Mathematical Statistician and Engineering Applications
ISSN: 2094-0343
2326-9865

Utilizing Flutter Framework and Tensorflow Lite Convolutional Neural Networks-based Image Classification for Plant's Leaf Disease Identification through Deep Learning

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Article Info
Page Number: 1381-1388
Publication Issue:
Vol. 72 No. 1 (2023)

ABSTRACT
Aim of this project is to develop an android application that detects plant diseases by using flutter,tensorflow lite and Convolutional Neural Networks (CNNs). The use of deep learning techniques, such as Convolutional Neural Networks (CNNs), for plant disease identification can help ensure healthy crop yields and prevent crop losses. In this study, researchers proposed a plant leaf disease identification system using CNNs and the Flutter framework for mobile app development. They trained a CNN model using transfer learning on a dataset of plant leaf images with various diseases, achieving high accuracy in identifying plant diseases. The Flutter app provided a user-friendly interface for accessing the model's predictions, making it easy for farmers to use the system without any technical expertise. This cost-effective system can assist farmers in identifying plant disease at an early stage, leading to timely interventions and increased crop yields. Overall, the proposed system using CNNs and Flutter for mobile app development can play a crucial role in improving crop yields and reducing crop losses due to diseases, leading to increased profitability for farmers and a sustainable food supply for the growing population.

Article History
Article Received: 15 October 2022
Revised: 24 November 2022
Accepted: 18 December 2022

Keywords: Flutter, Tensorflow lite, Convolutional neural network, Mobile app development.

1.1 Introduction

This study proposes a plant leaf disease identification system using Convolutional Neural Networks (CNNs) [1] and the Flutter framework for mobile app development[2][4]. The system utilizes Tensorflow Lite[3], a lightweight version of Tensorflow[15], to implement the CNN model on mobile devices. Model was trained on a dataset of plant leaf images with various diseases using transfer learning. The Flutter app[2][5] provides a user-friendly interface for accessing the model's predictions. The proposed system can assist farmers and agriculture experts in accurately identifying plant diseases[6], leading to timely interventions and

increased crop yields[9]. It is cost-effective and eliminates the need for expensive equipment and expert knowledge.Plant diseases can cause significant crop losses and reduce yields, affecting farmers' livelihoods and food supply.Accurately identifying plant diseases is crucial for timely interventions and increased crop yields, and this study aims to develop a cost-effective and accessible solution using deep learning techniques and mobile app development[2].The proposed system can accurately identify plant diseases, leading to timely interventions and increased crop yields. It is cost-effective and accessible to farmers without requiring expensive equipment or technical expertise. The user-friendly interface of the app makes it easy for farmers to use[1][5].

1.2 Scope of project

The scope of the project is to develop a mobile application that uses machine learning algorithms to identify plant diseases through image classification. The application will be built using Flutter framework[2] and Tensorflow Lite[3] Convolutional Neural Networks[1], and will be capable of providing accurate and efficient disease identification results to farmers and agriculture experts. The project aims to provide a cost-effective and accessible solution for plant disease identification in agriculture, leading to timely interventions and increased crop yields[9].

The mobile application will provide a user-friendly interface designed specifically for farmers and agriculture experts. Users will be able to capture images of plant leaves or affected parts using their device's camera, and the application will preprocess the images to optimize them for analysis. The images will then be fed into the CNN models trained on a large dataset of plant disease images to accurately classify and identify the diseases.

The application will integrate a comprehensive database of plant diseases, providing users with information about symptoms, causes, and recommended treatments. This database will help farmers and agriculture experts make informed decisions about interventions and treatments for the identified diseases.

To ensure accessibility, the application will support offline functionality, allowing users to capture images and perform analysis even in areas with limited or no internet connectivity. The results of the disease identification will be provided in real-time, and users may also receive push notifications or alerts with the identification results and recommended actions.

By providing an accessible and cost-effective solution for plant disease identification, the project aims to assist farmers and agriculture experts in timely interventions, leading to increased crop yields. The use of Flutter framework and Tensorflow Lite allows for efficient development and utilization of machine learning algorithms, making the application accessible to a wide range of users without the need for expensive specialized equipment.

In summary, the project's mobile application will utilize machine learning algorithms, image classification, a comprehensive disease database, and offline functionality to provide accurate and efficient disease identification results. It aims to improve agricultural practices by enabling timely interventions and ultimately increasing crop yields.

2.Literature Review

Plant disease identification is a critical task in agriculture to ensure healthy crop yields and prevent crop losses due to diseases.With advancements in technology, deep learning techniques such as Convolutional Neural Networks (CNNs) have shown great potential in accurately identifying plant diseases through image classification[1][6][7].

