International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

An Optimized Approach for Maximizing Business Intelligence using Machine Learning

Afsaruddin[1], Devendra Agrawal[2], Sandeep Kumar Nayak[3]
[1]Department of CSE
Dr. A.P.J. Abdul Kalam Technical University Lucknow
UP, India
afsar99786@gmail.com
[2]Department of CSE
Goel Institute of Engineering & Technology, Lucknow
UP, India
Dr.devendra@goel.edu.in
[3]Department of IT
BBAU-Satellite Center Amethi
UP, India
Nayak.kr.sandeep@gmail.com

Abstract—The subject of study known as business intelligence is responsible for the development of techniques and tools for the analysis of business information with the goal of assisting in the management and decision-making processes of corporations. In the current climate, business intelligence is essential to the process of formulating a strategy and carrying out operations that are data-driven. Throughout the many stages of the company operation, an organization will need assistance evaluating data and making decisions; a decision support system may provide this assistance by including business intelligence as an essential component. The fact that this enormous quantity of data is distributed over a number of different types of platforms, however, makes it a difficult challenge, in particular to understand the information that is actually relevant and to make efficient use of it for business intelligence. One of the most important challenges facing modern society is maximizing business intelligence through the application of machine learning. It offers a full analysis that is based on predictions and is extracted for Business Intelligence techniques along with current application fields. This anomalous gap has been pointed up, and solutions and future research areas have been offered to overcome it in order to create effective business strategies.

Keywords-Machine Learning; Business Intelligence; Prediction; Data Analytics;

I. INTRODUCTION

There are two primary meanings associated with the term "intelligence" that are linked to "business intelligence" [1]. The human intelligence ability that is employed in various economic tasks is the most important one. The second and most important one is connected to what constitutes intelligence in the form of information. One interpretation of this term is that it refers to the expert information, expertise, and technology that are used in the management of a firm. In recent years, a large number of academics have focused their attention on Business Intelligence (BI), and as a result, several business organizations have begun implementing the methodologies and technology that have emerged from these studies into their day-to-day operations. The vast number of publications in the BI domain is indicative of its significance, and various studies that seek to categorize them and identify the research concerns in BI analytics have been published. Business intelligence (BI) refers to the insights that are gleaned from the data of firms and marketing, on the basis of which a strategic decision-making process is conducted for the purpose of enhancing firm growth and marketing [2]. According to estimates [2–4], business intelligence (BI)-related industries currently account for the lion's share of all corporate investments in information technology (IT). One of the most important operations that BI can undertake is known as predictive analysis. Its purpose is to provide managers with the assistance they need to make sensible decisions by forecasting future development patterns on the basis of previous data [4]. For the purpose of expectation forecasting and the simulation of business strategies, analytic tools and technologies have undergone extensive development. These tools and technologies include statistical modeling, mathematical computation, result simulation, and the display of findings. Big data analysis has emerged as the approach with the most potential for the extraction of BI insights as a result of the increasing amount of data coming from both the company's internal and external platforms. In particular, the level of intensity of BI prediction analysis has been greatly increased due to the improved technology of artificial intelligence (AI), which demonstrates important advantages such as high

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

efficiency, high accuracy, time savings, and resource savings. It is quite different from the conventional business intelligence that arose in the 1960s and was recognized as a simple system that aids in sharing information across enterprises. This type of business intelligence was created alongside the development of computer models over the course of time. This demonstrates how much it has changed in response to the requirements of businesses over the course of the previous few decades [6]. The healthcare industry, the information technology industry, and the education sector are examples of major industries that have used BI. The following are some examples of platforms for business intelligence in action taken from the real world: a provider of meal kits Hello Fresh is employing business intelligence to overcome the problem of inefficient digital marketing reporting; Coca-Cola bottling is facing a difficulty where manual reporting methods are restricting access to real-time sales data. Machine learning is yet another subfield of artificial intelligence that has seen significant growth in prominence over the past several years. It is predicated on the theory that computers may be taught to learn from data by recognizing patterns in order to improve their decision-making abilities with minimal involvement from humans. Pattern recognition was the seed that grew into the idea that computers would one day be able to teach themselves new things and complete responsibilities without being explicitly programmed. To be able to carry out the operation on a variety of data formats and arrive at the required outcome requires the utilization of a number of fundamental in addition to more complex algorithms. Learning by observation, or supervised learning, and learning without observation, or unsupervised learning, are the two approaches to machine learning that see the greatest use. Several industries, including the transportation industry, health care, government, marketing, and financial services, are all using machine learning to improve their services.

