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Image reconstruction

Computerized Tomography (CT) was originally a method of diagnostic radiology to obtain the density distribution within the human body based on X-ray projection samples. From a mathematical point of view it seeks to determine an unknown function defined over the 3D Euclidean space from weighted integrals over subspaces, called projections. Since the values of the function can vary over a wide range, a huge number of projections are needed to ensure an accurate reconstruction. In the first part of the talk we investigate the above-mentioned image reconstruction problem.

Outside medicine, there are applications of tomography where the number of projections one can acquire is limited, therefore CT reconstruction methods are no longer successfully applicable. However, there is still a chance to get an accurate reconstruction from just a small number of projections. By exploiting prior knowledge that the range of the image function is discrete and consists of only a small number of known values the reconstruction quality can be enhanced. This leads us to the field of Discrete Tomography that will be discussed in the second part of the talk.