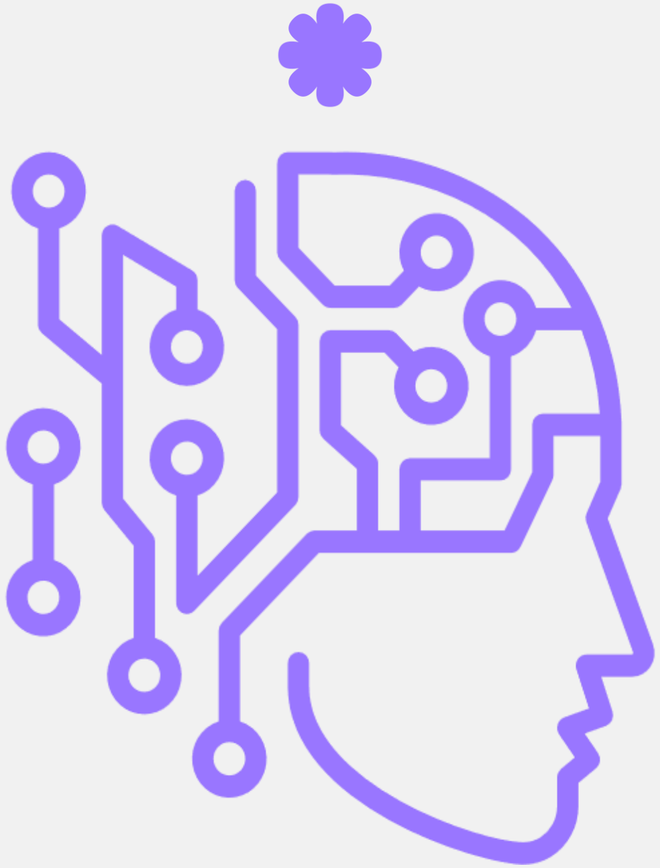
OXFORD BROOKES UNIVERSITY

A Separable Convolutional Neural Network Approach for Plant Disease Classification



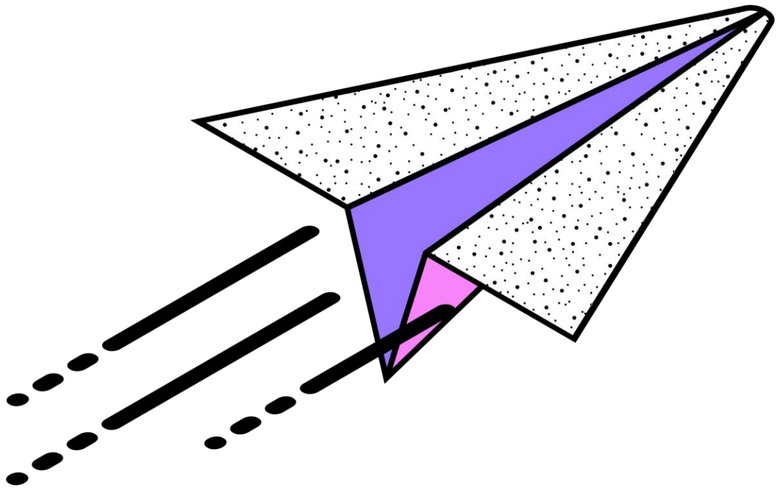
Department of Computing Science,
Chengdu University of Technology, Oxford Brookes University

Sky
202018010333
Supervised by Dr. Happy Nkanta Monday

OXFORD BROOKES UNIVERSITY

CONTENT

A Separable Convolutional Neural Network Approach for Plant Disease Classification



1 Background

2 Aims

3 Dataset

4 Model Architecture

5 Methodology

6 Results

7 Reflections & Conclusion

OXFORD BROOKES UNIVERSITY

01 Background

- **Global Population Growth**:
  - Rapid increase in population necessitates a sustainable and adequate food supply.
- **Challenges**:
  - Limited agricultural land and pure water resources.
  - Agricultural anomalies and plant diseases impacting crop yield and quality.

