GERBERA FLOWER DETECTION BY MACHINE LEARNING APPROACH

BY

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project/internship titled **"**GERBERA FLOWER DETECTION BY MACHINE LEARNING APPROACH**"**, submitted by Hasibul Islam, ID No:181-15-11103 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held 24/01/2023.

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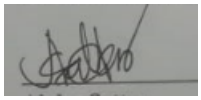

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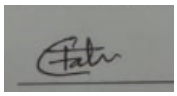

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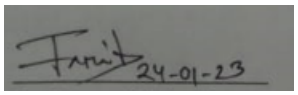

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DECLARATION

I hereby declare that this project has been done by us under the supervision of Ms. Subhenur Latif Assistant Professor and co-supervision Md. Tarek Habib Assistant Professor, Department of CSE Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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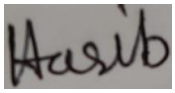

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ABSTRACT

Gerbera species from South Africa were formally recognized for the first time in 1889. It is now protected in its native habitats across the tropics. The flower has become a common ornament for backyard gardens in many parts of the world. Gerberas are originally cultivated in Magura. Many young farmers are engaged in farming in Faridpur, Jashore, and other locations. Godadhordangi village, Aliabad union, Faridpur Sadar upazila has a Gerbera flower garden. This "gerbera flower Detection by Machine Learning Approach" improves our life while also expanding our floral knowledge. This paper presents a strategy for finding and identifying indigenous gerbera blooms in Bangladesh using image processing and neural networking techniques. The project effort aims to use computer vision and AI techniques to teach the next generation how to distinguish Bangladeshi flowers, since most young people in the city have no idea how to differentiate between traditional and desi gerbera blooms. I assessed the experiment method's credibility using my own Dataset of 3140 sample images. To detect and analyze the color of a gerbera flower, the proposed model employs a sequential grassfire algorithm in conjunction with pre-processing approaches such as noise cancellation, gray scalability, the flood-fill approach, and binarization. A convolutional neural network (CNN) and the Visual Geometry Group (VGG-16) technique were then utilized to identify and recognize the observed gerbera flower.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Before three important holidays in February, florists in Godkhali, the "flower capital" of Bangladesh, in Jessore's Jhikorgacha upazila, anticipate that flower sales would bring in Tk 30-35 crore. On these three occasions—Pahela Falgun on the 14th, Valentine's Day on the 14th, and International Mother Language Day on the 21st—flowers are in high demand. Growers and merchants claim that sales of flowers have increased so far in current season, which started on Thursday. All 52 of the country's districts have their needs met by Godkhali Wholesale Flower Market. After satisfying domestic demand, the upazila flowers are sold to the UAE, Malaysia, Singapore, India, and South Korea. Following the harvest of rice and jute, farmers in the Godkhali and Panisara unions produce flowers.1,500 to 2,000 hectares of flowers, including marigolds, gladioli, tuberose, roses, and gerberas, were planted this year. A floriculturist named Md. Jalil claims that each rose cost around Tk. 4 to cultivate and is worth between Tk. 8 and Tk. 10 when it is harvested. Consequently, there is a sizable profit margin. On his 18-bigha plot, Abul Bashar, a different floriculturist, claimed to have grown gladiolus, gerbera, double tuberose, and hybrid tuberose. Bashar stated that while he once experienced losses, he no longer does. He plans to sell flowers this month for Tk. 1.50 to 2 lakh. In my project, a Visual Geometry Group and a deep neural network that can distinguish between common and regional gerbera flowers will be developed. The classification of gerbera flowers is the subject of two contributions made by this study. The first is a study that uses general-purpose images and data augmentation techniques to classify gerbera flower circumstances in a multi-class setting. For the feature extraction method, a variety of the architectures of convolutional neural network (CNN) and visual geometry Group (VGG-16) were researched. The creation of a fresh, original dataset with images of six different gerbera flower varieties is the second contribution.

1.2 Motivation

This idea originates from the fast-paced way of life of contemporary individuals in the twenty-first century. I've seen that a lot of individuals are ignorant of gerbera flowers' name and standard. Today, gerbera flowers are often used in a range of social contexts. The colors and elegance of gerbera flowers are unknown to many city people. On sometimes, the flower store defrauds us in a number of ways. If we are aware of the hue and cost of gerbera flowers, we might be able to avoid being conned.

1.3 Rationale of the Study

Only a few gerbera flower research initiatives make use of technology and feature extraction techniques. Gerbera blossoms from Bangladesh are exceedingly unique, and gerbera flower identification has gotten little attention. Long-term effects of my research on gerbera flower image processing can be seen in the following fields:

. To provide more detailed information on gerberas from Bangladesh.

. To provide details about each gerbera bloom, such as its quality.

. Leveraging the gerbera flower's unique qualities of form and color to address background and variety difficulties.

. To promote gerberas from Bangladesh to the rest of the world.

1.4 Research Problems

- ✓ Is the system using sample data to predict actual output?
- ✓ Using a machine learning system, can it identify six categories correctly?
- ✓ Is it true (yes/no) that all algorithms work correctly?
- ✓ Which algorithm performs better?

The main reason for decreased production and financial losses for growers of gerbera flowers is incorrect species detection in gerbera blooms. The manual method of the human eye may occasionally have difficulty identifying various species of gerbera flowers and farming them. Therefore, any potential remedy that is efficient, reliable, and automated will stimulate people's interest in this problem. Image processing is increasingly widely used in the field of species detection, particularly in farms and people, to help human specialists administer the proper care. The conventional method of getting accurate findings can be improved with the use of image

processing technologies. I employed the visual geometry group and convolutional neural networks, and I got good results from both. On the other hand, the alternative method did not provide us with precise or timely information.

1.5 Expected Outcome

Analyzing a digital image using a Matlab program is known as digital image processing. Discussions include appearance, translation, smearing, edge improvement, and other techniques. The use of digital image processing in the marine sector and other sectors, such as gerbera flowers, is still being studied by researchers. In this project, I'll create a model for identifying gerbera flower images and evaluate it using various machine learning techniques. To obtain a more accurate outcome, we employed 90% of the data is training, and 10% is test. The training data set consists of completely necessary for the validity of our conclusion [7]. When we have finished all the necessary steps for our system, our machine learning system will be ready to start. I use a variety of strategies to provide accurate results. On this machine, I obtained almost flawless accuracy using VGG-16.

1.6 Layout of the Report

Chapter 1: Introduction

This part included my motivation for doing the study, its purpose, research questions, and anticipated results.

Chapter 2: Background

This part will cover my research, comparative studies between my developed model and existing models that are comparable, as well as the challenges I faced.

Chapter 3: Research Methodology

The methodology I utilized for my research, including the methods I followed and the words I employed, will be covered in this part.

Chapter 4: Discussion of experimental results

I'll go over the findings of my study investigations in this section. I'll discuss the results I got from using machine learning algorithms on my data.

