Signal Enhancement Ratio (SER) are and relate it to explaining the output of the SER in 2c. in the exercise sheet. Try 2c. again but using two different slices than the one proposed in the exercise. Do you see any difference in the output? Can you give any comment on the difference if any?

4. Investigate what the T1 maps (R_1,S_0 and their variance) from 2e. on the execise sheet represent in general and try to understand and relate this to the visual appearance of these maps in the plots in 2e.

5. What are the major difference in the two implementations of the DCE signal to an effective R 1 relaxation rate function (Not necessarily in the code but rather in methodology). How does this difference affect the final output (try to explain the difference in the plots if possible).

6. Change the region of interest (ROI) used in the sample solution

   ```
   Ct_roi = np.reshape(Ct[100:110,90:100,:],(-1,nt))
   ```

   to use the mask for DCE data in 2d. Also repeat this for voxels outside the ROI in the mask for DCE data. Plot the two mean concentrations and compare the concentration inside and outside the ROI. Is there any noticeable difference? What do you think accounts for the difference(s) if any?