

Drumstick Leaf 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

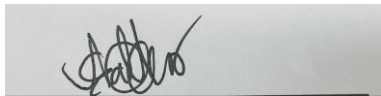
This Project/internship titled “**Drumstick leaf detection by Machine Learning Approach**”, submitted **Md Nasrullah**, ID No: **183-15-11873** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the 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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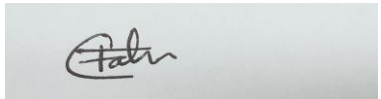
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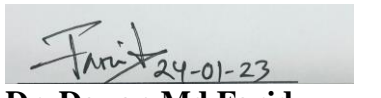
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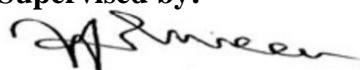
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DECLARATION

We 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. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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

ABSTRACT

This project titled “Drumstick Leaf Detection by Machine Learning Approach “. The traditional method of image recognition is to extract features manually, which cannot solve this problem well due to the complex background of and the taro plants 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, 97% accuracy at INCEPTIONV3, 99% at VGG19, and 99% at MOBILE NET. My system also achieved 81% accuracy at RESNET50.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Drumstick is an effective remedy for malnutrition. This tree can provide the patient with the necessary nutrients and energy. Drumstick is wealthy in nutrition due to the presence of a variety of fundamental phytochemicals exhibit in its leaves, pods and seeds. Actually, moringa is stated to offer 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach. Drumstick is an easily cultivable plant that can be a sustainable remedy for malnutrition. Countries like Senegal and Benin treat kids with drumstick. Children deprived of breast milk tend to show symptoms of malnutrition, such as difficulty digesting food and low levels of energy. Lactating women typically receive prescriptions for lactogogues to increase milk production. The lactogogue, composed of phytosterols, behaves as a precursor for hormones need for reproductive development. Drumstick is wealthy in phytosterols like stigmasterol, sitosterol and kampesterol which are precursors for hormones. These compounds enhance the estrogen fabrication, which in twist stimulates the proliferation of the mammary gland ducts to build milk. It's utilized to treat malnutrition in kids younger than 3 years. About 6 spoonful of leaf powder can meet a gentlewoman ' s daily iron and calcium provisions, in the course of pregnancy. This survey offers an overview on the cultivation, nutritional values, medicinal properties for commercial use and pharmacological properties of drumstick

1.2 Motivation

1. people easily detect drumstick tree leaves.
2. From the misconceptions people about drumstick leaf.
3. They can examine how it's classified and what medical characteristics it has.
4. people will learn about its side effects.
5. People also will learn Science-Based Health Benefits Off drumstick tree leaves.
6. From my own Curiosity

1.3 Rationale of the Study

AI (ML), which is regarded as a subset of Artificial Intelligence (AI), is a CSE field that facilitates information extraction based on example recognition. The development of this framework to decipher data and information in the employment area wretchedness examination has given important data to explore in a matter of cooperation, structure, and system of reasons for sorrow in the occupation are both male and female individuals in Bangladesh. A PC gained from previous blunders after repeating examinations of information and experts' tasks that work recently thought about excessively complex for machines to measure. The goals of this project were to detect any drumstick leaf object using photos from a database.

1.4 Objective

- To Classify of drumstick leaves
- To Demonstrate the accuracy and detection of vitamins from various food sources using deep CNN, INCEPTION V3, RESNET50, RESNET152V2, VGG16, and MOBILE NET to classify 3 different types of drumstick leaf.
- To make detection work faster.
- To use this model also to detect other leaves.
- To debunk common misunderstandings about the drumstick tree.

1.5 Research Questions

1. Does the system use sample data to forecast a real output?
2. What is the thesis's purpose?
3. We 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 drumstick it can easily predict all the leaf.

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

All the data were collected as raw data and all the data were collected through the

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 drumstick leaf 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 50% as test data. The accuracy of the drumstick tree leaf model which is solely dependent on the training dataset is what I want to find. Finding the training dataset's correctness is my goal. Our vitamin detection will be finished once all necessary steps have been completed. We achieved 100% accuracy at RESNET152V2, 99% accuracy at INCEPTIONV3, 99% accuracy at VGG19, and 99% accuracy at MOBILE NET. My system also achieved 86% accuracy at RESNET50.

1.6 Report Layout

Table 1.1: Report layout

Chapter	Discussion
Chapter 1	In this section, I've covered the motivation for my work, my goals, and the typical outcome of our project.
Chapter 2	In this section, I've discussed the theoretical underpinnings of my research and looked at related studies, similar investigations, the scope of the problems, and obstacles.
Chapter 3	I am discussing my study topic, the tool I utilized, my data collection process, statistical analysis, and implementation.
Chapter 4	In this chapter, I present the findings of my research experiments, together with descriptive analysis and summary.
Chapter 5	In this chapter, I discuss a summary of my predictions and findings and add a further study approach.

CHAPTER 2

BACKGROUND

2.1 Introduction

The drumstick leaf, also known as "The Miracle Tree," "Horseradish tree," or "Ben oil tree," is a plant of the Moringaceae family that is well-known and, more significantly, widely dispersed. It has a broad variety of medical uses and high nutritional value all over the globe.

