Development of a Deep Learning Model to Diagnose Pulmonary Embolism

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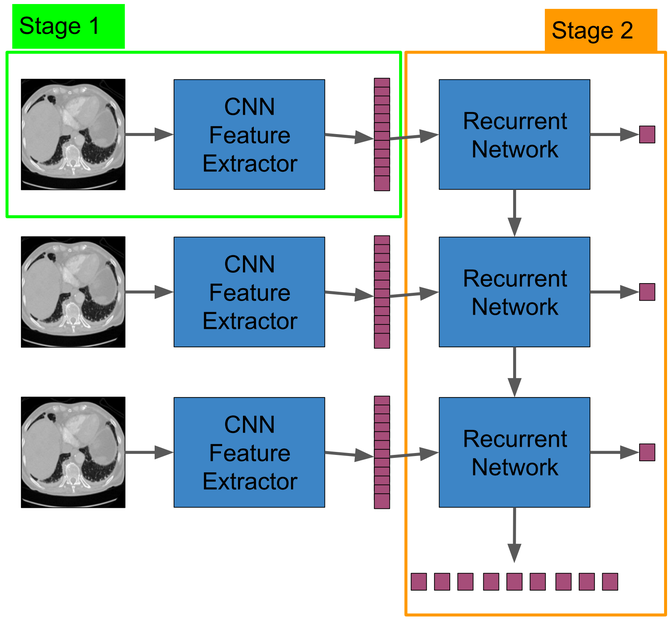
Github Link

Introduction

- A pulmonary embolism (PE) is a potentially life-threatening obstruction of the pulmonary artery.
- The gold standard diagnostic method for PE is imaging via computed tomography pulmonary angiogram (CTPA)
- The goal of this project was to develop a deep learning model using the RSNA-STR Pulmonary Embolism CT (RSPECT) Dataset to enable more rapid and accurate identification of PE.
- Advancements in the automated diagnosis of PE have the potential to expedite diagnosis, improve accuracy of PE detection, and improve patient outcomes.

Methods

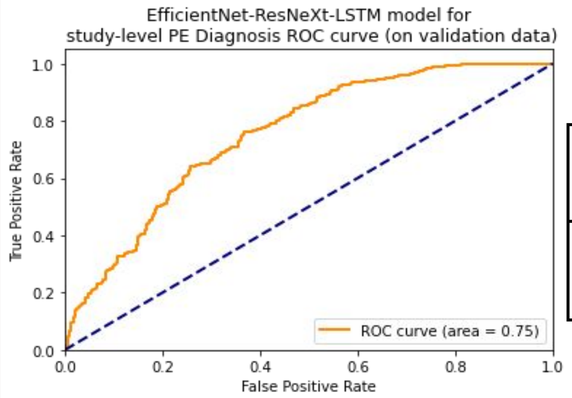
Illustration of CNN-LSTM model architecture



Results

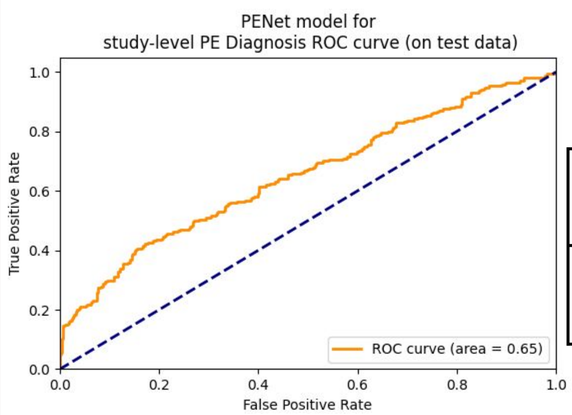
Two sets of results are presented:

- **CNN-LSTM model:** Novel model architecture trained on RSNA-STR dataset. Results are on 927 Validation studies. (AUC = 0.75)
- **PENet model**: State-of-the-art model that is clinically relevant. Tested on 3,805 studies. Baseline for CNN-LSTM model. (AUC = 0.65)



CNN-LSTM Model Confusion Matrix

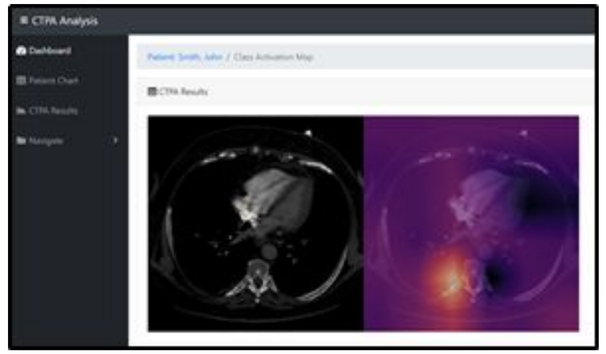
Pulmonary Embolism		Actual	
		+	-
Predicted	+	391	115
	-	177	244



PENet Model Confusion Matrix

Pulmonary Embolism		Actual	
		+	-
Predicted	+	1125	989
	-	1198	3493

Interface



We have developed a user-friendly clinician-facing interface to display patient data and results for interpretation and triage.

Future Directions

To improve our model, future directions include:

- **Training the model on the entire dataset.** We were limited by the disk space available on the computing nodes.
- **Implementing CAM visualizations** for the CNN-LSTM model.
- **Joint training of CNN and LSTM**.
- **Extracting features from 3D CNN model** focusing on study level targets for Stage 1.
- **Experimenting with more sophisticated models** for Stage 2.