IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Aushadhi Ved: Identification of medicinal plants using image Processing.

Aastha Sharma 0827IT201003, Akshat Bhandari 0827IT201013, Amatullah Saify 0827IT201016, Chinmayee Ahire 0827IT201038
Department of Information Technology, AITR, Indore (MP).

Abstract:

• Identification of plants through plant leaves based on their shape, color, and texture features using digital image processing techniques for classifying the plant species using different machine learning algorithms. This research work includes reviewing multiple image processing methods to use machine learning to identify multiple plants using its leave feature in the form of an image.

• Here the image processing technique is considered as the main method for classifying different plants of different characteristics or specific portions or regions of the plant leaves which will be then identified through image processing.

• The proposed research work only focuses on the identification and classification of different parts of leaves to identify the plant species. This research paper offers an overview of the various classification methods used in the classification of plant leaf identification. Throughout the research work, SVM is the main method or algorithm that we are using for the identification or classification of plants.

• The proposed work through experimental results claims a better accuracy in the identification of plant species through its leave feature and it makes the identification of plants much easier and safe time.

Keywords: - image processing, SVM, plant identification, Identification and Classification, machine learning, image preprocessing, image segmentation, feature extraction, Gaussian filtering, K-means clustering, Principal Components Analysis (PCA).

I. INTRODUCTION

• Medicinal plants have been used in traditional medicine practices for a long time because of their nutrients and medicinal properties.

• Plants are generally classified based on their various organs, but leaves are one of the most important organs of plants which largely differ among species and varieties in colors, shapes, and texture characteristics.

However, in some cases, there have always been challenges associated with identifying medicinal plants due to the apparent similarities of their leaves.

- The manual identification of plant species is a time-consuming process and requires a lot of expertise in the field.

- This system is developed to make this time-consuming task easier through technology. Here, we will use machine learning algorithms like CNN, MobileNetV2 based detection and image processing through OpenCV.

- The platform will be developed as a one stop solution for Medicinal plant identification using image processing.

Problem Statement

- India boasts a diverse range of medicinal plants, but accurate identification is a pressing issue in Ayurvedic Pharmaceutics. Similar names and lack of awareness among collectors and traders lead to confusion and misidentification. High demand strains resources and encourages adulteration. An image processing software using Machine Learning can greatly benefit the supply chain by identifying medicinal plants and raw materials at all levels and, hence improving the overall medicinal system.

Objective

- Leaves, due to their volume, and unique characteristics, are an effective means of differentiating plant species. We are going to apply different classification techniques to benchmark the relevance of classifiers in image classification problem.

- **The specific objectives to be addressed:**

- **Medicinal Plant Identification and Conservation:** This technology can aid in the accurate identification of medicinal plants, which is critical for the sustainable use and conservation of these valuable resources. It can help prevent over-harvesting and protect endangered species.
- **Herbal Medicine Quality Control:** Image processing can be used to ensure the authenticity and quality of herbal products. It can help identify adulteration and maintain the standards of herbal medicines.
- **Research and Education:** It can be a valuable tool in botanical research and educational institutions for the study and documentation of plant species.
- **Global Herbal Trade:** In the context of international trade, the technology can help in the verification of the plant species being exported or imported, preventing illegal or unsustainable trading practices.

Methodology:

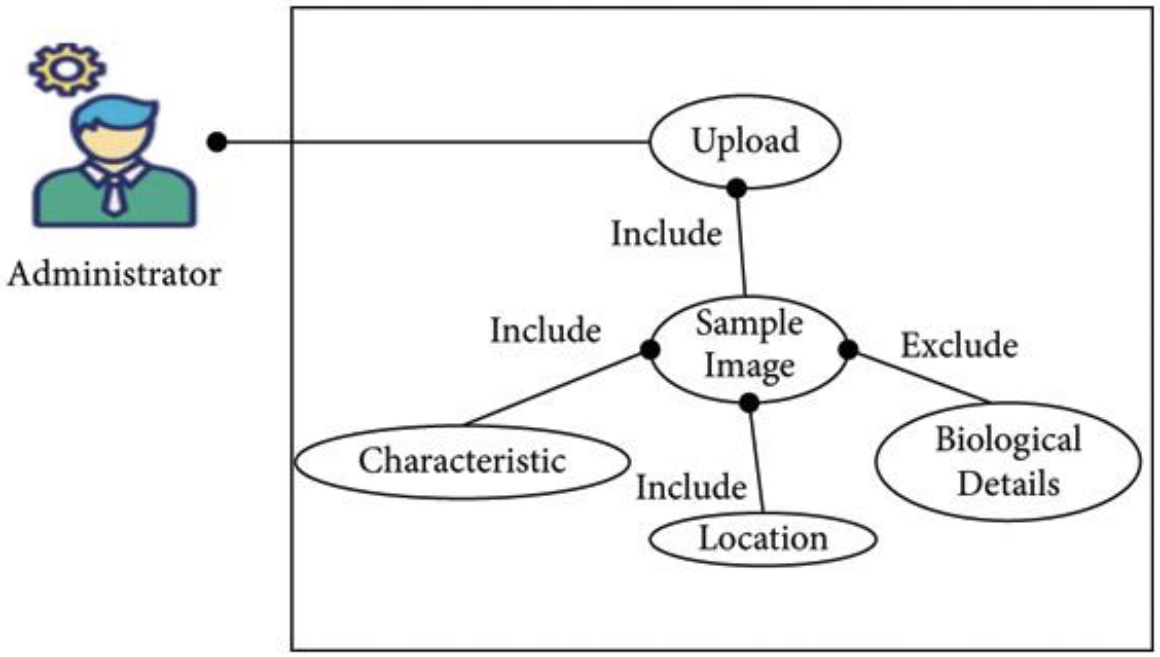
The following figure represents the steps involved in the proposed approach in a sequence manner:

- **Project Initiation:**
  - Defining the project's objectives and scope.
  - Establishing a project team with expertise in image processing, machine learning, botany, and software development.
  - Secure necessary resources.
- **Data Collection and Compilation:**
  - Gathering a comprehensive dataset of images of medicinal plants.
  - Ensuring that the dataset is diverse, covering various species, growth stages, and environmental conditions.
- **Data Preprocessing:**
  - Cleaning and preprocessing the image data to enhance the quality and consistency of images.
  - Normalizing image sizes and resolutions.
- **Machine Learning Model Selection:**
  - Choosing appropriate machine learning and image processing algorithms for plant identification.

- Selecting SVM model using the annotated dataset.

- **User Interface Development:**
- Designing and develop a user-friendly interface for the "Aushadhi Ved" application.
- Including features for users to capture or upload images of plants for identification.

- **Integration and Testing:**
- Integrating the machine learning model with the user interface.
- Conducting extensive testing to ensure the system's accuracy, reliability, and responsiveness.
- Addressing any bugs or issues that arise during testing.



Proposed System:

Our curated solution involves the development of a comprehensive system that comprises the following key components:

- Image Database: A vast collection of high-quality images of medicinal plants is curated as the dataset. These images are the primary data source for our image processing and machine learning model.

- Image Preprocessing: The collected images undergo preprocessing, which includes noise reduction, removing duplicate images, resizing, and enhancement of plant features to improve the overall model accuracy.

- Feature Extraction: State-of-the-art image processing techniques, including deep learning models such as Convolutional Neural Networks (CNNs), are used to extract essential features from the images. These features represent the unique characteristics of each plant species.

- Machine Learning Model: A machine learning model, trained on the extracted features, is developed to classify medicinal plants using MobileNetV2 model. The model will be fine-tuned and validated to ensure high accuracy.

- User Interface: A user-friendly application or web platform is developed to allow traditional medicine practitioners and enthusiasts to easily upload plant images for identification.

Benefits of the Proposed System:

- Improved accuracy in identifying medicinal plants, reducing the risk of misidentification.
- Time and effort savings for traditional medicine practitioners.
- Increased accessibility to plant identification, benefitting both experts and novices in Aushadhi Ved.
- Enhanced conservation efforts by promoting the proper use of medicinal plants.
- The platform can serve as an educational resource, providing information about the identified plants, their traditional medicinal uses, and other relevant details.
- Researchers in the field of traditional medicine and botany can benefit from the readily available tool to identify and study medicinal plants.

Scope:

Using machine learning algorithms, plant identification, and classification will be done more quickly and more efficiently.

Using multiple machine learning algorithms, the analysis of the plant will be more accurate than a botanist as there is no room for human error.Image preprocessing will be used as the main method for the identification of plants.

Existing System/Application:

1. Pl@ntNet

● **Problems Addressed:**
Pl@ntNet is a tool to help to identify plants with pictures.
● **Advantages**:
1. Has a scanning option which provides an ease in searching.
2. Provides additional information about plants according to your geographic location .
● **Disadvantages:**
1. Is not solely dedicated to medicinal plants.
2. Hard to upload documents.
3. It's not user friendly.
● **Reference link**: https://plantnet.org/en/

2. Medicinal plants & Herbs

●**Problems addressed:**
Encyclopedia of Herbal Medicine, a one-stop healing book with everything you need to know about herbs, featuring a detailed layout of over 1500 plants and their medicinal properties, with advice on how to sow, grow, and harvest your very own herb garden!
● **Advantages:**
1. It provides detailed information on every medicinal plants.
2. It is user-friendly.
● **Disadvantages:**
1. Doesn't have any scanning option.
2. Can't upload any documents.

3. Plant lens
●**Problems addressed:**
Plant Lens can identify 60,000+ plant species with an accuracy of 92.
● **Advantages:**
1. Has a scanning option which provides an ease in searching.
2. It is easy to use.
● **Disadvantages:**
1. Requires a monthly subscription.
2. Is not solely dedicated to medicinal plants.
3. Lack of complete and clear information.

