Optimizing Inventory by Minimizing Holding Costs and Stockout of Raw Materials of Denim Jacket Production Using LSTM Model: A Case Study

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Abstract

This case study explores the application of an AI-based Long Short-Term Memory (LSTM) model to optimize inventory management in denim jacket production. In the ready-made garments industry, particularly in denim manufacturing, production lines often face challenges such as raw material shortages and excessive inventory holding costs. Traditional forecasting methods, including Exponential Smoothing, often fall short in managing volatile and uncertain demand, resulting in either stockouts that disrupt production or overstocking that escalates costs. To address these limitations, this study proposes a data-driven forecasting approach using LSTM neural networks. The model leverages historical production data to forecast short-term raw material demand and align inventory levels with actual production needs. By integrating LSTM-based forecasting with Economic Order Quantity (EOQ) strategies, the proposed method ensures efficient inventory planning and minimizes disruptions in the supply chain. The case study was implemented with real production data from a denim jacket line collected and analyzed. Comparative analysis demonstrated that the LSTM model produced more accurate forecasts than traditional methods, enabling better decision-making in material procurement and reducing the risks of both shortages and surplus inventory. Moreover, the model's ability to learn from patterns in time-series data provided a dynamic and responsive solution tailored to the operational context of apparel manufacturing. The results emphasize the potential of AI-driven forecasting in enhancing supply chain resilience, reducing operational inefficiencies, and supporting timely production. This research highlights the practical value of LSTM in modern inventory optimization and offers a foundation for future AI integration in garment industry operations.

Keywords

LSTM, Stockout, Holding Cost, Artificial Intelligence, Inventory Optimization.