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## Hybrid Machine Learning Framework for Agriculture Optimization System

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**Abstract**: Agriculture is the backbone of livelihood for a substantial portion of India's population and remains a critical component of the primary sector. The proposed Optimization System, powered by machine learning, seeks to improve the efficiency of harvesting processes for farmers. Developing an advanced vision system capable of real-time fruit classification and analysis is crucial for enhancing the cost-effectiveness and productivity of harvesting robots.

Farmers in several parts of India struggle with challenges such as unfavorable climatic conditions and poor soil health. Furthermore, the lack of accessible resources to help them select appropriate crops using modern technological tools worsens the situation. The problem is compounded by limited literacy, which prevents many farmers from utilizing advancements in agricultural science, leading to continued dependence on conventional methods. This reliance often results in suboptimal yields, as seen in cases of crop failure caused by improper fertilization or irregular rainfall.

The growing availability of agricultural data holds immense potential for advancing crop management but also presents challenges in its effective utilization. This study introduces the Agriculture Optimization System—a machine learning-based framework designed to revolutionize agricultural decision-making. By accurately identifying crops and predicting yields, the system utilizes diverse datasets, including satellite imagery, soil health indicators, and climatic parameters. Advanced algorithms, such as Random Forest and Support Vector Machines (SVM), are applied to achieve precise predictions and reliable performance.

Keywords: Machine Learning, Processing, Training, Testing, Predictive Model, Text Processing

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