

An AI-Based Customer Relationship Management Framework for Business Applications

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Abstract: In the dynamic landscape of business applications, Customer Relationship Management (CRM) plays a crucial role in developing and sustaining connections with customers. This paper introduces a new framework that uses AI technology to revolutionise customer relationship management (CRM) systems, giving organisations a competitive edge. Customers now have more product and service information at their fingertips than ever before. Retailers have a problem in catering to client preferences for the correct goods and services due to the vast variation that results in consumer demand. In order to better understand client preferences, recommender systems might benefit from product evaluations, opinions, and shared experiences. In order to provide product recommendations, it is necessary to analyse a number of key factors, such as the number of items bought and seen, the list of people who have bought the products, and the total number of products. This proposes a hybrid recommendation strategy that integrates data analytics, collaborative filtering, and machine learning. In order to get an advantage over competitors, customer relationship management systems utilise machine learning models to analyse client personal and behavioural data in order to increase customer retention.

Keywords: Artificial Intelligence, Customer Relationship Management, business applications, recommender systems, machine learning

1. Introduction

Companies in today's cutthroat market must prioritise customer satisfaction above all else. When it comes to collecting and storing client data, the majority of companies go all out. Even in relationship marketing, this fad has taken root, giving rise to novel CRM approaches. CRM, as the term suggests, is all about using data-driven solutions to keep in touch with customers and make the company better. In terms of customer recognition, interest, distinction, and retention, it is an antagonistic process. Through the integration of the organization's whole supply chain at every level,[1][2] it assists in creating value for customers by reducing costs or increasing benefits. Contributes to the seamless coordination of many customer tasks, including revenue, customer support, promotions, field operations, and more. Organisations are able to know their clients, customise their service to meet their wants, understand their expectations, and provide goods that meet those

needs all thanks to customer relationship management.

One way that companies may improve their operations and reach new heights is by using a customer relationship management system.[3][4] Figure 1 also serves to illustrate the most important CRM characteristics, which are as follows:

- Contact management – It is considered as main key factor in customer satisfaction and an important element of CRM. This feature allows segmenting the contacts into groups and organizing them in a better way. With this CRM capability, it helps to collect important data of the customers and helps in planning better marketing strategies after a new product is launched.
- Customer Needs – To maintain a long term relationship, it is essential to know the needs of the customer to serve them effectively. To know and prioritize a customer, it becomes important to interview them about their likes and dislikes.[5]
- Customer Response – It is defined as the response given by the organization to their customer's queries or request. It plays a crucial role in gaining the customer's confidence and maintaining a long term relationship with them. All it takes to understand the customer's queries with patience and providing a satisfactory solution to it.[6]
- Customer Satisfaction – In today's competitive environment, customer satisfaction is one the biggest differentiating factor considered in business strategies and an important performance factor. It is defined as how

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the customer needs and responses are collaborated and delivered to excel the customer satisfaction.[7]

- Lead management – This feature allows a business to find their best customers based on their demographics features.
- Product Support – CRM software helps effectively collect the information about various products and services offered to the customers. This information helps manage the customer experience as it helps in organizing the information about what, when and how and with what the client is dissatisfied and how as that issue addressed.
- Data Reporting – This is the most prominent feature of CRM software. It helps to create flexible and realistic customer database. Without this feature, it is difficult to

find customer behavior, trends or the actions needed to be taken to improve their relationship with the customers.

- Sales Analytics – Considered as one of the most important component of CRM. It collects all the data from different sources like social media, forums, website, polls, etc and then analyzes it. Further, it helps to create better campaigns by analyzing the past data campaigns.
- Mobile CRM – With emerging technologies, everything these days is available at ease to the users and to benefit the business. With this feature, it takes CRM on remote device using mobile CRM apps and programs and one can receive alert messages about their campaigns on a mobile device.

