Demand Forecasting for Unmanned Retail Marts Using Machine Learning

A. S. Muthanantha Murugavel[1], J. Ramprasath[2], N. Logith[3], K. Niranjan[4], L. Surya[5]

[1]Associate Professor, Department of IT, Dr. Mahalingam College of Engineering and Technology, Pollachi, Tamilnadu, India. murugavel.asm@gmail.com

[2]Assistant Professor, Department of Information Technology, Dr. Mahalingam College of Engineering and Technology, Pollachi, Tamilnadu, India, ramprasathj135@gmail.com

[3]Student, Department of Information Technology, Dr. Mahalingam College of Engineering and Technology, Pollachi, Tamilnadu, India, logith0507@gmail.com

[4]Student, Department of Information Technology, Dr. Mahalingam College of Engineering and Technology, Pollachi, Tamilnadu, India, niranjankannan249001@gmail.com

[5]Student, Department of Information Technology, Dr. Mahalingam College of Engineering and Technology, Pollachi, Tamilnadu, India, suryaloganathan02@gmail.com

Abstract. Due to their convenience and effectiveness, unmanned retail stores have grown in popularity in recent years. However, the success of these markets depends on accurate sales and demand forecasting. In this paper, a machine learning-based method for forecasting demand and sales at unmanned retail stores is proposed. More specifically, we forecast demand and sales for various products in the unmanned retail market using a combination of time series analysis and machine learning algorithms. The success of these markets, which run without any staff and depend on technology to make the shopping experience easier, is highlighted by this project, which emphasizes the significance of precise sales and demand forecasting. The system will use historical sales data and real-time data to predict future sales and demand for different products which can be used in optimization of inventory management. This results in minimizing the stockout or overstocking risks and beforehand prediction of the trends. The proposed method, which uses machine learning algorithms to forecast sales and demand for various products in the unmanned retail market, is briefly described. It is also mentioned that the evaluation of the strategy using actual sales data demonstrated high accuracy in predicting sales and demand.

Keywords: Sales Prediction, Demand Forecasting, Retail Marts, Machine Learning, Random Forest**.**

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1 Introduction

Unmanned retail marts, also known as cashier less stores, have gained increasing popularity in recent years. However, the success of unmanned retail marts heavily relies on accurate prediction of sales and demand forecasting. Accurate sales and demand forecasting are crucial to ensure that the right amount of inventory is stocked, and the mart can operate efficiently. In this paper, we propose a machine learning-based approach to predict sales and demand forecasting of unmanned retail Marts. Traditional methods of sales prediction and demand forecasting in retail marts are based on statistical models, such as time-series analysis and regression analysis. However, these methods have limitations in terms of accuracy and performance. Machine learning algorithms have shown great potential in improving the accuracy of sales prediction and demand forecasting

The proposed approach is based on machine learning algorithms. It enables computer systems to identify patterns, and make predictions or decisions through learning from data without programming explicitly. Decision trees have several advantages over other machine learning algorithms, such as their ability to handle both categorical and numerical data, their interpretability, and their ability to handle missing values. There are many variations and extensions of decision trees, such as random forests, gradient boosting, and decision tree ensembles, which can improve their performance and reduce their weaknesses. Random Forest was used in this project because it is a powerful and versatile machine learning algorithm that has been proven to perform well in a variety of applications, including sales prediction and demand forecasting. One of the main advantages of Random Forest is that it is an ensemble algorithm that combines multiple decision trees to make a prediction. This means that it can handle complex and non-linear relationships between the input variables and the target variable, which is important in retail sales forecasting where there may be many factors that influence sales and demand.

2 Literature Survey

In this study [1], combined convolutional neural networks (cnns) and long short-term memory (lstm) networks to predict demand for different product categories.
In this study [2], using support vector regression (svr) algorithm to predict demand for different product categories.
In this study [3], combining cnn and bidirectional lstm (blstm) network to predict sales.
In this study [4], prediction of sales for different product categories by
combination of convolutional neural network (cnn) and recurrent neural network (rnn).
In this study [5], prediction of sales for different product categories by
combination of convolutional neural network (cnn) and artificial neural network (ann).