This plant is widely dispersed in the Philippines, Cambodia, America, and the Caribbean Islands. It is native to the Western and Sub-Himalayan regions of the republic of India, Pakistan, Asia, and Africa.

In many regions of the world, organizations including Trees for Life, Church World Services, and Educational Concerns for Hunger Organization have promoted drumstick as "Natural Nutrition for the Tropics."

Nearly every part of this revered tree has long been used by humans for food and for a variety of domestic purposes, including alley cropping, animal forage, biogas, domestic cleaning agent, blue dye, fertilizer, foliar nutrients, green manure, gum (from tree trunks), honey, and glucose cane juice-clarifier (powdered seeds), decorative plantings, biopesticide, pulp, rope, tannin for tanning hides, water purification, engine lubrication . Additionally, the prior reviews of the various organic characteristics associated with various portions of this tree's culinary and other domestic uses.

According to studies, drumstick leaves are an essential supply of macro- and micronutrients, a rich source of protein, vitamin C, calcium, and potassium, as well as a good source of common antioxidants. As a result, they extend the shelf life of foods that include fat.

Fruit (pod), drum sticks, and leaves have all been used to treat thyroid hormone imbalance as well as malnutrition, especially in newborns and nursing women to improve milk production.

Different drumstick portions are said to offer a variety of therapeutic characteristics that have been acknowledged by both the Ayurvedic and Unani medical systems. Because the nitrile, mustard oil glycosides, and thiocarbamate glycosides present in the plant's

roots, leaves, gum, flowers, and infusion of seeds—as well as other chemical components—are thought to be responsible for the tree's diuretic, cholesterol-lowering, antiulcer, hepatoprotective, and cardiovascular protective properties—the plant has a wide range of applications in the treatment of cardiovascular diseases.

The roots' well-known usage for treating diarrhea is based on claims that they have antispasmodic effect against calcium channel blockage.

Numerous plant parts and the energetic components they contain are known to have various organic activities, but sometimes little is understood scientifically about the antioxidant capacity of drumstick fruit (pod) and leaves.

Because the exhibit survey investigates, establishes, and clarifies a comparative analysis of the effects of ethanolic and aqueous extract of drumstick leaves and fruit on markers of oxidative stress, as well as its safety profile in mice as an example and correlation with antioxidant properties using *in vitro* and *in vivo* assays.

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], one of the most crucial methods in machine learning is classification. Data analysis is the primary function of machine learning. There are

several classification methods available, including decision trees, Naive Bayes, backpropagation, neural networks, artificial neural, multi-layer perception, multi-class classification, support vector machines, and K-nearest neighbor, among others. Three strategies are thoroughly detailed in this study.

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 drugs) that was used to induce ecstasy among the priestly caste.

2.3 Research Summary

Drumstick leaves are a good source of nutrition, but they lose their nutritional value quickly. They can be dried and stored for six months without losing their nutritional value. Drumstick leaves contain more protein than other leafy greens and are high in vitamin C and iron. Many vegetables are to be had in our country. Among them, drumstick is a beneficial vegetable. So, I research drumstick so that people can recognize it without problems. Because my task is photo dataset based. I split the dataset into four elements. CNN, INCEPTION V3, RESNET50, RESNET152V2, and VGG19 algorithms to realize model accuracy, specification, and prediction. We attempted to get as excessive accuracy as viable because the better the accuracy the better for our gadget model. The specification is an essential point of the project. Specification means to perceive and eventually, prediction, prediction models will help us to pick out the drumstick foundation.

2.1 Scope of The Problem

The main reason for my research on drumstick is to present a correct idea about drumstick to people. I can see that many of us do not know the number of vitamins and iron in drumstick and how beneficial it is for health and they have a negative attitude towards drumstick vegetables. My aim is to give details about drumstick through my research.

again, their cultivation method is also very easy. I have tried to highlight those things in my research.

2.2 Challenges

It is very challenging to collect data in the subcontinent of our country. Because accuracy prediction depends on an accurate dataset. There was no private source for my datasets, so I was challenged to collect the data. I am to find out what vitamins are in drumstick leaves. As the picture of drumstick leaves could be similar, I had to collect drumstick leaves from different varieties like as child leaves, young leaves, old leaves Which was very difficult for collecting me alone, as a result, I had to take a lot of trouble taking pictures. Another problem is that I thought the images would be available from Google. But when I search, I see that it is not possible in any way. As a result, I have to go to the village and collect the data. Another problem is changing the background which has caused a lot of problems. Changing the background was difficult due to the different shapes of the leaves. Let me finally manage to successfully retrieve data across all hurdles.

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.

