Flower Image Classification

Convolutional Neural Network

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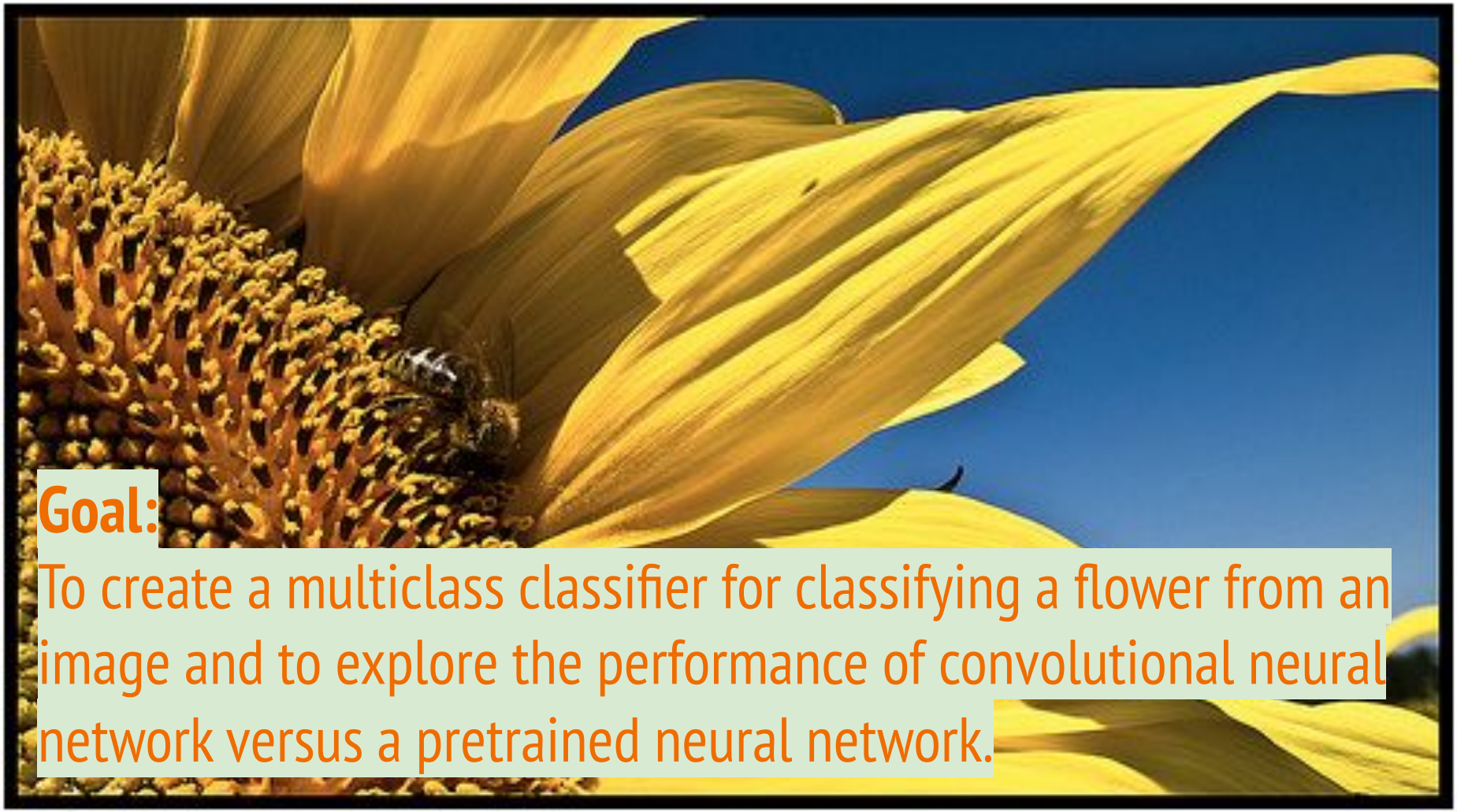
Background

We're **losing billions of bees each year** to many complicated causes, including viruses, climate change, decreasing crop diversity and habitat loss. Amid this population plummet, however, one threat remains under our control: pesticides and **lack of food resource**. -*www.earthday.org*

Without **bees**, the availability and diversity of fresh produce would decline substantially, and **human** nutrition would likely suffer. Crops that would not be cost-effective to hand- or robot-pollinate would likely be lost or persist only with the dedication of **human** hobbyists. - *www.britannica.com*



Goal:

To create a multiclass classifier for classifying a flower from an image and to explore the performance of convolutional neural network versus a pretrained neural network.