OXFORD BROOKES UNIVERSITY

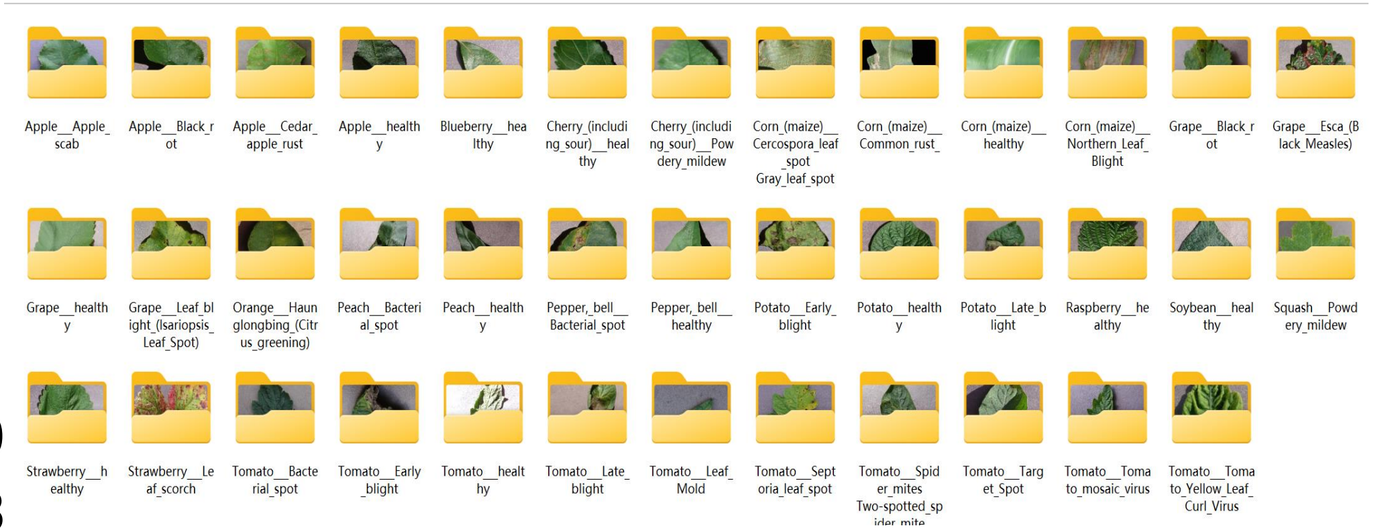
02 Aims

Improve the accuracy and interpretability of plant disease classification using deep learning.

- Employ residual learning and wavelet analysis techniques.
- Develop a comprehensive deep learning model integrating separable CNN, residual learning
- Enhance feature extraction and representation for accurate plant disease classification.

OXFORD BROOKES UNIVERSITY

03 Dataset



The dataset includes approximately 87000 RGB photos, which are divided into 38 different categories. These categories include healthy and sick crop leaves.

Division of the data set:
80% for training and 20% for testing.

