Topographic Medical Image Reconstruction Using Deep Learning

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Task Matrix for Milestone 4

Task Matrix for Milestone 4	Completion	Asher	Chris	Ty
Generate 3,000 sinograms using the model pipeline	98%	10%	10%	80%
Train and tune the PyTorch AED model to start reconstructing sinograms based on the data we have currently	95%	35%	35%	30%
Validate the model on synthetic data through AI Panther	95%	45%	45%	10%
Incorporate the validation scoring method for reconstruction quality	100%	40%	40%	20%

Generate 3,000 sinograms using the model pipeline

- Artificial data generation using the OpenGate pipeline from the previous milestones
- Added data augmentation to multiply our sinogram output by 50
- Developed automated pipelines so this process should be faster in the future

Train and tune the PyTorch AED model to start reconstructing sinograms based on the data we have currently

- Improved our AI from the previous milestone
- Experimented with different loss functions
  - Settled on (1 - SSIM)
- Getting good results so far
  - Will be shown in the demo

Validate the model on synthetic data through AI Panther

- Training time increased from 1 hour to 12 hours with SSIM loss function
- Moved our AI and data onto AI-Panther for faster training
  - Unfortunately, we have not yet been able to get faster training results using AI Panther. We are currently trying to fix this issue.
- Validation results shown in demo

Incorporate the validation scoring method for reconstruction quality

- Looked into a number of evaluation functions
  - Some generic for AI evaluation
    - RMSE - Root Mean-Squared Error
  - Some specific to image evaluation
    - FSIM - Feature Similarity Index Metric
    - SSIM - Structural Similarity Index Metric
    - PSNR - Peak Signal-to-Noise Ratio

Task Matrix for Milestone 5

Task Matrix for Milestone 5	Asher	Chris	Ty
Generate 5,000 sinograms using the model pipeline	10%	10%	80%
Continue to optimize training time in AI Panther	35%	35%	30%
Create project poster	33%	33%	34%
Test the AI on real medical data	40%	40%	20%

Video Demo

https://youtu.be/1t_Htv09OBg

Questions?