II. LITERATURE REVIEW

Without taking into account any specific data, offer in [7] a broad overview of the considerations that go into a literature analysis of business intelligence. Their strategy is founded on previously conducted research and compiled data. Their solution operates under the presumption that BI is integrated and put into practice somewhat differently among companies. As a result, they suggest doing a literature analysis on business intelligence by utilizing categories such as BI applications and their respective implementations, BI architectures, and enabling factors. In addition, they address how technology skills like as user access, data quality, and the integration of BI with other systems in the company, in addition to organizational capabilities such as flexibility and risk management assistance, are critical for the success of BI, regardless of the decision environment. They feel that their study might generate value and feedback for businesses who plan to adopt a BI application within their company, and they believe that this could be a potential application for their work. [8] did a methodical and comprehensive literature evaluation of business intelligence up till 2007 from the perspective of a management decision making process. They create a structure by incorporating the previously obtained outcomes into the managerial decision-making process. The findings of their research pertain to the influence that decision support technologies have on the many stages, traits, and outcomes associated with decision making processes. In conclusion, they address the findings as well as the significance of those findings for corporate intelligence and analytics systems from the standpoint of the decision making process.The authors of [9] have explored the current state of business intelligence as well as its contributions to the way in which it has assisted in gaining a successful as well as productive corporation. They have, in essence, provided a comprehensive explanation of what business intelligence is and how it may be of use in the modern world. They made use of a survey that they had themselves carried out in order to learn the various perspectives that individuals had towards the use of business intelligence in order to enable a more proactive business. According to one of the findings of the poll, almost 72 percent of those who participated indicated that they had decided to implement BI in the companies that they were affiliated with. As an illustration, the business intelligence system that Suzuki employs has been taken into consideration. An organization may more effectively build long-term goals to improve its operations and concurrently respond with intelligence to events that occur as a result of putting real-time business intelligence (BI) into action inside the organization. Have examined how business intelligence affects small and medium sized businesses along with the benefits and problems associated with it in [10]. Utilizing information effectively is one of the most important success criteria for businesses. Within the scope of their research, they investigated the ways in which the use of BI had an effect on Saxony's SME sector. They took the findings of the study and, using cluster analysis, came up with four different types of small and medium-sized businesses (SMEs), each of which has its own set of advantages and difficulties when putting it into practice. [11], in their essay, demonstrate the significance of business intelligence as well as its increasing relevance. They have brought attention to the importance of business intelligence systems inside an organization, as well as the requirement to lessen the complexity of the operating environment and cut down on a number of expenditures, both of which will assist the firm in surviving the current climate of intense competition. Additionally, the architectural ideas behind the system are discussed in this article.have provided an explanation of what

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

machine learning is, as well as its ideas, methods, and applications, in [12]. They utilized the Sentiment140 dataset to compare the training time, prediction time, and accuracy of the prediction of the three machine learning methods that are employed the most frequently: Naive Bayes Classifier, Support Vector Machine (SVM), and Decision Tree. In their study paper, the authors covered a variety of topics, including the potential future uses of machine learning. Lee, Yong Jae Shin's (2020) research investigates the classifications of machine learning and outlines the three different applications of machine learning in business settings. In addition to this, it examines the accuracy and interpretability of the algorithms that are used in machine learning. This is because it is extremely crucial to select the appropriate algorithm for the job at hand. In addition to that, it covers the advancements made and difficulties encountered in the implementation of machine learning. [14], Presents a model of Machine Learning algorithms that, according to the datasets, may be utilized most effectively for Business Intelligence. The model was developed by. The BI softwares make use of a variety of algorithms in order to establish a connection between the numerous pieces of data and variables. The data scientists are becoming increasingly interested in the development of business intelligence software as a novel instrument for decision making. The authors of [15] have reviewed the contributions that Machine Learning has made to economics, as well as the forecasts that have been made regarding its future contributions. Several concerns have been voiced in relation to the utilization of machine learning in the resolution of policy issues, including concerns around fairness and the capacity to be manipulated. Their study article also includes an outline of the predictions made regarding the future implications on the nature of partnerships, research tools, and problems regarding machine learning.

