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Efficient Approach for Crop Recommendation Using Soil Data and Support Vector Machine Model

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Abstract: *This research introduces a robust crop recommendation framework that integrates soil attributes with machine learning techniques, specifically Support Vector Machines (SVM). The methodology employs a well-curated dataset encompassing critical agronomic parameters, including nitrogen, phosphorus, potassium, soil pH, rainfall, temperature, humidity, and categorical crop descriptors. These variables are systematically preprocessed and organized into predictor and response sets to facilitate accurate classification. To address the complexity of nonlinear and multiclass relationships, the system adopts an SVM model within an Error-Correcting Output Codes (ECOC) scheme. A polynomial kernel with standardized inputs is utilized to enhance generalization capability, while a 5-fold cross-validation strategy ensures model reliability and robustness. The resulting prediction function enables precise crop recommendations for unseen data, thereby supporting precision agriculture and intelligent crop planning. Experimental evaluation highlights the superiority of the proposed approach, with the Cubic SVM achieving 99.9% accuracy, outperforming both Linear and Quadratic SVM configurations. Overall, the system demonstrates significant potential in advancing data-driven agricultural decision-making, offering a dependable tool for farmers, researchers, and policymakers to optimize crop selection under diverse soil and environmental conditions.*

Keywords: Crop Recommendation, Machine Learning, Support Vector Machine, Soil Data, Precision Agriculture, Error-Correcting Output Codes (ECOC)

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