Poisonous and Edible Mushroom detection

By Sai Neelesh Kuntimala(YT93657)

Problem statement

The Mushrooms which are in the Northeastern Region of Thailand, include some species of edible mushrooms and some of poisonous mushrooms. The detection of poisonous and edible mushrooms is a difficult task for any newcomer in that region. Developing a classification model which distinguishes between edible and poisonous mushrooms would greatly help inexperienced locals and newcomers to this region in identifying edible mushrooms, which is one of the most important survival traits in that region.

Data collection and preprocessing

The image data of the mushrooms is taken from https://zenodo.org/record/6378474#.ZCLOsC-B1MQ , which includes images of resolution **227x227 pixels** and there are in total 2000 images. The data here is downloaded into image directories, from which feature extraction is done using resnet50 as the base model.

We define a clean source function in order to identify just the image files and read them, preventing the reading of other non-image files. The images are converted into a readable format by feature extraction, which can be done in various methods. While in our problem we choose to extract the features using image_dataset_from_directory and the base model Resnet50. Principal component analysis is performed to obtain data with 3 features and a variance ratio of 0.767.

Model selection

There are different models used to solve this problem. Each of the models used and their validation accuracies are given below:

	Classification model	Validation Accuracy
1	RandomForestClassifier	0.733
2	Support Vector Machine	0.752

3	KNNeighborsClassifier	0.737
4	VGG16 keras CNN	0.964
5	MobileNetV2 keras CNN	0.949
6	Resnet50 keras CNN	0.986

From the above results, we select Resnet50 model as our ideal model for our classification problem.

Resnet50 model

Resnet50 is a pre-trained convolutional neural network mainly used for image classification. It uses a residual deep learning framework and has 50 layers, the network models the residual, as a layer has access to both the immediately prior layer and outputs further down the stack.

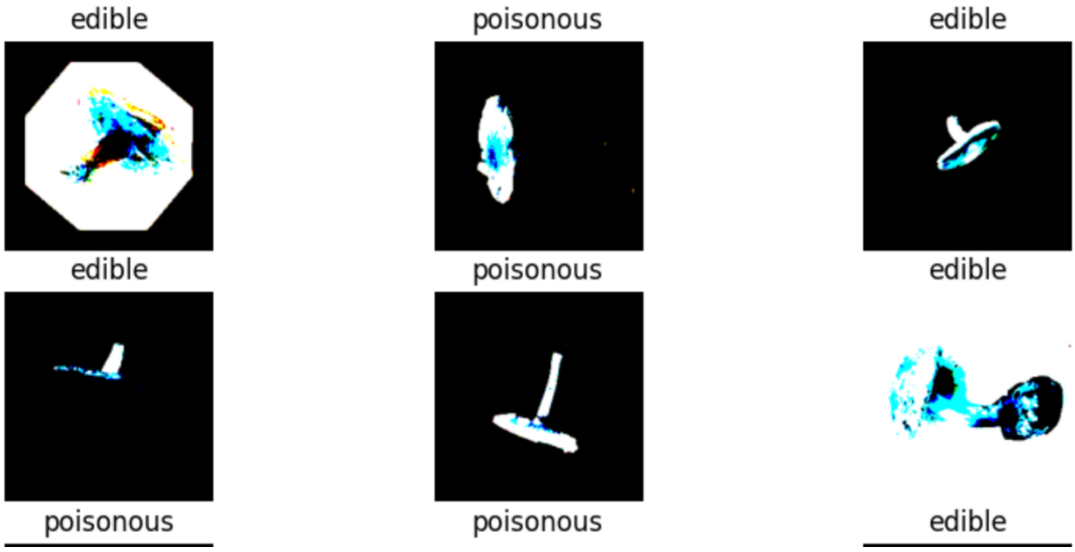
An ensemble of these residual network models achieves 3.57% error on the ImageNet test set, winning the 1st place on the ILSVRC 2015 classification task.

Evaluation and Results:

Using the Resnet50 model for our classification task yielded a training accuracy of 0.99 and a validation accuracy of 0.98.

A test image set of 30 images is separated from the image dataset which is subject to testing our winning model. This yields the following metrics: loss: 0.1906 - accuracy: 0.9666.

The edible and poisonous mushrooms in our model predictions are illustrated below:



Conclusion

The Mushrooms can now be classified into edible and poisonous with almost 99% accuracy, which is a pretty good prediction accuracy. Further developments would be collecting more images, like having more samples of the mushroom species and in different stages of their life cycle. This would broaden our approach in classification.

References:

i. ResNet-50 convolutional neural network - MATLAB resnet50. (n.d.). Www.mathworks.com. Retrieved May16,2023, from https://www.mathworks.com/help/deeplearning/ref/resnet50.html#responsive_offcanvas

ii. He, K., Zhang, X., Ren, S., & Sun, J. (2015). Deep Residual Learning for Image Recognition. https://arxiv.org/pdf/1512.03385v1.pdf

iii. Ketwongsa, W., Boonlue, S., & Kokaew, U. (2022, March 23). Poisonous and Edible Mushrooms in the Northeastern Region of Thailand. Zenodo; Zenodo. https://zenodo.org/record/6378474#.ZCLOsC-B1MQ