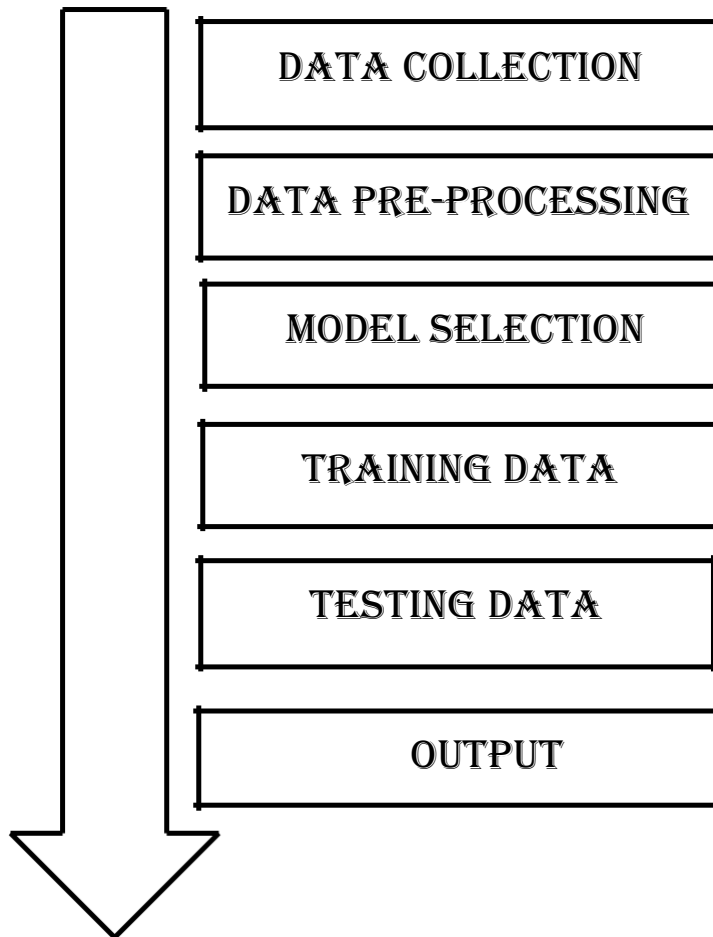


Figure 3.1: Methodology at a Glance

3.2 Research Subject and Instrumentation

I observed that it is challenging to distinguish drumstick leaf from others. 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 beside my home.

I have gathered over two thousand (2000) data points. And from those data, I selected 1216 data points in fig.3.2 for my study. I collected all the data in an offline setting using a Samsung a 52 to get a better image. There are three types of leaves in my dataset.

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

📁 Found 1216 images belonging to 3 classes.

Figure 3.2: Amount of datasets

3.3.1 Dataset

From the dataset, I have collected 03 varieties of drumstick leaves. Where there are 423 child leaves, 335 old leaves, and 456 young leaves available in our datasets shown in figure 3.3

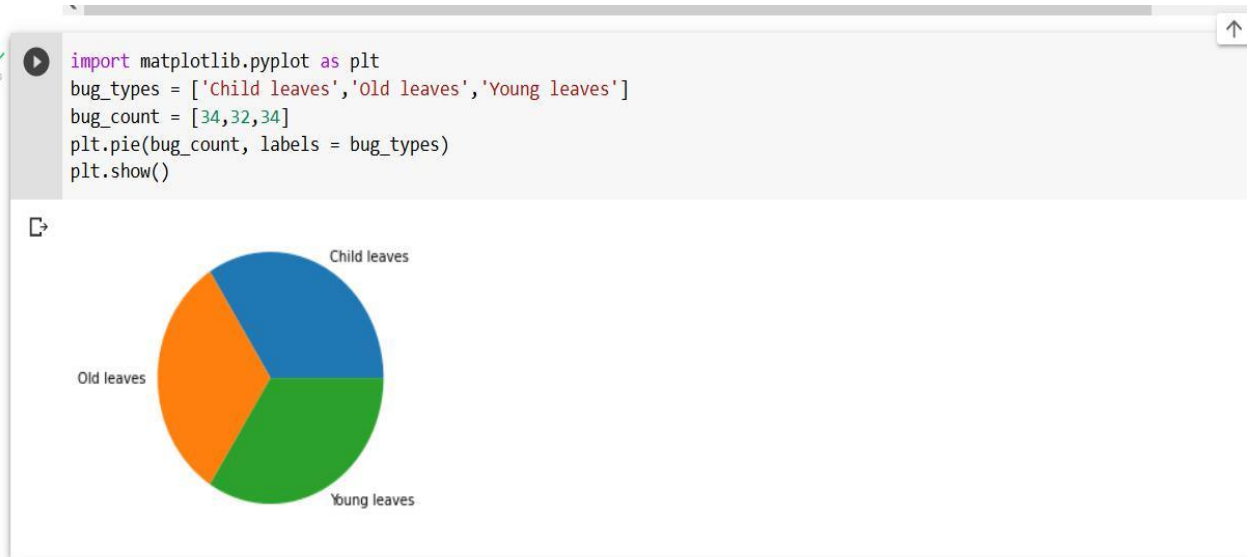


Figure 3.3: Datasets percentage

3.3.2 Class Labels

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

- Child leaves
- Young leaves
- Old leaves

Table 3.1: Amount of data

Category	Count
Child leaves	423
Young leaves	456
Old leaves	335

Percentages of each leaf from the datasets are child leaves: 34.0%, young leaves: 34.0%, old leaves: 32.0%, Figure is shown 3.4.

