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Identification of Medicinal Plant by Flower, Using Deep Learning

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***Abstract*— In image processing the key to correctly identify the medicinal herbs is crucial. Mislabeling of medicinal plants can have adverse effects. Plants can be recognized by their size, color, and texture of its leaves and flowers, they are also an example of morphological characteristics. Different plant's flowers have diverse shapes, colors, and textures, so it is impossible to categorize and identify them based on just one characteristic . This paper proposes a medicinal plant recognition technique based on images that contain texture and skeletal of the flower and leaf. Experiments are performed on 9 different medicinal plants with a collection of 300 flower images and visuals of leaves for each class. The suggested method is used to recognise floral pictures that contain particular phases. The first approach to improve the flower pictures is pre-processing ,then followed by segmentation of the flowers and leaf's skeletal, where as shape and texture are commonly extracted features. Additional features were put on and fed to classifiers like FRCNN(Fast region with convolutional neural network),RCNN(Region with convolutional neural network),VGG16(Visual geometry group 16) ,VGG19(Visual geometry group 19) for identification of plant through flowers. It also provides the description of medicinal benefits of the flower and the plant. Shape and texture features obtained a accuracy of 96.3% with FRCNN, 94.04% with RCNN, 92.4% with VGG16, and 93.2% with VGG19 when tested in the ratio of 80:20.**

Index Terms*— *FRCNN, RCNN, VGG16, VGG19, Shape features, Texture features, flower classification, Deep learning.

I. INTRODUCTION

Medicinal plant usage is an ancient system that is practiced in India. Plants' leaves, flowers, roots and other parts like barks, are the primary components of the medicine. In olden times, Ayurvedic practitioners harvested medicinal plants themselves to make medicines. Few people even today adhere to the outdated practices , and also the production of medicinal plants has evolved into a marketing element. There are nearly 250,000 labeled species of angiosperms in our planet. Flowers of all kinds are often found in gardens, parks, roadsides and many other places, the identification of flowers is often entirely the responsibility of taxonomists or botanists. Flowers of a plant can be classified in numerous ways. The general public ignore the information about these flowers and mainly gets relevant information through flower guides or related websites. The people who accumulate them may not be trained professionals to accurately identify medicinal plants. Due to these production facilities and the researchers, misrepresented herbal medicines are often received. Plant variety are normally identified using various features of plants like flower and leaf's shape, texture, color, odor . The different type of plant's flower and leaf are only few of the aspect where typical features being used in this project. Plant species can also be distinguished by shape based on factors like area, width, curvature etc. Therefore, a model to self act plant species identification must be proposed. Primarily two characteristics, such as the flower's shape, texture, leaves skeletal are used. The paper aims to get a good accuracy with the combination of shape, texture with the proper identification of plant and also to evaluate the effectiveness of the classifier.

II. LITERATURE SURVEY

In the majority of research :[1] Siraj et al. have concentrated their effort by using the flower's color and texture as its distinguishing characteristics. The picture apprehending , image processing, and neural network steps were all followed. The dataset has 18 classes of flower pictures . Four image processing steps make up this phase: region identification, picture segmentation, image filtering, and feature extraction. The pictures were categorised using NN using their texture and color. The general outcome vary from category of flowers. Depending on the flower, accuracy ranges from 69% to 100%. For the purpose of identification. Almogdady et al. [2]have employed methods for image processing. Identifying characteristics of flowers include shape , color, and texture. Figure intensification , image segmentation, classification and feature extraction are the four sections of their process. To streamline and improve the features extraction strategy , they used Chan-vese image processing, segmentation approach to separate the flowers from the background. The HSV color headline , the Grey Level Coincidence Matrix (GLCM) as a texture description, and the Invariant Moments (IM) as a shape description have all been employed for the extraction of features. The classification component was handled by a BACK Propagation ANN. They obtained an overall accuracy of 80% and involved all flower category with 20 photos . TTN Nguyen et al,[3] have used characteristics such as color, texture, and shape to identify flowers. The four processes in their method include pre-processing, segmentation, feature extraction from hand-drawn images, and categorization. They choose the Region-Of-Interest (RIO) on flower photos using saliency-based techniques to split the blossom from the background, and have employed the mean-shift algorithm. A widely used segmentation technique. For parameter optimization through CNN. Given the general outcome demonstrates CNN is effective at identifying flowers and the accuracy was 90%. Steven et.al,[4] worked with orchid flowers

