Species Identification and Classification of Rose Flower Images Using Convolutional Neural Network and K-Means Clustering Algorithm

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APPROVAL

This Project/internship titled **"Species Identification and Classification of Rose Flower Images Using Convolutional Neural Network and K-Means Clustering Algorithm",** submitted by **"Md. Nafiul Islam"**, ID No: **181-15-10694**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 **02-01-2022**.

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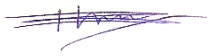

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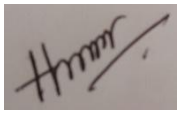

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DECLARATION

I declare that this project has been done by us under the supervision of **Ms. Nazmun Nessa Moon, Associate Professor and co-supervision of Md. Jueal Mia, Sr. 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.

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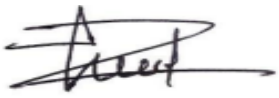

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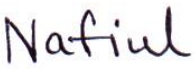

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ABSTRACT

The proposed work in this presented paper aims to identify and classify the rose species from the rose image. In my research title **"Species Identification and Classification of Rose Flower Images Using Convolutional Neural Network and K-Means Clustering Algorithm",** this experiment is conducted with a k-means clustering algorithm and convolutional neural network. The proposed work in this presented paper aims to identify and classify the rose species such as Old Garden and New Garden from the rose flower images. The experiment is conducted with a k-means clustering algorithm and convolutional neural network. The proposed work is approached in two ways. Firstly, the rose images are preprocessed by Adobe Photoshop. Secondly, the rose images are segmented multiple K values by the k-means clustering algorithm so that defective leaves are accurately recognized for classification. Furthermore, the K-means segmented images (k=8) and normal preprocessed images are employed by the classifier algorithm named convolutional neural network. As a result, the K cluster value (k=8) and normal preprocessed images give the accuracy that is 72% and 73% respectively. Finally, the results are compared with respect to the K cluster value and normal preprocessed image that extracted the standard normal preprocessed. The normal preprocessed image gives 1% better accuracy than the k-means cluster segmented image.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

There are about 320 recognized rose-growing plant species on the globe. Several blooming rose flowers can be found in the garden, park, roadside, and a variety of other places, and flower identification is often left to taxonomists or botanists. Because the general population lacks information about these flowers, they must rely on flower reference books or specialized websites for information. Roses are a plant that can be divided into several groups, each with its own set of characteristics and appearances. However, even within the same flower species, there can be differences. Because of the resemblance and dissimilarity, recognizing rose blooms with a high degree of accuracy is a difficult task. The ability of a professional plant scientist to identify unknown rose blooms is heavily reliant on his or her own data. Manual recognition, on the other hand, is frequently tedious and time-consuming. The rose blooms, on the other hand, are the most common and make it possible for computers to perceive them. In a sense, computer vision is the process of implying information about the world from observed image data. Deep learning is an artificial intelligence field (AI). It contains a series of techniques that enable the computer system to learn on its own. Furthermore, it allows systems to develop over time without having to be explicitly coded based on experience. Images are made up of pixels and include information that can be used to describe them, according to deep learning. Because this data is too large and mixed-up to be used directly by a deep learning system, it is not possible to do so. For feature extraction, image processing techniques were applied, and Deep Learning algorithms were used to develop a model using these features. As the amount of data grows exponentially, it is vital to organize it in order to extract useful information. Furthermore, it has been discovered that today's categorization challenges necessitate the prediction of several labels. In this research, the mentioned methods are used to detect and classification of two species such as Old Garden and New Garden in rose flower images based on k-means clustering image segmentation and convolutional neural network. In image processing, the k-means image segmentation algorithm method

is assigned for the feature extraction of the images. In deep learning, the convolutional neural networks method is employed for the classification of two different rose species.

1.2 Motivation

In the present day, technology is fast developing and many real-life problems are solved easily with the help of technology. Image processing techniques are widely used for solving many real-life problems. Nowadays, image processing methods are used in our daily life to solve many object detection and classification problems. The motive of this paper is to detect and classify the two rose species such as Old Garden and New Garden in rose flower through an image processing and deep learning method. The farmers of this country will get appreciable benefits from this work. These mentioned methods reduce the farmer's and flower's lover's work to find out rose flower species.

- Difficult to get rose flowers according to choice.
- Hard to cultivate rose flowers while we can't identify their species.
- Increased farmer profits and confine loss.

1.3 Rationale of the Study

Deep Learning thought about a part of Artificial Intelligence (AI), which is a field of Computer Science that offices extraction of the information based on example acknowledgment.

Deep Learning frameworks are currently being actualized in clinical neurosciences to devise imaging-based analytic and characterization frameworks of certain neurological and insane problems. In this paper, I am examining the Rose Flower Species Classification from the various type of rose flower images.

1.4 Research Questions

In this section, I will introduce the Image Classification problem, which is the task of assigning an input image one label from a fixed set of categories.

1. Does it predict an actual output by given sample data with the system?

2. Can it classify the accuracy of species identification and classification of rose images data?
3. Does every algorithm work perfectly (yes/no)?
4. Do we know the accuracy percentage of the classification model and segmentation algorithm?

1.5 Expected Outcome

In my rose species categorization prediction system, given data from our dataset is used to generate an expected result. To achieve a more accurate outcome, I am employed 80% training data and 20% test data. The accuracy of our result is totally dependent on the training data set. After all of our system's necessary operations have been completed, our deep learning system will be ready. I used a variety of ways to obtain accurate results. In this study, I employed Convolutional Neural Networks as a classification model. "K-means clustering image" and "normally processed image," which I applied to this system, produced around 72% and 73% accuracy, respectively.

1.6 Report Layout

Chapter 1 In this section I am talking about the inspiration of my task, targets, and furthermore the normal result of our undertaking.

Chapter 2 In this chapter I am talking about the presented foundation of my work and examined other related works, similar investigations, the extent of the issues, and difficulties in this section.

Chapter 3 This chapter is about my research subject and instrument used and also our data collection procedure and statistical analysis and also implementation.

Chapter 4 In this chapter I am talking out our research experimental result and descriptive analysis and finding out summary.

Chapter 5 In this chapter I am talking about the summary of prediction and conclusion and also I am added further study process.

