OXFORD BROOKES UNIVERSITY

Xian Lai

Depthwise Inception Residual Model for Rice Leaf Classification

Department of Computing Science, Chengdu University of Technology, Oxford Brookes University
Supervised by Dr. Happy Nkanta Monday

Abstract

Rice is an important part of agriculture and plays an important role in the global food chain. Subsequently, many diseases have affected the yield and quality of rice. The difficulty in differentiating leaf symptoms has become a significant barrier for the industry [1]. In this project, a customized convolutional neural network model is proposed to accurately identify and classify endemic diseases affecting rice leaves. The model is a network architecture that utilizes deep separable convolution techniques on the Inception-Residual network. The CNN model achieved an accuracy of 91.23% on 6 different types of rice leaf disease classification data sets.

Introduction

Fig. 1: 6 Classification Rice Leaf Dataset

Traditional rice leaf disease identification relies on manual identification, which has some problems such as low efficiency, poor real-time performance, low accuracy and high time cost [2]. With the development of computer vision and artificial intelligence, more and more researchers began to use these technologies to diagnose rice leaf diseases. By training the deep learning model, the automatic recognition and classification of rice leaf diseases can be realized. The aim of this project is to develop a rice leaf classification system to train an enhanced residual learning model of the Inception network of deep separation convolutions using data sets of six common rice leaf diseases.

Methodology

Software	Framework	TensorFlow
	Language	Python
	Libraries	Numpy, Scikit-learn, Input, Attention, Sequential, Conv2D, MaxPooling2D, Flatten, Dense, Dropout, and so on
	Version management plan	Git repository
Hardware	Operating system	Window 10
	Central Processing Unit (CPU)	Intel(R) Core (TM) i5-1035G1 CPU @ 1.00GHz 1.19 GHz
	Graphic Processing Unit (GPU)	NVIDIA GeForce MX330 WDDM
	Cloud-based Jupyter notebook environment	RTX A4000 / RTX 3080

Table 1: Hardware environment and software configuration

After designing the network structure, it is necessary to preprocess the image, enhance the data, adjust the hyperparameters, etc., so as to make the training data more diversified, improve the accuracy rate, and make the model adapt to the new data. Then the model is trained and evaluated.