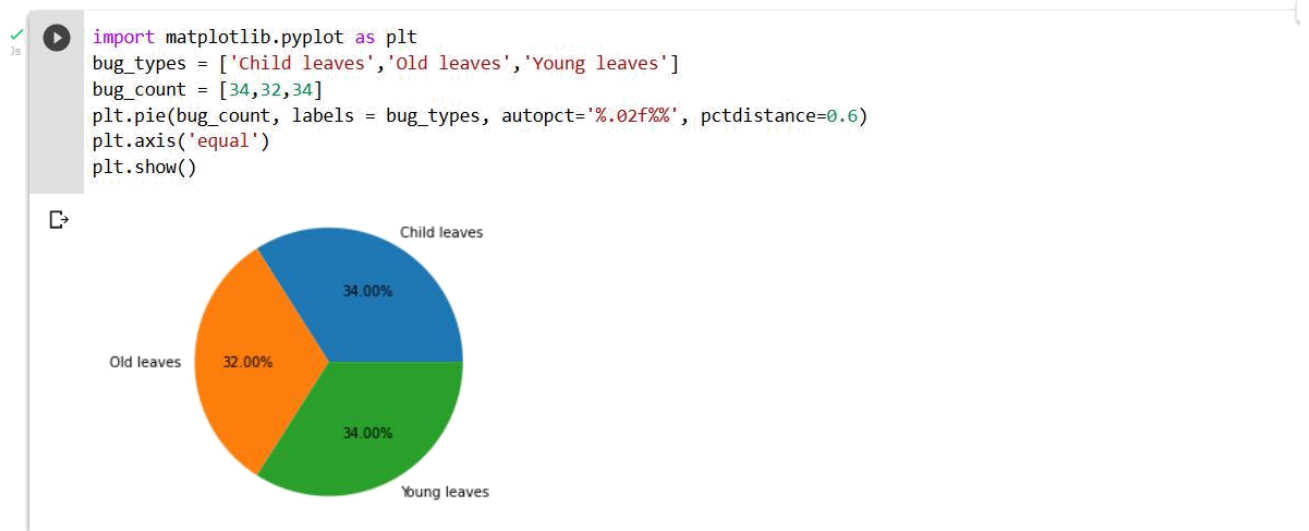


Figure 3.4: percentages of leaf

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 2700*4000 pixels before processing, has been reduced to 224*224 pixels in figure 3.6

<matplotlib.image.AxesImage at 0x7fad062d9f10>

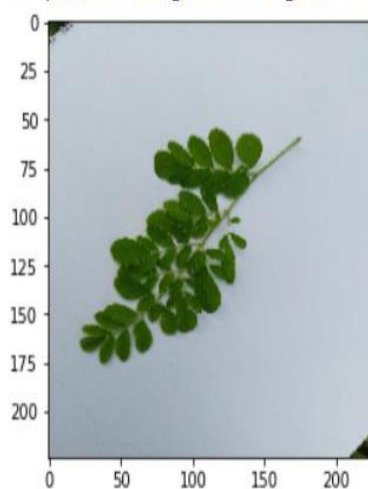


Figure 3.5: Data Preprocessing (1)

<matplotlib.image.AxesImage at 0x7fad06311460>

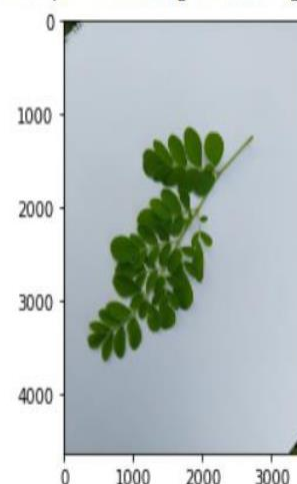


Figure 3.6: Data Preprocessing(2)

Similar to figure 3.7 figure 3.8 shows an image that was 2700*4000 pixels before processing and is now 224*224 pixels after processing

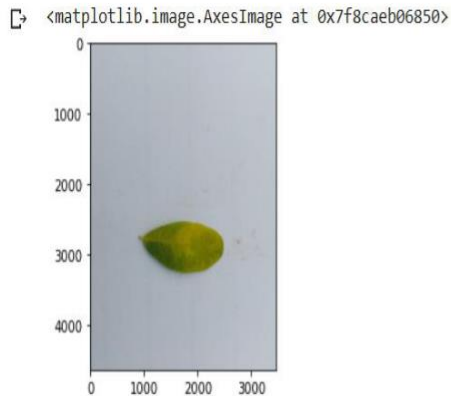


Figure 3.7: Data Preprocessing (3)
(4)

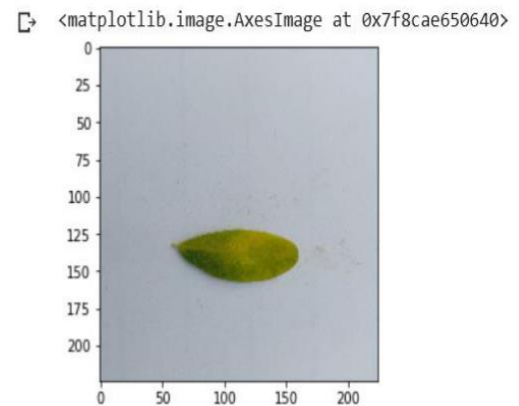


Figure 3.8: Data Preprocessing

And figure 3.9 and figure 3.10 shows an image that was 3468*4624 pixels before processing and is now 224*224 pixels after processing.