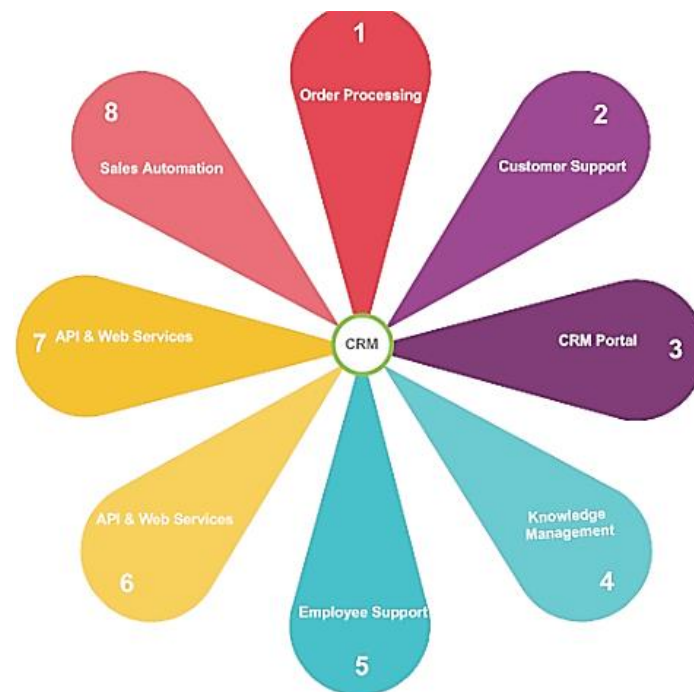


Fig 1: CRM features

Importance of CRM

CRM is must for all those business who desires to take customer satisfaction to a higher level (Salesforce).[8] For this to be achieved, it is important to deploy proper CRM tool, which helps to track and manage all the interactions and communications your representative have with the customers. There are several benefits of using CRM in any business:

- Enhanced Communication
- Improved Customer service
- Automations of tasks
- Organized Customer data

It is essential to establish long-term, mutually beneficial connections with their valued clients in order to survive the fierce and ever-increasing competition for consumers. From a purely financial standpoint, businesses have come to understand that maintaining relationships with current customers is more cost-effective than seeking out new ones. A one-time buyer is less valuable than a loyal consumer who buys from you again and again.[9] Eighty percent of a company's income comes from a small percentage of its clients, according to the Pareto Principle. On average, it takes seven to ten face-to-face calls to sell a product or service to a new customer, however it only takes two or three calls to convert a prospective repeat customer. Keeping a current consumer as a client is far simpler than finding a

new one. Profitability rises by 20% or more for every 4% to 5% improvement in retaining existing clients. Customer relationship management (CRM) aids in valuing customers and seeks to establish lucrative, long-term connections with them. Businesses that put an emphasis on customer connections are more likely to develop meaningful bonds with their clients, which in turn increases customer lifetime value and fosters loyalty. Any business, no matter how little, may benefit from attracting clients to their website, engaging with them on social media (Instagram, Twitter, Facebook, etc.), and encouraging them to read and comment on blog entries, among other things. Building trust, captivating consumers, and reducing customer turnover are the core goals of organisations.[10] Appealing to the customer's emotions is a great way to establish a solid rapport with them. By influencing client behaviour, a company may boost its earnings via the use of customer relationship management (CRM) systems and a mix of several procedures that aid in developing a solid business strategy. Gaining new customers, keeping existing ones happy, and increasing profits are all aided by this. The majority of companies lack confidence in their customer service, programme effectiveness, data storage, ability to fulfil client demands, etc. It becomes a huge problem for organisations since user interactions generate massive amounts of data.[11]

2. Relationship Between CRM and Artificial Intelligence

Thanks to technological progress, robots can now coordinate their mundane but necessary jobs, going above and beyond what people have always done to organise, accumulate, and distribute data according to user needs. The development of AI is a direct outcome of these technological advances. In the last ten years, both the quantity and quality of consumer data held by corporations and the channels by which customers interact with those firms have expanded exponentially.[12] With the help of AI, we can improve our interactions with customers and clients while simultaneously increasing our economic output. The competency of robots to acquire, grasp, decide, and provide precisely like humans is referred to as "intelligence" in this context. AI helps companies automate their consumer outreach and make the most of their data. In spite of the fact that clients find human mistake intolerable, it offers superior answers and eliminates it. The ever-increasing rivalry between well-known firms and newer ones has made customer service, happiness, and loyalty paramount. AI has the potential to increase output by facilitating workers' ability to focus on the tasks that directly contribute to the improvement of organisations' and businesses' quality of life. Problems

requiring communication with other people, including strengthening relationships with clients, might get their full attention. Having this done will alleviate some of the pressure that comes with doing mundane but necessary duties.[13] Artificial intelligence (AI) may help with data organisation, calculation mistakes, inaccurate names or numbers, and other problems, so it can avoid dealing with difficult consumers. By streamlining the processing of incoming data, businesses may better use their workers' full potential rather than wasting it on mundane, repetitive duties. This is especially true when considering the massive volumes of data that companies manage.[14]