Chapter 5: Summary, conclusion, suggestion, and implications for further study

The summary and finally, recommendations, as well as future suggestions direction of my work are covered in this part.

CHAPTER 2
BACKGROUND

2.1 Introduction

Flowers are employed for aesthetic purposes across a variety of contexts and seasons. Flowers of many kinds, some of which are particularly beautiful and brilliant, are all around us. One such flower is the gerbera. The Gerbera flower is available in many different shades and varieties in Bangladesh. Currently, commercial gerbera flower cultivation is taking place in Bangladesh, and the business is flourishing [1]. We will study about the many hues of gerbera flowers in this project. This section will outline the challenges with the research and my related project. We'll look at in-depth study publications that discuss my endeavors in the relevant area of job. Before describing strategies to improve accuracy in the challenge part, I will quickly discuss the guiding concepts of the overview part, I discussed my topic.

2.2 Associated Works

The findings demonstrate that this system's algorithm is capable of recognizing and counting the number of gerbera flowers in RGB images [4]. The use of CNN for picture segmentation and classification is discussed in this section. The job that is equivalent to the flower color and difference challenge is then explained [5]. A threshold-based technique is used to split the flower, and the scientist answers, unit of measurement, and texture selections—in particular, gray level co-occurrence matrix, color texture moments (CTMs) (GLCM), and CTMs—are recovered [9]. We'll examine in-depth research papers that relate to what I do in the relevant industry. In the overview phase, I will briefly go over the fundamentals of my subject before recommending ways to increase accuracy in the challenge section [11]. Adjust the loss function and other CNN parameters to come up with a solution for gerbera flower detection.

2.3 Research Summary

In my project, I'll be employing a number of complex machine learning techniques to create a machine learning model for categorizing gerbera blossoms and determining which varieties will endure over time. Several related studies that used different methods and different types of data were undertaken. Little research has been done on identifying gerbera flowers, and Bangladeshi gerbera blooms are unique. Someone used their personal information, and someone other used various web resources in different ways. I run my business with data I acquire myself. I utilized two methods to assess the prediction model's level of accuracy. The accuracy increases with system quality.

Scope of the Problem

Every research project has a scope for the issues it will explore. In my art, there are no exceptions. Simple to use and limited to the information I have acquired, my data collection should be useful. I must properly train my collected data before employing algorithms. If I don't get this right, My output will be inappropriate and will not adequately portray the scenario in real life. I need to approach the issue cautiously and systematically if I wish to succeed.

Challenges

Without difficulties, nothing can be done. Any phase of every action introduces fresh issues. The hardest part of my work has been getting information from the local field. Local farmers in Jessore Gadkhali provided the photos I used for my study. By 9 a.m., local farmers close their gerbera flower stands and depart from their homes. Plants for gerberas are raised in polythene-lined pots that are always kept closed from the outside. to collect the pictures. To collect the photos, I had to call the farmers out of their homes, open the gerbera flower bouquets, and then go back in. No outsiders are allowed in the order to protect the gerbera blooms. I had to browse through a lot of gerbera flower sets to find gerbera flower pictures. For me, it was the most challenging challenge. The farmers agreed to let me in and take the photos after I explained my research to them. I have to pay to submit a pair of two gerbera flowers.

CHAPTER 3

THE METHODOLOGY OF RESEARCH

3.1 Introduction

The field research instruments, data collection, study issues, pre-processing, analysis, mentorship, verification, and implementation will all be covered in depth in this part, along with my research approach and methods. As depicted in the accompanying figure 3.1.

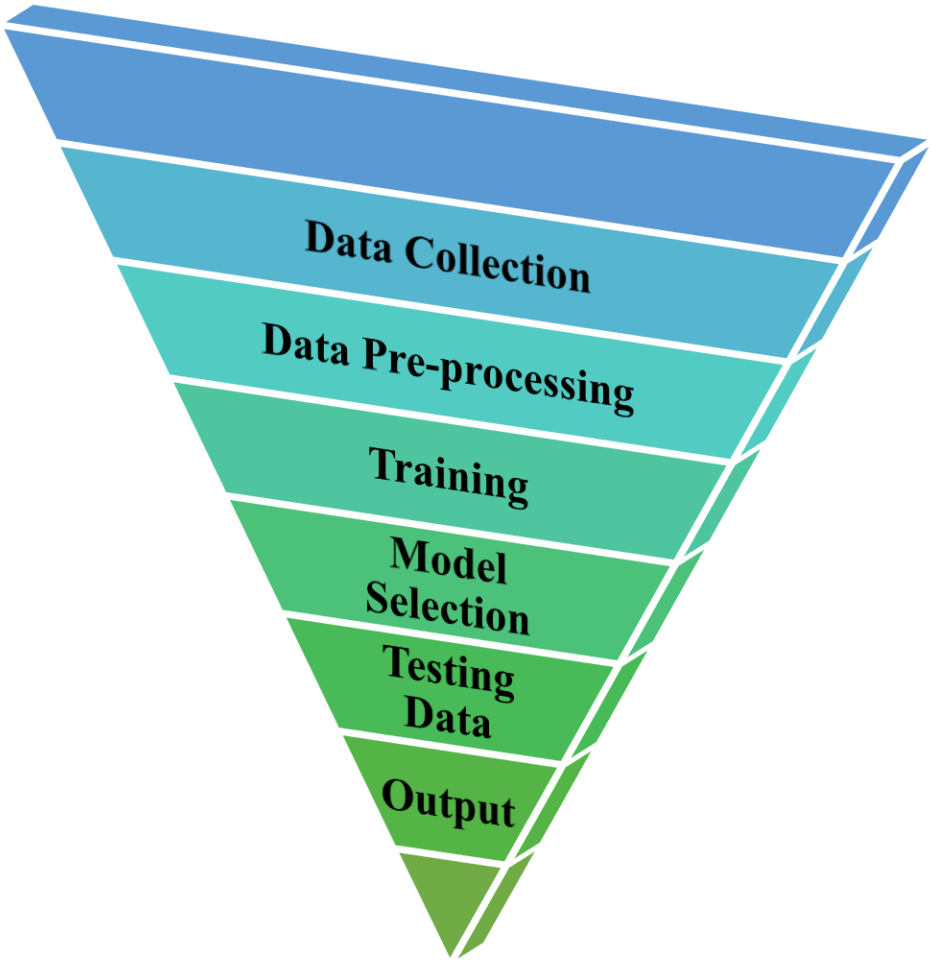

Figure 3.1: A Quick Look at Methodology

3.2 Topic and Tools of Study

In my research, I'm separating gerbera blossoms using a variety of machine learning methods. Therefore, A Comparative Study on Gerbera Flower Image Detection Using Machine Learning Algorithm is the subject of my research. Information is, in my opinion, the test's most crucial component. A crucial step for a professional is finding excellent data and a terrific technique or model for my research task. The exam papers will be the same ones I have to take. I had a few options available to me at the moment.

. What details need to be gathered?

. Which data organization method works the best?

. What labels are appropriate for each item of data?