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detection, their study concentrated on object evaluation and classification methods with a limited training dataset. It was difficult because there is such a wide range of colors and patterns in orchid flowers. Additionally, they wanted to create a system that almost never detected erroneous positives and guaranteed that only one flower detection. So, they used SVM classification. Krizhevsky et al.'s[5] performance of a deep CNN was shown to be superior for the ImgaeNet Large Scale Visual's thousand class categorization test. Working on flower image identification and recognition was Mengxiao Tian et al. [6]This dataset released of flowers by Oxford University, they used SSD deep learning methodology. In their trial, they managed to get an average level of accuracy of 83.64% using the Pascal (VOC2007) and Pascal (VOC2012) environments respectively , with the accuracy rate of 87.4%. Yuanyuan Liu et al. [7] have proposed a method for classifying 79 different types of plants they only managed to get 76.54% correctness for their representation and 70.12% accuracy for ordinary CNN .When they used CNN to estimate the color of flowers, the accuracy increased to 84.02 percent as they worked on their approach to the Oxford 102 Flowers dataset .A two-parameter CNN model was suggested by Tien Vo et al. [8] for classifying the advertisement's image. They termed it nLmF-CNN and displayed n network layers and m filters. In this investigation, they were able to classify the visual data into the YES and NO categories with an accuracy of 86%. When apple trees are sapling and need to be removed, Philipe A et al. [9] presented this Using deep convolutional networks and SVM to identify the strength of apple blooming flowers. They had a detection accuracy rating of more than 90% for the apple flower. Isha Patel et al.'s [10] description of a method for classifying and identifying the flower among its 102 species. The model in this study was built using 25,000 images. MKL and SVM work together to create a multi-label classification.

III. DATASET

A dataset images of medicinal flowers was constructed In-field. Images of Flowers with the visuals of skeletal of the leaves of various species are gathered from a plant nursery and public gardens around the regions of Mysuru. 9 different classes was considered, Around (3000) images are collected. The collected flowers images were photographed including the shapes of the leaf, at various distances and angles of flowers. Pictures of the flowers which are in various size are captured, For the development of the dataset system to focus on auto mode utilising a 720 x 1280 resolution and at 16:9 aspect ratio over IOS device ,As dataset is an organized collection of data used in machine learning . An image dataset consists of digitised images that have been carefully selected for use in training, testing, and assessing the performance of computer vision and machine learning algorithms. Data samples which are collected infield are shown in the figure1.And the table1 contains list of Local names and botanical names of the flowers. Flowers which are captured were certified as medicinal from the Mysuru CFTRI botanicals when survey was conducted .

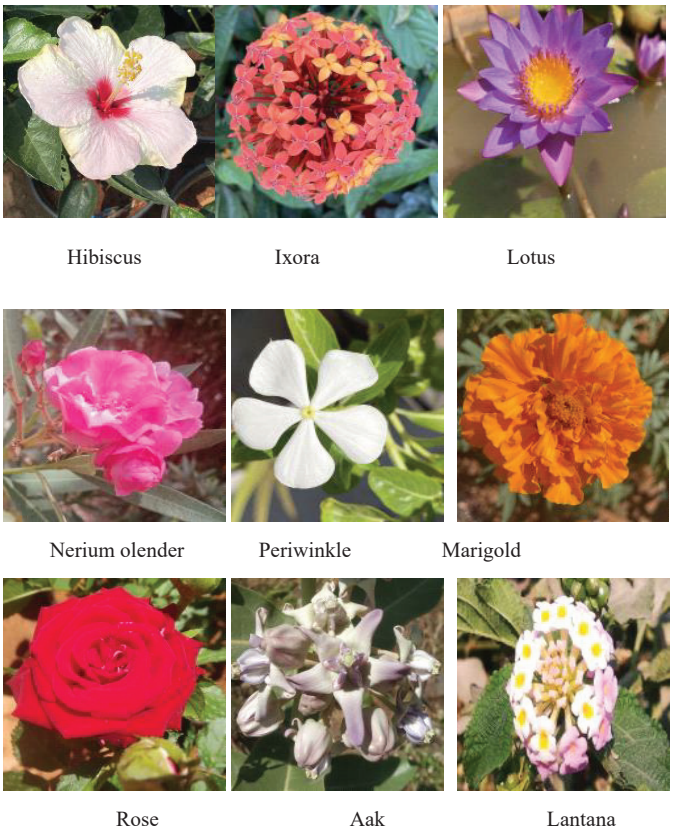

Fig. 1. Samples of infield flower images along with the visual skeletal of the leaves

