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Recognition of Flower Images using Deep Learning

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Abstract

Flower image recognition has become a trendy topic in the fields of deep learning and machine vision, which can be applied to horticulture, agriculture, forest management, medicinal flowers, and biological research to help people better understand and utilise flower resources. However, flower image datasets have intra-class similarities and diversity, as well as complex and diverse environments, which make it challenging to extract useful features. Therefore, this project used a transfer learning approach to train the Inception-v4 model to recognise images of flowers, ultimately achieving an accuracy of 83.33% on the validation set.

Introduction

Fig. 1: Oxford 17 Category Flower Dataset [4]

According to a review of the relevant literature, the implementation methods for flower image recognition can be roughly divided into two types: deep learning-based and non-deep learning based [1]. Without human intervention, the use of trained deep learning models to automatically recognise flower images increases efficiency and accuracy, facilitating the collection and analysis of flower data as well as horticultural and agricultural production [2]. This study aims to use machine vision and deep learning techniques to train Inception-v4 [3] using the Oxford 17 dataset [4] to design a simple graphical user interface for flower image recognition.

Methodology

	Classification	Environment
Hardware	Operating System	Windows 11
	CPU	Intel(R) Xeon(R) CPU E5-2686 v4 @ 2.30GHz
	Memory	12.00 GB
	Video Card	NVIDIA GeForce RTX 3080 Ti
Software	Integrated Development Environment	PyCharm 2022.2.4
	Deep Learning Framework	TensorFlow 2.6.0
	GUI Framework	PyQt5

Table 1: Hardware environment and software configuration

After defining the network structure, the images need to be pre-processed, performing data enhancement, setting rescaling factors, etc. to make the training data more diverse and improve generality so that the model can adapt to new data. Subsequently the model is trained and evaluated.

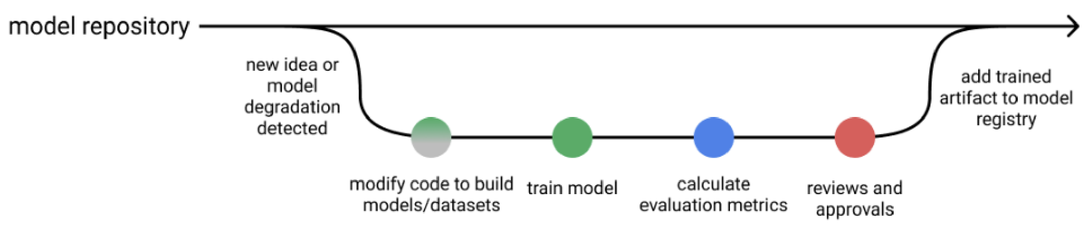

Fig. 2: Workflow for model development [5]

Model Design

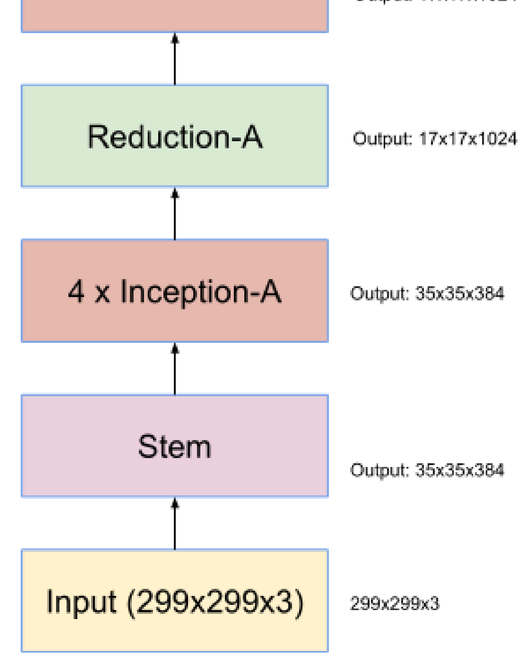

Fig. 5: Inception-v4 model structure [3]

