Tomographic Medical Image Reconstruction Using Deep Learning

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Task Matrix for Milestone 5

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%

Continue to optimize training time in AI Panther

- We were able to do a run on 4 GPUs, further decreasing time.
- Unfortunately, due to the high usage rate of AI Panther, this has not resulted in significant time savings.
- Training time on AI Panther is around 1 hour 30 minutes.

Identify Best AI Parameters and use them as our Final Product

- After testing on unaugmented synthetic data, we found that a model running a modified version of the RMSE loss outperformed the SSIM model.
- This modified RMSE model will be used at the Senior Design showcase.

Create User/Developer Manual

- This task was mostly completed by Chris.
- We have adapted the user manual from a modified version of an internal lab manual documenting our ML pipeline.

Test the AI on unaugmented test data

- We were able to achieve massive improvements on our synthetic test data performance.
- By using better training data, we were able to decrease our error on synthetic test data by 82%.

Bonus: User Interface

- As a bonus task, we created a web user interface to interact with the model. The UI has two modes:
  - (1) Showcase Mode: This mode allows the user to upload the ground truth and base sinogram, and the UI will return:
    - Image reconstruction
    - Difference matrix
    - Difference metrics
  - (2) Regular Mode: This mode allows the user to upload a sinogram file and get back a reconstruction.
- The UI is mainly for demo & internal lab purposes and we will continue working on it after the showcase. Dr. Mitra is thinking of hosting it on his lab's website.

Video Demo

Regular Mode:

https://youtu.be/GXW_kl_HW6A

Final thoughts:

- 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
- Having different people be the "experts" on different parts of the project works well, until it doesn't.
- 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.

Questions?