III. BUSINESS INTELLIGENCE

In this day and age, when technology progress is so rapid, business intelligence is an extremely important factor in the decision-making process of a firm in regard to its future aspirations. The phrase "business intelligence" (BI) refers to the methodologies, techniques, and concepts that have a beneficial influence on the decisions made for a corporation by extending the support of fact-based systems. The transformation of raw and unrelated data into meaningful and comprehensively informative data is enabled by the architecture and technology. These insightful data help in the process of developing new strategies, enabling operational excellence, tactical insights, and firm decision making for the company's future features. In this day and age, as well as in the not too distant future, business intelligence (BI) is poised to assume a position of critical importance in virtually all types of commercial enterprises. Business Intelligence, often known as BI, is an absolute necessity for effective analytics and decision making in any and all types of enterprises across all market segments. Not only does it improve the efficiency and effectiveness of business organizations, but it also lowers costs and prevents losses. The term "business intelligence" (BI) refers to the process of predicting future market trends. In order to put into practice a business intelligence (BI) idea for a specific company that makes use of demand forecasting, one tool that is employed is machine learning, and technology is used as the other tool. The subfield of predictive analytics known as demand forecasting [18] has garnered a lot of attention in recent years. The practice of demand forecasting generally makes use of two primary evaluation strategies. The first approach is known as qualitative evaluation [17], whereas the second approach is known as quantitative assessment [17]. With the passage of time and the expansion of study, these techniques have been expanded into more categories, and additional approaches forecasting concepts and combinations have been developed. The estimation of the amount of a good or service that will be needed in the future, based on data from the present and the past as well as several factors of the market. This is what is meant by "demand forecasting." owing to the fact that every company must contend with an unknowable future and the fact that we are unable to predict future product demand. Therefore, by evaluating data from the past as well as data from the current market, we are able to estimate the future demand and produce those things that will be in higher demand in the not too distant future. As a direct result of this, we are able to create the necessary goods in advance in accordance with the demand of the market. In addition to the items that the firm needs to make, this will also identify the possible buyers that are interested in the company's manufacturing facilities [18]. In the long run, having accurate predictions might lead to increased profits for the firm. In other words, doing demand forecasting is a crucial component of running management planning in an efficient and successful manner. In developed nations where the industrially required level of demand is unknown, demand forecasting is advantageous to such countries as well. In this age of rapid technological advancement, having access to actionable business intelligence is essential for supporting firms in making decisions regarding their future operations. Corporate intelligence may be defined as the approaches, tactics, and concepts that have a positive impact on company choices by applying fact-based systems. This type of intelligence is utilized by corporations to improve their decision-making processes. Data that is unstructured and lacks information may be converted into data that is usable by using a framework and equipment that has comprehensive information. The crucial information that was described above

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

is helpful in the process of developing new strategies, achieving functional superiority, developing a calculated perspective, and making a solid decision for the future of the firm. In the here and now, as well as in the not too distant future, business intelligence is positioned to play an important role in nearly every sort of company. For the sake of effective analysis and decision-making, business intelligence is an essential component of any and all types of companies operating in any industry. Not only does it improve the efficiency and effectiveness of corporate organizations, but it also lowers expenditures and prevents a fall in business. This has a positive impact on customer loyalty and appeal, as well as an increase in revenue and a wide variety of other major benefits. The future patterns of the market are anticipated by BI. One of the implements that may be used in the process of developing a BI model for an organization based on demand forecasting is machine learning, and another one of them is automation. The subfield of predictive analytics known as demand forecasting has been more important throughout the course of recent history. When it comes to demand forecasting, generally speaking, there have been two basic evaluation approaches that have been used [19]. Evaluation may be broken down into two distinct categories: quantitative assessment and qualitative assessment. These methods have been extended into other categories as a result of developments in research, and new techniques for predicting ideas and combinations have been put forward as a result of these developments. A product or service's future demand may be estimated using both current and historical data, in addition to a number of different market parameters, through the process of demand forecasting.

IV. MACHINE LEARNING

In our technology age, business intelligence helps companies make future decisions. Corporate intelligence uses fact-based methods to improve business decisions. Through framework and mechanism, all-encompassing data becomes usable. The following crucial knowledge helps create inventive strategies, functional superiority, calculating perception, and a powerful organization's future choice. Business intelligence will be crucial in most organizations in the near future. All firms need business intelligence for analytics and decision-making. It boosts company efficiency and effectiveness, cuts costs, and prevents business decline. This helps retain and recruit clients, boost income, and more. BI predicts market trends. Machine learning and automation are used to create a demand forecasting BI model for a business [20].Predictive analytics has become popular for demand forecasting. Demand forecasting historically used two evaluation methods. Evaluations are quantitative and qualitative. Research has expanded these methodologies into other areas and introduced new concepts and combination forecasting methods. Demand forecasting estimates future product/service demand using current and historical data and market conditions. ML is done at this step. Machine Learning engine divides data into training and testing data. Training data normalized. ML is done at this step. Machine Learning engine divides data into training and testing data.Training data normalized. For machine learning algorithms to classify literature, data must be formatted. Text data lacks features. Thus, we require a procedure to extract text data characteristics. Consider each word as a feature and find a measure to determine if it is in a sentence [21]. Bag-of-words (BoW) model. In this situation, sentences are word bags. Documents are sentences, and the corpus is all sentences. Create a dictionary of all corpus terms to start a Bow model. Only word occurrences are collected at this level. We then transform each document to a vector of words. This model uses word frequency to train a classifier and assess "Relevance." TDM is the result. Understanding that a TDM is an aggregated number "hides" the raw information in the text is crucial. Weighting terms by IDF is a popular approach to "normalize" phrase frequencies (TF). The n-gram conversion model predicts the recurrence of a word based on its n–1 prior word.

A. Unsupervised Learning Technique

Data must be formatted before using machine learning algorithms to literary categorization. Text data lacks characteristics, unlike structured data. We need a procedure to extract features from text data. One option is to treat each word as a feature and develop a measure to determine if it's in a phrase [21]. The bag-of-words model is used for this. Each sentence is a bag of words here. The corpus is all sentences. The first stage in developing a BoW model is creating a dictionary of all corpus terms. At this moment, we merely record word occurrences. Next, we'll transform each document to a vector of words. Each word's frequency is utilized to train a classifier and establish its "Relevance" in this model. This yields the TDM. Understanding that a TDM is an aggregated number that "hides" the text's raw content is crucial. To "normalize" term frequencies (TF), weight a term by the Inverse of Document Frequency (IDF). Using its n–1 prior word, the n-gram conversion model forecasts a word's occurrence.

