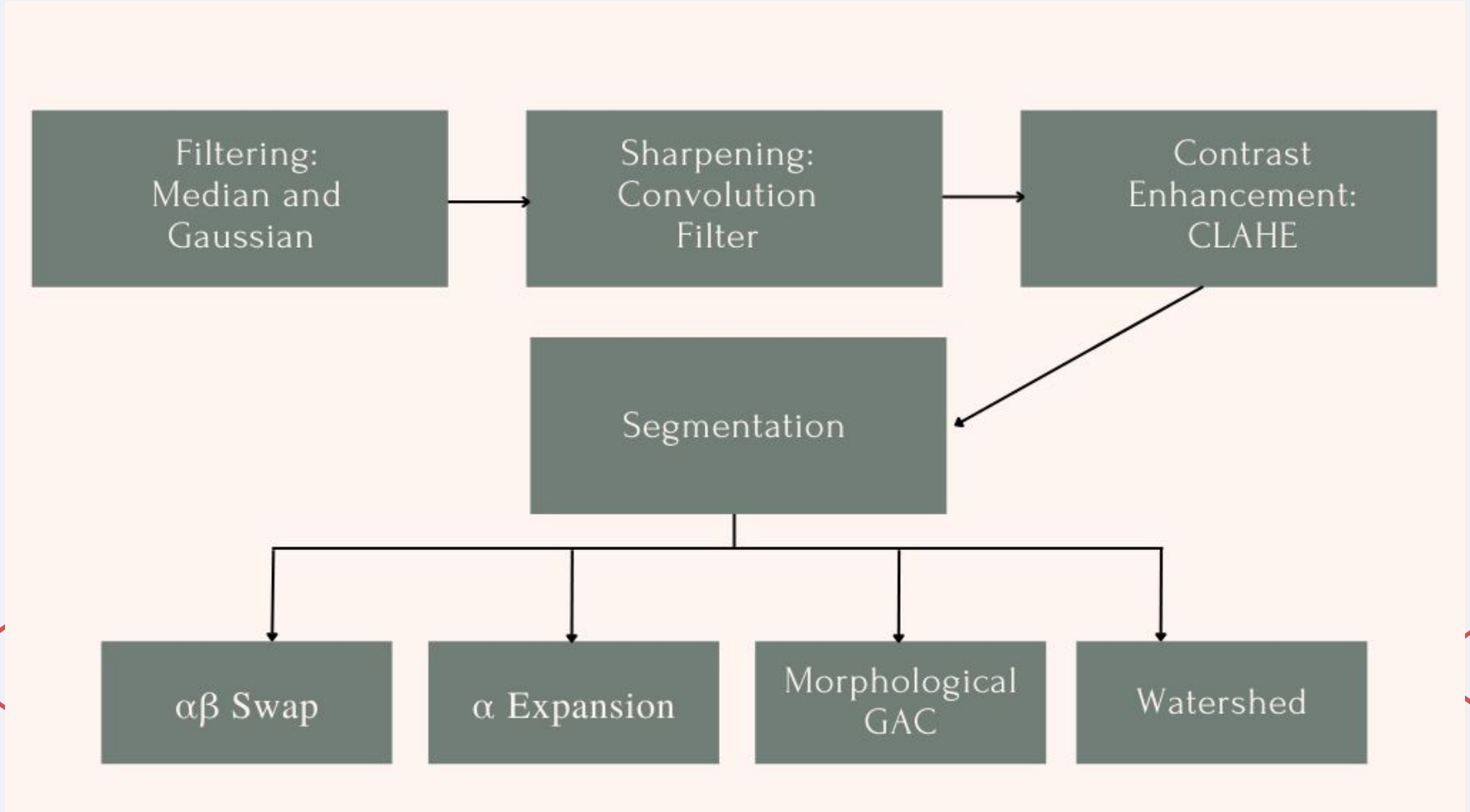
ED6001: Medical Image Analysis

Term Paper Presentation

Analysis Pipeline



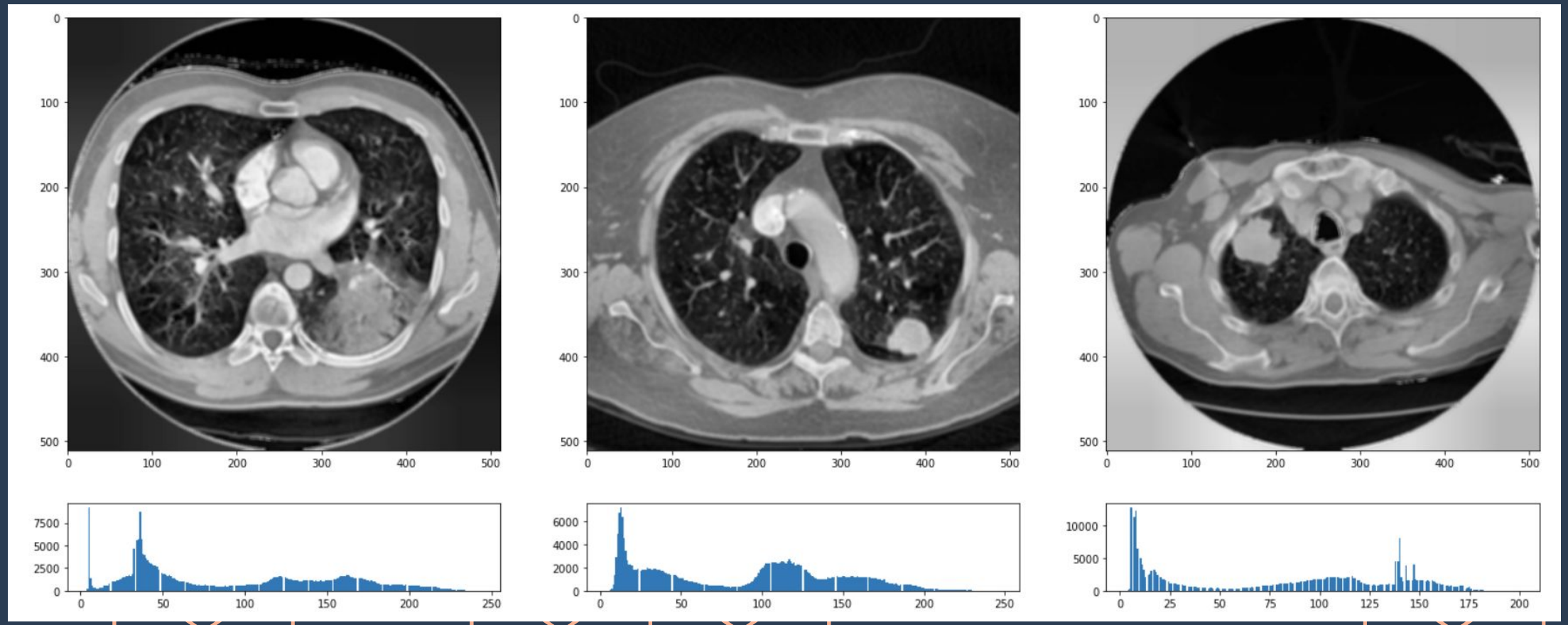
Preprocessing

At the time of CT Image acquisition process, some noise was inherently embedded in the scans which aids in false detection of nodules. In order to remove this noise, we have applied 2 filters:

- Median filter to remove any salt and pepper noise in the images.
- Gaussian filter to remove speckle noise and smoothen the images.

After the image has been smoothened by the two filters, sharpening filter is applied on to the image using convolution. And later contrast was improved using CLAHE.

Preprocessing Output



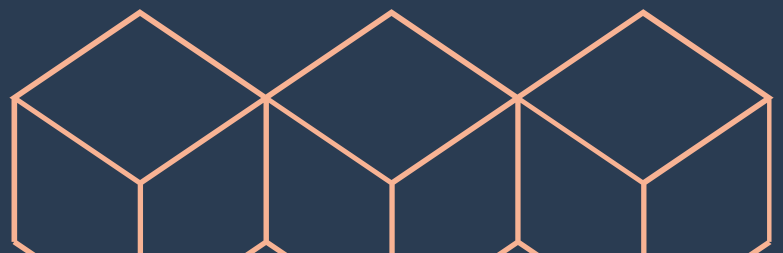
Preprocessed Scans 1, 2 and 3 (Left to Right)

