Image Classification of Skin Diseases Using Deep Learning.

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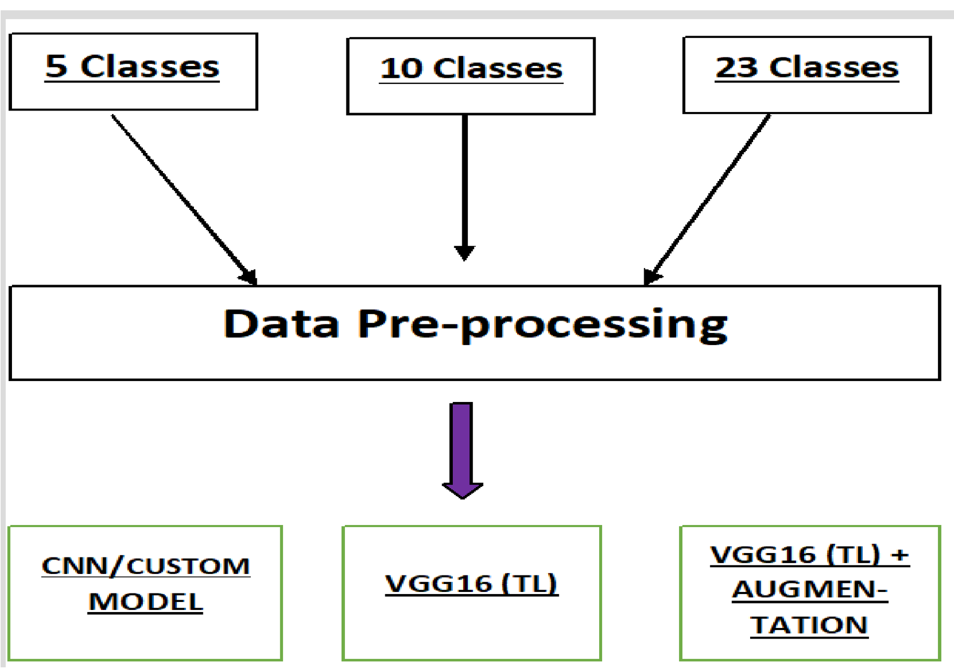
Introduction

Skin diseases are generally among the most common diseases. In 2001, in sub-Saharan Africa, mortality rates were around 20000, and skin diseases were among the high reasons for deaths, reports WHO (World health organization). Moreover, there is a shortage of elementary skills in managing skin diseases, which tends to be a problem. Also, several studies show that assessing success in the management of skin diseases in primary care that treatment failure is above 80%. Therefore, with so many resources available, a tool that diagnoses different skin diseases would be the perfect fit for these problems.

Project Aim

The Project Aim is to implement a skin disease classification pipeline that will be using different techniques of deep learning. Furthermore, this project aims to apply other techniques such as data augmentation, transfer learning, and the use of different models such as VGG16 and ResNEt50. These will help to deal with the highly complex and imbalanced dataset.

Methods



For this project, different Convolutional Neural Network(CNN) methods are used, which are present in figure 1. CNN is one of the best deep learning techniques to do feature extraction. Furthermore, the dataset used for this project is highly imbalanced and complex. Therefore, this became challenging since all the images needed to be one size to classify them into the CNN model.