B. Supervised Learning Technique

It's a predictive model that's used for tasks that need predicting one value based on other values from the data set that's now accessible. During the supervised learning process, predefined labels will be utilized. It does so by selecting a label from a set, analyzing its parameters, and then applying that label on the object. During the process of supervised learning, we have access to a wide range of algorithms that we may use

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

to build models. These algorithms include K Nearest Neighbors, Naive Bayes, Decision Tree, ID3 algorithm, Random Forest Algorithm, Support Vector Machine, and Regression techniques, amongst others. This determines which method is the most suitable for making predictions, taking into account the given requirements, labels, parameters, and data set [23]. When there is a lack of confidence, algorithmic processes are utilized to construct a model that generates evidences that are based on predictions. In order to make accurate forecasts with this project, we use a method known as the "Random Forest Technique," which is a powerful algorithm that performs admirably with a broad variety of input parameters. In addition to this, it generates exact findings and also provides precise forecasts.

V. PROPOSED ALGORITHMS

Parameter Initialization: Maximum iteration count, upper limit and lower limit, population size, dimension count

Val_In: Input Variable {trans _range, node density, iterations, sd_ale, };

Target: Criteria {anchor_ratio};

Step1: Data Preprocessing and Data Cleaning

Step2: For each variable Input data,

Dofeature statistics

Step 3: For each instance step 2 target columns (anchor_ratio) and classify data using SVM, kNN algorithm, neural network

Step 4: Determine the accuracy level

Find confusion metrics

Step 5: Find Rank of instances

Step 6: Predict appropriate Class as

Class=1 Positive=Normal State

Else if (class =0)

Negative= Variable State end for

This experiment uses three different datasets as its foundation. The selected data sets are all publicly available and can be downloaded either from the UCI machine learning repository or from the public machine learning competition site "Kaggle," which frequently provides access to high-quality datasets for the purpose of experimentation. This was done to make it easier to reproduce and compare the results of different studies. A summary of the case studies and datasets that were utilized in this research can be seen in figure 1.

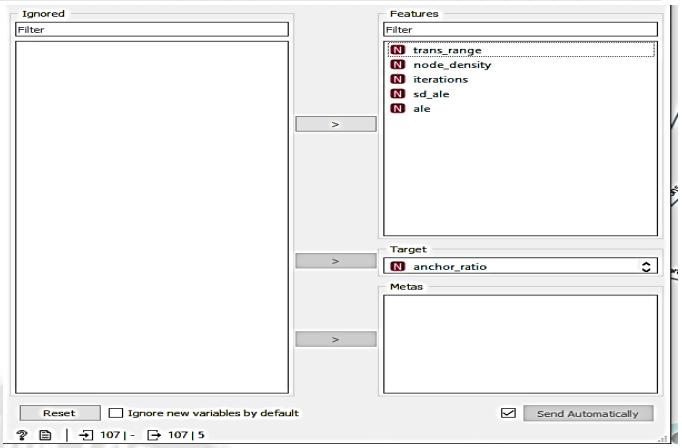

Figure 1. Overview of Dataset

In contrast to the use of aggregated data, seen in figure 2, Machine Learning makes use of individual data that include defining properties of each of the instances. 107 different cases may be utilized in this way to identify trends. Machine learning provides predictive analytics as an alternative to its traditional descriptive analytics foundation. In other words, it not only evaluates what has occurred and extrapolates general trends, but it also generates customized forecasts in which specifics and subtleties characterize future behavior. These predictions are made after an evaluation of what has occurred and an extrapolation of general patterns.