TABLE I. LOCAL NAMES AND BOTANICAL NAMES OF FLOWERS OF SELF CREATED DATABASE

Sl .no	LOCAL NAMES	BOTINICAL NAMES
1	Hibiscus	Hibiscus rosa-sinesis
2	Ixora	Ixora coccinea
3	Lotus	Nymphaeaceae
4	Nerium oleander	Oleander indica
5	Periwinkle	Catharanthus roseu L.G.Don
6	Marigold	Tagetes erecta
7	Rose	Rose
8	Aak	Giant calotrope
9	Putush	Lantana

IV. PROPOSED METHODLOGY

In this publication, The plant identification by flower is based on the features of flowers and skeletal of the leaf . There are many methods used for identifying a plant . The taxonomy of plant by flower image consist various steps i.e, Pre-processing, Segmentation, Feature extraction and classification. In each respective step the backup divisions are done and explained additionally. At the earliest step, the flower image is captured with the digital camera, the preprocessing method is put into the captured pictures to enhance the picture and convert them into gray-scale which is necessary for feature extraction , We have used Gray-scale conversion for the preprocessing technique. The next step is the segmentation, where OTSU method is used for Thresholding. Later, Features like shape and texture along with the skeletal of the leaves are

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selected from the preprocessed picture analysis methods. In the final phase, four separate deep learning classifiers are used. FRCNN, RCNN, Vgg16 and Vgg19 are the image classification algorithms which will identify the flower image and provide the medicinal benefits description of the plant.

The details for each step are explained below.

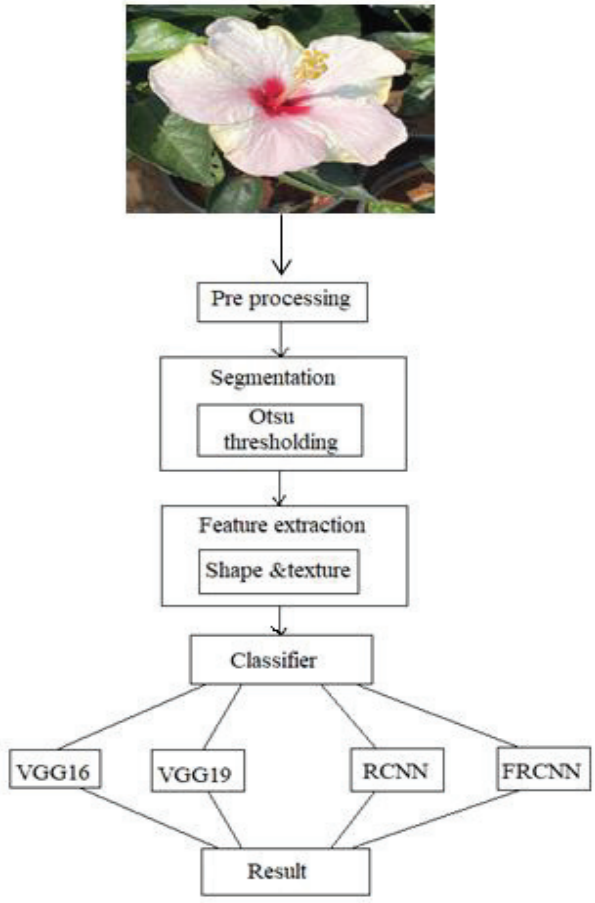


Fig. 2. Architecture of proposed work

A. *Image Preprocessing:*

Preprocessing in image processing refers to the initial setp of operations that are applied to an input image before applying any advanced analysis. The goal of preprocessing is to prepare the image for further analysis and to improve the quality of the image data. It also includes converting RGB photos to Grayscale, reducing image size, enhancing contrast, and using the histogram approach to improve image quality.

