Application of Gradient Boosting Regression Model in Intelligent Distribution of E-Commerce Platforms

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With the nation's e-commerce expanding quickly in recent years, the quantity of e-commerce purchases has continued to increase, and people's methods of consuming have also transformed. Digital shopping has lately been more practical and effective due to advancements in Internet innovation, particularly wireless connections, and 5G mobile connectivity technologies. Digital shopping has brought about the peak of globalization and has grown to be an essential sector of economic globalization. On the other hand, since e-commerce has grown rapidly, several issues have occurred. One of those is logistics distribution, it is an important component in the chain that affects customer fulfillment and has a big influence on e-commerce growth. Distribution in e-commerce pertains to the procedure of sending goods or commodities to the final customer after an online transaction. With e-commerce, efficient distribution is essential to ensure that goods are delivered to consumers promptly and effectively. This fosters user retention and encourages repeat purchases. It is necessary to provide an efficient model for the efficient e-commerce distribution. For an effective intelligent e-commerce distribution platform, we proposed the gradient boosting regression model (GBRM). The efficiency of the suggested system was assessed and contrasted with methods that were previously utilized. The results show that the suggested GBRM model significantly enhanced the distribution of e-commerce which generates a computation time of 60 and distribution speed of 90.

Povzetek: Predlagan je model gradientnega ojačanja za regresijo za učinkovito distribucijo v e-trgovini, kar znatno izboljša hitrost in čas distribucije.

1 Introduction

The phrase used for the buying and selling of goods and services over the internet refers to electronic commerce or e-commerce. Transactions involving both businesses and consumers can fall under this category. Since it offers convenience to both consumers and sellers, e-commerce has grown in popularity over the last several seasons. About being constrained by physical storefronts. Technology enables companies to expand their customer base and operate around the clock. Shopify, eBay, and Amazon are a few illustrative e-commerce systems. An e-commerce distribution channel is a route that products and services travel on their way from manufacturers to customers [1]. There are various kinds of distribution networks, such as manufacturers can communicate with customers directly, through retailers, wholesalers, consumers, and retailers, among other ways. The four flows of a company organization are the economic flow, the pleasant flow, the working capital, and the flow of information. Distribution data demonstrates the division of a collection across subgroups according to various traits. The number of units in the subgroup is expressed as a proportion of the whole group under consideration. Supply chain, blockchain, logistics, a framework for placing orders and billing, vendor relationship management (VRM), and customer relationship management are examples of the components of distribution monitoring systems, which are the actions taken to transport an item from the seller to the ultimate consumer (CRM) [2].

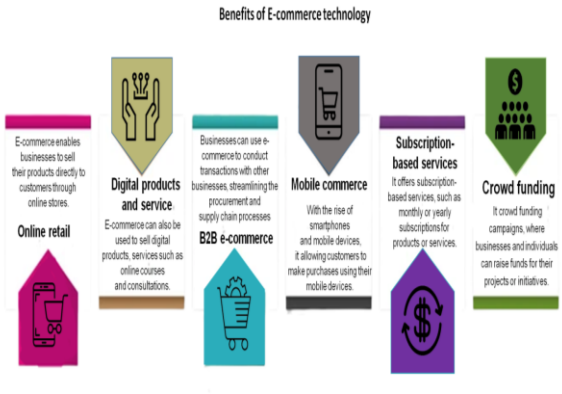

Figure 1: Benefits of e-commerce technology

Figure 1 depicts the various benefits of e-commerce technology. E-commerce has a worldwide reach since it allows companies and customers from all over the globe to trade the internet. Even though, each nation and area has a different amount of e-commerce adoption. The e-commerce industries in North America and Europe have been most developed, with elevated numbers of acceptance and internet expenditure. Although some nations in the Asia-Pacific area are still building up their e-commerce architecture, nations like China, Japan, and South Korea have sizable and expanding e-commerce marketplaces. Consumers will be more satisfied and inclined to use the services again with an effective distribution approach. Simplifying the company and making it more effective, might also be helpful [3].