. How do you know the data we gathered is accurate?

3.3 Procedure for Data Collection

I collected data from a local farmer's field in the village of Jessore Godkhali and altered it myself to create an open-source dataset that may help with future computer vision research. This theory is an ethical strategy to create a dataset that will be shared while respecting the content sources. It is an image processing approach. The images created as part of this research are included in the Gerbera Flower Dataset. Which shown in following figure 3.2.

Figure 3.2: Flower Data

The endless photographs, including weather images, were gathered and saved on the local disk, and the dataset was created. The dataset was classified by looking for image elements such as gerbera-red, gerbera-white, gerbera-light-pink, gerbera-yellow, and gerbera-pink. The dataset consists of six different types of gerbera flowers that were gathered from the aforementioned farmer fields; nevertheless, given that this is real-world data, any classification system for gerbera flowers should be able to handle it. The training set, which has about 3140 annotated images, includes the validation images. Pictures don't have fixed proportions and exist in a variety of sizes.

The images don't have borders [1]. Based on the class, each photo is saved in a separate folder and only has one gerbera flower category. The images are kept in folders, as illustrated in Figure 3.3

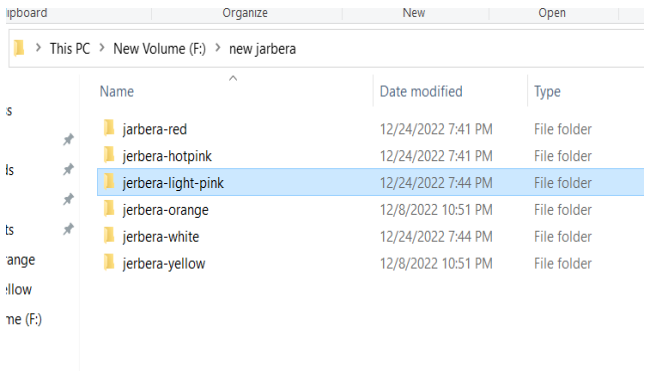

Figure 3.3: Image Folders

3.4 Data Preparation

First, the libraries that will be used in this system must be imported. As illustrated in the figure below 3.4.

```
In [1]: import tensorflow as tf
        import numpy as np
        import matplotlib.pyplot as plt
```

```
In [5]: from keras.layers import Input,Flatten,Dense
        from keras.models import Model
        from keras.applications.vgg16 import VGG16
        from keras.models import Sequential
        from glob import glob
```

Figure 3.4: Import libraries

View image: The connection to our photo library is saved as a variable when I create a function for processing picture folders into arrays. Figure 3.5 provides an illustration of this.

```
In [2]: base_dir=r"F:\new jarbera"
```

Figure 3.5: Finding Data

Image resizing : I must establish a minimum image size for all images input into Since the size of the images the camera takes and sends to our AI algorithms varies, so do my AI algorithms. original measurements (360, 480, 3), and so on. — (RGB channels, width, height, and no)

Resized (224, 224, 3). (224, 224, 3).

Figure 3.6 shows an example of this.

```
In [3]: IMAGE_SIZE=224
        BATCH_SIZE=64
```

```
In [6]: IMAGE_SIZE = [224, 224]
        vgg = VGG16(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top=False)
        vgg.input
```

```
cnn=tf.keras.Sequential()
cnn.add(tf.keras.layers.Conv2D(filters=6,padding='same',strides=2,kernel_size=3,activation='relu',input_shape=(224,224,3)))
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2,strides=2))
```

Figure 3.6: Pre-processing of Data

3.5 Training

By removing the identical per mean data point calculated on the train set, I center my visual data. I use arbitrary pinching, vertical rotations, brightness, intensity, and chromatic disturbances in my data augmentation for training. Which shown in following figure 3.7.

```
train_datagen=tf.keras.preprocessing.image.ImageDataGenerator(
    rescale=1./255,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    validation_split=0.1
    )
```

```
train_datagen=train_datagen.flow_from_directory(
    base_dir,
    target_size=(IMAGE_SIZE,IMAGE_SIZE),
    batch_size=BATCH_SIZE,
    subset='training'
)
```

Figure 3.7: training set of data

3.6 A computer learning algorithm

I suggest a method utilizing the group using visual geometry and convolutional neural network (CNN) (VGG-16) Classifier algorithms on experimental data set due to their known accuracy rates. All Python algorithms and modules are built on NumPy, Pandas, and Matplotlib.

Techniques and Algorithms

CNN: Conv Nets, also known as convolutional neural networks, are a type of neural network that analyzes visual input. Convolutional networks are regularized forms of multilayer perceptron (completely linked networks). Since the network made use in the mathematical formula for convolution, it was given "Convolutional neural network" is the term. Convolution is a kind of linear process. Convolutional neural networks are primitive neural networks that use convolution instead of traditional matrix multiplication at at least one layer. An inlet layer, an exit layer, and numerous hidden layers comprise a deep neural network. Convolutional layers

can be used to imitate doubling or another scalar product. The input signal and final convolution are followed immediately by the pooling layers, entirely connected layers, and normalizing layers. These layers are known as hidden units because the activation function and final pooling layers hide their underlying system components. In the final inversion, backpropagation is frequently used to boost the final output weighting. [10] As illustrated in Figure 3.8.

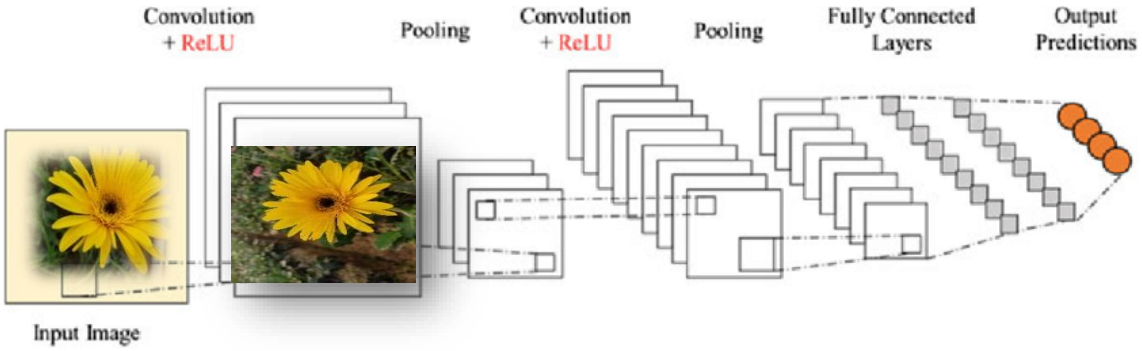

Figure 3.8: Convolutional layers apply

Convolutional:

The tensor's form (number of images) In terms of picture dimensions, there are x (image width), image height, number of pictures, number of images, number of images, number of images, number of images, number of images, number of images, number of images, and so on (number of images), etc (image depth) (image depth). Pictures: x (number of images), x (number of photographs), x (number of images), x (number of images), x (number of images), x (number of images), Pictures: x Number of photos: x Number of photos: (number of images) (Number of Images) x (Image Width) x (Image Height) x (Amount of Pictures) x (number of images). The following should be present in a neural network's convolutional layer [8]:

• The breadth and length of fully coupled cones in a neural network serve as indicators (hyper-parameters).

