

**An Advanced Deep Learning Approach to Detect Water Lily**

**BY**

**Mahtab Jamshed**

**ID: 183-15-11963**

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

Supervised By

**Ms. Nazmun Nessa Moon**

Associate Professor

Department of CSE

Daffodil International University

Co-Supervised By

**Mr. MD. Firoz Hasan**

Lecturer

Department of CSE

Daffodil International University



**DAFFODIL INTERNATIONAL UNIVERSITY**

**DHAKA, BANGLADESH**

**24 JANUARY 2023**

## APPROVAL

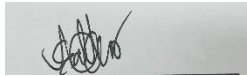
This Project titled “**An Advanced Deep Learning Approach to detect Water Lily**”, submitted by **Mahtab Jamshed** ID No: **183-15-11963** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 24 January 2023

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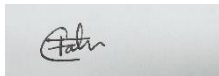


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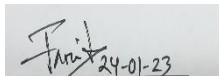


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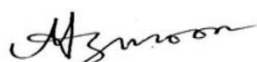
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United International University

## DECLARATION

I hereby declare that this project has been done by us under the supervision of **Ms. Nazmun Nessa Moon, Associate Professor**, and co-supervision of **Mr. Md. Firoz Hasan, Lecturer**, Department of CSE, Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

**Supervised by:**



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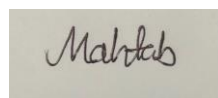
**Ms. Nazmun Nessa Moon**  
**Associate Professor**  
**Department of CSE**  
**Daffodil International University**

**Co-Supervised by:**

---

**Mr. Md. Firoz Hasan**  
**Lecturer**  
**Department of CSE**  
**Daffodil International University**

**Submitted by:**



---

**Mahtab Jamshed**  
**ID: 183-15-11963**  
**Department of CSE**  
**Daffodil International University**

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Finally, I must acknowledge with due respect the constant support and patients of my parents.

## **ABSTRACT**

This project is titled “to detect waterlily using deep learning” the traditional method of image recognition is to extract features manually, which cannot solve this problem well due to the complex background of flowers and the similarity between their categories. With the advancement of science and technology. This work will help us to detect different flowers. I used deep learning algorithms like CNN, INCEPTION V3, RESNET50, RESNET152V2, VGG19, and MOBILE NET to detect 3 different types of water lilies. I achieved 100% accuracy at RESNET152V2, 99% accuracy at INCEPTIONV3, 99% at VGG19, and 99% at MOBILE NET. My system also achieved 86% accuracy at RESNET50.

## TABLE OF CONTENTS

<b>CONTENTS</b>	<b>PAGE NO.</b>
Approval	i
Declaration	ii
Acknowledgments	iii
Abstract	iv
<b>CHAPTER</b>	
<b>CHAPTER 1: INTRODUCTION</b>	<b>1-5</b>
1.1 Introduction	1
1.2 Motivation	3
1.3 Rationale of the Study	3
1.4 Objectives	3
1.5 Research Questions	4
1.6 Expected Output	4
1.7 Report Layout	5
<b>CHAPTER 2: BACKGROUND</b>	<b>6-9</b>
2.1 Introduction	6
2.2 Related Works	7
2.3 Research Summary	8
2.4 Scope of the Problem	8
2.5 Challenges	8

<b>CHAPTER 3: RESEARCH METHODOLOGY</b>	<b>10-18</b>
3.1 Introduction	10
3.2 Research Subject and Instrumentation	11
3.3 Data Collection Procedure	11
+	
3.3.1 Dataset	11
3.3.2 Class Labels	12
3.3.3 Data Preprocessing	13
3.3.4 Data Organizing	14
3.3.5 Data Storing	15
3.3.6 Machine Learning Algorithms	15
3.4 Statistical Analysis	16
3.5 Implementation Requirements	18
<b>CHAPTER 4: EXPERIMENTAL RESULT AND DISCUSSION</b>	<b>19-23</b>
4.1 Experiment Setup	19
4.2 Model Summary	19
4.3 Experimental Result and Analysis	19
4.4 Discussion	23
<b>CHAPTER 5: IMPACT ON SOCIETY, ENVIRONMENT, AND SUSTAINABILITY</b>	<b>24-25</b>
5.1 Impact on Society	24
5.2 Impact on the Environment	24
5.3 Ethical Aspects	25
5.4 Sustainability Plan	25

<b>CHAPTER 6: SUMMARY, CONCLUSION, RECOMMENDATION, IMPLICATION FOR FUTURE RESEARCH</b>	<b>26-27</b>
6.1 Summary of the Study	26
6.2 Conclusions	26
6.3 Recommendations	27
6.4 Implication for Further Study	27
<b>REFERENCES</b>	<b>28</b>
<b>APPENDIX</b>	<b>29</b>
<b>PLAGIARISM REPORT</b>	<b>30</b>



## LIST OF FIGURES

<b>FIGURES</b>	<b>PAGE NO.</b>
Figure 3.1: Methodology at a Glance	10
Figure 3.2: Amount of Dataset	11
Figure 3.3: Datasets Percentages	12
Figure 3.4: Percentages of Water lily	13
Figure 3.5: Data processing	13
Figure 3.6: Data processing	13
Figure 3.7: Data processing	14
Figure 3.8: Data processing	14
Figure 3.9: Data processing	14
Figure 3.10: Data processing	14
Figure 3.11: Train and Test Data Set	15
Figure 3.12: Statistical Analysis	16
Figure 3.13: Proposed Model Structure	17
Figure 4.1: Resnet50 Model Accuracy	21
Figure 4.2: Mobile Net Model Accuracy	21
Figure 4.3: VGG19 Model Accuracy	21
Figure 4.4: InceptionV3 Model Accuracy	22
Figure 4.5: Resnet152V2 Model Accuracy	22
Figure 4.6: Predicting the test dataset	22

## LIST OF TABLES

<b>TABLE NAME</b>	<b>PAGE NO.</b>
Table 1.1: Description of water lily	2
Table 1.2: Report Layout	5
Table 3.1: Amount of dataset	12
Table 4.1: Accuracy Table (Train Dataset)	20
Table 4.2: Accuracy Table (Test Dataset)	20

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

A species of aquatic plant in the Nymphaeaceae family of flowering plants is the waterlily. In the world, there are roughly 60 different species of water lilies. Bangladesh has two species: *Nymphaea pubescens* (white & pink variety) and *Nymphaea nouchali* (blue variant). Waterlily blossoms are available in Bangladesh in a variety of hues, including pink, white, and blue. The white-Waterlily is Bangladesh's state flower and emblem. It stands for the innocence and purity of the inhabitants of the country. In Bangladesh's rivers, lakes, and ponds, waterlilies are abundant. The petals of waterlily blossoms deteriorate as the day goes on since they bloom in the morning. directly joined to the roots and stem. Underwater, the roots are joined to the stalks or peduncles of the flowers and the leaves. The leaves also float in the water, and this root is rooted in the ground. From the root, fresh leaves sprout. The circular, green leaves have a black underside and are green in color. Sharp edges may be seen on the floating leaves. The leaves are 20 to 23 cm in length and 0.9 to 1.8 m in width. These blooms have 13–15 petals and 4–5 stamens. The blooms resemble stars. The cup has an 11–14-centimeter circumference. Waterlilies bloom virtually all year long; the monsoon and fall are the finest times to grow them. [1]

