International Journal of Scientific Research in Computer Science, Engineering and Information Technology

ISSN : 2456-3307 OPEN ACCESS

Available Online at :www.ijsrcseit.com

doi : https://doi.org/10.32628/IJSRCSEIT

Development of an Automated Crop Disease Detection System

Prof. Y. L. Tonape, Rupali Bhujbal, Sarang Kale, Vishal Patil, Renuka Savale

Department of B.E. Computer, SBPCOE, Indapur, Maharashtra, India

ARTICLEINFO

Article History:

Accepted: 10Oct 2023

Published: 30 Oct 2023

Publication Issue

Volume 9, Issue 10

September-October-2023

Page Number

200-210

ABSTRACT

Crop diseases pose a significant threat to global food security, necessitating innovative approaches for early detection and intervention. This abstract presents an application that uses advanced machine learning algorithms to accurately identify and monitor diseases in crops. This imagery captures various spectral signatures, which are subsequently processed and analyzed to detect anomalies indicative of crop diseases. Image segmentation techniques are employed to separate healthy and diseased areas within the images, allowing for precise disease mapping. Machine learning plays a pivotal role in such applications by enabling automated disease recognition. Supervised learning models, such as Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs), are trained on labeled datasets containing a wide range of crop disease instances. These models learn to distinguish between healthy and infected crops based on the extracted features and spectral signatures, achieving high accuracy and minimizing false positives. Real-time monitoring is a core feature, enabling farmers and agricultural stakeholders to receive timely disease alerts. The system's user-friendly interface, accessible through web applications, provides actionable insights and recommendations for targeted interventions. This empowers farmers with the information needed to implement precision agriculture practices and adopt integrated pest management strategies, optimizing crop yields while minimizing the use of pesticides. By offering early disease detection and predictive modeling capabilities, the system supports sustainable and resilient agriculture, contributing to global food security efforts.

Keyword : Crop Diseases, Machine Learning, Image Processing, Crop Management, Data Analysis, User Interface

I. INTRODUCTION

In modern agriculture, the effective management of crop diseases is crucial for ensuring food security and sustainable agricultural practices. Crop disease detection systems have emerged as invaluable tools to help farmers and agricultural stakeholders monitor and combat these diseases efficiently. At the heart of these systems lies the user interface, a vital component that bridges the gap between advanced technology and end-users, typically consisting of farmers, agronomists, and decision-makers. This introduction provides an overview of the Crop Disease Detection System, highlighting its significance, key features, and its role in revolutionizing crop disease management. The crop disease detection system serves as the gateway to a wealth of information and actionable insights for crop disease management. It plays a pivotal role in democratizing cutting-edge technology, making it accessible and user-friendly for individuals with varying levels of technical expertise. The interface acts as a conduit through which users interact with complex algorithms, remote sensing data, and machine learning models, ultimately empowering them to make informed decisions that impact crop health and yield.

Features:

1. User-Friendly Design: Such applications are thoughtfully designed with a user-centric approach, ensuring that farmers and agricultural professionals can navigate and use the system with ease. Intuitive menus, icons, and a simple layout contribute to a seamless user experience.
2. Real-Time Monitoring: One of the standout features of the application is its ability to provide real-time updates on crop health. Users can receive instant notifications and alerts regarding disease outbreaks, enabling swift response and intervention.
3. Data Access: The interface provides access to a comprehensive database of historical and current crop disease data. Users can review trends, view disease history, and gain insights into disease prevalence in their region.
4. Machine Learning Insights: The application harnesses the power of machine learning to provide accurate disease identification. Users can upload images or data, and the system utilizes AI algorithms to diagnose diseases and suggest appropriate treatments.
5. Recommendations and Action Plans: Beyond diagnosis, the interface offers recommendations for disease management. This may include suggestions for pesticide application, crop rotation, or other strategies aimed at disease prevention and control.

II. LITERATURE SURVEY

Sr No.	Paper Title	Author Name	Year of Publication	Problem solved in this paper: Existing Problem Statement	The technique used to solve the problem: Existing Problem Solution	What will be future work: Future Scope
1	Demystifying Issues, Challenges, Solutions,	Haoran Yang, Weile Lian, Shaowei Wang,	2023	Multilingual software development refers to the	In this paper, we aim to answer these questions via a study on developer	The integration of AI and NLP technologies will play a significant

