

An Experimental work for Papaya Plant Leaf Disease Detection using Soft Computing

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Abstract-An essential component of India's strongly growing economy is agriculture. It contributes greatly to GDP and covers a large portion. Amongst the numerous crops, papaya farming is one of the extreme important practices since it donates to food safety and is a cash crop for most farmers. Still, numerous diseases can negatively impact papaya's quality of production and output. There have been many developments finished to discourse these problems through machine learning methods. Papaya plant diseases have a large effect on agricultural production and crop value; thus, initial and right disease investigation is crucial for supportable farming. Conventional manual disease identification methods are highly difficult, inefficient, and frequently dependent on particular knowledge. To enhance the exactness and clarity of disease diagnosis, this paper suggests an approach for detecting papaya plant leaf disease using XAI (Explainable Artificially Intelligence) and deep learning. Make collecting, preprocessing, data augmentation, feature extraction using CNNs (Convolutional Neural Networks), and disease cataloging using advanced deep learning models like VGG16, DenseNet121, EfficientNetB6 MobileNetV2, and are all part of the suggested methodology. Explainable AI methods, such as SHAP, and Grad-CAM, are combined to highlight affected areas that affect model predictions and offer visual explanations. According to experimental data, EfficientNetB6 exceeds other models in terms of correctness, accuracy, recall, F1-score, and AUC values. The suggested solution saves manual labor, promotes early disease detection, improves interpretability, and helps farmers make timely agricultural decisions. The creation of transparent, dependable, and intelligent smart agriculture systems for better crop health management is aided by this research.

Introduction -Papaya is a nutrient-rich crop that contains a number of vitamins and nutrients, such as fiber, antioxidants, and vitamin C, which help lower cholesterol, preserve cardiovascular health, prevent arthritis and cancer, increase platelets, enhance digestion, and helps in weight control. Many nations' economies and food security depend heavily on agriculture, and papaya is one of the greatest significant tropical fruit crops because of its great nutritive and commercial worth. Papaya Ring Spot, Powdery Mildew, Mosaic Disease, and Leaf Curl Disease are just a few of the leaf diseases that can severely lower crop quality and productivity. To reduce agricultural losses and increase crop output, initial and accurate recognition of these illnesses is crucial. Conventional disease detection techniques mostly rely on agricultural professionals' human examination, which remains expensive, slow, labour-intensive, and frequently wrong in extensive farming settings.

Current developments in ML (machine learning), DL (deep learning), and artificial intelligence (AI) have made it probable to diagnose plant diseases robotically using image examination methods. CNNs (Convolutional Neural Networks) have established extraordinary capability in