Lab 7

Medical Imaging

IST 2022-2023

Load the MRI raw data (`rawdata.mat`) obtained from a phantom using a spin-warp imaging pulse sequence using either `load` in Matlab or `loadmat` in Python. Assign one of the image dimensions to the readout direction and the other to the phase-encoding direction.

1. Display the magnitude and phase of the 2D *k*-space data.

2. Reconstruct the image by Fourier transform (in Matlab use `fftshift(ifft2(ifftshift(rawdata)))` or the equivalent `numpy` functions in Python). Display the magnitude and phase of the reconstructed image.

3. Repeat 1-2, by truncating the *k*-space data (i.e., reducing k_{max} and leaving Δk unchanged), by one half, one fourth and one eighth, along the phase-encoding direction.

4. Repeat 1-2, by under-sampling the *k*-space data (i.e., leaving k_{max} unchanged and increasing Δk) by half along the phase-encoding direction.

5. Repeat 1-2, by considering half Fourier imaging along the phase-encoding direction, i.e., sampling only half the phase-encoding steps and then using Hermitian symmetry to obtain a full *k*-space before image reconstruction:

$$M\left(-k_x,-k_y\right)=M^*\left(k_x,k_y\right)$$

6. Repeat 5, by considering 5/8 partial Fourier imaging. i.e., by adding 1/8 of the data points in the unsampled half of *k*-space. Explain the observed differences relative to 5.