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Comparative Analysis of CNN Models to Diagnose Pneumonia

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Abstract

Pneumonia disease is a significant health issue in the world. Due to the high mortality rate, World Health Organization (WHO) named Pneumonia a "Silent Killer." To diagnose Pneumonia disease, the medical personnel uses different medical images such as chest X-Rays, and chest CT (Computed Tomography) images to investigate the white spots of the lungs to diagnose whether the lung is affected by Pneumonia or not. This human-based analysis consists of subjective errors like fatigue, experience levels, biasedness, and time-consuming effort. This process can be automated with the aid of technological advancements like machine learning-based Convolutional Neural Networks (CNN) models and Transfer Learning & computer vision methods. The researchers have produced different machine-learning models that could use to automate this manual process. This paper presents a comparative analysis of the performances of seven (7) CNN models, namely DenseNet121, MobileNet, Vgg16, InceptionV3, Xception, RestNet50 v2, and Nasnet Mobile. The attributes of the performance analysis include training and validation accuracies under the same parameter values. As the approach of this analysis, the chest X-Ray dataset was augmented using rescaling, shearing, and horizontal flipping and then trained using a transfer learning mechanism with the weight of ImageNet and Keras API. The training was completed with categorical cross-entropy loss function, Adam optimizer, and softmax activation function under 30 epochs. The resulting training accuracies and validation accuracies were captured and compared. The training and validation accuracies, respectively, for DenseNet121 (96.36% & 95.9%), MobileNet (94.54% & 94.1%), Vgg16 (95.85% & 94.6%), InceptionV3 (92.97% & 91.97%), Xception (92.87% & 92%), RestNet50 v2 (96.63% & 96.1%), Nasnet Mobile (63.19% & 62.01%). The RestNet50 v2 obtained the highest accuracies, 96.63% of training accuracy and 96.10% of validation accuracy. The lowest training accuracy and the validation accuracy achieved by the Nasnet_mobile are 63.19% and 62.01%, respectively.

Keywords: *Chest X-Ray, CNN, Machine Learning, Pneumonia Detection.*

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