Classification is a systematic arrangement in groups and categories based on its features. *-dictionary.com*

Image classification Algorithms came into existence for decreasing the gap between the ***computer vision*** *and* ***human vision***. The machine learning in **convolutional neural network** consists of feature extraction module that extracts the important features such as edges, textures etc and a classification module that classify based on the features extracted.

On this project, both trained convolutional neural network and transfer learning with pretrained network- ***ResNet50***- is explored for classifying a flower type from an image.

The Dataset

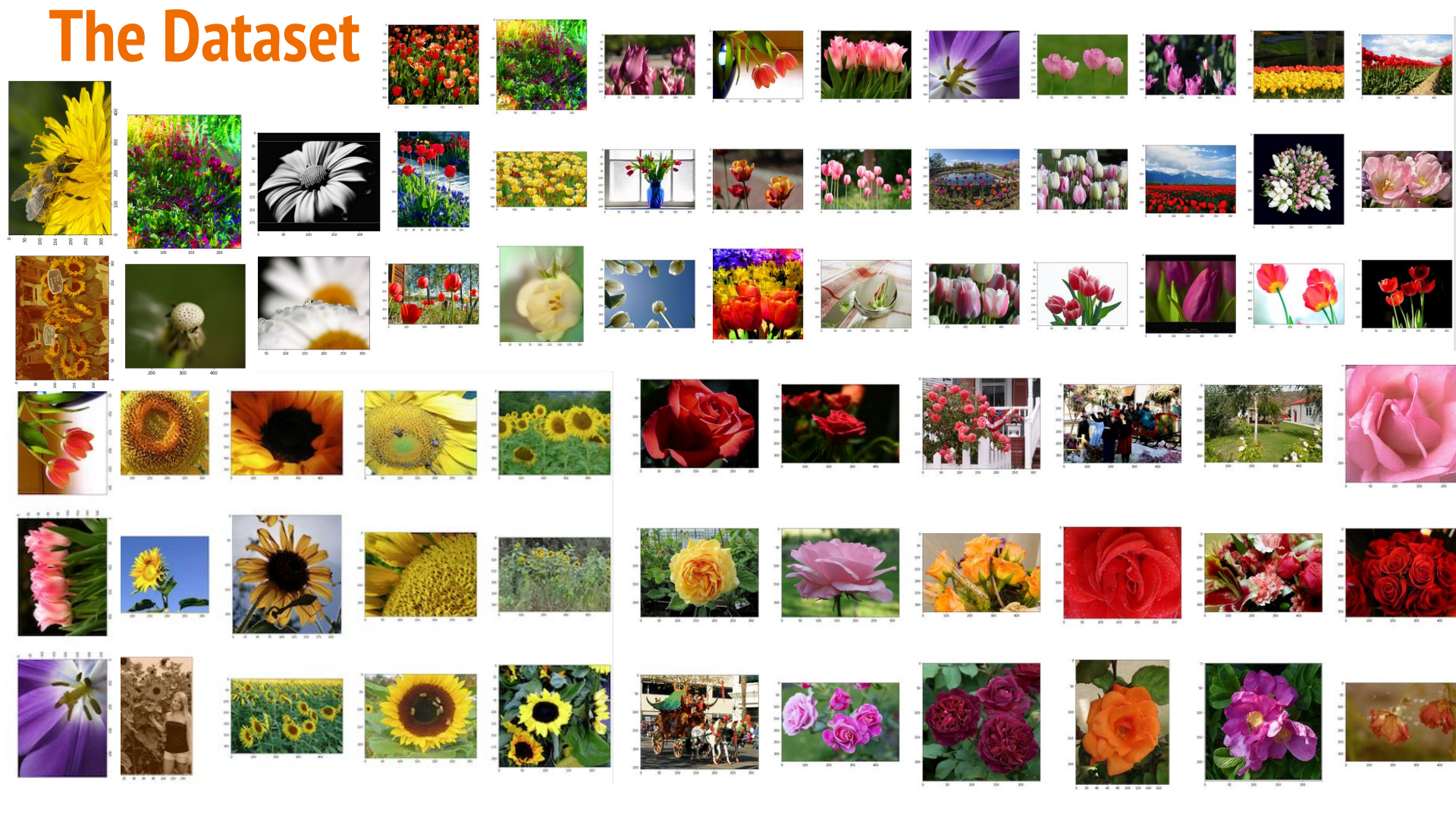
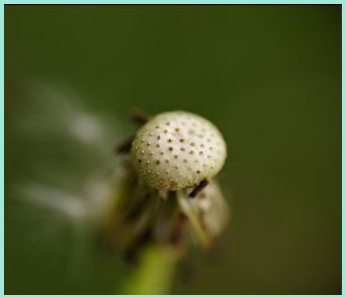
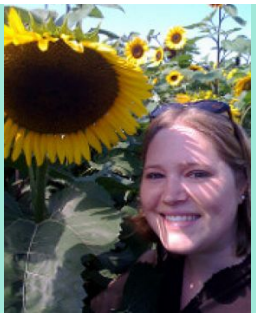