• The service's overall upstream and downstream channel count (hyper-parameter).

• The receptive field network's size (depth) and the context of the linear combination must match (input channels).

Pooling: Convnets may incorporate national or layers using global pooling to accelerate fundamental processing. reducing pooling layers data dimensionality involves creating a nerve cell at the subsequent layer by merging the responses of neuron groups at one level. Local

pooling connects a number of entities, maybe two or more. All of the neurons in the convolutional layer are impacted by global pooling. Pooling can also be used to calculate the maximum or average value. Max pooling uses the greatest value from each cluster of neurons in the preceding layer. The approximate number of each constellation of synapses from the preceding layer is utilized for batch normalization.

Total Connectivity: Each cell on a single level is attached to each perceptron in bindable layers. It functions similarly to a typical inter perceptron neural network in theory (MLP). The compressed grid is transmitted over a fully linked layer in order to identify the pictures.

Receptive Field: In a CNN design, each synapse gets input from a certain number of the layer above it sites. Every component of the layer preceding it receives data from every cell in a layer that is entirely connected. Only a little percentage of the previous step's input is passed on to the neurons of a convolutional layer. Squares are the most prevalent type of subarea. The area of a cell that accepts input is called the receptive field. As a result, the whole preceding layer forms the receptive field of a wholly linked layer [3]. The receptive area of a convolutional layer is less than the outer surface area of the layer beneath it. Figure illustrates how 3.9.

Figure 3.9: Convolutional layers apply

Weights: Each neuron in a neural network applies a formula to the receptive field input parameters from the preceding layer to analyze a final output. The method used to process the incoming data is determined by a bias and weight matrix (Often, actual numbers). A neural network iteratively adjusts its biases and weights in order to learn. A bias and a collection of weights that characterize the properties of the input make up filters.

VGG stands for Deep Convolutional Neural Networks: The Oxford Visual Geometry Group's VGG-16 Net, which won the 2014 ImageNet ILSVRC competition, came in first. The 3x3 Convolutional and Max. Pooling layers make up the overall VGG design, which also includes a fully connected block at the bottom. The pretrained model may be used with Keras,

TensorFlow, Caffe, Torch, and other well-known deep learning libraries because it is open source. In their initial investigation, they showed how CNN model thickness affected efficiency in a big picture recognition setting. They used extremely small (3x3) convolution filters throughout the design and increased the depth to 16–19 hidden layers to show a significant advancement over earlier setups. Their discoveries formed the basis of the 2014 ImageNet Challenge submission by their team, which won first and second place honors in the localization and classification challenges. Their two most effective Conv Net models are now freely used by others [7]. Which shown in following figure 3.10.

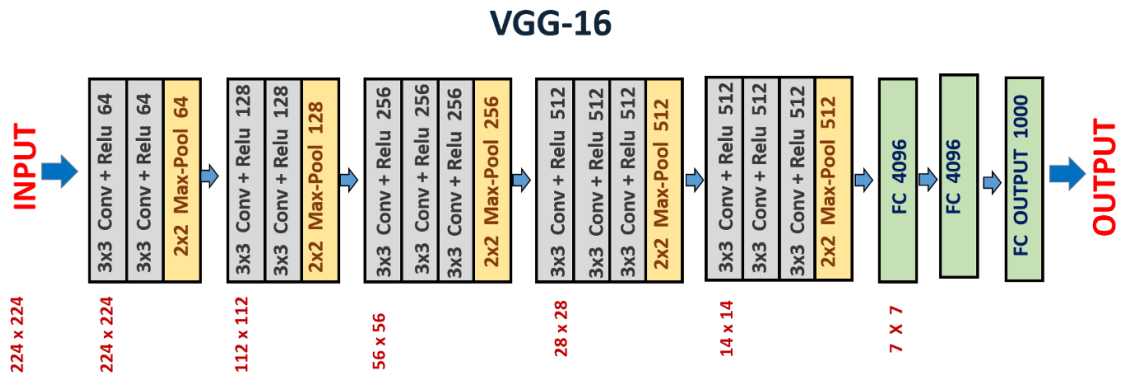

Figure 3.10: Layers of Very Deep Convolutional Networks are used.

VGG-16 and CNN Layer Architecture:

• **Convolution:** Convolutional layers convolve around an image to identify edges, lines, color blobs, and other visual elements. Hyperparameters for causing nonlinearity in convolutional layers include the number of channels, frequency response, speed, buffer, and initiation functions.

• **Max Pooling:** By removing some of a picture's pixels, the dimensionality of the picture is reduced when layers are pooled. Max Pooling replaces a n n area with the biggest pixel value from that region in order to down sample a picture.

• **Dropout:** Dropout is a quick and efficient method for minimizing overfitting in neural networks while they are being trained. A neuron is activated only when it has a probability of p

and deactivated otherwise to achieve dropout. The network is hence compelled to refrain from discovering redundant data

• **Flatten:** Prior to sending the output from the convolution layers to the Dense layers, it is flattened.

• **Dense:** The table below lists the configuration (number of filters) used in the VGG-16 and VGG-19 versions of the design in the two far-right columns. Dense layers are completely connected traditional networks that employ an activation function to convert the numbers of convolutional layers into the proper labels (SoftMax is used here).

3.7 Statistical Analysis

3140 pictures from six different classes are in my dataset. There are 165 photos of gerbera red, 389 photographs of gerbera hot pink, 454 photographs of gerbera light pink, 682 photographs of gerbera orange, 774 photographs of gerbera white, and 676 photographs of gerbera yellow. In this case, I used 90% train data and 10% test data to build my model. To improve the accuracy of MY model, I used machine learning techniques as the Visual Geometry Group (VGG-16) and Convolutional Neural Network (CNN) [1]. In Figure 3.11, I demonstrate the diagram of the dataset's use for the suggested model. As seen in Figure 3.1