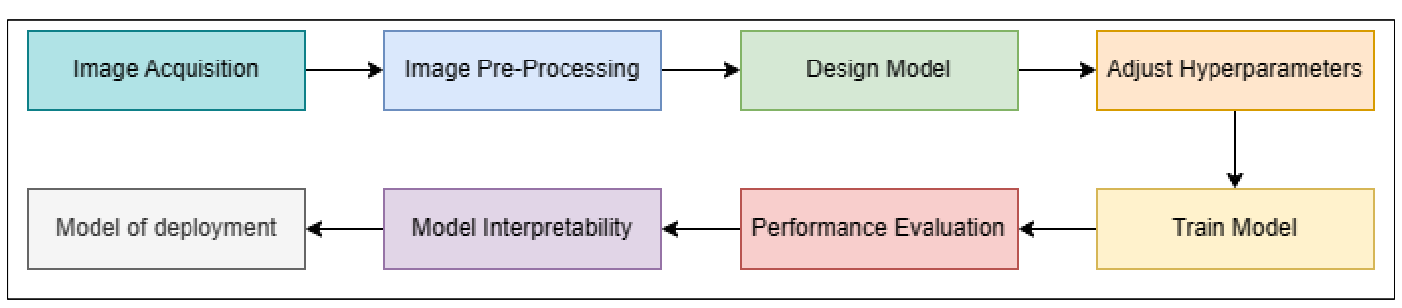

Fig. 2: Experimental process

Model Design

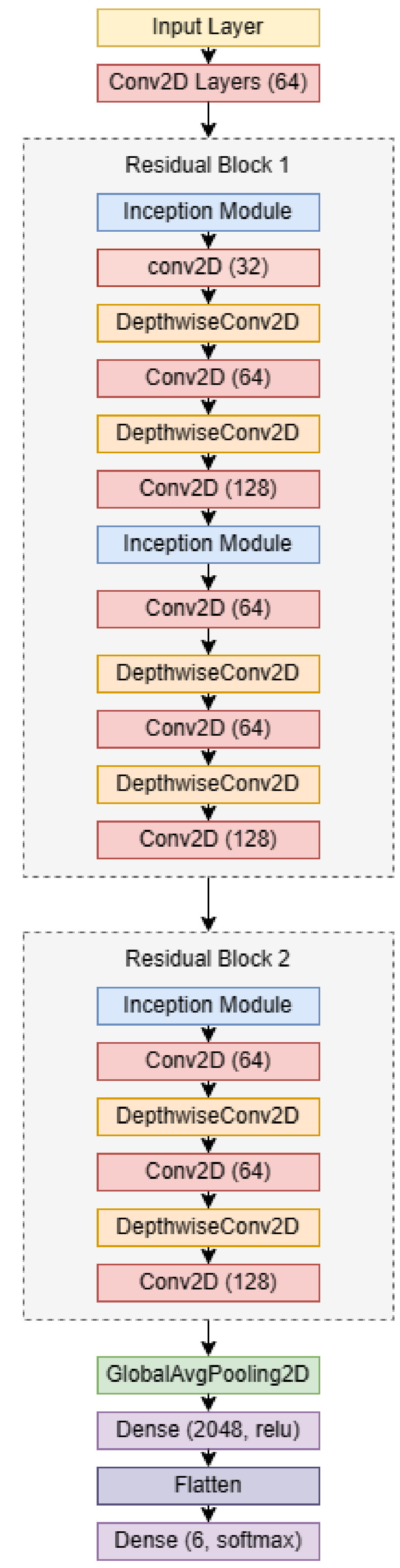

Fig. 3: Depthwise Inception Residual Model Structure

Result and Discussion

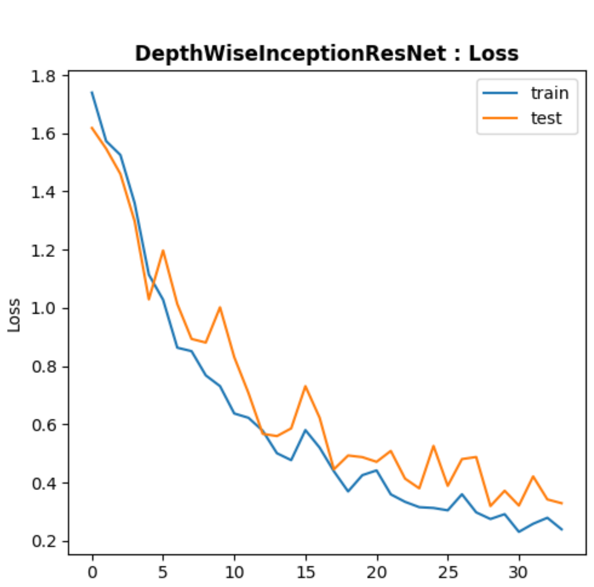

Fig. 4: Loss variation

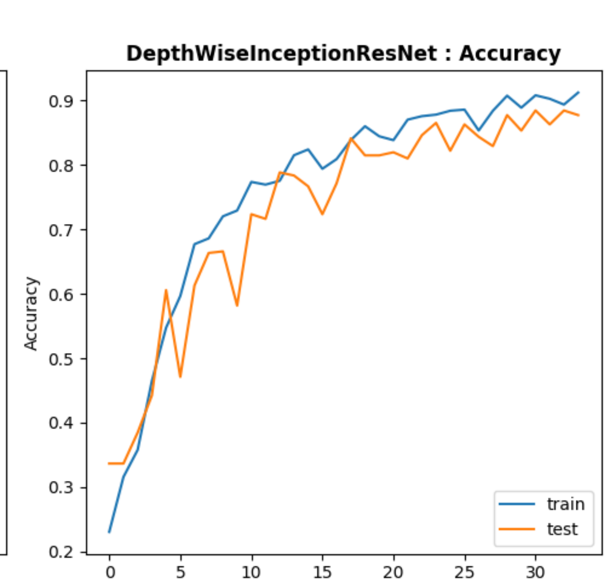

Fig 5: Accuracy

After 34 epochs, when the learning rate is 0.001, the batch size is 16, the optimizer is Adam, and the dropout rate is 0.2, the optimal results are obtained. The accuracy of the training set is 91.24%, and the accuracy of the verification set is 87.74%.

