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| Title | **MangoLeafXNet: An Explainable Deep Learning Model for Accurate Mango Leaf Disease Classification** | | |
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| Abstract |  |
| Addressing the global challenge of ensuring a consistent and abundant supply of fresh fruit, particularly in the context of fruit crops, is hindered by the prevalence of plant diseases. These diseases directly impact the quality of fruits, leading to a decline in overall agricultural production. Mango leaf diseases pose significant threats to global mango production, necessitating accurate and efficient classification techniques for timely disease management. Our study focuses on introducing MangoLeafXNet, a customized Convolutional Neural Network (CNN) architecture specifically tailored for the classification of mango leaf diseases, along with a healthy class. Our proposed model comprises six layers optimized to capture intricate disease patterns, demonstrating superior performance compared with prevalent pre-trained models. The model is trained and evaluated on three publicly available datasets: MangoLeafBD (4000 images across 8 classes), MangoPest (16 pest classes including healthy leaves), and MLDID (3000 high-resolution images across 5 classes). Our model demonstrated exceptional classification performance, attaining 99.8% accuracy, 99.62% recall, 99.5% precision, and an F1-score of 99.56%. Further validation on the MangoPest dataset and the Mango Leaf Disease Identification Dataset (MLDID) resulted in accuracies of 96.31% and 96.33%, respectively, confirming the robustness and adaptability of MangoLeafXNet across different datasets. Additionally, we incorporate Explainable AI techniques, including GRAD-CAM, Saliency Map, and LIME to enhance the interpretability of our model. We deployed Gradio web interface to create an interactive interface that allows users to upload images of mango leaves and get real-time classification and validation results along with confidence scores. This contribution not only advances the state-of-the-art in mango leaf disease classification but also offers promising prospects for real-time disease diagnosis and precision agriculture... | |