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Pest and Diseases Detection System using Convolutional Neural Networks (CNNs) for Crops in Myanmar

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A B S T R A C T

As science and technology are of great importance in building a modern and developed nation, technical support is needed to develop agriculture. Myanmar is a country that focuses on agriculture, and in order to further improve agricultural activities, we have worked to build a system that will support agricultural activities using modern technologies, identify and prevent diseases that affect crops, and make timely repairs. Myanmar's agricultural sector relies heavily on facing constant threats from various pests and diseases that can compromise yield quality and output. This paper presents the development of a Pest and Diseases Detection System utilizing machine learning (ML) technologies designed to assist farmers in identifying and managing these threats effectively. The system, implemented as a mobile application, leverages modern technologies to enhance agricultural practices, ensuring timely and efficient interventions.

Keywords: machine learning (ML), Pest and Diseases Detection System, Convolutional Neural Networks (CNNs)

1. Introduction

Myanmar is fundamentally an agrarian society, where rice serves as the primary staple crop. In recent years, the integration of science and technology has been recognized as essential for enhancing agricultural productivity and sustainability. This research focuses on creating a Pest and Diseases Detection System that employs machine learning algorithms to allow farmers to swiftly identify diseases and pests affecting their crops using mobile devices. The initiative aims to incorporate modern technological advancements into the traditional practices of Myanmar's agricultural community.

1.1 Objectives

The primary objectives of this paper are:

Establish a Machine Learning Model: To create a robust ML model capable of accurately diagnosing pests and diseases affecting plants.

Develop a Mobile Application: To design an intuitive mobile application that enables farmers to use the prediction model conveniently.

Enhance Agricultural Productivity: To provide farmers with timely insights and recommendations, thereby improving crop yield and reducing potential losses.

2. Methodology

2.1 Data Collection

To build an effective detection system, the following datasets were utilized:

Plant Disease Dataset: A collection of images sourced from online databases, agricultural research stations, and Kaggle.

Plant Dataset: Images gathered through IoT devices in the field to ensure local relevance and accuracy.

2.2 Machine Learning Model Development

The detection system employs Convolutional Neural Networks (CNNs), a type of deep learning algorithm particularly suited for image classification tasks. In deep learning techniques, CNN is a class of deep, feed-forward artificial neural networks and most commonly applied to analyzing visual imagery. CNNs have emerged from the study of brain's visual cortex. The dataset underwent preprocessing, including image resizing and normalization,

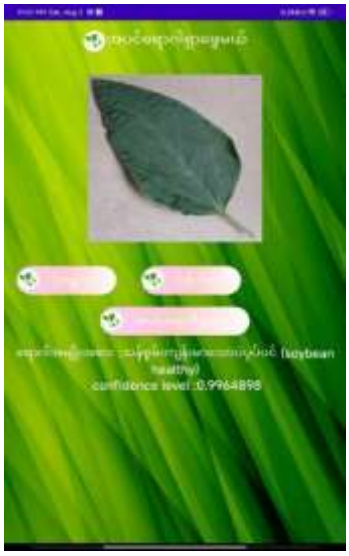
to facilitate effective training. This approach ensures the model achieves higher accuracy and adaptability to various pest and disease types. The research is divided into two main parts:

Building and creating a machine learning model using machine learning algorithms (CNN)

Using the obtained prediction model, an App that can be used on Mobile phones / tablets is built (Deploying the model to an Android application)

2.3 Mobile Application Development

The mobile application, named "PinLab," was developed using Android Studio and Kotlin. The application allows users to upload images for analysis or take photos directly using the device's camera to identify pests and diseases in real-time. Fig.1 is what you will see when you click on the Plant Disease Diagnosis button. In Fig.1 (a), you can select Select Image and take a picture, or you can select Take Picture and take a picture using your phone camera, and then select the Disease Diagnosis button to identify the disease. Then, the disease will be identified as shown in Fig.1 (b).



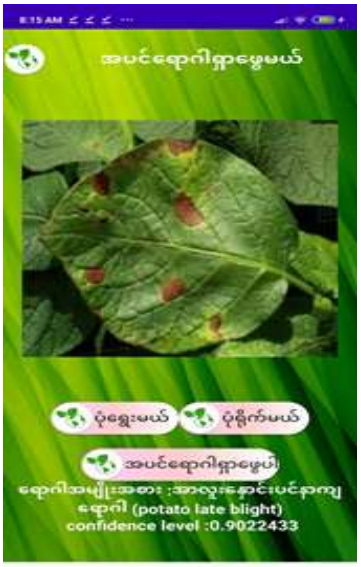


Fig. 1 - (a) image for diagnosing plant diseases; (b) image after diagnosing plant diseases.

2.4 Key Features of the Application

The key features of the mobile application are described in this sections. These are as follow:

User-Friendly Interface: Simple navigation allowing farmers to select images or capture new ones for diagnosis.

