Reconstruction of Undersampled Fourier Data

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Magnetic Resonance Imaging is one of the most important tools in the medical world today. From minor joint injuries to detecting cancer, there are no shortage of use cases for this formidable machine. This also means that the quality of the MRI images are of utmost importance. MRI machines take samples in the Fourier domain, which then have to be transformed to the image domain. On the one hand, we wish to take as many samples as possible in the Fourier domain to increase the quality of the images. On the other hand, this increases the time the patient needs to spend in the machine, which could cause movement and hence, inaccurate images. To improve the speed of imaging, a subset of the Fourier domain measurements needs to be taken, but reconstructing undersampled Fourier data is no trivial matter. In this presentation we observe different reconstruction methods of the undersampled Fourier data, including linear reconstruction, Generalised Auto-calibrating Partial Parallel Acquisition (GRAPPA) and the Split Bregman Algorithm and compare these methods. Furthermore, we also attempt to reconstruct the image directly in the image domain instead of the Fourier domain using transfer learning.