Fan-Beam Computerized Tomography Simulation

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Abstract—This project report demonstrates the implementation of Fan Beam Computerized Tomography simulation. The effect of different design parameters including the length of the detector, the number of beams and the angle between consecutive projections is inspected and discussed comparatively in both quantitative and qualitative manner. The work is derived from the previously developed code in Parallel Beam X-Ray Computerized Tomography ugurlu2021. The developed software and GUI to run it can be found in github.com/kutay-ugurlu/Fan-Beam-Computerized-Tomography-Simulation

Index Terms—imaging, medical imaging, X-Ray computerized tomography, image reconstruction

I. Introduction

The purpose of this project report is to demonstrate the procedure followed to simulate Fan-Beam Projected X-Ray Computerized Tomography. This project report consists of Theory, Implementation, Results and Discussion sections. The second section introduces the technical background for the CT simulation and the following section illustrates the algorithm using pseudocode snippets. Results and Discussion section presents the comparative results regarding different user-specified parameters with the conclusion and reasons behind them.

A. History

The history of X-Ray Computerized Tomography can be dated back to 1917, when an Austrian mathematician called Johann Radon invented an algorithm, referred to as Radon transform today, on how to calculate line integrals in a two-dimensional section. The idea of computed tomography was developed in 1967 and was first used in a medical setting was in 1971 richmond2004sir, by Godfrey Hounsfield. The device was tested at James Ambrose's department at Atkinson Morley Hospital in Wimbledon. This first model did not include a computer, instead the waves was written on a magnetic tape of the device EMI Scanner CT1010 in Figure 1. It was in 1973 that commercial CT scanners were available to the public. CTHist

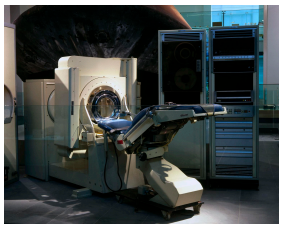

Fig. 1: First EMI Scanner emict

II. Theory

$$I_{measured} = I_0 e^{-\int\limits_{object} \mu(x,y)dxdy} \quad (1)$$

Radon Transform computes the line integrals along the objects to obtain projections.

III. Implementation

IV. Results

V. Discussion