International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Plants Species Recognition using Image Processing

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Abstract –

Plant species reorganization is vital for biodiversity conservation and ecosystem preservation. Traditional methods, relying on manual labor and expert knowledge, are time-consuming and subjective, leading to inconsistencies. Emerging image processing techniques automate this process by leveraging algorithms for feature extraction and classification. These systems analyze plant samples' visual characteristics and match them with known species, eliminating human subjectivity for more reliable identification. Automation reduces time and effort, potentially making reorganization more cost-effective.

In recruitment, AI innovations optimize the interview process. An AI-based mock interview evaluator assesses candidate responses in simulated scenarios. Utilizing machine learning and natural language processing, it offers real-time feedback, enhancing the interview experience and providing insights for self-improvement. Candidates can choose between video and audio interviews, facilitating a seamless experience. The system analyzes facial expressions, capturing emotional cues for comprehensive evaluation. Post-interview, candidates receive immediate feedback with visual performance representations, aiding in identifying areas for improvement and tracking progress.

Key Words:
Image Processing, Plant Species,Support vector machines(SVM), random forests(RF),Decision Tree(DT),Convolutional neural networks(CNN), Preprocessing ,Classification.

I. INTRODUCTION -

Plant species recognition via image processing employs algorithms to classify plants based on visual features. Utilizing computer vision techniques like segmentation and classification, this technology offers fast and reliable species identification. With 310,000–420,000 known plant species worldwide, manual identification is impractical. AI-based methods streamline this process, offering better results in ecology, agriculture, and conservation. Leaf color, texture, and shape serve as key classification factors, with texture veins providing consistent characteristics. Various algorithms extract features from images, aiding in plant categorization. These advancements promise efficient and accurate plant species recognition, crucial for ecological research and conservation efforts.

By leveraging machine learning and pattern recognition algorithms, image processing can enable accurate and efficient plant species identification without the need for manual intervention. This technology has numerous applications in ecology, agriculture, conservation, and botanical research, offering a fast and reliable solution for plant species recognition in a variety of settings.Plant, a biology existing everywhere, is a greatly significant thing for human's living and development. All over the world, there are currently about 310 000–420 000 known plant species, and many are still unknown yet

The numbers of plant species are extremely enormous, hence it is impossible and not practical for an expert or botanist to be able to identify and classify all the plant species. Traditional methods involve time consuming, detailed and complex process. Computer vision, pattern recognition and image processing technologies provide better results for identification and classification

Leaf color, texture and shape are the mainly three basis for leaf based classification. The color of most leaves changes slowly with time but the shape features of leaves in distinct stages are homogenous, only changes in the size happens. The texture veins have constant characteristics compared with color and shapes, texture framework differ greatly for different leaves. So it is simple to determine the category of plants. Various methods are used for plant species recognization and different algorithms are utilized for feature extraction from pre-processed images and classified using different classifiers.

II. LITERATURE –

1) Conventional methods use Local Binary Pattern (LBP), Haralick textures, Hu moments, and Color channel statistics for feature extraction, while deep learning employs pre-trained models like VGG-16, VGG-19, Inception-V3, and Inception ResNet-V2. Machine learning classifiers including Linear Discriminant Analysis, Logistic Regression, K-Nearest Neighbor, Classification and Regression Tree, Bagging Classifier, and Random Forest are utilized for plant species recognition in both approaches. Deep learning methods demonstrate higher performance metrics compared to conventional ones.

2) This paper introduces a Self-Organizing Feature Map (SOM) for plant species identification from leaf images, focusing on shape and texture features of leaf venation. Kohonen SOM operates in training and identification phases, utilizing known plant species leaf samples for training. Modules for leaf image acquisition, preprocessing, feature extraction, and identification comprise the system. Experimental results on 15 plant species, with 144 leaf images, yield a 95.83% recognition rate. While SOM offers simplicity and low learning complexity, it may not address complications from complex backgrounds or radiance.