Several studies have explored the use of CNNs in plant disease identification. Sladojevic et al. trained a CNN model on a dataset of plant disease images to achieve high accuracy in classification. Mohanty et al. used a CNN model to classify 14 different crop diseases with an accuracy of 98.32%[7].

Mobile app development frameworks[2], such as Flutter,have also gained popularity in recent years due to their cross-platform compatibility and ease of use. Studies have explored the use of Flutter in various fields, including healthcare, education, and even fields like

entertainment[2].

In this study, the researchers proposed a plant leaf disease identification system using CNNs and the Flutter framework for mobile app development. To implement the CNN model on mobile devices, they used Tensorflow Lite, a lightweight version of Tensorflow[15]. They collected a dataset of plant leaf images with various diseases and trained a CNN model using transfer learning.

Transfer learning has been widely used in deep learning applications, including plant disease identification.In they used transfer learning to improve the classification accuracy of plant diseases by fine-tuning pre-trained CNN models[7].

The results of the proposed system showed that the CNN model achieved high accuracy in identifying plant diseases, and the Flutter app provided a user-friendly interface for accessing the model's predictions[2]. The proposed system can help farmers and agriculture experts accurately and efficiently identify plant diseases, leading to timely interventions and increased crop yields[9].

Cost-effectiveness is an essential factor in developing solutions for farmers and agriculture experts. The proposed system eliminates the need for expensive equipment and expert knowledge, making it accessible to farmers. This approach is consistent with the findings of other studies, which have explored cost-effective solutions for plant disease identification[1].

For instance, in a study given in , a low-cost smartphone-based solution was proposed for identifying plant diseases in the field. The system utilized a smartphone camera and a custom-built cradle to capture images of plant leaves for analysis[4].

In conclusion, the proposed system using CNNs and Flutter for mobile app development can play a crucial role in improving crop yields and reducing crop losses due to diseases. It can also lead to increased profitability for farmers and a sustainable food supply for the growing population.The proposed system's cost-effectiveness and accessibility make it a promising solution for plant disease identification in agriculture[5][6][7].

3.Proposed System

3.1 Proposed System Overview

The proposed system is a plant leaf disease identification system that utilizes Convolutional Neural Networks (CNNs) and the Flutter framework for mobile app development[1][2][3].

The system aims to accurately identify plant diseases through image classification and provide a user-friendly interface for farmers and agriculture experts to access the model's predictions[5].

To implement the CNN model on mobile devices, Tensorflow Lite, a lightweight version of Tensorflow, is used. The system uses transfer learning to train the CNN model on a dataset of plant leaf images with various diseases. The proposed system is cost-effective and eliminates the need for expensive equipment and expert knowledge, making it accessible to farmers[2][5].

In this project using Flutter,CNN and Tensorflow lite we are detecting plant disease.The proposed system aims to assist farmers and agriculture experts in identifying plant diseases through the use of CNNs and mobile app development frameworks[2][3].

Its purpose is to provide a cost-effective and user-friendly solution for plant disease identification, leading to timely interventions and increased crop yields. By leveraging the advancements in technology and deep learning.

the proposed system can help address the challenges faced in plant disease identification and contribute to the development of a more sustainable agricultural industry.

This app aims to provide a cost-effective and accessible solution for plant disease identification in agriculture, leading to timely interventions and increased crop yields[9].

4.Implementation

Fig. 1: Architecture diagram

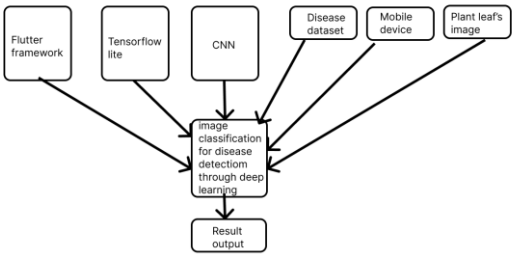
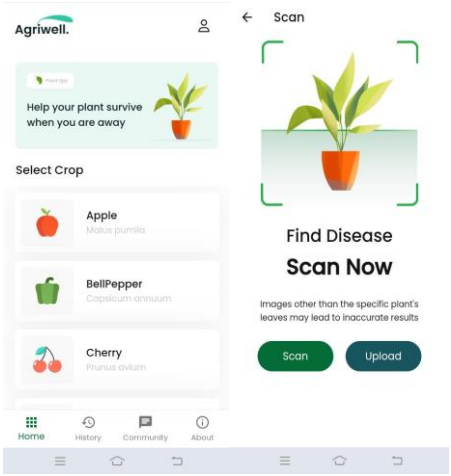
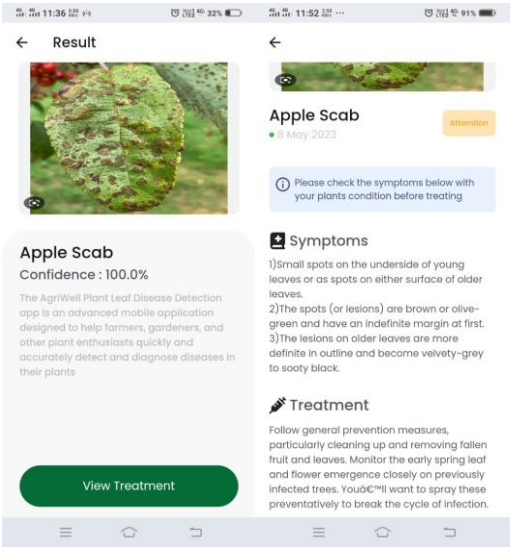