Image Observation

- Close-Ups and Zoom-Outs
- Color Scheme
- Flower's life cycle
- Focus
- Frame Positioning
- Lighting
- Photo View
- Pixel Sizes
- Presence of Objects

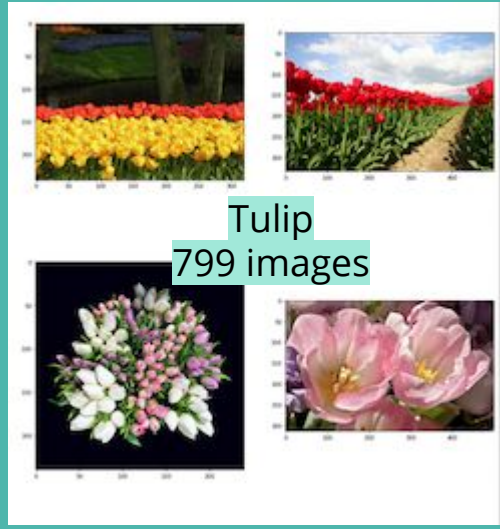


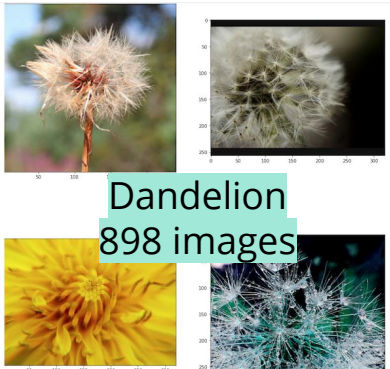

Classes

Rose
648 images

Sunflower
699 images

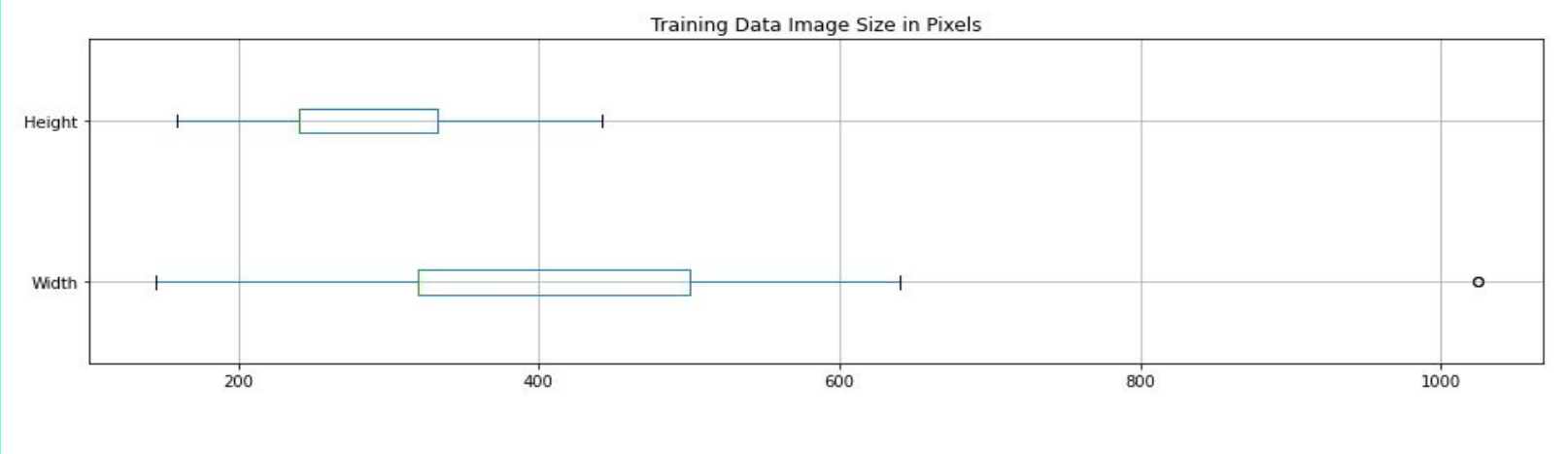


Tulip
799 images



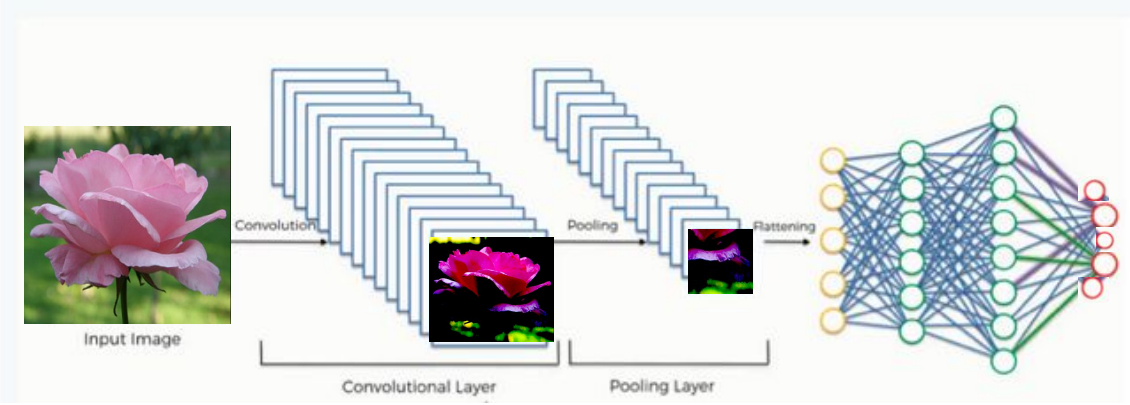
Dandelion
898 images

Daisy
633 images



	Width	Height
count	3209.000000	3209.000000
mean	366.055781	271.990651
std	116.689141	51.790442
min	145.000000	159.000000