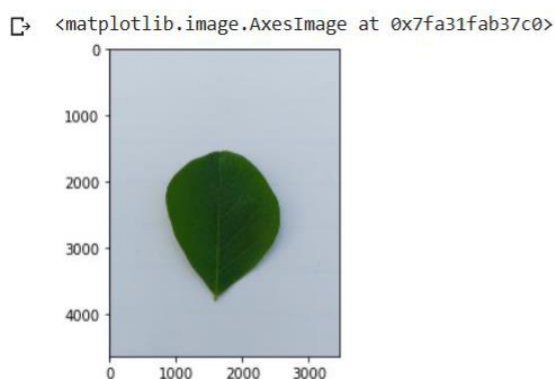


Figure 3.9: Data Preprocessing (5)

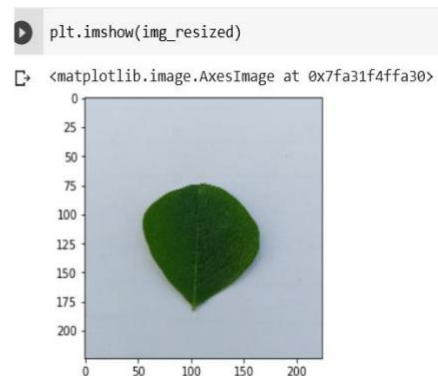


Figure 3.10: Data Preprocessing (6)

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 one thousand two hundred sixteen (1216) images. Each class of training dataset contains almost five hundred (500) images. On the other hand, in the test dataset in three (3) classes I have nine hundred fifty-six (956) images and each class of test dataset contains almost four hundred fifty (450) images, shown in figure 3.11

