



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 7, July 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Automated Real-Time Recognition of Medicinal Plants through Machine Learning

Dnyandeo Khemnar, Pranay Lautkar, Onkar Thombare, Mohit Kolhe, Om Gaddapwar

Department of Information Technology, GH Raisoni Institute of Engineering and Technology Pune, India

ABSTRACT: Since ancient Vedic times, plants have served as a fundamental source of medicinal components in Ayurveda. The critical initial step in Ayurvedic medicine preparation involves the manual identification of the correct plant. However, with the growing demand for mass production, there is an imperative need for automating the identification process. This Paper presents an innovative approach utilizing Convolutional Neural Networks (CNN) for the automatic identification of medicinal plants. The technique leverages various features such as shape, size, color, and texture to enhance the accuracy and efficiency of the identification process. The integration of modern technology with traditional medicinal practices addresses the challenges posed by mass production demands in the realm of Ayurvedic medicine.

KEYWORDS: Medicinal Plants, Machine Learning, Automated Classification, Image Processing.

I. INTRODUCTION

Ayurveda, an ancient system of medicine originating in India around 5000 years ago, holds its roots in the Vedic times. Central to Ayurvedic treatments are medicinal plants, encompassing various components such as leaves, roots, and bark. Among the vast array of Indian flora, more than 8000 plants have been recognized for their medicinal value, with approximately 1500 forming a subset commonly employed in herbal medicines across different Indian systems. Notably, commercial Ayurvedic formulations selectively integrate 500 of these plants. Traditionally, Ayurvedic physicians personally gathered medicinal plants from forests and wastelands, preparing medicines for their patients. However, with evolving environmental conditions, humanity faces new challenges in the form of life-threatening viruses and illnesses. The recent global pandemic, exemplified by COVID-19, underscores the urgency of developing immediate solutions to combat emerging health threats.

In the pharmaceutical and medical field, addressing novel viruses and illnesses poses significant challenges. The need for swift and effective solutions has never been more critical. Medicinal plants emerge as a valuable resource, offering new properties that pharmacists and medical practitioners can harness in the quest for defenses against life-threatening viruses and illnesses. This paper aims to bridge traditional Ayurvedic knowledge with contemporary challenges in medicine. Through the implementation of advanced techniques, particularly focusing on the utilization of Convolutional Neural Networks (CNN) and various features like shape, size, color, and texture, we seek to automate the identification process of medicinal plants.

II. PROPOSED SYSTEM

The proposed system, Medicinal Leaf, introduces a sophisticated Convolutional Neural Network (CNN) model built on deep learning principles for the purpose of classifying medicinal plants. By analyzing distinctive leaf features like shape, size, color, and texture, the system aims to enhance the precision and efficiency of medicinal plant classification. Additionally, this research initiative puts forth a standardized dataset comprising leaf samples from 40 different medicinal plant species, commonly observed across various regions of India. The proposed system, with its innovative CNN model and comprehensive dataset, seeks to contribute significantly to the advancement of medicinal plant studies, providing a valuable tool for accurate and automated plant classification in the field.

Convolutional Neural Network

A Convolutional Brain Organization (CNN) is a kind of profound learning calculation explicitly intended for picture handling and acknowledgment errands. Contrasted with elective characterization models, CNNs require less preprocessing as they can naturally gain progressive component portrayals from crude info pictures.