E-commerce distribution is highly reliant on elements including internet availability, online transactions, and logistical setup. Electronics, apparel, and home goods are just a few of the many things that are sold online. Consumer electronics, clothing, and cosmetics are often among the most popular e-commerce product categories. The technology for logistics and distribution is essential to e-success. Commerce for things to be transported quickly and efficiently, organizations like FedEx, UPS, and DHL are essential. In speeding up deliveries in addition to saving costs, several e-commerce sites have even built their logistical systems [4]. E-commerce has greatly grown recently, with strong extension rates up to two numbers in the majority of advanced economies. As a consequence, last-mile transport related to Internet sales has increased. Beyond of immediate effects of the self-isolation and lockdown durations implemented across several nations, the economy's basic structure may be changing, further quickening the market's shift towards e-commerce. Delivery services shipments have significantly grown because of the current e-commerce growth, which has also caused a significant rise in the number of items dispatched. Besides, since every residence might potentially serve as a destination point in e-commerce, the effect of urban freight distribution is compounded in new ways and transportation numbers are growing more quickly [5]. In examining whether driven B2C e-consumers are to put sustainability above delivery speed and cost in their authorizations, the effort intends to close this gap. Consumers purchase goods and services online using a variety of platforms and websites, including e-commerce platforms, smartphone applications, social media platforms, and online marketplaces. B2C the grown of e-commerce in popularity in the previous few years as more and more people prefer the ease of purchasing online and more companies realize the advantages of expanding their customer base and lowering the overhead expenses connected with traditional locations [6]. In light of monetary limitations, the average consumer-churning forecast models for e-commerce are simplistic and unrefined. Clients who haven't signed in or made some purchases are regarded as abandoned. In addition, due to the restricted ability of technology for information gathering and storing, just the information on prior orders is examined by each program. The prediction algorithm seldom takes into consideration other customer information kinds, such as the profile, browsing history, favorites, and comments [7]. The circulation of an internet-based shopping center may be significantly increased by an e-commerce classification method. Amazon's customized suggestion algorithm has raised the online shopping store's overall sales by 35 percent. In contrast to conventional Google search, customized recommended techniques identify users' interest areas by observing users' activity, allowing consumers to find the things they are looking for more quickly. A good recommender system may increase users' feeling of community and develop positive relationships with them in addition to increasing consumers' ability to make more efficient purchases [8]. Customers have a comfortable option to buy goods and services from the comfort of their homes due to e-commerce marketplaces. The ability to provide online classes, publications, and other learning materials directly to students and learners is made possible through e-commerce platforms. Lastly, e-commerce platforms provide smaller, independent enterprises a platform to offer their goods and services on an even level field, enabling businesses to engage with bigger companies. That benefits either firms or consumers by fostering competition and innovation in the economy [9]. A popular machine learning approach for

analyzing and predicting data is gradient boosting regression (GBR). GBR may be a potent tool for e-commerce platforms to maximize their product offerings, distribution network, and consumer pleasure. It is important to remember that GBR is only one of several effective options and that its effectiveness will be influenced by the compassionate amount of data that is accessible along with the unique context of the e-commerce platform [10]. In this article, we proposed (GBRM) techniques for classifying the intelligent distribution of E-Commerce.

2 Related works

Table 1: survey of related works

Sl.No	Proposed	Result	Limitations
[6]	The sustainable delivery model is emphasized in the research's exploration of sustainable SC management based on demand from e-consumers.	The outcomes demonstrate the possibility of educating consumers on the internet by assisting them in reconsidering their priorities and distributing environmental information.	They assume that the outcomes of the specimen cannot be applied to the entire nation or all e-consumers due to the constraints of the research's investigation limit (one geopolitical region in one country).
[7]	The investigation develops a hybrid logistic regression (LR) and XGBoost algorithm model-based customer churn prediction model.	The findings of the investigation provide e-commerce businesses with essential information on how to increase client adhesiveness.	The hybrid model exceeds logistic regression in predicting customer attrition when measured by accuracy, precision, and recall.
[8]	A recommendation model for an online shopping platform is based on a combination of different personalized recommendation algorithms, including extreme gradient boosting (XGBOOST), gradient boost decision tree (GBOOSTDT), and random forest (RF).	It is demonstrated by the outcomes that the proposed framework increases recommendation accuracy with decreasing recommendation sparsity.	A customized recommendation system can include more recommendation instances based on the application's different customer demands, thus offering a more comprehensive user experience.
[9]	The methods by international companies of e-commerce can develop supply chain service (SCS) capacities that lead to enhancements in the quality of supply chain relationships for online retailers and other platform users.	The data provide valuable information about how international e-commerce companies should manage their relationships to promote relationship quality, which has become an essential selling point in the marketplace.	It addressed twelve international e-commerce businesses, and after evaluating them based on supply chain relationship quality and service skills, it ultimately selected four. To

