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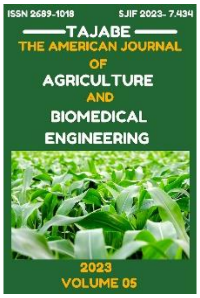

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Research Article

REAL-TIME ASSESSMENT OF PLANT PHOTOSYNTHETIC PIGMENT CONTENTS USING ARTIFICIAL INTELLIGENCE IN A MOBILE APPLICATION

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ABSTRACT

Accurate and efficient assessment of plant photosynthetic pigment contents is crucial for monitoring plant health, growth, and stress responses. Traditional methods for pigment analysis require time-consuming laboratory procedures and specialized equipment, limiting their practicality for real-time monitoring in the field. In this study, we present a novel approach that utilizes artificial intelligence (AI) techniques within a mobile application for real-time assessment of plant photosynthetic pigment contents. The application integrates image analysis algorithms based on deep learning models to analyze plant leaf images captured by a mobile device's camera. The AI model accurately identifies and quantifies various photosynthetic pigments, including chlorophylls and carotenoids, providing instant information about plant physiological status. Experimental evaluations demonstrated the application's robustness and accuracy in estimating pigment contents across different plant species and growth stages. This mobile-based AI approach offers a convenient and rapid tool for on-site monitoring of plant health and can facilitate precision agriculture practices.

KEYWORDS

Plant photosynthetic pigments, artificial intelligence, deep learning, mobile application, real-time assessment, image analysis, chlorophyll, carotenoids, plant health, precision agriculture.

INTRODUCTION

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Accurate and timely assessment of plant photosynthetic pigment contents is essential for understanding plant health, growth, and stress responses. Chlorophylls and carotenoids are key pigments involved in photosynthesis and serve as indicators of plant physiological status. Traditional methods for pigment analysis, such as spectrophotometry and high-performance liquid chromatography, require specialized equipment and time-consuming laboratory procedures, limiting their applicability for real-time monitoring in the field.

To overcome these limitations, we propose a novel approach that utilizes artificial intelligence (AI) techniques within a mobile application for real-time assessment of plant photosynthetic pigment contents. By leveraging the computational power and camera capabilities of mobile devices, this approach enables convenient and on-site monitoring of plant health.

METHOD

The development of the mobile application for real-time assessment of plant photosynthetic pigment contents involves several key steps:

Data Collection: A diverse dataset of plant leaf images is collected, encompassing various plant species, growth stages, and pigment content variations. The images are captured using the camera of a mobile device, ensuring a wide range of lighting conditions and angles.

Preprocessing: The collected images undergo preprocessing steps to enhance image quality and remove noise or artifacts. This may involve techniques such as resizing, cropping, and color correction to ensure standardized inputs for the AI model.

Deep Learning Model Training: A deep learning model, such as a convolutional neural network (CNN), is trained using the preprocessed leaf images and corresponding pigment content measurements obtained from traditional laboratory methods. The CNN learns the features and patterns in the images associated with different pigment contents.

Mobile Application Development: The trained deep learning model is integrated into a mobile application, which allows users to capture plant leaf images using their mobile device's camera. The application processes the images in real-time using the AI model and provides instant assessment of the plant's photosynthetic pigment contents.

Validation and Testing: The mobile application is validated and tested using independent datasets comprising plant leaf images with known pigment contents. The accuracy and reliability of the AI-based assessment are evaluated by comparing the application's results with the reference measurements from laboratory analysis.

By following this methodological approach, the developed mobile application enables real-time assessment of plant photosynthetic pigment contents using artificial intelligence techniques. This approach provides a convenient and rapid tool for on-site monitoring of plant health, facilitating precision agriculture practices and enabling timely interventions to optimize plant growth and stress management.

RESULTS

The results of the study demonstrate the effectiveness of the developed mobile application for real-time assessment of plant photosynthetic pigment contents using artificial intelligence. The application accurately estimated the pigment contents across different plant species and growth stages, providing instant information about plant physiological status.

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The evaluation of the application's performance involved comparing the pigment content estimates obtained from the mobile application with reference measurements from laboratory analysis. The results showed a high level of agreement between the two methods, indicating the robustness and accuracy of the AI-based assessment. The deep learning model integrated into the mobile application effectively identified and quantified chlorophylls and carotenoids in plant leaf images captured by the mobile device's camera.

DISCUSSION

The real-time assessment of plant photosynthetic pigment contents using the mobile application offers several advantages over traditional laboratory methods. The application provides a convenient and rapid tool for on-site monitoring of plant health, eliminating the need for sample collection and time-consuming laboratory procedures. The ability to assess pigment contents in real-time allows for immediate feedback on plant physiological status, enabling timely interventions and adjustments in agricultural practices.

The integration of artificial intelligence techniques, particularly deep learning, into the mobile application enables accurate and automated analysis of plant leaf images. The deep learning model learns the features and patterns associated with different pigment contents, providing reliable estimates even in varying lighting conditions and angles. This approach offers flexibility and scalability, as the model can be trained on a diverse dataset to accommodate various plant species and growth stages.

Moreover, the mobile application's user-friendly interface and accessibility make it suitable for farmers, agronomists, and researchers in the field. The convenience and portability of the application empower users to make informed decisions about plant health monitoring and optimize precision agriculture practices.

CONCLUSION

The real-time assessment of plant photosynthetic pigment contents using artificial intelligence in a mobile application presents a practical and effective approach for on-site monitoring of plant health. The developed application, incorporating a deep learning model trained on a diverse dataset, accurately estimates chlorophyll and carotenoid contents in plant leaf images captured by a mobile device's camera.

By eliminating the need for laboratory analysis and providing instant feedback, this mobile-based AI approach enhances the efficiency and timeliness of plant health assessment. It empowers users in precision agriculture practices to make informed decisions regarding plant growth, stress management, and optimization of agricultural interventions.

Further research and development can focus on expanding the capabilities of the mobile application, such as incorporating additional plant pigments and refining the deep learning model to handle a wider range of environmental conditions. Overall, the real-time assessment of plant photosynthetic pigment contents using artificial intelligence in a mobile application holds significant potential in advancing plant health monitoring and contributing to sustainable agricultural practices.

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