Pneumonia Detection Using Deep Learning

SALIM HABIB UNIVERSITY
(FORMERLY BARRETT HODGSON UNIVERSITY)

Wardah Ali | Eesha Qureshi | Omama Ahmed Farooqi
F18CSC05 | F18CSC24 | F18CSC26
Supervised By: Dr. Rizwan Ahmed Khan

INTRODUCTION

Pneumonia is a principal infectious cause of death in children worldwide. In accordance with the statistics published by the World Health Organization (WHO), 740,180 children under the age of 5 died because of pneumonia in 2019 [1]. Pneumonia remains a disease that requires active prevention and treatment. **Computer-Aided Diagnosis (CAD)** is a very popular set of techniques that assist doctors to detect and interpret various types of abnormalities in medical imaging. **Chest X-rays** are mainly used to detect lung-related diseases including pneumonia thus we proposed an intelligent transfer learning-based framework that detects pneumonia in an effective and efficient manner. The performance of the proposed framework will be measured its sensitivity as well as AUC score.

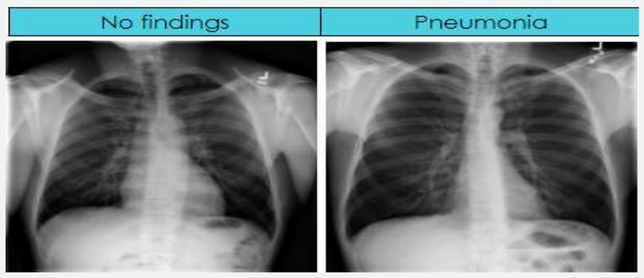

Figure 1. Normal and Pneumonia images from the ChestX-Ray8 dataset.

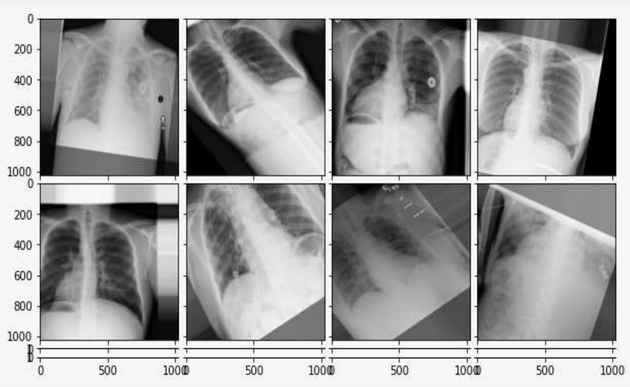

Figure 2. Images generated through conventional augmentation techniques .

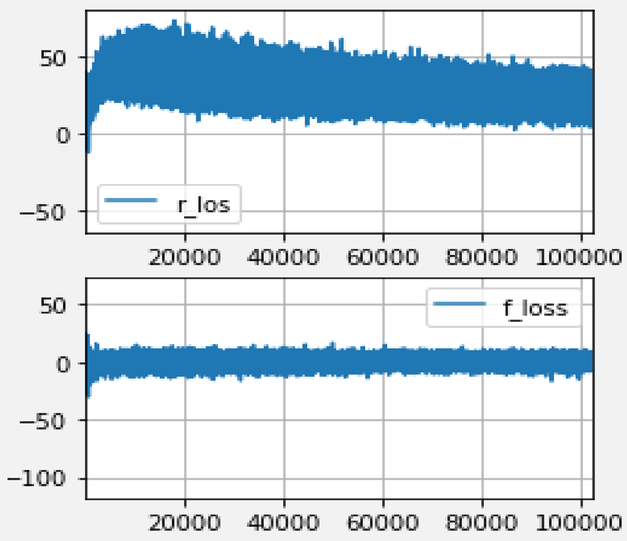

Figure 3. r_loss corresponds to the loss on the real images and f_loss corresponds to the loss on the fake images of the critic in the GAN over 100000 epochs

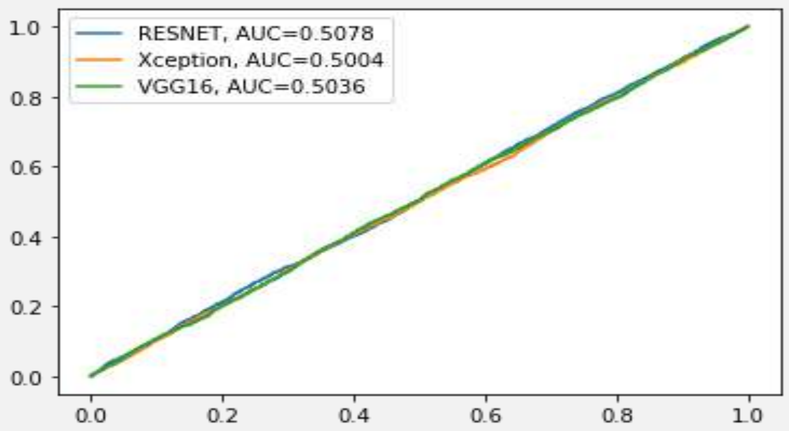

Figure 4.: ROC curve of the three models (ResNet-50, VGG-16 and Xception) used for classification with their respective AUC score through which we determine our error metric