			validate the model created in that research, an extensive sample assessment needs to be executed.
[10]	Using web features user behavior and data mining (DM) methods with the Gradient Boosted Trees algorithm, the article attempts to anticipate customer churn.	The outcomes demonstrate that, compared to other methods, gradient-boosted trees perform better with an accuracy of 86.90%.	More instances or more precise properties could be used to improve the method.

3 Application of e-commerce

To get extensive inventory information for the research [11], an e-commerce corporation was used in the study. The main step in the AI method for building a framework for intense data forecasting is construction. The research demonstrates that to analyze and optimize an AI model, facts and challenges from particular businesses must be merged. The paper emphasizes the crucial steps in the AI-predicting inventory model and offers improvement recommendations. In the research [12], an analysis is combined to create an integrated theoretical approach that can be used to describe urban last-mile e-commerce distribution methods in both developed and developing countries. After that, they evaluate and compare several last-mile distribution systems, highlighting factors that affect the choice of network design options, using the organized approach. In the study [13], they examine the trade-offs in approach efficiency that occur from integrating first-mile collection and last-mile delivering processes in a distributed metropolitan environment. They extend the body of knowledge on a continuous estimate of optimum route lengths and provide effects different that take the impacts of coordinated pickup and delivery activities into consideration. According to the research, combining first-mile collection and last-mile distribution processes may lead to efficiency benefits of up to 30 percent. In the context [14], provide a comprehensive overview of existing attempts to implement ML techniques in different e-commerce situations. E-commerce platforms are the majority of people's search to search, consider, and ultimately purchase. They use artificial intelligence, machine learning, business intelligence, mathematical formalism, and further technology to provide effective information about consumer activity. They help both consumers and sellers. The state-of-the-art location does not contain a thorough assessment that analyses the most prevalent goals of e-commerce similar research and the very suitable ML frameworks and techniques for some circumstances. The study [15] examined the e-commerce pattern and looked into how e-commerce activities are grouped in China's Jiangsu Province. Taobao Village's establishment has emerged as a new development model for China's rural market. Great profits have been produced by the typical e-commerce sector grouping model, which is significant for the local economy in addition to having some significance for other regions with undeveloped e-commerce sectors. A spatial weight matrix is created to calculate the e-commerce industry sort grouping that takes the shape of Taobao villages. The investigation [16] of Cross-border electronic commerce has been accomplished by Lemon Company. It evaluates and classifies its business goods, main client objectives, and current logistics-related distribution method, and manages to combine the condition of Lemon Company's logistical operations to evaluate the logistical elements of the business. That used the analytic hierarchy method and Matlab, and an index factor for the package was developed with quantitative scoring. The cross-border e-commerce industry's everything score for the 3 distinct logistical distribution modes has been calculated. Lemon Business has chosen a logistics and distribution method that may be utilized as an international warehouse and method of distribution. The study [17] demonstrates that e-commerce packaging with an emphasis on the environmental side provides a historical overview of packaging over the last century. In e-commerce packaging to better comprehend various designs and materials, pinpoint issues like oversizing, and educate potential readers on the most recent advancements in materials, sustainability, and logistics. In the study [18], a thorough analysis of various goods and materials traded on multiple online platforms during the latter stages of the COVID-19 pandemic has been conducted. The assessment primarily

examines how the COVID-19 epidemic has affected businesses by examining the changes in consumer buying behavior. Moreover, a complete evaluation of customer responses has been done based on several variables, including the usage, performance, security, utility, and satisfaction factors of internet technology during lockdown phases. The review finds a comparison of all multiple lockdown stages as they were seen in India, with the most frequent items arranged by category.

