A MULTIVARIATE APPROACH TO PREDICTING WHOLESALE FRESH PRODUCE WASTE

Simeon Monov, Hristo Karaperev

Abstract. *The food supply chain of fresh produce is vulnerable to food loss and waste due to product perishability, the environment and market conditions beyond the control of wholesale distributors [1]. Traditionally, inventory models rely heavily on forecasting demand using historical data, typically assuming that the quality of fresh produce sold by suppliers is uniform and the expiration dates are fixed. Recent literature on the matter suggests that it is not enough to use historical sales data to create models for managing perishable goods [2]. In real environments, food loss and waste is driven also by biological decay, differences in handling of fresh produce by suppliers, among other factors, rather than mere overstocking. This research paper investigates the shortcomings of exclusively demand-driven predictions and proposes an enhanced, multivariate predictive model for food loss and waste.*

Using a comprehensive five-year dataset, including supply, sales, and waste records from a wholesale fresh produce operation, this study compares a baseline demand-forecasting model against an augmented predictive framework. The proposed model integrates climate and seasonal data, local holiday patterns, supplier reliability metrics, and a survival probability function to model expiry of fresh produce without fixed dates.

With the help of machine learning techniques, this paper quantifies the accuracy gain in predicting food loss and waste by moving away from a static inventory approach to a more dynamic degradation model. The experimental results indicate that integrating weather, holiday, supplier reliability, and probability of survival data reduces food loss and waste prediction errors, offering a modern data-driven approach to reducing food loss and waste in wholesale supply chains.

Key words: Food Loss and Waste, Perishable Inventory Management, Predictive Modeling, Supplier Reliability, Survival Probability Function, Machine Learning

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