3) Texture extraction begins with Gaussian kernel convolution and subsampling to reduce image order, followed by Otsu's thresholding for background removal and edge detection for foreground extraction. Gabor filters are employed for texture analysis, generating co-occurrence matrices for each pixel and comparing them using probability density functions. Evaluation on four texture datasets, including samples from the Brodatz texture database, yields recognition rates of around 95.50%, demonstrating effectiveness in laborious plant classification tasks.

4) This paper proposes various Local Binary Pattern (LBP) approaches—Region mean-LBP, Overall-mean LBP, and ROM LBP—for plant leaf recognition based on extracted texture features. These methods filter images, considering overall mean and region instead of center pixels for coding. Fusion of parameters from these methods is employed for the ROM LBP method. Performance evaluation using FLAVIA, Swedish, ICL, and Foliage plant leaf datasets indicates higher recognition accuracy compared to previous LBP methods. The proposed method achieves classification accuracies of 98.94%, 99.46%, 83.7%, and 92.92% for FLAVIA, Swedish, ICL, and Foliage datasets, respectively, outperforming other image descriptors for both noiseless and noisy images.

III. SYSTEM ARCHITECTURE -

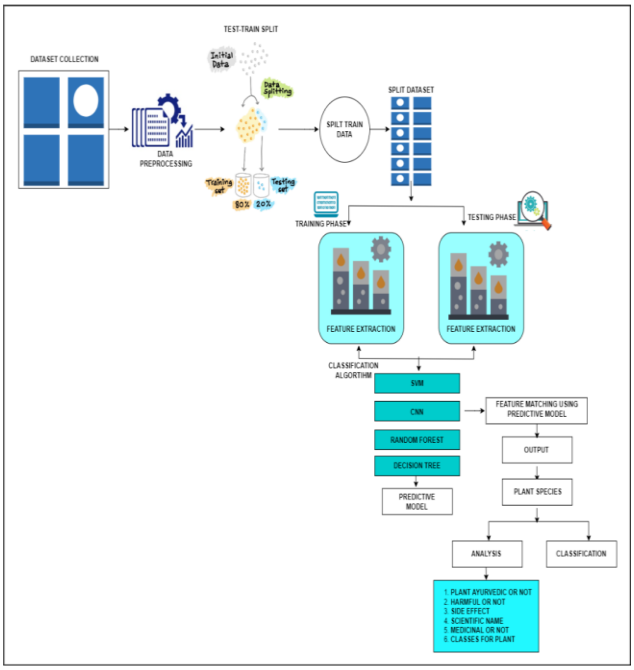


Fig 3.1. System Architecture

The proposed system relies on a diverse dataset of plant images sourced from online databases, botanical gardens, or user platforms. Preprocessing steps, including resizing and normalization, enhance image quality. Features like shape, color, and texture are extracted using techniques such as edge detection and histogram analysis. These features are fed into a classification model, trained using machine learning algorithms like SVM or CNN. The model is optimized iteratively for accuracy and then evaluated on a separate testing set. Metrics like accuracy,precision, recall, and F1 score assess the model's performance. This integrated approach of image processing and machine learning enables precise plant species identification from input images.

IV. DEVLEOPMENT

Plant species recognition using image processing involves the application of computer vision algorithms to analyze and identify different plant species from digital images. It aims to automate the process of plant species identification, which traditionally requires manual work by botanists or plant experts.it includes the following components:

I. Dataset collection: The system collects data .

II. Preprocessing: The captured images undergo preprocessing steps to enhance the image quality and remove any noise or artifacts. This may include image resizing, cropping, denoising, and color correction.

III. Training and Testing: The system requires a dataset with labeled plant images for training the classification model. The training dataset is used to train the model, optimizing its parameters to achieve the highest accuracy. Once trained, the model is tested using a separate testing dataset to evaluate its performance and generalization ability.

IV. Feature Extraction: Various features or characteristics of the plants are extracted from the preprocessed images. These features can be shape-based (leaf shape, petal shape), texture-based (leaf texture, flower texture), or color-based (leaf color, flower color). Feature extraction techniques like edge detection, texture analysis, and color quantization are commonly used.

