# Improvement of CT Images by Convolutional Neural Networks

Project for Bachelor Thesis
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## 1 Background

The problem of recovering a function from its integrals over lines has first been studied by Johann Radon in [2] and is the mathematical basis of computed tomography (CT). For the inversion of the analytic Radon transform exact formulas exist, however in practice there are only finitely many measurements (line integrals) available and due to radiation of the patients it is being attempted to keep the number of measurements small. This leads to a bad image quality which can be improved by machine learning approaches like the usage of convolutional neural networks (CNNs) 1.

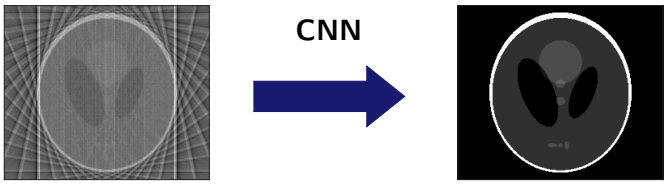


Figure 1.1: Artifact removal by CNN

## 2 Aims of the bachelor thesis

In [1], a particular CNN, namely the U-net has been employed to remove artifacts from limited data reconstructions in photoacoustic tomography. Based on this network architecture the aim of this bachelor thesis is to implement a deep convolutional network, where the input is a stack of backprojected images instead of a single reconstruction.

This bachelor thesis precisely defines the Radon transform and the filtered backprojection inversion formula and implements the approach described above in Python using the deep learning framework keras.

## References

[1] Stephan Antholzer, Markus Haltmeier, and Johannes Schwab. Deep learning for photoacoustic tomography from sparse data. *Inverse Problems in Science and Engineering*, pages 1–19, 2019.

[2] Johann Radon. Über die bestimmung von funktionen durch ihre integralwerte längs gewisser mannigfaltigkeiten. *Classic papers in modern diagnostic radiology*, 5:21, 2005.