RGB to grayscale:

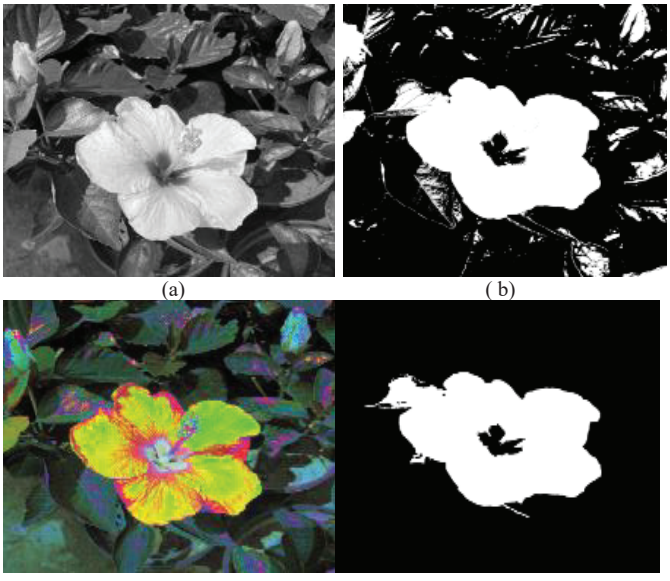
It reduces the challenges brought on by computing requirements and makes it easier to simplify algorithms. It enables easier learning for those who are not experienced with image processing. This is due to the fact that Gray scale compression strips away all but the simplest pixels from an image. It enhances straightforward visualization . It can discern in the middle of an image's shadow particular feature and highlights since it effectively employs 2 spatial dimensions (2D) as opposed to 3D. Additionally, color complexity is reduced. Among other things, a regular 3D image requires camera calibration. The gray scale alternative choice is especially useful when taking pictures without having to match every color detail. Where figure 3 indicates input image and gray scaled image.

(a) Input image (.b) Output image

Fig. 3. Shows the result of Gray scaled images.

B. *Segmentation:*

The technique of segmenting of an input image into various parts depending on their visual characteristics, such as color, texture, and intensity, is crucial to the processing of images. To make it simpler to handle and analyses the regions of interest in the input image, It aims to separate them from the image. Segmentation consists of Thresholding: This straightforward technique demand picking a threshold value and binarizing the image in accordance with it. Pixels are regarded to be either background or objects if their intensity levels are greater than the threshold. Otsu thresholding: Image thresholding is carried out automatically.by the Otsu algorithm. In its simplest form, the method splits pixels into foreground and background classes using a single intensity threshold. The largest interclass variance connecting the backdrop and the target image is used as the selection rule for this method. Otsu is employed in such a way that the image input is processed in order to generate the picture histogram (pixel distribution), after which it calculates the cutoff value and converts image pixels to white in sections of the image where saturation is higher and to dark in the contrary circumstances. figure 4 represents segmented images.



(a) (b)

(c) (d)

Fig. 4. Result of segmented image

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C. Feature extraction:

Feature extraction is a fundamental task in image processing, where a collection of relevant features are extracted from the input pictures for further analysis and recognition tasks. Feature extraction is a crucial stage in image processing, as it can directly affect the accuracy and robustness of the downstream tasks such as object recognition and classification. However, Given that many flowers are found in similar colors, shape and texture features were taken into consideration for the extraction because they produce more accurate results than color features. Figure5 represents feature extracted.

Morphological and Texture features of flowers for feature extraction :

1) Skewness

A symmetry measure more precisely, skewness is the absence of symmetry. Any regular data should have close to zero skewness. Skewness is equal to random variable subtracted by mean of distribution divided by number of variables in distribution .

2) Kurtosis

Kurtosis quantifies how peaked or flat the data are in association to a normal distribution. Mean of variables is divided by sample size and then the whole will be divided by standard deviation.

3) Variance

The user has the option to both provide and receive a variance image of the output that has been smoothed out. where the value of one observed value is subtracted by whole observed value then divided by number of samples.

4) Covariance

The covariance descriptor in image segmentation is frequently constructed using certain fundamental characteristics of a set of pixels, such as color, intensity, locations, gradients, etc. And to find the covariance between two variables the data of two different variables is divided by total number of samples.