Table 1.1: Different types of water lily

<b>Name of the Water Lily</b>	<b>Description of Water Lily</b>
<b>White Waterlily</b>	<ul style="list-style-type: none"> <li>• The spread of the leaves per plant is 150 cm, and they can reach up to 30 cm in diameter.</li> <li>• It is indigenous to North Africa, temperate Asia, Europe, and tropical Asia (Jammu and Kashmir).</li> <li>• White lilies are symbolic of purity.</li> </ul>
<b>Pink Waterlily</b>	<ul style="list-style-type: none"> <li>• Their size ranges from 10 to 20 cm wide, with many red petals, reddish green leaves, and double flowers.</li> <li>• It belongs to the Bengal genus.</li> <li>• Passion is symbolized by pink lilies.</li> </ul>
<b>Blue Waterlily</b>	<ul style="list-style-type: none"> <li>• Their size ranges from 20 to 23 cm, and they can extend up to 1.5 m from the rhizome.</li> <li>• This aquatic plant is indigenous to a wide range of places, including Afghanistan, the Indian subcontinent, Taiwan, Southeast Asia, and Australia.</li> <li>• Blue lilies stand for strength.</li> </ul>

## **1.2 Motivation**

- I chose “The detection of waterlily” as my topic because of being the national flower of our country.
- Lack of research on waterlily flowers.
- From the misconceptions, people have about water lilies.
- Through the course of my thesis, I would like to promote water lilies all over the world.

## **1.3 Rationale of the Study**

Information extraction through example recognition is made easier by the CSE field of AI (ML), a subset of Artificial Intelligence (AI). The creation of this framework to analyze data and information in the employment area wretchedness examination has provided significant data to investigate in a matter of collaboration, structure, and system of causes for gloom in the occupation are both male and female persons in Bangladesh. After performing information and expert task analyses previously deemed too complicated for computers to quantify, a computer learned from its mistakes. This research used images from a database to categorize any waterlily object and identify waterlilies of interest.

## **1.4 Objective**

- To optimize and detect a waterlily from the given data set.
- To Demonstrate the accuracy and detection of waterlilies from various flowers sources using deep CNN, INCEPTION V3, RESNET50, RESNET152V2, VGG19, and MOBILE NET to classify 3 different types of water lilies.
- To make detection work faster.
- To use this model also to detect other flowers.
- To develop a common model that developers may use to build various apps that can recognize three different varieties of waterlilies.

## **1.5 Research Questions**

1. Does the system use sample data to forecast a real output?
2. What is the thesis's purpose?
3. I use what dataset, exactly?
4. What algorithms will I employ?
5. Do all algorithms operate flawlessly (yes/no)?
6. How accurate was it?

Yes, it can. The dataset is properly collected and all the data were processed properly.

As all the data was about finding the water lily it can easily predict all the flowers.

The main purpose of the thesis is to enlighten people about the country's national flower.

All the data were collected as raw data and all the data were collected through the rural area of my hometown.

Six algorithms have been applied. Such as CNN, INCEPTION V3, RESNET50, RESNET152V2, VGG19, MOBILENET.

Yes.

I have got a good output but the rest of the algorithms didn't give us proper accuracy and feedback.

## **1.6 Expected Outcome**

My waterlily detection technique aids in producing an anticipated result based on the supplied dataset. In this case, I used 80% of the dataset as training data and 20% as test data. The accuracy of the waterlilies model which is solely dependent on the training dataset is what I want to find. Finding the training dataset's correctness is my goal. My waterlilies detection will be finished once all necessary steps have been completed. I achieved 100% accuracy at RESNET152V2, 99% accuracy at INCEPTIONV3, 99% at VGG19, and 99% at MOBILE NET. My system also achieved 86% accuracy at RESNET50.

## 1.7 Report Layout

Table 1.2: Report Layout

<b>Chapter</b>	<b>Discussion</b>
<b>Chapter 1</b>	In this section, I've discussed my motivation for working on this project, my objectives, and the typical results of my research.
<b>Chapter 2</b>	I've covered the theoretical foundations of my research in this section along with comparable studies, similar investigations, the size of the issues, and challenges.
<b>Chapter 3</b>	I am discussing my study topic, the tool I utilized, my data collection process, statistical analysis, and implementation.
<b>Chapter 4</b>	In this chapter, I give the results of my research studies together with a summary and analytical description.
<b>Chapter 5</b>	The effects of my research on society and the environment are discussed in this chapter.
<b>Chapter 6</b>	I summarize my predictions and outcomes in this chapter and also introduce a new research strategy.

## **CHAPTER 2**

### **BACKGROUND**

#### **2.1 Introduction**

The national flowers of Sri Lanka and Bangladesh are blue and white-water lilies. The waterlily tree first appeared on Earth about 16 million years ago. There is proof that white and blue beads were used in ancient Egypt. Ayurvedic medication is created using waterlilies. Indigestion can be treated with this medication. Recent research has revealed that waterlilies provide vital therapeutic benefits for diabetes. The waterlily flower regulates blood sugar levels by maintaining steady insulin levels. The advantages of waterlily blossoms are crucial to lowering the vulnerability of heart disease. Two cups of water, five grams of rose and ten grams of waterlily flowers, and a good boil. After straining the mixture, add as much sugar as you can. You will see positive benefits if you regularly take it twice a day for a month. By reducing liver damage, the waterlily flower promotes liver healing. Beets, which are easily accessible, provide great health benefits. Waterlilies boost heart health, satisfy thirst, and keep the body cool. Waterlilies are essential for treating gas, dysentery, and burning pee. Another popular curry is made using waterlilies. Both in cities and rural areas, it is becoming more and more popular. It is nutrient-rich. An extremely nutrient-dense vegetable is cabbage. Compared to veggies, it typically has a significantly higher nutritional content. There is a lot of calcium in waterlilies. Beets provide seven times more calcium per serving than potatoes. The remedy for skin and blood dysentery is waterlilies. Waterlily vine provides 142 kilograms of nutrients, 1.3 grams of minerals, 1.1 grams of fiber, 3.1 gram of protein, 31.7 grams of sugar, and 76 mg of calcium per 100 grams.

The nutritional value of the waterlily tree's various components varies. Seeds have the lowest water content (4.18%) and pods or tubers have the greatest (20.4%). Seeds contain a lot of fat. Stems have the least protein (10.1%) and leave the most (25.4%). There is 9.5–15.1% dietary fiber. Sodium (1.9-4.21%) and potassium (1.56-4.63%) are the two most prevalent minerals in the Nile. Significant calcium, zinc, iron, and sodium levels are also present.[2]



## 2.2 Related Works

As stated by Ghazi and all [1], they analyze many parameters influencing the performance of these networks using deep convolutional neural networks to identify the plant species taken in an image.

As stated by Mete and all [2], they are categorizing flowers to help with the development of the recognition of uncommon plant species, which will be helpful in areas like botany, agriculture, trade, and the pharmaceutical business.

As stated by Dias and all [3], early in the growing season, apple trees must have some of their blossoms and fruitlets removed to maximize fruit production.

As stated by Zawbaa and all [4], this work aims to develop an effective flower classification approach using machine learning algorithms. Eight flower categories were analyzed to extract their features.

As stated by Lin and all [5], in this study, researchers suggested a method for detecting strawberry flowers based on cutting-edge deep-level region-based visual representation architecture and the Faster R-CNN.

As stated by Mohammed and all [6], the relative composition of waterlily leaves, petioles, roots, rhizomes, and seeds collected from the marshes and floodplain of Tatabu was calculated and evaluated in percentage form.