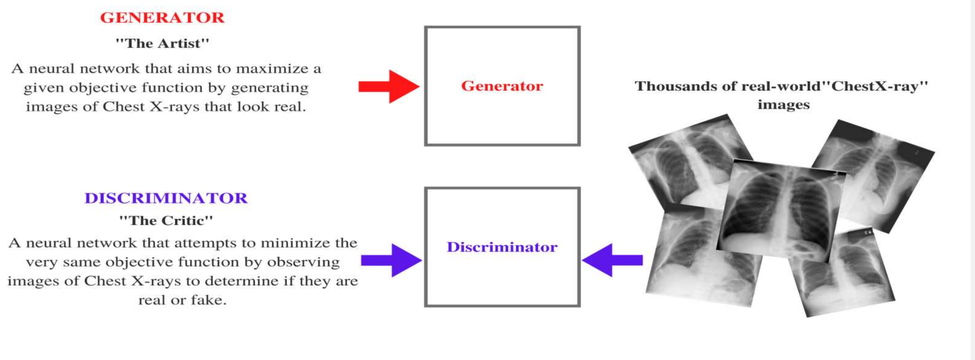

Figure 5. The two models in GAN (Generator and Discriminator) that are trained simultaneously via an adversarial method

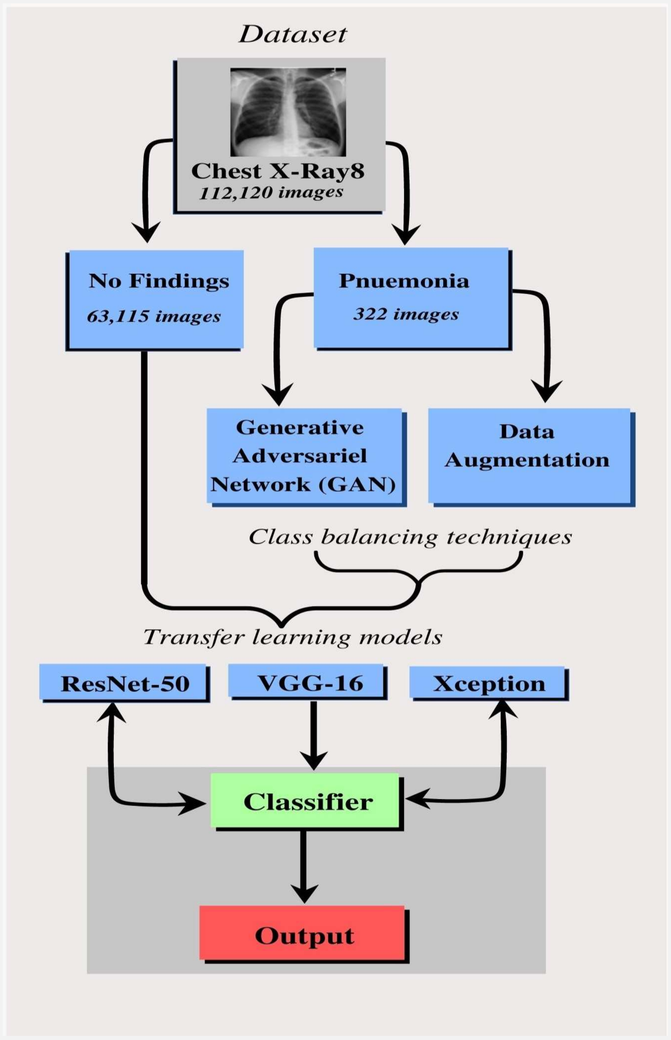

Figure 7. General workflow of the methodology.

RESULTS AND DISCUSSIONS

We performed certain experiments by training the baseline models, and then testing the model with the test set. We then compared the state of the art baseline models used on the basis of sensitivity (recall), precision and F1-Score as depicted in Table 1, through which we observed that the model is giving biased results as the imbalance even now exists. Additionally, instead of using conventional augmentation techniques (cropping, translation, rotation etc.), we applied a state-of-the-art technique for data augmentation i.e. The Generative Adversarial Network (GAN) for catering the imbalance problem in our dataset. However as of yet, we didn't acquire clear and accurate results by applying GAN. Therefore, improved and optimized codes for GAN that'll give state-of-the-art results are being analyzed.

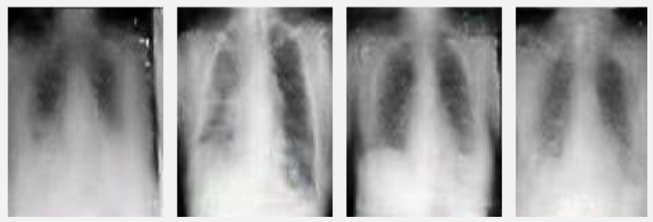

Figure 7. GAN generated images as of yet with 128x128 image resolution

Model	Epochs	Precision (%)	Recall (%)	F1-Score (%)
ResNet-50 (No Finding)	10	50%	54%	52%
ResNet-50 (Pneumonia)	10	51%	47%	49%
Xception (No Finding)	10	51%	51%	51%
Xception (Pneumonia)	10	51%	50%	51%
VGG-16 (No Finding)	10	49%	50%	50%
VGG-16 (Pneumonia)	10	50%	49%	50%

Table 1. Classification report of state of the art as of yet, before promptly dealing with the imbalance problem in the "ChestX-Ray8" dataset for pneumonia classification on the test set.

CONCLUSION

Pneumonia is one of the biggest threat to human life all over the world. Early diagnosis of pneumonia is critical for identifying the best course of treatment and further preventing the disease from posing a life-threatening hazard to the patient.
For this matter, we propose a deep learning framework based on pre-trained transfer-learning models and perform comparison between them to see which model accurately detects if pneumonia is present or not, in order to aid medical practitioners, for efficient and early pneumonia diagnosis.

REFERENCES

1. Johnson, S.; Wells, D. Healthline. Viral Pneumonia: Symptoms, Risk Factors, and More. Available online: https://www.healthline.com/health/viral-pneumonia (accessed on 31 December 2019) via: https://www.thoracic.org/patients/patient-resources/resources/top-pneumonia-facts.pdf