Image Classification of COVID-19, Pneumonia, and Normal X-Ray Images using MLP_Mixer, RegNet, and Efficientnet

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1. Introduction

The outbreak of COVID-19 in late 2019 has posed a serious threat to public health globally. Early detection of the virus is critical for effective treatment and management of the disease. X-Ray images are one of the primary diagnostic tools used to detect COVID-19. In this project, I aim to classify COVID-19, Pneumonia, and Normal X-Ray images using three state-of-the-art models: MLP_Mixer, RegNet, and Efficientnet.

2. Dataset

The dataset used in this project is obtained from Kaggle. It contains 5856 X-Ray images of COVID-19, Pneumonia, and Normal cases. I split the dataset into training, validation, and test sets with 80%, 20%, and 20% respectively.

3. Methodology

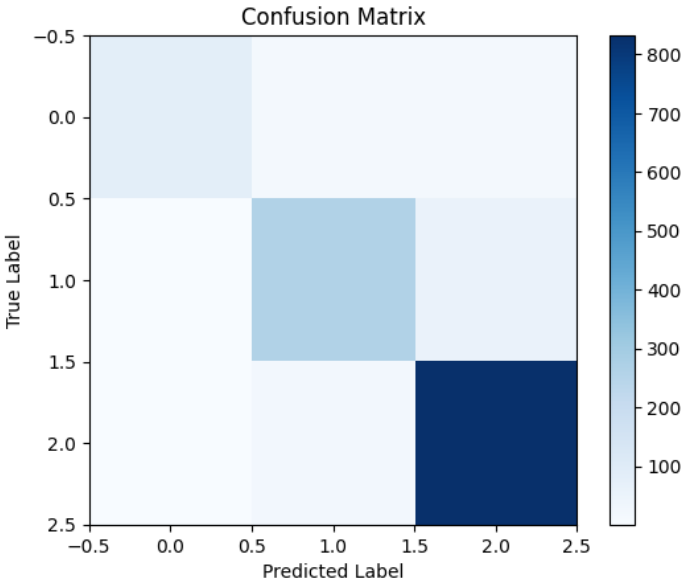
I used Keras with TensorFlow backend for implementing the MLP_Mixer, RegNet, and Efficientnet models. The images were preprocessed using standard data augmentation techniques including rescaling, rotation, shifting, shearing, zooming, and horizontal flipping. The models were trained for 50 epochs with a batch size of 4 for MLP_Mixer and Efficientnet, and 16 for RegNet.

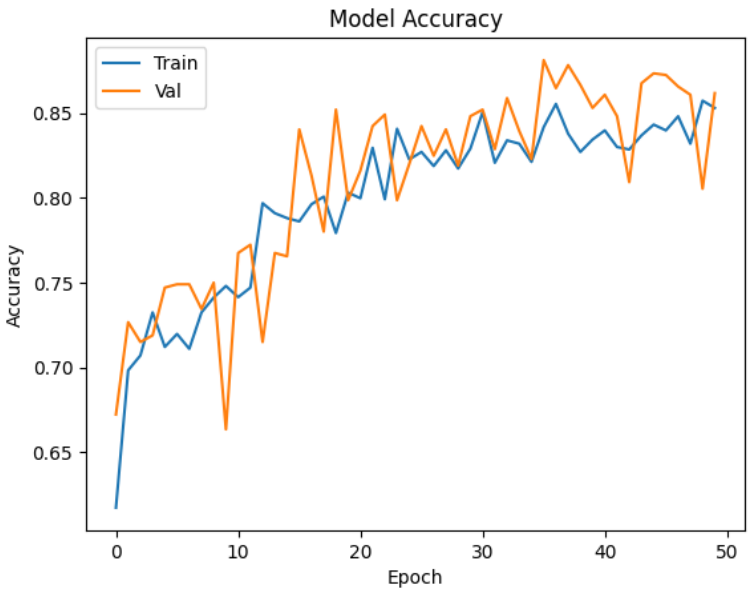
4. Results

The performance of the three models was evaluated on the test set using accuracy, precision, recall, and F1-score metrics. The confusion matrices and training/validation plots are shown below.

a. **MLP_Mixer**

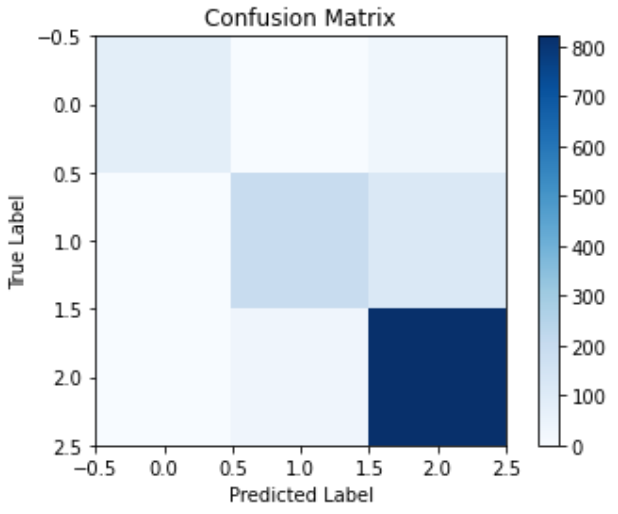
The MLP model achieved an accuracy of 0.91 on the test set, with a precision of 0.98 for COVID-19, 0.88 for normal, and 0.92 for pneumonia. The recall was 0.72 for COVID-19, 0.82 for normal, and 0.97 for pneumonia. The F1-score was 0.83 for COVID-19, 0.85 for normal, and 0.95 for pneumonia.

