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DISEASED BETEL NUT DETECTION USING IMAGE PROCESSING

Siddu Ravindra Pangargi[1], Smruthi P Kotian[2], Sabanna[3], Shashidhar Bhat KS[4], Mr. Shivaraj B G[5]

Student, Dept. of Computer Science & Engineering, Mangalore Institute of Technology & Engineering, Moodabidri, India[1,2,3,4]

Assistant Professor, Dept. of Computer Science & Engineering, Mangalore Institute of Technology & Engineering, Moodabidri, India [5]

Abstract: Arecanut, commonly known as betel nut, is a significant tropical crop, with India being the second-largest producer and consumer worldwide. Throughout its lifecycle, it faces various diseases, affecting its roots, leaves, and fruits. Currently, disease detection relies solely on visual observation, requiring farmers to meticulously inspect each crop periodically. This project proposes a system utilizing Convolutional Neural Networks (CNNs) to detect diseases in arecanut leaves and trunk, offering corresponding remedies. CNNs are Deep Learning algorithms designed to analyze images by assigning learnable weights and biases to different features, thereby distinguishing between them. To train and validate the CNN model, a dataset comprising healthy and diseased arecanut samples was curated. The dataset was split into training and testing sets in an 80:20 ratio. For model compilation, categorical cross-entropy was employed as the loss function, with adam serving as the optimizer function and accuracy as the metric. Training the model over 50 epochs yielded high validation and test accuracies with minimal loss. The proposed approach demonstrated effectiveness, achieving a remarkable 98% accuracy in identifying arecanut diseases.

Keywords: Arecanut, betel nut, disease detection, Convolutional Neural Networks (CNN), deep learning, image classification, dataset creation, training, validation, optimization, accuracy, remedies, agricultural technology.

I. INTRODUCTION

In countries like India, where agriculture serves as the backbone of the economy, there's a pressing need for efficient disease detection in crops. The current reliance on manual observation methods proves to be laborious, time-consuming, and prone to errors. Therefore, the development of an automated disease detection system is imperative to address these challenges effectively. Such a system would harness advanced technologies like machine learning and image processing to streamline the detection process. By promptly identifying diseases, especially in their early stages, farmers can take necessary actions to minimize their impact and prevent further spread. Moreover, the adoption of this system would enhance productivity by enabling farmers to survey larger areas more efficiently. The cost-effectiveness of this solution lies in its potential to reduce labor costs and mitigate crop losses. With the accessibility of technology such as smartphones and drones, the implementation of this system could be democratized, benefiting farmers across diverse regions, including remote areas. Ultimately, the integration of an automated disease detection system holds significant promise for transforming agriculture in India and promoting its sustainable development.

II. LITERATURE SURVEY

[1] "Classification of Diseased Areca nut based on Texture Features," proposed by Suresha M et al., introduces a technique for segmenting and classifying raw arecanut using color-based classification methods after segmentation and masking.

[2] "Areca Nut Disease Detection using Image Processing Technology," proposed by Dhanuja K C et al., proposes a system for disease detection in arecanut utilizing texture-based grading and the K-Nearest Neighbor (KNN) algorithm.

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[3] "Detection of plant leaf diseases using image segmentation and soft computing techniques," presented by Vijai Singh et al., surveys different techniques for plant leaf disease detection, proposing an algorithm for image segmentation using MATLAB, with a focus on co-occurrence features for recognition and classification.

[4] "Detection of Diseases in Areca nut Using Convolutional Neural Networks," presented by Dr. Abhay Deshpande et al., focuses on early disease detection in arecanut using Convolutional Neural Networks, involving preprocessing, feature extraction, training, and classification, with varying detection accuracy based on image quality and disease stage.

[5] "Detection and Identification of Plant Leaf Diseases based on Python," proposed by Mr. Ashish Nage and Prof. V.R. Raut from Ram Meghe Institute of Technology & Research, Badnera, presents a methodology for recognizing plant diseases using image processing, with a focus on developing an Android application for farmers to identify diseases by uploading leaf images.

III. SCOPE AND METHODOLOGY

Scope

The scope entails creating a user authentication system allowing login via username and password, alongside a registration process for new users to input personal information. It involves integrating an image uploading option within the user interface, followed by preprocessing these images for input into a specialized CNN architecture. The CNN model then predicts the presence of diseases in the uploaded betel nut images, providing valuable insights to users. This comprehensive approach ensures a seamless user experience while leveraging advanced technology for accurate disease detection.

