

<Conference abbreviation>

<Conference Series name> <Volume number and Year> <DOI Number>

CropTalk- AI-Driven Crop Disease Prediction And Management System

Aparna Torade¹, Apurv Deshmukh², Harshad Jadhav³, Monali Tingane⁴

^{1,2,3,4}, School of Computing, MIT Art Design and Technology University, Pune, Maharashtra, 412201, India, aparna.torade@mituniversity.edu.in

Abstract.

There is a lack of easily accessible knowledge-sharing platforms in agriculture due to recent technology breakthroughs. We have created a communal online application for the agricultural community that is similar to Twitter in order to address this. Through direct messaging (DMs), the website enables farmers to solve each other's issues, share success stories, and spread expertise. The software also incorporates a real-time weather API, which offers crucial meteorological information for agricultural planning, for even more user control. We have also added a machine learning model that can forecast any plant disease using our knowledge of data science and artificial intelligence.

Keywords. Machine Learning, Plant-Disease Prediction, Direct Messaging (DMs)

1. INTRODUCTION

Agriculture plays a vital role in the economy, but farmers often lack timely access to information and peer support. This work proposes a digital farming platform that enables farmer communication through direct messaging, provides real-time weather information through an API, and uses a machine-learning model to identify plant diseases from leaf images. The platform aims to create an integrated ecosystem for agricultural information, disease detection, and farmer collaboration.

2. RELATED WORK

CNN-based models have demonstrated strong performance in plant disease detection, with reported accuracies above 99% using datasets such as PlantVillage [1,4,7,8]. However, these approaches often require large datasets and significant computational resources. Traditional machine-learning methods, including Random Forest, SVM, and ensemble models, have also shown potential for early disease prediction [6].

Digital platforms and social media can improve knowledge sharing, collaboration, and agricultural decision-making among farmers [3,9,11]. However, challenges such as poor connectivity, limited infrastructure, and internet costs can restrict their use [9]. Existing studies largely address disease detection or farmer communication separately; therefore, this work combines plant disease detection, weather information, and farmer networking within a single platform.

3. KEY CONTRIBUTION

Through the development of a single, farmer focused system that combines prediction of crop diseases and sharing knowledge via community, the Croptalk system is able to improve agriculture through innovations in technology. Unlike other methods which address these three different issues separately, the Croptalk system combines them all into one convenient application using machine learning, social networking features, and current weather data. Realistic implementation is stressed throughout, as well as scalability and simplicity for farmers who lack technical skills. Such a system will enable more effective farming activities and decisions.

4. METHOD

To ensure reliability, scalability, and usability, the proposed system for disease detection and agricultural information dissemination was designed using a structured methodology involving different phases. System designing, system development, deployment, testing, and system support were some of the phases involved in the process. First, there was the design of the system that involved both functional and non-functional requirements of the system. Afterward, there was the selection of a cloud infrastructure that ensured high scalability and availability. This resulted in the decision to choose a cloud platform that had back-end hosting, database management, and API integration. In this regard, the chosen cloud provider is Amazon Web Services. There was the setting up of the front-end and back-end development environments that involved installing such key software as Postman (for API testing) and Git (for version control).

There was the designing of the frontend using JavaScript, HTML/CSS, and React. This helped in ensuring a sophisticated interface. This is done to ensure a sophisticated interface through which farmers can submit images of crops affected by diseases. The CNN-based machine learning algorithm was developed and included as one of the modules of the system. Both normal and disease-affected crop images, which were collected from an open-source database, were used to train this module. Pre-processing techniques were also applied to the images to improve the performance of the model under different conditions. After training, the algorithm was then used as a disease detection API service in real-time. On the other hand, the frontend application was successfully deployed in connection with the backend APIs, while the backend was hosted on the AWS cloud platform during deployment. To ensure secure connections to the database and APIs as well as proper authentication process, environment variables were established.

Then came the testing process of the system. In this case, integration testing was done to ensure that there were no problems in the communication between various system modules, while functional testing was performed to verify the performance of every system component. In addition, performance testing was conducted to ensure that the system could function efficiently and securely. Security testing was also done. Detected bugs were fixed before the system release.

Pilot testing was done by implementing the application with a few numbers of users to get inputs from actual use. For guiding users in using different features such as uploading images, getting disease diagnosis, and accessing information about agriculture, training and

manuals were provided. Modifications were done for increasing the effectiveness and usability of the application, depending on pilot testing feedbacks.

After implementation, the system is continuously monitored to ensure that there will be no problem with its working and technical assistance can be readily provided. Feedback methods were embedded in the system to help with continuous learning, improve machine learning, and ultimately extend the scope of the system to other types of diseases and crops.

5. EXPERIMENTAL RESULTS

The functional aspects, accuracy, and performance of the Crop talk system were analysed based on practical experiments conducted on the system. The outcome is a clear picture of how the system integrates three things that farmers are looking for, in one seamless platform: Crop disease detection, community communication and weather awareness. To test the social side of things a group of users was given access: farmers talking to other farmers to send messages, post updates and interact in real-time. It was found to be very durable; communication was relatively swift and users were able to share information and react to one another without any difficulties. Not only was it a test for the feature, it was more like a community rallying together. Testing the weather module weather information that counts when it counts where real data was collected from a variety of sources and tested for successful reception. Always accurate and relevant information on temperature, humidity and forecasts. The API could provide data within reasonable time for farmers to not have to wait for the data when making a time-sensitive decision. A module that detects diseases, evaluated using the various leaf images healthy and diseased. CNN model has shown to be effective in diagnostic of diseases with accuracy and timeliness. Most significantly, it was of practical use: farmers could have an idea of what was ailing their plants and use it without going to an expert first. Finally, the functional and integration testing were performed to validate the system's reliability when used as a whole.