As stated by Pinto and all [7], Classification is one of the most important techniques in machine learning. Machine learning's primary purpose is data analysis. Decision trees, Naive Bayes, backpropagation, neural networks, artificial neural, multi-layer perception, multi-class classification, support vector machines, and K-nearest neighbor are just a few of the classification techniques that are accessible. In this study, three strategies are described in great depth.

As stated by Mileva and all [8], plants from the Rosacea family are highly valued and employed in the food sector, perfumes, and cosmetics because they are abundant in natural compounds with advantageous biological qualities.

As stated by Ervik and all [9], in South America, Cyclocephala scarab beetles (Scarabaeidae: Cyclocephalini) pollinate night-flowering water lilies (Nymphaeaceae) through coordinated flowering movements, potent floral aroma, food tissues, and heat-producing blooms.

As stated by Emboden and all [10], the ancient ritual usage of Nymphaea (Nymphaeaceae) flowers in Mayan and Egyptian cultures are contrasted. According to

recurring themes found in the artwork of these two ancient civilizations, the water lily served as a narcotic (psych drug) that was used to induce ecstasy among the priestly caste.

### **2.3 Research Summary**

The main goal is to identify the waterlily in various types of flowers. I looked for the types of flowers that make up the majority of the blooms because flowers might be of many different types. Since our study relies on image collection, I split the dataset into three main types of water lilies, such as Blue, Pink, and White. I will determine the origins of the waterlilies using the dataset.

Algorithms from CNN, INCEPTION V3, RESNET50, RESNET152V2, VGG19, and MOBILE NET were used to assess the model's precision, specification, and prediction. I made an effort to get the highest accuracy possible because our system model benefits from accuracy at a higher level. The project's specification is also essential. Finding Waterlilies is what specification entails. Finally, predictive models will assist us in finding the sources of waterlilies.

### **2.4 Scope Of the Problem**

The major reason I work with waterlilies is that anyone can easily identify waterlilies among other flowers. I can see that most people do not know that a waterlily is a special flower, If I divide the country into different regions for investigation. As a result, we will see that the waterlily will lose its essence. Indeed, it is very difficult to collect water lilies and assess their quality and beauty. Although research supports many of the waterlily's properties, it remains controversial in the scientific community. So more large-scale research is needed.

### **2.5 Challenges**

Data collection is quite difficult on the subcontinent of my country. Prediction accuracy depends on an accurate dataset. Since there is no single source for the dataset, I had a lot of difficulties. And as my objective is to discover waterlilies in other flowers, thus I had to gather them. I have to get additional waterlilies because the identical waterlilies data might be comparable. For instance, if a waterlily has a pink waterlily in it, I might

take a picture of it. However, after taking three or four pictures, I might need to change it and go grab another waterlily. As a result, no similarities between the identical waterlilies were discovered. Another problem I faced was collecting data. Because the waterlily is a rare flower. It is not easily available at hand. So, it was not easy to collect data. So, I took the help of a friend from my village. He invited me to come to his village. On his invitation, when I took pictures of the waterlilies flower. It was afternoon and then the waterlilies flower was not blooming. Then I remembered that the waterlilies flower blooms at night and blooms till morning. Then I decided to go out to photograph the waterlilies flower the next morning. I left for the village early the next morning. After going to the village, there was the village Pond and the Lake. I got down there and started taking pictures of waterlilies flowers. All the women, men, boys, and girls of the village were looking at me with surprise when they saw me taking pictures of waterlilies flowers so early in the morning and some were asking why I was taking pictures of waterlilies flowers. Then I explained it to them and I was able to collect the data. The background was another issue. I made an effort to gather photos that were all the same color and lighting. Getting a good picture was quite difficult. Since I took all of the photos using an iPhone, their file extensions changed to "heic," which is incompatible with jupyter notebook and Google colab. Therefore, I changed the "heic" extension of all the photos to "jpg".

# CHAPTER 3

## RESEARCH METHODOLOGY

### 3.1 Introduction

I will go over the study approach and procedures in more detail in this section. In contrast, the project's tools, data collecting, study topic, processing, and pre-processing. This chapter will cover statistical analysis and its application. In figure 3.1 the entire process is displayed.

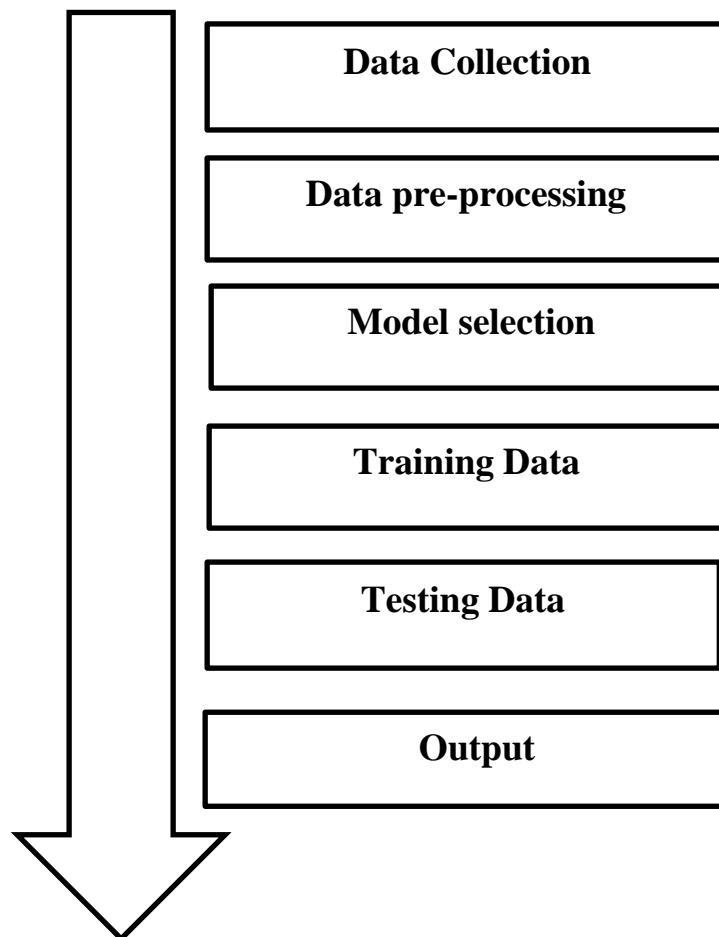


Figure 3.1: Methodology at a Glance

## 3.2 Research Subject and Instrumentation

I realized that it is difficult to tell waterlilies from other types of flowers. There was something I needed to watch out for.

- Choosing the right dataset to collect
- making sure the collection was flawless
- Organizing the data correctly
- And labeling the dataset correctly.

## 3.3 Data Collection Procedure

All of the Data I used in the project was gathered from my village. In my village, there are numerous ponds and lakes.