25%	320.000000	240.000000
50%	320.000000	240.000000
75%	500.000000	333.000000
max	1024.000000	442.000000

Creating a Model



1. Explore dataset

Explore Data then convert to neural network ready inputs using tensorflow.

2. Build an input pipeline

Preprocess image pixels using keras for training efficiency.

3. Create a Base Model

Convolutional Neural Network

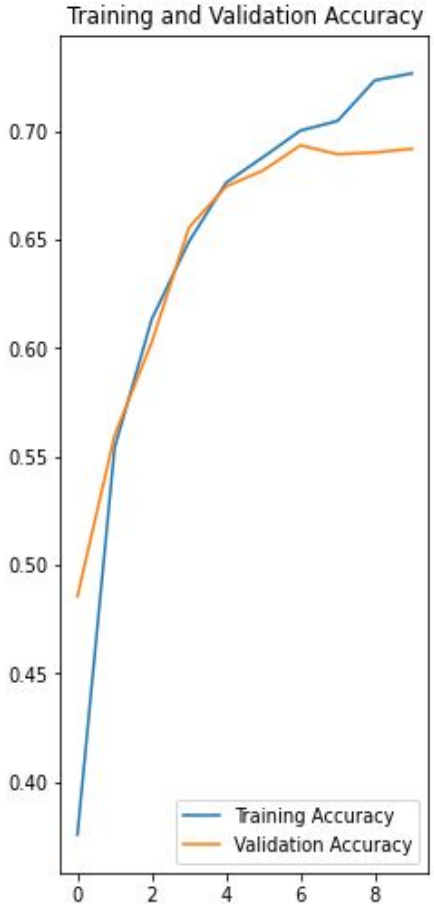
4. Data Augmentation

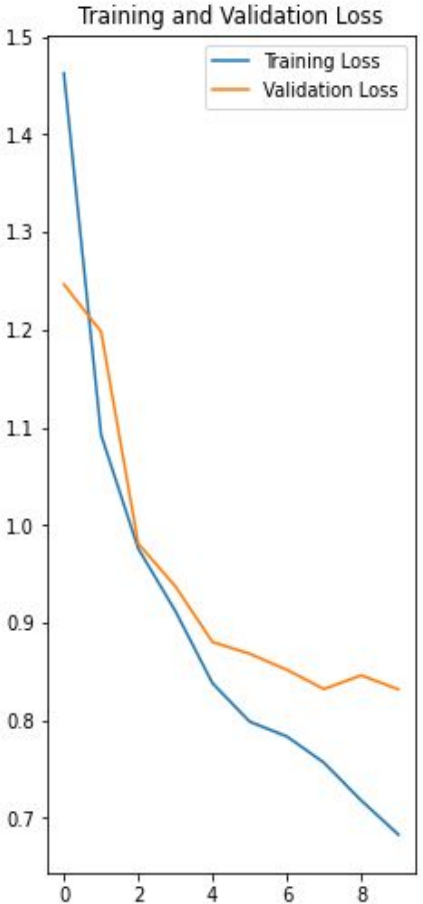
To diversify the dataset and in hopes of maximizing the capture of the signal