Advantages of AI integration with CRM

- More Efficient Data management – In CRM, all Social Media data can be centralized for the AI to view and provide real value to the goals of the organization
- Improved Consumer Comprehension– Like humans, the primary motive of AI is to constantly learn. An AI would be more accurate in evaluating and studying consumer trends critically, which would eventually boost CRM
- Tailored Plan for Sales - Through Automated data entry and predicting customer behavior, companies can provide material of real interest to their customers and can establish strategies that can increase the engagement level of customers.
- The Perfect Assistant- By automating the sending and processing of communications without direct response, artificial intelligence (AI) used in customer relationship management (CRM) helps to generate more successful marketing campaigns. Separating the customer based on their hobbies, purchasing habits, and history demands a significant amount of time away from the company. The data can be readily and successfully handled using CRM driven by AI. The software suggests when and how to contact based on rapidly analysed data, which increases productivity and efficiency by delivering automatic warnings.[15]

Impact of AI on businesses

In general, AI advancement is the cornerstone of the updated execution of all other advancements and leading to Industry 4.0 evolution. There are adequate pieces of evidence available in the writing that shows that the AI technology provides new openings that can lead to exceptional market change depicted in figure 2. and therefore affecting the overall economic system. At the commercial level, a few of the benefits of AI are:

- Speedy unveiling of big data trends,
- Rapid visualization and analysis

- Progressed product plan
- Business expansion

- Improved efficiency etc. It is expected that these benefits will bring new service levels, raised profit and market growth, enhanced quality and price structures

