Lung Cancer Segmentation

Deep Neural Networks Final Project

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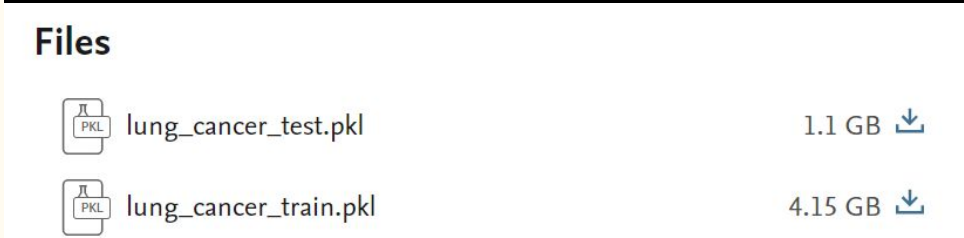
Research Question

Can we use deep learning to identify lung cancer in CT scan images?

The Dataset

- Fusion of Kazakh Research Institute of Oncology & Radiology and LIDC-IDRI dataset
- 972 CT images labeled by radiologists using the Lung-RADS System
- Each image is labeled with a mask overlaying the cancer

Nam, Diana; Panina, Alexandra; Pak, Alexandr (2024), "Lung cancer segmentation dataset with Lung-RADS class", Mendeley Data, V1, doi: 10.17632/5rr22hgzwr.1

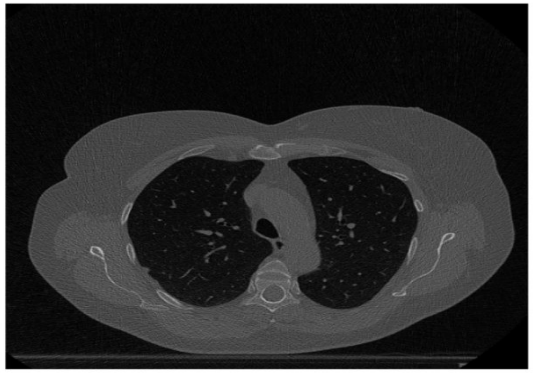
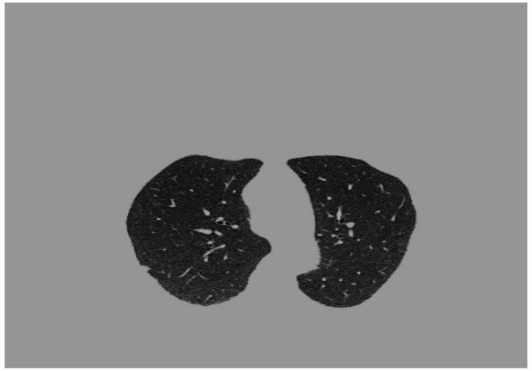


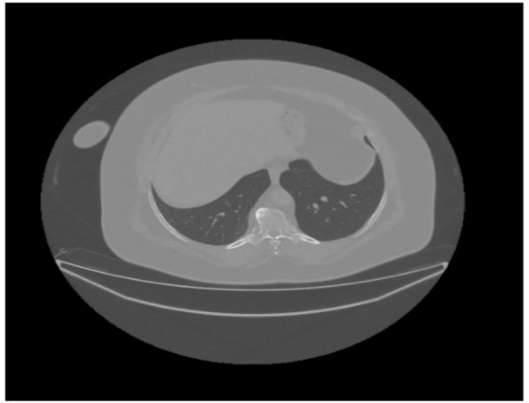
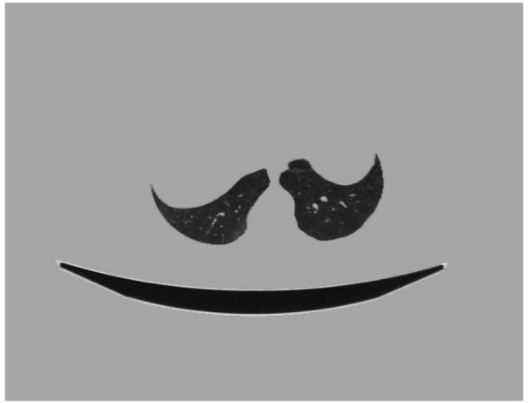
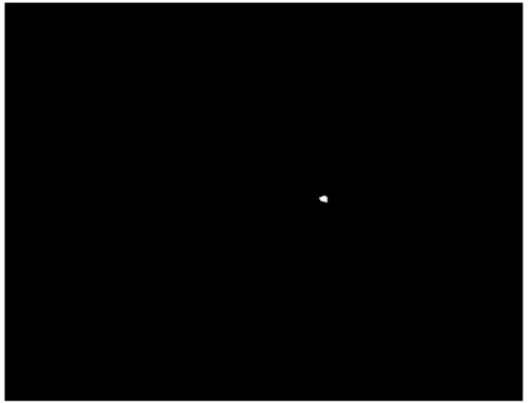
Dataset