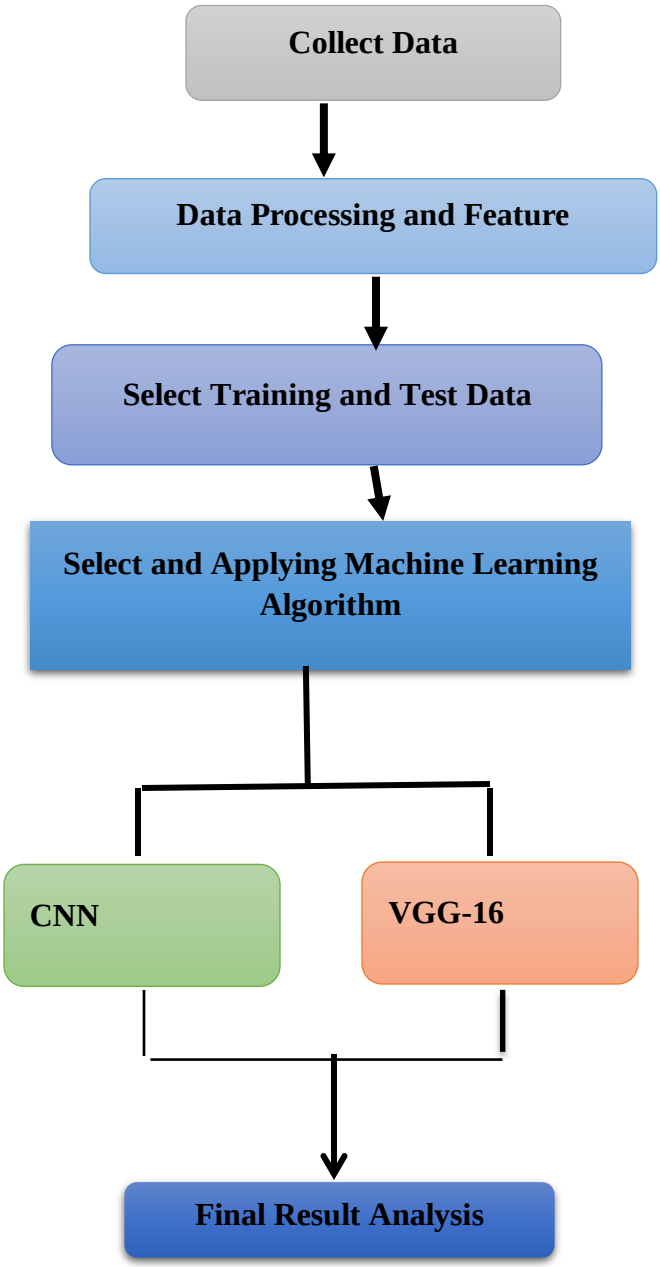

Figure 3.11: Diagram of the proposed model

I describe in further detail how I carry out my research in this graphic. depth. Figure 3.12 shows how I can work my way toward my goal in stages.

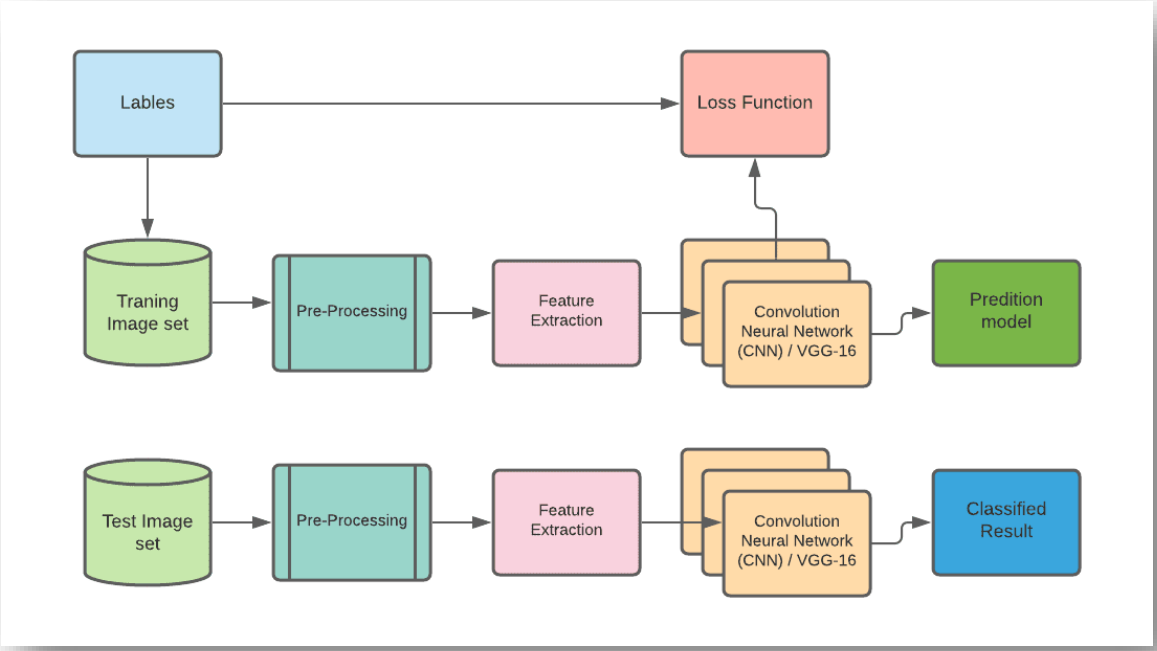

Figure 3.12: Model Structure Under Discussion

3.8 Implementation Requirements

Python version 3.7

Python 3.7 is an alternative to Python. It has a high degree of abstraction and is a sophisticated programming language. It is used by most researchers to carry out their study. It is a widely recognized programming language for AI-related work, and the younger generation of programmers love it for how easy it is to learn and understand.

• The Jupyter Notebook

For data developers, Jupyter Notebook is a free, open-source online tool that enables them to browse and share documents that contain narrative prose, active script, formulas, analytical output, graphs, and other multimedia elements.

• Hardware/Software Prerequisites

. an operating system (Windows 7/8/10 or later) that is completely functioning
. Internet Explorer (preferably Google Chrome, Microsoft Edge, or Mozilla Firefox)
. A hard drive (Minimum 4 GB)
. A Ram (More than 4 GB)

CHAPTER 4

RESULTS OF EXPERIMENTS AND DISCUSSION

4.1 Prepare for the Experiment

To use the model and execute the code, I first collected the data. The system is as follows**:**

• My data had been preprocessed at the time. I took pictures from the Jessore godkhali local farmer field since I am working with gerbera flower pictures.

• My data had been preprocessed at the time. The dataset consists of six different types of gerbera flowers that were gathered from the aforementioned farmer farms. Each shot is kept in a different folder according to the class and only corresponds to one type of gerbera flowers.

• My data had been preprocessed at the time. I've also gathered data online using Google Forms.

• The data is prepared for usage in a number of ways once I label it.

• At that time, I had completed and standardized the information, allowing me to start the planning.

• My data had been preprocessed at the time.

4.2 Model Summary

All around us, there are several flower species in a range of colors. One such flower is the gerbera. Gerbera flowers from Bangladesh are available in a range of hues, including red, yellow, pink, and white. When we purchase flowers from our neighborhood flower shops, we frequently observe the many colors of gerbera flowers. The color of gerbera daisies is something that many of us are unaware of. We usually receive instructions from the flower shop to bring one color of flower and another color of flower. So, utilizing CNN and Vgg-16, I was able to ascertain the gerbera flower's color correctness throughout my inquiry. In this way, we may discover the color of gerbera flowers, assess how accurate the color is, and choose the right flower.

