Progression Detection of Idiopathic Pulmonary Fibrosis using Deep Learning

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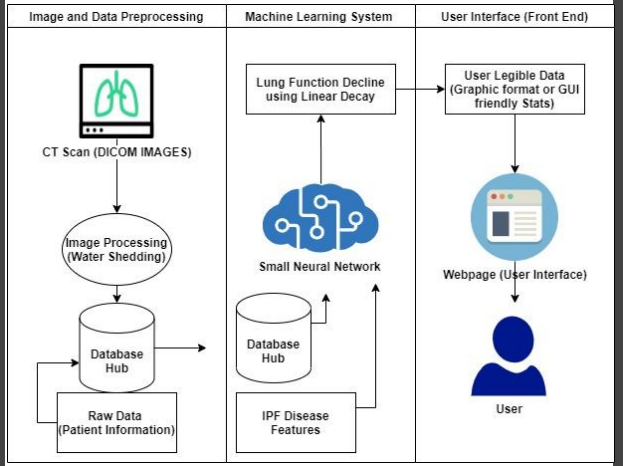
Introduction

- Our goal is to create an architecture that analyzes CT scans and patient data to assist radiologist in diagnosing patients and their progression of IPF
- This project was inspired by the Kaggle competition, "OSIC Pulmonary Fibrosis Progression".
- The condensed block diagram below goes over the process of the project at a high-level.



EfficentNet Models

We compared ResNet and EfficientNet models and found efficient net to be faster and more accurate.

Best loss function was the mean absolute error over mean square error and 0/1 loss.

Higher number model have more internal layers.

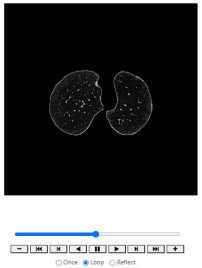
Higher epoch models are much larger and slower.

Out chosen model was b1 with 30 epochs.

Model	Epoch	Batch Size	Loss type	Steps per epoch	Best Val. Loss
b1	30	4	MAE	32	3.33968
b1	30	4	MSE	32	23.75476
b5	30	2	MAE	64	2.97277
b6	30	1	MAE	64	4.53971
b0	30	4	MAE	64	3.63311
b3	45	2	MAE	32	3.51753
b5	45	2	MAE	64	3.38816
b7	150	1	MAE	64	3.24935
b2	30	4	-1/0	64	-94.14971
b1	100	4	MAE	64	3.58895
b5	100	2	MAE	64	2.85531
b5	128	2	MAE	128	3.59042

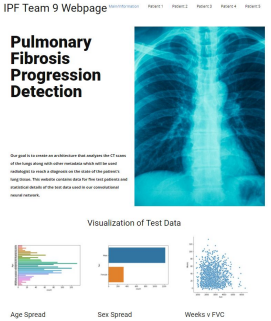
Image Processing Methods

- The Hounsfield (HU) Unit was a measure used throughout this project. The HU is a dimensionless unit in CT scans which measures radiodensity.
- Watershed and Black Top-Hat Image processing was used to show different views of the patient's lungs.



Results

- Our system model was able to predict the decline of lung function based on the CT scans and FVC scores.
- A website was created to show the user patient data from which a diagnosis could be resolved.



Conclusions

- Our models predict a decay rate for lung function based 50% on CT scans and 50% on given FVC.
- It's meant to be used by doctors in addition to pre-existing medical technology to help patients have a better understanding of their disease progression and give them some peace of mind.
- We hope to continue to build on this foundation, and develop data driven systems to aid doctors.

Acknowledgements

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