Disease Identification: The application provides a list of pests and diseases detectable through the system, including:

- ✓ ပြောင်းရွက်ပြောက်ရောဂါ (corn maize cercospora leaf spot gray leaf spot)
- ✓ ပြောင်းသံချေးရောဂါ (corn maize common rust)
- ✓ ပြောင်းရွက်ခြောက်ရောဂါ (corn maize northern leaf blight)
- ✓ သန်စွမ်းကျန်းမာသောပြောင်းပင် (corn maize healthy)
- ✓ စပျစ်အမဲပုတ်/မှင်စက်ရောဂါ (grape black rot)
- ✓ စပျစ်ဒေါင်းနီးရွက်ခြောက်ရောဂါ (grape esca black measles)
- ✓ စပျစ် ရွက်ပြောက်ရောဂါ (grape leaf blight isariopsis leaf spot)
- ✓ သန်စွမ်းကျန်းမာသောစပျစ်ပင် (grape healthy)

- ✓ ငရုတ်ကောင်းဘက်တီးရီးယားပင်ညှိုးရောဂါ (pepper bell bacterial spot)
- ✓ သန်စွမ်းကျန်းမာသောငရုတ်ကောင်းပင် (pepper bell healthy)
- ✓ အာလူး စောပင်နာကျရောဂါ (potato early blight)
- ✓ အာလူးနှောင်းပင်နာကျရောဂါ (potato late blight)
- ✓ သန်စွမ်းကျန်းမာသောအာလူးပင် (potato healthy)
- ✓ သန်စွမ်းကျန်းမာသောပဲပုပ်ပင် (soybean healthy)
- ✓ သခွားမွေး ဖားဥမှိုရောဂါ (squash powdery mildew)
- ✓ စတော်ဘယ်ရီ ရွက်လောင်ရောဂါ (strawberry leaf scorch)
- ✓ သန်စွမ်းကျန်းမာသောစတော်ဘယ်ရီပင် (strawberry healthy)
- ✓ ခရမ်းချဉ် ဘက်တီးရီးယားပင်ညှိုး/ဘက်တီးရီးယားရွက်စက်ပျောက်ရောဂါ (tomato bacterial spot)
- ✓ ခရမ်းချဉ် စောပင်နာကျရောဂါ (tomato early blight)
- ✓ ခရမ်းချဉ် နှောင်းပင်နာကျရောဂါ (tomato late blight)
- ✓ ခရမ်းချဉ် ရွက်ကြွေရောဂါ (tomato leaf mold)
- ✓ ခရမ်းချဉ် ဆက်တိုးရီးယား ရွက်ပြောက်/ အစက်ပျောက်ရောဂါ (tomato septoria leaf spot)
- ✓ ခရမ်းချဉ် မွားပင့်ကူကျခြင်း (tomato spider mites two spotted spider mite)
- ✓ ခရမ်းချဉ် အမည်းစက်ရောဂါ (tomato target spot)
- ✓ ခရမ်းချဉ် ရွက်လိပ်ရောဂါ (tomato yellow leaf curl virus)
- ✓ ခရမ်းချဉ်ပင် နူထွတ်ခြင်း (tomato mosaic virus)
- ✓ သန်စွမ်းကျန်းမာသောခရမ်းချဉ်ပင် (tomato healthy)

3. Results

3.1 Model Performance

The performance of the machine learning model demonstrated a high degree of accuracy in identifying various pests and diseases, allowing for timely interventions by farmers. Field tests indicated enhanced decision-making capabilities, reducing the time spent on diagnosis and the costs associated with pest management. The outcomes by using CNN in Plant Diseases Detection System are as shown in Table 1.

Table 1 – Evaluation of the System

Names of Evaluation	Numbers of Evaluation
Training Images	64185
Validation Images	18165
Class	38
Epoch	25
Accuracy	94.5

3.2 Benefits to Farmers

The Pest and Diseases Detection System offers several advantages:

Increased Efficiency: Immediate access to diagnostic tools helps farmers manage their crops more effectively.

Cost Savings: Early detection leads to better pest management and reduces the expenses related to pesticides and crop loss.

Enhanced Knowledge: The app educates farmers about the specific challenges their crops face, promoting better agricultural practices.

4. Discussion

The implementation of the Pest and Diseases Detection System not only aids in crop management but also serves as a step towards modernizing agriculture in Myanmar. Farmers gain autonomy in monitoring their crops, which can further lead to sustainable agricultural practices. Nevertheless, challenges such as internet connectivity in rural areas and the need for training in using the technology must be addressed to maximize the system's impact. By establishing a Pest and Diseases Detection System, farmers can save time and money, increase yield and production, and achieve benefits such as timely and appropriate maintenance.

5. Conclusion

The development of the Pest and Diseases Detection System using CNN represents a significant advancement in integrating technology into agriculture in Myanmar. By harnessing machine learning and mobile applications, this initiative empowers farmers to make informed decisions, ultimately enhancing crop production efficiency and sustainability. Future work will focus on expanding the model's capabilities to address a broader spectrum of agricultural challenges.

6. Future Recommendations

Research on Pest and Diseases Detection System, which is a component of Smart Agriculture System, can save a lot of time and manpower for agricultural entrepreneurs and improve their products. Therefore, we have to plan as future works to do as follows:

Training Workshops: Conduct educational programs to raise awareness and train farmers on using the application effectively.

Enhancement of the Dataset: Continuously gather data to improve the model's performance and expand the range of detectable pests and diseases.

Collaborative Partnerships: Work with local agricultural organizations to facilitate better outreach and infrastructure support for rural farmers in Myanmar.

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References

Pandey, S., & Maji, P. (2019). "Machine Learning Approaches for Predicting Crop Diseases." Journal of Agricultural Science.

Zhang, Y., et al. (2020). "Convolutional Neural Networks for Plant Disease Detection." Computers and Electronics in Agriculture.

Anindita, R., Rasmita, R., et al. (2022) "Rice Insects Classication Using Transfer Learning And CNN." International Research Journal of Engineering and Technology (IRJET)

Kaggle. "Plant Village Dataset." Available at https://www.kaggle.com.

TensorFlow Developers. "TensorFlow: Large-Scale Machine Learning on Heterogeneous Distributed Systems." (2015).