38 categories

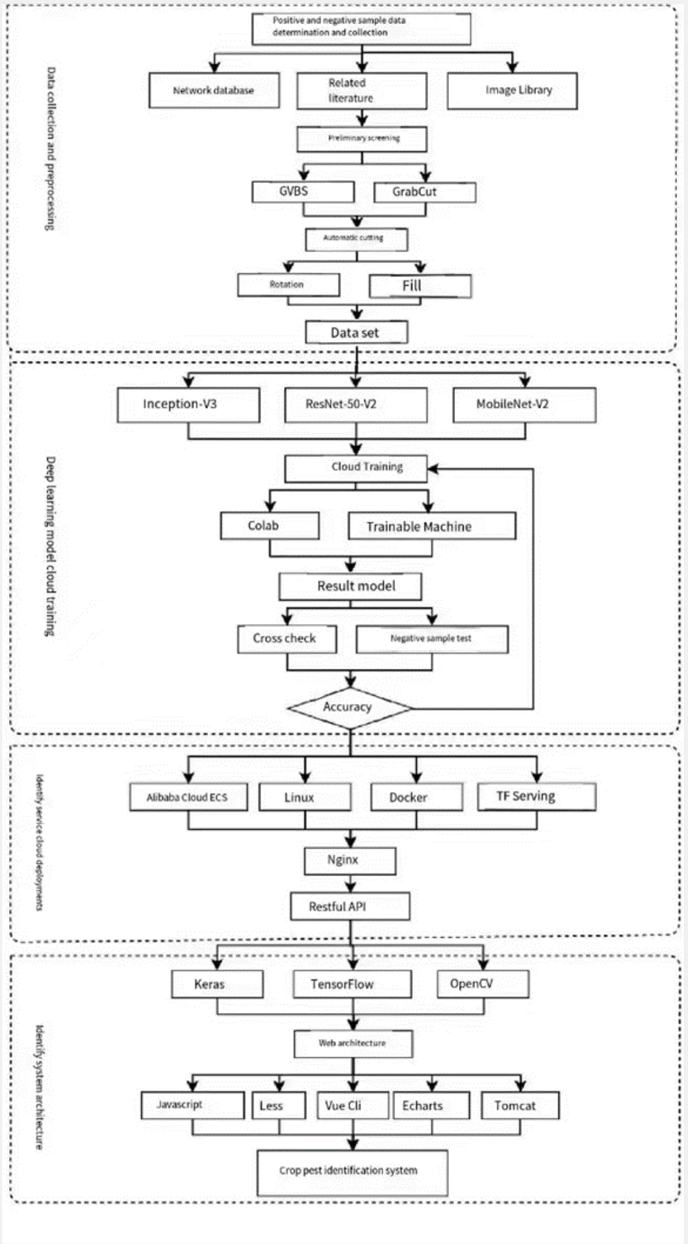
Each category has 2000 images

A total of 76000 images

OXFORD BROOKES UNIVERSITY

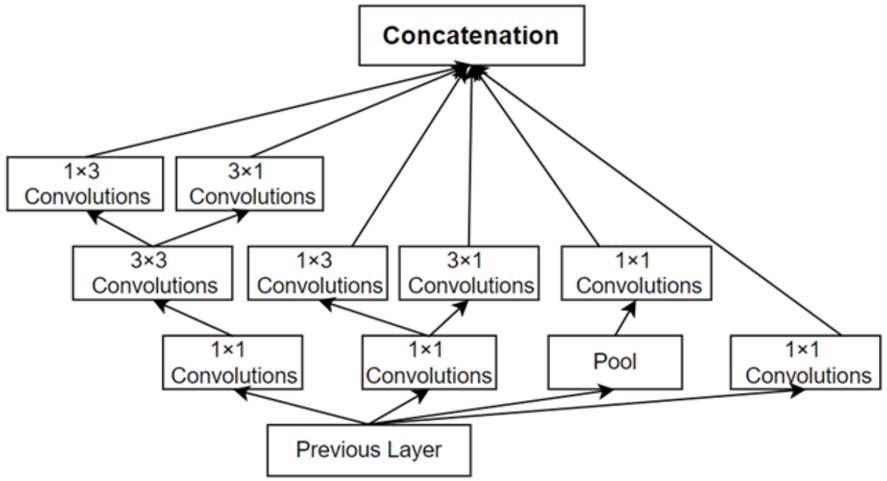
04 Model Architecture

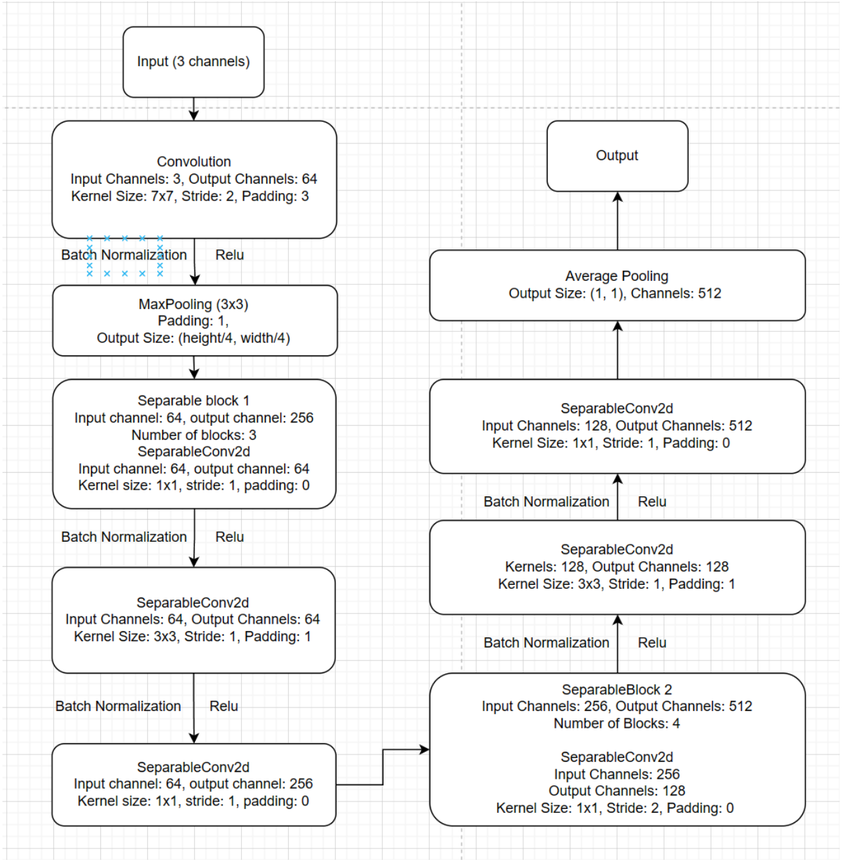
epoch	10epoch accuracy	20epoch accuracy	40epoch accuracy
2	0.1279	0.4817	0.6421
4	0.2749	0.5674	0.7202
6	0.3684	0.6152	0.7595
8	0.4009	0.6494	0.7756
10	0.4326	0.6660	0.7908
12	0.4502	0.6836	0.7988
14	0.4675	0.6887	0.8047
16	0.4810	0.7139	0.8208
