Problem 1 (Partial Fourier Imaging)

The file used to generate each figure in this problem is `p1.m`.

(a) Zero-Filled Reconstruction: The original data is shown in Figure 1.

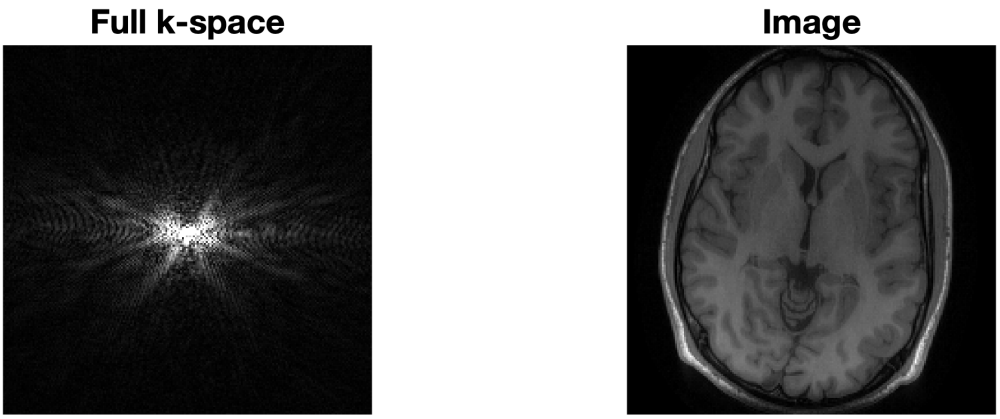

Figure 1: Fully-sampled data from T_1-w brain scan. Left: kspace. Right: Image.

The under-sampled data using a partial Fourier factor of $5/8$ is shown below.

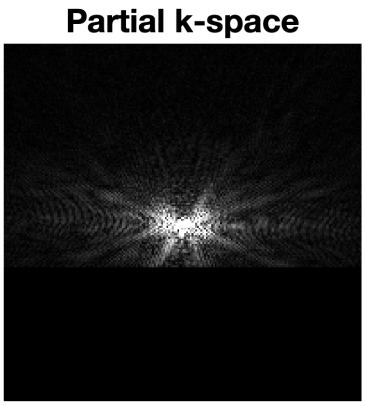

Figure 2: Partial Fourier factor of $5/8$.

Assuming that the phase encoding direction is oriented vertically, the zero-filled reconstruction is shown in Figure 3.

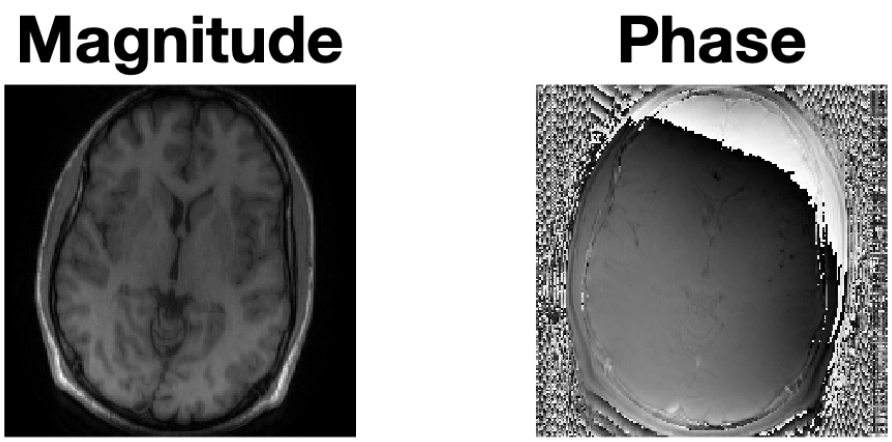

Figure 3: Magnitude and phase of zero-filled reconstruction.

The difference in magnitude and phase between the zero-filled reconstruction and the fully-sampled image are shown in Figure 4.