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

↳ Found 1216 images belonging to 3 classes.
```

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

↳ Found 956 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 Jupiter 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 Tensor Flow, Kera's, NumPy,

Torch, Flatten, etc. are used to implement all algorithms. These libraries aid in the program's initialization.

3.4 Statistical Analysis

I have 2000 photos in the dataset for the detection of drumstick leaf. Nearly 1500 photos make up the training dataset, and nearly 1000 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

The flowchart of my working process:

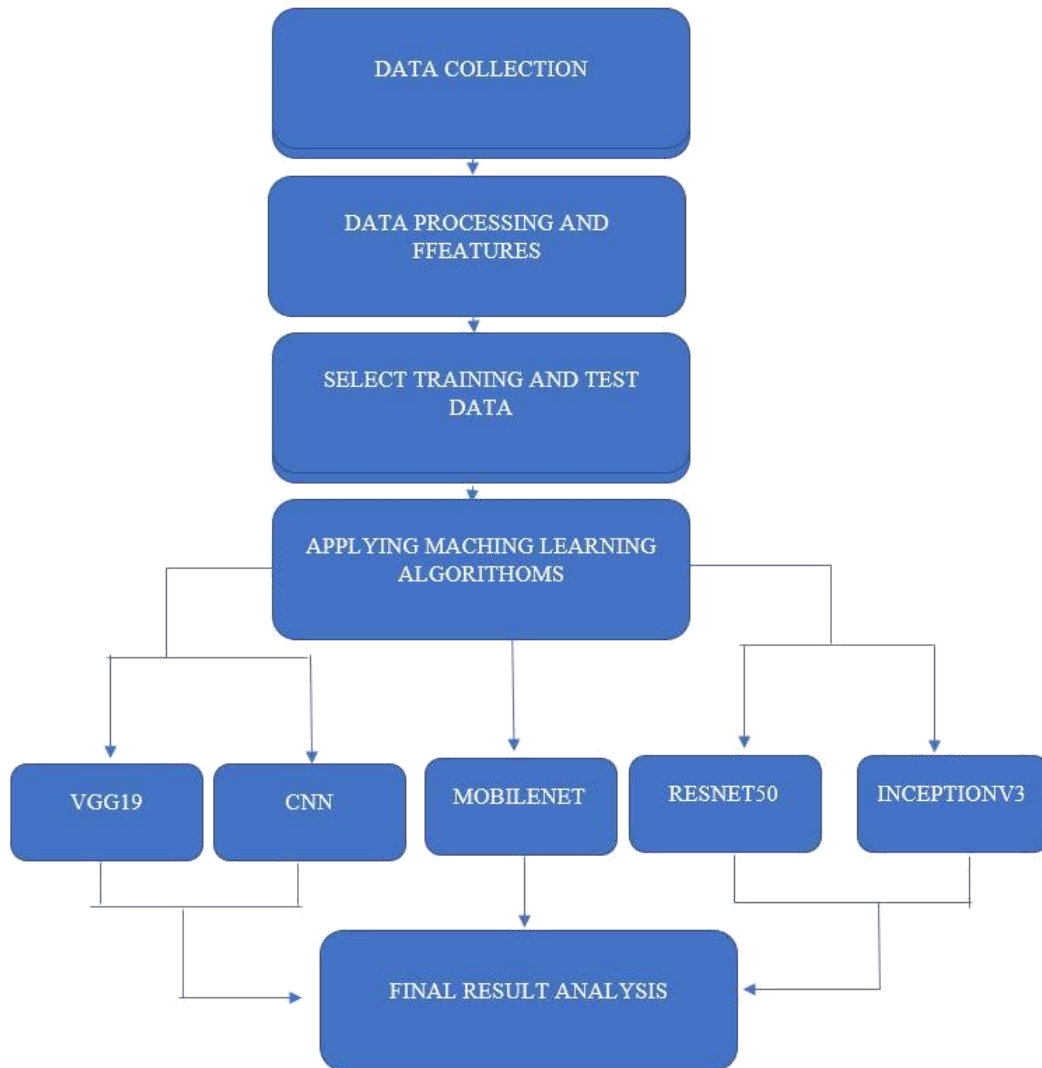


Figure 3.13: Proposed Model Structure

In this figure 3.6, we show our working procedures step by step. From the flow diagram, our 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)

CHAPTER 4

EXPERIMENTAL RESULT AND DISCUSSION

4.1 Experimental Setup

For my model and code implementation 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 drumstick tree leaf .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

As my main goal is to detect drumstick leaf. Then I predicted our model based on test datasets. The main thing depends on the accuracy rate and we are satisfied with the accuracy we got. And then testing our model was also fruitful. Testing my model after that was also successful. I reached an accuracy of 0.81 at Resnet50, 0.87 at Cnn,0.97 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