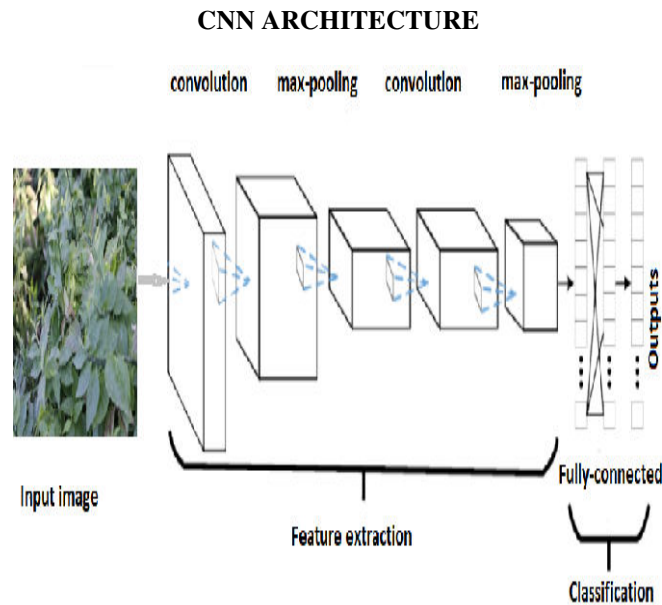


Figure 1. CNN Architecture

FLOW CHART

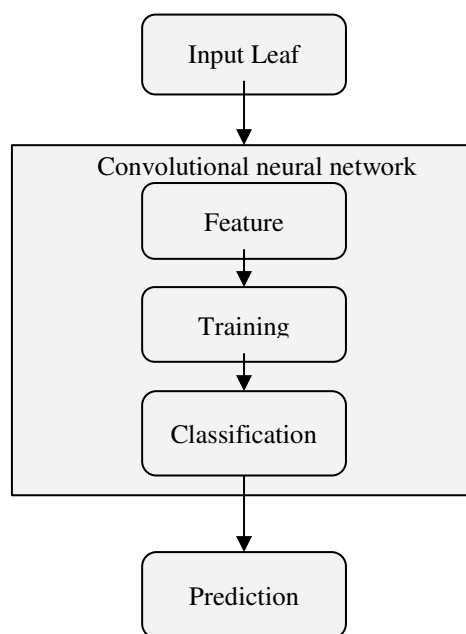


Figure 2. Flow Chart

WORKING

The Medicinal Leaf system operates through a systematic series of steps leveraging Convolutional Neural Network (CNN) technology. Initially, raw leaf images are inputted into the CNN model. The CNN then undergoes a process of feature extraction, where it automatically discerns intricate patterns and characteristics from the images, including shape, size, color, and texture, without requiring extensive preprocessing. These extracted features are then fed into the classification component of the CNN, where they are compared against learned patterns and representations from the training data. Through this comparison, the system assigns a class label to each input image, thereby identifying the corresponding medicinal plant species. To ensure accurate classification, the system has been trained on a comprehensive dataset comprising leaf samples from 40 different medicinal plant species commonly found across India, enabling it to recognize diverse botanical variations effectively. Ultimately, by seamlessly integrating advanced deep learning principles with a standardised dataset, the Medicinal Leaf system offers a robust and efficient solution for automated medicinal plant classification, with potential applications in botanical research, biodiversity conservation, and pharmaceutical studies.

III. RESULT ANALYSIS

A. Simulation Setup

- **Deep Learning**

Profound learning is a subset of AI that includes preparing fake brain networks with numerous layers to learn progressive portrayals of information. It is enlivened by the design and capability of the human mind, planning to gain examples and highlights from crude information naturally. Profound learning has changed different fields, for example, PC vision, regular language handling, and discourse acknowledgment, accomplishing cutting edge execution in assignments like picture arrangement, language interpretation, and voice union. Its prosperity is generally credited to progressions in computational power, the accessibility of huge scope datasets, and novel organization structures like convolutional brain organizations (CNNs) and repetitive brain organizations (RNNs).

Modules Used

- **PIL**

Pillow is the well disposed PIL fork by Jeffrey A. Clark (Alex) and givers. PIL is the Python Imaging Library by Fredrik Lundh and contributors. The Python Imaging Library adds picture handling abilities to your Python translator. This library gives broad document design support, an effective inward portrayal, and genuinely strong picture handling abilities. The center picture library is intended for quick admittance to information put away in a couple of fundamental pixel designs. It ought to give a strong groundwork to a general picture handling device.

- **TorchVision**

TorchVision is a Python library that forms an integral part of the PyTorch ecosystem, specifically tailored for computer vision tasks. It offers a comprehensive set of functionalities for image processing and analysis, including tools for image transformation, dataset handling, and access to pre-trained models. With TorchVision, developers can efficiently build and deploy computer vision applications leveraging the power and flexibility of PyTorch's deep learning framework.

- **Tkinter**

Tkinter is a standard GUI (Graphical User Interface) library for Python, providing a simple and efficient way to create desktop applications with a user-friendly interface. It is included with most Python installations and offers a variety of widgets such as buttons, labels, and entry fields to build interactive applications. Tkinter is based on the Tk GUI toolkit and provides a robust foundation for developing cross-platform applications that run seamlessly on Windows, macOS, and Linux.