Fig. 2: working model

Screenshots:



1.Home Screen 2.Scan Screen



4.Result Screen. 5.Treatment Screen.

5.Conclusion and Future Enhancement

In conclusion, our research paper presents an implementation of a mobile app that utilizes Flutter Framework[2] and TensorFlow Lite[3] for plant leaf disease identification through deep learning[6]. This app has the potential to significantly improve agricultural practices by allowing farmers and gardeners to quickly and easily identify diseases in their crops. Our approach demonstrates the power of machine learning in agriculture and offers a promising solution for reducing the impact of plant diseases on the environment[5].The combination of Flutter's cross-platform capabilities and TensorFlow Lite's efficient convolutional neural networks establishes a robust and accessible tool that empowers users to make informed decisions and take timely interventions, ultimately fostering improved crop yield and sustainability in the agricultural domain.

The future work of this research could focus on expanding the current implementation to include multi-class classification, real-time disease detection, integration with other agricultural technologies, and improving the accuracy of the CNN model. These potential directions offer promising avenues for further research and could have significant impacts on agricultural practices and reducing the impact of plant diseases on the environment[1][7].

By exploring these future directions, the research can contribute to advancing the field of machine learning in agriculture and promoting sustainable practices. The combination of multi-class classification, real-time detection, integration with agricultural technologies, and improved accuracy of the CNN model would lead to more effective disease management, increased crop yields, and reduced environmental impact[9].

6. References

1. Hassan, S. M., Maji, A. K., Jasiński, M., Leonowicz, Z., & Jasińska, E. (2021). Identification of plant-leaf diseases using CNN and transfer-learning approach. Electronics, 10(12), 1388.
2. K. Nagaraj, B. Prabakaran and M. O. Ramkumar, "Application Development for a Project using Flutter," 2022 3rd International Conference on Smart Electronics and Communication (ICOSEC), Trichy, India, 2022, pp. 947-951, doi: 10.1109/ICOSEC54921.2022.9951938.
3. Obam, Y. S. (2019, July 16). Plant Disease Classification with tensorflow 2.0. Medium. https://yannicksergeobam.medium.com/plant-disease-classification-with-tensorflow-2-0-268fe7f72c2a
4. R. K. Moloo and K. Caleechurn, "An App for Fungal Disease Detection on Plants," 2022 International Conference for Advancement in Technology (ICONAT), Goa, India, 2022, pp. 1-5, doi: 10.1109/ICONAT53423.2022.9725839.
5. S. Shah, N. Jain, S. Shah and P. J. Bide, "A Flutter Application For Farmers," 2021 Asian Conference on Innovation in Technology (ASIANCON), PUNE, India, 2021, pp. 1-8, doi: 10.1109/ASIANCON51346.2021.9544511
6. Mohanty Sharada P., Hughes David P., Salathé Marcel, "Using Deep Learning for Image-Based Plant Disease Detection", 2016, doi: 10.3389/fpls.2016.01419.