Result and Discussion

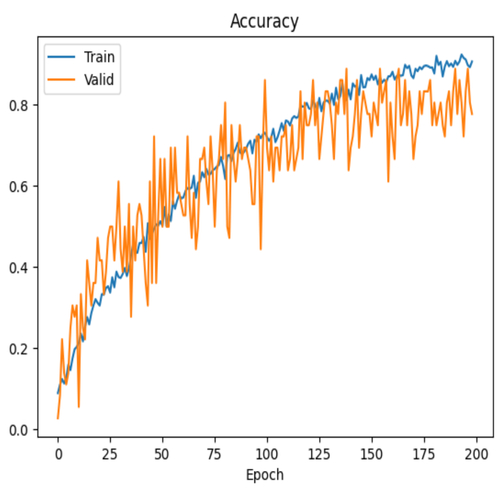

Fig. 3: Accuracy variation

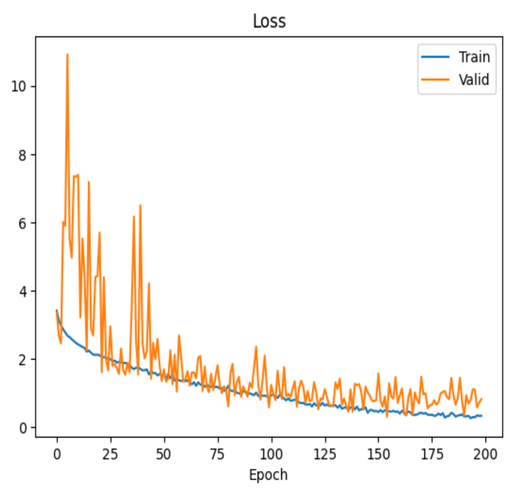

Fig. 4: Loss variation

By defining different learning rates and optimisers, after the model is trained for 200 epochs, the optimal result is achieved when the learning rate is 0.0001 and the optimiser is Adam, with an accuracy of 91.26% on the training set and 83.33% on the validation set.

Due to the different backgrounds and lighting of the flower images, as well as limited equipment resources, the performance of the model cannot be reached optimally. The use of background removal techniques or larger video memory will be considered in the future to improve the performance and reliability of the model.

Interface Design

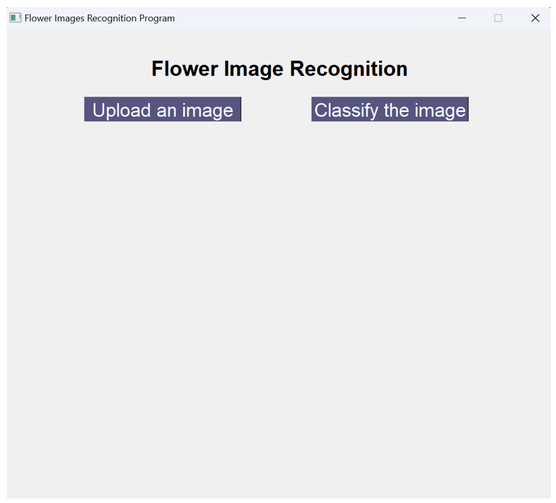

Fig. 6: Graphical user interface design

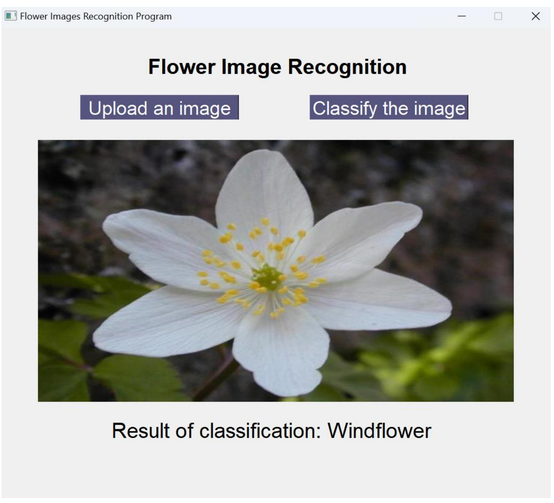

Fig. 7: Graphical user interface result

References

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