Segmentation Methods

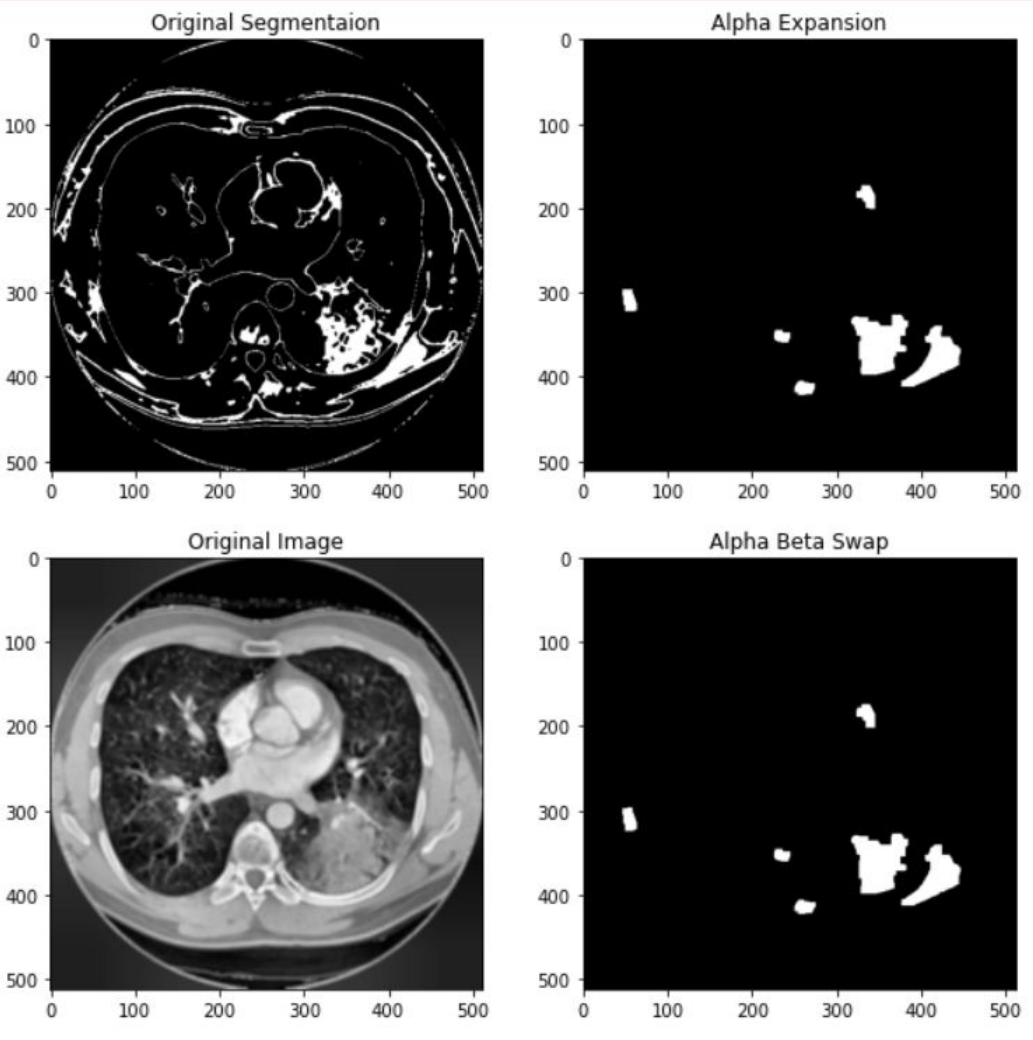
We performed four segmentation methods:

1. Alpha-Beta Swap
2. Alpha Expansion
3. Active Contours using Morphological GAC Snakes
4. Watershed Segmentation

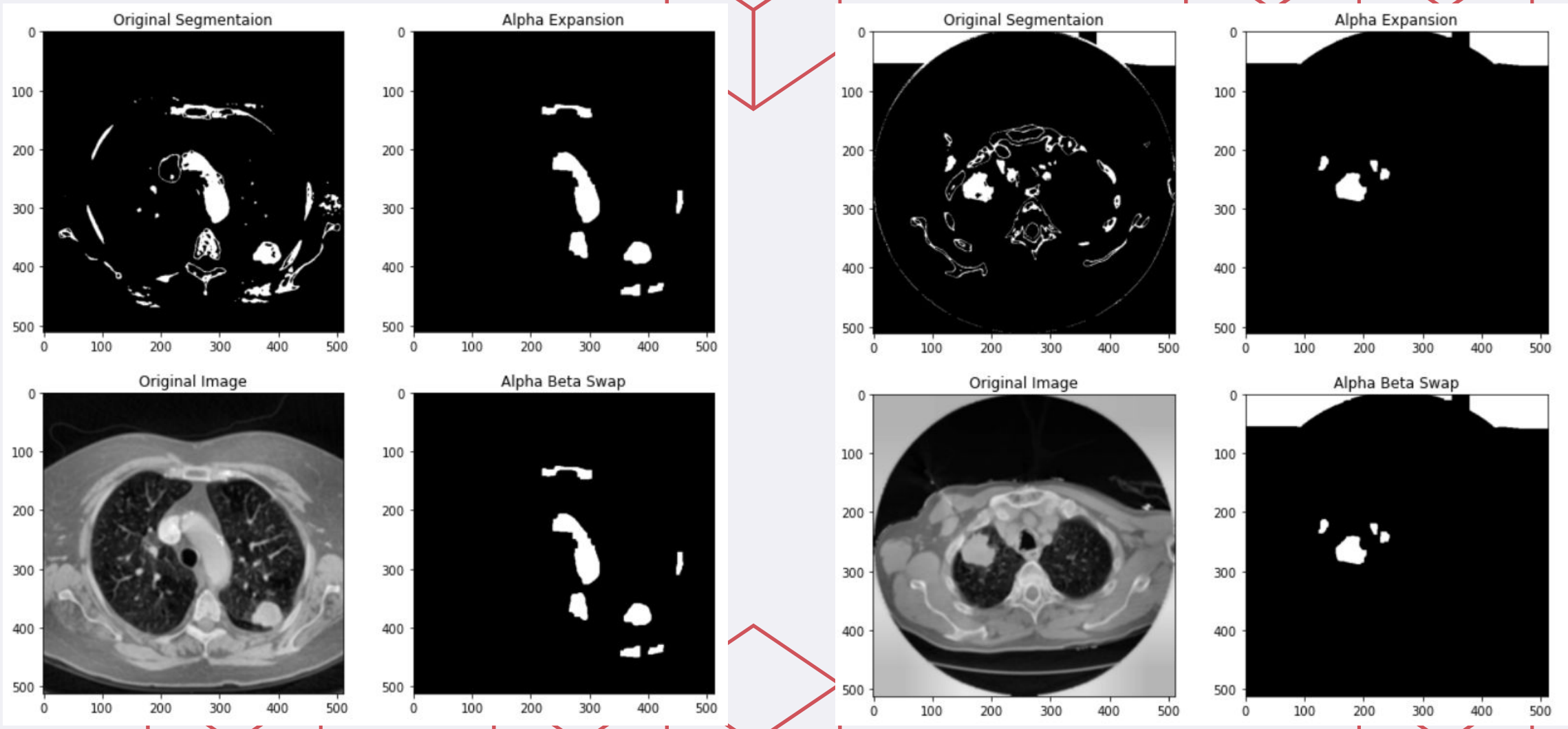
Alpha Beta Swap & Alpha Expansion



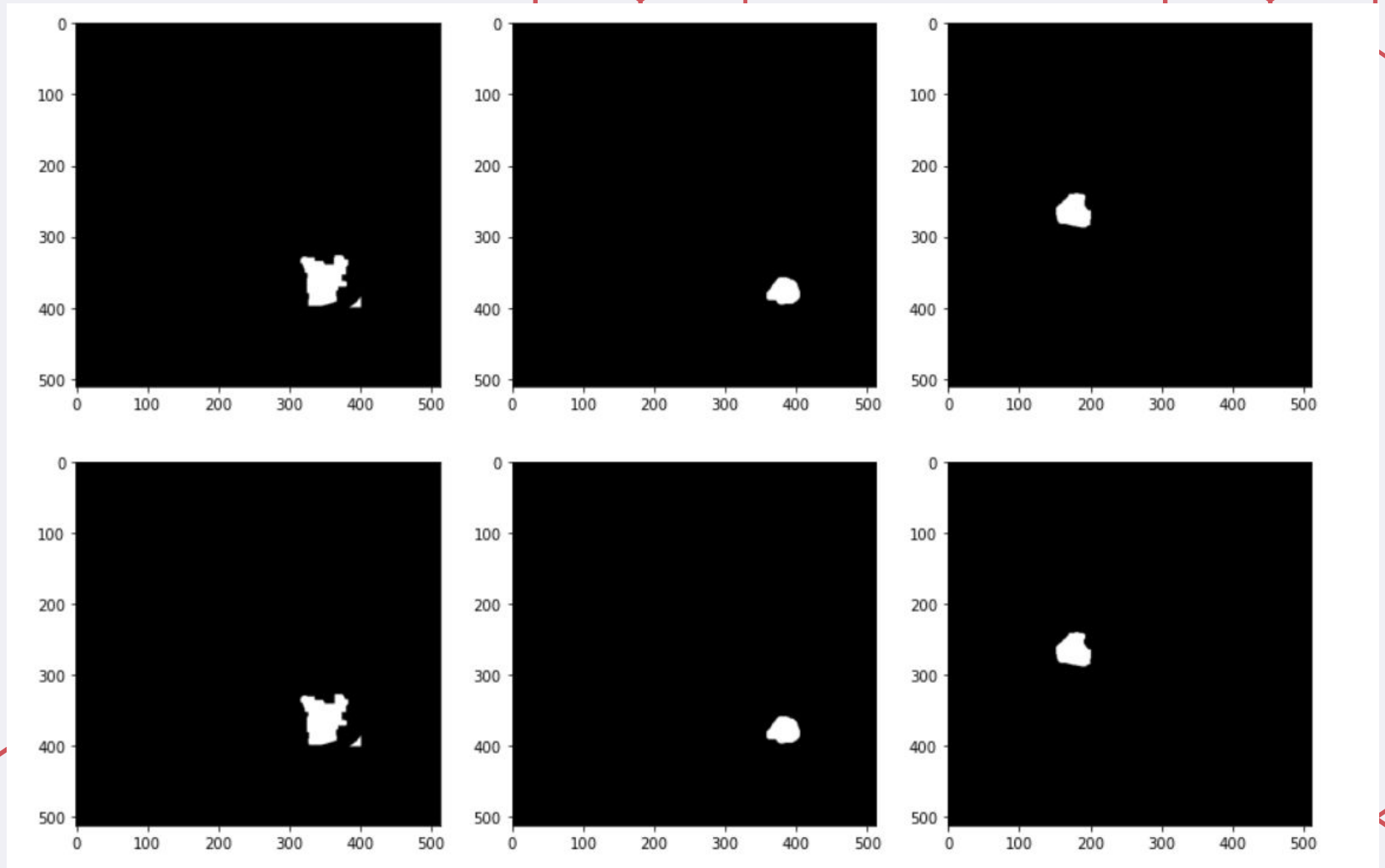
Segmentation Results



Results of Alpha Beta Swap and Alpha Expansion on Scan 1



Results of Alpha Beta Swap and Alpha Expansion on Scans 2 and 3 (Left to Right)