I have gathered over three thousand five hundred (3500) data points. And from those data, I selected 2983 data points in fig.3.3 for my study. I collected all the data in an offline setting using an iPhone 12 Pro Max to get a better image. There are three (03) water lilies in my dataset.

```
[ ] training_set = train_datagen.flow_from_directory('/content/drive/MyDrive/Datasets/train dataset',
                                                target_size = (224, 224),
                                                batch_size = 16,
                                                class_mode = 'categorical')

Found 2983 images belonging to 3 classes.
```

Figure 3.2: Amount of datasets

### 3.3.1 Dataset

From the dataset, I have collected 03 varieties of Waterlilies. Where there are 1021 white water lily, 1009 pink waterlilies, and 953 blue waterlilies available in our datasets shown in figure 3.3

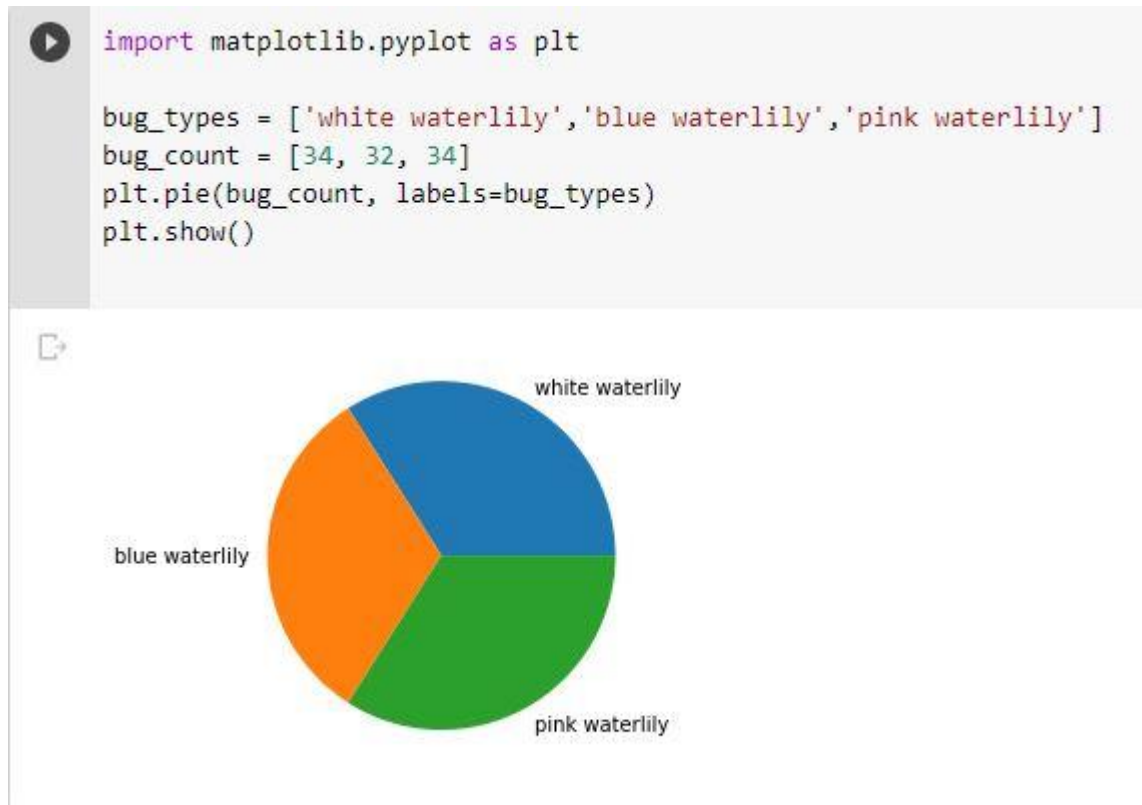


Figure 3.3: Datasets percentages

### 3.3.2 Class Labels

Here I have Three (3) classes. The classes are:

- White Waterlily
- Blue Waterlily
- Pink Waterlily

Table 3.1: Amount of data

Category	Count
White	1021
Pink	1009
Blue	953

Percentages of each waterlily from the datasets are White Waterlily: 34.0% Blue waterlily: 34.0%, Pink waterlily: 34.0%, Figure is shown 3.4

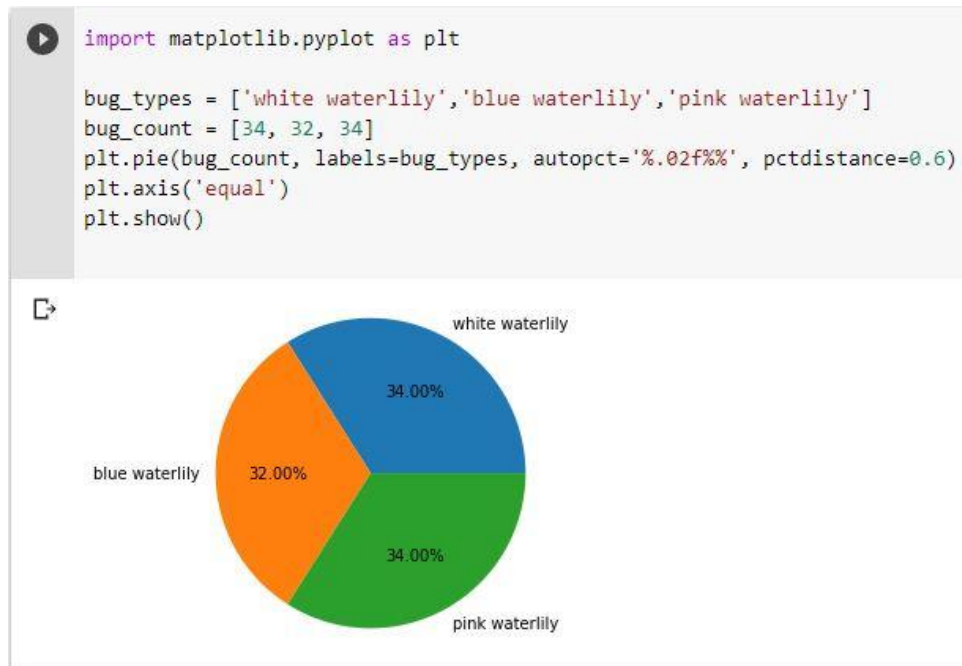


Figure 3.4: percentages of water lilies

### 3.3.3 Data Preprocessing

I pre-processed all the data for this portion. because there are several methods of image regulation in the datasets. The accuracy rate will decrease if all photos are not transformed into a single set of rules. In this example, the image in figure 3.5, which was almost 600\*450 pixels before processing, has been reduced to 224\*224 pixels in figure 3.6

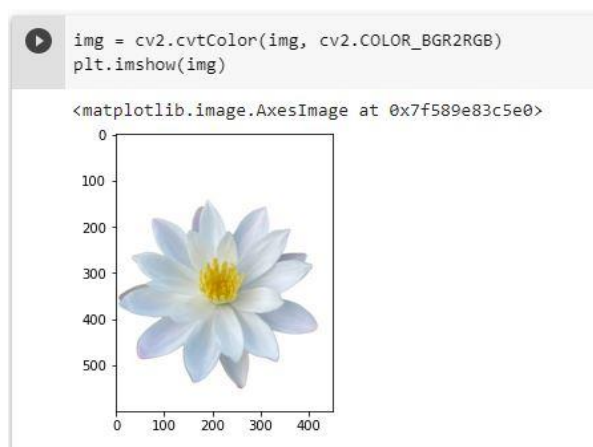


Figure:3.5

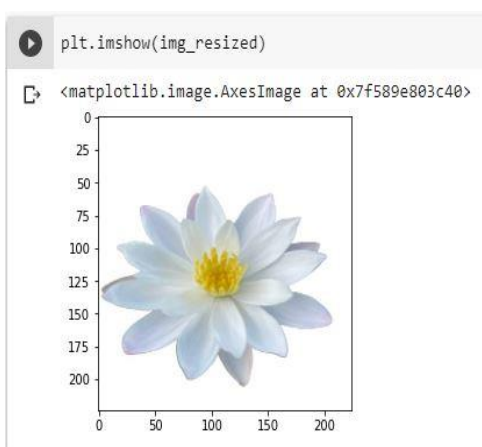


Figure:3.6

Similar to figure 3.7 and figure 3.8 shows an image that was 488\*442 pixels before processing and is now 224\*224 pixels after processing.

