Plagiarism Scan Report

0% Plagiarism	0% Exact Match	100% Unique	Words 765
	0% Partial Match		Characters 6014
			Sentences 33
			Paragraphs 1
			Read Time 4 minute(s)
			Speak Time 6 minute(s)

Content Checked For Plagiarism

Sandeep Muhal: Potato Leaf Disease Classification Using an Efficient Convolutional Neural Network Potato Leaf Disease Classification Using an Efficient Convolutional Neural Network SANDEEP MUHAL 1 Bikaner Technical University, Bikaner, Rajasthan, India Corresponding author: Sandeep Muhal (sandeepmuhal9982@gmail.com) This work was supported by the Dr. Jai Bhaskar ABSTRACT arly identification of potato leaf diseases plays a vital role in minimizing crop losses and enhancing agricultural productivity. Conventional disease diagnosis practices largely depend on manual inspection by experts, which is labor-intensive, subjective, and difficult to scale in large farming environments. Although recent advances in deep learning have enabled automated plant disease detection with high accuracy, many existing solutions rely on deep and computationally heavy architectures, resulting in slow training convergence and limited feasibility for deployment in resource-constrained agricultural settings. This study presents a lightweight convolutional neural network specifically designed for efficient potato leaf disease classification with an emphasis on rapid training convergence. The proposed model is constructed using stacked convolutional layers integrated with batch normalization and ReLU activation to ensure stable feature learning. To reduce parameter complexity, global average pooling is employed in place of traditional fully connected layers. In addition, adaptive training strategies, including the Adam optimizer, dynamic learning rate adjustment, and early stopping, are utilized to improve optimization stability and accelerate convergence. The effectiveness of the proposed approach is validated on a three-class potato leaf image dataset comprising Early Blight, Late Blight, and healthy leaf samples. Experimental evaluation demonstrates that the model achieves a classification accuracy of 98% within only 10 training epochs, while consistently maintaining strong precision, recall, and F1- score across all categories. Performance comparison with existing deep and transfer learning–based models highlights that the proposed architecture attains comparable or superior results with substantially reduced training time and model complexity. The obtained results confirm that compact CNN architectures optimized for fast convergence offer a reliable and practical solution for real-time plant disease diagnosis, particularly in low-resource and smart agriculture applications. INDEX TERMS Potato leaf disease classification, convolutional neural networks, lightweight CNN, fast convergence, plant disease detection, precision agriculture. I. INTRODUCTION Agriculture remains a fundamental pillar of global food security, with potato (Solanum tuberosum) ranked among the most extensively cultivated and consumed crops worldwide. Despite its economic and nutritional importance, potato production is highly vulnerable to several plant diseases, of which Early Blight and Late Blight are considered the most severe. These diseases can propagate rapidly across crop fields, leading to substantial yield reduction and economic losses when timely preventive measures are not adopted. As a result, early and accurate identification of potato leaf diseases is a critical requirement for sustainable agricultural productivity and effective crop management. Conventional potato disease diagnosis primarily depends on visual examination conducted by experienced agricultural specialists. While this approach can provide reliable results in certain cases, it is inherently labor- intensive, subjective, and difficult to scale for large E Sandeep Muhal: Potato Leaf Disease Classification Using an Efficient Convolutional Neural Network agricultural fields. Furthermore, in rural and resource- constrained regions, the availability of trained agronomists is often limited, which may lead to delayed diagnosis and improper treatment decisions. Such limitations significantly reduce the effectiveness of traditional disease management strategies and highlight the need for automated and intelligent diagnostic solutions. In recent years, advancements in computer vision and artificial intelligence have enabled the development of data-driven approaches for agricultural disease detection. In particular, deep learning techniques—most notably Convolutional Neural Networks (CNNs)—have demonstrated remarkable performance in image-based classification tasks. CNNs are capable of learning hierarchical feature representations directly from raw images, thereby eliminating the dependency on handcrafted feature extraction methods. This capability has led to significant improvements in plant disease classification accuracy under controlled experimental environments. Multiple studies have reported that deep CNN architectures can achieve high recognition performance on benchmark plant disease datasets. However, these approaches often rely on deep and computationally intensive models such as VGG, ResNet, and other transfer learning–based frameworks. Although such architectures deliver impressive accuracy, they typically require large- scale annotated datasets, prolonged training durations, and substantial computational resources. These constraints severely limit their applicability in real-world agricultural scenarios, particularly for deployment on low-power devices such as mobile phones, edge systems, and embedded platforms commonly used in smart farming applications. To mitigate these challenges, recent research efforts have shifted toward lightweight CNN architectures, including MobileNet and EfficientNet, which aim to reduce inference-time complexity through techniques such as depthwise separable convolutions and compound scaling. While these models successfully lower parameter count and computational overhead during inference, the majority of existing studies primarily emphasize model size reduction and runtime efficiency. Comparatively less focus has been placed on training efficiency,

Matched Source

Congratulations !

No Plagiarism Found