Results of application of ROI mask on the segmentation outputs

Evaluation Results

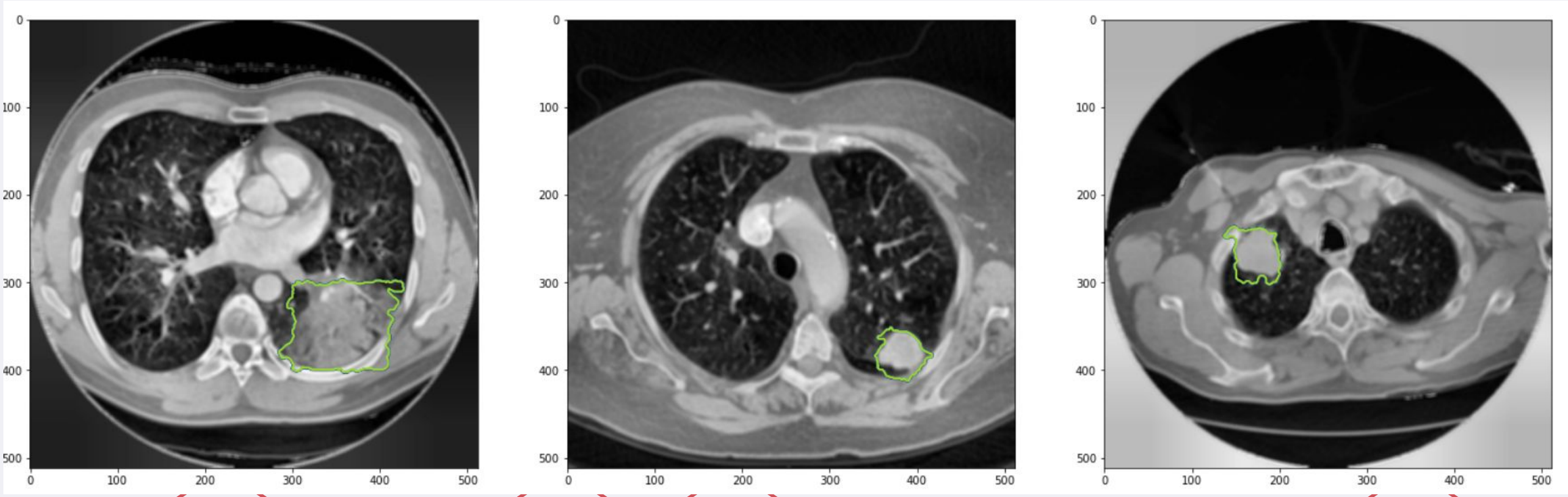
Alpha Beta Swap	Jaccard Score	Accuracy Score	F1 Score	Hausdorff Distance
Scan 1	0.353196	0.777344	0.522018	6.855655
Scan 2	0.790323	0.919922	0.882883	3.741657
Scan 3	0.799176	0.890625	0.888380	3.605551