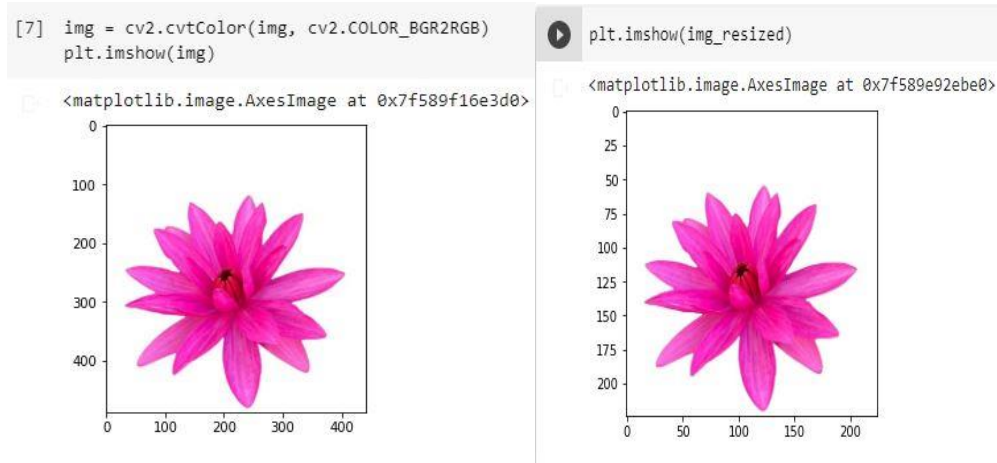


Figure 3.7

Figure 3.8

And figure 3.9 and figure 3.10 shows an image that was 450\*600 pixels before processing and is now 224\*224 pixels after processing.

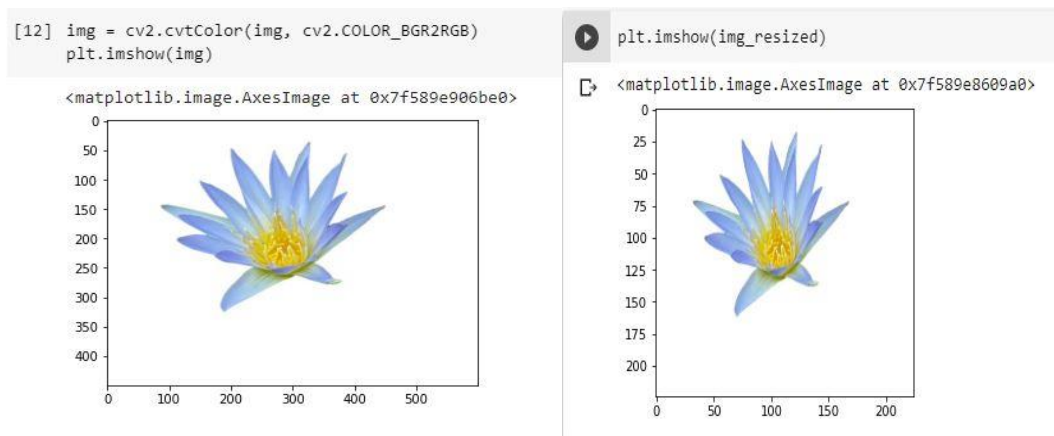


Figure 3.9

Figure 3.10

### 3.3.4 Data Organization

I have created two folders named training and test dataset. In the training dataset, I have three (3) classes and a total of two thousand nine hundred eighty-three (2983) images. Each class of training dataset contains almost one thousand (1000) images. On the other hand, in the test dataset in three (3) classes I have one thousand three hundred forty-six



(1346) images and each class of test dataset contains almost four hundred fifty (450) images, as shown in figure 3.11

```
[ ] training_set = train_datagen.flow_from_directory('/content/drive/MyDrive/Datasets/train_dataset',
                                                    target_size = (224, 224),
                                                    batch_size = 16,
                                                    class_mode = 'categorical')

Found 2983 images belonging to 3 classes.

[ ] test_set = test_datagen.flow_from_directory('/content/drive/MyDrive/Datasets/test_dataset',
                                                target_size = (224, 224),
                                                batch_size = 16,
                                                class_mode = 'categorical')

Found 1346 images belonging to 3 classes.
```

Figure 3.11: train and test the dataset

### 3.3.5 Data Storing

Data storing has begun following data arrangement. I kept the dataset for this section in both the local PC directory and Google Drive. I had to utilize the local PC directory because I was using a Jupyter notebook. I also used Google Colab for security. I also uploaded those datasets to Google Drive for this reason. And uploading to Google Drive seemed the safest option if I needed to use those datasets in the future to improve the project. All the datasets would be lost if there was a technical issue with the local computer. I also uploaded the dataset to Google Drive because of this.

### 3.3.6 Machine Learning Algorithms

For greater accuracy, I used CNN, INCEPTION V3, RESNET50, RESNET152V2, VGG19, and MOBILE NET. I used both training and test datasets when I implemented these techniques. Python libraries like TensorFlow, Keras, NumPy, PyTorch, Flatten, etc. are used to implement all algorithms. These libraries aid in the program's initialization.

### 3.4 Statistical Analysis

I have 3500 photos in the dataset for the detection of water lilies. Nearly 3000 photos make up the training dataset, and nearly 1500 serve as the test dataset. I used numerous algorithms, but improving accuracy was my major goal. I received the needed accuracy via CNN, INCEPTION V3, RESNET50, RESNET152V2, VGG19, and MOBILE NET. To determine the necessary precision, I kept some processes. like as-

