Order Demand Forecasting Through Customer Behavior and Seasonal Pattern With Risk Adjusted

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*Abstract*— The Bullwhip Effect is a supply chain phenomenon wherein even slight changes in consumer demand at the store level will have an impact on all other supply chain participants. This frequently results in production and inventory imbalances as well as other issues that can harm the supply chain's effectiveness and profitability. In the supply chain, there are other factors that can affect the bullwhip effect, including Lack of communication may cause misunderstandings and incorrect readings of demand signals, which may result in overproduction, underproduction, or other inefficiencies. If the retailer's estimates were incorrect, it would have a significant negative impact on having too much inventory, raising the expense of maintaining it and lowering its profit of the firm. In order to solve the aforementioned issues and boost the company's profitability, an efficient forecasting technique must be used. This study suggests a deep learning model that, using data from the previous seven years—2011 to 2017—predicts product demand by examining a variety of variables. To anticipate the product demand sparked at the retailer level by the end customer, it specifically uses RNN-LSTM Model.

Keywords—Recurrent Neural Network (RNN), Long Short-Term Memory (LSTM), Deep Learning, Demand Forecasting, Neural Network.

# INTRODUCTION

The technique of predicting future demand for a good or service is known as demand forecasting. For businesses to have the correct amount of inventory, manpower, and resources to meet consumer demand and optimize profitability, accurate demand forecasting is essential. This kind of information can assist merchants in determining the quantity of inventory needed to satisfy customers. If the quantity of inventory needed is known in advance, we can also optimize the manpower needed for maintenance, thus lowering the cost of maintenance.

The model is designed to forecast the ideal amount of stock needed for a specific product in a specific warehouse on a specific day. With historical data, which includes a retail store's past sales history, this will function. The information includes the product code, the warehouse where the item must be dispatched from, the category to which the item belongs, the date the demand was first noticed, and lastly the quantity of demand for the item.

# RELATED WORKS

Hyojeoung Kim [2023] compared the CatBoost machine learning and CNN deep learning model and presented it as a single model CNN-CatBoost hybrid model prediction method that gives better performance. They also noticed that the accuracy changed when adding wind speed and precipitation to the hybrid model. Hyojeoung Kim [2023] proposed a solution for predicting solar radiation which will resolve the issues in solar energy due to climate change.

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*a**b* 

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