18	0.4954	0.7236	0.8223
20	0.5017	0.7280	0.8230



OXFORD BROOKES UNIVERSITY

04 Model Architecture

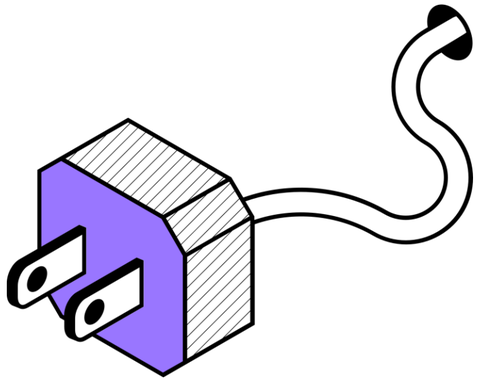




OXFORD BROOKES UNIVERSITY

05 Methodology

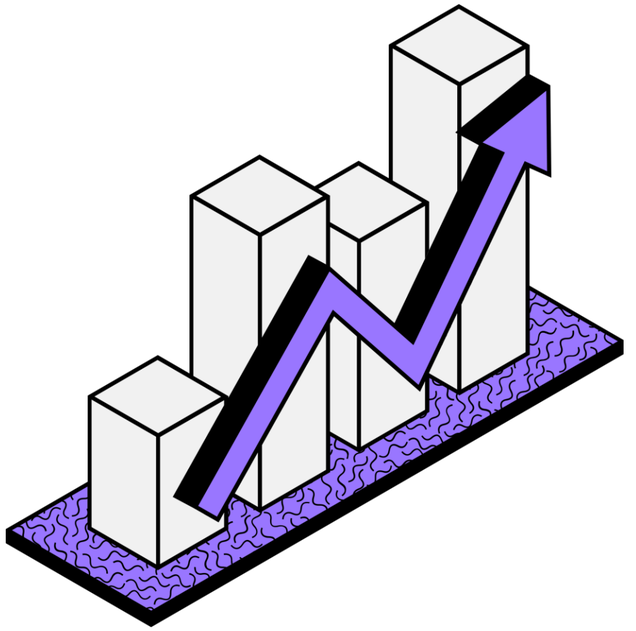
Software	Framework	PyTorch
	Language	Python
	Libraries	Numpy, Scikit learn, Pandas, OpenCV, Scipy
	Version management plan	Git repository
Hardware	Central processing unit(CPU)	AMD Ryzen 7 5800H CPU 3.20GHz GHz
	Graphic Processing Unit(GPU)	NVIDIA GeForce RTX 3060



