

A decorative graphic on the left side of the slide consisting of two overlapping parallelograms. The front one is blue and the back one is a light greenish-blue. They are positioned diagonally, with the blue one in front of the green one.

Topographic Medical Image Reconstruction Using Deep Learning

Asher Burrell, Christopher Hinton, Ty Mercer
Advised by Dr. Debasis Mitra




Task Matrix for Milestone 3

Task	Completion	Asher	Chris	Ty
Generate 1,000 sinograms using the model pipeline	100%	10%	10%	80%
Develop a new machine learning model to classify the generated sinograms	100%	40%	40%	20%
Train and tune the PyTorch AED model to start reconstructing the sinograms based on the data we have currently	90%	35%	35%	30%
Figure out how to run OpenGate on a multithreading program.	100%	10%	10%	80%




Generate 1,000 sinograms using the model pipeline

- Artificial data generation using the OpenGate pipeline from the previous milestone
- Added data augmentation to multiply our sinogram output by 50



Develop a new machine learning model to classify the generated sinograms

- Used pre-existing neural network
 - Developed for mouse images
- Adapted for sinograms



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

- Main focus of this milestone - discussed in upcoming slides
- Good results - see demo


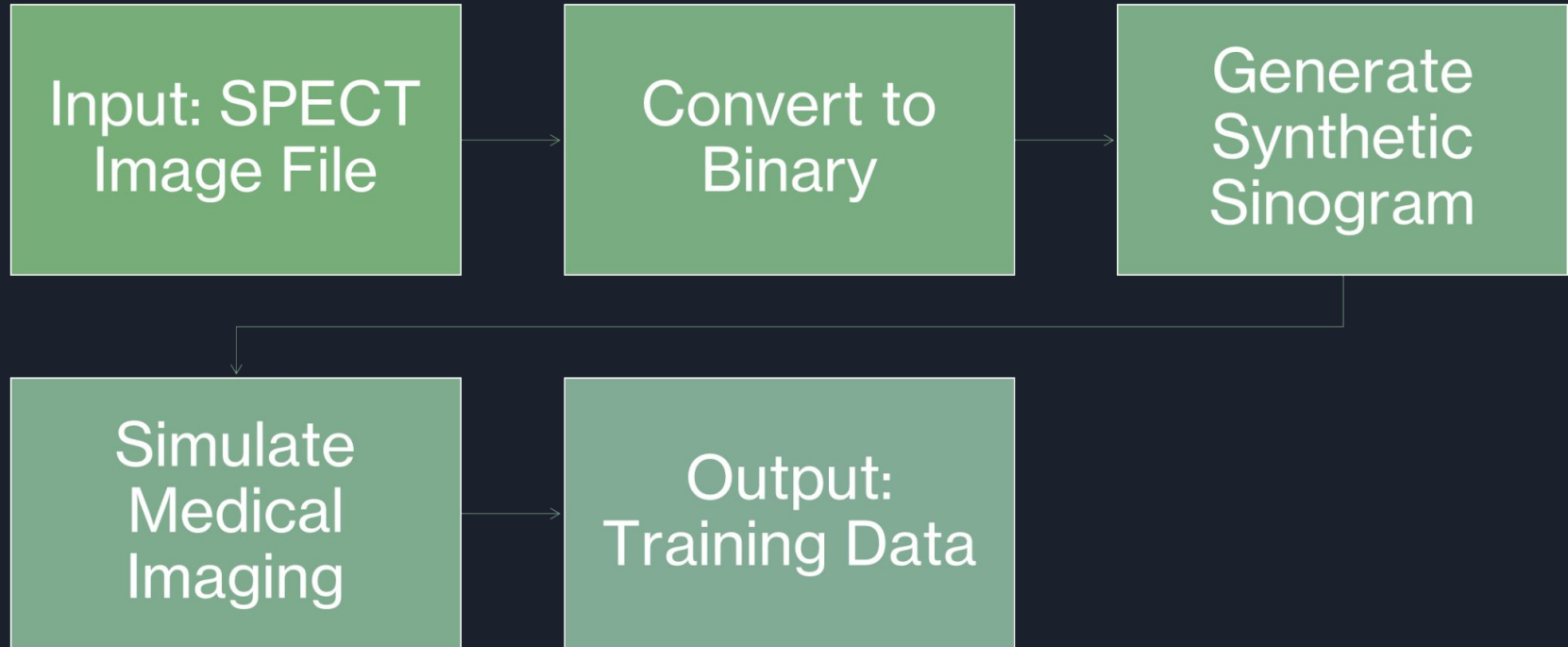


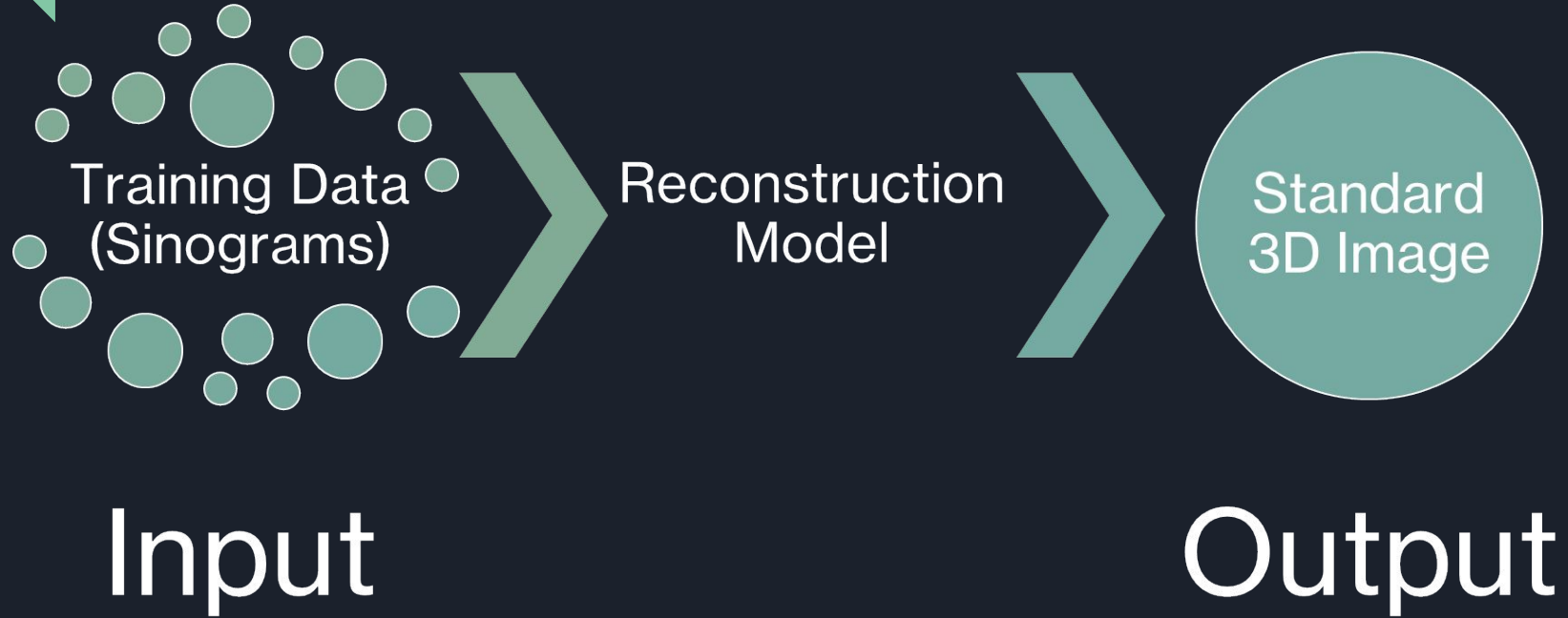
Figure out how to run OpenGate on a multithreading program.


- It runs with multithreading now
- Also runs on multiple computers

Process to Produce Training Data



Model Inferencing Process

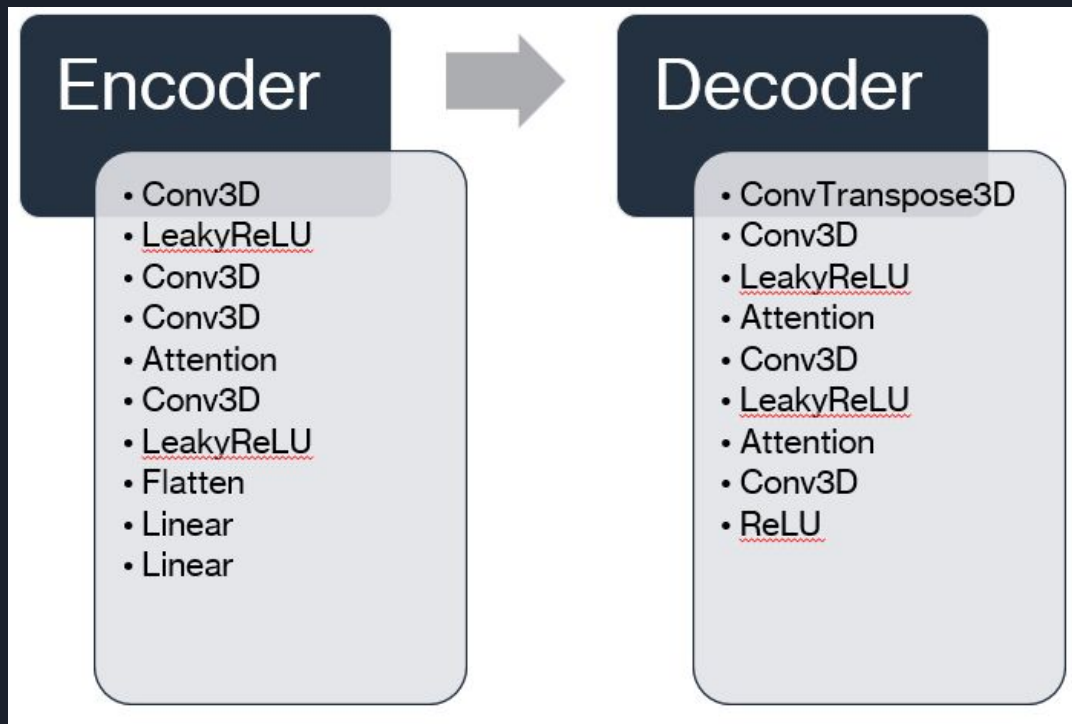




Characteristics of Training Data (Model Input)

- The training data serves as the input to our model.
- Each sample has three main features: width, height, and number of cross sections.
- Input dimensions: 128x128x120
 - 128 is the width of the sinogram
 - 128 is the number of cross sections (rotational space)
 - 120 is the height of the sinogram
- Each sample is a representation of the cross section of the patient.

Neural Network Architecture Design





Characteristics of Output Data

- The output data is a standard 3D image reconstruction in Euclidean space.
- Each sample has three main features: width, height, and length.
- Input dimensions: 128x128x64
 - 128 is the width of the sinogram
 - 128 is the number of cross sections
 - 64 is the height of the sinogram



Task Matrix for Milestone 4

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



Video Demo

<https://youtu.be/XHaO4lgztrc>



Questions?