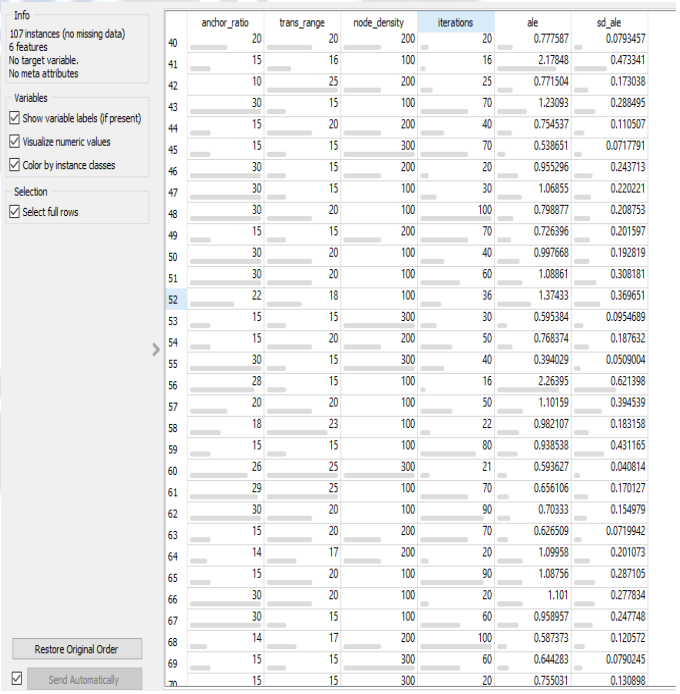

Figure 2. Dataset Instances and Features

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

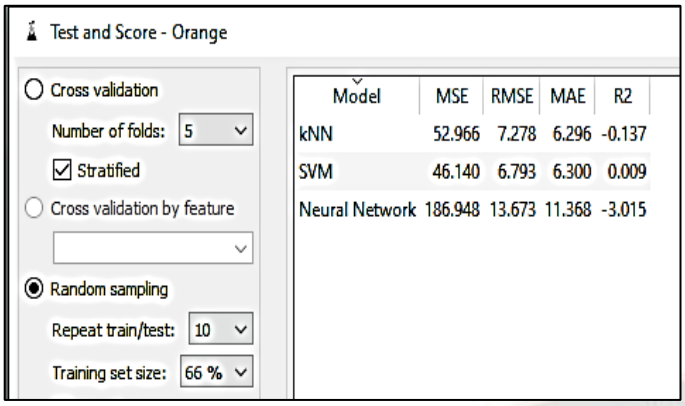

Figure 3. Test and Score with 10 (test) and 66% train

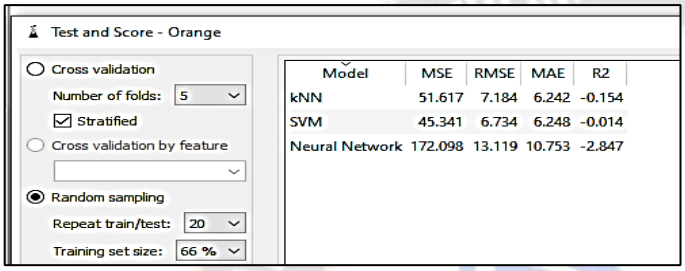

Figure 4. Test and Score with 20 (test) and 66% train

Figure 4 illustrates how accurate the models employed in the business diagnosis system's predictions were for each of the three goals. The findings indicate that every model developed for the purpose of prediction provided an accuracy rate that was greater than fifty percent. It is planned that in the future additional data will be obtained in order to enhance the percentage of accuracy that the system now possesses. Additionally, the significance of the accuracy, recall, and f-measure demonstrates that the diagnostic system can be relied upon for prediction despite the fact that it has room for improvement.

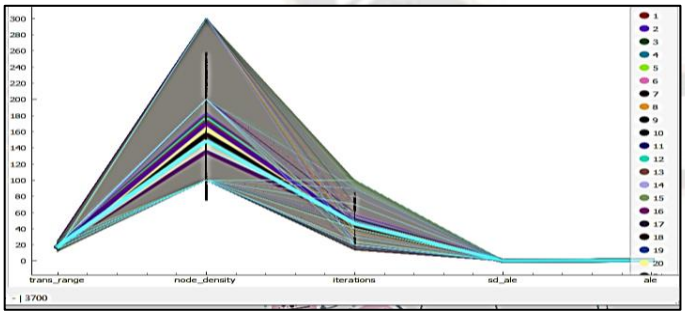

Figure 5. Instances impact with variables

Produce the result of the diagnosis system's forecast, which can be found in Figure 5; this will help you determine how successful your business skills will be. The user may additionally make additional inquiries into the prediction system in order to obtain additional information regarding the result that was anticipated. The user will be able to have a better grasp of the prediction result and utilize this information to increase the prospects for the success of their business since the system offers explanation by making it possible to access the rules that were used to develop the projected outcome.

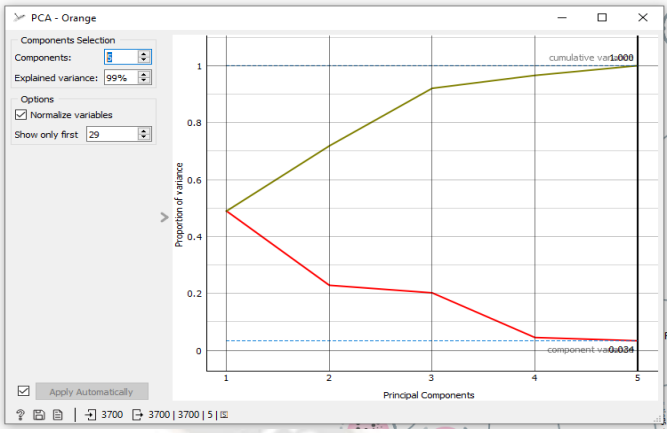

Figure. 6 PCA Evaluation

Figure 6 demonstrates the usability study that was performed on the business diagnostic system by utilizing PCA. The results of the evaluation show that out of the 1 and 0.034 that were utilized for the evaluation, 99% of the people who were evacuated agreed that the quality of the diagnosis is higher than average.