CHAPTER 2

BACKGROUND

2.1 Introduction

Roses are available in a variety of species and cultivars, and the qualities of the rose blossom might differ depending on these factors. Although many of us are familiar with the classic red rose, various colors such as white, pink, dark mauve, yellow, and tints in between can be equally lovely. Bi-color or tri-color rose petals can be found on some roses. The petals of hybrid roses can have a variety of designs, including speckles and stripes. All roses have soft, smooth petals that are frequently doubled, which means they have two sets of petals. The petals occur in a variety of forms, ranging from pointed to rounded, depending on the type. It is critical to distinguish and classify the right rose species, both Old Garden and New Garden, which is crucial for farmers and flower enthusiasts. I am embarking on this research project in order to determine the most essential characteristics of the species Old Garden or New Garden, as well as the percentage of accuracy of Old Garden or New Garden based on rose blooms.

This section will provide our connected occupations, the project synopsis, and the research problems. I will discuss additional research articles that are connected to our work in the related job area. I will explain our project summary in the summary section, then I will discuss ways to improve accuracy in the challenge section.

2.2 Related Works

Isha Patel, Sanskurti Patel has worked on Flower Identification and Classification using Computer Vision and Machine Learning Techniques. This paper Computer vision and machine learning approaches can be used to automate the process of extracting, analyzing, and comprehending information from images. The research developed a hybrid methodology that combined MKL and SVM with multi-label classification and was tested on a dataset of 25000 floral photos representing 102 distinct spices. To increase classification accuracy, basic and morphology features such as color, size, texture, petal-type, petal count, disk flower, corona, aestivation of flower, and flower class are retrieved. On the extracted feature set, various classifiers are used, and their performance is

discussed. The accuracy rate of MKL – SVM with multi-label classification is 76.92 percent, which is quite promising. In summary, the purpose of this work is to investigate a unique morphology for feature extraction, as well as the application of symbolic representation schemes and several classification algorithms for effective multi-label categorization of flower spices [1].

Hossam M. Zawbaa, Mona Abbass, Sameh H. Basha, Maryam Hazman, Abul Ella Hassenian have focused on an automatic flower classification approach using machine learning algorithms. The goal of this project is to use machine learning techniques to create an effective flower classification method. In order to extract their characteristics, eight floral categories were examined. Flower features are extracted using the Scale Invariant Feature Transform (SIFT) and Segmentation-based Fractal Texture Analysis (SFTA) techniques. The proposed method is divided into three stages: segmentation, feature extraction, and classification. The flower region is segmented during the segmentation phase to eliminate the complicated background from the image dataset. Then the features of the floral image are extracted. Finally, the proposed approach applied Support Vector Machine (SVM) and Random Forests (RF) algorithms to classify different types of flowers during the classification phase. On a dataset of 215 flower photos, an experiment was conducted using the proposed method. When employing the SIFT as a feature extraction approach, it indicates that the Support Vector Machine (SVM) based algorithm delivers superior accuracy than the Random Forests (RF) algorithm. The Random Forests (RF) method, on the other hand, is more accurate with SFTA. Furthermore, the technology is capable of accurately recognizing the flower name automatically [2].

S Kishotha**,** B. Mayurathan have proposed on Machine Learning Approach to Improve Flower Classification Using Multiple Feature Set. Large picture datasets and advanced classification techniques are used in image-based classification systems to achieve the best results. The majority of floral classes, such as plant leaves and grass, share similar shapes, appearances, or background information. As a result, flower image classification remains a difficult task. The purpose of this study is to look at how multiple local factors affect flower image classification. To describe distinct elements of flowers, shape, texture, and color features are taken from floral photographs. The proposed method's classification

performance is also compared to state-of-the-art flower classification performance. In flower classification, the performance of local feature descriptors such as SIFT, SURF, HSV, RGB, and CTM is also examined. In the domain of floral image classification, the combined SURF + CTM delivers superior performance than other combinations of features based on the performance of the local descriptors [3].

Siyuan Lu, Zhihai Lu, Shuihua Wang, Xianqing Chen, Yudong Zhang have worked on Flower Classification.Based on Single Petal Image and Machine Learning Methods Based on computer vision and machine learning approaches, this study proposed a novel automatic floral classification system. First, we used a digital camera to collect 157 petal photos from three different categories. We extracted color characteristics and wavelet entropies from the petal photos after pre-processing. Then, to reduce the number of features, principal component analysis was used. Finally, four different classifiers were trained to distinguish the petals' categories: Support Vector Machine, Weighted k Nearest Neighbors, Kernel-based Extreme Learning Machine, and Decision Tree. The classifiers' out-of-sample performance was evaluated using 5-fold cross-validation. Weighted K-nearest Neighbors fared the best out of all four classifiers, with an overall accuracy of 99.4%. In comparison to current approaches, the proposed strategy is effective at identifying floral categories [4].

2.3 Research Summary

Our research will determine whether the rose species are Old Garden or New Garden. Because our rose flower image is based on two different groups or classes, any of the two outcomes are possible. Because our rose flower photographs are of various types, I divided them into two categories: Old Garden and New Garden, which contain a variety of rose flower species. Because I don't have many missing images for some of the questions, I am used a couple of the most commonly used computations for both of the scenarios.

I have used two different types of images which are normal preprocessed images and k-means segmentation images (k=8). After that, the mentioned two different species of rose

flower images are employed in a deep learning model named Convolutional Neural Networks.

The convolutional neural network is to find out the accuracy, precision, recall, specificity, and f-measure of our predictive model. The higher the accuracy the better will be the system. Precision is also an important factor, where precision means the total number of true positives in all the predictions of yes. For our system, that is actually classified from all the predicted classified images. Recall another important part of the prediction system, which is the number of true positives in actual yes results.

2.4 Scope of the Problem

The scope characterizes the territory of the investigation, that is, the degree to which I will contemplate the subject. In most exploration, for different reasons, it is unimaginable to expect to concentrate on each part of the point. Something else, the examination will take an extremely lengthy timespan, if not until the end of time! Hence, you need to characterize or limit the territory you will consider. For example, for your theme, you may decide to take a gander at a specific reason for despondency. For example, individual, natural, or financial, and not certain others, for example, social, mental, or geographic. Also, you may decide to contemplate certain gatherings, regardless of whether as far as age, sex, or societal position, and not certain others.

