

Agrinova Edge: Deep Learning-Based Mulberry Disease Intelligence

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ABSTRACT

Mulberry trees are also the primary source of food for sericulture industry, since mulberry leaves is then only feed for silkworm. Leaf spot, leaf rust and many of the diseases have major impact on the quality of leaves leading to poor silk output and ultimately economic loss for the farmers. The visual observation by experts is the traditional methods for detecting diseases, which are time consuming and labour-intensive approaches that are not feasible in large scale cultivation. This project propose an Edge AI empowered deep learning and mobile computing based mulberry leaf disease recognition system.

The system utilizes a CNN was trained on a publicly accessible dataset of mulberry leaves that includes both healthy and diseased leaves. To make on-device inference easier the trained model is optimized and transformed into a TensorFlow Lite format. We use Java in Android Studio to create an Android app that incorporates the trained model.

The user can click on a leaf photo that was chosen with the smartphones camera or choose one from the gallery. The app processes the acoustic data in real-time to classify disease and does not require internet connection, which helps to provide an immediate action plan while protecting privacy.

The system correctly discriminates mulberry leaf status as healthy, leaf spot, and leaf rust by additionally providing confidence scores and disease-specific recommendations. This can be a very affordable, handheld approach to early disease detection for farmers and agricultural professionals.

INTRODUCTION

Agriculture is the main driving force in the economic development of most countries, and mulberry cultivation is particularly significant because of its direct relationship with the sericulture industry. Early detection of leaf diseases is essential because mulberry leaf quality directly impacts silk production. Once more wait for a large fruit yield if the variety is not discovered and cured in time to prevent rust and blight. Conventional disease detection techniques rely on farmers or experts subjective time-consuming visual evaluations. As a

results of advancements in deep learning and artificial intelligence automated detection of leave disease detection have become a potent substitute for boosting agricultural sustainability and productivity.

I. LITERATURE REVIEW

Recent advancements in artificial intelligence have significantly improved plant disease detection systems. Early approaches relied on traditional image processing and machine learning techniques that required manual feature extraction, making them sensitive to lighting conditions and background noise. The introduction of Convolutional Neural Networks (CNNs) enabled automatic feature learning from leaf images, resulting in improved accuracy and robustness. Several studies have demonstrated the effectiveness of CNN-based models in detecting diseases in crops such as rice, tomato, and maize, highlighting the potential of deep learning in agricultural applications.

However, many existing plant disease detection systems depend on cloud-based architectures, requiring internet connectivity for image analysis and prediction. This limits their practical use in rural and remote farming areas. Recent research has shifted towards edge computing using lightweight frameworks such as TensorFlow Lite to perform on-device inference. Although edge AI-based solutions have shown promising results, limited work has been carried out specifically on mulberry leaf disease detection, which is vital for the sericulture industry. Most current methods rely on manual inspection or laboratory analysis, emphasizing the need for an offline, mobile-based, and efficient disease detection system for mulberry cultivation.

II. EXISTING SYSTEM

Currently manual inspection and conventional farming methods are the primary means of identifying mulberry leaf disease. Using their eyes farmers examine mulberry plants to identify symptoms such as spots discoloration and patterns on the leaves. In order to diagnose the disease using experience and observational knowledge some farmers or growers seek

the advice of an extension officer. Despite the widespread acceptance of this approach the method can be subjective and heavily relies on human expertise.

Large-scale mulberry production cannot benefit from the time-consuming process of manually identifying the disease. Early-stage diseases often have mild symptoms that go unnoticed and treatment is postponed causing significant harm to the crop. Additionally, the current approach is less effective because of the lack of farming expertise especially in rural and remote areas. The fact of each person level of disease identification accuracy varies is another inconsistency with current methods.

Certain systems depend on desktop image processing techniques or laboratory analyses which add to the systems expenses and dependence. These approaches are expensive and inappropriate for real-time field use. Generally speaking, the current system has shortcomings such as poor accuracy high reliance on human labour delayed diagnosis and lack of automation all of which point to the need for an intelligent portable method of disease detection.

III. PROPOSED SYSTEM

AgriNova Edge: Deep Learning-Based Mulberry Disease Intelligence system built on mobile and deep learning technologies is exhibited in this work. Based on photos of leaves taken with smartphone cameras the suggested system can automatically identify mulberry leaf diseases in their early stages. Using images of both healthy and sick mulberry leaves we train a CNN model on the labelled dataset. In series for our trained model to function on mobile apps with few processing power we optimize it and convert it to the TensorFlow Lite format.