5. Train the Model!

Result

Base





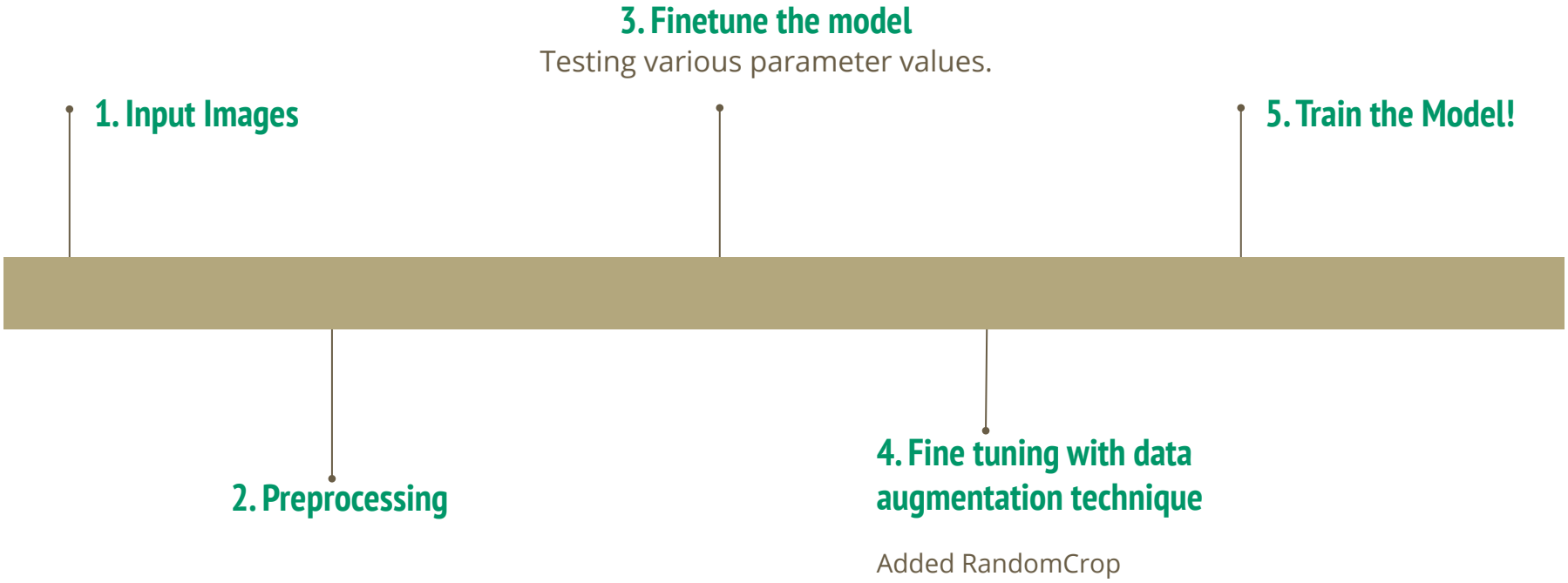
Validation Accuracy Score: 70.32%

Image Augmentation

Data Augmentation Techniques used:
RandomFlip
RandomRotation
RandomZoom

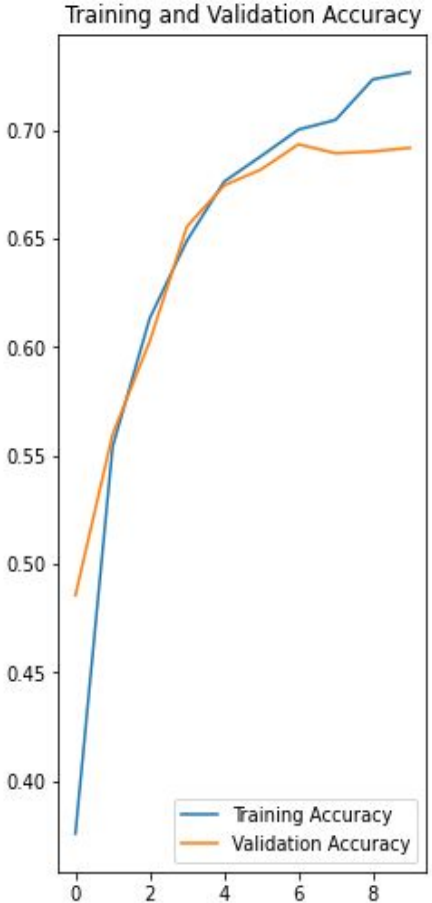
Data Augmentation Techniques used:
Everything on the left and RandomCrop

