FLOWER IMAGE CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORK AND TRANSFER LEARNING

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Motivation

We investigated flower image classification using Convolutional Neural Network (CNN) and Transfer Learning approach and evaluated the regular CNN model and transfer learning on VGG16 model architecture based on their accuracy measures. This was significant because accurate identification of floral species is critical for biodiversity protection, botanical research, and pharmaceutical industry development. Also, image classification is handled quickly and accurately using this technique as opposed to traditional methods because complex image pre-processing is avoided.

Dataset

Data Source: Kaggle
https://www.kaggle.com/competitions/ee596-flower-classification-deep-neural-networks/overview

Original Data:

4315 Flower Images = 3452 training images + 863 test images
5 Image Classes: Daisy, Dandelion, Rose, Sunflower, Tulip
Image Resolution: 320 x 240 pixels

Pre-processed Data:

Train Data: 2,762
Validation Data: 690
Test Data: 863
Rescaled Image: 240 x 240 pixels

Fig. 1: Sample of flowers in dataset

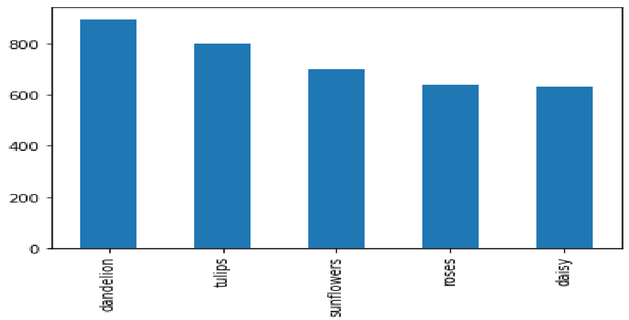

Fig. 2: Distribution of flower classes in dataset

Methodology

- On Colab IDE, import relevant python libraries: Pandas, NumPy, Sklearn, metrics, TensorFlow datasets, TensorFlow hub, Matplotlib etc
- Download flower image dataset using Kaggle API to Colab and create file directory for each classes of flower.

Experiment Set-Up

Hyperparameter	Simple CNN	VGG16
Activation function	Relu, Sigmoid	Softmax
Optimizer	Adam	Adam
Batch size	10	30
Epoch	10	90
Learning Rate	0.0001	0.0001

Fig 3: Hyperparameter

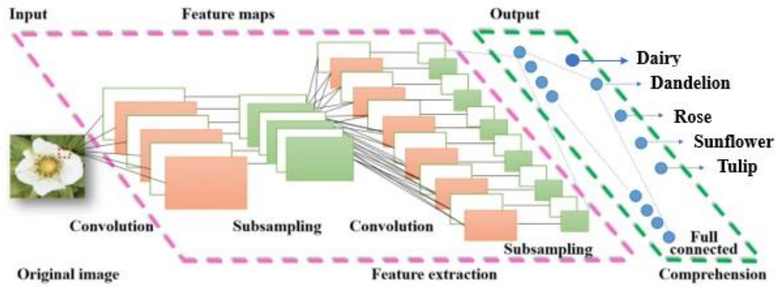

Fig 4: Simple CNN Architecture

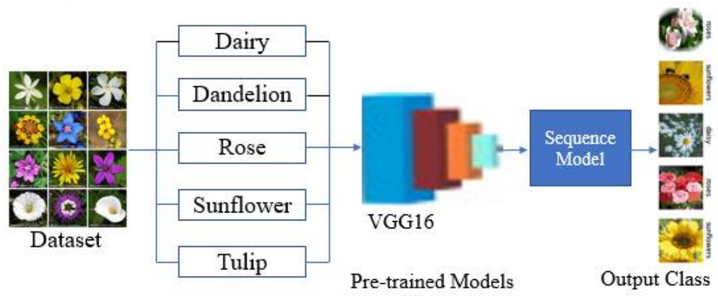

Fig 5: CNN Transfer Learning Architecture

Result

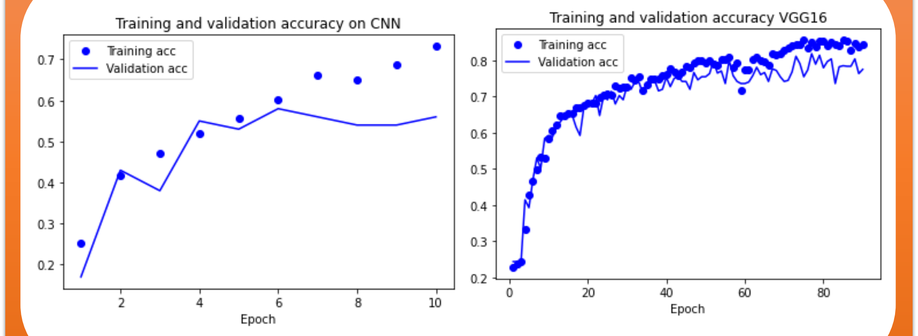

Fig 6: Accuracy Comparison between regular CNN vs VGG16

Evaluation and Discussion

Model	Training Accuracy	Validation Accuracy
CNN	73.2%	56%
VGG16-Transfer	85.55%	81.45%

Fig 7: Our Result

Related work	Model	Training Accuracy	Validation Accuracy
[1]	CNN	75.46 %	72.39 %
[1]	VGG16-Transfer	87.78 %	85.45 %
[2]	VGG16-Transfer	87.95 %	85.73 %
[3]	CNN	70.12 %	64.60 %

Fig 8: Results from Relation Works

Figure 6 and 7 depicts the VGG16 transfer learning model performed better than the regular CNN model on training and validation data. Meanwhile, both curves also indicated overfitting is minimized.

Comparing our results with existing results in fig 8, it shows our models performed averagely efficient.

Conclusion and Reference

It is clear from this work that using simple CNN and VGG16 transfer learning models to classify flower images is a viable strategy. It is useful to identify plants for medicinal purposes. However, our models can be subjected to further augmentation and model hyperparameter fine-tuning to improve accuracy.

References

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