Brainomix Coding Challenge

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This report outlines the Brainomix Coding Challenge which handles a Lung CT NIFTI dataset.

1 Question 1

The images first underwent thresholding between the units -1000 HU and -300 HU.

To individualise the lungs, skimage was used to find contours of the image and to select the two contours for the lungs. This is exemplified in the code and illustrated in the Appendix for all images.

The lung volumes were then calculated using nibabel library's header().get_zooms() function.

2 Question 2

The vessels were determined using the lung mask, which was set above -500 HU. The volumes for the vessels, along with the vessel-to-lung volume ratio are given in the table below.

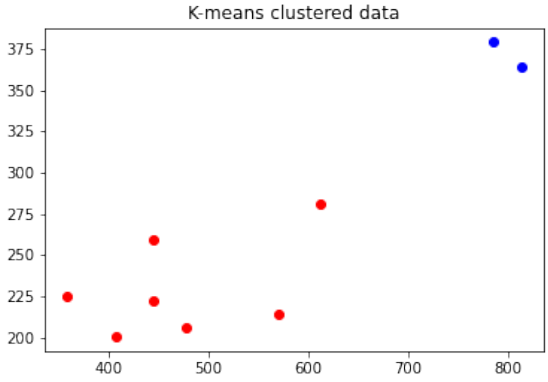
	Lung	Lung Volumes	Vessel Volumes	Vessel-Lung Ratio
0	vol_06	358.68655476332555	224.90216850758455	62.69573659631533
1	vol_08	784.6158993944183	379.2746606920277	48.33657182740038
2	vol_04	611.3639831542969	281.1591204474954	46.1402872625456
3	vol_02	569.5257396596995	214.3000124255662	37.62866212520669
4	vol_07	445.4855237693787	222.5304892570859	49.94648666352476
5	vol_09	812.7850038585486	364.6413554424373	44.8618624151746
6	vol_05	445.2128661917886	259.2445743340316	59.8722700740702
7	vol_01	478.0183784641158	206.27039176388487	43.15232261237649
8	vol_03	406.8923034667969	200.55506852093865	49.28413957914219

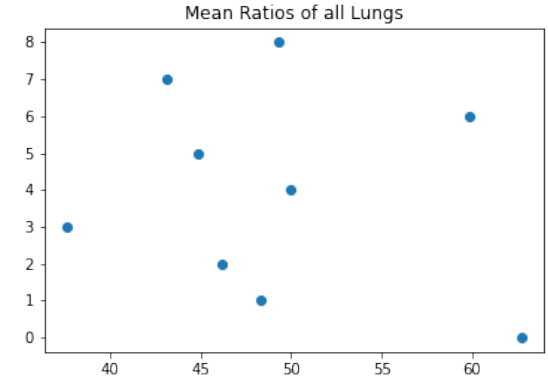
It is evident that the volume calculation has not been successful and I suspect this is because of the total pixels in my lung mask. The vessel and lung areas were previously calculated for the last slice of each image and this was executed successfully, with the ratios ranging from 3-10%.

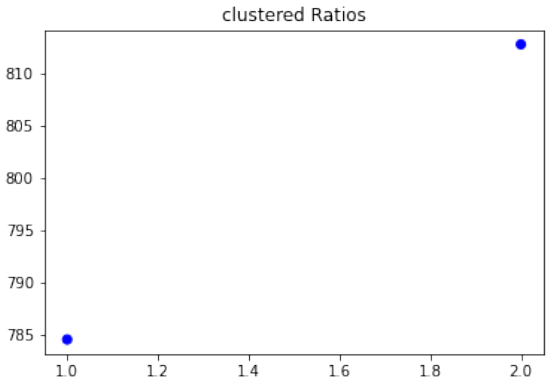
3 Question 3

For the classification of the dataset, I used skimage's KMeans algorithm. This is implemented in the code. I used a 2-class division here as the dataset gets affected by imbalance for classes

above 2. Since the previous error with the code is affecting the next steps of the challenge, to ensure I have the correct technique, I applied KMeans to the Lung and Vessel areas instead. This was executed correctly with 9 datapoints per image.







I unfortunately did not have enough time to give this coding challenge my best, which is reflected in my current results. Having said this and despite it being a learning curve, I thoroughly enjoyed exploring this dataset as well as learning biomedical image segmentation techniques!

4 Appendix

Masks of the Lungs and Vessels:

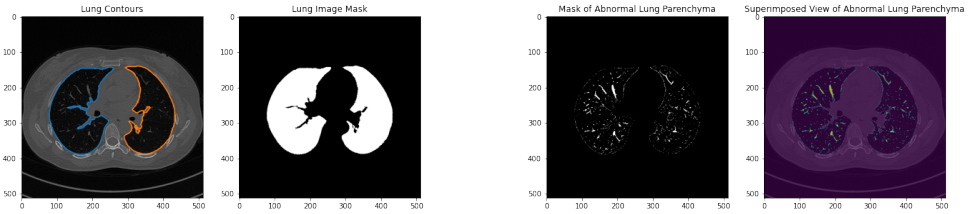


Figure 1: Lung 1

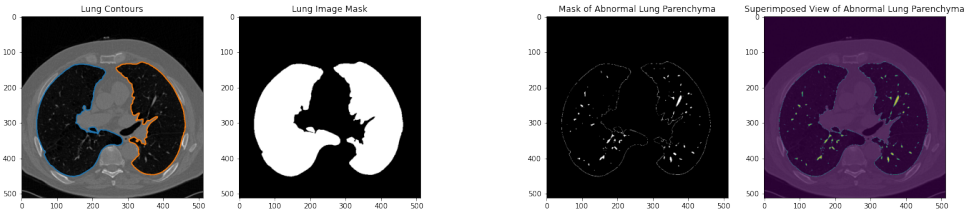


Figure 2: Lung 2

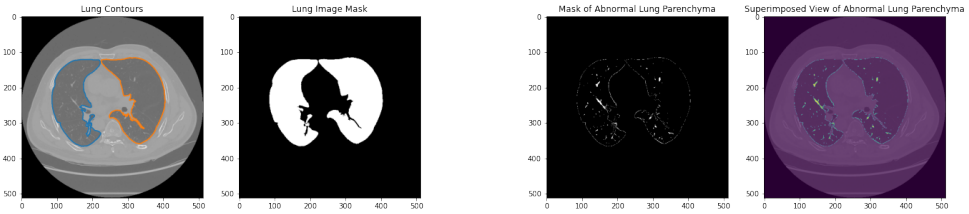


Figure 3: Lung 3

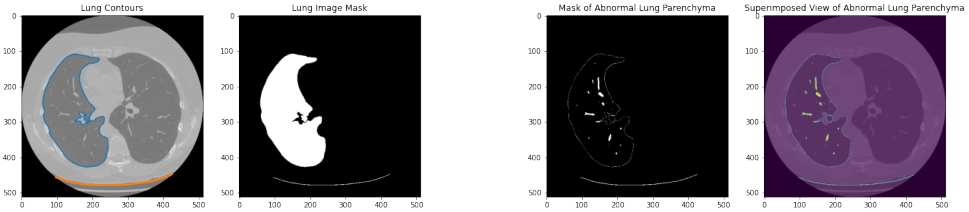


Figure 4: Lung 4

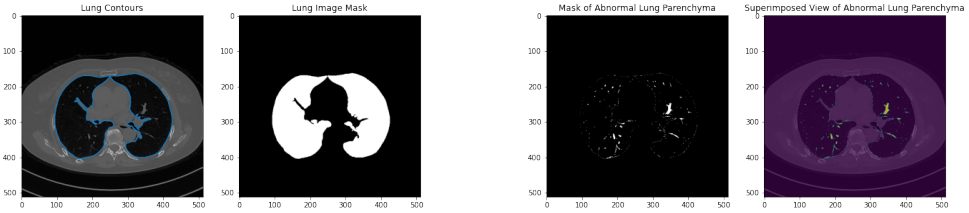


Figure 5: Lung 5

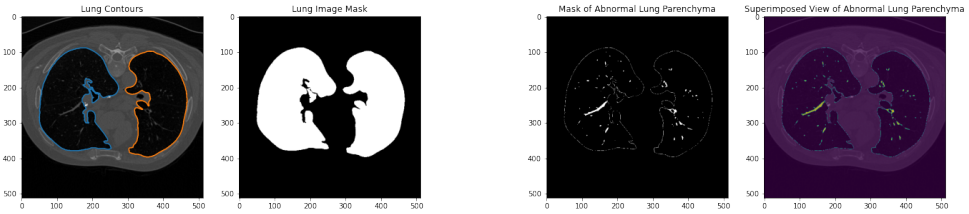


Figure 6: Lung 6

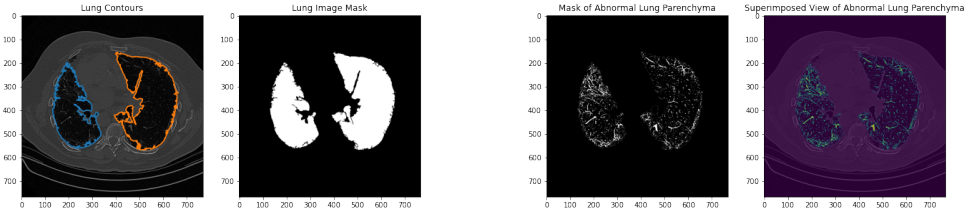


Figure 7: Lung 7

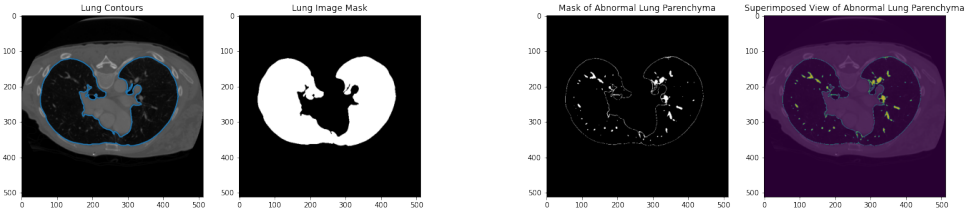


Figure 8: Lung 8

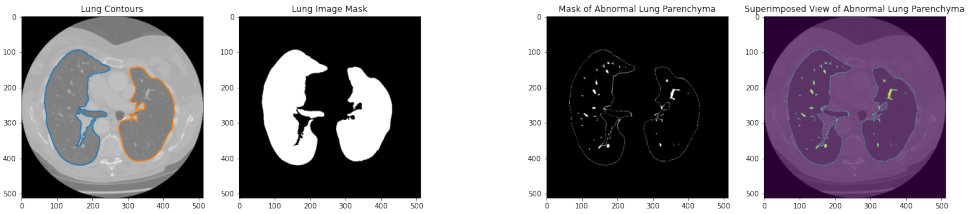


Figure 9: Lung 9