V. Feature Selection: Not all extracted features may be relevant for plant species recognition. Feature selection methods are applied to identify the most informative and discriminative features that can effectively differentiate between plant species. This helps in reducing dimensionality and improving the classification accuracy.

VI. Classification: The selected features are fed into a machine learning or pattern recognition algorithm to classify the plants into different species. Various classification techniques like support vector machines (SVM), random forests, or deep learning models (e.g., convolutional neural networks) can be applied. The algorithm learns from a training dataset, which includes labeled images of different plant species, to create a classification model.

VII. Predictive Model: The performance of the classification model is evaluated using validation datasets to determine its accuracy, precision, recall, and other metrics. The model may undergo iterations of refinement and improvement based on the evaluation results.

VIII. Output/Result:

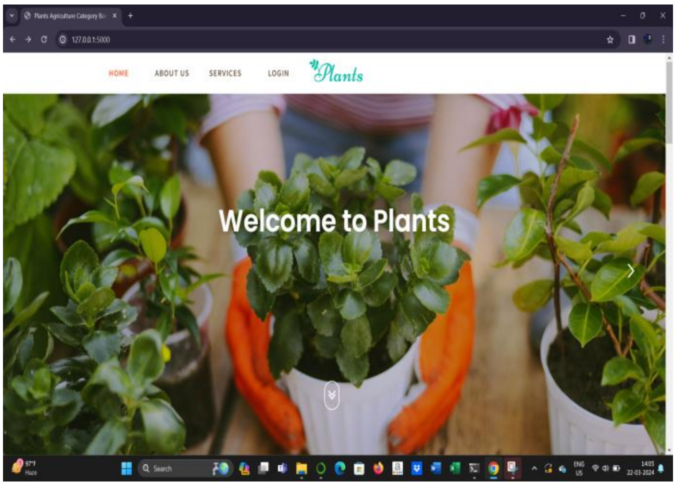


Fig:8.1 Home Page

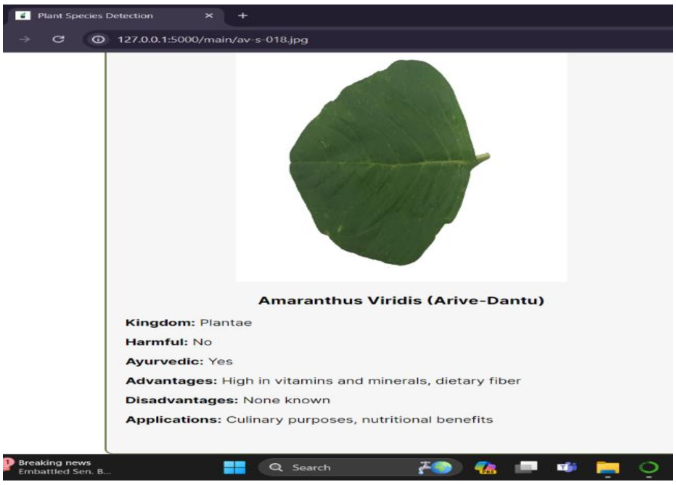


Fig:8.2 Result of that plant

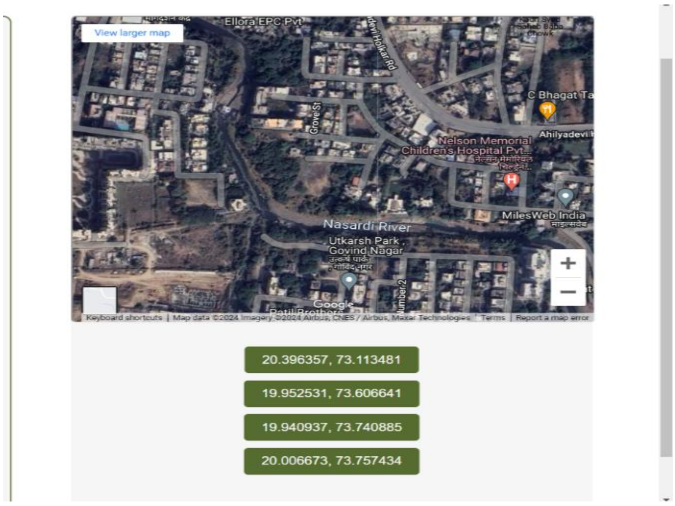


Fig :8.3 Getting Near Location Coordinate

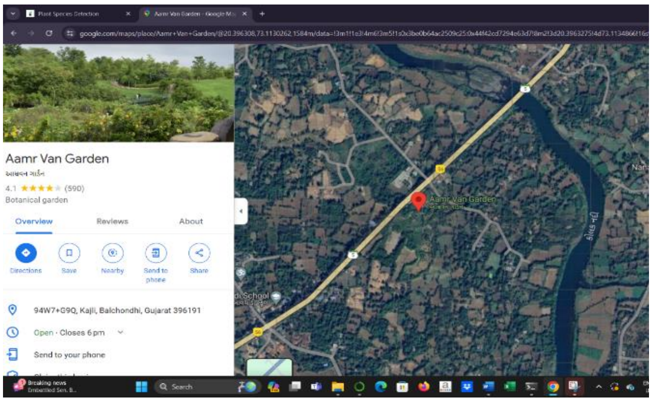


Fig :8.4 Finding Location Through Coordinate

V. ALGORITHM –

Fig 5.1:CNN algorithm

1) Convolutional Neutral Network Algorithm :

