Develop Machine Learning Models to Predict Customer Lifetime Value for Banking Customers, Helping Banks Optimize Services

Archana Todupunuri *[ID]

Email Correspondence*: archana.todupunuri@gmail.com

[1] Fidelity Information Services, USA

Abstract:

Machine learning algorithms are useful in obtaining suitable data related to customer lifetime value for the banking professionals. The banking officials utilise the Customer lifetime value for fostering suitable business strategies to enhance customer satisfaction in this competitive market. This present study includes knowledge regarding machine learning model inclusion to predict customer lifetime values in taking services as well as analysing customer motivation for a banking sector. The inclusion of ML is also effective in handling customer insight in managing business profitability in managing overall business operational activity maintenance. This research has summarised the importance of machine learning models in predicting CLV to Mint and business performance of banks.

Keywords: Machine Learning, Data analytics, Customer Lifetime Value, Banks Services.

1. Background

The present market is highly competitive and very dynamic in nature due to the presence of a large number of service providers in the context of banking industry. According to [1], prediction of customer churn using machine learning models is quite helpful for enhanced customer segmentation and targeting also. The determination of customer lifetime value using machine learning models can help the banks improve their services through providing improved personalised offers for the consumers [2]. It has been observed that 44% of financial services companies used machine learning applications regularly and they purchase machine learning embedded applications for workplace purposes [3]. Apart from that, the machine learning models are helpful in assessing risks and proper credit scoring by using the data about consumer behaviour patterns [4]. The customers are considered as the primary assets for the banking sector and banking organisations are responsible for implementing suitable policies to prolong the lifetime of consumers [5]. CLV modelling has been utilised in the banking sector with the help of four machine learning algorithms such as linear regression, random forest, decision tree and support vector machine (SVM) for finding out the expected business estimate of a consumer [6]. The SVMs are employed by banking officials for detecting anomalies in consumer transaction patterns and it is helpful in obtaining customer integrity and financial stability for the consumer banks [7]. Hence, it can be inferred that machine learning algorithms are highly helpful in predicting business estimation considering the consumers and in offering personalised services to improve business transactions.

2. Rationale

The specific research topic is quite important in the present era as it is related to financial matter such as strategies of banking organisations for improved customer experience. Apart from that, this study is also

---

[*]Fidelity Information Services, USA.

important in understanding the effectiveness of customer lifetime value in the aspect of decision making while fostering long-term strategic goals by the banking organisations.

3. Aim

The aim of this research study is to explore the ways of developing machine learning models for predicting Customer Lifetime Value for banking customers to assist the banks in optimising services

Research Objectives

- To evaluate the impacts of machine learning models in predicting Customer Lifetime Value for banking customers.
- To assess the benefits of Customer Lifetime Value prediction through machine learning models for banks in optimising services
- To investigate current challenges in predicting customer lifetime value of customers using machine learning models and in optimising banking services
- To recommend suitable strategies for successful utilisation of machine learning models in predicting customer lifetime value of customers and optimising banking services

Research questions

RQ1: What is the impact of predicting customer lifetime value of customers using machine learning models in banks?

RQ2: What are the advantages of using machine learning models in predicting customer lifetime value and in optimising baking services?

RQ3: What are challenges faced by banks in determining customer lifetime value using machine learning models?

RQ4: What are suitable strategies to mitigate the issues with customer lifetime value prediction using machine learning models and optimise the banking services?

Scope of the paper

The scope of this paper is to describe the efficacy of machine learning models in predicting customer lifetime value of the banking consumers in terms of optimising banking operations. The paper also illustrates the reason behind the use of machine learning algorithms for determining consumer business estimates and also in offering the best quality services to the consumers for business improvements. This study entails different kinds of machine learning models used in predicting customer churns for improving efficiency of banking operations.

4. Literature Review

Issues faced by banking organisations in using machine learning models for predicting customer lifetime value

The banking officials have been facing issues with the complexity of different machine learning models in terms of using the outcomes for predicting customer lifetime value. It has been observed that ML algorithms largely depend on training data that helps the ML framework to achieve specific goals [12]. It is quite difficult for the banking officials to manage such complex data for their business operations. In addition to that, lack of proper data is considered a big issue in this context. The incomplete information about user

transactions and behavioural patterns leads towards malfunctions of the machine learning algorithms in the aspect of predicting correct customer lifetime value [13]. It has also been associated with cyber risks such as the attackers can mislead data through corrupting the particular machine learning model used for detection of consumer churn.

Recommended strategies for mitigating issues related to machine learning algorithm outcomes in prediction of customer lifetime value

Banking professionals need to arrange good quality data for correct prediction outcomes about customer lifetime value using machine learning algorithms [14]. The correct information about transaction frequency of the customers can help in this regard to generate suitable insights as the outcomes of machine learning models. It can help the banking officials in fostering best quality business strategies to establish long-term relationships with potential consumers.