6. DISCUSSIONS

The platform really helps to make communication between farmers easier; farmers can now update one another, ask questions, and share their knowledge, without having to call or pass the message by mouth. It's the quick and casual conversation you'd have face-to-face but before! Weather Insights Instead of trying to guess today or getting a road weather forecast, farmers have access to real-time local data and it allows them to plan around it. Which translates into less surprises and better judgement on when to plant, irrigate or harvest. Before the disease can spread, the CNN model won't get it right in all conditions and image quality is important too but it will give farmers a first impression quickly and practically, of what may be wrong with their crops.

7. CONCLUSIONS

Farmer will be needing tools that carry disease prediction and identification, sharing information and statistics collected in one place, not distributed across detached place. The system was made to fill that gap. The aim was to take honestly valuable technologies and fit them around the way farmers actually work rather than trying to fit agricultural needs into a technical term. To do that the system combines a CNN-based model to notice and analyze

the crop diseases, live weather data from external APIs and a social layer for farmers to share experiences and guidance. All services run as a web application with React for the interface and Node.js with Mongo DB for the cloud backend. Farmers on the platform might be able to detect disease faster, make better decisions with weather context, and connect with others facing the same challenges. The system has its limitations the model's precision can vary depending on image quality and environmental conditions, and it's worth being upfront about that. Future scope may include investigate on evolving wider variety of datasets and supporting several crops and languages.

8. REFERENCES

- [1] S. P. Mohanty, D. P. Hughes, and M. Salathé, "Using Deep Learning for Image-Based Plant Disease Detection," *Frontiers in Plant Science*, vol. 7, p. 1419, 2016, doi: 10.3389/fpls.2016.01419. <https://doi.org/10.3389/fpls.2016.01419>.
- [2] K. P. Ferentinos, "Deep Learning Models for Plant Disease Detection and Diagnosis," *Computers and Electronics in Agriculture*, vol. 145, pp. 311–318, 2018, doi: 10.1016/j.compag.2018.01.009. <https://doi.org/10.1016/j.compag.2018.01.009>
- [3] J. Sharp, E. Imerman, and G. Peters, "Community Supported Agriculture (CSA): Building Social Connections," *Journal of Community Development Society*, vol. 33, no. 1, pp. 76–91, 2002, doi: 10.1080/15575330209490145. <https://doi.org/10.1080/15575330209490145>
- [4] K. P. Ferentinos, "Deep Learning Models for Plant Disease Detection and Diagnosis," *Computers and Electronics in Agriculture*, vol. 145, pp. 311–318, 2018, doi: 10.1016/j.compag.2018.01.009. <https://doi.org/10.1016/j.compag.2018.01.009>
- [5] O. Kulkarni, "Crop Disease Detection Using Deep Learning," in *Proc. Int. Conf. Advances in Computing, Communication, and Control (ICAC3)*, 2021, doi: 10.1109/ICAC353642.2021.9697166. <https://doi.org/10.1109/ICAC353642.2021.9697166>
- [6] E. P. Pathrose and P. Verma, "E-commerce and teleworking: Business opportunities in the COVID-19 era," *Electrochemical Society Transactions*, vol. 107, no. 1, pp. 12585–12594, 2022.
- [7] E. C. Too, L. Yujian, S. Njuki, and L. Yingchun, "A Comparative Study of Fine-Tuning Deep Learning Models for Plant Disease Identification," *Computers and Electronics in Agriculture*, vol. 161, pp. 272–279, 2019, doi: 10.1016/j.compag.2018.03.032. <https://doi.org/10.1016/j.compag.2018.03.032>
- [8] S. P. Mohanty, D. P. Hughes, and M. Salathé, "Using Deep Learning for Image-Based Plant Disease Detection," *Frontiers in Plant Science*, vol. 7, p. 1419, 2016, doi: 10.3389/fpls.2016.01419. <https://doi.org/10.3389/fpls.2016.01419>
- [9] C. W. Kuria, "Use of Social Media as a Source of Agricultural Information by Smallholder Farmers: A Case Study of Lower Kabete, Kiambu County," Master's thesis, University of Nairobi, Nairobi, Kenya, 2014.
- [10] S. Burbi and K. Hartless Rose, "The Role of Internet and Social Media in the Diffusion of Knowledge and Innovation Among Farmers," *Centre for Agroecology, Water and Resilience*, Coventry University, 2016.
- [11] P. Verma and R. Verma, "Predictive analytics for sustainable investment portfolios in banking," *Multidisciplinary Science Journal*, vol. 7, 2025, Art. no. 2025ss0231.

Biographies



Prof. Aparna Torade having 11 years of combined experience in the IT industry and academia. Currently working as an Assistant Professor at MIT Art, Design and Technology University, Loni Kalbhor, Pune. I am also pursuing my PhD at MIT ADT University, focusing on Blockchain and Federated Learning-based security. My areas of interest include cybersecurity, blockchain technology, federated learning, and data science.



Dr. Monali Tingane is an Assistant Professor in Computer Science and Engineering with over nine years of academic and industry experience. She holds a Ph.D. in Machine Learning from Sant Gadge Baba Amravati University.



Apurv Deshmukh Completed a Bachelor of Technology (B.Tech.) in Computer Science and Engineering (CSE – Core) from the School of Computing, MIT Art, Design and Technology University, Pune, Maharashtra, India



Harshad Jadhav Computer Science and Engineering (CSE – Core) graduate from the School of Computing, MIT Art, Design and Technology University,