

Onion Pulse AI: Solving Onion Market Instability by Forecasting Onion Price Using ML Approach

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Abstract: *Onion price volatility is a major economic challenge in India, affecting farmers, traders, policymakers, and consumers. Prices fluctuate due to seasonal production, weather variability, supply-demand imbalance, and supply chain disruptions. In key agricultural markets such as Lasalgaon, one of Asia's largest onion trading hubs, even small changes in arrival volume can significantly influence national price trends. These unpredictable fluctuations create financial uncertainty and complicate agricultural planning, buffer stock management, and inflation control.*

This paper presents Onion Pulse AI, a Machine Learning-based framework developed to forecast onion price categories to reduce market instability. Historical price and arrival data are collected from AGMARKNET, while meteorological data are obtained from the India Meteorological Department. After preprocessing and feature engineering, five supervised Machine Learning algorithms- LSTM Neural Network, Random Forest, XGBoost, ARIMA and Facebook Prophet are implemented and evaluated. Instead of predicting exact numerical prices, the system classifies future prices into three categories: preferable (low), economical (mid), and expensive (high). The comparative evaluation is performed using accuracy and other classification metrics to determine the most reliable model. The proposed system provides decision support for farmers, policymakers, and supply chain managers, demonstrating the practical application of Artificial Intelligence in stabilizing agricultural markets..

Keywords: Onion Price Forecasting, Machine Learning, Agricultural Market Analysis, Price Classification, Market Instability, Artificial Intelligence, Decision Support System