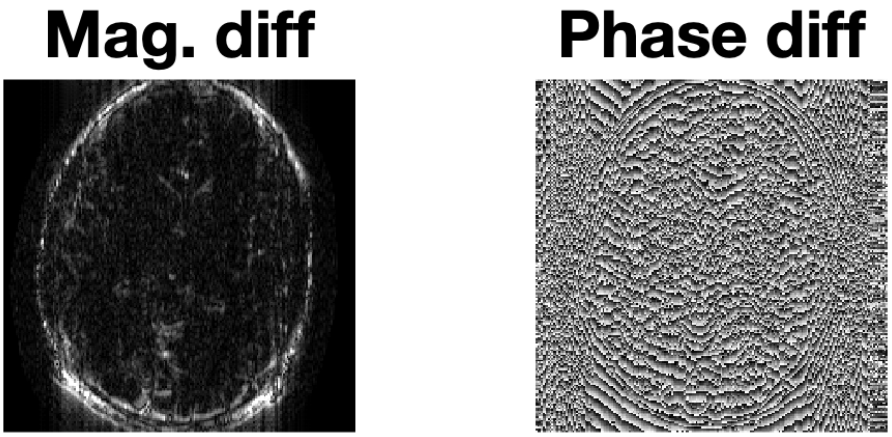

Figure 4: Magnitude and phase of the difference image.

(b) Conjugate Phase Reconstruction: The magnitude and phase of the image are shown below.

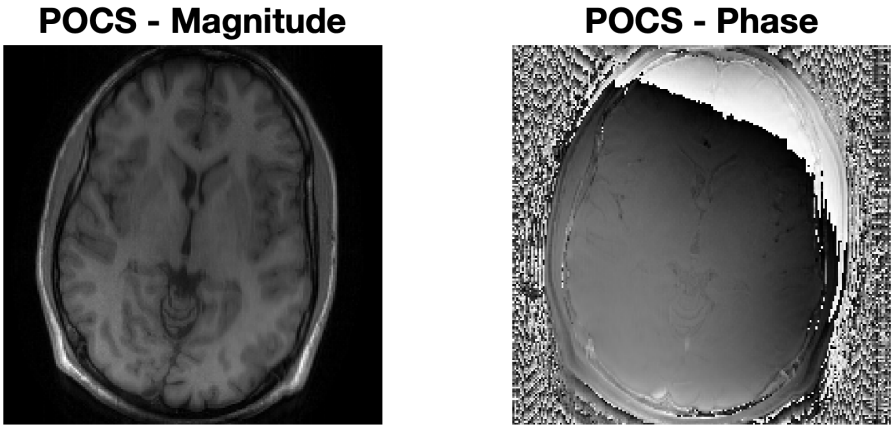

Figure 5: POCS conjugate phase reconstruction.

The difference in magnitude and phase between the zero-filled reconstruction and the fully-sampled image are shown in Figure 6.

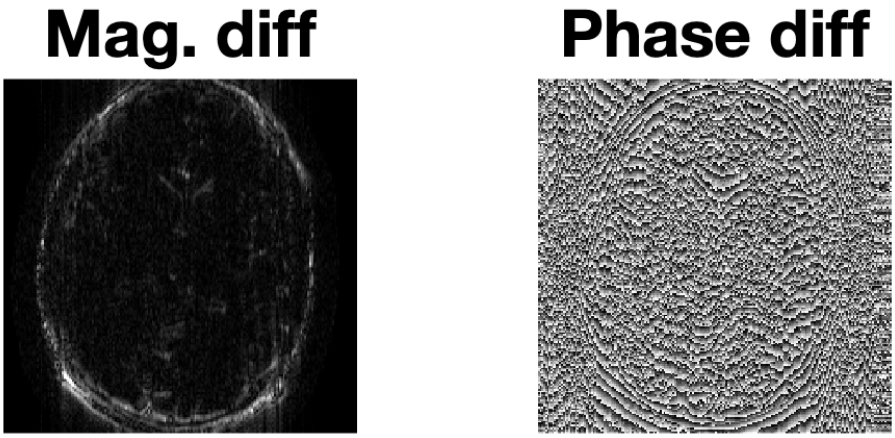

Figure 6: Magnitude and phase of the difference image.

Problem 2 (SENSE)

The file used to generate each figure in this problem is `p2.m`.

(a) Fully-Sampled Image: Root sum of squares of the fully-sampled kspace data and coil sensitivity from 8-channels are shown in Figure 7.