2.5 Challenges

Data collection is the biggest challenge to get our predicting accuracy. Using an online perspective, different rose species image data collection is not a simple process. There have been no collected data in any online database such as Kaggle and research institutions in our country which is helpful for our project. As a result, I went to many individual websites to collect individual species rose flower image data manually and then I store it in a jpg file on our PC. For this reason, I scraped many times that is so much time-consuming. Firstly, I was searched various online data repository platforms like Kaggle, GitHub, UCI Machine Learning Repository, etc. Then, I can’t find more data that is not compatible with our project. I informed our supervisor mam then she provides a reference as the side of our

research work. Moreover, I scraped enough datasets with different rose species images from various websites. As a result, the proposed architecture has been subjected to a different algorithm. Finally, the implementation procedure has been designed in order to obtain the anticipated value accurately. Several obstacles arose as a result of the working procedure.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

In this section, our research technique and procedures will be discussed. In addition, this session will cover tools for the research project, image data collecting, study topics, image segmentation, processing, graphical visualization, statistical analysis, and its implementation.

In Figure 3.1, I can see the full methodology at a glance.

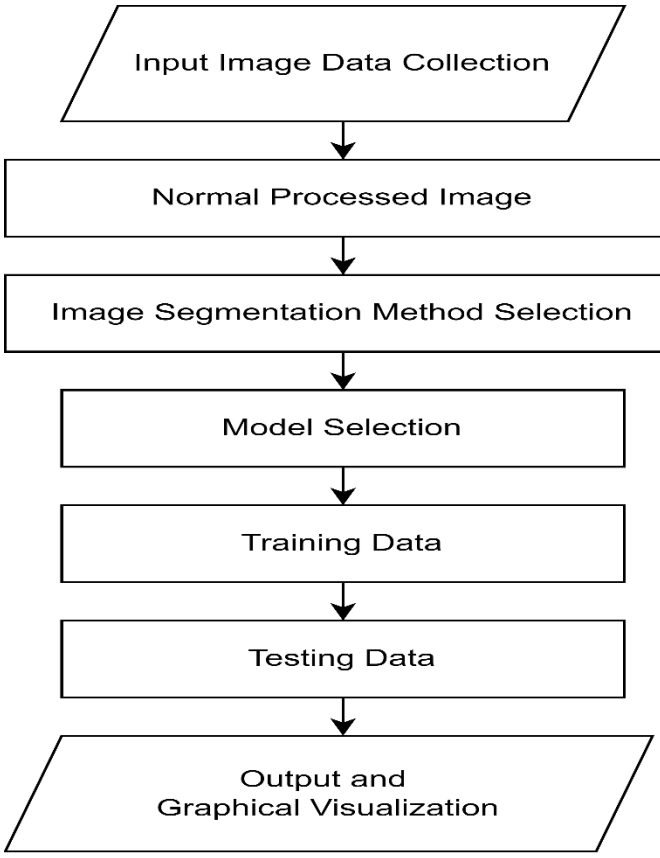


Figure 3.1: Methodology at a Glance

3.2 Research Subject and Instrumentation

I have seen that information is the most important aspect of the evaluation. Finding spectacular image data and amazing algorithms or models for our research work is an

extremely important component for a researcher. We'll also need to look over similar research paperwork. At that time, I have must choose between a few options:

- Which data should be collected?
- How to ensure that the collected data are okay?
- How each data should be organized?
- How each data should be labeled?
- Which algorithm would be suitable for this research?

3.3 Data Collection Procedure

All of the information was gathered from secondary sources. The data for this project was gathered from a variety of web sources. The majority of the information was gathered from various websites that offer rose photos. I am using Google Chrome to search for and collect photos from various classes.

I have collected almost 2500+ data in which I have used 1948 data in our research. In our research, I will be using 2 classes. I have collected 974 image data for each class

3.3.1 Attributes

A rose is a flowering perennial woody plant with a woody stem. There are around three hundred species and tens of thousands of cultivars to choose from. They are a collection of plants that might be erect shrubs, climbing plants, or trailing plants with stinging prickles on their stems. Their flowers come in a variety of sizes and shapes, but they are often enormous and showy, with hues ranging from white to yellow to red. The majority of species are endemic to Asia, with a few exceptions in Europe, North America, and northwest Africa. Species, cultivars, and hybrids are all popular because they are attractive and often aromatic. In many cultures, roses have acquired cultural significance.

In this research, I am working with 45 different species. Firstly, I have selected the 45 species and the individual datasets were collected online. And, also, I am tried to find accurate species and collect the individual image.

In Figure 3.2, I can see some normal processed data.

Figure 3.2: Normal processed data

3.3.2 Image Segmentation Algorithms

To analyze the image with different colors, shapes, and textures, the image segmentation technique is very useful for solving many image processing problems. Image segmentation is the method of dividing an image into several regions based on the characteristics of pixels to identify objects or edges to simplify an image and more efficiently examine. There are some wonderful segmentation techniques that are used from the ninth century to the present day. These are namely; Threshold-based segmentation, Edge-based segmentation, Morphological methods-based segmentation, Graph-based segmentation techniques, Clustering-based segmentation techniques, and Probabilistic image segmentation technique respectively. Some of the clustering-based image segmentation techniques are k-Means clustering, watershed algorithm, quick shift, SLIC, etc. In this research, k-means clustering is used for image segmentation. A cluster refers to a group of data a point that is combined together because of certain similarities. The K-means algorithm identifies the k number of centroids, and every data point is allocated to the nearest cluster. A centroid is a fictional location representing the interval of the cluster. Afterimage pre-processing is applied, different types of k numbers are used for the image segmentation. But I have used the value of k, which number is 8.

In Figure 3.3, I can see some processed data after K-means clustering

Figure 3.3: Processing Data After K-means Clustering

3.3.3 Data Organizing

I am tested and trained the data before saving it in two folders for the organization. In addition, I am using the validation folder to check train data validity. Then, in the test and train folders, I made sub-folders for Old garden and New garden roses.

