



Topographic Medical Image Reconstruction Using Deep Learning

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Project Goals

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- Generate high quality synthetic medical data.
- Build a neural network that can efficiently reconstruct medical SPECT data.

Motivation

- We would like to enhance our knowledge of deep-learning and understand how it can be applied to medical imaging.
- We aim to improve how medical image reconstruction is performed.



Features

- The user can generate synthetic SPECT data
- The user can reconstruct SPECT data using a pre-trained neural network
 - This is a form of zero-shot learning, as our training data is all synthetic
- A user with the proper training can evaluate the reconstructed images and identify potential heart defects.
 - They will be able to rotate the image, zoom out, etc. in order to do this



Novel features and functionalities

Ways in which our project is unique:

- To the best of our knowledge, no one has ever done a 3D medical image reconstruction by training a neural network without real data.
- The user can view the reconstructed image in milliseconds, whereas it would take upwards of 30 seconds using traditional reconstruction methods.



Tech Stack

Languages

- Python
- C

Libraries

- PyTorch
- Pandas
- Numpy

Other Tools

- Fiji
- GATE



Technical Challenges

- Converting from floating-point real numbers to integers involves a loss of precision and speed, which will be detrimental to our project.
- Nobody in our group has experience using neural networks to generate 3D images, and only one of us has any experience with medical images.
- We have little to no experience using PyTorch for neural networks.



Action Items for Milestone 1

- Make a simple ML design to be trained to provide the 3d image
- Learn about iterative reconstruction and the technology to be used for this project
 - Demo existing reconstruction techniques as a baseline for our project
- Set aside data as a validation set for the AI
- Create Requirement Document
- Create Design Document
- Create Test Document



Action Items for Milestone 2

- **Generate the synthetic SPECT data**
 - Demo this data generation for our presentation



Action Items for Milestone 3

- Train the neural network on the synthetic data
 - Demo the neural net for our presentation

Task Matrix (Milestone 1)

Task	Asher	Chris	Ty
Learn about medical imaging	50%	0%	50%
Learn about the technology we will be using for this project	40%	20%	40%
Create a baseline machine learning model	33%	33%	33%
Set aside real data as a validation set	0%	100%	0%
Requirement Document	15%	15%	70%
Design Document	70%	15%	15%
Test Plan	15%	70%	15%