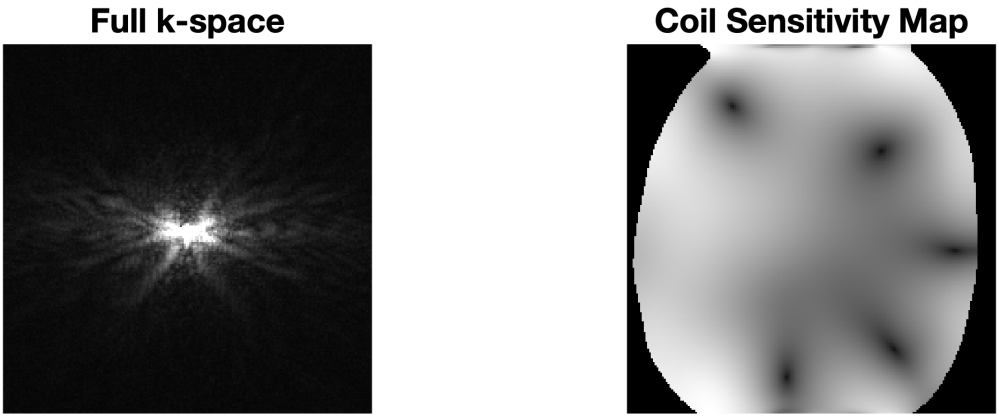

Figure 7: Fully-sampled kspace data and sensitivity maps from 8 coils.

The coil-combined image is shown below.

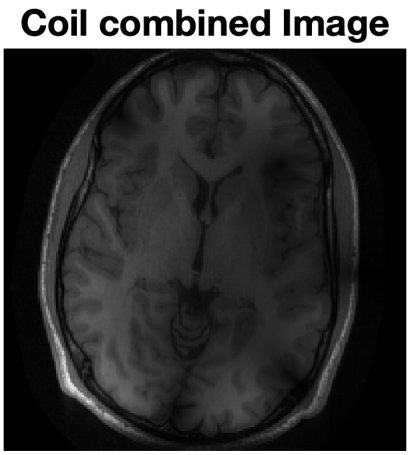

Figure 8: Coil combined image.

(b) Aliased R=2 Image: The under-sampled k-space and magnitude of the image are shown below.

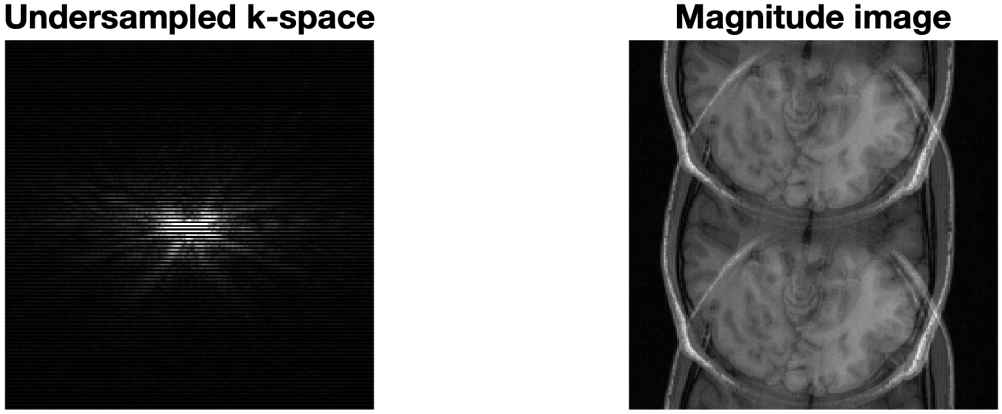

Figure 9: Under-sampled k-space and image ($R = 2$).