VI. DISCUSSION AND FUTURE SCOPE

In the context of suggested algorithms (figures 7, 8, and 9), state-of-the-art classifiers in the field of business predictions are investigated so that comparative analyses may be performed. The following figures offer a comparison of the results obtained by an AI-based framework with those obtained by some of the most successful traditional classifiers, such as SVM, kNN, and neural networks. The suggested methods have an accuracy of 95%, which is significantly higher than the accuracy of the previous classifiers. However, placing one's only emphasis on the precision of the suggested framework may result in erroneous conclusions. When we take into account additional characteristics, such as the sensitivity of the classifier, which informs us the hit rate or the rate of true positives, we see that the prospects are pretty encouraging. In terms of specificity, also known as the true negative rate, and F measure, random forest fares much better than the suggested ensemble in terms of classification accuracy. It demonstrates that random forest is more effective than other methods in identifying situations of real negativity. As a consequence of this, the F measure of the SVM is only marginally superior to the other constructed ensemble. However, placing too much emphasis on the true negative and the F measure might lead to incorrect conclusions. Due to the fact that the data are unbalanced, MCC and AUC parameters will also be taken into consideration. When compared with the other traditional approaches, the area under the curve (AUC)

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

for this method, which is 0.97, has seen a considerable increase, as indicated in the findings presented in Table 1. The value of the AUC that is generated by the suggested technique is also observable to be fairly near to the optimal value of one, which is the best value. It indicates that the framework that was suggested worked flawlessly in cutting down the amount of biasing that the data experienced. The prediction method has been selected as the candidate for the suggested prediction algorithms model for the business decision support system since it performs better than other strategies. The purpose of developing the test cases is to validate or invalidate the fraudulent firm predictor for the company. Numerous test scenarios are carried out, and the ones that are unsuccessful are worked on once again. Cases that have successfully passed the tests are listed in Table 1.

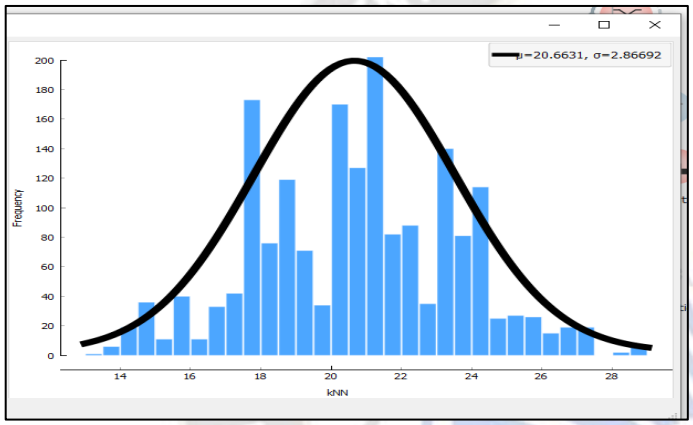

Figure 6. kNN Evaluation (between 20.6631, 2.86692)

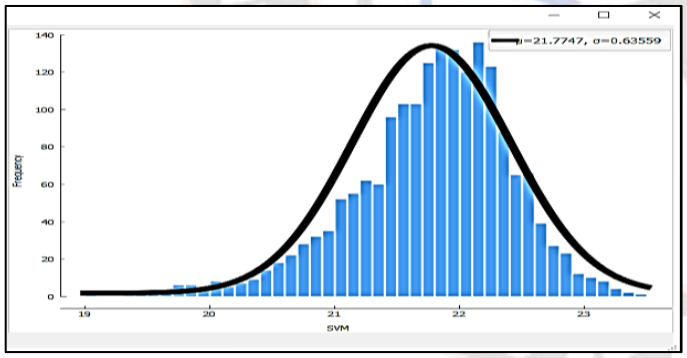

Figure 7. SVM Evaluation (between 21.7747, 0.63559)

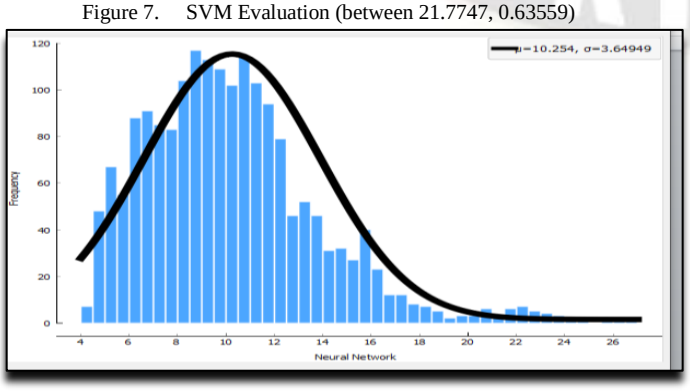

Figure 8. Neural Network Evaluation (between 10.254, 3.64949)

Table 1: Comparative Valuation

Metric	Ensemble	SVM	Neural	kNN	Proposed Algorithm
MAE	0.94	0.35	0.56	0.57	0.93
RMSE	0.896	0.89	0.58	0.43	0.23
AUC	0.96	0.45	0.68	0.82	0.42
F	0.78	0.49	0.61	0.56	0.96
Sensitivity	0.91	0.78	0.37	0.577	0.42
MCC	0.86	0.64	0.72	0.83	0.26