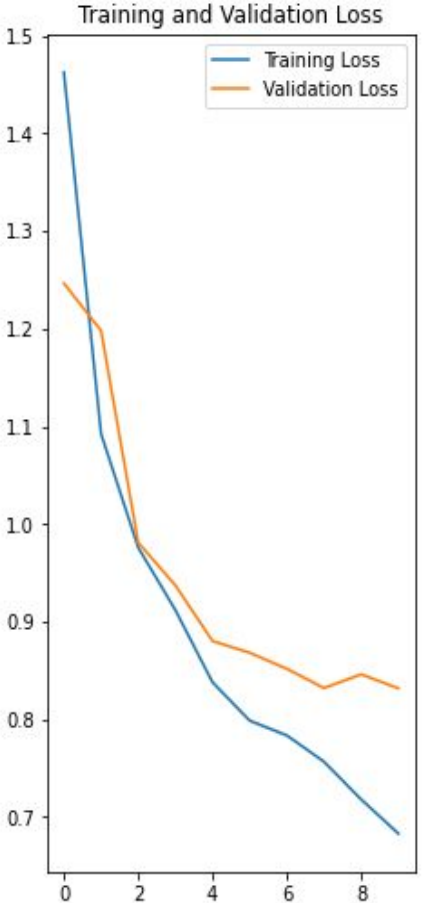
Fine tuning the Model



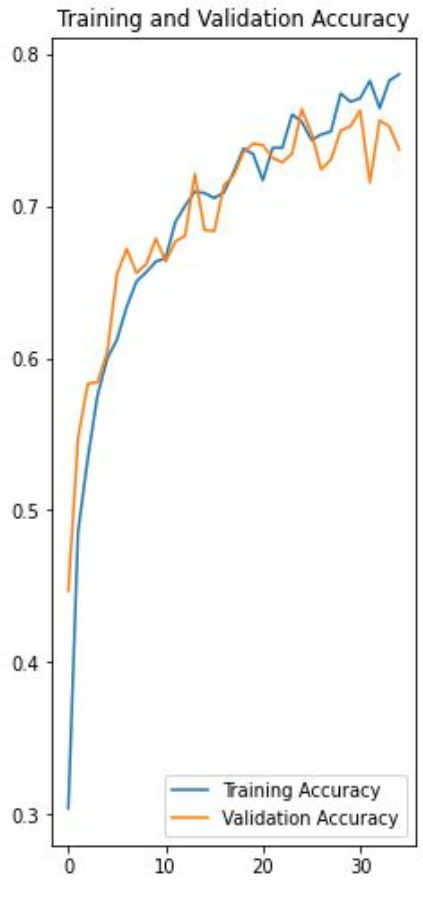
Result

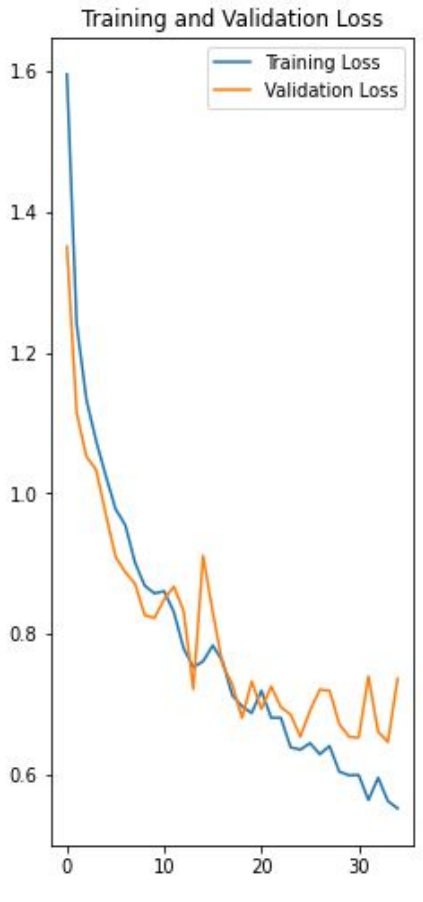
Base





Finetuned






Transfer Learning:
ResNet50

ResNet50:

A convolutional neural network that is 50 layers deep. Pretrained version of the network is loadable and are trained on more than million images from the ImageNet database.

