2018 Internship Project & Abstract - Raunak Dey

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Efficacy of Machine Learning Algorithms in Aiding Radiologists

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Background: The work of a radiologist often involves repetitive tasks. Machine learning and computer vision could help identify anomalies in imaging studies, speeding up the overall diagnostic process. Deep learning algorithms have been developed using Python programming language and a publicly available dataset, Lung Image Database Consortium image collection, to detect and diagnose pulmonary lung nodules. However, this dataset does not contain verified biopsy data. In this study, we test the efficacy of previously developed algorithms, built from radiologist's annotations on the public dataset, on biopsy verified test samples curated from the Marshfield Clinic.

Methods: Computed Tomography (CT) images representing benign and malignant lung cancer nodules were procured from Marshfield Clinic's electronic health records (n=100). The detection model was used to detect tumors in a 2D slice of a CT scan by producing a mask of the tumor. A k-means clustering was used over the whole 3D volume to identify the center of tumors. The deep learning model then classified the nodules as benign or malignant based on the 3D patches extracted using the centers as input. We evaluated the performance of the detection and classification modules separately and together by comparing the predicted outcome to manually curated outcomes abstracted from radiology narratives.

Results: The detection module had a True Positive Rate of 76.2% and 100% True Negative Rate, while the classification model classified every tumors presented with 100% accuracy. The ground truth curation was derived in a double blind setting by abstractors not radiologists and evaluation of false positives was not possible.

Conclusions: Deep learning models could potentially assist radiologists in noninvasive detection and diagnoses of anomalies. More research is needed to improve accuracy of the detection module.