OXFORD BROOKES UNIVERSITY

05 Methodology

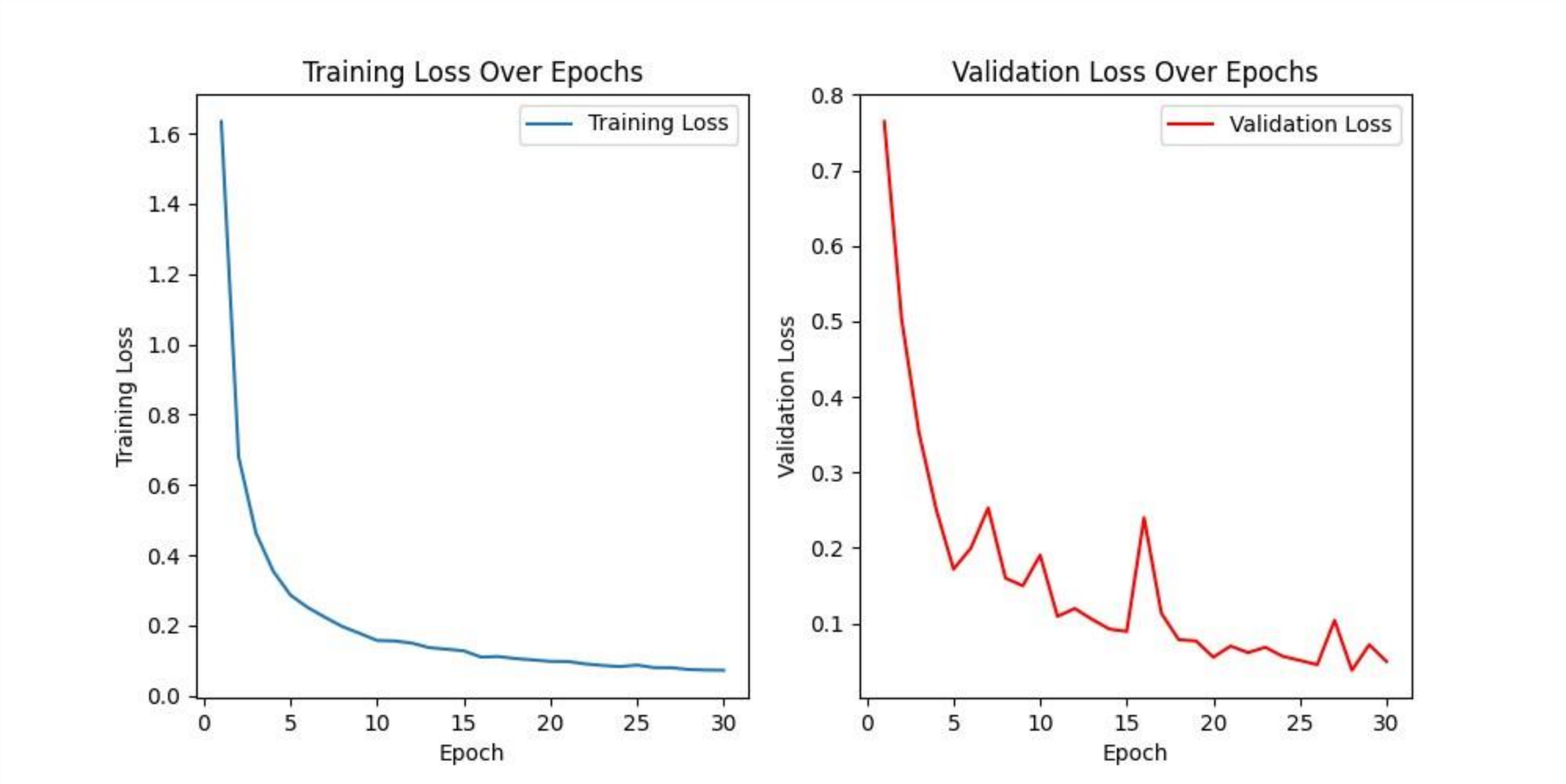
Optimizer	Learning Rate	Accuracy
Adam	0.01	37.10%
	0.001	64.89%
	0.0001	83.33%
SGD	0.01	53.59%
	0.001	75.22%
	0.0001	79.47%
RMSprop	0.01	61.93%
	0.001	73.48%
	0.0001	80.19%