Table 4.1 is presenting the accuracy of the training dataset. And table 4.2 is presenting the accuracy of the testing dataset.

Table 4.1: Accuracy Table

Algorithm Name	Accuracy (test Datasets)
Resnet50	81%
CNN	87%
Mobile net	97%
Vgg19	99%
InceptionV3	99%
Resnet152V2	100%

The accuracy of the training dataset is shown in table 4.2.

Table 4.2: Accuracy Table

Algorithm Name	Accuracy (train Datasets)
Resnet50	96%
CNN	88%
Mobile net	99%
Vgg19	99%
InceptionV3	100%
Resnet152V2	100%

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 this figure 4.3

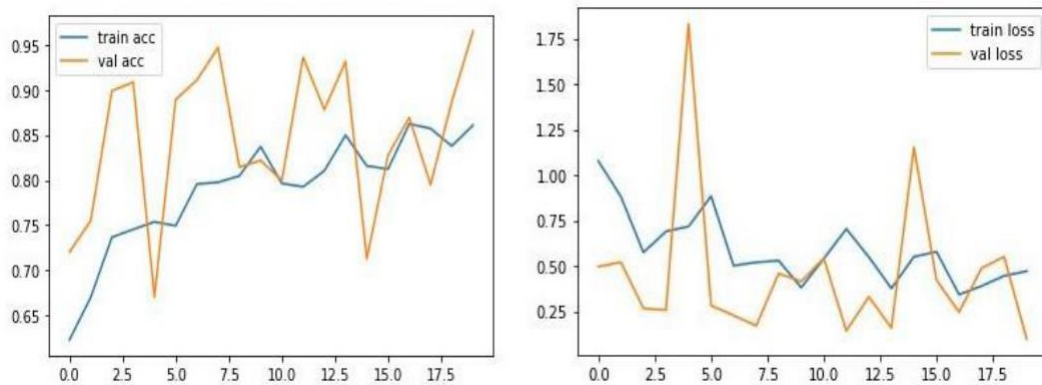


Figure 4.3: RESNET50 Model Accuracy

MOBILENET: The accuracy model of mobile net has given below in this figure 4.4

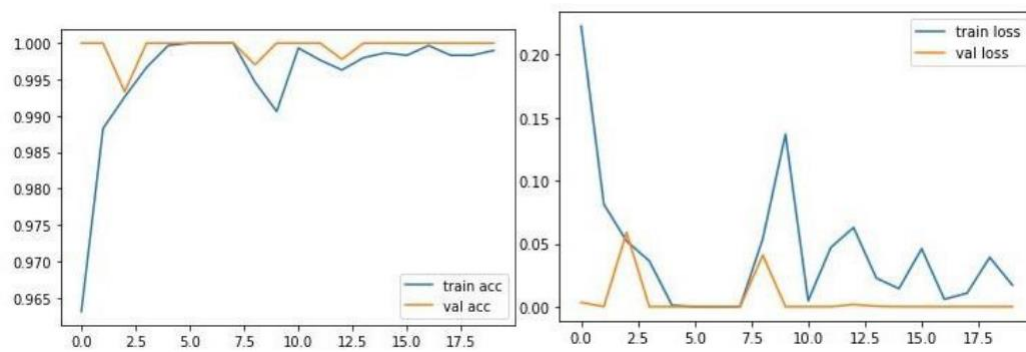


Figure 4.4: MOBILE NET Model Accuracy

VGG19: The accuracy model of vgg19 has given below in this figure 4.5

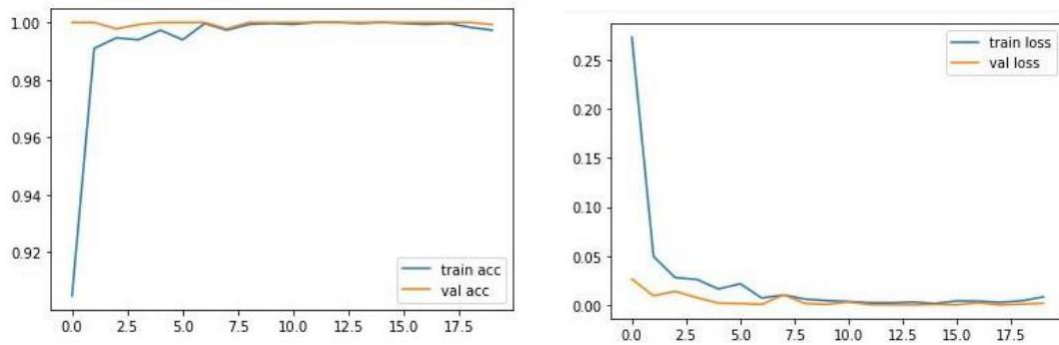


Figure 4.5: VGG19 Model Accuracy

INCEPTION V3: The accuracy model of inception v3 has given below in this figure 4.6

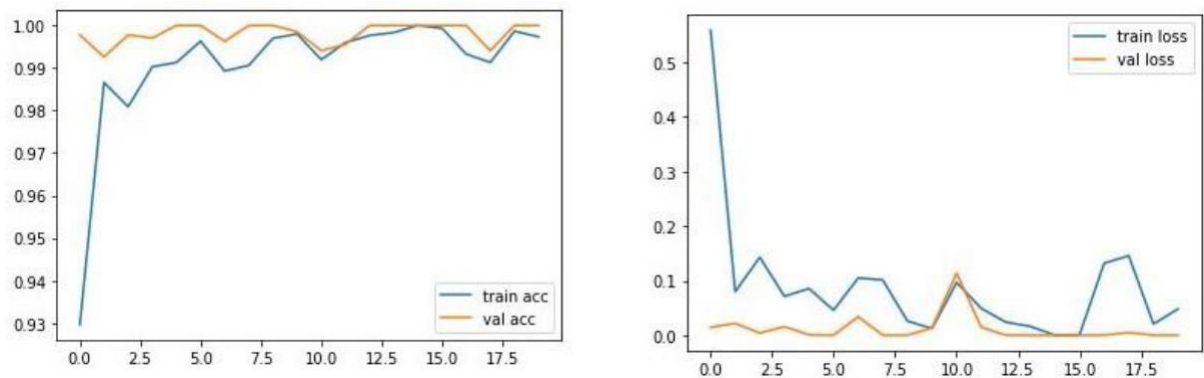


Figure 4.6: INCEPTION V3 Model Accuracy

RESNET152V2: The accuracy model of resnet152v2 has given below in this figure 4.6

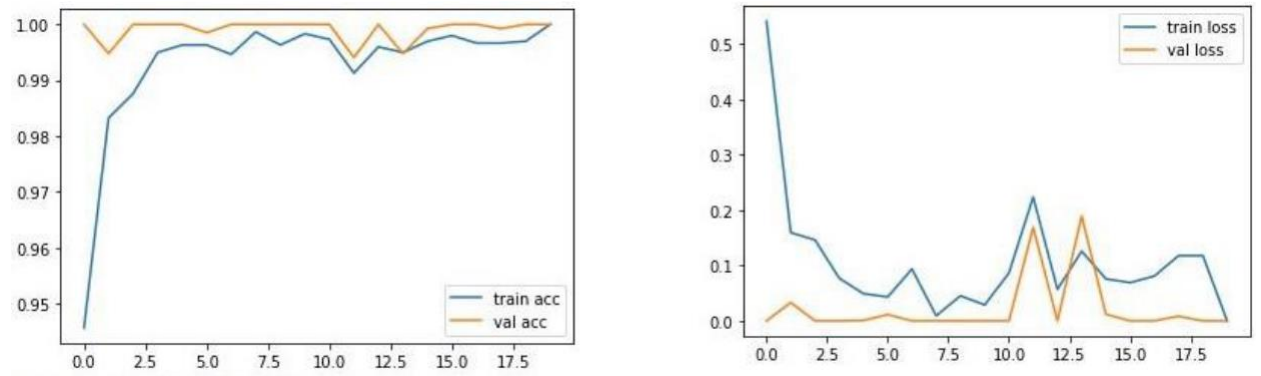


Figure4.6: RESNET152V2 Model Accuracy

Prediction: I tried to use test data as the prediction in my model. Based on the test dataset, I will identify the drumstick leaves. The test code has been attached below in figure 4.7.