7. Hassan, S. M., Maji, A. K., Jasiński, M., Leonowicz, Z., & Jasińska, E. (2021). Identification of plant-leaf diseases using CNN and transfer-learning approach. Electronics, 10(12), 1388.
8. Khan, P. A., Ali, M. R., Assistant Professor, & Assistant Professor. (n.d.). Methodological implementation of academic organizational operated data with clustering mechanism using an improved k- means algorithm. Ijmec.com. Retrieved May 10, 2023, from https://doi-ds.org/doilink/10.2022-22255487
9. Khan, P. A., Mir, M., Zakir, M. D., & Khan, A. (n.d.). Crop yield prediction using machine learning algorithms. Jespublication.com. Retrieved May 10, 2023, from https://jespublication.com/upload/2022-V13I5017.pdf
10. Baig, M. S., Bari, D. R. M. A., & Khan, P. A. (n.d.). Weapon detection using artificial intelligence and deep learning for security applications. Ijarst.In. Retrieved May 10, 2023, from https://www.ijarst.in/public/uploads/paper/612441667180338.pdf
11. Afreen Fathima, Samreen Jameel, Pathan Ahmed khan. (n.d.). Accident-detection-and-alerting-system IEEE PROJECTS PAPERS. Engpaper.com. Retrieved May 10, 2023, from https://www.engpaper.com/accident-detection-and-alerting-system.htm
12. Ali, R., Ishaqui, S. Y. A., Shareef, M. F., & Khan, P. A. (n.d.). Machine learning inspired code word selection for dual connectivity in 5G user-centric ultra- dense networks. Ijrar.org. Retrieved May 10, 2023, from https://www.ijrar.org/papers/IJRAR22B2442.pdf
13. Fayaz, N., Fatima, H., Fatima, S., Ahmed Khan, P., & Student, B. E. (n.d.). Diagnosis of diabetic patient and analyzing insulin dosage by using gradient boosting and logistic regression algorithm. Jetir.org. Retrieved May 10, 2023, from https://www.jetir.org/papers/JETIR2205237.pdf
14. Ishtiyaq, M., Khan, D. R. P. A., & Khare, D. R. A. (n.d.). FACIAL RECOGNITION ATTENDANCE SYSTEM. Ijarst.In. Retrieved May 10, 2023, from https://www.ijarst.in/public/uploads/paper/671721667179798.pdf
15. Hafsa Fatima, Shayesta Nazneen, Maryam Banu, Dr. Mohammed Abdul Bar," Tensorflow-Based Automatic Personality Recognition Used in Asynchronous Video Interviews", Journal of Engineering Science (JES), ISSN NO:0377-9254, Vol 13, Issue 05, MAY/2022
16. Khan, 1. Pathan Ahmed, & Waheed Farooqi, 2. M. R. M. (n.d.). Functional outsourcing of linear programming in secured cloud computing. Pen2print.org. Retrieved May 10, 2023, from https://journals.pen2print.org/index.php/ijr/article/download/4968/4783
17. Mohammed Abdul Bari, Shahanawaj Ahamad, Mohammed Rahmat Ali," Smartphone Security and Protection Practices", International Journal of Engineering and Applied Computer Science (IJEACS) ; ISBN: 9798799755577 Volume: 03, Issue: 01, December 2021 (International Journal,U K) Pages 1-6
18. Sharma, R., & Dhabliya, D. (2019). Attacks on transport layer and multi-layer attacks on manet. International Journal of Control and Automation, 12(6 Special Issue), 5-11. Retrieved from www.scopus.com
19. Sherje, N. P., Agrawal, S. A., Umbarkar, A. M., Dharme, A. M., & Dhabliya, D. (2021). Experimental evaluation of mechatronics based cushioning performance in hydraulic cylinder. Materials Today: Proceedings, doi:10.1016/j.matpr.2020.12.1021

20. Sherje, N. P., Agrawal, S. A., Umbarkar, A. M., Kharche, P. P., & Dhabliya, D. (2021). Machinability study and optimization of CNC drilling process parameters for HSLA steel with coated and uncoated drill bit. Materials Today: Proceedings, doi:10.1016/j.matpr.2020.12.1070
21. Shukla, A., Almal, S., Gupta, A., Jain, R., Mishra, R., & Dhabliya, D. (2022). DL based system for on-board image classification in real time, applied to disaster mitigation. Paper presented at the PDGC 2022 - 2022 7th International Conference on Parallel, Distributed and Grid Computing, 663-668. doi:10.1109/PDGC56933.2022.10053139 Retrieved from www.scopus.com
22. Shukla, A., Juneja, V., Singh, S., Prajapati, U., Gupta, A., & Dhabliya, D. (2022). Role of hybrid optimization in improving performance of sentiment classification system. Paper presented at the PDGC 2022 - 2022 7th International Conference on Parallel, Distributed and Grid Computing, 541-546. doi:10.1109/PDGC56933.2022.10053333 Retrieved from www.scopus.com
23. Mohammed Shoeb, Mohammed Akram Ali, Mohammed Shadeel, Dr. Mohammed Abdul Bari, "Self-Driving Car: Using Opencv2 and Machine Learning", The International journal of analytical and experimental modal analysis (IJAEMA), ISSN NO: 0886-9367, Volume XIV, Issue V, May/2022
24. Mr. Pathan Ahmed Khan, Dr. M.A Bari,: Impact Of Emergence With Robotics At Educational Institution And Emerging Challenges", International Journal of Multidisciplinary Engineering in Current Research(IJMEC), ISSN: 2456-4265, Volume 6, Issue 12, December 2021,Page 43-46
25. Shahanawaj Ahamad, Mohammed Abdul Bari, Big Data Processing Model for Smart City Design: A Systematic Review ", VOL 2021: ISSUE 08 IS SN : 0011-9342 ;Design Engineering (Toronto) Elsevier SCI Oct