3.3.4 Data Storing

In this part, I am stored all the data in local storage because it makes our work easier. I can use those locally stored data in our research project then I have saved all the image data as jpg formats. Then I have stored them in Google drive so that they are not lost. Later, I could use those data in our project work through coding by following some simple steps or code.

3.3.5 Deep Learning Algorithms

In the revolutionary era, many machine learning and deep learning classification algorithm are used for image classification problems. The proposed work is used a convolutional neural network classifier algorithm to identify the different species of rose images. The experiment has been conducted in the process of the classification algorithm. Multilayer convolutional neural network has been used to recognize rose species through rose images. The different species of labeled images are used as input to train a convolutional neural network. The convolutional neural network has two-part such as feature extraction and classification. A convolutional layer and max-polling

layer are used for feature extractions. Also, a flatten layer and a fully connected layer are used for the classification. In the feature extraction part, convolutional layers, and max-pooling layers are analyzed and identified the various characteristics of an image. The proposed convolutional neural network model is built by the Keras library. A sequential model is used to build a convolutional neural network model. The sequential model is developed by a sequential function, 2d convolutional layers, max-pooling 2d layers; flatten layer , and dense layers. The convolutional neural network models are implemented by the seven layers. The seven layers 2d convolutional neural network has been used as ReLU (Rectifier Linear Unit) activation function. Also, the SoftMax activation function has been used in the output dense layer. As a result, the end of the layer is a dense layer (output layer) that produces two output classes for the categorical classification. Adam optimizer is used to handle sparse gradients on noisy problems in training the convolutional neural network model. Also, categorical cross-entropy has been used to train the convolutional neural network model which is used for multiclass classification problems. The results are compared between the two different approaches. I see the Architecture of the convolutional neural network model in Figure 3.4 .

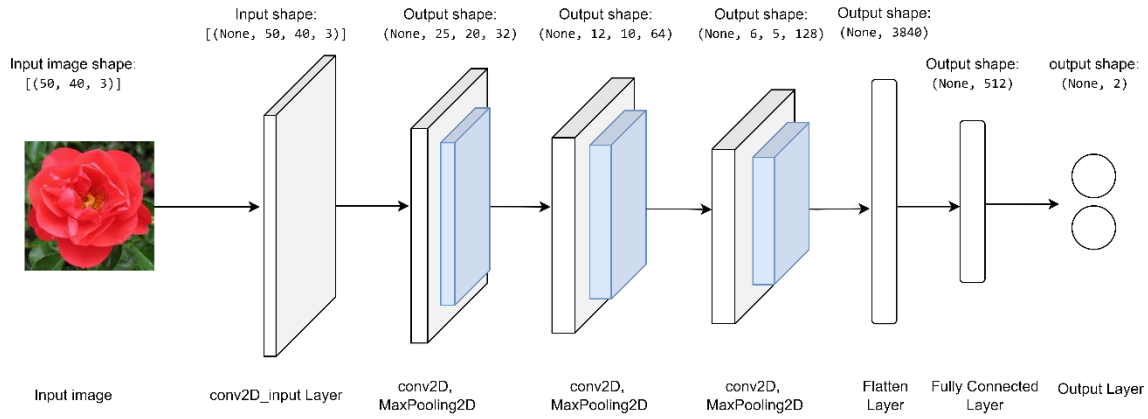


Figure 3.4: Architecture of the convolutional neural network model

3.4 Statistical Analysis

There are over 2500 records in our dataset, with 1568 records for trained image data and 380 records for validation image data. In this case, I am using 80% train data and 20% test data in our model. I tried to improve the accuracy of our model by using deep learning methods such as (Convolutional Neural Networks, VGG16, and ResNet50).

The dataset flowchart and how I use the dataset for the proposed model are presented in Figure 3.5.

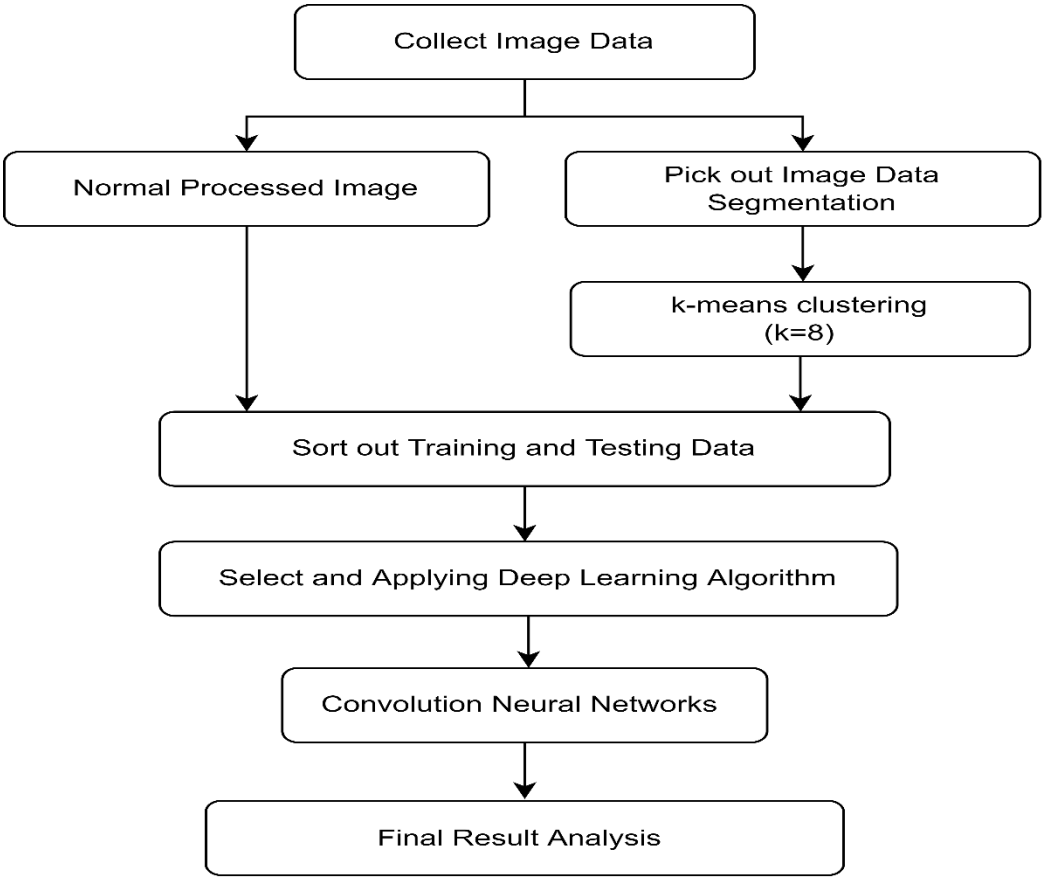


Figure 3.5: Proposed Model Structure

In this diagram, I show how we conducted our research in great detail. I can see how to proceed with our goal step by step in this diagram 3.5.

