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Performance Evaluation of Machine Learning Algorithms for Crop Yield Prediction

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Abstract: *The accurate prediction of crop yield is crucial for effective agricultural planning and food security. This study evaluates the performance of various machine learning algorithms in predicting crop yields, focusing on both traditional statistical methods and advanced machine learning techniques. The research compares models such as Linear Regression, Decision Trees, Random Forests, Support Vector Machines (SVM), and Neural Networks, assessing their accuracy, computational efficiency, and robustness across diverse datasets representing different climatic and geographic conditions. The data used in this study encompasses a wide range of environmental factors, including soil properties, weather conditions, and historical yield data. Feature selection and engineering techniques are applied to enhance model performance, while cross-validation methods ensure the reliability of the results. The evaluation criteria include metrics such as Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and R-squared, providing a comprehensive view of each model's predictive capabilities. Our findings reveal that ensemble methods, particularly Random Forests and Gradient Boosting Machines, outperform other algorithms in terms of accuracy and generalizability. Neural Networks also demonstrate strong predictive power, particularly when large datasets are available, although they require more computational resources and fine-tuning. In contrast, simpler models like Linear Regression and SVMs, while less accurate, offer faster training times and are easier to interpret, making them suitable for scenarios with limited computational resources or when model interpretability is critical..*

Keywords: Crop Yield Prediction, Machine Learning Algorithms, Agricultural Data Analysis, Model Performance Metrics, Precision Agriculture etc