

Development of Jejakpadi System with Bagging Regressor Integration for Rice Yield Prediction to Support National Food Security

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ABSTRACT

Population growth and climate anomalies necessitate the adoption of precision agriculture to ensure food security. The JejakPadi platform supports supply chain traceability but lacks crop yield prediction features, resulting in manual and error-prone estimates. This study compares six artificial intelligence algorithms three, including tree-ensemble-based machine learning models (Random Forest, Gradient Boosting, Bagging Regressor) and three deep learning architectures (LSTM, GRU, SimpleRNN) to predict yields of 10 major commodities. The dataset consists of 28,242 rows of global historical data from FAO and the World Bank. The results show that tree-based ensemble models consistently outperform deep learning, with Bagging Regressor achieving R^2 above 0.90 (rice 0.9209; corn 0.9360) and Random Forest recording the lowest MAE of 0.063. Feature importance analysis indicates that historical yield (`rolling_yield_mean3`) dominates (>95%), while environmental factors have minimal influence. The best-performing model was integrated into the JejakPadi platform as a cloud-based Decision Support System to provide predictive recommendations and mitigate crop failure risks.

Keywords: *Machine Learning, Deep Learning, Crop Yield Prediction, JejakPadi, Feature Importance, Bagging Regressor.*