In the course of this research, an efficient algorithm for identifying churned vs non-churned clients in the commercial sector was developed. The model's goal is to reduce the amount of computing complexity required while also improving churn detection. A novel strategy for picking feature subsets from pre-processed customer data is incorporated into the algorithm that has been suggested. In addition, the machine learning approach is utilized in the telecommunications sector for the purpose of churner categorisation. In this context, the application of the algorithm for MF selection significantly improves overall prediction performance. The incorporation of the algorithms led to improved predicted outcomes compared to those obtained using the traditional methods. A comprehensive simulation study is carried out on the benchmark dataset in order to ascertain whether or not the model is accurate. The findings of the simulation suggested an improvement in the algorithms' capacity for prediction and presentation. In comparison to the other methods used in this investigation, the approaches exhibited lower levels of performance and, accordingly, greater average best values for algorithmic solutions. Figures 7, 8, and 9 demonstrate that the AICCP-TBM approach outperformed the other two procedures, achieving the highest level of accuracy across all three datasets that were investigated. The results of the study show that the proposed algorithms performed better than the most current models that are considered to be state-of-the-art in terms of performance ratios. In the near future, the future paradigm will be able to be expanded to a big data platform, which will enable it to manage the consistent production of large volumes of data by real-time organizations. The analysis of large amounts of data helps firms attract new customers. It's a really straightforward equation: satisfied business patrons Equals Big Data. Artificial intelligence (AI), data science, and deep learning are commonly mentioned in conjunction with big data. Big Data will be very necessary for enhancing the existing models as well as the prospective study. Big data is an umbrella term that encompasses all methods and programs used to manage very large data quantities. The analysis of Big Data can help companies determine which of their clients are the most

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

profitable. It also has the potential to assist in the production of new things. The use of big data in marketing allows for the collection of real-time cloud data. The examination of big data is beneficial since it helps save both time and money.

REFERENCES

[1] U. Paschen, C. Pitt, and J. Kietzmann, "Artificial intelligence: building blocks and an innovation typology," Business Horizons, vol. 63, no. 2, pp. 147–155, 2020.
View at: Publisher Site | Google Scholar

[2] C. Ramalingam and P. Mohan, "An efficient applications cloud interoperability framework using I-anfis," Symmetry, vol. 13, no. 2, p. 268, 2021.
View at: Publisher Site | Google Scholar

[3] S. Neelakandan, M. A. Berlin, S. Tripathi, V. B. Devi, I. Bhardwaj, and N. Arulkumar, "IoT-based traffic prediction and traffic signal control system for smart city," Soft Computing, vol. 25, no. 18, pp. 12241–12248, 2021, https://doi.org/10.1007/s00500-021-05896-x.
View at: Google Scholar

[4] A. Rodan, A. Fayyoumi, H. Faris, J. Alsakran, and O. Al-Kadi, "Negative correlation learning for customer churn prediction: a comparison study," The Scientific World Journal, vol. 2015, 2015.
View at: Google Scholar

[5] Falak Khursheed, Mohammad Suaib, "A Survey on Importance of Requirement Traceability in Software Engineering" in International Journal of Engineering and Innovative Technology (IJEIT)Volume 5, Issue 4, pp 109-112, ISSN: 2277-3754 October 2015.
View at: Google Scholar

[6] A. Keramati and S. M. S. Ardabili, "Churn analysis for an Iranian mobile operator," Telecommunications Policy, vol. 35, no. 4, pp. 344–356, 2011.
View at: Publisher Site | Google Scholar

[7] PratibhaTripathi, Mohammad Suaib, "Security Issues On Cloud Computing" in International Journal of Engineering Technology, Management and Applied Sciences Volume 2 Issue 6, pp 1-8 ISSN 2349-4476 November 2014.
View at: Publisher Site | Google Scholar

[8] A. K. Ahmad, A. Jafar, and K. Aljoumaa, "Customer churn prediction in telecom using machine learning in big data platform," Journal of Big Data, vol. 6, no. 1, pp. 28–24, 2019.
View at: Publisher Site | Google Scholar

[9] D. Paulraj, "An automated exploring and learning model for data prediction using balanced CA-SVM," Journal of Ambient Intelligence and Humanized Computing, vol. 12, no. 5, 2020.
View at: Google Scholar

[10] C. Saravanakumar, R. Priscilla, B. Prabha, A. Kavitha, M. Prakash, and C. Arun, "An efficient on-demand virtual machine migration in cloud using common deployment model," Computer Systems Science and Engineering, vol. 42, no. 1, pp. 245–256, 2022.
View at: Publisher Site | Google Scholar

[11] H. Jain, A. Khunteta, and S. Srivastava, "Churn prediction in telecommunication using logistic regression and logit boost," Procedia Computer Science, vol. 167, pp. 101–112, 2020.
View at: Publisher Site | Google Scholar

[12] T. Xu, Y. Ma, and K. Kim, "Telecom churn prediction system based on ensemble learning using feature grouping," Applied Sciences, vol. 11, no. 11, p. 4742, 2021.
View at: Publisher Site | Google Scholar
View at: Publisher Site | Google Scholar

[13] Mohammad Suaib, Dr. M. Akheela Khanum, "Web Page Personalization Techniques in the Purview of Page Ranking Methodology using Artificial Intelligence" in International Journal of Computer and Information Technology, Volume 8, Issue 6, ISSN: 2279-0764, November 2019.