	and Solutions for Multilingual Software Development [1]	Haipeng Cai		process of creating software that can operate in multiple languages or support users from different linguistic backgrounds. Developing such software comes with its own set of issues and challenges, but with the right solutions and best practices, it can be achieved effectively.	discussions on Stack Overflow.	role in automating and improving multilingual software development. AI-powered language translation, sentiment analysis, and chatbots capable of handling multiple languages will become more advanced.
2	AI-based Desktop Voice Assistant [2]	Pankaj Kunekar, Ajinkya Deshmukh, Sachin Gajalwad, Aniket Bichare, Kiran Gunjal, Shubham Hingade	2023	All actions performed by the system will be based on the voice of the user. The System helps the user based on voice notes i.e., the system works on commands given by the user.	A voice assistant utilizes cloud computing to integrate AI and communicate with users in natural language. Programs based on desktop voice assistants recognize and respond to human voices via an integrated voice system.	Over the past few years, Artificial Intelligence (AI) has shown remarkable progress, and its future is growing day by day. Natural Language Processing (NLP) is an application of AI.
3	Crop disease detection and classification transfer learning and hyperparame ter sized convolutional	R. Meena Prakash, M. Vimla, K. Ramalakshmi, B. Balakrishna Prakash	2022	Automatic detection of plant diseases is an essential research topic as it may prove beneficiating to monitoring large	To identify plant disease at an early stage, image processing techniques are used in the detection and classification of plant diseases. In	There are an increasing number of imaging and noninvasive sensors available that can support diagnosis and

	neural network [3]			fields of crops, and thus automatically detect the symptoms of diseases as soon as they appear on plant leaves.	this paper, CNN with transfer learning and optimized CNN are proposed for detection and classification of crop diseases.	plant detection-Tion. The progress in sensor and information technologies together with the expansion of geographic information systems opens new opportunities for precision agriculture and plant phenotyping.
4	Voice Assistant System [4]	Selvaganapathy G, Thirugnanam M, A Sheela	2022	All actions performed by the system will be based on the n voice of the user. The System helps thuse-basedofnof voice note notes. The system works on command given by the user.	A voice assistant utilizes cloud computing to integrate AI and communicate with users in natural language. Programs based upon desktop voice assistants recognize and respond to human voices via an integrated voice system	Technological advances are making voice assistants more capable, particularly in AI, natural language processing (NLP), and machine learning. To build a robust speech recognition experience, the artificial intelligence behind it must become better at handling challenges such as accents and background noise.

5	Design and Development of UI/UX on Company Profile Web with Design Thinking Method [5]	YudhoYudhandoo, Sahid Aldi Susilo, WinitaSulandhari	2022	Currently, the human need for documents in this modern world is increasing, which was originally in the form of paper now turned into a digital file. Businesspeople think this is an opportunity, because there are so many people who need to create or understand documents but can't do it all. Be it due to limited time or lack of knowledge.	One solution to overcome some of these problems is to create a system, one of which is a website. A website is a collection of pages that can be accessed via the internet. With the website, users can access information. The design of this website is made using the Design Thinking method, which is a problem-solving method that focuses on the user.	Growth and Opportunities. With the expanding market and the increasing demand for products and services, experienced and talented UI/UX designers are in high demand. As people spend more time on mobile devices, the need for a flawless user experience becomes crucial
6	Crop diseases detection using deep learning [6]	Omkar Kulkarni	2021	In recent times, drastic climate changes and lack of immunity in crops has caused substantial increase in growth of crop diseases. This causes large scale demolition of crops, decreases cultivation and eventually leads to financial loss of farmers. Due to rapid growth in variety of	The leaves have texture and visual similarities which are attributed to the identification of disease type. Hence, computer vision employed with deep learning provides the way to solve this problem. This paper proposes a deep learning-based model which is trained using public dataset containing images of healthy and	Deep learning models, particularly convolutional neural networks (CNNs) and recurrent neural networks (RNNs), will continue to improve the accuracy of crop disease detection. Researchers will develop more robust and specialized architectures for

				diseases and adequate knowledge of farmers, identification and treatment of the disease has become a major challenge.	diseased crop leaves. The model serves its objective by classifying images of leaves into diseased category based on the pattern of defect	different crops and diseases. Deep learning can contribute to sustainable agriculture by optimizing resource use, reducing the environmental impact of farming practices, and minimizing the need for pesticides.
7	Plant diseases detection and classification by deep learning [7]	Lili Li, Shujuan Zang, Bin Wang	2018	In this paper, we present the current trends and challenges for the detection of plant leaf disease using deep learning and advanced imaging techniques. We hope that this work will be a valuable resource for researchers who study the detection of plant diseases and insect pests. At the same time, we also discussed some of the current challenges and problems that need to be resolved.	The application of deep learning in plant disease recognition can avoid the disadvantages caused by artificial selection of disease spot features, make plant disease feature extraction more objective, and improve the research efficiency and technology transformation speed. This review provides the research progress of deep learning technology in the field of crop leaf disease identification in recent years.	In recent years, with the advantages of automatic learning and feature extraction, it has been widely concerned by academic and industrial circles. It has been widely used in image and video processing, voice processing, and natural language processing. At the same time, it has also become a research hotspot in the field of agricultural plant protection, such as plant disease recognition and

