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# Plant Disease Detection: A Machine Learning Approach for Smart Agriculture

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**Abstract:** *This paper delves into the development and application of an advanced plant disease detection system, powered by artificial intelligence (AI) and data-driven methodologies, designed to enhance the precision, efficiency, and sustainability of agricultural practices. By integrating state-of-the-art machine learning algorithms, predictive analytics, and real-time monitoring technologies, the system addresses critical gaps in traditional crop disease management practices.*

*The proposed system leverages big data from diverse sources, including leaf imagery, environmental sensors, and agronomic records, to create a holistic view of crop health. Advanced data preprocessing techniques and feature engineering ensure the reliability and accuracy of predictions. The system not only aids in early disease detection and risk assessment but also offers actionable recommendations for crop treatment, fostering improved yield and resource optimization.*

*This research emphasizes the multidisciplinary approach required to build such a system, combining AI, agricultural expertise, and robust data collection methods. Case studies demonstrating the system's effectiveness in identifying various plant diseases and enabling timely interventions are discussed.*

*Furthermore, this paper explores challenges such as data variability, model generalization, and integration into existing agricultural systems, while outlining potential solutions. The findings underscore the transformative potential of AI-driven plant disease detection systems in modern agriculture, paving the way for future innovations and a more resilient, smart farming ecosystem..*

**Keywords:** Artificial Intelligence (AI), Smart Agriculture, Data Analytics, Data Science, Machine Learning (ML), KNN Algorithm, Plant Disease Detection



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