

# F-PuPS: Fibrotic Pulmonary Prediction System

Using ML to Improve Patient Outcomes (Kaggle Competition)

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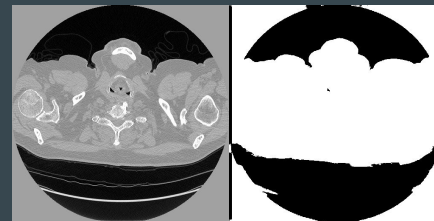
## Background

- Recent advances in ML have led to a rise in CAD techniques for diagnoses
- IPF: Idiopathic Pulmonary Fibrosis
  - Lung disease caused by scarring of lung tissue
  - Leads to decline in patient lung capacity
  - Challenging to predict
  - FVC (forced vital capacity) metric is used to predict lung capacity
- Mission: F-PuPS improves IPF prognosis accuracy by utilizing machine learning and requires only a single lung scan whereas conventional methods require multiple.

## Methods

- Model utilizes open-source BCDU-net architecture
  - U-net is a CNN commonly used for segmentation of images
  - We converted 2D-BCDU-net architecture to 3D
- We incorporated patient metadata prior to fully connected layers to produce final FVC prediction
  - Metadata includes weeks since scan, age, sex, and smoking history
- Model backbone weights are initialized on existing lung segmentation model

BCDU-Net Segmentation Results



## Results

- Application GUI implemented for clinician ease of use
- Laplace log likelihood metric is used to measure performance on Kaggle
  - Our score is -10.707
  - Best Kaggle score is -6.83

True FVC	3020	2739	3294	2925	1930
Predicted FVC	2768	2689	2682	2488	2768

## Future Work

- We hope to improve model results by combining our neural network-based approach with the greater domain knowledge we have developed throughout this project
  - Integrating prior knowledge that FVC will decay over time can improve model performance
- We would like to also improve our segmentation network
- A large, 3D neural network may be overkill for this problem

Application Interface