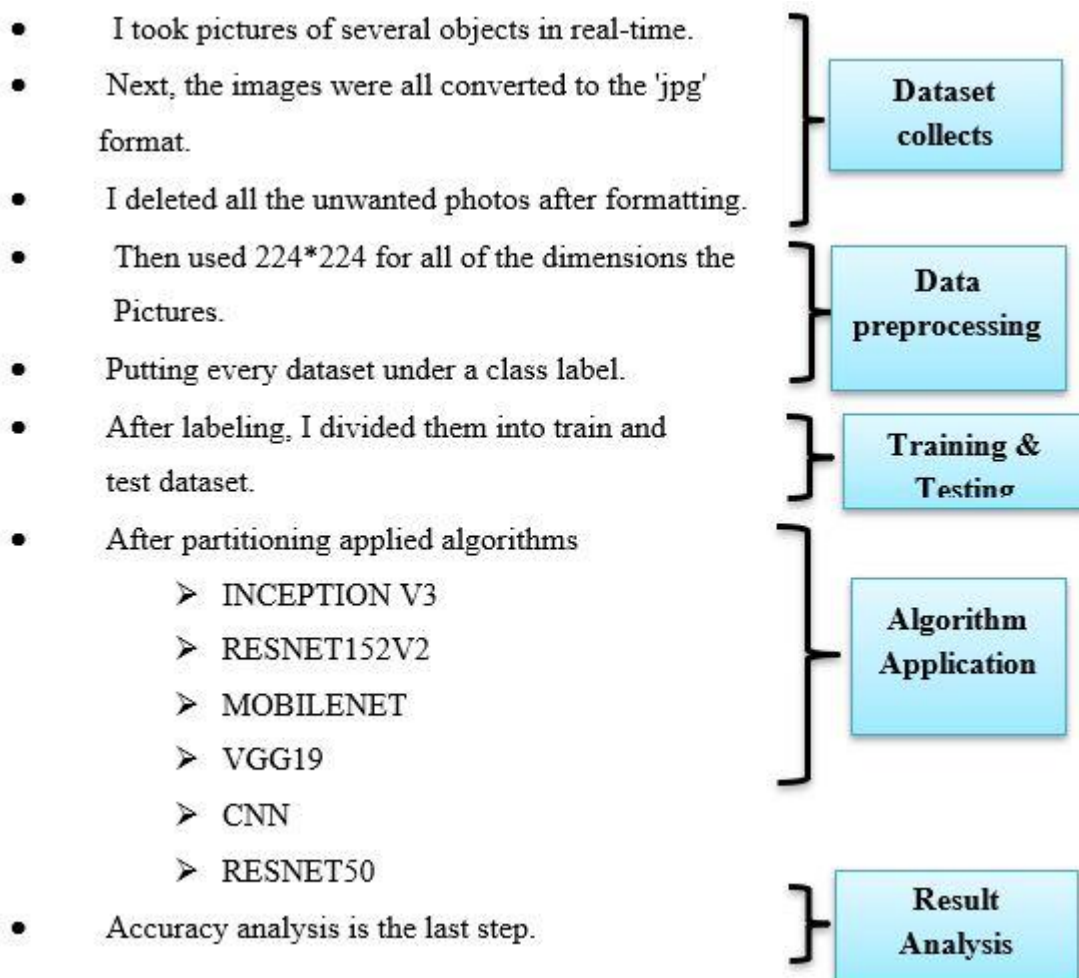


Figure 3.12: Statistical Analysis

Here is the flowchart of my whole working process:

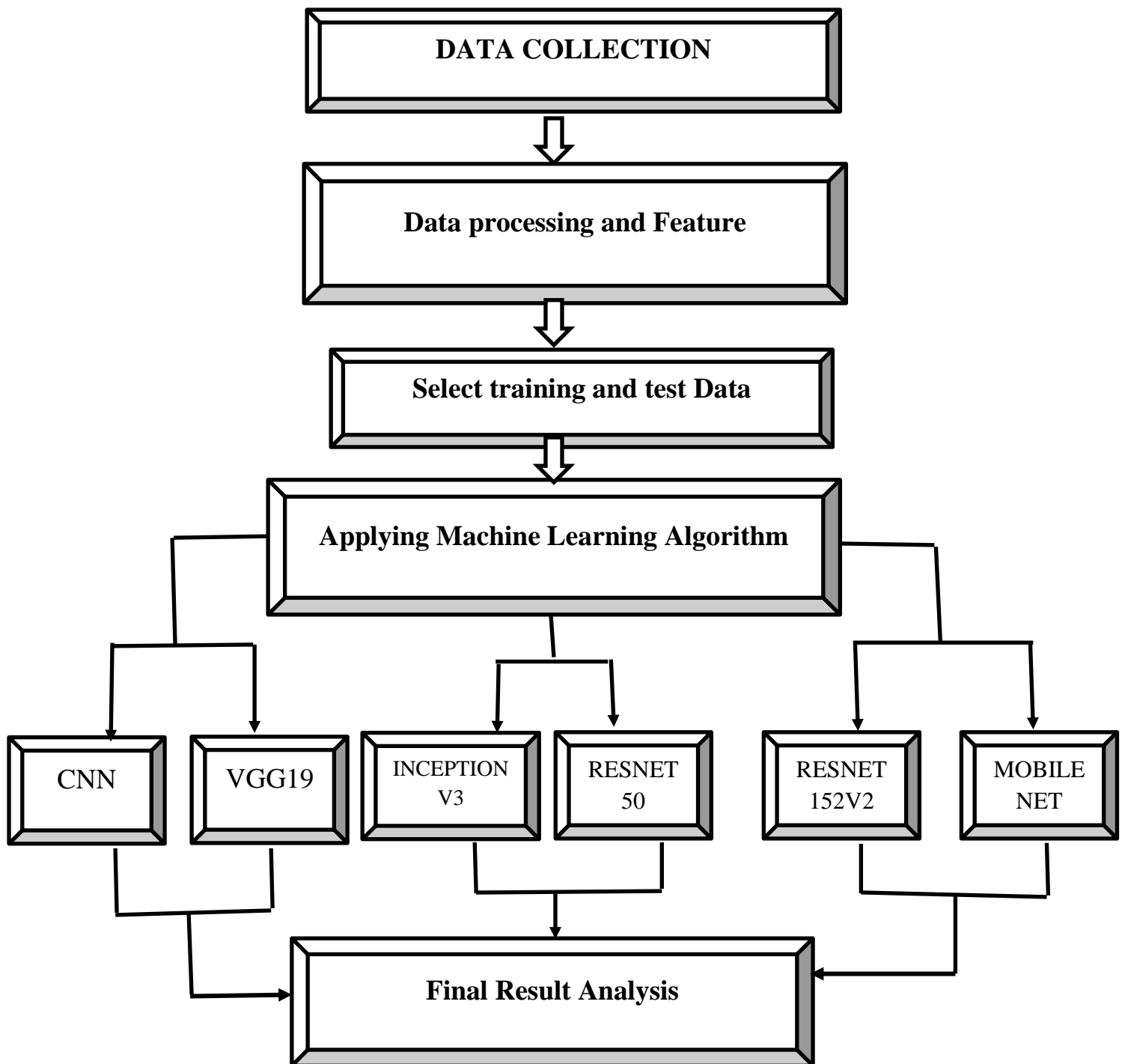


Figure 3.13: Proposed Model Structure

In this figure 3.13, I show my working procedures step by step. From the flow diagram, my working flow has been shown.

## 3.5 Implementation Requirements

- **Python 3.10.2**

The most recent Python version is 3.10.2. Python is a High-Level programming language that is open-source, simple to use, and touted as being the strongest of all computer languages. It will be exceedingly challenging to use another language with CNN, VGG19, InceptionV3, Mobile net, Resnet152v2, and Resnet50 due to their extremely complicated architectural designs. Because Python's built-in functions and commands are so simple, implementing them takes less time. It would take a long time in other programming languages that would have been used.

- **Google Colab/Jupyter Notebook**

Colab is a hosted Jupiter that has been installed and set up so that we may access cloud resources directly from the browser and don't need to do anything on our computers. It operates just like Jupiter. Because only the Python kernel may now be utilized, rather than Jupiter Collab, they are based on notebooks or notebooks, which can be text, image, or code.

The same thing is also done using a Jupyter notebook. Hardware capabilities set them apart from one another. The Jupyter notebook is ideal if somebody has an external GPU with a high-end build. Since it was collaborative work, we had to use both platforms.

- **Hardware/Software Requirements**

- Operating System (Windows 7 or more / Linux)
- Web Browser (Chrome, Firefox, or Microsoft Edge)
- Hard Disk (At least 120GB)
- Ram (More than 4 GB)
- GPU (At least 2GB)

## **CHAPTER 4**

### **EXPERIMENTAL RESULT AND DISCUSSION**

#### **4.1 Experimental Setup**

For my model and code implementation, the first task was to gather datasets. The further system process is given below:

- The initial step was to collect datasets for the implementation of my model and code. The following system process is provided:
- As my objective is to identify the sources of the three various forms of waterlilies, so I collected all the datasets from some rural areas of my village.
- Gathering all of the data was the hardest effort. The dataset collection required a significant amount of time.
- And converting them into jpg format took a lot of time.