Alpha Expansion	Jaccard Score	Accuracy Score	F1 Score	Hausdorff Distance
Scan 1	0.359315	0.777344	0.517766	6.855655
Scan 2	0.790323	0.919922	0.882883	3.741657
Scan 3	0.797938	0.890625	0.887615	3.605551

2

Active Contours using Morphological GAC Snakes

Segmentation Results



Results of Segmentation through Active Contouring on Scans 1, 2 and 3 (Left to Right)

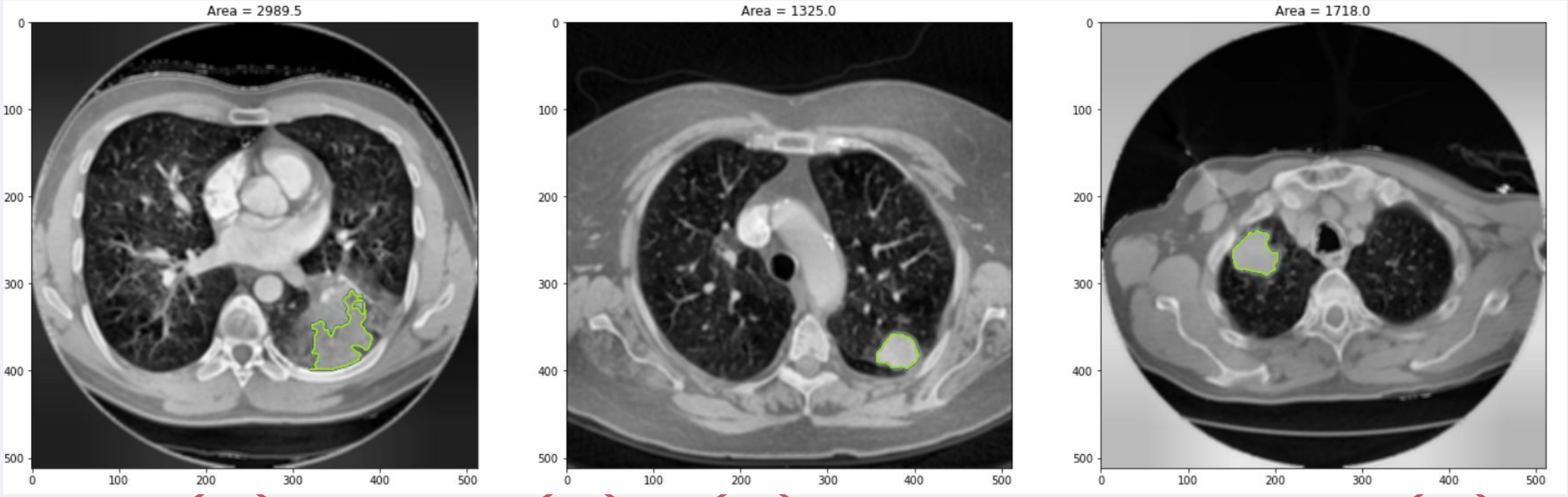
Evaluation Results

Active Contouring	Jaccard Score	Accuracy Score	F1 Score	Hausdorff Distance
Scan 1	0.634204	0.773438	0.776162	7.00000
Scan 2	0.487057	0.878906	0.655062	3.872983
Scan 3	0.557832	0.869141	0.716165	4.582576

3

Watershed Segmentation

Segmentation Results



Results of Watershed Segmentation on Scans 1, 2 and 3 (Left to Right)

Evaluation Results

Watershed	Jaccard Score	Accuracy Score	F1 Score	Hausdorff Distance
Scan 1	0.343266	0.781250	0.511092	6.78233
Scan 2	0.801379	0.919922	0.889740	3.741657
Scan 3	0.805102	0.890625	0.892029	3.741657

Thank You!

Presented By:

Kunal Vartia (AE19B039)

Omesh Kandregula (ED18B048)