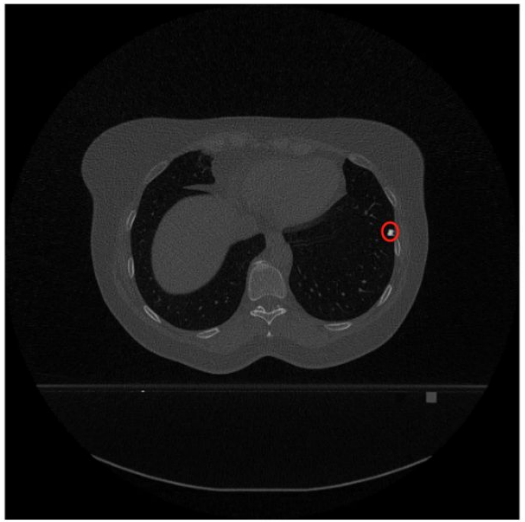
	label1	mask	hu_array	hu_array_old
0	LR2	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1024.0, -1024.0, -1024.0, -1024.0, -1024.0,...
1	LR2	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1024.0, -1024.0, -1024.0, -1024.0, -1024.0,...
2	LR2	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1024.0, -1024.0, -1024.0, -1024.0, -1024.0,...
3	LR2	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1024.0, -1024.0, -1024.0, -1024.0, -1024.0,...
4	LR2	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1024.0, -1024.0, -1024.0, -1024.0, -1024.0,...
...	...	...	...	...
703	LR4B	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1015.0, -1024.0, -972.0, -975.0, -1013.0, -...
704	LR4B	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1022.0, -1024.0, -957.0, -987.0, -1022.0, -...
705	LR4B	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1024.0, -1024.0, -951.0, -998.0, -1019.0, -...
706	LR4B	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1024.0, -1009.0, -968.0, -1022.0, -1007.0, ...
707	LR4B	[[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,...	[[-0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0...	[[-1024.0, -1005.0, -957.0, -1017.0, -1013.0, ...

