The Classification of Beau's lines, Terry's nails, and Clubbing through AlexNet with Attention

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Abstract— **Nail diseases can be significant indicators of severe health problems including many chronic illnesses, making early diagnosis of nail diseases crucial. Previously, there has been no research done on the classification of three nail diseases: Beau's lines, Terry's nails, and Clubbing. AlexNet with Attention (AWA) is applied to classify the three nail diseases. A testing accuracy of 86.67% is achieved, and the model can effectively distinguish these three categories to better assist doctors in nail disease diagnosis.**

Keywords—Nail diseases, AlexNet with Attention, classification

I. Introduction

Because many nail diseases indicate severe health problems, it is crucial to diagnose patients early on. This study focuses on three such nail diseases: Beau's lines, characterized by depression of the nail plate, Terry's nails, characterized by obliteration of the lunula, and Clubbing, characterized by soft tissue swelling in the terminal phalanx. Previous scholars have done research on these three nail diseases. Nijhawan et al. classified multiple nail disease, one of which is Beau's lines, through a hybrid of Convolutional Neural Networks, but was only able to achieve an accuracy of 84.58% [1]. Yani et al. classified Terry's nails through Inception V3 and achieved an accuracy of 95.24% [2]. However, only Terry's nails were classified, which is not as applicable to the real world since Terry's nails is not the only severe nail disease. Abdulhadi et al. classified multiple nail diseases including Clubbing, but we use a larger dataset to improve model generalization [3]. No previous studies have classified these three nail diseases. Because nail diseases are defined by less noticeable traits in the nail plate, lunula, and nail bed areas, we use AlexNet with Attention (AWA) to classify these diseases.

II. Methods and Results

In this paper, the datasets are composed of the Nails Image Dataset(https://www.kaggle.com/datasets/nuttidalapthanachai/nails-new-test). A total of 300 nail disease images were used, with 100 images for each class of disease: Beau's lines, Terry's nails, and Clubbing, as shown in Fig. 1. To increase accuracy, data augmentation is used through methods such as rescaling, rotating, and shifting. The final dataset had 55200 total images. For model training and testing, the data was divided with 80% as the training dataset, 10% as the validation dataset, and 10% as the testing dataset.

(a) (b) (c)

Figure 1. Three types of nail disease images: (a) Beau's lines, (b) Terry's nails, and (c) Clubbing.

Attention module in AWA was used to focus on the important traits that characterize the three diseases. The third convolution layer and third max pooling layer are fed into one attention module, while the fourth convolution layer and third max pooling layer are fed into the second attention module.

In the first experiment, the batch size value was set to 16, the epoch value was 210, and the learning rate was set to 0.001 with the Adam optimizer during training. The training accuracy was 100% and the testing accuracy was 83.33%. In the second experiment, the batch size value was increased to 22, the epoch value was 230, and the learning rate was also set to 0.001. The training accuracy was 97.50% and the testing accuracy was 86.67%. The testing accuracy improved by 3.34% between these two experiments. Besides, we found the testing result shows that recognition of Beau's lines and Terry's nails are more likely to be inaccurately classified compared to Clubbing. The first possible reason is that the resolution of these misclassified images is not as clear. The second possible reason is that some images include more than one nail and will be misclassified by the model.

III. Conclusion

For earlier diagnosis of diseases associated with Beau's lines, Terry's nails, and Clubbing, we use AWA to focus on the important features of nails that define these diseases. A testing accuracy of 86.67% was achieved. Images with darker lighting or consisting of more than one nail are inaccurately classified more frequently. In the future, we hope to improve the accuracy and classify more categories of nail diseases.

References

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