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SS 2010
Exercise Sheet Reconstruction Methods
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Exercises in Computer Aided Medical Procedures II

Exercise 1 Analytic Reconstruction

The script `main.m` contains some example code how to get started with exercise 1 and 2.

a) Implement the Direct Fourier Reconstruction algorithm as outlined in the lecture. You can use the script `fourier.m` to get started.

Hint: Check out the Matlab functions `fft, fftshift, interp2, ifft2`.

b) Implement the Filtered Backprojection algorithm using the Ram-Lak filter as outlined in the lecture. You can use the script `fbp.m` to get started.

Hint: The convolution of two functions can be computed as a simple multiplication in the Fourier domain - check out the Matlab functions `fft, fftshift, ifft, ifftshift` for that. The Ram-Lak filter in Fourier domain is just a ramp function like abs(x). Note that the filter has to be applied to each projection (aka column of the sinogram).

Exercise 2 Play around with Fourier/FBP

a) Test the parameters of the Fourier and FBP reconstruction from Exercise 1, e.g. the interpolation method and the type of filter (see `iradon` documentation of Matlab).

b) What happens if you vary the number of projections used to generate your sinogram?

c) What happens if you add noise to the sinogram?

Exercise 3 Algebraic Reconstruction Technique

a) Implement the ART method as outlined in the lecture. You can use the script `mainART.m` and `art.m` to get started.

b) Test your ART implementation with the sample data provided in `Ab30.mat`, `Ab64.mat`.

c) Play around with the number of iterations, the projection access order and the relaxation factor `lambda`. See how the noise in the noisy measurement `bn` influences your result. Observe how the built-in linear system solver (\) in Matlab deals with the reconstruction problem.