

Title: A Lightweight CNN-SVM Explainable AI Approach for Classification and Visualization of Grape Leaf Disease(Conference Paper)

Author:

- Peyal, H.I.,
- Leion, Z.M.,
- Abdal, M.N.,
- Islam, M.I.,
- Miraz, S.,
- Remon, M.R.,
- Kontho, M.M.R.,
- Tasnim, N.

- View Correspondence (jump link)
- ^aRajshahi University of Engineering & Technology, Dept. of Electrical & Computer Engineering, Rajshahi, Bangladesh
- ^bUniversity of Liberal Arts Bangladesh, Dept. of Computer Science and Engineering, Dhaka, Bangladesh
- ^cUttara University, Dept. of Computer Science & Engineering, Dhaka, Bangladesh

[View additional affiliations](#)

Abstract

Grape is highly esteemed as a significant agricultural crop in Bangladesh. Plant diseases primarily result from the presence of pathogens and pest insects, leading to a significant decline in productivity if not properly addressed. The fundamental aim of this research is to employ a streamlined CNN-SVM architecture, utilizing deep learning techniques, to accurately categorize grape leaves into three distinct disease classes and one healthy class. The proposed model surpasses the accuracy of the previously trained transfer learning models VGG-16 and VGG-19 while having approximately 257× to 267× times fewer parameters (0.537 M). On average, the proposed model achieves a classification accuracy of 99.18%, which is significantly higher than the 93.42% and 91.94% achieved by the transfer learning models, respectively. With a precision, recall, and F1 score close to 99%, the suggested model provides excellent results. The model's outstanding performance is further validated by its remarkable Area Under Curve (AUC) score of 99.98%. In addition to using less disc space (about 6 MB), the suggested model because of being lightweight shows a significant decrease in parameters. To visually display the disease identified by the proposed model, a transparent AI methodology has been utilized, specifically the Gradient Weighted Class Activation Mapping (Grad-CAM) technique. To better understand which area was responsible for the classification, a heatmap has been created. © 2024 IEEE.

Author keywords

Area Under Curve (AUC) score Explainable AI Gradient Weighted Class Activation Mapping (Grad-CAM) heatmap lightweight CNN-SVM architecture region VGG-16 VGG-19

- **ISBN:** 979-835038828-2
- **Source Type:** Conference Proceeding
- **Original language:** English
- **DOI:** 10.1109/ICAEEE62219.2024.10561852
- **Document Type:** Conference Paper
- **Publisher:** Institute of Electrical and Electronics Engineers Inc.