3 Existing Model

3.1 Demand Forecasting using ARIMA models

There are some software solutions available in the market that offer sales forecasting and inventory management capabilities. For example, some popular options include QuickBooks, Fishbowl, and TradeGecko. These software solutions use traditional forecasting methods, such as exponential smoothing and ARIMA, to predict sales and demand for different products. However, these software solutions are not specifically designed for unmanned retail stores and marts. They may not be able to account for the unique challenges and constraints of unmanned retail operations, such as limited space, lack of staffing, and limited access to real-time data. Therefore, there is a need for a machine learning-based approach that can accurately predict sales and demand for unmanned retail marts, considering the unique challenges and constraints of these operations. The proposed approach in this paper aims to fill this gap by developing a machine learning-based approach for predicting sales and demand forecasting.

4 Proposed Model

4.1 Demand Forecasting for Unmanned Retail Store Using Machine Learning

The proposed system for this project is a machine learning-based approach for predicting sales and demand forecasting in unmanned retail marts. Our approach consists of two main steps. First, we conduct time series analysis to identify the trend and seasonality of sales data. This helps us understand the historical sales patterns and predict future sales based on past trends. Second, we use several machine learning algorithms such as Linear Regression, Random Forest, XGBoost, ADABoost and Support-Vector Regression to predict sales and demand forecasting. These algorithms are trained using historical sales data, product features such as price, brand, and location. The system will use historical sales data and real-time data to predict future sales and demand for different products. The system will use machine learning algorithms, such as support vector regression (SVR) and Ensemble-based Techniques, to predict sales and demand for different products. The models will be trained on historical sales data and will consider real-time data to make predictions. The system will use the trained machine learning models to forecast sales and demand for different products. The forecasts will be updated in real-time to reflect changes in market conditions and other factors. Traditional forecasting methods often rely on historical data and assumptions, which can lead to inaccuracies in predictions. The proposed system, on the other hand, uses machine learning algorithms to learn patterns and relationships in the data, resulting in more accurate predictions.