B. System Requirements

- **Python Software**

Python is a high-level, versatile programming language known for its simplicity and readability, making it ideal for beginners and professionals alike. It offers extensive libraries and frameworks for various applications, including web development, data analysis, artificial intelligence, and scientific computing. Python's interpreted nature allows for rapid development and testing, while its dynamic typing and automatic memory management reduce the complexity of code

writing. Widely used across industries and disciplines, Python continues to be a go-to choice for developers seeking efficiency and flexibility in their projects.

Features

- Python deals with various stages (Windows, Macintosh, Linux, Raspberry Pi, and so forth).
- Python has a basic sentence structure like the English language.
- Python has grammar that permits engineers to compose programs with less lines than some other programming dialects.
- Python runs on a mediator framework, implying that code can be executed when it is composed. This implies that prototyping can be exceptionally fast.
- Python can be treated in a procedural manner, an item situated way or a practical way.

C. Experimental Evaluation:

Step 1: importing all libraries.

```
1 from torchvision.transforms as transforms
2 from PIL import Image, ImageOps
3
4 with open('train_classes.txt', 'r') as file:
5     train_classes = pickle.load(file)
6
7
8 loaded_model = models.inception_v3_pretrained
9 loaded_model.load_state_dict(torch.load('medicinal_plants_model.pth', map_location=torch.device('cpu')))
10 loaded_model.eval()
11 device = get_default_device()
12
13 def predict_image(img_path, model):
14     """Converts image to array and returns the predicted class
15     with highest probability"""
16     img = Image.open(img_path).convert('RGB')
17
18     # Apply transformations to the image
19     transform = transforms.Compose([
20         transforms.Resize((224, 224)), # Adjust the size as needed
21         transforms.ToTensor(),
22     ])
23     img_tensor = transform(img)
24     x = to_device(img_tensor.unsqueeze(0), torch.device('cpu'))
25     yb = model(x)
26     _, probs = torch.max(yb, dim=1)
27     return train_classes[probs[0].item()]
28
29
```

