**2. Proposed Methodologies: Give updates regarding the methods used/to be used. Discuss the chosen dataset and**

**CNN model in more detail than the proposal.**

Methods Used-:

1. Preprocessing-: <Elaborate>
2. Training -: <Elaborate>
3. Hyperparameter Optimization-: <Elaborate>

Dataset Chosen details-:

This [8] dataset contains 5,856 validated Chest X-Ray images. Images are labeled as (disease:NORMAL/BACTERIA/VIRUS)-(randomized patient ID)-(image number of a patient).The images (anterior-posterior) were selected from retrospective cohorts of pediatric patients of one to five years old from Guangzhou Women and Children’s Medical Center, Guangzhou.

CNN Models used-:

1. Efficient Net -: EfficientNet-b0 is a convolutional neural network that is trained on more than a million images from the ImageNet database. If you count the total number of layers in EfficientNet-B0 the total is 237 and in EfficientNet-B7 the total comes out to be 813.[5]
2. Mobile Net -: MobileNet is a streamlined architecture that uses depthwise separable convolutions to construct lightweight deep convolutional neural networks and provides an efficient model for mobile and embedded vision applications. Counting depthwise and pointwise convo- lutions as separate layers, MobileNet has 28 layers. [6]
3. ResNet -: Deep residual networks like the popular ResNet-50 model is a convolutional neural network (CNN) that is 50 layers deep. ResNet, short for Residual Networks is a classic neural network used as a backbone for many computer vision tasks. This model was the winner of ImageNet challenge in 2015. The fundamental breakthrough with ResNet was it allowed us to train extremely deep neural networks with 150+layers successfully.[7]

**3. Attempts at solving the problem: elaborate on failed or successful attempts at tackling the problem. Furthermore,**

**discuss any possible/preliminary results.**

We are doing pre-processing of our dataset using Gaussian Blur and Histogram Equalization because the authors in [1] were able to get good results with these techniques. In order to mitigate the dataset imbalance problem, we are using data augmentation techniques like Horizontal Flip, Resize, Sharpness and Contrast adjustments along with Normalization [2]. For the Training Phase, We have tried using different backbone Models like EfficientNet, MobileNet and ResNet50 as we wanted to experiment different networks having different learnable parameters [3].

| **Model** | **Number of model parameters** |
| --- | --- |
| ResNet-50 | 23,512,130 |
| MobileNet | 2,226,434 |
| efficientNet-b0 | 44,578 |

On the dataset [4], we were able to get Training Accuracies of 94.02% and Testing Accuracy of 72.75% on EfficientNet Model when using batch size of 96 along with Number of Epochs 25 and cross entropy loss.

On the same dataset, we were able to get Training Accuracies of 91.19% and Testing Accuracy of 77.60% on ResNet Model when using batch size of 96 along with Number of Epochs 25 and cross entropy loss.

While keeping the dataset same we were able to get Training Accuracies of 90.01% and Testing Accuracy of 75.60% on ResNet Model when using batch size of 96 along with Number of Epochs 25 and cross entropy loss.

Failed Attempts-: When Increased number of epochs to 100, the training accuracy almost reached to 100% which indicates towards Overfitting problem of model.

During Pre-Processing steps, used very low contrast parameters which resulted in loss of much useful information in xray and hence lower performance while training the model.

[1] Giełczyk A, Marciniak A, Tarczewska M, Lutowski Z. Pre-processing methods in chest X-ray image classification. PLoS One. 2022 Apr 5;17(4):e0265949. doi: 10.1371/journal.pone.0265949. PMID: 35381050; PMCID: PMC8982897.

[2] <https://pytorch.org/vision/stable/transforms.html>

[3] Yang Y, Zhang L, Du M, Bo J, Liu H, Ren L, Li X, Deen MJ. A comparative analysis of eleven neural networks architectures for small datasets of lung images of COVID-19 patients toward improved clinical decisions. Comput Biol Med. 2021 Dec;139:104887. doi: 10.1016/j.compbiomed.2021.104887. Epub 2021 Sep 24. PMID: 34688974; PMCID: PMC8461289.

[4] Daniel Kermany, Kang Zhang, Michael Goldbaum, et al. Labeled

optical coherence tomography (oct) and chest x-ray

images for classification. Mendeley data, 2(2), 2018. 1

[5] <https://arxiv.org/pdf/1905.11946.pdf>

[6] <https://arxiv.org/abs/1704.04861>

[7] <https://arxiv.org/abs/1512.03385>

[8] <https://www.kaggle.com/datasets/tolgadincer/labeled-chest-xray-images>