II. PERFORMANCEEVALUATION

Model Performance:

- Classification Metrics
  - Accuracy: 90 percent.
  - Precision: 80 percent

- Confusion Matrix
  - True Positives (TP)
  - True Negatives (TN)
  - False Positives (FP)
  - False Negatives (FN)

Website Performance

- Usability
  - Evaluate the website's user-friendliness.
  - Consider aspects like navigation, user interface, and responsiveness.
  - Observations: Highlight key usability factors.

- Responsiveness
  - Tested how well the website responds to user interactions.
  - Consider load times, smoothness of interactions, and adaptability to different devices.

Testing Analysis

The testing process of Aushadhi Ved has shown the accuracy of around 90 percent and it predicted the plant name using the image feature extraction. The model was able to predict species along with their biological names and uses which offered users a deep insight into the plant recognition process.

Website is responsive and has a user-friendly Interface which makes it easy to use and also increases the reachability of the website.

III. Limitation

While the identification of medicinal plants using image processing is a promising field, it also comes with several limitations and challenges. Some of the key limitations and constraints include:

1. **Image Quality and Variability:** The quality and variability of plant images can significantly affect the accuracy of identification. Factors such as lighting, background, focus, and image resolution can impact the performance of image processing algorithms.
2. **Limited Datasets:** The availability of comprehensive and diverse datasets containing images of medicinal plants is a significant challenge. Creating and maintaining such datasets can be time-consuming and resource intensive.
3. **Plant Growth Stage:** The appearance of a plant may change significantly depending on its growth stage. Image processing models need to account for these variations, which can be complex.

Feasibility Study

The proposed system is feasible in all required aspects such as:

1. Technical Feasibility:
• Hardware Requirements:
RAM:
1. 8GB or more
2. Free digital storage

• Software Requirements:
Operating system:
1. Microsoft Windows 8/10(64-bit)
2. Mac-OS 10.14(Mojave) or higher
3. Any 64-bit Linux distribution that supports Gnome, KDE, or Unity DE, GNU C Library(glibc) 2.31 or later.

Technical Expertise: Confirming the availability of technical expertise in image processing, machine learning, and software development. If required skills are not readily available, assess the feasibility of hiring or training staff.

Data Availability: Determining the availability and accessibility of a diverse and comprehensive dataset of medicinal plant images. Ensure the dataset is of sufficient quality and size for training and testing the machine learning models.

2. Economic Feasibility:
Cost Estimation: Creating a detailed budget outlining the costs associated with hardware, software, personnel, data acquisition, development, testing, and ongoing maintenance.
Revenue Generation: Exploring potential revenue sources, such as subscription models for advanced features, partnerships with research institutions, or grants from organizations interested in traditional medicine and conservation.
Return on Investment (ROI): Calculating the expected ROI, taking into account the project's costs and anticipated benefits, including time savings for traditional medicine practitioners and potential contributions to conservation efforts.

3. Operational Feasibility:
User Acceptance: Assessing the willingness and readiness of traditional medicine practitioners and other potential users to adopt this technology. Conduct surveys or interviews to gauge their interest and needs.
User Training: Evaluating the feasibility of providing training to users to ensure they can effectively utilize the system.
Legal and Ethical Considerations: Addressing potential legal and ethical issues related to plant data usage, intellectual property, and consent for image uploads.

IV. Future Scope

The identification of medicinal plants using image processing has promising future prospects with numerous applications in the field of herbal medicine, agriculture, and environmental conservation. Here are some of the potential future scopes and applications for a project like Aushadhi Ved:

1. **Agriculture and Farming:** Farmers and agricultural scientists can use this technology to identify and monitor the growth of specific plant species, including medicinal herbs. It can assist in crop management and yield optimization.
2. **Pharmaceutical Industry:** The pharmaceutical industry can benefit from this technology by ensuring that the raw materials used in herbal medicine production are of the correct plant species and quality.

3. **Mobile Apps for Plant Identification:** Develop mobile applications that allow users to take pictures of plants and receive information about their medicinal properties.
4. **Environmental Conservation:** Beyond medicinal plants, the technology can be used to monitor and conserve various plant species in the wild, aiding in ecological preservation efforts.

IV. CONCLUSION

The main benefit and the importance of the proposed approach presented in this paper are that through machine learning algorithm plant species can be identified using leaf feature which can save and eases the identification of plants.

With the help of Image processing algorithms, we perform the extraction and enhancement of images, thereby turning the same into some useful information and process it in. The experimental results support the supremacy of the proposed approach.

REFERENCES

Pl@ntNet:

Link : https://identify.plantnet.org/

Data set:

Link:
https://www.kaggle.com/datasets/yudhaislamisulistya/plants-type-datasets
https://www.kaggle.com/datasets/aryashah2k/indian-medicinal-leaves-dataset
Google Colab:

Link : https://colab.google/
Google Drive:

https://drive.google.com/drive/folders/1xhhf_o8Ocn3zRPHfis0EoMX04PNd8u6o?usp=sharing