A Convolutional Neural Network (CNN) is a type of neural network commonly used for analyzing visual data, like images. It consists of layers that learn to recognize patterns and features within the data, making it effective for tasks like image classification and object detection.

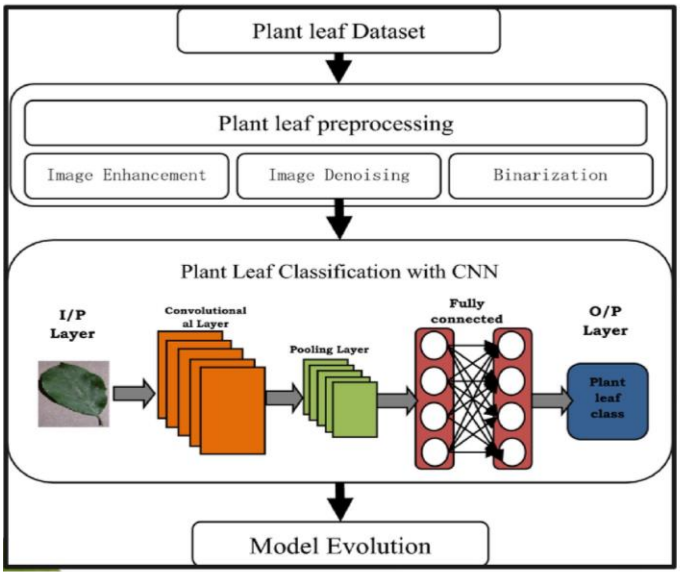
- ✈ Gather dataset different plant species.
- ✈ Resize and normalize data.
- ✈ Design CNN architecture.
- ✈ Spilt the dataset.
- ✈ Assets model performance.
- ✈ Deploy the model for recognizing plant species in new images.

VI.DATASET –

https://www.kaggle.com/c/link-prediction-for-socialnetworks

VII. CONCLUSIONS

Plants species recognition using image processing is a promising approach to automate and improve the accuracy of plant identification. Through the use of various image processing techniques, such as feature extraction and machine learning algorithms, it is possible to accurately classify plant species based on their visual characteristics. This technology has the potential to greatly benefit fields such as agriculture, forestry, and conservation by enabling faster and more efficient plant identification. However, further research and development are still needed to enhance the robustness and generalizability of the recognition systems, as well as to address challenges such as variations in lighting conditions and image quality.



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