						pest range assessment, etc.
8	Plant diseases detection using machine learning [8]	Shima Ramesh, Ramachandra Hebbar, Nivedita M., Pooja R., Prasad Bhat N.,Shashank N., Vinod P.V.	2018	Crop diseases are a noteworthy risk to sustenance security, however their quick distinguishing proof stays troublesome in numerous parts of the world because of the non-attendance of the important foundation. The emergence of accurate techniques in the field of leaf-based image classification has shown impressive results.	This paper makes use of Random Forest in identifying between healthy and diseased leaf from the data sets created. Our proposed paper includes various phases of implementation namely dataset creation, feature extraction, training the classifier and classification. The created datasets of diseased and healthy leaves are collectively trained under Random Forest to classify the diseased and healthy images. For extracting features of an image, we use Histogram of an Oriented Gradient (HOG). Overall, using machine learning to train the large data sets available publicly gives us a clear way to detect disease present in plants in a colossal scale.	As machine learning algorithms continue to advance, we can expect higher accuracy in disease detection. Fine-tuning of models, larger and more diverse datasets, and the development of specialized architectures will contribute to better detection rates. Machine learning can contribute to sustainable agriculture by optimizing resource use and reducing the environmental impact of farming practices.
9	Plant diseases	Sachin D.	2018	Identification of	Disease detection	The future scope

	detection using image processing [9]	Khirade, D. B. Patil		the plant diseases is the key to preventing losses in the yield and quantity of the agricultural product. The studies of plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plants is very critical for sustainable agriculture. It is very difficult to monitor plant diseases manually. It requires a tremendous amount of work, expertise in plant diseases, and requires excessive processing time. Hence, image processing is used for the detection of plant diseases	involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. This paper discussed the methods used for the detection of plant diseases using their leaves images. This paper also discussed some segmentation and feature extraction algorithms used in plant disease detection.	of plant disease detection using image processing holds great promise and is likely to continue evolving in several exciting directions. the future of plant disease detection using image processing is bright, driven by advancements in technology, machine learning, and the increasing need for sustainable and efficient agriculture. It has the potential to improve crop yields, reduce pesticide use, and contribute to global food security.
10	Language Identification on Indian Multilingual Document Using Profile Feature	M. C. Padma, P.A. Vijaya, P. Nagabhushan	2009	To reach a larger cross section of people, it is necessary that a document should be composed of text contents in	In this research work, this problem of recognizing the language of the text content is addressed, however it is perhaps	We have proposed to learn identifying the language of the text by thoroughly understanding

	[10]			different languages. But on the other hand, this causes practical difficulty in OCRing such a document, because the language type of the text should be pre-determined, before employing a particular OCR.	impossible to design a single recognizer which can identifymany scripts/languages. As a via media, in this research we have proposed to work on the prioritized requirements of a particular region, for instance in Karnataka state in India, generally any document including official ones, would contain the text in three languages- English-the language of general importance, Hindi-the language of National importance and Kannada -the language of State/Regional importance.	the nature of top and bottom profiles of the printed text lines in these three languages. The experimentation conducted involved 800 text lines for learning and 600 text lines for testing. The performance has turned out to be 95.4%.

III.LIMITATIONS IN EXISTING SYSTEM

Existing crop diseases detection systems have made significant strides in improving agricultural practices and crop management. However, they are not without their limitations. Here are some common limitations of existing crop diseases detection systems:

1. Dependency on Data Quality: Many crop disease detection systems rely heavily on data quality, including the accuracy of satellite imagery, sensors, or input data. If the data used for detection is of poor quality, it can lead to inaccurate results.
2. Limited Data Availability: Data availability can be a significant challenge, especially in remote or underdeveloped regions. Lack of access to up-to-date imagery, weather data, or historical disease data can hinder the effectiveness of these systems.