4 Materials and method

To be productive, economical, and satisfy consumer requirements, distribution operations for e-commerce operations should be properly managed. Hence, for the effective distribution, we presented the gradient boosting regression model (GBRM). Figure 2 illustrates the flow of Methodology.

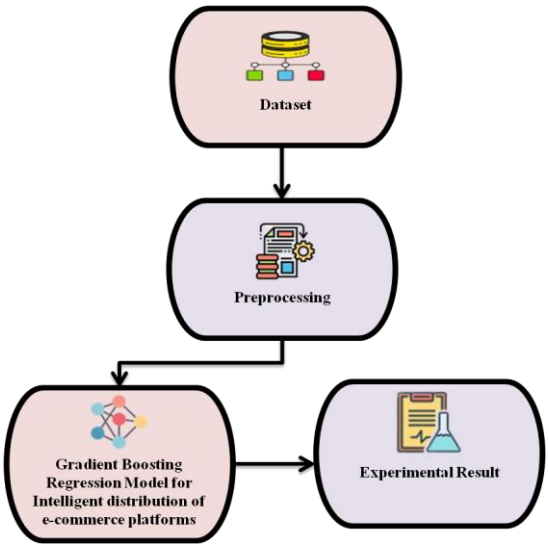

Figure 2: Methodology flow

4.1 Dataset

Improper datasets have a significant impact on prediction accuracy when GBRM techniques have high standards for datasets. The processes of data collection and data preprocessing [22] comprise the data preparation process. Selecting appropriate data is important for assignments involving research, including finding the frequency and how much customers purchase. The earning and loss provision of e-commerce is an essential concern for businesses in the local market. Purchase needs, frequency, and quantity are determined by the customers. E-commerce performance is more fundamentally reflected in these datasets. Eliminating noise from data, determining the missing values, and finishing data type conversion are often steps in the data prediction process. Similar distributions must characterize the data that are collected, and extreme values cannot develop which can result in high prediction errors. The primary components of the dataset, which forms the GBRM, are the customer's consumption quantity, frequency, and particular products purchased.

4.2 Gradient boosting regression model (GBRM) for intelligent distribution of e-commerce platforms

A machine learning approach for predictive modeling is called the Gradient Boosting Regression Model (GBRM). This kind of ensemble model mixes different decision trees to get precise predictions. GBRM is used for requirement prediction, inventory management, and supply chain improvement across various sectors, notably e-commerce. By anticipating product requirements and managing inventory levels, GBRM may be utilized for distribution in e-commerce to ensure that things are always accessible when consumers need them. To reduce shipping expenses and distribution times, the model may also be utilized to optimize distribution and service patterns.

The gradient boosting regression model (GBRM) is an extension of a linear model that utilizes the tree structure as its foundation. The fundamental idea is to strengthen a deficient designation system's iterative efficiency to create a strong, more excellent forecasting predictor. In contrast to linear analysis, where the goal variable is a numerical quantity, GBRM's parameter is discrete. Multimodal specification complications are most effectively addressed with GBRM. Each characteristic is multiplied by a regression factor during the regression procedure, followed by introducing a sigmoid function and the result of a value in the range [0, 1] using a linear model. Labels are categorized as either class 1 or 0, depending on whether the value is more significant than 0.5 . Establishing the prediction component $g_{\vartheta}(a)$ to predict the assessment using the input data, creating a failure component regarding alteration of the anticipated throughput from the group of training information, and acquiring the correlation feature with the least amount of loss are the critical elements in the logistic dependent variable. In GBRM, the sigmoid indicator is crucial. Suppose a multimodal distribution issue occurs, with the objective variable's result being $b \in$

$\{0,1\}$ and the expected result of the sequential analysis being $c = \vartheta^T a + \vartheta_0$. Consequently, as seen in equation 1, a step variable $f(c)$is required to change c into 0/1.