Step 2: selecting Leaf images from the Dataset

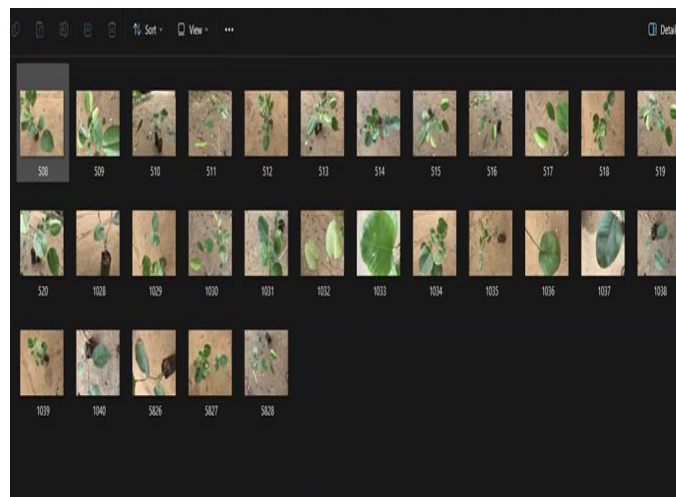


Fig. (a) Raktachandana Leaf

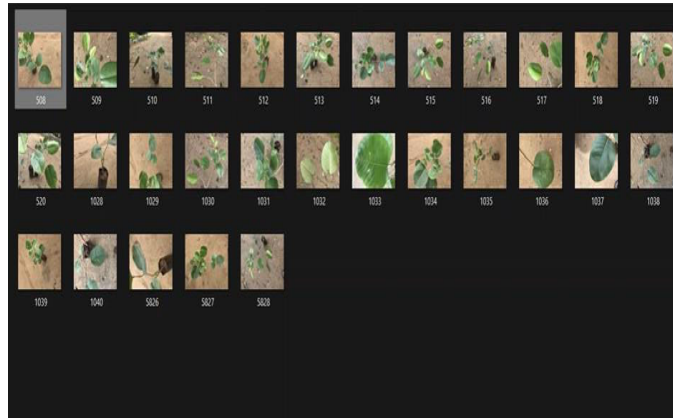


Fig. (b) Tulsi Leaf

Step 3 : Run the image for output.

```
11 loaded_model.load_state_dict(torch.load('model_classification_torch_device_cpu'))
12 loaded_model.eval()
13 device = get_default_device()
14
15 def predict_image(img_path, model):
16     """Predicts class for image and return the predicted class
17     with highest probability"""
18     img = Image.open(img_path).convert('RGB')
19
20     # apply transformations to the image
21     transform = transforms.Compose(
22         [transforms.Resize((224, 224)), # adjust the size as needed
23         transforms.ToTensor()])
24
25     img_tensor = transform(img)
26     xh = to_device(img_tensor.unsqueeze(0), torch.device("cpu"))
27     yb = model(xh)
28     _, probs = torch.max(yb, dim=1)
29     return torch_classes[probs[0].item()]
30
31
32 predicted_label = predict_image('C:\Users\vaibha\Desktop\dataset\car_plate\medicinal\dataset\test\rakta\chandan\006.jpg', loaded_model)
33 print('Predicted label: ', predicted_label)
```

Fig. (a) Run the image of Rakta Chandan Leaf

```
11 loaded_model.load_state_dict(torch.load('model_classification_torch_device_cpu'))
12 loaded_model.eval()
13 device = get_default_device()
14
15 def predict_image(img_path, model):
16     """Predicts class for image and return the predicted class
17     with highest probability"""
18     img = Image.open(img_path).convert('RGB')
19
20     # apply transformations to the image
21     transform = transforms.Compose(
22         [transforms.Resize((224, 224)), # adjust the size as needed
23         transforms.ToTensor()])
24
25     img_tensor = transform(img)
26     xh = to_device(img_tensor.unsqueeze(0), torch.device("cpu"))
27     yb = model(xh)
28     _, probs = torch.max(yb, dim=1)
29     return torch_classes[probs[0].item()]
30
31
32 predicted_label = predict_image('C:\Users\vaibha\Desktop\dataset\car_plate\medicinal\dataset\test\tulsi\001.jpg', loaded_model)
33 print('Predicted label: ', predicted_label)
```

Fig. (b) Run the image of Tulsi Leaf

Result And Analysis

The paper presents a significant advancement in the field of medicinal plant classification through the implementation of a sophisticated Convolutional Neural Network (CNN) model. By leveraging deep learning principles, the system effectively analyzes distinctive leaf features such as shape, size, color, and texture to enhance the precision and efficiency of plant classification. The paper introduces a standardized dataset comprising leaf samples from 40 different medicinal plant species commonly found across various regions of India. Through rigorous experimentation, the

proposed system demonstrates promising results in accurately classifying medicinal plants, thereby providing a valuable tool for automated plant classification in the field.