4.3 Experiment Analysis and Results

After data processing, I segregate forecasts in the work holder using a variety of calculations. I'll quickly go over the results of certain computations. To assess the precision of my model, I combine my general takeaways from reading a number of articles with a number of AI calculations. With an average accuracy of greater than 100%, I am incredibly accurate. I use my approach with a person's data to determine our projected level. I've seen that the computer can quickly predict outcomes based on the information given. I obtained almost identical multiple sorts of accuracy using Convolutional Neural Network (CNN) Table 4.1 displays my results using the Visual Geometry Group (VGG-16) Classifier, which were 0.80 accuracy and 1.00 accuracy, respectively.

Table 4.1: Precision Table:

Formula Name	**Accuracy**
Convolutional Neural Network (CNN)	78%
Visual Geometry Group (VGG-16)	86%

CNN:

The recognition rate was 78%, while the accuracy rate was 86%. The localization technique was unable to locate all of the gerbera flowers in an image since it was only intended to locate one particular image enhancement. The results achieved utilizing the top heterogeneous network topologies and training settings are as follows:

Training Accuracy: 78%

Validation accuracy: 86%

The CNN Classifier algorithm result is shown in Figure 4.1:

```
In [17]: cnn=tf.keras.Sequential()
cnn.add(tf.keras.layers.Conv2D(filters=6,padding='same',strides=2,kernel_size=3,activation='relu',input_shape=(224,224,3)))
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2,strides=2))

cnn.add(tf.keras.layers.Conv2D(filters=32,padding='same',strides=2,kernel_size=3,activation='relu'))
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2,strides=2))

cnn.add(tf.keras.layers.Conv2D(filters=32,padding='same',strides=2,kernel_size=3,activation='relu'))
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2))

cnn.add(tf.keras.layers.Flatten())
cnn.add(tf.keras.layers.Dense(6,activation='softmax'))
```

```
In [18]: cnn.compile(optimizer=tf.keras.optimizers.Adam(),loss='categorical_crossentropy',metrics=['accuracy'])
```

```
In [19]: history = cnn.fit(train_datagen,epochs=10,validation_data=test_datagen)
```

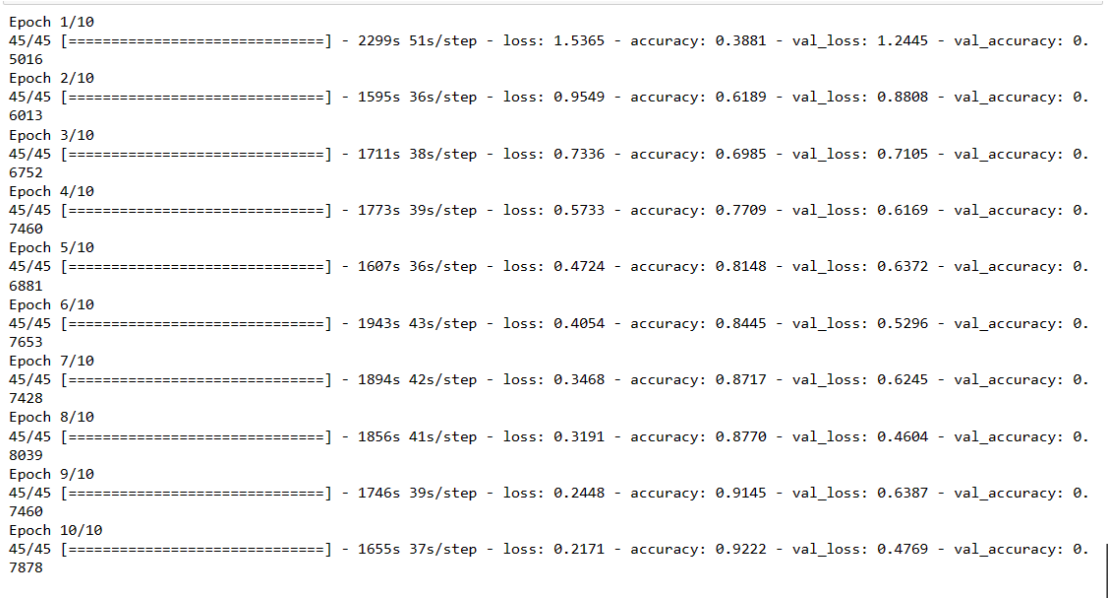

Figure 4.1: (CNN) Algorithm Output

The accuracy of CNN model algorithm shown in table 4.2.

Table 4.2: CNN's accuracy table:

Exercise Loss	**Training Precision**	**Loss of Validation**	**Validation Exactness**
1.6938	0.3881	1.5365	0.50
0.9549	0.6189	1.8808	0.60
0.7336	0.6985	1.7105	0.67
0.5733	0.7709	1.6169	0.74
0.4724	0.8148	1.6372	0.68
0.4054	0.8445	0.5296	0.76
0.3468	0.8717	0.6245	0.74
0.3191	0.8770	0.4604	0.80

0.2448	0.9145	0.6387	0.74
0.2171	0.9222	0.4769	0.7878

Performance Evaluation of the CNN Model:

model failure: the figure 4.2, we can see the CNN Classifier algorithm Loss Graph:

```
In [22]: plt.plot(history.history['loss'])
         plt.plot(history.history['val_loss'])
         plt.title('Model Loss')
         plt.ylabel('Loss')
         plt.xlabel('Epochs')
         plt.legend(['train', 'test'])
         plt.show()
```

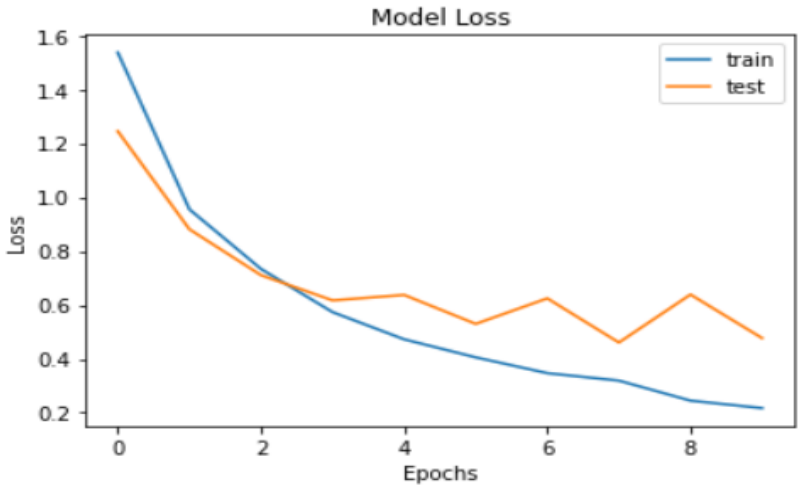

Figure 4.2: Graph of the CNN Algorithm Model Loss

Model Reliability: The Figure 4.3, we can see the CNN Classifier algorithm accuracy Graph:

```
In [23]: plt.plot(history.history['accuracy'])
         plt.plot(history.history['val_accuracy'])
         plt.title('Model Accuracy')
         plt.ylabel('Accuracy')
         plt.xlabel('Epochs')
         plt.legend(['train', 'test'])
         plt.show()
```