$$f(c) = \begin{cases} 0\ if c < 0 \\ 0.5 if c = 0 \\ 1 if c > 0 \end{cases} \quad (1)$$

Instead of being monotonous and distinguishable, $f(c)$is discontinuous. Equation 2 describes the sigmoid function, which offers a device with high separability and homogeneity.

$$b = \frac{1}{1+e^{-c}} \quad (2)$$

C is always strongly connected with b if $c > 0$ and $y > 0.5$, and z is always unfavorably associated with b if $c < 0$ and $b < 0.5$. The forecasting function may be created using equation 3 following the sigmoid function.

$$g_\vartheta(a) = \frac{1}{1+e^{-\vartheta^T a}} \quad (3)$$

Equations 4 and 5 may be used to define the odds for an intake to be assigned to Category 1 or Category 0.

$$Q(b_x = 1|a;\vartheta) = g_\vartheta(a) \quad (4)$$

$$Q(b_x = 0|a;\vartheta) = 1 - g_\vartheta(a) \quad (5)$$

In a GBRM, the contradiction of the response variable may be taken into account to calculate the failure value. Equation 6 can be used to build the possibility activity because of equations (4) and (5).

$$Q(b|A;\vartheta) = g_\vartheta(x)^y (1 - g_\vartheta(a))^{1-b} \quad (6)$$

The possibility operation may be found in equation 7, considering that the data are independent of one another.

$$L(\vartheta) = \prod_{i=1}^{t} P(b_x|a_x;\vartheta) = \prod_{i=1}^{S} g_\vartheta(x_i)^{y_i} (1 - g_\vartheta(a_x)^{1-b_x} \quad (7)$$

After that, equation 8 may be used to generate the log possibility activity.

$$l(\vartheta) = \log\big(L(\vartheta)\big) = \sum_{i=1}^{t} (y_i log g_\vartheta(a_x) + (1 - b_x)\log(1 - g_\vartheta(a_x))) \quad (8)$$

The goal of the maximum possibility assessment is to increase $I(\vartheta)$.

Every leaf node receives an input feature as part of the GBRM process, which subsequently outputs a score. The anticipated outcome for every sample is created by adding the outcome values of all the plants. Assume there are P trees that can be predicted. Equation 9 may then be used to build the forecasting model.

$$b_a = \sum_{p=1}^{P} l_k(a_x), l_p \in E, x \in [1, N] \quad (9)$$

Where N is the sample size, E denotes the collection of all regression models, and lk denotes a component of E. The goal variable may thus be represented by equation 10.

$$Obj(\vartheta) = F(\vartheta) + \delta(\vartheta) \quad (10)$$

Where, $F(\vartheta)$ is the failure rate used to fit learning data and assess how well the system fits experimental data from the training set, and $\delta(\vartheta)$ represents the normalization factor used for gauge intricacy models, One might conclude that equation 11 is the goal role of GBRM.

$$Obj(s) = \sum_{x=1}^{n} L(b_x) + \sum_{x=1}^{m} \delta(b_x) \quad (11)$$

For a specific tree topology, this value reflects the most significant reduction in the goal. Structural value is the label given to the procedure result. The quality of the tree layout increases with a lower structure rating. The estimate may be carried out using the gradient ascending approach, and the parameter that is produced must be the greatest. The following procedures are part of the GBRM modeling:

Configuration: Establish the regression model after determining the dependent and independent factors following the aim. Estimating the ratio by recognizing the model's regression value and calculating it.

Evaluating the equation: Use the F-value and P-value to determine the logistic equation's importance. The regression coefficient satisfies the assessment if the p-value is less than the relevance threshold; else, it has to be recreated using new factors. It is important to keep in mind that just because the regression coefficient satisfies the relevance test does not always suggest that each independence factor has a meaningful impact on the dependence factor. Constant

verification once the whole modeling and correlation factor meets the relevance test, tests the importance of every independent aspect, eliminates the essential and irrelevant factors, and reconstructs the solution.