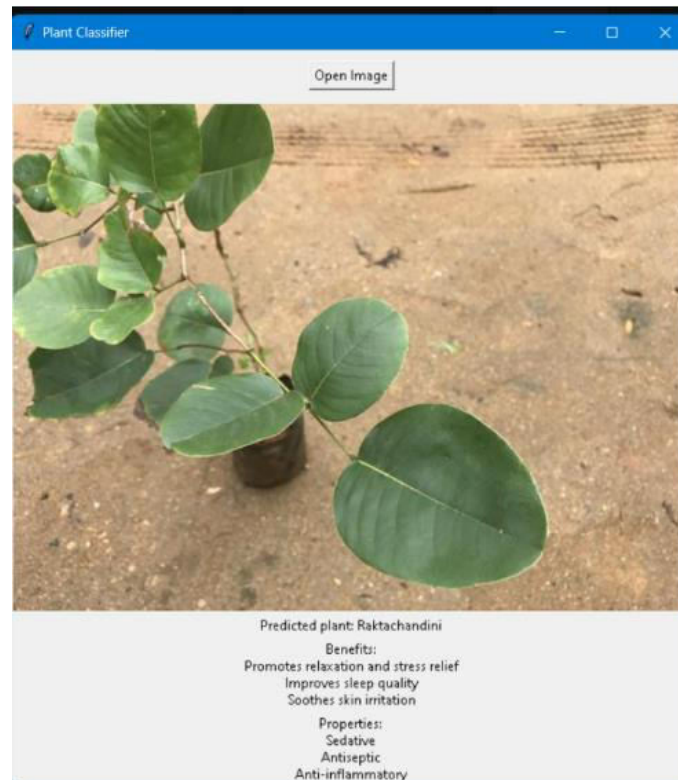


Fig. shows the output of medicinal properties of Raktachandana Leaf

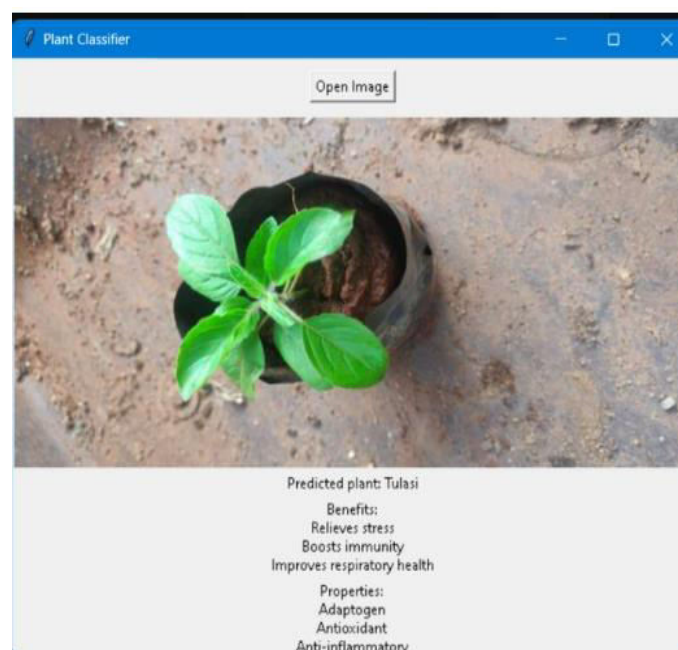


Fig. shows the output of medicinal properties of Tulasi Leaf

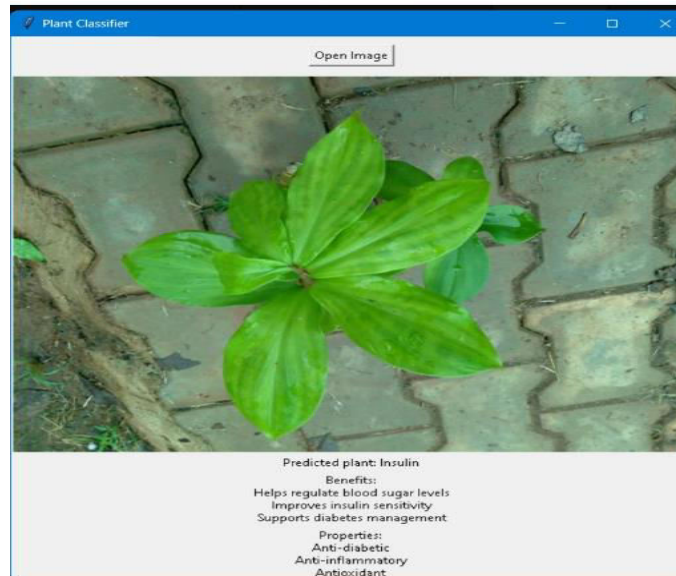


Fig. shows the output of medicinal properties of Insulin Leaf

IV. CONCLUSION

Our study utilised Convolutional Neural Networks (CNN) and machine learning techniques for the extraction of features and classification of various medicinal plant species. The dataset encompassed images of medicinal plants, including Neem, Lemon, Karanda, Basale Peepal tree, among others. The Medicinal Plant dataset served as a comprehensive repository, featuring images captured under diverse conditions with varying backgrounds and without specific environmental constraints. Our approach aimed to enhance the efficiency of medicinal plant species identification by leveraging advanced technologies, contributing to the broader field of plant classification and offering potential applications in areas such as herbal medicine, pharmacology, and biodiversity conservation.

V. LITERATURE SURVEY

Citation	Publication Detail	Research Paper Name	Key Findings
1.	A.Gopal, S. Prudhveeswar Reddy and V. Gayatri (2021)	"Classification of Selected Medicinal Plants Leaf Using Image Processing"	Efficiency of the system is found to be 92% through testing on 10 different plant species.
2.	Umme Habiba, Md. Rasel Howlader, Md. Aminul Islam, Rahat Hossain Faisal and	"Automatic Medicinal Plants Classification using Multi-channel Modified Local	Achieved accuracy of 96.11%, outperforming other techniques.