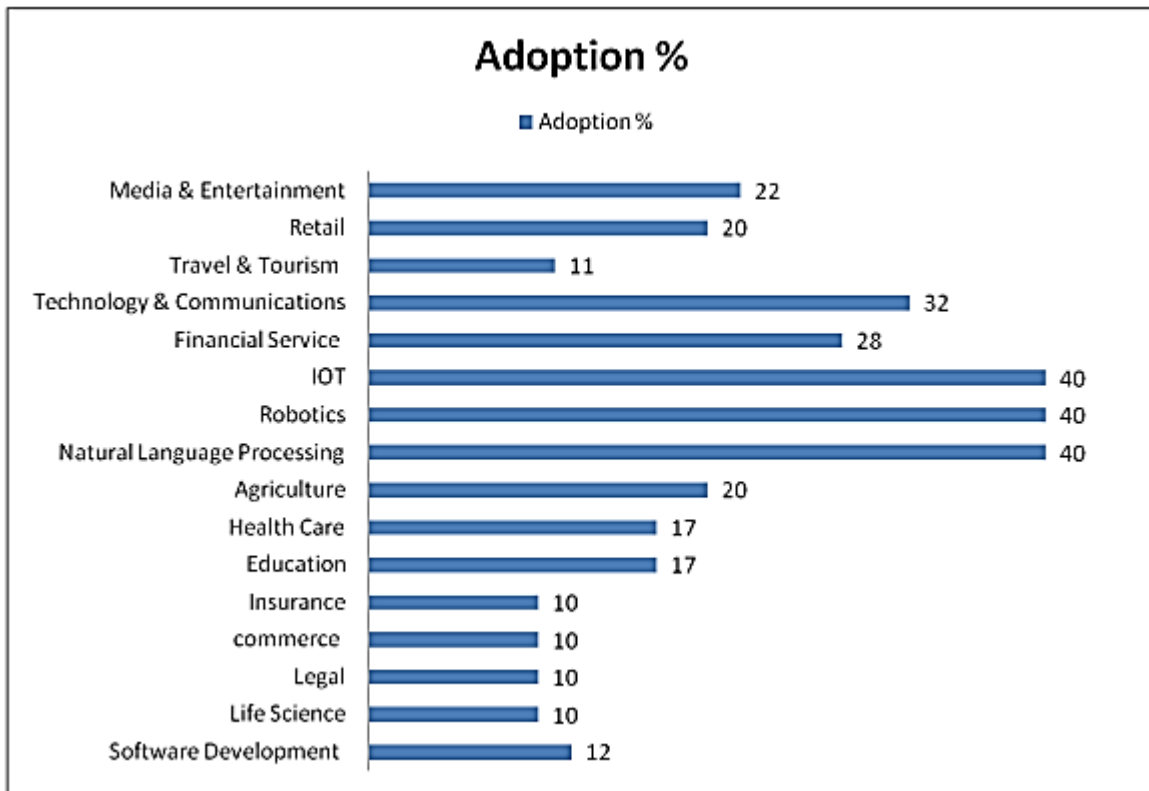


Fig 2: Percentage of start-ups with AI in various market sectors

In today's scenario, every real-world applications are backed by an intelligent agent. To communicate with the environment, this agent follows a repeated pattern of sense-think-and-act. It analyses the input data to understand correlations, extracting features, for detecting similarities, and discovering good depiction at various levels. Prior to this, the inaccessibility of knowledge and efficient equipment had impeded AI's advancement. However over the last few years, the accessibility of low-cost and low-power sensors has resulted in the generation of a huge amount of data.[16] For exploring input data, AI or machine learning instruments such as support vector machines (SVM), Bayesian algorithms, deep learning networks (DLN), decision trees and ensemble configurations are needed. Over the last few years, DLN has become the most successful algorithm. Various Business intelligence applications are developed using different algorithms to detect patterns, trends and for creating insights using company's database or external inputs. Over the next ten years, business intelligence applications are projected to be one of the fastest growing fields of AI technology. HANA is one of the examples of use business intelligence. The cloud

systems of SAP help businesses handle their database[17].

Predictive Analysis

Think about it: how does Amazon convey timely purchase suggestions or Facebook choose who you may add to your "Friend" list? A few of the most significant uses of Predictive Analytics (PA) are these. The quantitative and, at times, exciting market consequences produced by this kind of study are all around us.[18] Current information from many sources is integrated into predictive analytics. Using a combination of art and science, it may construct models that can enhance future results. A lot of people think that predictive analytics is the next logical step after data analytics in terms of improving decision-making and boosting corporate performance. Predictive analytics may help supply chain managers make better decisions by providing them with important information. Estimating demand, finding problems, optimising marketing tactics, maximising hardware value, doing preventative maintenance, retaining consumers, and forming industry aftermarket service associations might all benefit from this. The goal of predictive analytics is not to foretell the future. To a

reasonable extent, it aids in making consistent and accurate predictions about the future. For companies, it means being able to see promising prospects and potential dangers.

Predictive Analytics in CRM

Predictive analytics in customer relationship management have led to a rising tide. It is one method that helps companies understand their customers' behaviours, which in turn helps them get new customers, keep the ones they have, and get the most out of them. In a customer-centric economy, it supports marketing strategy development and CRM decision-making. Relationship management with customers is considered a top priority for every company's management team. Customer relationship management (CRM) is a set of tools and techniques for building fruitful, long-term partnerships with clients. Customer relationship management strategies rely heavily on customer data. Financial institutions and telecoms companies have made heavy use of predictive analytics to track customer actions and revenue generation for quite some time. In recent years, numerous companies involved in business-to-consumer interactions have quickly adopted predictive analytics technologies. The capacity to create valuable insights from preexisting databases and the principles of big data are the primary factors that dictate the adoption of predictive analytics. Consequently, a growing number of businesses are seeking partnerships with PA providers. Predictive algorithms identify the obstacles by examining transactional and historical market data. For better customer experience decision-making, predictive models highlight the interconnections between unique data bits, which aid in determining the driving forces behind consumer behaviour and spotting potential market gaps.

Also, unlike traditional approaches to corporate intelligence, predictive analysis is very unique. While conventional business intelligence (BI) approaches are helpful for tracing trends and organisational results in historical data, predictive analytics are more suited for making predictions, informing choices, and predicting how consumers and businesses will behave in the future. CRM predictive analytics may be quickly implemented with the help of IT technologies. One of the tenets of customer relationship management (CRM) is the use of information technology (IT) as a tool for businesses to develop stronger ties with their customers and the value of customer data analysis in providing in-depth understandings of consumer behaviour. Both operational and analytical CRM are essential parts of a strong CRM system. Too far, most customer relationship management (CRM) systems have concentrated on improving CRM from an operational standpoint, with the goal of

increasing customer loyalty and satisfaction via innovations that increase customer inquiries and fix problems.