5) Mean

The process of converting a picture into a digital format and subjecting it to specific operations in order to extract any valuable information. Mean is obtained by calculating by sum of data divided by number of data .

6) Median

Median is a filtering method for signal and image noise reduction. As it maintains edges during noise removal. Median is calculated by total number of samples is added to one and divided by two.

7) Rmean , Gmean , Bmean

Are computed based on their colors red , green , and blue where sum of all data is divided by number of data .

8) Pattern

A group of patterns with similar characteristics or features is referred to as a pattern class. where pattern is equal to difference linear pattern and constant number.

9) Gradient

An image's gradient can be utilized to extract data from it. It is a basic component of edge detection and image processing. And it is obtained by Weighted difference of pixel in some direction.

```
[[ 41  48  35]          [[[ 75  97 125]
 [ 41  48  35]            [ 73  95 123]
 [ 45  52  39]            [ 71  93 121]
 ...                      ...
 [ 61  71  48]            [100 115 141]
 [ 60  70  47]            [103 118 144]
 [ 48  58  35]]           [ 99 114 140]]

[[ 26  33  20]          [[ 78 100 128]
 [ 37  44  31]            [ 73  95 123]
 [ 45  52  39]            [ 68  90 118]
 ...                      ...
 [ 59  69  46]            [ 97 112 138]
 [ 55  65  42]            [ 96 111 137]
 [ 51  61  38]]           [ 90 105 131]]

[[ 16  23  10]          [[ 81 103 131]
 [ 34  41  28]            [ 75  97 125]
 [ 44  51  38]            [ 69  91 119]
 ...                      ...
 [ 57  67  44]            [ 98 113 139]
 [ 60  70  47]            [ 93 108 134]
 [ 71  81  58]]]          [ 85 100 126]]
```

V. RESULT OF FEATURES EXTRACTED

A. Classification:

Image categorization demand selecting a label for an image from a list of predetermined categories. Our aim is to identify the plant through their flower input image using the analysis of the image. The category from which the label is chosen is always predetermined. The goal of classification is to determine the grouping for particular case in the data. Deep learning's classification method divides data into a predetermined number of classes. The decision tree is a supervised machine learning technique that anticipates the class label of data objects. Below are the classification algorithms used .

1) FRCNN:

Machine learning comprise CNN, It is one of several artificial neural network models that are employed for different tasks and data sources. A CNN is a particular type of network design waged by deep learning algorithms for operations like image recognition and pixel data processing. The CNNs are one of several artificial neural network models that are employed for different tasks and data sources. A CNN is a individual sort of network design employed by deep learning algorithms for operations like image recognition and pixel data processing. The CNNs are chosen network architecture for detecting and recognising objects in deep learning, despite the fact that there are several types of neural networks. FRCNN stands for fast RCNN , In training and testing sessions, R-CNN significantly outperforms FRCNN. When Incorporating region

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suggestions makes Fast R-CNN perform significantly worse than when it doesn't , according to testing results. Therefore, region proposals represent a performance bottleneck in the Fast R-CNN algorithm thus provides the accuracy of 96%.

```
******************FRCNN*********************************
Outcome values :
 484 32 0 484
Classification report :
              precision    recall  f1-score   support

           1       1.00      0.94      0.97       516
           0       0.94      1.00      0.97       484

    accuracy                           0.97      1000
   macro avg       0.97      0.97      0.97      1000
weighted avg       0.97      0.97      0.97      1000

FRCNN Accuracy Score :  96.35937117775096
```

Fig. 5. Result of FRCNN

2) RCNN:

Deep learning technique known for combining regions using convolutional neural networks about proposition and CNN features , as two-stage detection method is R-CNN. A selection of potential areas in a picture that might contain an item are discovered. The CNN acts as an object extractor, and the output layer consists of features extracted from the image and fed into the system to extract the existence of features in the target area. The system calculates four compensation values to improve the accuracy of the closed box and decide if an object would be available inside the region suggestions. For occurrence , if the algorithm received a region suggestion have expected a flower to be there, but the texture of that flower might have been chopped in two within that geographic suggestion. The region bounding box can be altered as a result of the offset settings. R-CNN algorithm thus provides the accuracy of 94%.

```
******************RCNN*********************************
Outcome values :
 470 59 0 471
Classification report :
              precision    recall  f1-score   support

           1       1.00      0.89      0.94       529
           0       0.89      1.00      0.94       471

    accuracy                           0.94      1000
   macro avg       0.94      0.94      0.94      1000
weighted avg       0.95      0.94      0.94      1000

RCNN Accuracy Score :  94.04121372826444
```

