Milestone 5 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 5	Completion	Asher	Chris	Ty
Generate 5,000 sinograms using the model pipeline	80%	10%	30%	60%
Continue to optimize training time in AI Panther	50%	90%	10%	0%
Create project poster	80%	20%	60%	20%
Test the AI on real medical data	50%	45%	45%	10%

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

Task 1: Generate 5,000 sinograms using the model pipeline

Unfortunately, we were unable to reach this goal because our data generation script encountered an error over spring break, and we did not notice until we got back. We also focused on creating unaugmented test data for the AI, instead of the training data. We currently have about 3,825 sinograms.

Task 2: Continue to optimize training time in AI Panther

In our last milestone, we discussed an unknown glitch that has drastically increased our training time on AI Panther. We believe that our AI is not being allowed to access the AI Panther GPU cores, but even through discussion with Dr. White we were able to figure out

what the issue was. Thankfully, we were able to reduce our training time on AI Panther from 14 hours to 1 hour, 40 minutes. However, this is still slower than running on the lab computer.

Task 3: Create project poster

We were required to do this for the senior design showcase. The poster shows what we have done this semester in a format that is appealing to the Northrop Grumman judges and is understandable for someone who does not know about medical images. It is not finished because we need results from the final version of our AI, which has not yet been determined.

Task 4: Test the AI on real medical data

We were able to run some preliminary experiments on real medical data with the AI. The results were very visually different from the expected results, to the point that applying the statistical methods we use for the synthetic data is moot. However, we plan to implement other measures of similarity, such as location (based on centroids of heart reconstructions in expected and actual results), in order to identify what the AI is successfully reconstructing until the output starts to look like the expected results.

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

- Asher Burrell

Asher was mainly focused on making further improvements to the ML model scripts. He was responsible for making changes to the ML model. He has also created new validation metrics and methods using suggestions made by Dr. Chan. Additionally, he has been the main person responsible for getting all training data, validation data, and model scripts running on AI Panther.

- Chris Hinton

Chris created most of the poster and assisted with data generation and AI testing. He preprocessed data to be used in testing for the AI. He also assisted Ty in generating training and test data, and refactoring our code to be more flexible and modular.

- Ty Mercer

Ty continued running the simulations. Admittedly, he encountered an issue with the data generation that wasn't recognized during Spring Break, which meant we had less data

points then we should have. However, he was diligent in designing the scripts so that they would be easier to rewrite, maintain, and terminate as needed. He worked on designing the scripts to restart automatically after termination from the last simulation and file, which isn't currently possible and difficult to configure.

7. Plan for the next Milestone (task matrix) or [skip if this is for Milestone 6]

Task Matrix for Milestone 6	Asher	Chris	Ty
Continue to optimize training time in AI Panther	35%	35%	30%
Identify best AI parameters and keep them as our final product	80%	10%	10%
Create user/developer manual	33%	33%	33%
Test the AI on unaugmented synthetic data	40%	40%	20%

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

Task 1: Continue to optimize training time in AI Panther

Currently training on AI Panther is about 10% slower than training on the local machines. We plan to decrease this time by performing more advanced GPU acceleration and looking at training multiple GPUs. Also, we are thinking about employing forms of distributed computing (including federated) to drive down times as well. If implemented, this last suggestion would be done in collaboration with the second senior project group.

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

We will compare some of the different models that we have created so far and determine which one we will use for the senior design showcase. To compare models, we have created a composite metric that combines all the error functions currently used in our models. We have determined visually that the composite metric is a good measure of the accuracy of

the models. Therefore, whichever model performs best on the composite metric is the model that we will use for the showcase.

Task 3: Create user/developer manual

We have already been documenting all the aspects of the system so that other lab members (and the Year 2 Senior Design Lab Group) can build on what we have already created. Our next step is to compile all of this documentation into one place.

Task 4: Test the AI on unaugmented synthetic data

This is another task that will be done in collaboration with the Year 2 senior project group. We want to validate the strength of the model on sinograms that have not been fully augmented. We plan to expand our current testing data with more samples of synthetic medical data from different patients than the ones the model has seen in order to see how useful the model will be in the real world. We began work on this during our current milestone, but will need to fix some issues in the data formatting in order to properly test the data.

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

3/24/2024

10. Client feedback on the current milestone

See Faculty Advisor feedback below.

Task 1: Generate 5,000 sinograms using the model pipeline

Advisor Feedback: Some problems led to generating blank sinograms resulting in less data, which will be fixed.

Task 2: Continue to optimize training time in AI Panther

Advisor Feedback: Now it is running on GPU but still slower than that on the lab computer, possibly memory issues. Asher is looking into it.

Task 3: Create project poster

Advisor Feedback: Draft looks nice.

Task 4: Test the AI on real medical data

Advisor Feedback: Need not use real data for this project. Should test on synthetic set-aside test data.

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

3/24/2024

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

Faculty Advisor Signature: DocuSigned by: Debasis Mitra 360AC3A20617469... _____ Date: 3/25/2025

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: _____