After training 200 epochs with different optimizers and learning rates, the accuracy of the test set are shown in the table above. It can be seen that the highest accuracy is achieved when the optimizer is Adam and the learning rate is 0.0001.

OXFORD BROOKES UNIVERSITY

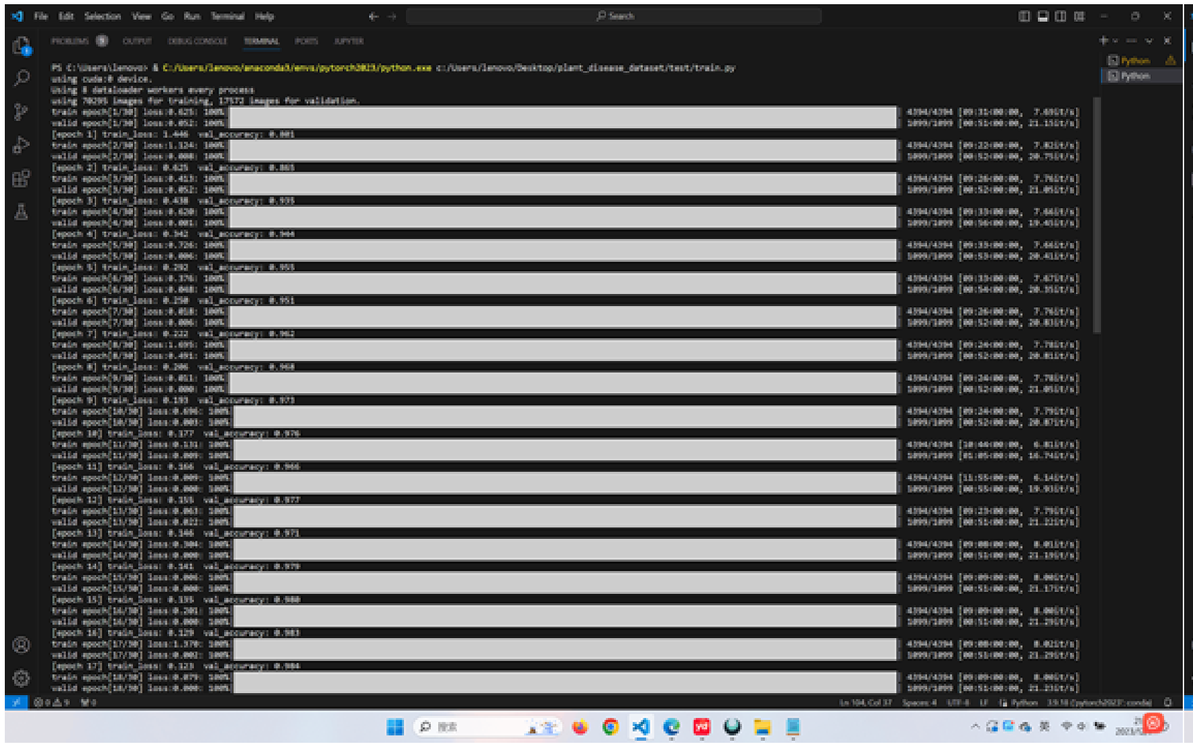
06 Results

