Sparse CAT Medical Imaging Reconstruction via Deep Learning

Chris Light, Michael Ingerman

April 16th

1 Project Idea

Our project is an exploration of Deep Learning as it applies to Medical Imaging. One very common Medical Imaging technique is Computed Axial Tomography (typically referred to as CAT-scan), where projections of X-rays through a patients body are used to reconstruct a detailed internal image.
The use of such X-rays pose a health risk and much effort has been made to reduce a patients exposure [1]. We seek to explore the use of a Convolutional Neural Network, like [2]. The way that this application of Deep Learning will benefit CAT medical imaging is by reducing the number of projections needed for a meaningful reconstruction.

2 Dataset

Harvard's "COVID19-CT-Dataset" will be used to generate data for our deep learning model via inverse Radon transform. First, images from the data set will be converted from their native image type, dicom, to png using the pydicom library. These png images will then be converted to data via inverse Radon transform. Various methods for image post processing will be explored to provide the best performance for producing data for our model.

3 Methods

Typically with color images and CNNs, they are fed to the network as $[H \times W \times C]$, where C is the number of color channels. We will simply be using C as the number of slice projections.
For training, we plan to use the L2 loss function. This is using the output of the CNN after feeding input the slice projections and the true image.

4 Milestone Goals

Our goal for the milestone is to have a network trained and to have results we can observe.

References

[1] Jonas Adler and Ozan Oktem. Learned primal-dual reconstruction. *IEEE Transactions on Medical Imaging*, 37(6):1322–1332, jun 2018.

[2] Dong Hye Ye, Gregery T. Buzzard, Max Ruby, and Charles A. Bouman. Deep back projection for sparse-view ct reconstruction, 2018.