Milestone 6 Progress Evaluation

1. Project title, names and email addresses of team members (CSE members first)

Project Title: Tomographic Medical Image Reconstruction using Deep Learning
Group Members: Asher Burrell (aburrell2022@my.fit.edu), Christopher Hinton (chinton2022@my.fit.edu), Ty Mercer (tmercer2022@my.fit.edu)

2. Faculty Advisor: Dr. Debasis Mitra, dmitra@fit.edu
3. Client: See Faculty Advisor
4. Progress of current Milestone (progress matrix)

Task Matrix for Milestone 6	Completion	Asher	Chris	Ty
Continue to optimize training time in AI Panther	95%	100%	0%	0%
Identify best AI parameters and keep them as our final product	100%	90%	10%	0%
Create user/developer manual	100%	10%	90%	0%
Test the AI on unaugmented synthetic data	100%	85%	10%	5%
Continue generating sinogram-reconstruction pairs for model training	100%	5%	5%	90%

5. Discussion (at least a few sentences, ie a paragraph) of each accomplished task (and obstacles) for the current Milestone:

Task 1: Continue to optimize training time in AI Panther

We were able to reduce training time on AI Panther to 1 hour, 40 minutes, thanks to the use of parallel GPU cores. However, we found that it was still faster to train the AI on the lab computer, and it was easier to interface with the rest of our data. As a result, we kept the AI training on the local computers instead of the AI panther server. Final training time was 110 minutes.

Task 2: Identify best AI parameters and keep them as our final product

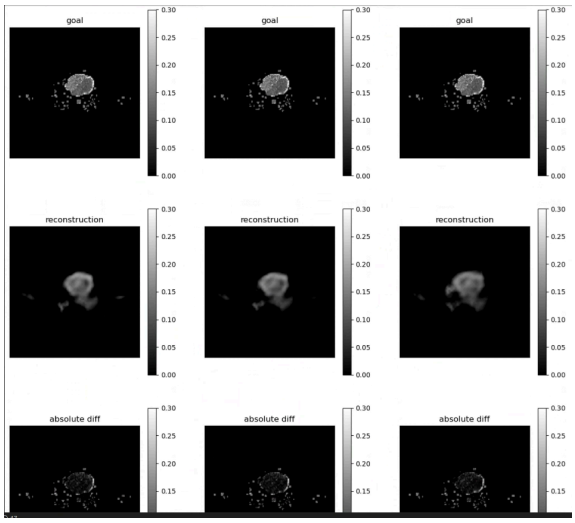
After some experimentation, we were able to get good results from our AI model. We saved this version of the model and connected it to a simple webapp in order to demo it at the showcase. Further experimentation resulted in lower quality reconstructions from the AI model, even after adding more training data. We believe that this is either due to overfit (as our training data has a lot of internal similarities) or because the algorithms we have experimented with for loss functions (RMSE and SSIM) prioritize different aspects of the images than our visual observations.

Task 3: Create user/developer manual

We were required to do this for the senior design showcase. A manual was created for internal documentation in Dr. Mitra's lab, and, because this manual is meant for internal use only, a separate user/developer manual was created with the details one would need to understand a hypothetical public release of the project. No public releases of the project at its current stage are planned.

Task 4: Test the AI on unaugmented synthetic data

Following the model's lackluster performance on real SPECT data, we were instructed to first work towards the easier goal of getting the AI to work on unaugmented synthetic data. After a few attempts, we were able to do this successfully. A sample of results from our best model (in terms of both visual appearance and evaluation metrics) can be found below:



Task 5: Continue generating sinogram-reconstruction pairs for model training

We were able to generate 40 sinogram-reconstruction pairs pre-augmentation, 2200 sinogram-reconstruction pairs post-augmentation. We did not set a specific numerical goal for this task, as we had lost some of our data unexpectedly due to an error in the process and we were advised to focus on test data generation instead. However, as seen from our AI results the data generated was sufficient to produce reasonably accurate reconstructions.

6. Discussion (at least a few sentences, ie a paragraph) of contribution of each team member to the current Milestone:

- Asher Burrell

Asher created a web interface to interact with the model inference script. The web interface allows users to upload any number of sinogram files, and the front end calls the model inference pipeline to return slices of the reconstruction available for viewing. The web interface uses a Python Flask backend and a ReactJS frontend. He also finished the last improvements to the machine learning model and collected the metrics for its performance on unaugmented testing data.

- Chris Hinton

Chris primarily worked on documentation, particularly the user and lab manuals, and did some work on the poster. He also preprocessed both real and synthetic data to be used in testing for the AI, reported the group's progress to Dr. Mitra at weekly lab meetings, and helped refactor and organize the final code.

- Ty Mercer

Ty worked on maintaining the data generation and augmentation pipeline, being sure to restart it at various hiccups and identify problems. He also helped identify a generation issue midway through and adjusted the scripts accordingly.

7. Skip if this is for Milestone 6

8. Discussion (at least a few sentences, ie a paragraph) of each planned task for the next Milestone or
"Lessons Learned" if this is for Milestone 6

Lessons Learned:

Communication is very important, especially on projects where different people are

working on connected parts of the project. We had a couple of setbacks caused in part by a lack of communication (i.e. two people each thought the other had tested a certain part of the code).

Having different people be the "experts" on different parts of the project works well, until it doesn't. For a couple of milestones we had Asher as the AI expert, Ty as the data generation expert, and Chris working with the preexisting lab code and helping Asher and Ty where it was needed. This was fine until the later milestones, when Asher ended up doing a lot of the work simply because he was the only one who understood all of the code for the AI.

Having smaller tasks besides the milestone goals would have been helpful to maintain a steady workflow. Although we were able to complete everything by the given deadlines, having weekly tasks assigned would have helped to keep everyone on track, identify problems early, and make sure we all knew what we were supposed to be doing.

9. Date(s) of meeting(s) with Client during the current milestone:

4/18/25

10. Client feedback on the current milestone

See Faculty Advisor feedback below.

Task 1: Continue to optimize training time in AI Panther

Advisor Feedback: Running good!

Task 2: Identify best AI parameters and keep them as our final product

Advisor Feedback: Should document them

Task 3: Create user/developer manual

Advisor Feedback: Had shown me the draft.

Task 4: Test the AI on unaugmented synthetic data

Advisor Feedback: Results coming good.

Task 5: Continue generating sinogram-reconstruction pairs for model training

Advisor Feedback: Okay!

11. Date(s) of meeting(s) with Faculty Advisor during the current milestone:

4/18/2025

12. Faculty Advisor feedback on each task for the current Milestone

Faculty Advisor Signature: _____ Date: _____

13. Evaluation by Faculty Advisor

- Faculty Advisor: detach and return this page to Dr. Chan (HC 209) or email the scores to pkc@cs.fit.edu
- Score (0-10) for each member: circle a score (or circle two adjacent scores for .25 or write down a real number between 0 and 10)

Asher Burrell	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Christopher Hinton	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Ty Mercer	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10

Facutly Advisor Signature: _____

Date: _____