```

▶ 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 4.7: 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 our 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. Our accuracy ratio, therefore, reached 99% for the training set and 90% for the test set.

CHAPTER 5

PROJECTS ETHICS

5.1 Impacts on Society

I have normally researched drumstick leaves because of there has a various type of vitamin and iron which is important our body and health. So i want to inform everyone about drumstick leaf benefits. Raw vegetables are rich in nutrition, it is not valued according to their nutrition in our country. As a result, cultivation is less. Drumstick shows new possibilities in the era of commercial agriculture. Drumstick can be a profitable crop in terms of health and money. In continuation of many countries of the world, some have started commercial production of drumstick leaves in Bangladesh. The versatile properties of the leaves of the drumstick tree are now well known all over the world. In terms of nutrition, drumstick leaves are many times better than milk, oranges, carrots or bananas. Plantation of drumstick has started in many parts of the country. Farmer Abdul Kader of Chuadanga Sadar has planted hundreds of saplings in abandoned places. I hope drumstick and drumstick leaves will save people from malnutrition, and fulfill their vitamin and iron needs. The incredible nutritional qualities of the drumstick tree, including those of its seeds, leaves, bark, pods, flowers, and other parts, are what have caused it to become so popular on the international market.

It stands out for a wide range of health care regulars due to its bioactive components and nutritional components like carbohydrate, protein, calcium, vitamins, phosphorus, potassium, iron, and beta-carotene.

Because of their anticancer, antioxidant, and antibacterial properties, drumstick components are significant in the pharmaceutical industry.

5.2 Impacts on The Environment

Drumstick tree play a vital role in environmental sustainability through:

- erosion control

The 3 main principles to temperance erosion are to:

- 1) use land acting in accordance with the capacity.
- 2) save the soil surface with several beget of mask.
- 3) temperance runoffs before it develops into an erosive force.

- Reforestation

Planting trees in degraded or deforested areas can help the environment by ensuring, or accelerating the re-establishment of healthy forest structure by regrowing the forest canopy and preserving biodiversity within the ecosystem.

- Reduction of greenhouse gases

The goal of cutting greenhouse gas emissions is to slow climate change, which will also reduce air pollutants. This improved air quality and health benefits are worth the cost, as research has shown that reducing greenhouse gas emissions by at least 25 percent can halve global warming potential (GWP) over a four-decades period.

- Reversal of desertification

Planting the trees reverses desertification by preventing soil erosion and offering nutrients for other plants and crops to enlarge. The tree is a local tree, it puts nutrients rear into the soil, offers shelter for crops below its branches and offers fodder for livestock

- Increased biodiversity

Planting of drumstick trees can offer shelter and meal to a range of species like birds, animals, insects and fungi. Save your trees from diseases. Offer inundate protection and slope stability.

5.3 The Sustainability Plan

As the global scenario is now swapping towards the advancement of sustainable and bio secure aquaculture by utilizing of trustworthy and eco-friendly products. This money reviews the application of drumstick plant for growth of sustainable aquaculture.

The drumstick plant shows numerous applications in aquaculture as an example antimicrobial activity, antibacterial efficiency, larvicidal activity, piscicide, anti-cyanobacterial activity, antifertility execute, meal supplement and seafood preservative. The use of drumstick as antimicrobial activity of the seed coat and pod husks; as a medicinal plant for protection of *Penaeus indicus* from pathogenic *Vibrio Harvey*; as an evidence for cyanobactericidal activity of filtrate from crushed drumstick seeds and isolation of a protease inhibitor. to sum up, these outcomes advise that drumstick showed potentially indispensable plant for advancement of sustainable aquaculture.

CHAPTER 6

SUMMARY, CONCLUSION, RECOMMENDATION, IMPLICATION FOR FUTURE RESEARCH

6.1 Summary of The Study

I have developed a model that perfectly captures the drumstick tree. Get ideas for a drumstick tree was the primary objective. Because our test depends 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 our test and prediction. As a result, both train and test dataset accuracy have to be carefully considered.

We can readily conclude from our five data models that Resnet152v2 and InceptionV3 both provide us with almost the same accuracy in terms of test and train sets. Our accuracy rate was around 99%. As a result, both our test and prediction will be more precise.

6.2 Conclusion

Most of the people in our country are poor so most of them struggle to fulfil their vitamin needs, I think the small amount of drumstick and drumstick leaves can be immense to meet the vitamin requirements. The drumstick leaves are nutritionally extremely wealthy, leaving behind carrots, oranges and even milk in terms of nutrition worth. The leaves search numerous utilizes in Bangladesh cuisine as they're versatile and might be incorporated into the diet in various ways. Adding them to juices and utilizing them as stir-fry vegetables are the greatest current ways whereat, they're eaten. When consumed in their commonplace beget, the drumstick leaves have no side effects. my target was detecting good drumstick tree and find out it's nutrition value so that people can easily know that the benefit of drumstick leaves.

6.3 Recommendations

Artificial intelligence is a supporter of computer science, which applies human intellect and reasoning capacity. Artificial intelligence, to put it simply, is the embodiment of human intellect and thinking capacity via machines. What is artificial intelligence technology's drawback for people? In many respects, the author is the solution to this

question. However, if we can advance artificial intelligence too far, it will bring about the biggest or worst shift. Even humanity may have. Humans, however, are clever and observant. We wish to observe what takes happening. And it is brides who improve artificial intelligence. Making computers as intelligent as humans is our 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 of various types of drumstick leaves.
- The development of a web application for the prediction dataset is my main objective. The drumstick leaves can be seen in any leaf's photographs.

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APPENDIX RESEARCH REFLECTION

Building this project was difficult. The project and I ran across a few problems. The first problem was finding the appropriate dataset.

I started by doing research online. Such images, however, weren't appropriate for better accuracy.

I then started the difficult work of compiling raw data. To acquire the pictures, I had to go back to my hometown. The second problem I encountered was trying to find an appropriate algorithm. A CNN algorithm I found only offered 40% accuracy. But after some research, I found that the parameters were inappropriate, so I again changed the algorithm and ultimately got the right accuracy.

The picture extension has yet another problem.

"heic" to; "jpg"

Plagiarism Report

Drumstick leaf detection by Machine Learning Approach

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