(c) SENSE R=2 Reconstruction:

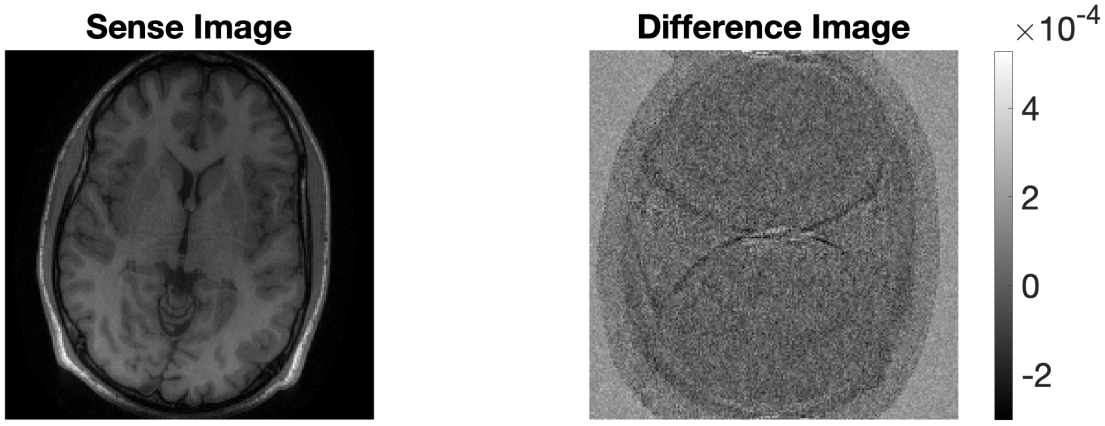

Figure 10: Left: SENSE reconstruction. Right: Magnitude of the difference image.

(d) SENSE R=4 Reconstruction:

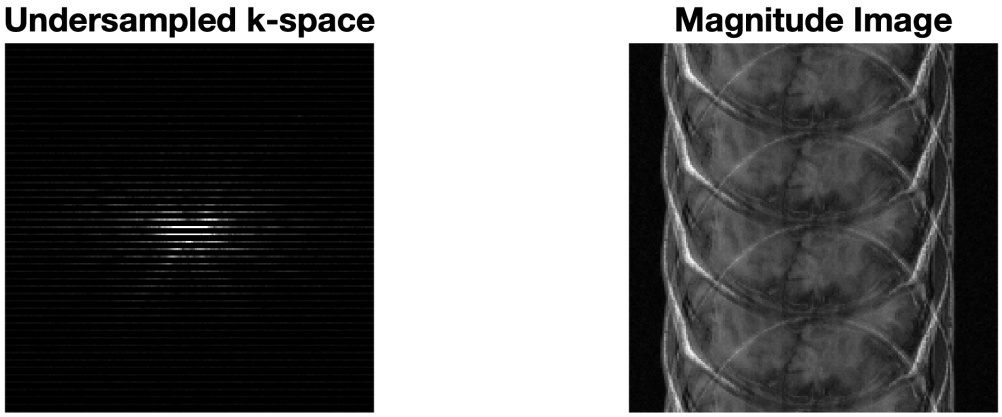

Figure 11: Under-sampled k-space and image ($R = 4$).

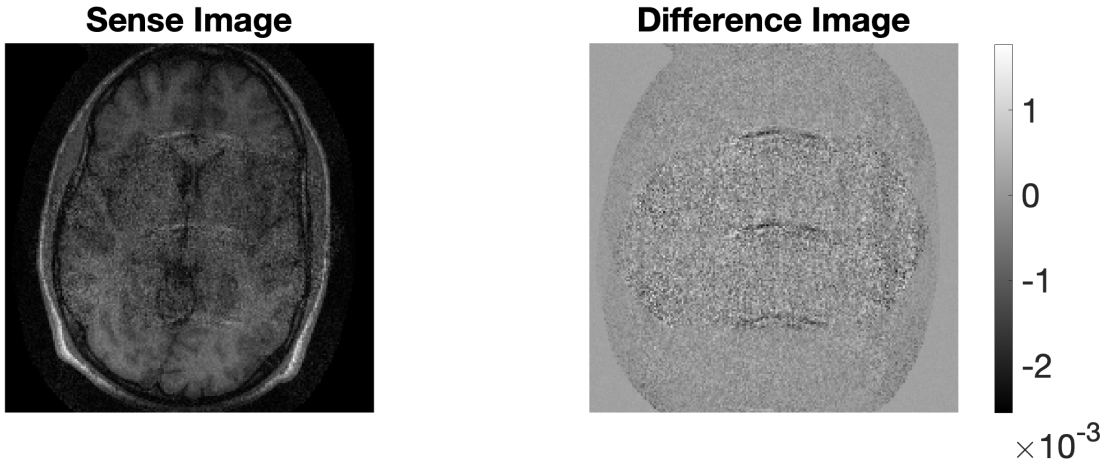

Figure 12: Left: SENSE reconstruction. Right: Magnitude of the difference image.