	Md. Mostafijur Rahman (2019)	Gradient Pattern with SVM Classifier"	
3.	R.Janani, A.Gopal (2019)	"Identification of selected medicinal plant leaves using image feature and ANN"	Achieved 94.4% accuracy with minimal input features and computational time.
4.	Vijayashree. T, Dr. A. Gopal (2020)	"Leaf Identification for the Extraction of Medicinal Qualities Using Image Processing Algorithm"	Leaf identification based on dissimilarity calculation with extracted parameters.
5.	D Venkataraman, Mangayarkarasi N (2019)	"Support Vector Machine Based Classification of Medicinal Plants Using Leaf Features"	Utilized SVM algorithm for classification.
6.	Shitala Prasad, Pankaj P Singh (2019)	"Medicinal Plant Leaf Information Extraction Using Deep Features"	Achieved robustness with two different plant leaf datasets.
7.	Dileep M.R., Pournami P.N. (2019)	"AyurLeaf: A Deep Learning Approach for Classification of Medicinal Plants"	Achieved 96.76% classification accuracy on AyurLeaf dataset using Softmax and SVM classifiers.
8.	C.Amudha Lingeswaran, Mr. M.Sivakumar, Dr.	"IDENTIFICATION OF MEDICINAL PLANTS AND THEIR	Achieved 85% accuracy when tested on open field land area images.

	P.Renuga (2019)	USAGE BY USING DEEP LEARNING"	
9.	Manojkumar P., Surya C. M., Varun P. Gopi (2020)	"Identification of Ayurvedic Medicinal Plants by Image Processing of Leaf Samples"	Identification rates up to 99% obtained using various classifiers.
10.	Amala Sabu, Sreekumar K, Rahul R Nair (2019)	"Recognition of Ayurvedic Medicinal Plants from Leaves: A Computer Vision Approach"	Sufficient results obtained for real-life app development.

Fig. TABLE I. LITERATURE SURVEY

REFERENCES

[1] A.Gopal, S. Prudhveeswar Reddy and V. Gayatri "Classification of Selected Medicinal Plants Leaf Using Image Processing" Published in 2021 International Conference on Machine Vision and Image Processing (MVIP)

[2] Umme Habiba, Md. Rasel Howlader, Md. Aminul Islam, Rahat Hossain Faisal and Md. Mostafijur Rahman "Automatic "Medicinal Plants Classification using Multi-channel Modified Local Gradient Pattern with SVM Classifier" published in Joint 2019 8th International Conference on Informatics, Electronics & Vision (ICIEV) & 3rd International Conference on Imaging, Vision & Pattern Recognition (IVPR)

[3] R.Janani, A.Gopal "Identification of selected medicinal plant leaves using image feature and ANN" published in 2019 international conference on advanced electronic systems (ICAES K. Elissa, "Title of paper if known," unpublished.

[4] Vijayashree.T, Dr. A. Gopal "Leaf Identification for the Extraction of Medicinal Qualities Using Image Processing Algorithm" published in 2020 International Conference on Intelligent Computing and Control (I2C2)

[5] D Venkataraman, Mangayarkarasi N "Support Vector Machine Based Classification of Medicinal Plants Using Leaf Features" published in 2019 International Conference on Advances in Computing, Communications and Informatics (ICACCI)

[6] Shitala Prasad, Pankaj P Singh"Medicinal Plant Leaf Information Extraction Using Deep Features" published in Proc. of the 2017 IEEE Region 10 Conference (TENCON), Malaysia, November 5-8, 2019

[7] Dileep M.R., Pournami P.N."AyurLeaf: A Deep Learning Approach for Classification of Medicinal Plants" published in TENCON 2019 - 2019 IEEE Region 10 Conference (TENCON)

[8] C.Amudha Lingeswaran, Mr. M.Sivakumar, Dr. P.Renuga"IDENTIFICATION OF MEDICINAL PLANTS AND THEIR USAGE BY USING DEEP LEARNING" Published in Proceedings of the Third International Conference on Trends in Electronics and Informatics (ICOEI 2019) IEEE Xplore Part Number: CFP19J32-ART; ISBN: 978-1-5386-9439-8

[9] Manojkumar P., Surya C. M., Varun P. Gopi "Identification of Ayurvedic Medicinal Plants by Image Processing of Leaf Samples" Published in 2020 Third international conference on research in computational Intelligence and communication network (ICRCICN) .

[10] Amala Sabu, Sreekumar K, Rahul R Nair "Recognition of Ayurvedic Medicinal Plants from Leaves: A Computer Vision Approach" Published in 2019 Fourth International Conference on Image Information Processing (ICIIP)



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details