Information on customers is gathered by operational CRM via many product lines, such as website, fax, sales, call centre, call management system, and mail. Inside this structure, all users inside a company have access to the data stored in a client-centric database, which allows for seamless communication with customers. Any way you slice it, analytical customer relationship management is all about digging into customer data. In the analytical CRM technique, a mix of tools is used to analyse customer data held in databases, create profiles and segments of customers, find trends in consumer behaviour, and forecast their level of happiness.

These analytical tools are useful for determining the worth of customer benefits and for identifying customers who are likely to leave. To better understand customers, enhance their experiences, and manage their benefits, analytical customer relationship management (CRM) and data-based analytical methodologies are gaining traction. Businesses may improve their processes and make better use of their resources with the help of analytical customer relationship management software. A number of studies have addressed "CRM portals," "data warehouses," "predictive and analytical engines," "sequential trends," "clustering," "classification," and "customer value assessment" as advancements that enable analytical CRM systems. One significant technique to study customer data in the analytical CRM system is using predictive analytics (PA) technologies. Managers may now make better choices on customer relationships and the delivery of customer-based goods and services according to this study's findings on consumer segmentation.

Problem Formulation

Using a database alone, customer relationship management (CRM) might accomplish its goals in the post-digitalization age. But up until now, information management has been a tiresome chore that has mostly concerned itself with collecting, storing, and providing data to clients in response to their requests. The process of extracting, reviewing, and interpreting information—essential operations that turn knowledge into a valuable commodity—has not been taken into account. Companies have been under more pressure to be quick on their feet and open to new ideas in the last two or three decades due to the tremendous and rapid growth in competition in the market. By tracking their purchases, use habits, and other metrics, CRM enables businesses to better meet the needs of their consumers. Customers

today expect high-quality service at low pricing, since they are more informed and discerning. Understanding customers, their needs, and expectations in order to give them with tailored, practical products is the main goal of customer relationship management (CRM). When CRM first emerged, it was thought of as a database that stored customer information. A company needs AI and CRM to react to and carry out digital transformation in the face of ever-increasing data quantities. In order for organisations to maintain a competitive edge, customer care, contentment, and loyalty must be prioritised. To do this, customer relationship management software should provide quicker and better solutions, enhancing human efforts.

Artificial intelligence, machine learning, and predictive analytics make a customer relationship management system as useful as a lost needle. Businesses may benefit from customer relationship management software that incorporates AI by identifying which audiences are most likely to buy certain items. Artificial intelligence allows businesses to better anticipate their customers' needs without ever picking up the phone. CRM powered by AI can help organisations keep tabs on their customers at all times, respond to their demands, and ensure that no client ever falls between the cracks by automatically notifying the right person depending on their status.

When customers used to phone in with questions, the customer service representative would go over their whole profile before responding. The amount of time spent interacting with customers by customer service representatives decreases due to this tedious procedure. Even yet, there are plenty of instances when clients end the call after being on hold for too long. A new era in customer relationship management is dawning with the incorporation of artificial intelligence into this system. Artificial intelligence's keen data analysis skills allow for faster, more accurate analysis of individual consumer profiles, leading to better engagement in less time. In addition, agents will benefit from it since they will get timely, accurate information that will allow them to answer to consumer inquiries with greater knowledge.

In addition, AI can facilitate the automation of customer services, the prediction of consumer interests from their online behaviour, and the facilitation of a productive experience via the timely delivery of alerts. As AI develops further, business platforms will have access to a

plethora of new advantages. It may provide businesses the ability to connect with their consumers on a deeper level, create better experiences for them, and establish lasting relationships that were previously impossible. By forging new connections between humans and machines, AI has the potential to significantly increase worker output while simultaneously tripling yearly GDP growth rates by the year 2035.

3. Objectives

- 1) Using data analytics, create a database of customer information.
- 2) Create an algorithm that can forecast and propose products for purchase.
- 3) To use predictive analytics and data analytics to target customers based on their online conduct.
- 4) Evaluate how well the created virtual assistant responds to company services.

