Project Proposal

Cardiomegaly is a condition caused by various heart diseases where the heart becomes enlarged due to the ventricle muscle becoming overworked. The primary cause is coronary artery disease, which affects an estimated 18 million people in the United States.[1] For patients with heart failure symptoms, mortality after one year remains at 30% and mortality after five years is 50%.[2]

Cardiomegaly is commonly diagnosed by assessing the size of the heart through imaging techniques including chest X-rays.[3] X-rays can be used to determine if the cardiothoracic ratio (the ratio of the maximal cardiac width to the maximal thoracic width) is greater than 50%.[4]

AI provides an opportunity to identify cardiomegaly more efficiently for radiologists and aid patients in receiving the care they need to maintain heart health and prevent further effects of heart failure. This will aid hospitals in efficiency and patients through expediting their care. Additionally, X-rays are some of the most common and cost_effective imaging techniques available to hospitals, making this technology accessible to many hospitals and communities.

The National Institutes of Health published a dataset of 112,120 images of chest X-rays that were labeled through Natural Language Processing by Wang et al.[5] The images contain a multitude of patients and conditions, including atelectasis, consolidation, infiltration, pneumothorax, edema, emphysema, fibrosis, effusion, pneumonia, pleural thickening, nodule mass, hernia, and cardiomegaly. From the findings, I can extract and label images for cardiomegaly.

I propose to use this data to create a model that predicts the presence of cardiomegaly with a recall of 70%. This project will focus solely on cardiomegaly. Further studies may investigate other factors caused by heart failure such as edema. A constraint of this data is that the findings for each X-ray were labeled by Natural Language Processing deemed to have an estimated accuracy of more than 90%, so some of the image labels may be incorrect.

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[1] https://my.clevelandclinic.org/health/diseases/21490-enlarged-heart-cardiomegaly
[2] https://pubmed.ncbi.nlm.nih.gov/8376698/
[3] https://www.ncbi.nlm.nih.gov/books/NBK542296/
[4] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4676601/
[5] https://nihcc.app.box.com/v/ChestXray-NIHCC