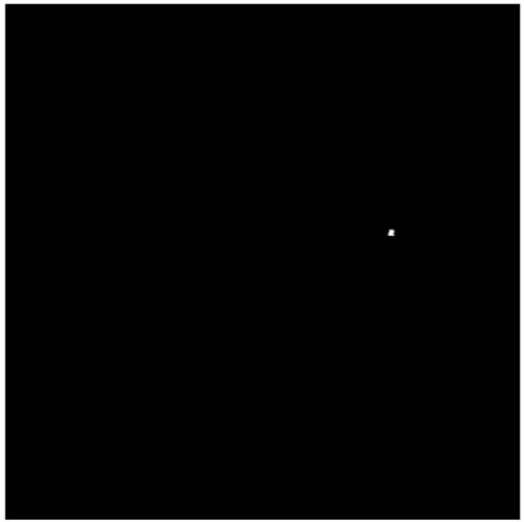
708 rows × 4 columns

Dataset

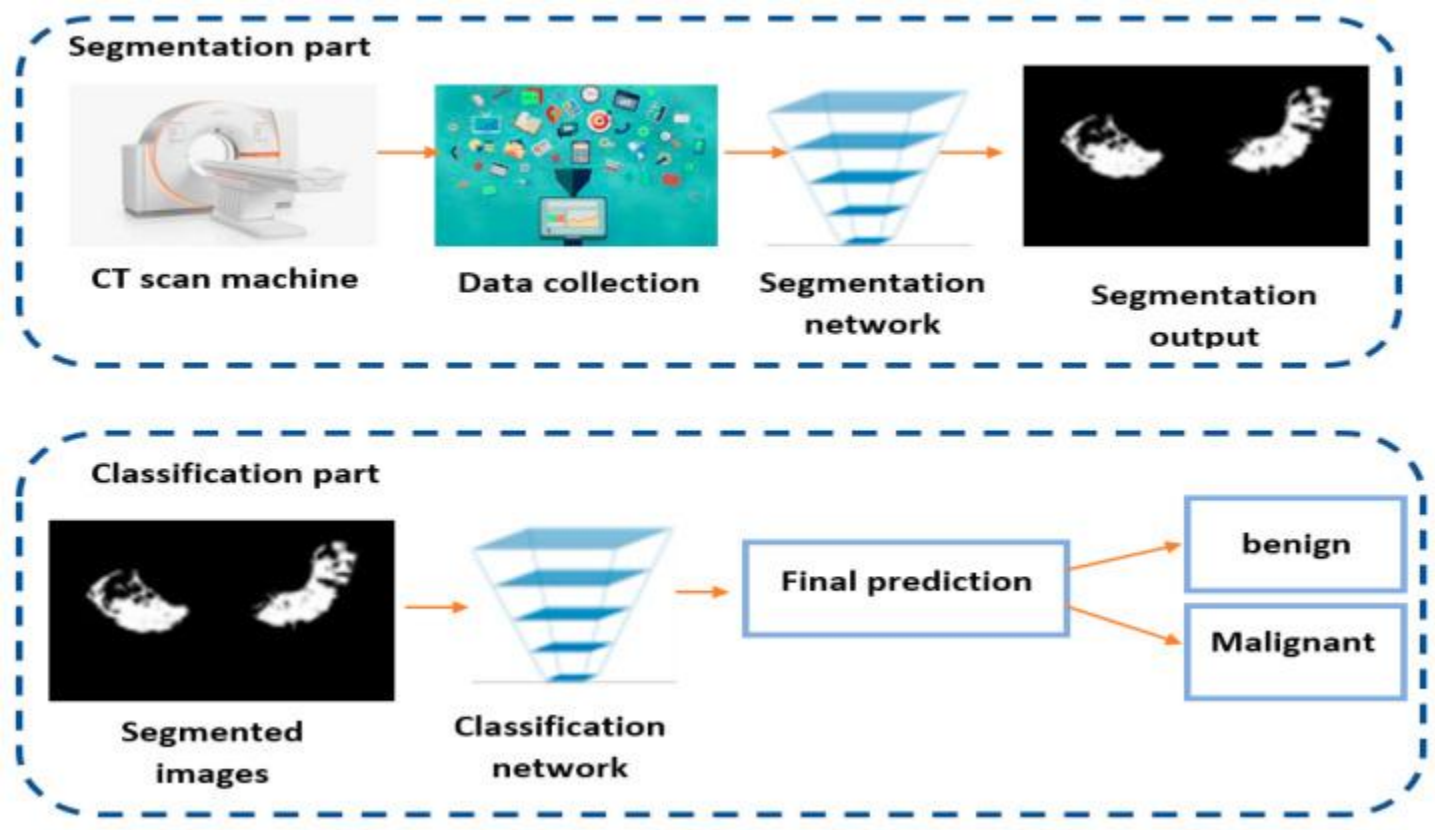








Literature Review - Key Points

- Most research in the current field is done using pre-trained models and using transfer learning to get it to work with another dataset.
- Models used for segmentation stem from the UNET architecture (E.G. MobileNetV2).
- More modern research focuses on segmenting multiple CT scans for a 3D segmentation.


Segmentation part
CT scan machine
Data collection
Segmentation network
Segmentation output
Classification part
Segmented images
Classification network
Final prediction
benign
Malignant

Literature Review - Citations

- Riaz, Z., Khan, B., Abdullah, S., Khan, S., & Islam, M. S. (2023). Lung Tumor Image Segmentation from Computer Tomography Images Using MobileNetV2 and Transfer Learning. Bioengineering (Basel, Switzerland), 10(8), 981. https://doi.org/10.3390/bioengineering10080981
- Said, Y., Alsheikhy, A. A., Shawly, T., & Lahza, H. (2023). Medical Images Segmentation for Lung Cancer Diagnosis Based on Deep Learning Architectures. Diagnostics (Basel, Switzerland), 13(3), 546. https://doi.org/10.3390/diagnostics13030546
- Primakov, S.P., Ibrahim, A., van Timmeren, J.E. et al. Automated detection and segmentation of non-small cell lung cancer computed tomography images. Nat Commun 13, 3423 (2022). https://doi.org/10.1038/s41467-022-30841-3

Tentative Development Schedule

Apr 11-18.....Dataset sourcing and literature review

Apr 18-25.....Finetune a pretrained model with this dataset

Apr 25-May 2.....Develop CNN baseline model from scratch

May 2-9.....Performance enhancement

May 9-16.....Presentation & Paper