Experimental Setup and Performance Analysis For Recommending Products

We discovered an e-commerce dataset on Kaggle after doing an extensive online search. In order to implement our suggested design, we will be making use of these datasets. The three primary parts of the experimental setup and performance evaluation are:

- 1 Data Pre-processing
- 2 Train as well as Testing of Data

Data Pre-processing

In this stage, the data is processed according to the relevance needed to provide product suggestions. In order to prepare datasets for analysis, pre-processing is necessary. Out of a total of 27,56,101 occurrences, 14,07,580 distinct visitors completed 22,457 transactions, 69,332 added items to their carts, and 26,64,312 views. There are matching attributes for around 90% of events in the item_properties.csvl files.

Attribute Selection

This phase includes the selection of attributes, with the aid of which the training and test data will be framed. Visitor ID, items viewed, view count, bought count for a consumer, and whether or not a product is purchased will be used from the selected data as different attributes.

	visitorid	num_items_viewed	view_count	bought_count	purchased
	25283	414494	1	1	0
	31516	211489	1	1	0
	15170	857478	1	1	0
	10500	1261557	12	15	5
	35120	1004036	2	2	0

Fig 3: Attribute selection

4. Predictive Modelling

Now we can analyse the values for the decision tree by dividing it into three pieces and framing it as shown in figure 4. In order to forecast future purchases from the pool of all viewers who have ever visited the website, regardless of the product category, a Random Forest model is applied to the chosen consumer characteristics using train-test models. To create the train and test sets of data, we removed attributes with categorical values, such as visitor id, purchased, and bought count. A 70:30 split was used to divide the full data set into a train set and a test set. The next step was to use the random forest

model to forecast the test attributes. In this case, a binary classification is the best option as it allows for the categorization of future purchase predictions. To determine the importance of each attribute, random forest uses either the Gini index or the Mean Decrease in Impurity (MDI). Gini significance is another way of describing the general decline in node impurity. One way to put it is as the rate at which a model's accuracy drops when a variable is removed. An indicator of a variable's significance is its magnitude of decrease. One method used to evaluate the model was the Receiver Operating Characteristic (ROC) analysis.

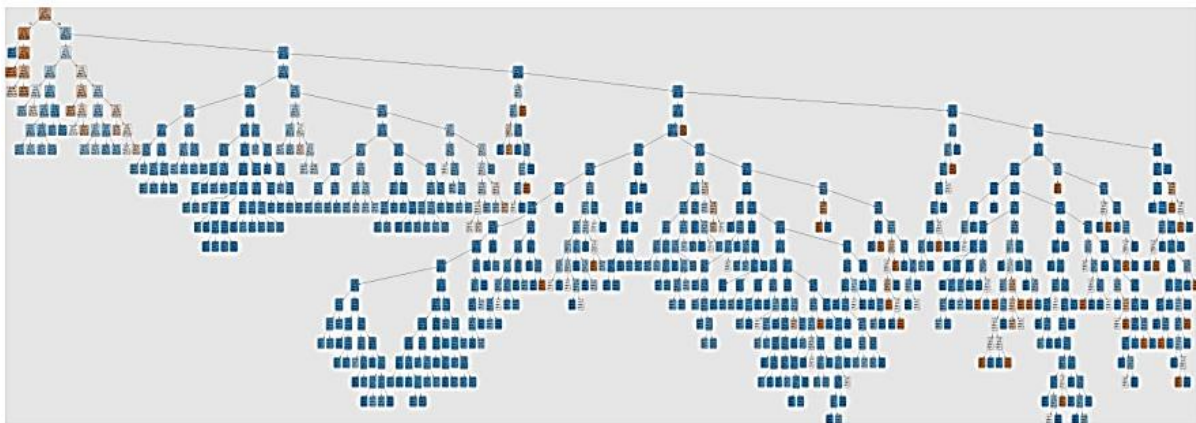


Fig 4: Decision Tree formed from random data Samples

Customers' purchase forecasts for any product may be aided by the framework. Figure 5 shows the results of visualising the clustered data in order to get the total number of website visits. Using the aforementioned

framework, a random forest model was built. As shown in Figures 6 and 7, the Logistic regression is used to assess the accuracy. The created model is evaluated using ROC curve.