#### **4.2 Model Summary**

My model summary was a little complicated because it involves multiclass image processing. This is why I activated SoftMax. For each algorithm, I've listed the total parameters, trainable parameters, and nontrainable parameters. Additionally, the model determines how the model is assembled. The dataset is flattened, and there are six (6) dense layers. Each of the 20 epochs I used has 20 layers.

#### **4.3 Experimental Result and Analysis**

Discovering waterlilies is my major objective. Based on test datasets, I then forecasted my model. The accuracy rate is what matters most, and I'm happy with what I got in terms of accuracy. Testing my model after that was also successful. I reached an accuracy of 0.86 at Resnet50, 0.90 at Cnn, 0.99 at Mobile net, and 0.99 at Vgg19, 0.99 at Inception V3, 1.00 at Resnet152V2. The accuracy of the training dataset is shown in Table 4.1. The accuracy of the testing dataset is shown in table 4.2.

Table 4.1: Accuracy Table (Train Datasets)

<b>Algorithm Name</b>	<b>Accuracy (Train Datasets)</b>
<b>Resnet50</b>	<b>86%</b>
<b>CNN</b>	<b>90%</b>
<b>Mobile net</b>	<b>99%</b>
<b>Vgg19</b>	<b>99%</b>
<b>InceptionV3</b>	<b>99%</b>
<b>Resnet152V2</b>	<b>100%</b>

Table 4.2: Accuracy Table (Test Datasets)

<b>Algorithm Name</b>	<b>Accuracy (Test Datasets)</b>
<b>Resnet50</b>	<b>96%</b>
<b>CNN</b>	<b>88%</b>
<b>Mobile net</b>	<b>99%</b>
<b>Vgg19</b>	<b>99%</b>
<b>InceptionV3</b>	<b>100%</b>
<b>Resnet152V2</b>	<b>100%</b>

Consequently, I can infer from tables 4.1 and 4.2 that Resnet152V2 has the highest accuracy rate. I use the Resnet152V2 algorithm and have 100% accuracy in both the train and test datasets. For the reason that Resnet152V2 has the most settings, as I have previously explained. The execution will therefore be precise and quick, Now Let's see a graphical representation of the training and loss dataset percentages.