[14] Kumar Pandey, A. . ., Arivazhagan , D. ., Rane , S. ., M. Yadav , S. ., Nabilal , K. V. ., & Oberoi , A. . (2023). A Novel Digital Mark CP-ABE Access Control Scheme for Public Secure Efficient Cloud Storage Technique. International Journal of Intelligent Systems and Applications in Engineering, 11(3s), 100–103. Retrieved from https://ijisae.org/index.php/IJISAE/article/view/2536

[15] D. Rb, in Proceedings of the International Conference on Innovative Computing & Communication (ICICC), Delhi, India, April 2021.

[16] N. I. Mohammad, S. A. Ismail, M. N. Kama, O. M. Yusop, and A. Azmi, "Customer churn prediction in telecommunication industry using machine learning classifiers," in Proceedings of the 3rd International Conference on Vision, Image and Signal Processing, pp. 1–7, Columbia, Canada, August 2019.
View at: Google Scholar

[17] Siddiqui, F., & Mohammad Suaib. (2023). Machine Learning Approaches for Fake User and Spammer Detection: A Comprehensive Review and Future Perspectives. International Journal of Engineering and Management Research, 13(3), 23–46. https://doi.org/10.31033/ijemr.13.3.4

[18] D. Manzano-Machob, ''The architecture of a churn prediction system based on stream mining,'' in Proc. Artif. Intell. Res. Develop., 16th Int. Conf. Catalan Assoc. Artif. Intell., vol. 256, Oct. 2013, p. 157.

[19] Reddy, A. ., & Waheeb , M. Q. . (2022). Enhanced Pre-Processing Based Cardiac Valve Block Detection Using Deep Learning Architectures. Research Journal of Computer Systems and Engineering, 3(1), 84–89. Retrieved from https://technicaljournals.org/RJCSE/index.php/journal/article/view/47

[20] T. Kotler, Marketing Management: Analysis, Planning, Implementation and Control. London, U.K.: Prentice-Hall, 1994.

[21] F. F. Reichheld and W. E. Sasser, Jr., ''Zero defections: Quality comes to services,'' Harvard Bus. Rev., vol. 68, no. 5, pp. 105–111, 1990.

[22] J. Hadden, A. Tiwari, R. Roy, and D. Ruta, ''Computer assisted customer churn management: State-of-the-art and future trends,'' Comput. Oper. Res., vol. 34, no. 10, pp. 2902–2917, Oct. 2007.

[23] H.-S. Kim and C.-H. Yoon, ''Determinants of subscriber churn and customer loyalty in the Korean mobile telephony market,'' Telecommun. Policy, vol. 28, nos. 9–10, pp. 751–765, Nov. 2004.

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8
DOI: https://doi.org/10.17762/ijritcc.v11i8.7925
***Article Received**: 01 May 2023 **Revised**: 24 June 2023 **Accepted**: 23 July 2023*

[24] Y. Huang and T. Kechadi, ‘‘An effective hybrid learning system for telecommunication churn prediction,’’ Expert Syst. Appl., vol. 40, no. 14, pp. 5635–5647, Oct. 2013.

[25] J. Vijaya and E. Sivasankar, “Computing efficient features using rough set theory combined with ensemble classification techniques to improve the customer churn prediction in telecommunication sector,” Computing, vol. 100, no. 8, pp. 839–860, 2018.

[26] Kamalraj, S. Neelakandan, M. Ranjith Kumar, V. Chandra ShekharRao, R. Anand, and H. Singh, “Interpretable filter based convolutional neural network (IF-CNN) for glucose prediction and classification using PD-SS algorithm,” Measurement, vol. 183, Article ID 109804, 2021.

[27] Hussain Bukhari, S. N. . (2021). Data Mining in Product Cycle Prediction of Company Mergers . International Journal of New Practices in Management and Engineering, 10(03), 01–05. https://doi.org/10.17762/ijnpme.v10i03.127

[28] R. Sharma and P. Kumar Panigrahi, “A neural network based approach for predicting customer churn in cellular network services,” International Journal of Computer Application, vol. 27, no. 11, pp. 26–31, 2011.

[29] A. Qureshi, A. S. Rehman, A. M. Qamar, and A. Kamal, “Telecommunication subscribers’ churn prediction model using machine learning,” in Proceedings of the 8th International Conference on Digital Information Management (ICDIM ’13), pp. 131–136, Islamabad, Pakistan, September 2013.