

# Reconstruction of Undersampled Fourier Data and Analysis of Modified ACS Sampling:

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In applications such as Magnetic Resonance Imaging (MRI), data are acquired in the Fourier domain and to accelerate imaging, a subsample of the discrete Fourier data is often taken. In order to recover the image, we need to reconstruct the missing Fourier data and then apply the discrete inverse Fourier transform. However, reconstructing missing data in the Fourier Space poses significant challenges. Unlike the image domain, the Fourier domain is not localised, which means the data are not as easily reconstructed. In this talk, we will see why linear interpolation in the Fourier domain is futile and discuss alternative reconstruction methods, namely “Generalized Autocalibrating Partially Parallel Acquisitions” (GRAPPA), a widely adopted approach in MRI reconstruction. GRAPPA leverages the “Auto-Calibration Signal” (ACS) region, which is an area in the low-pass part of the Fourier data that is fully sampled. In GRAPPA and many other MRI methods, data outside of the ACS region are often subsampled with a constant subsampling rate of  $R$ . We will examine the critical role of subsampling strategies outside the ACS region and how these influence reconstruction quality and we will consider alternative subsampling methods to utilise GRAPPA to its full capacity.