CheXpert: A Large Chest Radiograph Dataset with Uncertainty Labels and Expert Comparison

Summary of the paper -

The authors of this paper created a dataset based on chest radiographs. The dataset consists of 224,316 chest radiographs from 65,240 patients. The dataset has 14 distinct pathologies/findings and these findings were combined into 3 distinct labels – positive(1), negative(0) and uncertain(u) with help of NLP. They used various approaches to work with the uncertain labels for example – ignoring them, combining them with either positive or negative labels and by using multiclass classification. They used different approach for almost each pathology selected for the study, for example on Cardiomegaly U- Multiclass model worked slightly better. They used CNN models like ResNet152, DenseNet121, Inception-v4, and SEResNeXt101 and they found out that DenseNet121 produces the best results. The final ensemble model they created beat 3 radiologists in 3 out of 5 selected pathologies based on ROC and PR space. Finally they mentioned that there has been a lack of such public-access datasets for researches to work on them.

Resnet explanation - https://www.youtube.com/watch?v=woEs7UCaITo

Densenet explanation - https://www.youtube.com/watch?v=y81RrUHMRSA

My approach -

As I had not worked with DenseNet121 or any DenseNet model before and I mostly use tensforflow/keras for my projects, so I completed fews practice projects first. I first created the DenseNet121 model from scratch using PyTorch, but I could not replicate the number of layers because of technical shortcomings. Then I created the same model using TransferLearning where I took the weights from pretrained model on ImageNet data. Additionally, I did the same project on tensorflow as well to see the difference in implementations. But, for all of these projects I had to reduce the number of training/testing images and also the number of epochs for faster running. Especially, using the TransferLearning technique as the model includes 121 layers the running time is too high.

So, based on my understanding from the previously completed project I knew I could not use all of the images from the CheXpert dataset, also I did not include all 14 of the labels as I will be only using smaller sample of images. Also, for the main project used TransferLearning instead of creating the model from scratch as

it is more efficient. As I could not run a high number of epochs I could not actually see the power of DenseNet121 model. But, for such a small amount of epochs the accuracy was still great. Also, I added a GUI for the project using streamlit.

My understanding of DenseNet121 model-

Consists of 3 types of blocks – Bottleneck, Dense, Transition. Bottleneck layer works within the dense block and reduces the number of feature maps to make the whole process computationally less expensive. The dense block is where the magic happens it concatenates the feature maps/outputs from the previous layers as its input and transforms it to a higher dimension and then its output is provided to the next layer. All the layers in the dense block are connected to every other layer in feed-forward method. Transition block is present between the dense block and it is also used to reduce the spatial dimensions and feature maps while keeping the relevant information.

A Feature Map (also called an Activation Map) is the output of one specific filter/kernel after it has been slid across the entire input.