An Android Studio mobile application for Java that integrates the learned model. Users have the option of using the gallery or their mobile camera to take live pictures of mulberry leaves. After receiving an image capture pre-processing is done directly on the device and sent to TensorFlow Lite for classification. In addition to basic treatment recommendations the system predicts the disease category and a confidence score. The system is completely offline with quick response times data privacy and cost savings since all computation is done on the device.

Advantages of Proposed System

Offline Functionality

The system of the present invention works based on the mobile phone and does not need network support. This can be very handy in rural and less connected agricultural areas.

Fast and Real-Time Detection

As the disease detection is carried out directly on the device, so that a TensorFlow Lite model is used, and it gives real-time output with no delay. This allows farmers to react quickly to prevent additional crop damage.

Improved Accuracy

With the application of deep learning-based CNN, this system can learn complex visual patterns of mulberry leaf diseases accurately and perform stable disease classification.

Cost-Effective Solution

The invention requires no extensive laboratory testing, or expert input. Only a basic smartphone is required to conduct disease detection, minimizing operational costs.

User-Friendly Interface

The mobile application is built with easy user-interface suitable for farmers and field workers who hardly have any technical knowledge can use the system easily.

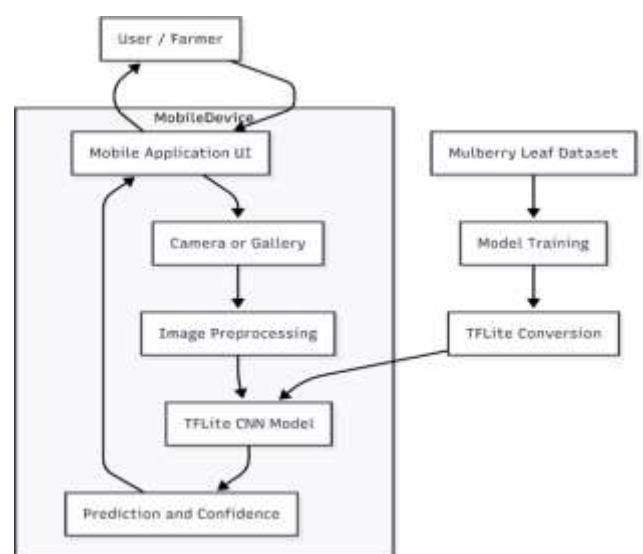
Portability and Accessibility

The smart phone-based method allows the system to be more portable and practical in the field, as disease can be detected directly on the cultivation site.