5 Results and discussion

Online buying and selling of goods and services is referred to as e-commerce. Online purchases involving businesses, customers, and authorities are affected. The distribution of goods has to be streamlined for effective e-commerce solutions. As a result, we provided the gradient boosting regression model (GBRM) for efficient e-commerce platform distribution. The performance indicators used for evaluation are distribution quality, customer satisfaction, distribution speed, inventory management, and computation cost. The conventional techniques used for comparison are big data [19], cloud-native architecture (CNA) [20], and personalized recommendation algorithm (PRA) [21].

5.1 Distribution quality

The act of distributing a good is making it available to a wide audience for purchase. In e-commerce, distribution quality is crucial since it affects product delivery, customer satisfaction, and ultimately, organizational growth. A distribution's quality may be determined in a variety of methods, including by visually examining its form, examining its summary statistics, and comparing it to theoretical distributions. The efficiency and correctness of customer orders, shipping, and recovery handling may all be referred to as distribution quality in e-commerce. Figure 3 shows the distribution quality of the proposed and existing techniques. Table 2 illustrates the distribution quality results.

Compared to existing methods, the recommended approach offers a high level of distribution quality. Data distribution quality for big data was 75%, and CAN performed at 85%. PRA's 66% distribution quality was indicative of a weak performance. Distribution quality of 95%, the proposed GBRM technique exceeded the existing methods.

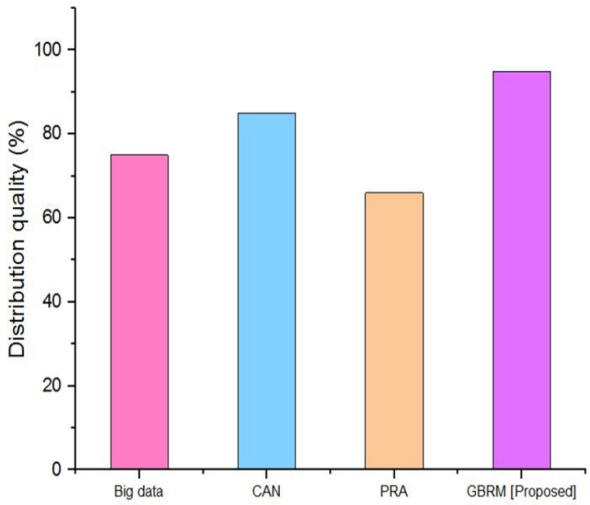

Figure 3: Distribution quality of the proposed and existing methodologies

Table 2: Outcomes of distribution quality

Methods	**Distribution quality (%)**
Big data	75
CAN	85
PRA	66
GBRM [Proposed]	95

5.2 Customer satisfaction

Customer satisfaction is the degree of happiness or fulfillment of consumer experiences with a product or service. Customer satisfaction is crucial in e-commerce since consumers often depend on online purchases to fulfill their needs.

E-commerce companies must focus on creating a great customer experience when customers cannot physically interact with the product or service. Customers demand quick and dependable shipment, therefore e-commerce companies should work to deliver on that promise. E-commerce companies may enhance customer happiness, provide customers with a good experience, and foster steadfast consumer loyalty. Figure 4 demonstrates customer satisfaction with the proposed and existing techniques. Table 3 shows the results of customer satisfaction. Customer satisfaction is greater in the proposed method in comparison to other methods.

The proposed method offers 94% customer satisfaction assessment exceeding existing methods. Big data obtains 65%, CAN obtains 77%, and PRA obtains 82%. The proposed method maintains the most effective method, demonstrating its capacity to significantly improve customer satisfaction levels.

Figure 4: Customer satisfaction with the proposed and existing methodologies

Table 3: Outcomes of customer satisfaction

Methods	Customer satisfaction (%)
Big data	65
CAN	77
PRA	82
GBRM [Proposed]	94

5.3 Distribution speed

An e-commerce distribution platform is a route that products and services travel on their way from manufacturers to customers. Distribution speed in e-commerce is essential for delivering a great customer experience and keeping a market lead. The more quickly a consumer gets their order, the more probable it is that they will be pleased with what they bought and returned. Rapid delivery times may also lower cart abandonment rates and boost conversion rates. E-commerce businesses could boost their rate of distribution. The dispersion speed is displayed in Figure 5. The distribution speed outcomes are displayed in Table 4.