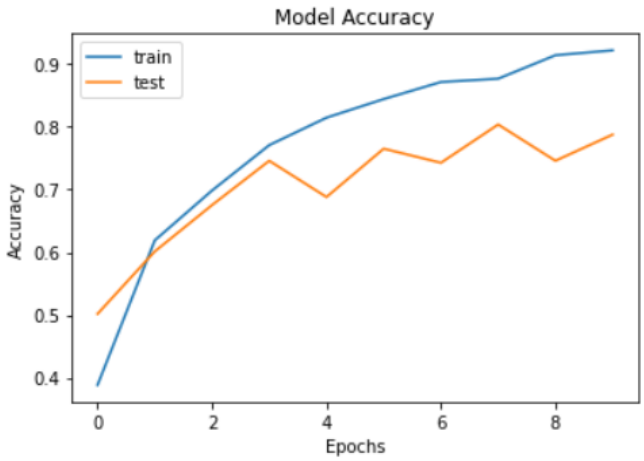

Figure 4.3: Graph of CNN Algorithm Model Accuracy

VGG-16:

Both the precise rates for training and validation were 100%. Now let's look at our model and its results:

Library of the Visual Geometry Group (VGG-16) : The Figure 4.2, we can see the VGG-16 Model import libraries:

```
In [5]: from keras.layers import Input,Flatten,Dense
        from keras.models import Model
        from keras.applications.vgg16 import VGG16
        from keras.models import Sequential
        from glob import glob
```

Figure 4.4: import libraries for the VGG-16 Model

```
In [9]: x = Flatten() (vgg.output)
        prediction = Dense(len(folders), activation='softmax')(x)

        model = Model(inputs=vgg.input, outputs=prediction)
        model.summary()
```

```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_1 (InputLayer)        [(None, 224, 224, 3)]     0
 block1_conv1 (Conv2D)       (None, 224, 224, 64)      1792
 block1_conv2 (Conv2D)       (None, 224, 224, 64)      36928
 block1_pool (MaxPooling2D)  (None, 112, 112, 64)      0
 block2_conv1 (Conv2D)       (None, 112, 112, 128)     73856
 block2_conv2 (Conv2D)       (None, 112, 112, 128)     147584
 block2_pool (MaxPooling2D)  (None, 56, 56, 128)       0
 block3_conv1 (Conv2D)       (None, 56, 56, 256)       295168
 block3_conv2 (Conv2D)       (None, 56, 56, 256)       590080
 block3_conv3 (Conv2D)       (None, 56, 56, 256)       590080
 block3_pool (MaxPooling2D)  (None, 28, 28, 256)       0
 block4_conv1 (Conv2D)       (None, 28, 28, 512)       1180160
 block4_conv2 (Conv2D)       (None, 28, 28, 512)       2359808
 block4_conv3 (Conv2D)       (None, 28, 28, 512)       2359808
 block4_pool (MaxPooling2D)  (None, 14, 14, 512)       0
 block5_conv1 (Conv2D)       (None, 14, 14, 512)       2359808
 block5_conv2 (Conv2D)       (None, 14, 14, 512)       2359808
 block5_conv3 (Conv2D)       (None, 14, 14, 512)       2359808
 block5_pool (MaxPooling2D)  (None, 7, 7, 512)         0
 flatten (Flatten)           (None, 25088)             0
 dense (Dense)               (None, 6)                 150534
=================================================================
Total params: 14,865,222
Trainable params: 150,534
Non-trainable params: 14,714,688
_________________________________________________________________
```

Figure 4.5: VGG-16 Model Summarization is used

The outcome of the (VGG-16) Classifier method is shown in Figure 4.6:

In [10]:
```
from keras import optimizers
#adam = optimizers.Adam()

#adam = optimizers.Adam()
model.compile(loss='categorical_crossentropy',
              optimizer='adam',
              metrics=['accuracy'])
```

In [11]:
```
history = model.fit(train_datagen,
                    steps_per_epoch=len(train_datagen),
                    epochs=10,
                    validation_data=validation_generator,
                   validation_steps=len(validation_generator)
                   )
```

```
Epoch 1/10
45/45 [==============================] - 2601s 58s/step - loss: 1.1764 - accuracy: 0.6331 - val_loss: 0.9126 - val_accuracy: 0.
6849
Epoch 2/10
45/45 [==============================] - 2328s 53s/step - loss: 0.3254 - accuracy: 0.9247 - val_loss: 0.7391 - val_accuracy: 0.
7717
Epoch 3/10
45/45 [==============================] - 2421s 53s/step - loss: 0.2123 - accuracy: 0.9526 - val_loss: 0.6796 - val_accuracy: 0.
7781
Epoch 4/10
45/45 [==============================] - 2316s 51s/step - loss: 0.1647 - accuracy: 0.9671 - val_loss: 0.5945 - val_accuracy: 0.
8650
Epoch 5/10
45/45 [==============================] - 2428s 54s/step - loss: 0.1116 - accuracy: 0.9788 - val_loss: 0.5972 - val_accuracy: 0.
8360
Epoch 6/10
45/45 [==============================] - 2391s 53s/step - loss: 0.0949 - accuracy: 0.9844 - val_loss: 0.6245 - val_accuracy: 0.
8296
Epoch 7/10
45/45 [==============================] - 2416s 53s/step - loss: 0.0854 - accuracy: 0.9841 - val_loss: 0.7232 - val_accuracy: 0.
7621
Epoch 8/10
45/45 [==============================] - 2389s 53s/step - loss: 0.0614 - accuracy: 0.9929 - val_loss: 0.6094 - val_accuracy: 0.
8103
Epoch 9/10
45/45 [==============================] - 2334s 53s/step - loss: 0.0518 - accuracy: 0.9940 - val_loss: 0.6212 - val_accuracy: 0.
8424
Epoch 10/10
45/45 [==============================] - 2158s 48s/step - loss: 0.0493 - accuracy: 0.9933 - val_loss: 0.6095 - val_accuracy: 0.
8617
```

Figure 4.6: Algorithm Output (VGG-16)

The accuracy of VGG-16 model algorithm shown in table 4.3.

