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| **Author(s) Name:** | Mr. Md Tanvir Rahman, Mr. Durjoy Roy Dipto, Mr. Sowrov Komar Shib, Mr. Abu Shufian, and Mr. Md Sajid Hossain | | |
| **Contact Email(s):** | shufian.eee@aiub.edu | | |
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| **Abstract:** |  |
| Plant diseases pose significant threats to crop quality and yield, making early detection critical for ensuring agricultural productivity and public health. Traditional manual inspection methods are inefficient for large-scale farming and prone to human error. This study introduces a Convolutional Neural Network (CNN) model for automated plant disease diagnosis using leaf images. The model incorporates advanced architectures, including EfficientNet, ResNet, and Inception, and leverages transfer learning to enhance performance on limited datasets, reducing the need for extensive labeled data. By integrating deep learning with machine vision, the system enables real-time monitoring, offering actionable insights for timely intervention. The model, tested on a system equipped with a 12th Gen Intel(R) Core (TM) i5-12450HX CPU, 24 GB of RAM, and a 64-bit operating system, achieves a computation time of just 40 seconds. It delivers an overall accuracy of 97%, with precision rates of 95.39% for Healthy, 98.89% for Rust-Affected, and 97.06% for Scab-Affected leaves, and recall rates between 96.49% and 98.33%. These results demonstrate the potential of deep learning to improve plant disease detection, minimize chemical use, and support sustainable agriculture, with reproducibility ensured through hardware documentation. | |