The speed distribution from multiple techniques is shown below. While CAN indicates a distribution speed of 77%, big data obtains a rate of 63%. PRA provides 81% speed. Compared to the speed range with the existing method our proposed method offers a 90% distribution speed.

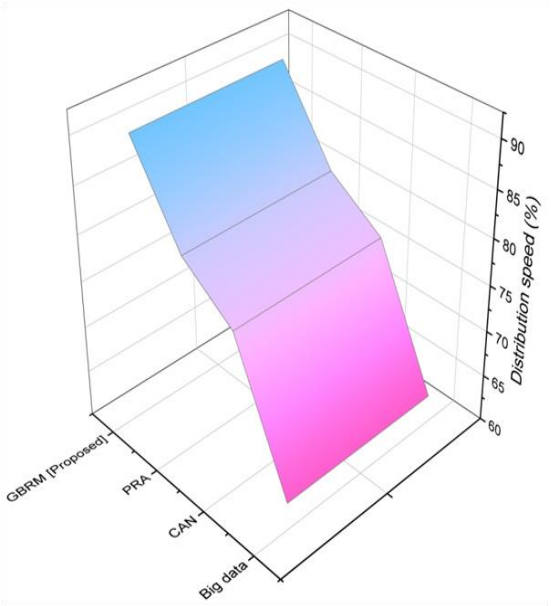

Figure 5: Distribution speed of the proposed and existing methodologies

Table 4: Outcomes of distribution speed

Methods	Distribution speed (%)
Big data	63
CAN	77
PRA	81
GBRM [Proposed]	90

5.4 Control of inventory

The process of controlling the movement of goods from manufacturers to customers, ensuring that the correct items are accessible at the proper moment, in the correct amounts, and at the right offer. Monitoring the movement of items from suppliers to consumers is an important element of inventory management in e-commerce. Efficient inventory management is important in avoiding excess inventory and overstocking, guaranteeing that products are accessible when consumers want to purchase products, and increasing profitability. Figure 6 depicts the Inventory management of the proposed and existing techniques. Table 5 shows the results of Inventory management. In comparison to existing methods, the suggested approach offers a high level of Inventory.

The efficacy of inventory management techniques was assessed. PRA executed 84%, big data demonstrated an efficiency of 67%, and CAN 77%. 97% efficacy in improving inventory management processes, the proposed GBRM method was established to be efficient compared with existing methods.

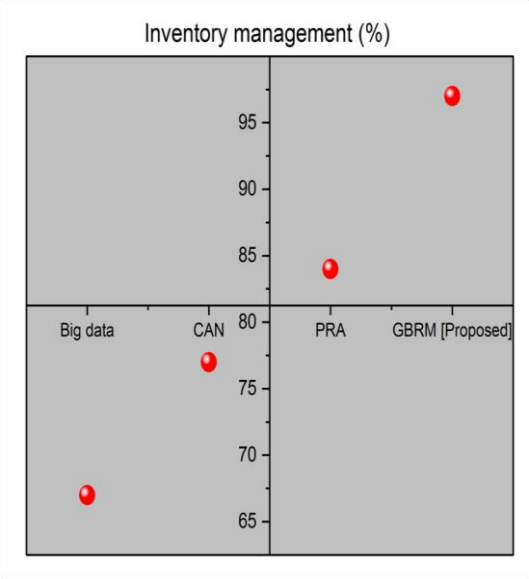

Figure 6: Inventory management of the proposed and existing methodologies

Table 5: Outcomes of inventory management

Methods	Inventory management (%)
Big data	67
CAN	77
PRA	84
GBRM [Proposed]	97

5.5 Computation cost

The amount of computer resources needed to complete a certain activity or process is referred to as the computation cost. The processing period for each sampling interval in a simulation is the computational cost. Computational costs in e-commerce may relate to the hardware resources needed to manage inventories, process orders, and handle website visitors. For e-commerce websites to provide an outstanding user experience, they must be able to manage a high number of visitors, particularly during peak hours, and process orders and payments quickly. Figure 7 shows the computation cost of the proposed and existing techniques. Table 6 shows the results of the computation cost. It proves that the suggested method uses less computation cost.