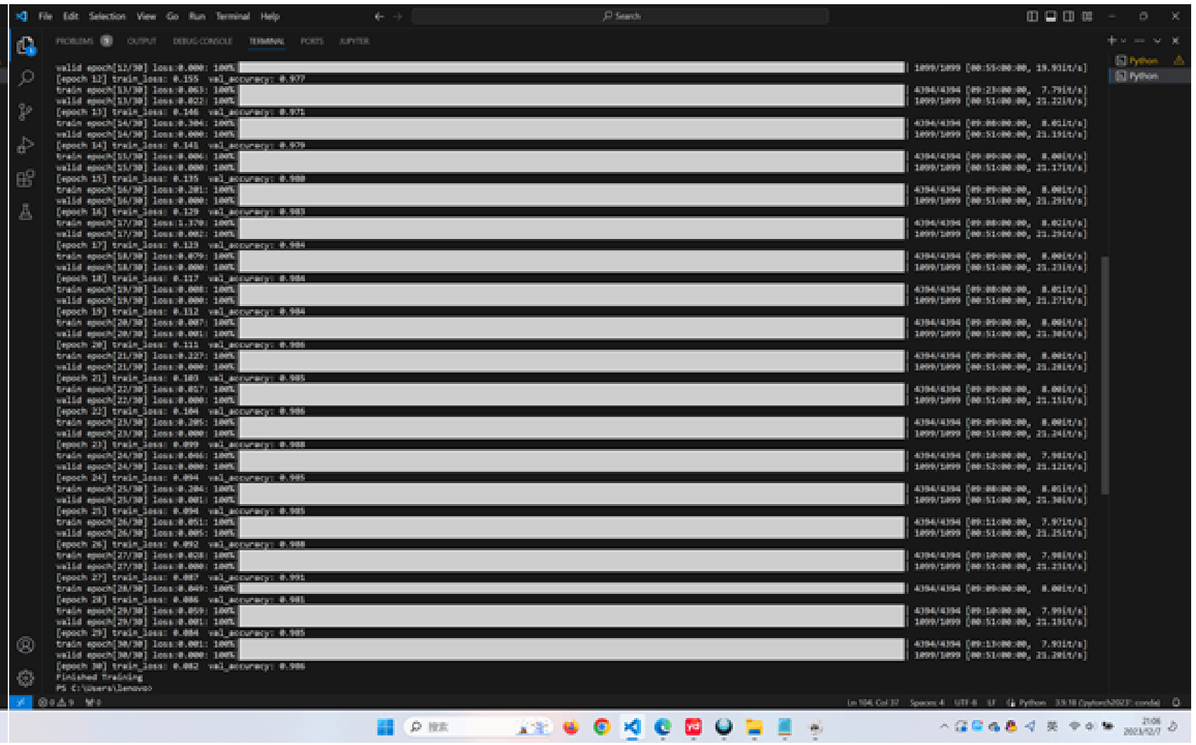


The proposed model demonstrates high accuracy and precision, outperforming established architectures like Inception-V3, MobileNet-V2, and ResNet-50-v2. Visualizations such as graphs and charts depict its superior performance across various metrics, affirming its efficacy in tackling the specified task.