Table 4.3: VGG-16 Accuracy Table:

Exercise Loss	Training Precision	Loss of Validation	Validation Exactness
1.1764	0.6331	0.9126	0.6849
0.3254	0.9247	0.7391	0.7717
0.2123	0.9526	0.6796	0.7781
0.1647	0.9671	0.5945	0.8650
0.1116	0.9788	0.5972	0.8360
0.0949	0.9844	0.6245	0.8296
0.0854	0.9841	0.7232	0.7921
0.0614	0.9929	0.6094	0.8103

0.0518	0.9940	0.6212	0.8424
0.0493	0.9933	0.6095	0.8617

Performance Evaluation of the VGG-16 Model:

Model Demise : The (VGG-16) Classifier algorithm model loss graph is shown in Figure 4.7.

```
In [12]: plt.plot(history.history['loss'])
         plt.plot(history.history['val_loss'])
         plt.title('Model Loss')
         plt.ylabel('Loss')
         plt.xlabel('Epochs')
         plt.legend(['train', 'test'])
         plt.show()
```

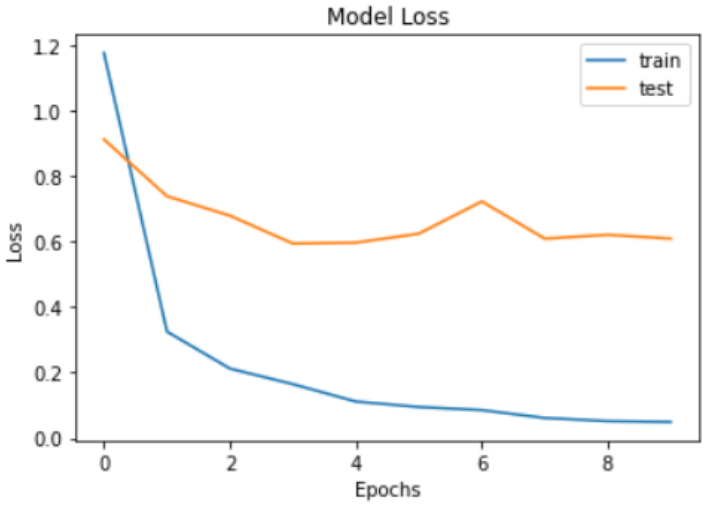

Figure 4.7: Graph of the VGG-16 Algorithm Model Loss

Model Accuracy: The (VGG-16) Classifier algorithm model accuracy graph is shown in Figure 4.6.

```
In [23]:
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.title('Model Accuracy')
plt.ylabel('Accuracy')
plt.xlabel('Epochs')
plt.legend(['train', 'test'])
plt.show()
```

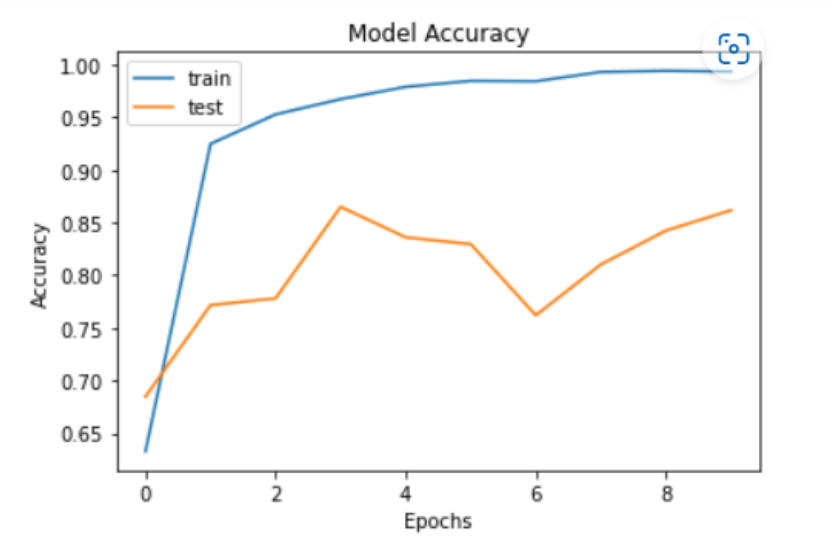

Figure 4.8: Accuracy Graph for the VGG-16 Algorithm

4.4 The Discussion

I updated both my dataset and my mode. I now know that this classifier can predict whether or not a dataset is correct over a wide range of datasets thanks to the improvements. My ability to accurately describe 100% of effect forecasts is becoming better. You can consider your options and select the best one using the example.

CHAPTER 5

Conclusion, summary, advice, and implications for further research

5.1 Overview of the Study

In order to estimate the color of a local gerbera flower in Bangladesh, I used the Vgg-16 and CNN Algorithms in my research. The general public will be greatly helped in understanding about the hue of gerbera flowers thanks to my research comparing some of the earlier hoaxes that were circulated. Due to a lack of accurate data, it is rather challenging for average people to determine the precise grade of gerbera flowers. We regularly fall victim to fraud when attempting to purchase gerbera flowers at typical outlets. From several neighborhood farms in Bangladesh, I gathered pictures of gerbera flowers. By using this method, we may purchase gerbera daisies in a variety of colors from several local markets without worrying about getting conned [5].

5.2 Conclusion

In the domains of science and technology, image processing is becoming more and more prevalent. Image processing technology is being used to enhance the manual approach technique and give more exact conclusions. This study used a custom dataset of 3140 photos to recognize and classify native Bangladeshi gerbera flowers using the VGG-16 and CNN (Convolutional Neural Network) methods. We tested the accuracy of the CNN algorithm first, then we compared it to the accuracy of the VGG-16 approach. Yellow gerbera flowers perform the best and red gerbera flowers perform the worst, with CNN's accuracy ranging from 78 to 86 percent. The training phase of the VGG-16 image classifier ends with a loss of 0.0102 and a training accuracy of 100%. The VGG-16 algorithm will outperform the others on our dataset. [11]

5.3 Recommendations

Large data analysis may reveal various significant advancements, such as identifying the cause of discouragement at work. Artificial intelligence ultimately controls the course of the globe. A crucial element of this breakthrough is AI. Therefore, developing frameworks that use AI to address human challenges is crucial to the development of current trends. As a result, this problem requires the focus of technicians and specialists. The most important AI component, in my opinion, is the information classifier. It could change how people see the thing in general.

Implications for Future Research

. I'll be using more information to improve the effectiveness of our analysis.

. In the future, I intend to use additional deep learning techniques.

. With my current technology, I can now identify the item from a still image. I'd want to go one step further and implement real-time photography.

. In our current way, I can only identify gerbera flower images; in the future, I will be able to identify gerbera flower issues.

. To more precisely identify the gerbera flower, I'll edit the sample data.

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[4] https://www.sciencedirect.com/science/article/abs/pii/S0168169920315428 Fernando Palaciosa,b , Gloria Buenoc , Jesús Salidoc , Maria P. Diagoa,b , Inés Hernándeza,b , Javier Tardaguilaa,b,∗ a Televitis Research Group, University of La Rioja, 26006 Logroño, Spain b Instituto de Ciencias de la Vid y del Vino (University of La Rioja, CSIC, Gobierno de La Rioja), 26007 Logroño, Spain c VISILAB group, University of Castilla-La Mancha, 13071 Ciudad Real, Spain

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APPENDIX RESEARCH REFLECTION

Over the course of the project's efforts, a number of difficulties emerged. There were, however, some significant challenges. The best algorithm must be chosen before creating survey questions and gathering data. Prior to working with the visual geometry group (VGG-16) [5,] I attempted a number of methods to solve my issues but was not successful in getting the best results. I had a great deal of trouble finding information. And we succeeded after a protracted period of time, multiple attempts, and a great deal of effort.

Gerbera Flower Detection

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