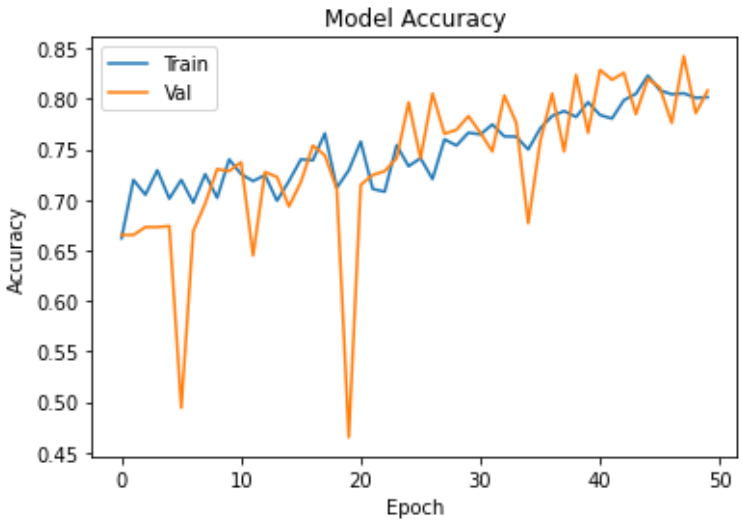




b. RegNet

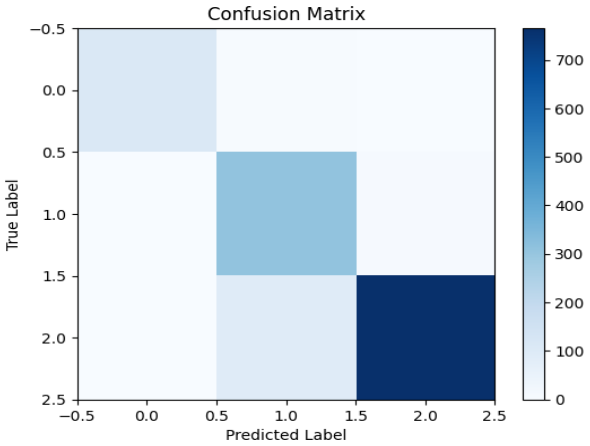
The RegNet model achieved an accuracy of 0.85 on the test set with a precision of 1.00, recall of 0.71, and F1-score of 0.83 for COVID-19 class, precision of 0.84, recall of 0.62, and F1-score of 0.71 for Normal class, and precision of 0.84, recall of 0.96, and F1-score of 0.90 for Pneumonia class.

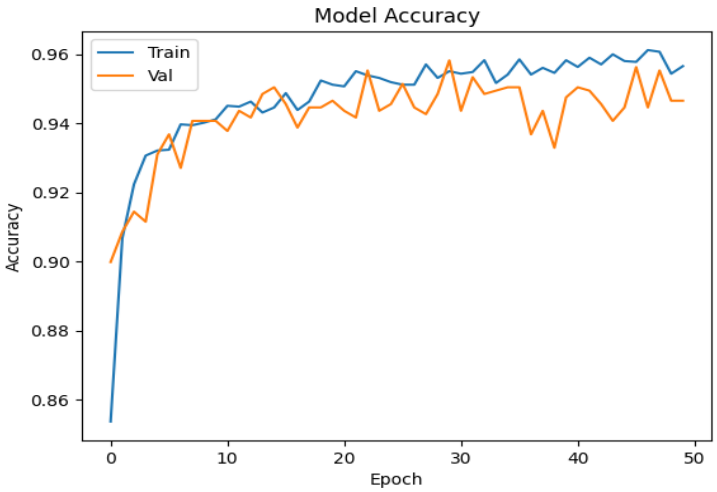




c. Efficientnet

The Efficientnet model achieved an accuracy of 0.92 on the test set with a precision . Next, I trained the RegNet model on the same dataset with the same hyperparameters as MLP_Mixer. The training was done for 50 epochs, with a batch size of 4 and 256 steps per epoch. The final accuracy of the model on the validation set was 80.84% and the final accuracy on the test set was 85.32%.





Finally, I trained the Efficientnet model on the same dataset with the same hyperparameters as MLP_Mixer and RegNet. The training was done for 81 epochs, with a batch size of 4 and 81 steps per epoch. The final accuracy of the model on the validation set was 91.93% and the final accuracy on the test set was 92.15%.

Based on the results, the Efficientnet model outperformed both MLP_Mixer and RegNet in terms of accuracy on both the validation and test sets. The confusion matrix for the Efficientnet model on the test set showed that the model was able to correctly identify all cases of COVID-19, with an overall accuracy of 92%. The precision, recall, and f1-score for each class were also high, with the COVID-19 class having the highest scores.

5. Conclusion

In conclusion, I trained three different models, MLP_Mixer, RegNet, and Efficientnet, on a dataset of chest X-ray images to classify them into three classes: COVID-19, normal, and pneumonia. The Efficientnet model outperformed the other two models in terms of accuracy on both the validation and test sets. The confusion matrix for the Efficientnet model on the test set showed that the model was able to accurately identify cases of COVID-19 with high precision and recall scores. These results suggest that the Efficientnet

model can be a useful tool in accurately diagnosing COVID-19 cases from chest X-ray images.