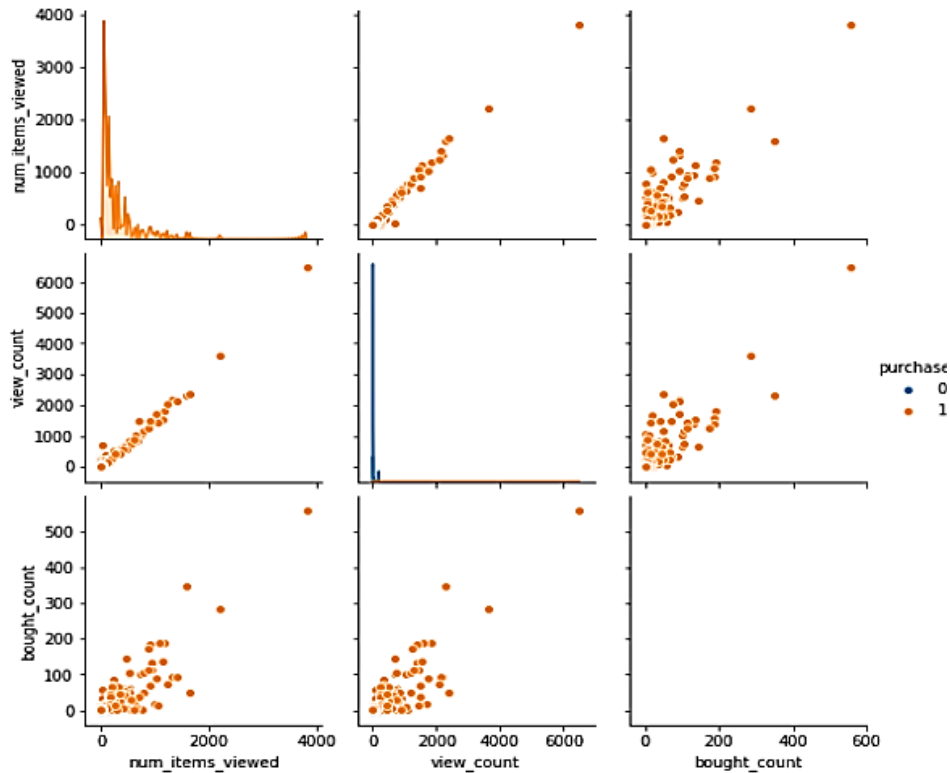


Fig 5: Data Visualisation after attribute selection

```

: from sklearn.ensemble import RandomForestClassifier
  #Running new regression on training data
  treeclass = RandomForestClassifier(n_estimators=100)
  treeclass.fit(X_train, y_train)
  #Calculating the accuracy of the training model on the testing data
  y_pred = treeclass.predict(X_test)
  y_pred_prob = treeclass.predict_proba(X_test)[:,:1]
  accuracy = treeclass.score(X_test, y_test)
  print('The accuracy is: ' + str(accuracy *100) + '%')

```

The accuracy is: 81.74001011633788%

Fig 6: Random Forest Model results

```

LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
intercept_scaling=1, l1_ratio=None, max_iter=100,
multi_class='auto', n_jobs=None, penalty='l2',
random_state=None, solver='lbfgs', tol=0.0001, verbose=0,
warm_start=False)

```

```

y_pred_class = logreg.predict(X_test)

```

```

print('accuracy = {:.4f}'.format(metrics.accuracy_score(y_test, y_pred_class)))

```

accuracy = 0.7978

Fig 7: Logistic Regression Results

5. Conclusion

In Online Business the e-commerce field still faces a formidable challenge when it comes to researching how

to calculate product similarity across different sectors. One of the most important things for every e-commerce agency to do is to analyse consumer preferences and

comprehend their choices and behaviours. Thanks to advancements in IT, it is now possible to comprehend and interpret consumer needs in the most beneficial and efficient method. This article presents a data analytics-based method for discovering other users with similar tastes and then making product recommendations to them. Cosine and user-item Finding comparable users from thousands of datasets relies on two primary factors: similarity and similarity. Integrating AI into customer relationship management allows for more efficient data analysis and the sharing of that insight with other users. To extract user actions from clickstream data, several methods were used. Accurate user conversions based on various datasets have been achieved with the use of Deep noising auto encoders and Adam optimisers. Online Stores and Digital Marketing Might Find This Assignment Useful. When combined with deep learning approaches, empirical data show that ensemble classifier improves the accuracy of user conversion predictions. Testing using real-time data and impacts on real-time data may be included into further analyses. Consumer Relationship Management (CRM) frameworks powered by artificial intelligence provide a game-changing way to improve organisational efficiency and handle consumer interactions.

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