3.5 Implementation Requirements

- **Python 3.9**

Python 3.9 is a version of Python. It is a programming language with a high level of abstraction. It is used by the majority of researchers to conduct their research. It is a highly recommended programming language for deep learning-based work, and it is extremely popular among the new generation of programmers due to its ease of learning and comprehension.

- **Anaconda Navigator**

Anaconda is a Python programming language distribution aimed at simplifying package management and deployment for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, and so on). Data-science packages for Windows, Linux, and macOS are included in the compilation. I used this application for opening jupyter notebook IDE.

- **Jupyter Notebook 6.4.3**

Jupyter Notebook is a Python programming language distributor that is open-source and free to use. I can work on this locally using both our browser and Jupyter Notebook.

- **Hardware/Software Requirements**

❖ Operating System (Windows 7 or above)
❖ Web Browser (Preferably Chrome)
❖ Hard Disk (Minimum 4 GB)
❖ Ram (More than 4 GB)
❖ Jupyter Notebook 6.4.3
❖ Anaconda Navigator

CHAPTER 4

EXPERIMENTAL RESULT AND DISCUSSION

4.1 Introduction

This chapter will give a general review of the achieved results, and the experimental process to solve the given classification of Old Garden and New Garden rose species images. In this present work, the rose flower images are preprocessed by Adobe Photoshop and evaluated by the Convolutional Neural Network. And also, the rose flower images were segmented by a k-means clustering algorithm and evaluated into different cluster segmentation images to achieve a better cluster image for detecting and classifying the rose flower different species images through the convolutional neural network. The normal preprocessed image result and k-means clustering with different K value segmented image results are compared by their classification accuracy perspectives.

4.2 Experimental Results

The findings of the tests with evaluating the model performance using the k-means clustering segmentation technique and normal preprocessed images will be shown in this section. The results-based examination of the K-means clustering technique has been shown in that subsection for the same assignment.

Table 4.1: Comparison between different K values of k-means clustering segmentation images results and normal preprocessed images result.

SL No	Image Size	CNN Layer	K-Cluster value	Accuracy	Loss
01	50x40	(32,64,128)	Normal Image	0.7264	0.5504
02	80x60	(32,64,128)	8	0.7158	0.5872

From Table 4.1 , The accuracy and loss values of different image forms, as well as the usual preprocessed image and K cluster values, change. For each K cluster segmentation

value and normal preprocessed image, a total of ten tests with different image shapes are done in this proposed work. The table above shows the highest accuracy and loss values.

Table 4.2: The performance of proposed convolutional neural network model.

Image Processing Method	Accuracy	Deficiency Classes	Precision	Recall	F1-score
Normal preprocessed images	0.73	New Garden	0.70	0.63	0.66
		Old Garden	0.74	0.80	0.77
Image segmented with K-means clustering (k=8)	0.72	New Garden	0.78	0.61	0.68
		Old Garden	0.68	0.83	0.74

From Table 4.2, K values of different cluster segmented images and normal preprocessed image performances are shown with their accuracy, precision, recall, and f1-score. The normal preprocessed image gives the highest accuracy and performance during the training of the convolutional neural network model. The normal processed image shape has given 73% accuracy during the research.

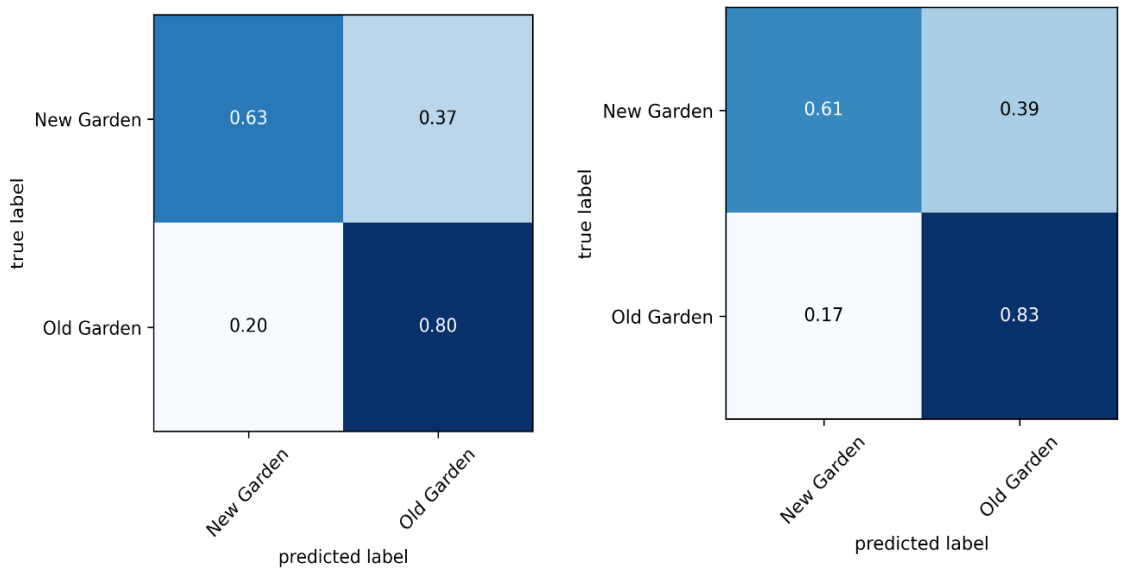
4.3 Descriptive Analysis

Evaluating the model's performance, it's important to consider how accurate the building model's predictions are. The constructing models in the field of Machine Learning or Deep Learning are measured in a variety of ways. Confusion Matrix, Accuracy, Precision, Recall, and F1 score are some of the methods. The Confusion Matrix is a visual representation of the projected model performance in tabular form. Confusion Matrix is capable of accurately or erroneously classifying multiclass. The confusion matrix is a metric used in deep learning to assess the predictability of a model. The confusion matrix also evaluates precision, recall, and f1 score.