Methodology

The methodology begins with a thorough analysis of project requirements, encompassing user authentication, registration, and image processing. Following this, suitable technologies are selected, including front-end frameworks for user interface development and back-end frameworks for server-side logic. System architecture is then meticulously designed, delineating the integration of components such as user authentication modules and image processing pipelines. Development proceeds with the implementation of front-end features like login forms and image upload interfaces, alongside back-end functionalities for user authentication and image processing logic. Machine learning components are developed concurrently, focusing on designing and training a CNN model for disease prediction in betel nut images. Integration efforts are undertaken to seamlessly connect the front-end, back-end, and machine learning components, ensuring cohesive operation. Thorough testing is conducted at each stage to validate functionality and reliability, culminating in deployment and documentation for user guidance and system maintenance.

IV. SYSTEM ARCHITECTURE

The system architecture is designed to facilitate seamless interaction between front-end, back-end, and machine learning components. At its core, the architecture features a client-server model where the front-end communicates with the back-end via RESTful API endpoints. User authentication and registration functionalities are implemented on the server-side to ensure secure access to the system. Upon successful login, users are presented with an intuitive interface enabling them to upload betel nut images for disease classification. These images are processed server-side before being passed to a customized CNN architecture for disease prediction. The architecture is scalable and modular, allowing for easy integration of additional features and future enhancements while ensuring efficient data flow and system performance. Thorough documentation accompanies the architecture to facilitate understanding and maintenance.

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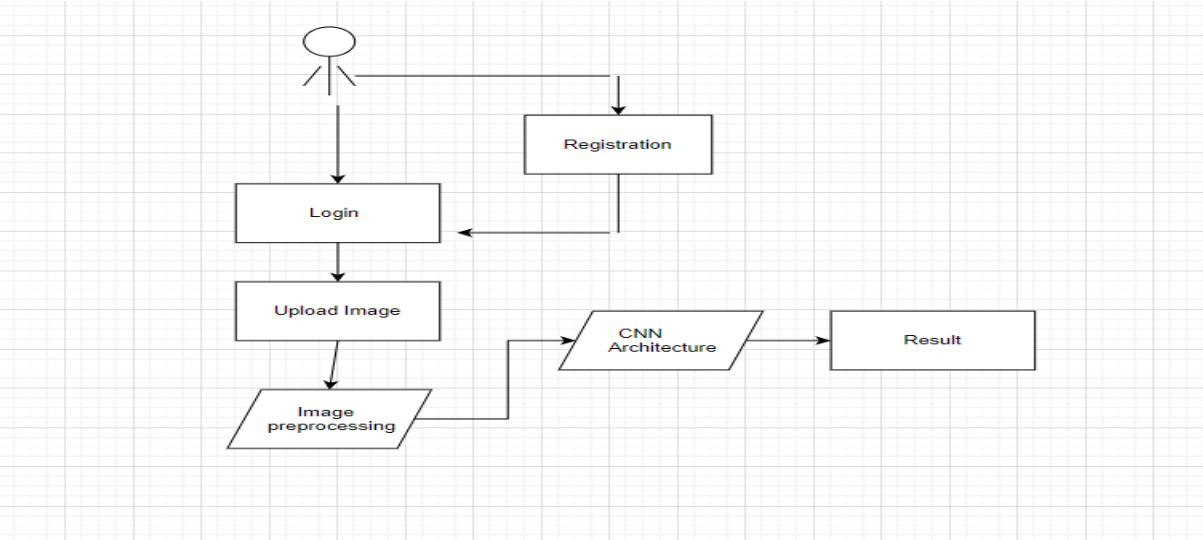

Fig. 1: System architecture

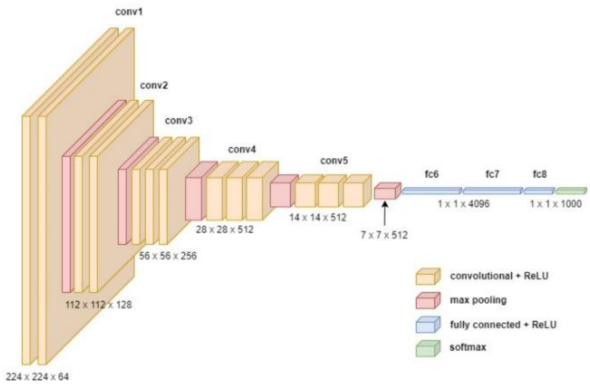

Fig. 2 CNN architecture

V. CONCLUSION

In conclusion, the development of this comprehensive system has successfully addressed the key objectives outlined, including user authentication, registration, and image processing functionalities. The seamless integration of front-end, back-end, and machine learning components ensures a smooth user experience and accurate disease prediction for betel nut images. By adhering to a meticulous methodology encompassing requirement analysis, technology selection, system design, development, and testing, the system has been meticulously crafted to meet user needs. The robust architecture allows for scalability and flexibility, enabling potential future enhancements and adaptations. Thorough documentation and training materials accompany the system to facilitate user understanding and ongoing maintenance, ensuring its long-term viability and effectiveness.

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