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Residual-Based Dual Attention Ensemble model for Diabetic Retinopathy classification
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Abstract

Diabetic Retinopathy (DR) is a leading cause of vision loss among diabetic patients, and early detection is crucial. This project proposes a novel ensemble model combining ResNet50 with a dual attention mechanism to classify DR using the imbalanced APTOS 2019 dataset. The model achieved strong performance, with an AUC of up to 1.0 in the No DR class and 0.97 in the Advanced class. Additionally, LIME was employed to enhance interpretability. The proposed model demonstrates high potential for medical diagnosis support, especially in handling imbalanced data.
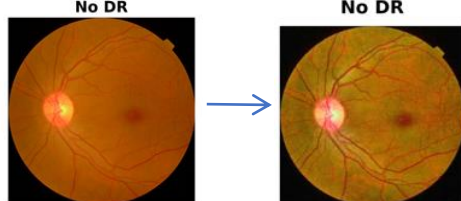
Dataset

Figure 1: Gray threshold clipping

Figure 2: Orignal image and Augmentation image
Gray threshold clipping preserves the effective retinal area while eliminating the black background area of the fundus image.
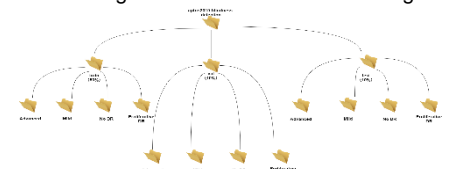

Figure 3: Data split

Ensemble models

Figure 3: ResNet50 Architecture
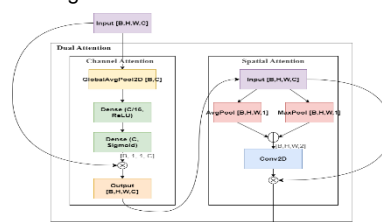
Figure 4: Dual Attention Architecture
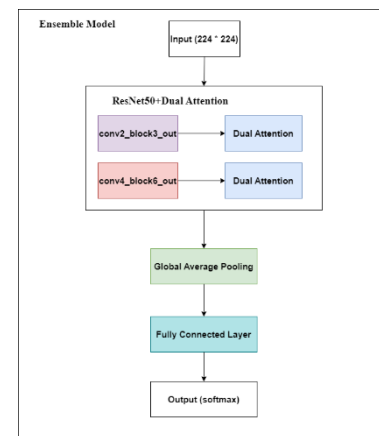
Figure 5: Ensemble models
In this part, the model will be separated into single ResNet50 and Dual Attention mechanism. Combined the two single model to an ensemble model.

Model evaluation

Figure 5: Accuracy

Figure 6: Loss

Figure 7: Precision-Recall Curve

Figure 8: ROC

Figure 9: ROC

Figure 10: F1 score

The figure above shows the result of proposed model training on the dataset, indicating the model has ability to identify different categories.

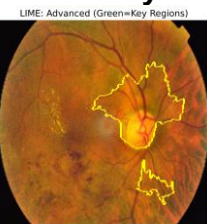## Interpretability and significance analysis of the model
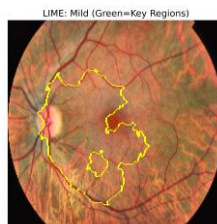

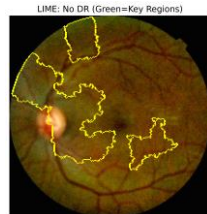Figure 11: LIME of Advanced

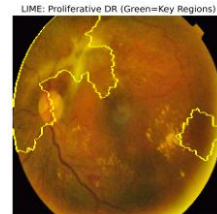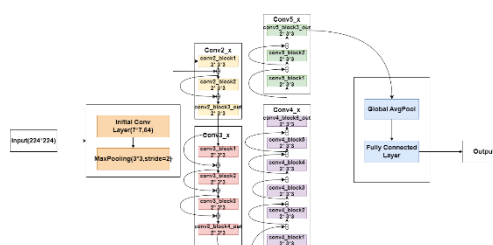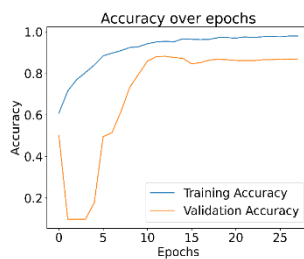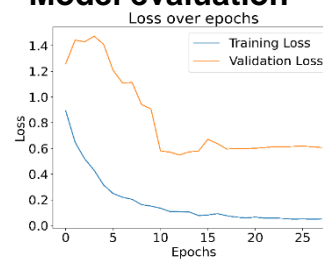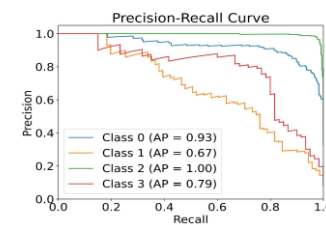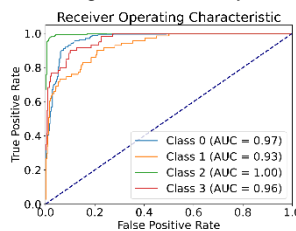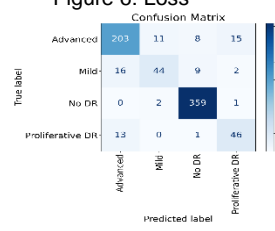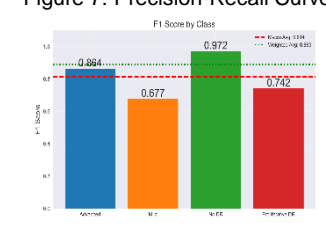Figure 12: LIME of Mild

Figure 12: LIME of No DR

Figure 13: LIME of Proliferative DR

This project utilizes localinterpretable Model Interpretation (LIME) as the interpretable AI tool to virutalize the focus point.

WEB APPLICATION DEVELOPMENT
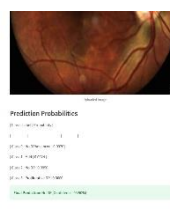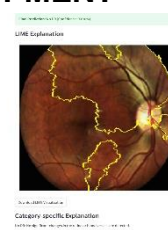

Figure 14: Upload image

Figure 15: Results

Figure 16: LIME

Figures 14 to 16 illustrate the local deployment website, which guides users to upload images, view class prediction confidence, receive a final DR level prediction with LIME-based visual explanation, and support to download the results.

Future work

1. Exploring new attention mechanisms and optimizing the network structure to enhance model's performance and generalization ability.
2. Collect more not DR images to further address the imbalance of the dataset.
3. Try to make the model be lightweight.