Step 1

Get dataset ready for modeling

This is already set!

Step 2

Use ResNet layers.

For this project, all ResNet50 layers are kept on 'freeze' except the last one.

Step 3

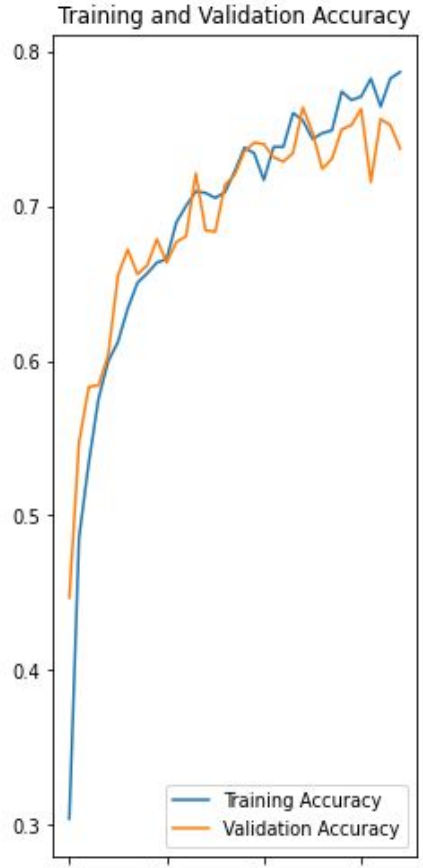
Connect the pretrained model with the layers of the model.

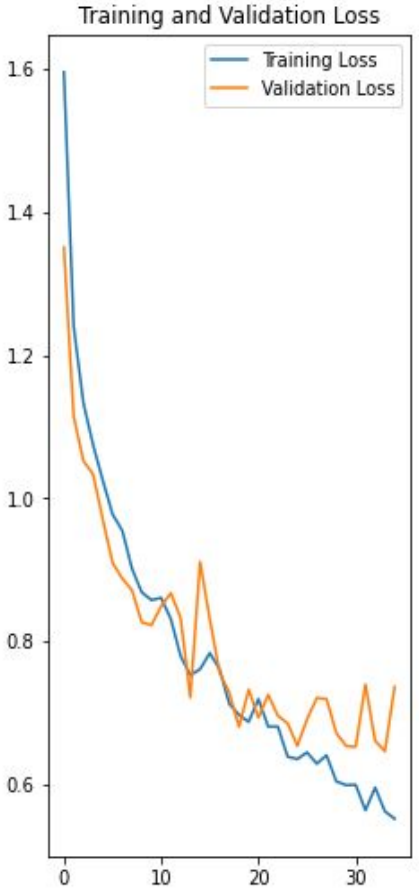
Adding Normalizers and Regularizers to avoid overfitting.

Transfer learning is using this pretrained network for fine tuning or feature extraction.