3. Sensitivity to Environmental Conditions: Environmental factors such as weather, soil conditions, and lighting can impact the accuracy of detection. Variability in these factors can lead to false positives or false negatives in disease identification.
4. Crop and Disease Diversity: Crop diseases vary widely in terms of symptoms, and not all diseases manifest in the same way. Existing systems may struggle to identify less common or emerging diseases due to limited training data.
5. Resource Intensiveness: Some detection systems require significant computational resources, making them less accessible to small-scale farmers or resource-constrained regions.
6. Need for Expert Annotation: Machine learning-based systems often require annotated training data, which can be time-consuming and expensive to collect. Additionally, the accuracy of the system may be limited by the quality of annotations.
7. Overfitting and Generalization Issues: Machine learning models used for disease detection may overfit specific training data, resulting in poor generalization to new or unseen cases.
8. Language and Accessibility: The user interfaces of some systems may not be available in local languages or accessible to users with limited technological literacy.
9. High False Positive Rates: Many systems prioritize sensitivity to detect diseases, which can lead to high false positive rates. Farmers may become skeptical of the system's recommendations if they receive frequent false alarms.
10. Cost: Implementing and maintaining some crop disease detection systems can be costly, which may deter adoption by smallholder farmers or resource-limited regions

IV.CONCLUSION

The development and implementation of crop diseases detection systems represent a significant step forward in modern agriculture, offering promising solutions to address the challenges posed by plant diseases. As we conclude our exploration of this field, it becomes evident that these systems have the potential to revolutionize crop management practices and contribute to global food security. In conclusion, crop diseases detection systems hold great promise for transforming agriculture into a more resilient, sustainable, and productive industry. As advancements continue, and as these systems become more accessible and fine-tuned, they have the potential to make significant contributions to global food security and the well-being of farming communities worldwide. To realize this potential, ongoing research, development, and collaboration are imperative to overcome challenges and refine these systems for the benefit of all.

V. REFERENCES

[1]. H. Yang, W. Lian, S. Wang and H. Cai, "Demystifying Issues, Challenges, and Solutions for Multilingual Software Development," 2023 IEEE/ACM 45th International Conference on Software Engineering (ICSE), Melbourne, Australia, 2023, pp. 1840-1852, doi: 10.1109/ICSE48619.2023.00157.

[2]. P. Kunekar, A. Deshmukh, S. Gajalwad, A. Bichare, K. Gunjal and S. Hingade, "AI-based Desktop Voice Assistant," 2023 5th Biennial International Conference on Nascent Technologies in Engineering (ICNTE), Navi Mumbai, India, 2023, pp. 1-4, doi: 10.1109/ICNTE56631.2023.10146699.

[3]. R. M. Prakash, M. Vimala, K. Ramalakshmi, M. B. Prakash, A. Krishnamoorthi and R. S. S. Kumari, "Crop Disease Detection and Classification with Transfer learning and hyper-parameters optimized Convolutional neural network," 2022 Third International Conference on Intelligent Computing Instrumentation and Control Technologies (ICICICT), Kannur, India, 2022, pp. 1608-1613, doi: 10.1109/ICICICT54557.2022.9917901.

[4]. S. G, T. M and A. Sheela, "Voice Assistant System," 2022 1st International Conference on Computational Science and Technology (ICCST), CHENNAI, India, 2022, pp. 1025-1030, doi: 10.1109/ICCST55948.2022.10040374.

[5]. Y. Yudhanto, S. A. Susilo and W. Sulandari, "Design and Development of UI/UX on Company Profile Web with Design Thinking Method," 2022 1st International Conference on Smart Technology, Applied Informatics, and Engineering (APICS), Surakarta, Indonesia, 2022, pp. 159-164, doi: 10.1109/APICS56469.2022.9918714.

[6]. O. Kulkarni, "Crop Disease Detection Using Deep Learning," 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), Pune, India, 2018, pp. 1-4, doi: 10.1109/ICCUBEA.2018.8697390.

[7]. L. Li, S. Zhang and B. Wang, "Plant Disease Detection and Classification by Deep Learning—A Review," in IEEE Access, vol. 9, pp. 56683-56698, 2021, doi: 10.1109/ACCESS.2021.3069646.

[8]. S. Ramesh et al., "Plant Disease Detection Using Machine Learning," 2018 International Conference on Design Innovations for 3Cs Compute Communicate Control (ICDI3C), Bangalore, India, 2018, pp. 41-45, doi: 10.1109/ICDI3C.2018.00017.

[9]. S. D. Khirade and A. B. Patil, "Plant Disease Detection Using Image Processing," 2015 International Conference on Computing Communication Control and Automation, Pune, India, 2015, pp. 768-771, doi: 10.1109/ICCUBEA.2015.153.

[10]. M. C. Padma, P. A. Vijaya and P. Nagabhushan, "Language Identification from an Indian Multilingual Document Using Profile Features," 2009 International Conference on Computer and Automation Engineering, Bangkok, Thailand, 2009, pp. 332-335, doi: 10.1109/ICCAE.2009.35.