Enhanced Diabetic Retinopathy Classification through Depth wise Separable CNN, Residual Learning, and Inception Technique Integration

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ABSTRACT

Diabetic retinopathy (DR) is an important complication of diabetes mellitus (DM) that affects a significant portion of the global population and can lead to vision loss if left untreated, This project aims to enhance the classification of diabesity lesions through the integration of deep separable integration neural networks (CNNs), residual learning, and initialization techniques, 'The method includes comparative analysis of three CNN models (ResNet, VGGi6, and Inception V3), data set preprocessing, data enhancement, and model integration. The results show that by improving training process and data set processing, the accuracy of the model is significantly improved, reaching more than 90%The project helps advance the diagnosis and treatment of diabetic retinopathy, offering potential benefits to patients and healthcare practitioners

Dataset

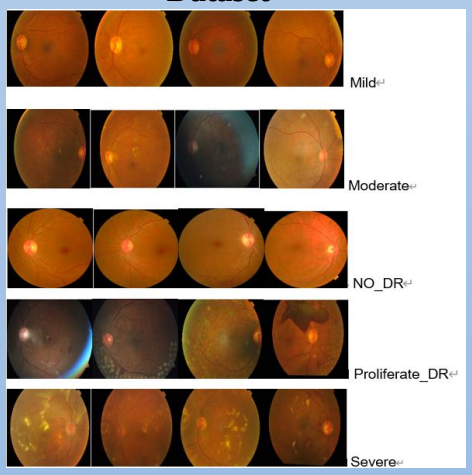

Figure 1 Dataset

the project used five disaggregated datasets of diabetic ophthalmopathy, which are available on the Kaggle public platform which of the five categories has five labels: Mild, Moderate, No_DR, Proliferate and Severe

Ensemble models

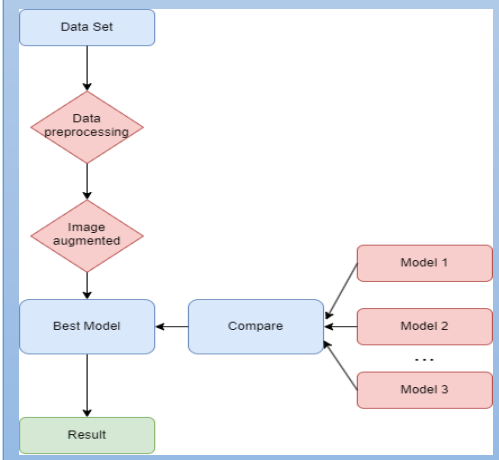

Figure 2 The basic approach to the model

By comparing VGG16, ResNet50 and Inception30 of transfer learning, this project selected the two models that best fit the diabetes data set, and then assembled the models to form the best model.

The figure on the left shows the specific process of data processing in this project. Firstly, data is divided by data preprocessing, and then the divided data is enhanced, such as flipping and pulling up, and finally the enhanced data is trained in the best model.

Bifurcated dataset

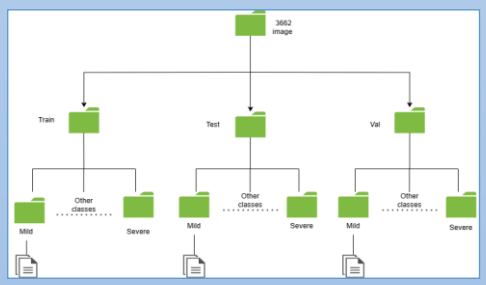

Figure 3 Partitioning of data sets before processing

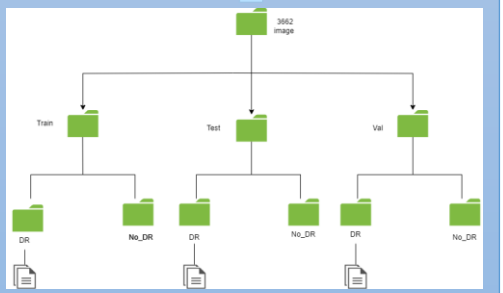

Figure 4 After the bifurcation processing

Due to the best combined model performance, this project adopts the method of bifurcated data sets to improve the model performance

Model evaluation

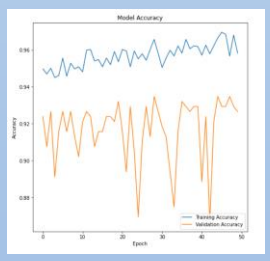

Figure 4 best model accuracy

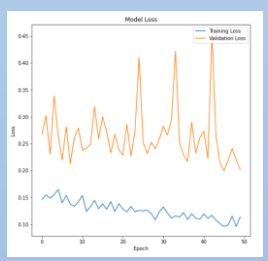

Figure 5 best model loss

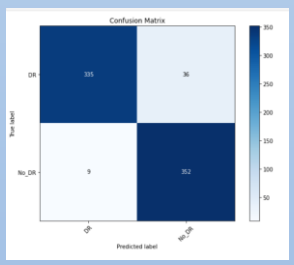

Figure 6 best model confusion matrix

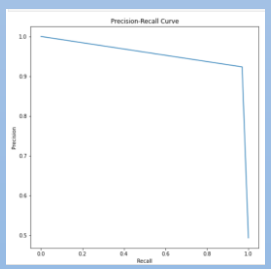

Figure 7 best model PRC

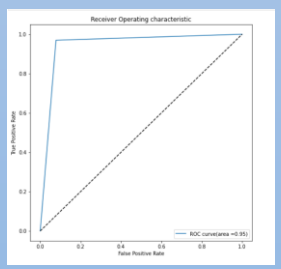

Figure 8 best model ROC

The above picture shows the basic performance of the evaluation model, and it can be seen that the model performed very well after partitioning the data set

GUI DEVELOPMENT

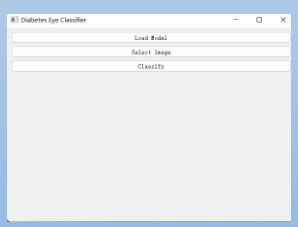

Figure 9 Visual interface

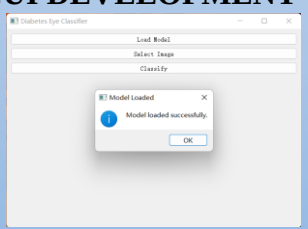

Figure 10 Load model success interface

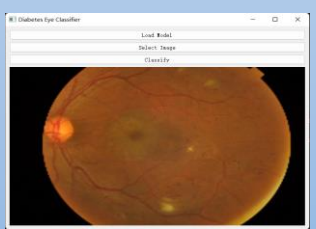

Figure 10 Load Image interface

Future work

1. Improving the accuracy of the model allows the model to recognize not only binary categories, but each category.
2. The project can be deployed to other operating systems, such as medical devices, to achieve end-to-end one-click identification