RESNET50: The accuracy model of resnet50 has given below in figure 4.1

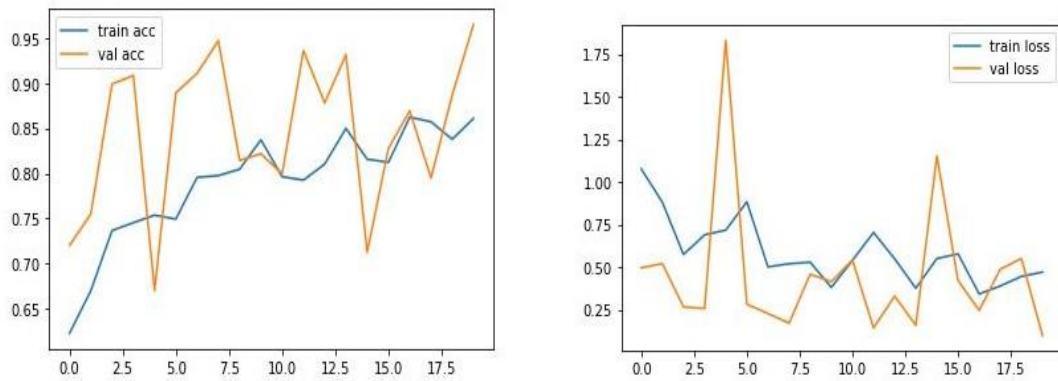


Figure 4.1: RESNET50 Model Accuracy

MOBILE NET: The accuracy model of the mobile net has given below in figure 4.2

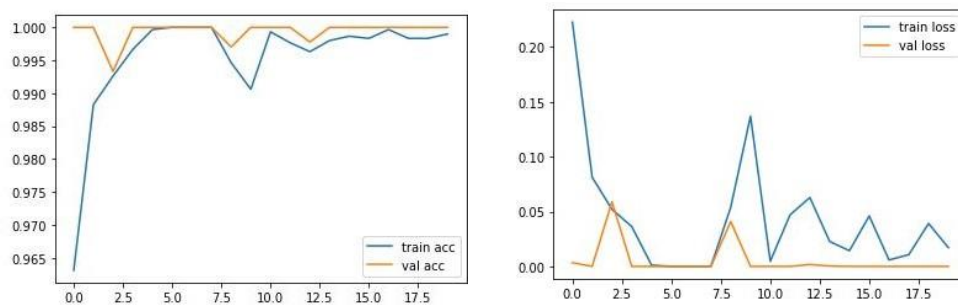


Figure 4.2: MOBILE NET Model Accuracy

VGG19: The accuracy model of vgg19 has given below in figure 4.3

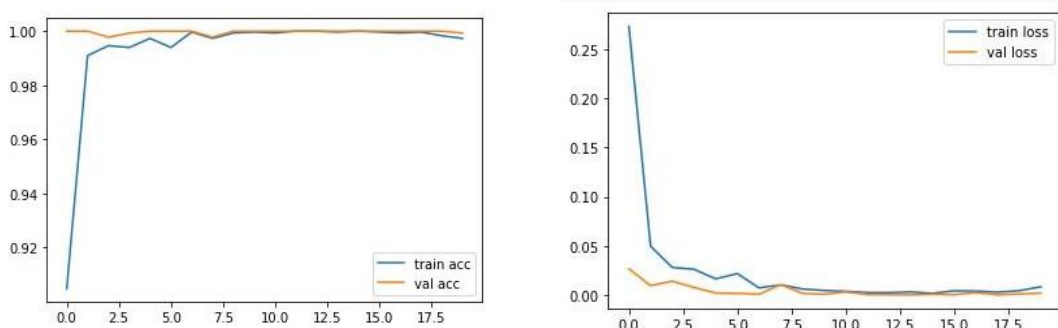


Figure 4.3: VGG19 Model Accuracy

INCEPTION V3: The accuracy model of inception v3 has given below in figure 4.4

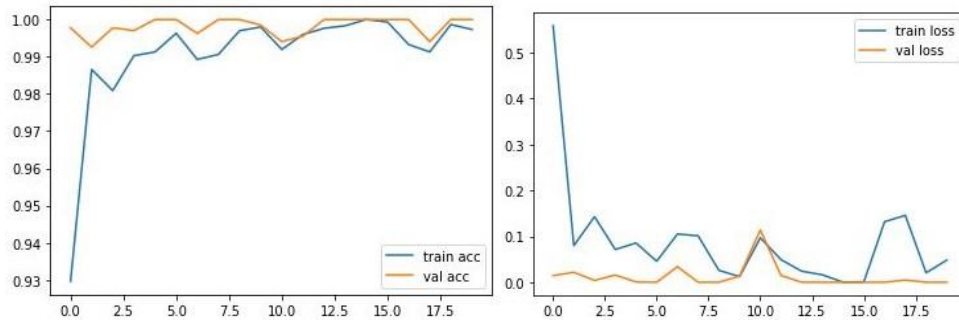


Figure 4.4: INCEPTION V3 Model Accuracy

RESNET152V2: The accuracy model of resnet152v2 has given below in figure 4.5

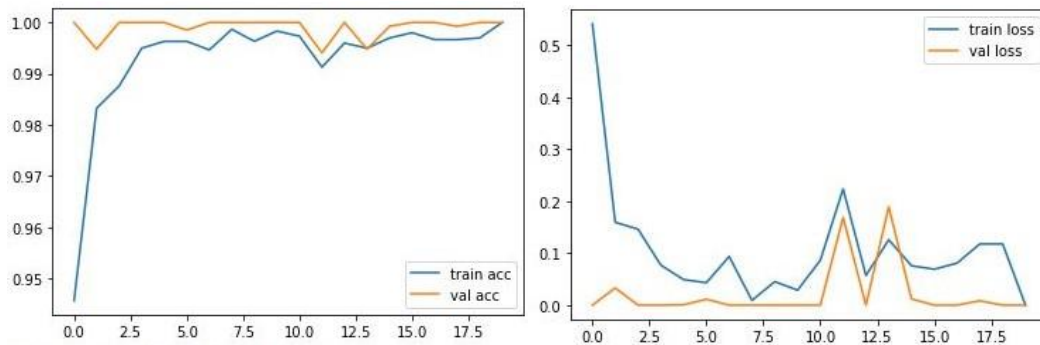


Figure 4.5: RESNET152V2 Model Accuracy

**Prediction:** I tried to use test data as the prediction in my model. Based on the test dataset, I will identify the Water lilies. The test code has been attached below in figure 4.6



```
▶ y_pred = model.predict(test_set)

↳ 85/85 [=====] - 10s 117ms/step

▶ y_pred
array([[2.6980083e-11, 1.3255886e-15, 1.0000000e+00],
       [1.0000000e+00, 2.4194638e-13, 3.3591712e-12],
       [8.7483105e-09, 1.0000000e+00, 1.3230704e-11],
       ...,
       [9.9997759e-01, 2.2431332e-05, 2.3611351e-08],
       [2.4272025e-12, 6.3387504e-11, 1.0000000e+00],
       [7.4628888e-12, 1.9041988e-09, 1.0000000e+00]], dtype=float32)
```

Figure 4.6: predicting the test dataset

#### 4.4 Discussion

I have developed a model that can be used to identify the sources. But the accuracy rate is what I mostly learn. The success of my future efforts depends on this accuracy rate. Furthermore, accuracy primarily depends on the dataset. Since the research is image-based, the image quality and clarity may be very high. And it worries me a great deal. the algorithms, second. A good algorithm is also essential to accuracy. Since accuracy increases with more parameters. My accuracy ratio, therefore, reached 90% for the training set and 99% for the test set.

## **CHAPTER 5**

### **IMPACT ON SOCIETY, ENVIRONMENT, AND SUSTAINABILITY**

#### **5.1 Impact on Society**

Bangladesh's national flower, the waterlily, is a representation of the country's numerous rivers. Although the waterlily is the national flower of Bangladesh, we don't have much research about it. The waterlily is an ancient flower. It has many qualities. In our society, many people think of the waterlily flower as a weed. In my thesis, I found many valuable things about water lilies. Which will help people in our society to know more about water lilies. They will know about the positive aspects of water lilies. I have worked with three types of water lilies, which have different characteristics. The present young generation has no idea about waterlily flowers. These will help future students research water lilies. Also, I discussed the quality and nutrition of waterlilies in my thesis.

#### **5.2 Impact on The Environment**

The quantity of waterlilies improves the ecosystem significantly. They provide both aquatic and non-aquatic species with food and shelter. In addition to offering cover to fish, lily pads serve as vital food supplies for beavers, some types of beetles, and pollinators. By enhancing the water's oxygen content, growing submerged aquatic plants like water lilies will maintain the pond's health. A water lily's rapid growth poses a threat since too much growth will cover the water's surface and decrease light penetration. Water lily growths that are too dense might hinder the exchange of oxygen and, in the worst situation, become a source of floods.

### **5.3 Ethical Aspects**

The water lilies are a lovely symbol of healing, peace, hope, joy, and celebration. In all ancient cultures, white lilies were treasured as representations of enlightenment and divinity. The waterlily was primarily used to treat indigestion and is considered a therapeutic plant in Indian Ayurvedic medicine. Its therapeutic advantages as an antihepatotoxic and antidiabetic have been demonstrated by recent research. The waterlily bulb and root are used to make medicine. However, there isn't any conclusive scientific evidence to support these claims. American white waterlily is used topically and orally for burns, boils, problems of the mouth and throat, and diarrhea.

### **5.4 Sustainability Plan**

we need more detailed research on water lilies. Although it is the national flower of our country, it has grown carelessly and neglected. If we don't save it, it will disappear from our national flower. Waterlily flower is often extinct. At present, the waterlily is not seen blooming as before. A larger range of water lily flowers needs to be cultivated and knowledge about its properties is needed. We should preserve it for the larger interest of the country.

## **CHAPTER 6**

### **SUMMARY, CONCLUSION, RECOMMENDATION, AND IMPLICATION FOR FUTURE RESEARCH**

#### **6.1 Summary of The Study**

I have created a model that provides accurate information on waterlilies. Getting inspiration for waterlilies was the major objective. Because my test relies on the dataset, accuracy was a crucial component for this reason because if it drops, there would be no gain. The test dataset affects both my test and prediction. As a result, I had to pay attention to both train and test dataset accuracy.

From my six data models, I can confidently state that Resnet152v2 and inceptionV3 both provide us with nearly the same accuracy in terms of test and train sets. I obtained an accuracy of around 99%. Because of this, my test and prediction will both be more precise.

#### **6.2 Conclusion**

Bangladesh's natural beauty is enhanced by flowers. The waterlily is a partner of beauty, just like other flowers. All parts of Bangladesh have easy access to water lilies. Bangladesh is covered in waterlily flowers, which are quite beautiful. Given their natural beauty and accessibility, waterlilies have been designated as national flowers. Like our national flower, the white waterlily, other nations also have national flowers. For instance, the lotus is the national flower of India, the rose is the national flower of Iran, and the blue waterlily is the national flower of Sri Lanka. Waterlilies are aquatic flowers since they grow in water. A flower can be found in rivers, lakes, ponds, streams, canals, and deserted reservoirs. A flower doesn't need to be grown. There are color differences. White, pink, blue, yellow, dark red, purple-red, blood-purple, blue-purple, and more colors are available in water lilies. I worked with the hues white, pink, and blue because they are all readily available in Bangladesh.

### **6.3 Recommendations**

Artificial intelligence is a supporter of computer science, which applies human intelligence and reasoning power. To put it simply, artificial intelligence is the embodiment of human intelligence and thinking power through machines.

What is artificial intelligence technology's drawback for people? In many respects, the author is the solution to this query. However, if we can advance artificial intelligence too far, it will bring about the biggest or worst shift. Even humanity might have. Humans, however, are intelligent and observant. I wish to observe what takes place. And it is brides who improve artificial intelligence. Making computers as intelligent as people is my goal.

### **6.4 Implication for Further Study**

To make my examination more effective, I will work with more data.

- I'll try to get as much information as I can.
- I'll try to include the % rate for water lilies as well.
- My main objective is to develop a web application for the prediction dataset. The waterlilies can be seen in any flower-related photographs.

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## **APPENDIX RESEARCH REFLECTION**

It was challenging to build up this project. I had a few issues with the project. Getting the right dataset was the first issue. I began by gathering information online. However, such pictures weren't suitable for greater precision. I then began the challenging task of gathering raw data. I had to travel to my hometown to gather the photos.

Finding a suitable algorithm was the second issue I ran upon. I discovered a CNN algorithm that only provided 40% accuracy. However, after some investigation, I discovered that the parameters were not suitable, so once more, I adjusted the algorithm and eventually obtained the correct accuracy.

There is yet another issue with the photo extension "heic" to "jpg."

## Plagiarism Report

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