Bonus (GRAPPA) The file used to generate each figure in this problem is `bgrappa.m`.

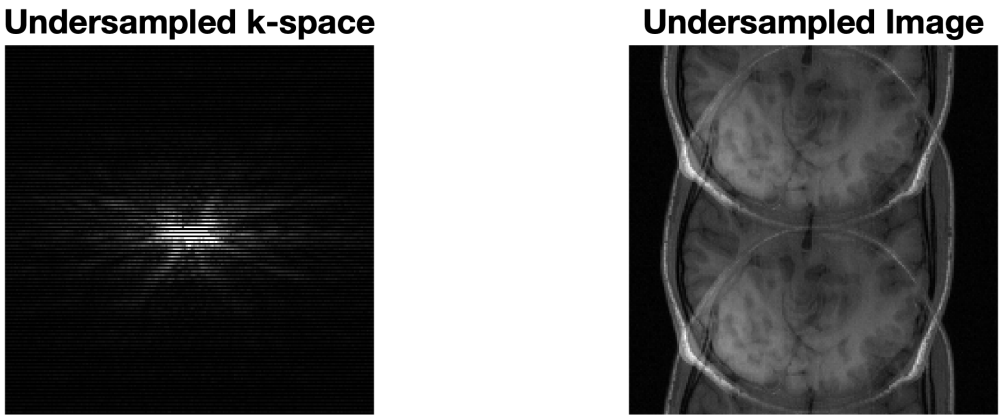

Figure 13: Under-sampled k-space and image (R=2).

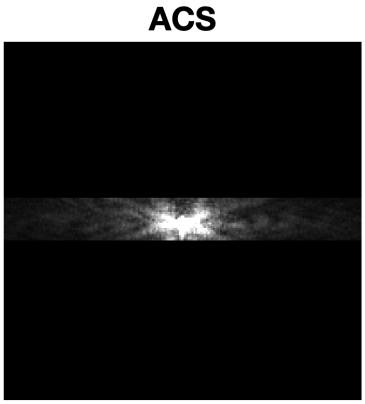

Figure 14: Autocalibration Signal.

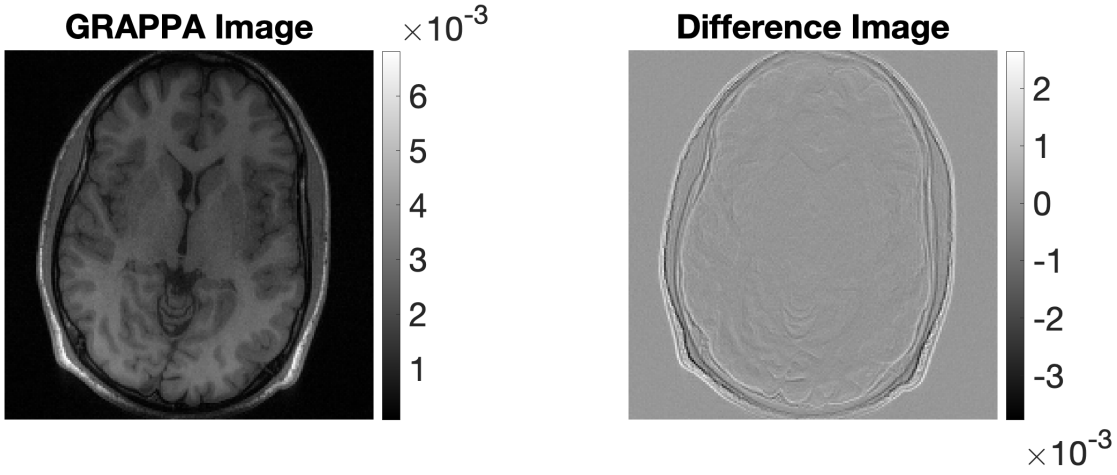

Figure 15: GRAPPA reconstruction and difference image.