Precision = $\frac{TP}{TP+FP}$ - - - - - - 1

Recall = $\frac{TP}{TP+FN}$ - - - - - - - 2

Where, TP is True Positive, FP is False Positive and FN is False Negative.



(a) (b)

Figure 4.1: Confusion matrices of proposed CNN model (a) Normal preprocessed images result (b) K-means clustering segmented images (k=8) result.

The anticipated and true values for the two alternative approaches of the same convolutional neural network model are displayed in Fig.4.1. The confusion matrix shows that the k-means segmented images result with numerous K values and the normal preprocessed images result are considerably dissimilar. Batch size 32 and validation dataset batch size 32 were used to train the convolutional neural networks. For the training convolutional neural network model, the categorical cross-entropy loss function was used, and the Adam optimizer was used for stochastic gradient descent. 15 epochs were used to do the prediction on the test dataset during the training period.

Table 4.3: Output of the normal preprocessed images using proposed CNN model

Epoch No	Loss	Accuracy	Val_lass	Val_accuracy
01	0.6349	0.6271	0.6328	0.6674
02	0.5863	0.6726	0.6338	0.6193
03	0.5665	0.6964	0.6263	0.6630
04	0.5477	0.7102	0.6242	0.6696
05	0.5347	0.7208	0.6008	0.7046
06	0.5213	0.7280	0.5909	0.7177
07	0.5018	0.7607	0.5878	0.6761
08	0.4750	0.7584	0.5776	0.7177
09	0.4682	0.7806	0.5928	0.7221
10	0.4459	0.7934	0.5702	0.6937
11	0.4122	0.8227	0.5791	0.6871
12	0.4045	0.8061	0.5554	0.7352
13	0.3908	0.8094	0.5767	0.7068
14	0.3659	0.8305	0.5471	0.7418
15	0.3608	0.8366	0.5409	0.7309

In Table 4.3 I am showing the training accuracy and loss, as well as the validation accuracy and loss, of the proposed convolutional neural network model utilizing normal preprocessed images.

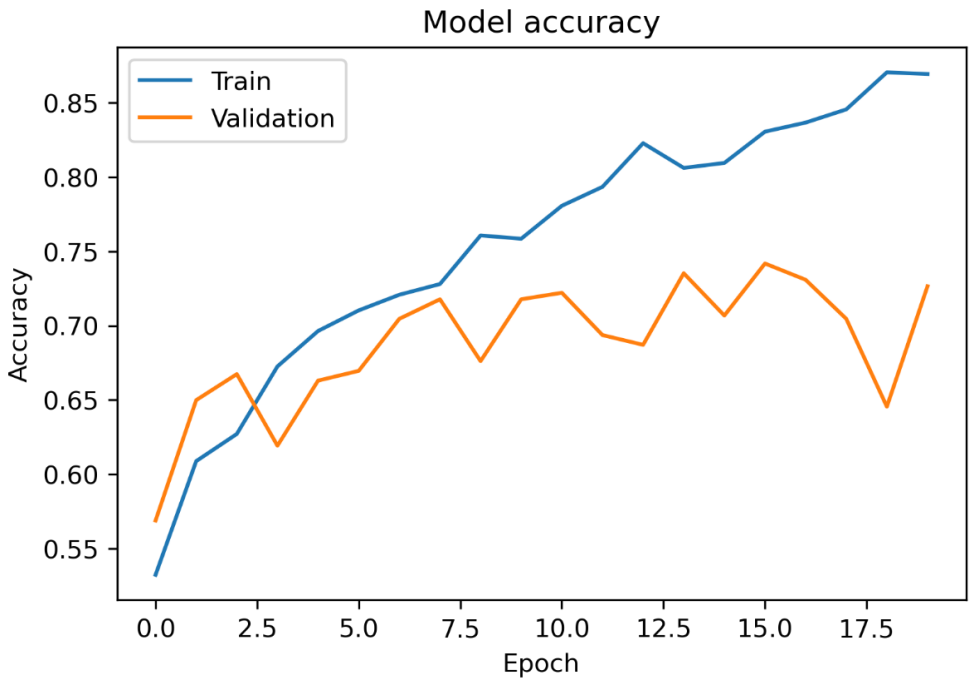


Figure. 4.2: Accuracy of the normal preprocessed images

In Figure 4.2, The suggested convolutional neural network model accuracy values are displayed along with train and test accuracy. Both train and test accuracy are growing during each epoch's performance. However, test accuracy is lower than train accuracy.

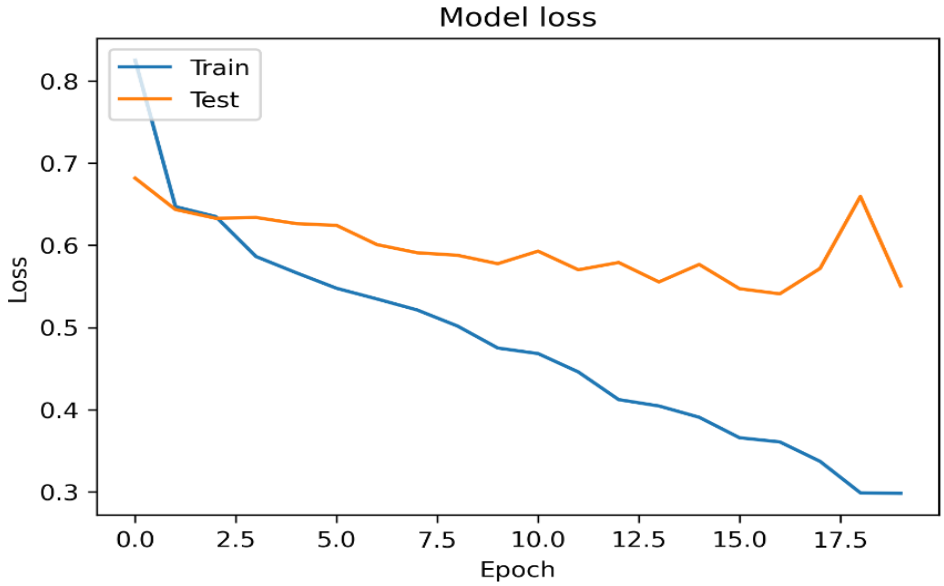


Figure 4.3: Loss of the normal preprocessed images

From Figure 4.3, The train and test loss values for the proposed convolutional neural network model are shown by epochs. In comparison to the testing dataset, the train dataset's loss and accuracy decrease as each epoch in the training phase progresses.