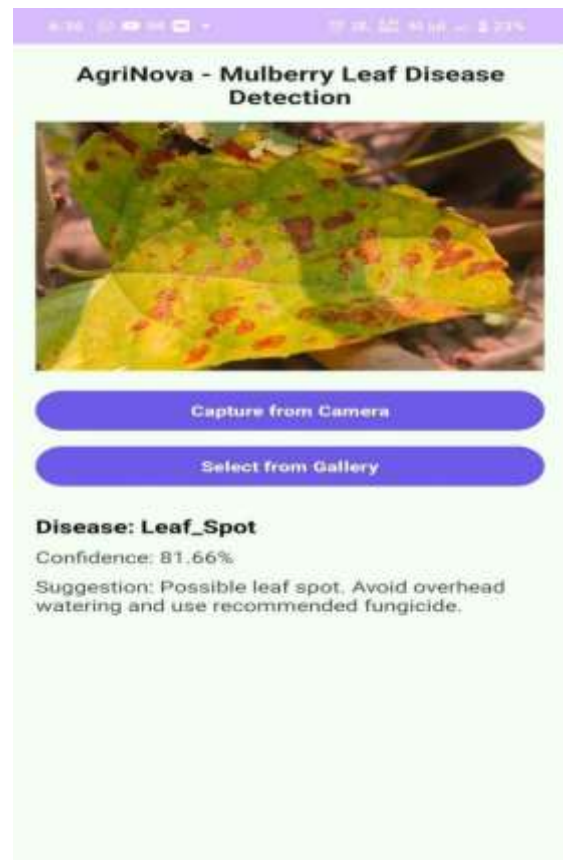
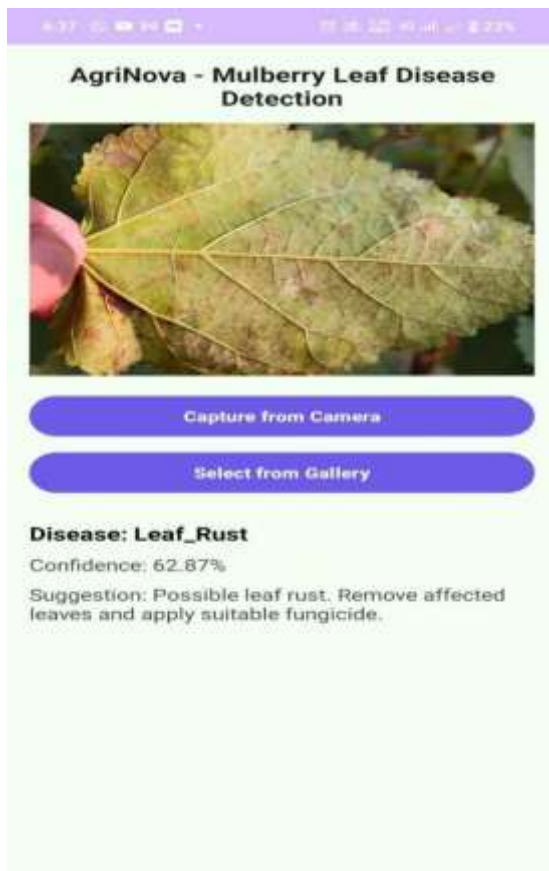
Data Privacy and Security

Since all computing is done on device, user data and images are never sent to any server which potentially introduces security & privacy concerns.

IV. SYSTEM ARCHITECTURE



V. EXPERIMENTAL RESULTS



VI. CONCLUSION

Using deep learning and mobile technology the work presents a workable advanced AI mulberry leaf disease diagnosis system. In addition, automatically accurately and instantly detecting mulberry leaf diseases developed system effectively addresses the shortcomings of traditional disease identification techniques. Using a labelled dataset, we trained a CNN model and used TensorFlow Lite to optimize it for mobile device deployment for effective on-device inference.

The trained models are incorporated into an Android mobile app which allows users to snap a picture of a leaf or choose an image from the gallery to instantly obtain the disease prediction its degree of confidence and treatment suggestions. Since the entire system is mobile it can be used in remote and rural agricultural locations and operates offline with post-response time and data privacy.

The system performs well in classifying both healthy and sick mulberry leaves under various backgrounds according to the experiment results. It can be an easy-to-use tool for farmers and agricultural advisors because of its portability and user-friendly interface. In summary the prototype systems overall performance is dependable and economical offering a helpful technique for enhancing crop management and lowering crop loss while also introducing cutting-edge artificial intelligence techniques into agriculture.

VII. REFERENCES

1. S. Sladojevic, M. Arsenovic, A. Anderla, D. Culibrk and D. Stefanovic, "Deep Neural Networks-Based Recognition of Plant Diseases by Leaf Image Classification", Computational Intelligence and Neuroscience vol 2016, pp. 1–11-2016.
2. Mohanty S. P, Hughes D. P, and Salathe M, "Using Deep Learning for Image Based Plant Disease Detection," Frontiers in Plant Science, vol. 7, pp. 1–10-2016.
3. I. Goodfellow, Y. Bengio, and A. Courville, Deep learning. Cambridge, MA: MIT Press, 2016.
4. TensorFlow Documentation, "TensorFlow: An End-to-End Open-Source Machine Learning Platform". Available: <https://www.tensorflow.org>.
5. TensorFlow Lite Documentation, "Deploy machine learning models on mobile and edge devices". Available: <https://www.tensorflow.org/lite>.
6. Kaggle, "Plant Disease Image Datasets" accessed January 2020. Available: <https://www.kaggle.com>.
7. OpenCV Documentation, "Open-Source Computer Vision Library". Available: <https://opencv.org>.
8. Android Developers, "Android Application Development Documentation". Available: <https://developer.android.com>.
9. Chollet F, Deep Learning with Python, Manning Publications Press, 2018.
10. Available: <https://code.visualstudio.com> Visual Studio Code Documentation, VS Code for Python Development.