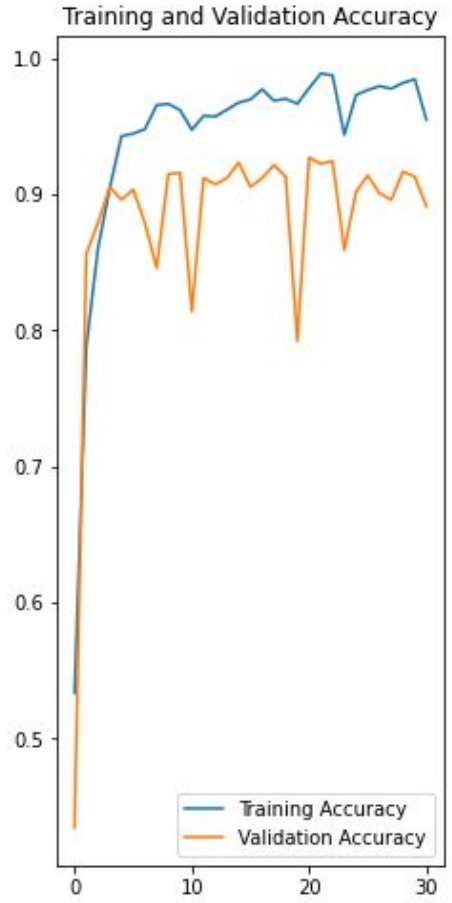
Result

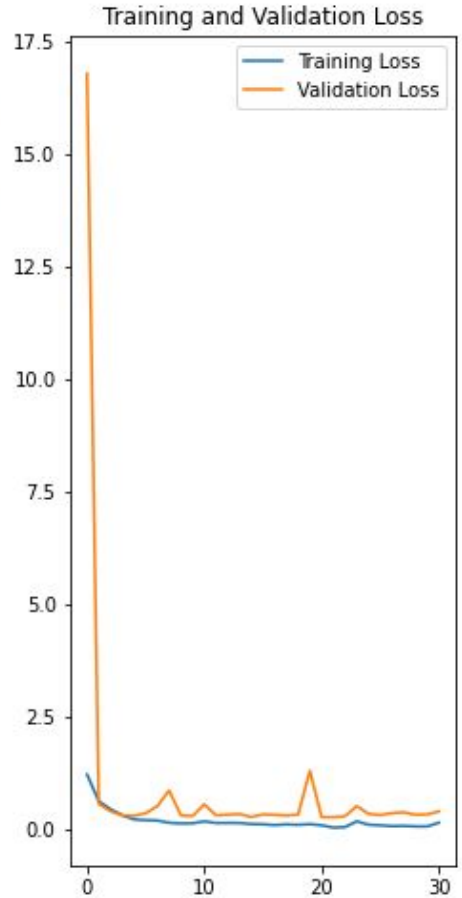
Finetuned





Transfer Learning





Model Validation Accuracy Scores:

Let's recap..

Base Model
70.32%

Finetuned Model
79.44%

With Transfer Learning
92.72%


Now, let's see how the best
model performed..

Test Evaluation

	Dandelion	
Other	255	0
Dandelion	113	154
	Predicted Dandelion	Predicted other type

	Sunflower	
Other	409	45
Sunflower	16	52
	Predicted Sunflower	Predicted other type

	Daisy	
Other	462	58
Daisy	2	0
	Predicted Daisy	Predicted other type

	Rose	
Other	499	6
Rose	12	5
	Predicted Rose	Predicted other type

	Tulip	
Other	302	52
Tulip	18	150
	Predicted Tulip	Predicted other type

This image most likely belongs to Rose with a 41.45 percent confidence.

Image Class = Tulip

```
This image most likely belongs to Rose with a 41.45 percent confidence.
```

This image most likely belongs to Rose with a 99.99 percent confidence.

Image Class = Rose

```
This image most likely belongs to Rose with a 99.99 percent confidence.
```

Image Class = Sunflower

```
This image most likely belongs to Sunflower with a 99.56 percent confidence.
```

Image Class = Dandelion

This image most likely belongs to Dandelion with a 96.93 percent confidence.

Image Class = Tulip

```
This image most likely belongs to Tulip with a 99.79 percent confidence.
```

Image Class = Rose

This image most likely belongs to Rose with a 47.12 percent confidence.

Image Class = Tulip

```
This image most likely belongs to Dandelion with a 85.35 percent confidence.
```

Image Class = Daisy

```
This image most likely belongs to Daisy with a 99.58 percent confidence.
```

Image Class = Sunflower

This image most likely belongs to Sunflower with a 99.16 percent confidence.

Image Class = Rose

```
This image most likely belongs to Rose with a 99.96 percent confidence.
```

Image Class = Tulip

```
This image most likely belongs to Rose with a 66.86 percent confidence.
```

This image most likely belongs to Sunflower with a 92.05 percent confidence.

Image Class = Tulip

This image most likely belongs to Sunflower with a 92.05 percent confidence.

Conclusion:

Five types of flowers under five classification images are sunflower, rose, tulip, dandelion, and daisy are chosen to train a convolution neural network. Data augmentation techniques played a huge part on fine tuning this neural network.

However with same dataset used for testing and validation of ResNet50 attached to a convolution neural network for classification, it is observed that the images are classified correctly at a higher accuracy rate, and misclassified understandable images and the need for human insight and better dataset. This shows the effectiveness of deep learning algorithm.

Next Steps:

- Hypertuning the parameters
- More images!
- Create a Model that doesn't just return a confidence rate on its classification, but also more information for the type of flower plant or tree.
- Incorporate object detection: Computer Vision

Thank You!

Questions?