With train and test accuracy, the suggested convolutional neural network model accuracy values are shown. Both train and test accuracy are dropping during each epoch's performance. However, test loss is significantly worse than train loss.

Table 4.4: Results of the normal preprocessed images using proposed CNN model

SL No	Image Size	CNN Layers	Accuracy	Loss
01	50x40	(32,64,128)	0.7264	0.5504
02	80x60	(32,64,128)	0.6936	0.5821
03	90x60	(32,64,128)	0.6870	0.5739
04	120x60	(32,64,128)	0.7203	0.5724
05	120x120	(32,64,128)	0.6651	0.6108

From table 4.4, the proposed convolutional neural network model is trained by different normal preprocessed image shapes for the species classification of rose flower images. While the input image size is increasing and the validation accuracy and loss value are relatively changed. The (50x40) normal processed image shape has given 73% accuracy during the training period.

Table 4.5: Output of the k-means segmented images (k=8) using proposed CNN model

Epoch No	Loss	Accuracy	Val_lass	Val_accuracy
01	0.4946	0.7423	0.6243	0.6500
02	0.4493	0.7864	0.6026	0.6789
03	0.4187	0.7997	0.6002	0.7053
04	0.3952	0.8189	0.5902	0.6868
05	0.3974	0.8144	0.5851	0.7026
06	0.3469	0.8374	0.5891	0.7028
07	0.3469	0.8374	0.5817	0.6921
08	0.3301	0.8584	0.5845	0.7079
09	0.3469	0.8374	0.5817	0.6921
10	0.3301	0.8584	0.5845	0.7079
11	0.3328	0.8635	0.5923	0.6842
12	0.3001	0.8731	0.5767	0.7132
13	0.2854	0.8795	0.5984	0.7026
14	0.2796	0.8795	0.5892	0.6974
15	0.2709	0.8871	0.5873	0.7158

In Table 4.5, 15 epochs are shown the training accuracy and loss, and validation accuracy and loss of the proposed convolutional neural network model using the k-means segmented images (k=8).

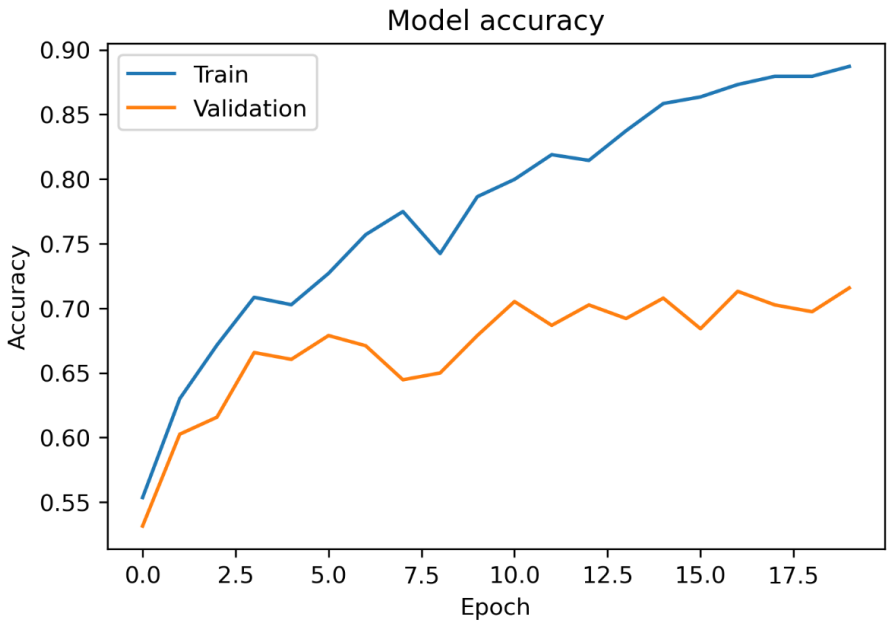


Figure 4.4: Accuracy of the k-means segmented images (k=8).

Form Figure 4.4, The accuracy values of the proposed convolutional neural network model are shown by epochs, with train and test accuracy. The train dataset's accuracy increases throughout each epoch of the training period, while the test dataset's accuracy increases as well, relative to the training dataset.

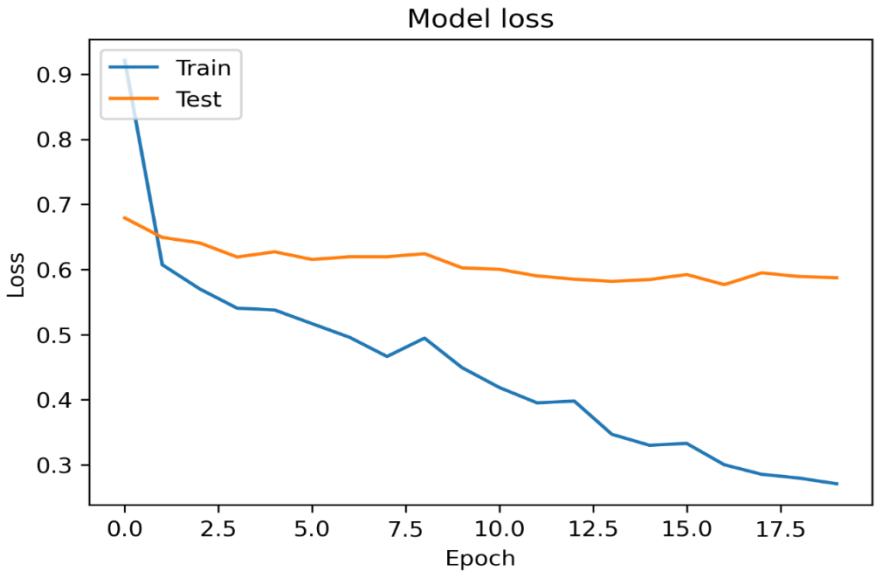


Figure 4.5: Loss of the k-means segmented images (k=8).