Comparing the proposed techniques to the existing methods, there is a significant reduction in computing costs. 94% of computational resources are required for big data, and 85% and 74% are used for CAN and PRA. Assuming 60% of the total computing cost, the proposed method maximizes efficiency.

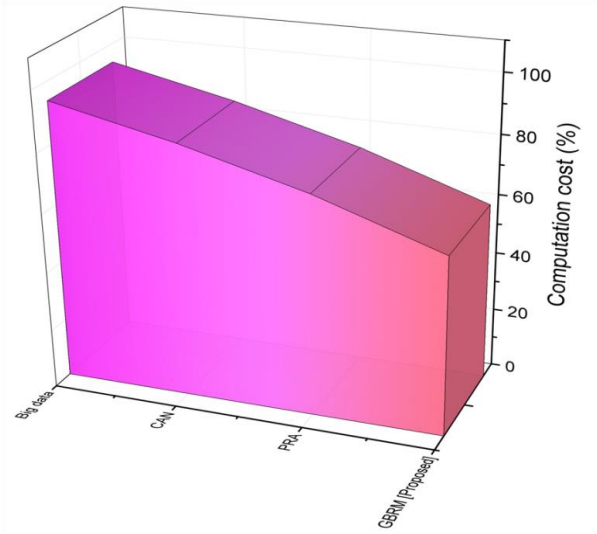

Figure 7: Computation cost of the proposed and existing methodologies

Table 6: Outcomes of computation cost

Methods	Computation cost (%)
Big data	94
CAN	85
PRA	74
GBRM [Proposed]	60

6 Discussion

Big Data has numerous uses, but it also has limitations relating to scalability, security, and data quality. It requires an effective system for managing large datasets, and it can be difficult to ensure data privacy compliance, Even though CAN is flexible and scalable, it has drawbacks such as the requirement for competent employees, potential locking in vendors, and security issues. It can be complicated to transfer existing platforms to the cloud and PRA issues in generating diverse and accurate recommendations include the possibility of bubbles in filters, cold start issues, and moral concerns. Our proposed method all the existing methods by detecting complex correlations in data, improving predicting accuracy, and minimizing errors, the proposed GBRM perform in efficient distribution of e-commerce platforms. The result of the recursive learning method, GBRM is skilled in handling a variety of features in e-commerce databases by consecutively optimizing predictions. Enhancing the distribution method for e-commerce platforms is the outcome as this leads to enhanced demand forecasting and effective management of stocks.

7 Conclusion

The quantity of e-commerce activities and people's consumption habits have changed as a result of the nation's modern rapid e-commerce expansion. The relationship between e-commerce and distribution has become more substantial over a period with the advent of the online technology age. Distribution becomes an important consideration when evaluating the viability of e-commerce businesses. The cost and the level of reliability of logistics distribution for e-commerce enterprises are directly influenced by the distribution mechanism. Customers get the most extraordinary e-commerce services through effective distribution strategies. Hence, for intelligent distribution of e-commerce platforms, we presented the gradient boosting regression model (GBRM). Performance measures such as distribution quality, customer satisfaction, distribution speed, inventory management, and computation cost are used to assess the success of the suggested approach. The outcomes are contrasted with those of several

conventional methods. According to the findings, the GBRM is a potent tool for e-commerce enterprises that helps them manage their inventory levels, estimate demand, and improve shipping and delivery routes. In the future, optimization strategies may be integrated into the system that has been suggested to increase its efficiency in the field of e-commerce distribution. GBRM can be useful, although they can be difficult to use with large datasets and need a lot of processing power. It can be similarly difficult to provide transparent perspectives on distribution decisions due to the limited interpretability of this method. Future developments in the intelligent distribution of GBRM-based e-commerce platforms show prospective. Future research can focus on enhancing the interpretability of the model, maximizing computational effectiveness, and integrating real-time data to create more flexible and adaptable distribution methods. The general application of GBRM in electronic commerce distribution can also be improved by investigating hybrid models and incorporating innovative technologies including machine learning explanation methods.

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