OXFORD BROOKES UNIVERSITY

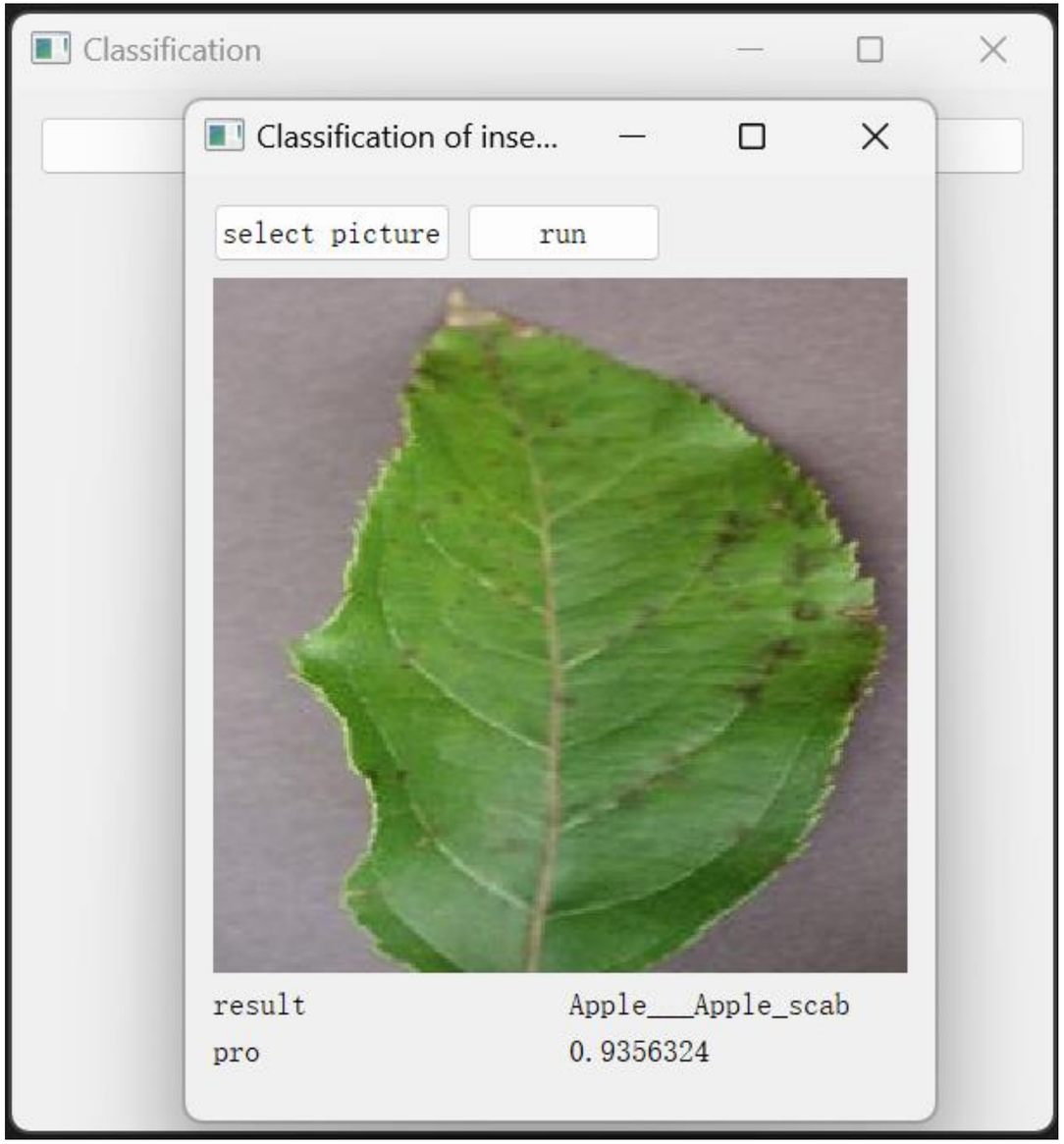
06 Results





OXFORD BROOKES UNIVERSITY

06 Results



This GUI program implements a simple image classification interface, where users can select images for classification and view classification results and probabilities.

OXFORD BROOKES UNIVERSITY

07 Reflections & Conclusion

Given the variations in the backgrounds and lighting conditions of the plant disease photos, as well as the limited availability of equipment resources, the model's performance cannot be optimized. In order to enhance the performance and reliability of the model, we will explore the implementation of background removal techniques and the allocation of bigger video memory in the future.

Thank you for your listening!