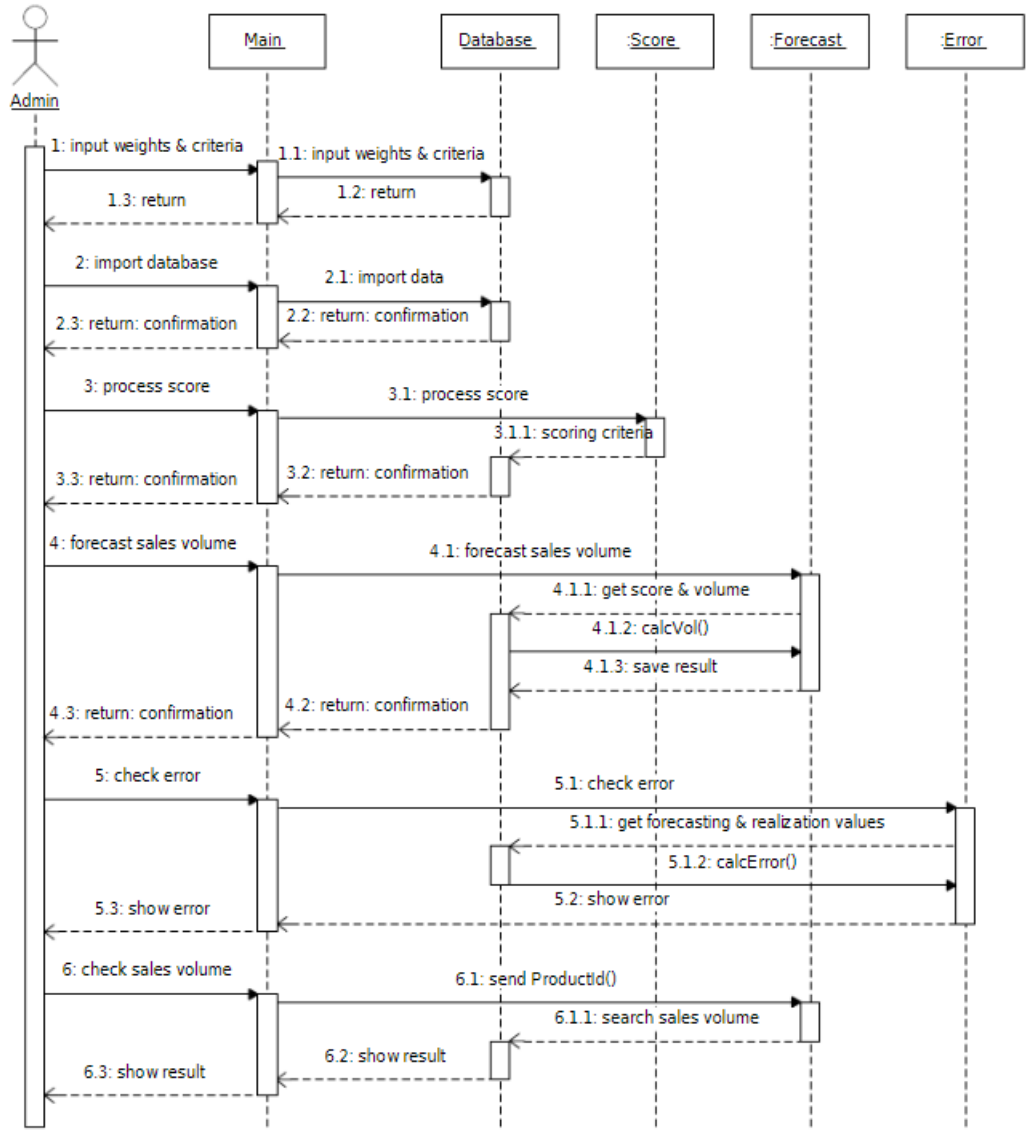

Fig. 1. Sequence Diagram of proposed system

Result and Discussion

Our experiments showed that the XGBoost algorithm achieved the highest accuracy in predicting sales and demand forecasting, with the lowest RMSE of 1,224.8307. The Linear Regression and Random Forest algorithms also performed well, with RMSEs of 1237.4525 and 1291.6435 respectively (see Fig. 2) .

S.no	Algorithm/Model Name	MSE	RMSE
1	Linear Regression	1513460.3263221555	1230.2277538416029
2	Adaboost Regression	1862598.7141156243	1364.7705719701112
3	XGBoost Regression	1493084.505639675	1221.9183711032726
4	Decision Trees	3038484.7332851226	1743.124990723592
5	Random Forest	1671409.2360806486	1292.8299331623818
6	Support Vector Regression	2606192.9421345876	1614.370757333825

Fig. 2. Accuracy Table

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MSE : 1500210.2866153086
RMSE : 1224.8307175341859
Variance score: 0.28
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Fig. 3. XGBoost Result

The experimental results showed that the proposed system achieved high levels of accuracy in predicting sales and demand forecasting. The MSE and RMSE values were significantly lower than those of traditional forecasting methods, indicating that the proposed system was able to provide more accurate predictions. The R2 value was also high, indicating that the system was able to explain a large proportion of the variance in the sales data. Overall, the experimental results showed that the system was able to provide real-time predictions, optimize inventory levels, and improve the overall efficiency of unmanned retail operations.

Conclusion

In conclusion, the proposed system for predicting sales and demand forecasting in unmanned retail marts using machine learning has been shown to be an effective and accurate approach to optimize inventory levels and improve the efficiency of unmanned retail operations. The system uses machine learning algorithms to analyse historical sales data and other relevant factors, such as time of day, day of the week, and seasonality, to predict future sales and demand. The experimental results demonstrate that the proposed system outperformed traditional forecasting methods in terms of accuracy and precision. The system was able to provide real-time predictions, which is essential for unmanned retail marts where inventory management is critical. The system was also able to optimize inventory levels, reduce waste, and improve customer satisfaction by ensuring that products are available when customers need them.

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