When dealing with complex data sets, simply increasing the depth or width of the model may not improve performance, and the design of the model may not adequately represent the more advanced features of the data.

Interface Design

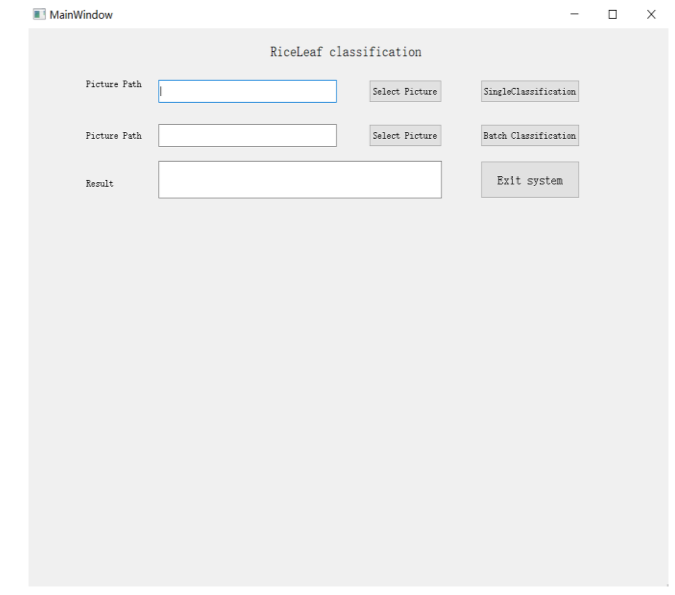

Fig. 6: Graphical user interface design

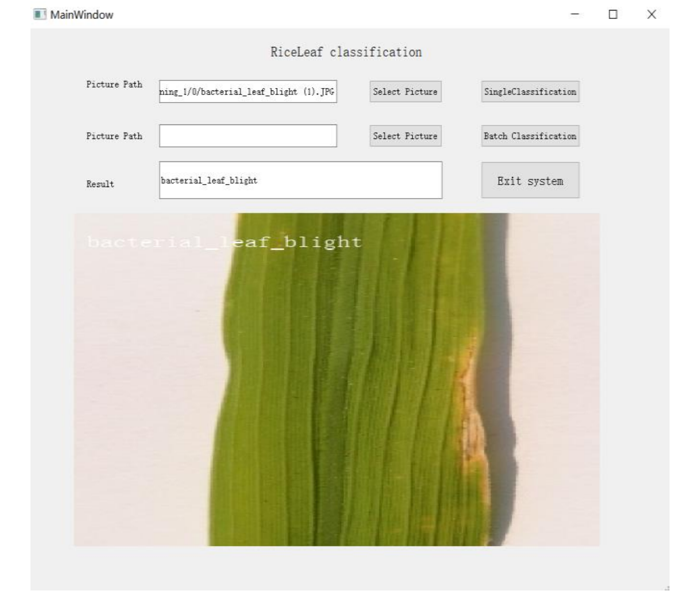

Fig. 7: Graphical user interface result

References

[1] P. Mekha and N. Teeyasuksaet, "Image Classification of Rice Leaf Diseases Using Random Forest Algorithm," 2021 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunication Engineering, 2021, pp. 165-169, doi: 10.1109/ECTIDAMTNCON51128.2021.9425696.

[2] L Yang, X. Y. Yu, S. P. Zhang, H. B. Long, H. H. Zhang, S. Xu, Y. J. Liao, "GoogLeNet based on residual network and attention mechanism identification of rice leaf diseases," Computers and Electronics in Agriculture, Vol. 204, 2023, doi: https://doi.org/10.1016/j.compag.2022.107543.