Fig. 6. Result of RCNN

3) Vgg19:

The VGG19 convolutional neural network, which contains 19 layers, employs sixteen completely connected, three convolutional and three fully connected layers to classify the images into 1000 object categories. The VGG19 algorithm is trained using the photos. It is a highly efficient method since each convolutional layer employs multiple 3x3 filters ,in the image classification process. The feature extraction layers are divided into eleven groups, and each group follows the limits of clustering. As pre-trained VGG19 model is utilised in the paper to extract features, and several machine learning techniques are employed for classification. The feature extraction process, CNN model determines a lot of different factors, hence the size of the attribute line must be decreased through dimensionality reduction. VGG19 algorithm thus provides the accuracy of 93%.

```
******************VGG19*********************************
Outcome values :
 466 68 0 466
Classification report :
              precision    recall  f1-score   support

           1       1.00      0.87      0.93       534
           0       0.87      1.00      0.93       466

    accuracy                           0.93      1000
   macro avg       0.94      0.94      0.93      1000
weighted avg       0.94      0.93      0.93      1000

VGG19 Accuracy Score :  93.2023978919261
```

Fig. 7. Result of VGG19

4) Vgg16:

When putting the object identification and classification algorithm VGG16 has a 92.4% correctness when classifying 1000 pictures into similar classes. It is a technique for classifying pictures and it is easy to use and transfer learning . It is a very useful class because it offers a wide range of functions for rescaling, rotating, zooming, flipping, and other activities. The best feature of this category is that it has no impact on the information that is kept on the disc. This class updates real time data as it is being delivered to the model. The ImageDataGenerator will apply an automatic label to every piece of data in the folder. This makes feeding data into the neural network simple. Anyhow it provides less accuracy when compared to other algorithms.

```
******************VGG16*********************************
Outcome values :
 462 75 0 463
Classification report :
              precision    recall  f1-score   support

           1       1.00      0.86      0.92       537
           0       0.86      1.00      0.93       463

    accuracy                           0.93      1000
   macro avg       0.93      0.93      0.92      1000
weighted avg       0.94      0.93      0.92      1000

VGG16 Accuracy Score :  92.49684947999347
```

Fig. 8. : Result of VGG16

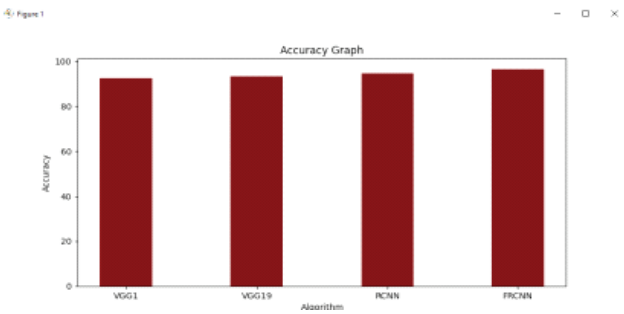

Fig. 9. Accuracy comparison graph:

```
Classification : Hibiscus
Hibiscus is used for treating loss of appetite, colds, heart and nerve diseases,
 upper respiratory tract pain and swelling, fluid retention and disorders of cir
culation. It is also lower blood pressure, decreasspasms in the stomach, intesti
nes, and uterus; and work like antibiotics to kill bacteria and worms.
```

Fig. 10. Overall accuracy of the classifiers Description of medicinal benefit of the particular flower : Hibiscus.

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VI. CONCLUSION

This paper focuses the identification of medicinal plant by it's flower with the use of methodologies utilizing several feature extraction techniques . Dataset have made it easier to conduct successful tests the usage of classifier such as Fast RCNN have improved system performance on the original R-CNN and VGG models by introducing a combination of faster processing, end-to-end training, joint computation, classification and regression. These factors make Fast R-CNN the recommended choice for object detection tasks compared to R-CNN, VGG19, and VGG16. Which produces better results of 96% in identifying the plant by its flower

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