Identification of Different Medicinal Plants/Raw materials through Image Processing Using Machine Learning Algorithms

Submitted by,

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Under the guidance of,

Dr. PAJANY M

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER ENGINEERING

At

GAIN MORE KNOWLEDGE
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SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

PRESIDENCY UNIVERSITY

BENGALURU

MAY 2025

PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING

CERTIFICATE

This is to certify that the Project report "**Identification of Different Medicinal Plants/Raw materials through Image Processing Using Machine Learning Algorithms**" being submitted by **K C VINDYA, RUSHAB A R, NIKHIL S, MUKESH K A** bearing roll number(s) **20211COM0063, 20211COM0082, 20211COM0078, 20211COM0084** in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Engineering is a bonafide work carried out under my supervision.

16/5/2025

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DECLARATION

We hereby declare that the work, which is being presented in the report entitled **"Identification of Different Medicinal Plants/Raw materials through Image Processing Using Machine Learning Algorithms"** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Engineering**, is a record of my own investigations carried under the guidance of **Dr. Pajany M, Assistant Professor - SCSE, School of Computer Science Engineering, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

The increasing demand for herbal medicines and natural remedies has intensified the need for accurate identification and authentication of medicinal plants and raw materials. Traditional identification techniques, which rely heavily on manual observation by botanical experts, are often slow, inconsistent, and susceptible to human error, particularly when differentiating between species with similar morphological features. To address these limitations, this project proposes an intelligent plant identification system that combines advanced image processing with machine learning algorithms, specifically convolutional neural networks (CNNs), to achieve reliable and automated classification of medicinal plants using leaf images.

The methodology adopted includes multiple phases: image acquisition, preprocessing, feature extraction, model training, and validation. High-resolution images of various medicinal plant leaves were collected from open-source datasets and field samples. Preprocessing techniques such as resizing, normalization, contrast enhancement, and noise removal were applied to ensure image consistency and clarity. Morphological features like leaf shape, vein structure, color, and texture were extracted using a combination of traditional algorithms and deep learning-based techniques. These features were then fed into CNN models, including custom and pre-trained architectures, to perform multi-class classification.

To improve performance, data augmentation strategies were employed to increase dataset variability and reduce overfitting. The model was trained and tested using stratified data splits and evaluated through accuracy, precision, recall, F1-score, and confusion matrix analysis. The proposed hybrid model achieved a classification accuracy of up to 92.7%, significantly outperforming traditional and CNN-only approaches. Real-world testing was conducted on unseen images, confirming the model's robustness and adaptability.

Furthermore, the system was integrated into a user-friendly interface for practical deployment, enabling real-time prediction from user-uploaded images. The project also explores potential extensions, including mobile deployment using Tensor Flow Lite and scalability for raw material adulteration detection using spectral imaging. By automating the plant identification process, this system contributes to the standardization and quality assurance of herbal products, supporting researchers, practitioners, and manufacturers in the fields of Ayurveda, botany, agriculture, and pharmaceutical science.

In conclusion, the integration of image processing and machine learning presents a scalable, efficient, and highly accurate solution for medicinal plant identification. This project lays the foundation for future AI-driven botanical applications, contributing to sustainable healthcare practices and biodiversity preservation.

ACKNOWLEDGEMENTS

First of all, we indebted to the **GOD ALMIGHTY** for giving me an opportunity to excel in our efforts to complete this project on time.

We express our sincere thanks to our respected dean **Dr. Md. Sameeruddin Khan**, Pro-VC - Engineering and Dean, School of Computer Science and Engineering & School of Information Science, Presidency University for getting us permission to undergo the project.

We express our heartfelt gratitude to our beloved Associate Dean **Dr. Mydhili Nair,** School of Computer Science Engineering, Presidency University, and **Dr. Gopal Krishna Shyam**, Professor Head of the Department, School of Computer Science Engineering, Presidency University, for rendering timely help in completing this project successfully.

We are greatly indebted to our guide **Dr. Pajany M, Assistant Professor** and Reviewer **Ms. Impa B H, Assistant Professor,** School of Computer Science Engineering, Presidency University for her inspirational guidance, and valuable suggestions and for providing us a chance to express our technical capabilities in every respect for the completion of the project work.

We would like to convey our gratitude and heartfelt thanks to the CSE7301 University Project Coordinator **Mr. Md Ziaur Rahman and Dr. Sampath A K,** department Project Coordinator Dr. Sudha P and Git hub coordinator **Mr. D Muthuraj.**

We thank our family and friends for the strong support and inspiration they have provided us in bringing out this project.

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