Figures and Results

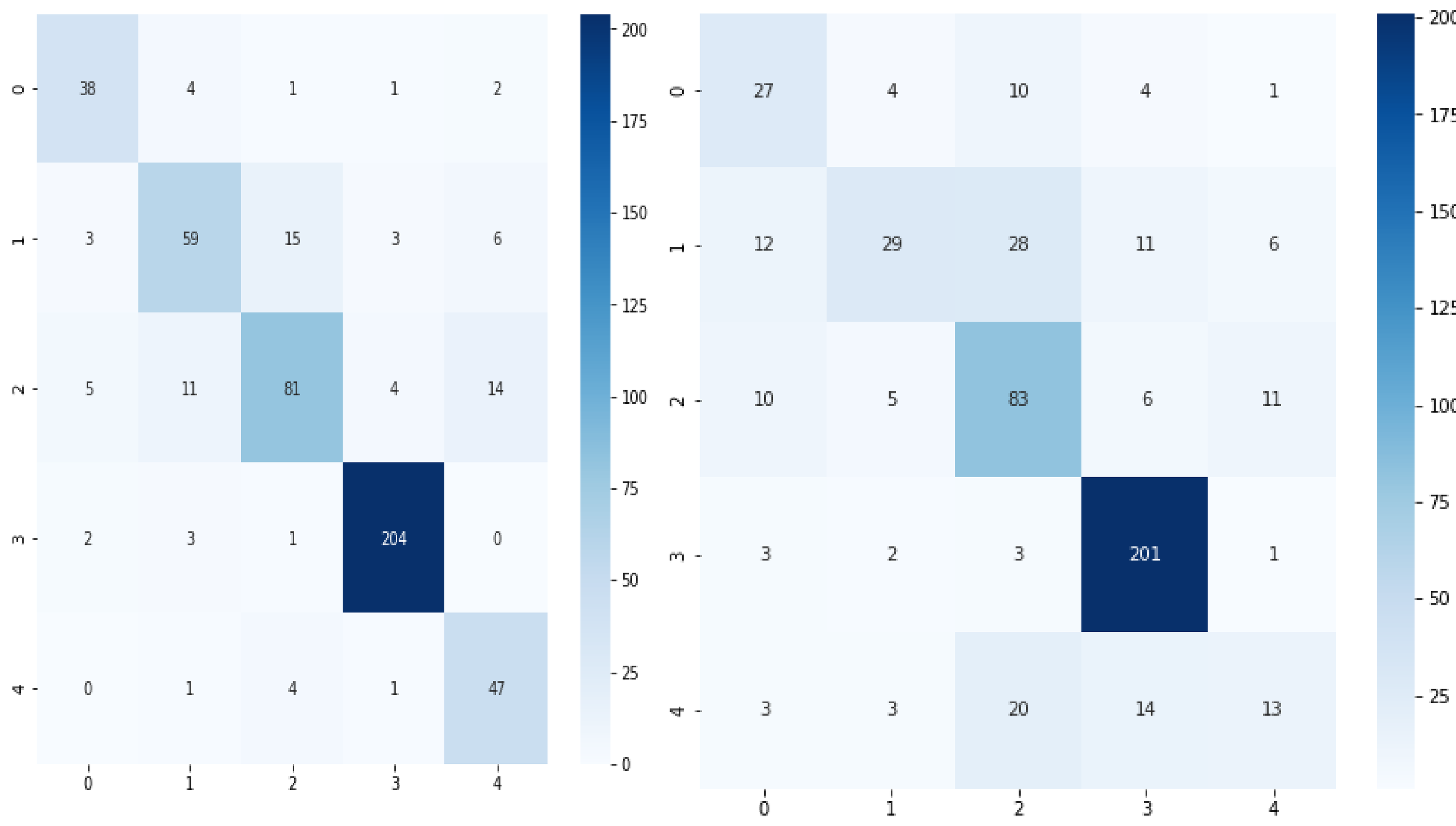


Figure 1:Confusion metric without Aug (left) & with Aug (right)

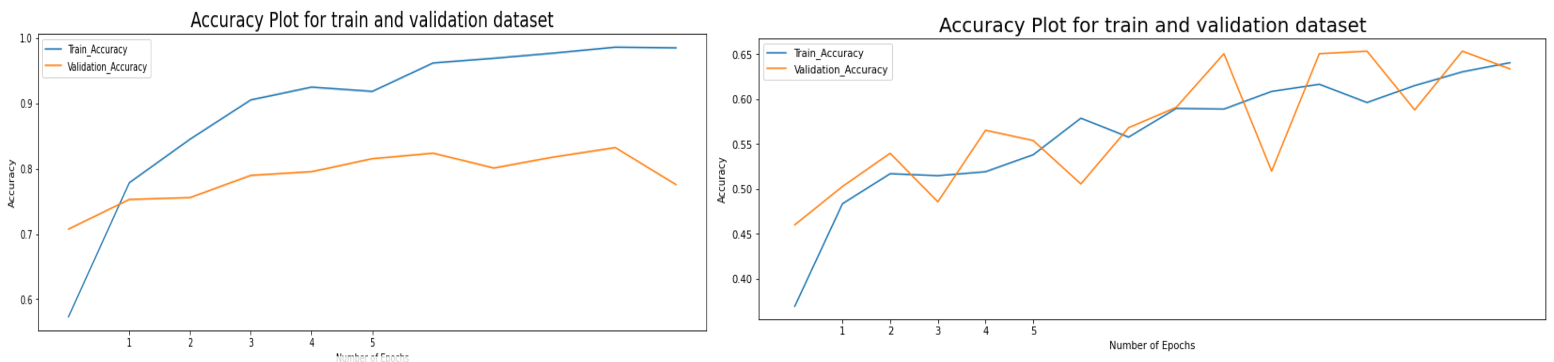


Figure 2:Accuracy plot without Aug (left) & with Aug (right)