From Figure 4.5, The train and test loss values for the proposed convolutional neural network model are shown by epochs. In comparison to the testing dataset, the train dataset's loss and accuracy decrease as each epoch in the training phase progresses.

Table 4.6: Results of the k-means segmented images (k=8) using proposed CNN model

SL No	Image Size	CNN Layers	Accuracy	Loss
01	50x40	(32,64,128)	0.7026	0.6012
02	80x60	(32,64,128)	0.7158	0.5872
03	90x60	(32,64,128)	0.6641	0.6053
04	120x60	(32,64,128)	0.6657	0.5926
05	120x120	(32,64,128)	0.6473	0.6308

From table 4.6, the proposed convolutional neural network model is trained by k-means cluster segmented with (K = 8) different image shapes for the species classification of rose flower images. While the input image size is increasing and the validation accuracy and loss value are relatively changed. The (80x60) k-means segmented image shape has given 72% accuracy during the training period.

In the Figure 4.6, I can see the Comparison of the performances between two methods

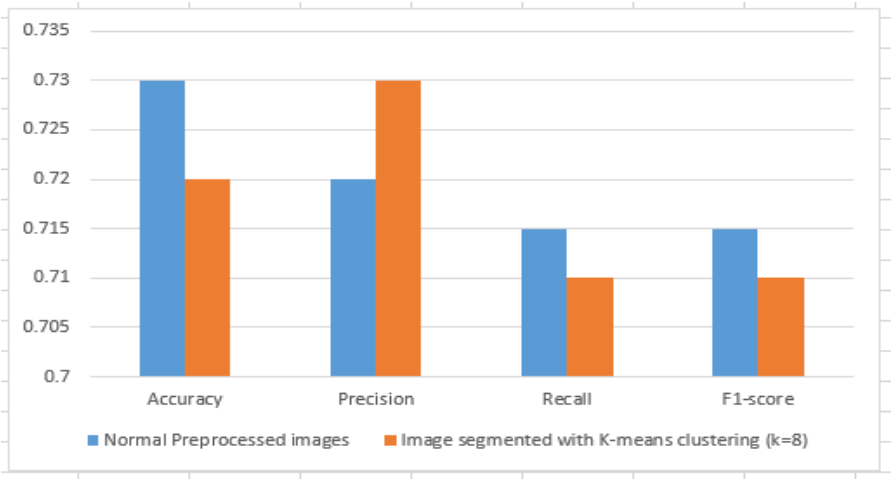


Figure 4.6 : Comparison of the performances between two methods.

4.4 Discussion

In this research, I have modified my dataset and model. From the update, I comprehend that this classifier is usable for a wide range of contrasting dataset with anticipating whether they are exact. I have gotten fruitful in characterizing the exactness of 73% of effect expectations.

The model allows you to think about as well as locate the suitable result.

CHAPTER 5

SUMMARY, CONCLUSION, RECOMMENDATION, IMPLICATION FOR FUTURE RESEARCH

5.1 Summary of the Study

This chapter will address the discussion of the achieved results, the chosen methodology, the accuracy, and the loss of the experiments. Section 4.1 will reflect on the performance analysis and outline what has been achieved as well as figure out the main problems concerning the experiments. Furthermore, section 4.2 was evaluated, and interpreted of the results will be performed. Considering these cogency points, a conclusion on the authenticity of the experiment's results will be drawn.

The k-means clustering segmentation algorithm-based rose flower images and normal preprocessed based images are conducted to identify and classify the rose flower species using a convolutional neural network. The k-means clustering segmentation with K values is considered for the classification of primary nutrient deficiency. Moreover, the k-means clustering segmented images are achieved by using Convolutional Neural Networks with an accuracy of 72% respectively. On the other hand, the normal preprocessed image-based experiment result is achieved by using Convolutional Neural Networks with an accuracy of 73%. The best result among all procedures 25 for the research work is obtained by Convolutional Neural Networks. In this research, the concerning term is image segmentation has affected the accuracy and loss value which gives very high accuracy than the normal preprocessed images result. Overall, image segmentation is a very significant thing for image processing, machine learning, and deep learning. And, the use of standard values in the k-means clustering segmentation algorithm is very important for the image processing field.

5.2 Conclusion

The motivation of this research is to classify rose species from the rose images based on a convolutional neural network. The work is effectively performed to classification the rose species from the rose images. Also, the research is employed with the k-means clustering algorithm. The K values have been assigned and analyzed the values according to trained

by the classification model. The K cluster values are used in respect 8. As a result, the accuracy of this k-cluster segmented image is 72%. And also, the normal preprocessed images are employed in the classifier model and the accuracy is 73%. The results of the experiment have proved that the K value of a k-means clustering segmentation algorithm is very significant for research because K values are affecting the experiment's accuracy. Furthermore, all experimental results are compared with their respective performance of the primary nutrient deficiency classification. As a result, the normal preprocessed images are selected to the highest accuracy.

5.3 Recommendations

- Using more data.
- Using the clear picture for best accuracy.
- Using the best quality picture for good accuracy.

5.4 Implication for Further Study

I will work with more data to make our examination more proficient.

- With more data to make my research more efficient.
- Include more categories of data to widen my research areas.
- Used more algorithms to find the best accuracy for this research.

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APPENDIX RESEARCH REFLECTION

During this project activity, I have faced many problems. But some problems were major among them. Looks like data collection, best algorithms selection ,etc. Before working with K-means clustering I am changing the K value is many times. And try to find which value is best for this research. And when I collect the data for this research then I faced many problems because I can't find any dataset for the rose flower so I can make it manually. So, I collect a single picture of roses and after collect all data I make a dataset. And after a long time and a lot of attempts and this hard work and get succeed.

Rose leaf

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