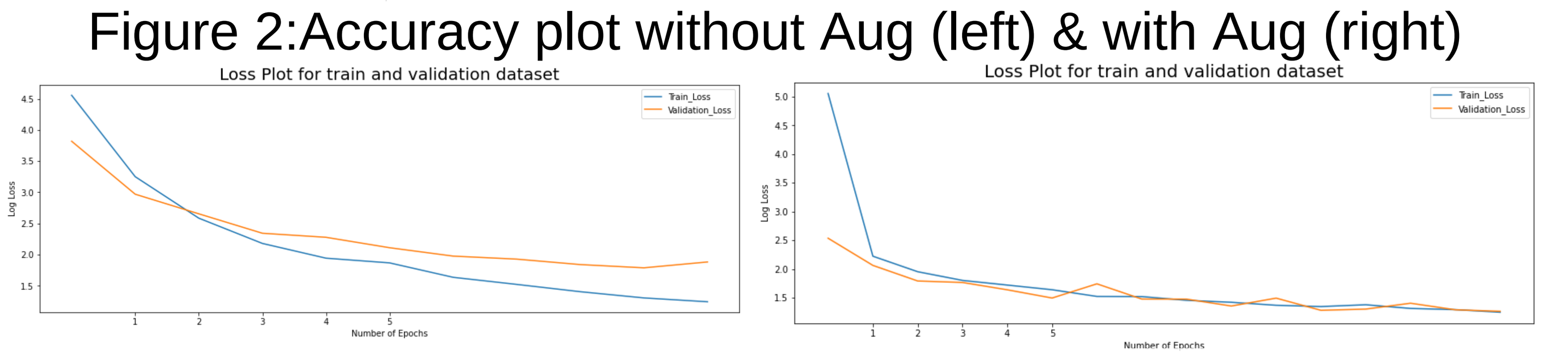


Figure 3: Loss plot without Aug (left) & with Aug (right)

After running several experiments and doing hyper-parameters optimization, we ran an initial model, and it did not show good results. Therefore, we chose to go for pre-trained (transfer learning) architecture such as VGG16 and ResNEt50. Furthermore, after running the pre-trained model with augmentation, we obtained an accuracy of **67%** on the test set. Although, we have to say that the model was **low** in **precision** due to the highly complex and imbalanced dataset. Moreover, in figure 1, the confusion matrix shows that the model is slightly biased towards classes two and four out of those five classes. In figure 2 and 3, we can find the accuracy and loss plots of the models trained with and without augmentation. We can see that the accuracy plot without augmentation is overfitting.

Model	F1 Score	Accuracy	Overfitting
Custom Model / CNN	0.54	0.57	No
VGG16 (Transfer Learning) Without Augmentation	0.84	0.84	Yes
VGG16 (Transfer Learning) With Augmentation	0.69	0.67	No

Table 1: Summary of Models Performance

We can observe in table 1 the accuracy, F1-score, and whether it is overfitting, a performance for each of the algorithms is evaluated. Furthermore, three different algorithms are compared. In this case, transfer learning is used and shows an optimal result compared to other algorithms. We can view that the CNN model built of convolutional layers is showing very low accuracy. However, using the model VGG16 shows a better result than the custom model; VGG16 with augmentation comes up to 67%, which we could say is high for this complex dataset. Although using the model without augmentation is given a higher accuracy, but it is overfitting.

Conclusion

In conclusion, various Convolutional Neural Network models are trained and tested on different skin diseases as they appear in the dataset. We can observe that using methods such as transfer learning through the VGG16 model performed better than a custom model built with convolutional layers. Moreover, other techniques are used, such as data augmentation, which helped with the imbalanced classes in the dataset. Overall, there is a brief overview of the deep learning techniques applied to medical images to detect a different kind of skin diseases. In In future work, we hope to build a more generalized classification pipeline on more than five diseases at once that can be held higher in accuracy too.

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References

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