Theoretical Perspectives
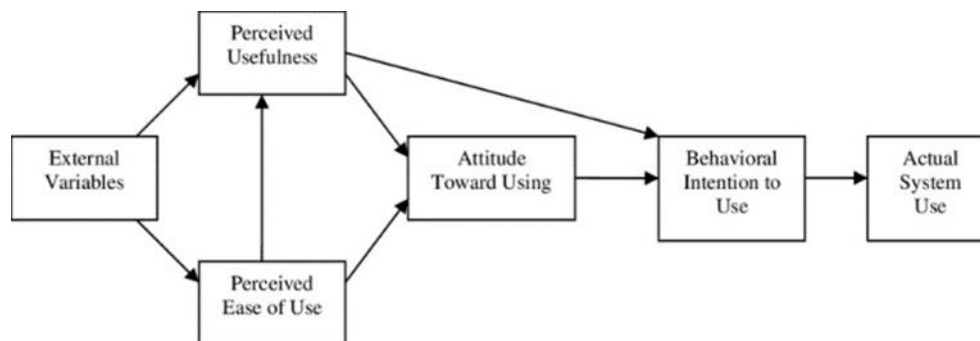
Technology Acceptance Model (TAM)

Figure-1 Technology Acceptance Model

TAM has been considered as the suitable information theory that suggests the ways individuals can utilise or implement technological concepts for business improvement. This theory encompasses perceived usefulness along with perceived ease of use 'to modify individual intention about acceptance of technological usage [15]. According to the concept of this theory, TAM is relevant with identifying the acceptance factors. For instance, banking officials can effectively recognise the loopholes in their marketing strategy by using the outcomes of machine learning algorithms. The behavioural patterns of consumers are evaluated in this aspect by predicting customer lifetime value to make suitable policies to involve the consumers in banking business operations to obtain significant return from business operations. The consumer attitude has been prioritised in this scenario to make suitable business strategies using the machine learning models. Therefore, it can be stated that the banking officials can achieve greater results by implementing informed decisions with the help of machine learning algorithms in optimisation of banking services.

5. Methodology

The methodology section infers about necessary procedures for the researchers to design suitable methods for conducting research study. Research philosophy, strategy, approach, data collection process and data analysis methods are required to design properly to accomplish the research study with suitable outcomes.

Interpretivism philosophy has referred to the guidance about research procedures such as data collection process and data analysis process [16]. Interpretivism research philosophy has been utilised in this research study to accumulate suitable information about banking operations regarding utilisation of machine learning algorithms and prediction of customer lifetime value. The inductive approach has been incorporated in this research study to provide a description about the cause-and-effect phenomenon behind acceptance of machine learning model outcomes for making effective strategies to attract consumers for banks [17].

Empirical data about the effectiveness of machine learning algorithms and monitoring of Customer lifetime value has been collected for this study. Secondary data is easily available and cheaper than primary research data [18]. The specific accumulated data has been analysed to obtain information about impact of customer lifetime value monitoring through machine learning model on business operations of banking organisations.

Secondary qualitative data collection process has been maintained in this research study and _Google Scholar has been considered as the main database in this aspect. In addition to that, thematic analysis has been integrated in this research study to discuss meaningful conclusions on the basis of obtained secondary data. The themes have been generated using research objectives in this research study, while secondary data collection along with the thematic analysis process have been utilised for addressing the research questions.

6. Impact and Implication

Theme 1: Benefits of development of machine learning algorithms to obtain customer lifetime value data

Machine learning algorithms are useful in predicting consumer churns for the banking organisations and on the basis of these outcomes of machine learning applications, the banking officials can modify their marketing strategies. Banking professionals can obtain proper information about consumer behavioural patterns in terms of customer lifetime value with less effort in this aspect. It basically helps them in making suitable business strategies for the banks to obtain greater profitability through involving more consumers [19]. The banks are also enabled to make correct financial forecasts with the help of machine learning applications. In addition to that, the specific machine learning algorithms are also helpful in detecting frauds related to customers transactions. Hence, it can be stated that use of machine learning applications is beneficial for the banking professionals in various dimensions such as proper financial forecast, risk assessment and suitable insights about potential consumers also.

Theme 2: Advantages of prediction of customer lifetime value for banking strategies

The prediction of customer lifetime value plays a crucial role in making necessary strategies for the banking organisations. The banks can identify the areas that need immediate improvement to fulfil the consumer demand. Apart from that, the banks are also enabled to make informed decisions in this regard through understanding the actual demand of the consumers [20]. The effective business strategies such as hassle-free KYC update, cashback as well as discount offers are highly significant for the banks in gaining competitive advantages from the global market.

Theme 3: Challenges for developing machine learning models in predicting customer lifetime value in banking sector services

Machine learning based innovation is effective in managing online working activity, and service inclusions that helps to manage overall business services. Challenges in predicting CLV have been noticed in using ML for improper data quality and integration maintenance [21]. The banking sector includes a complex system to store consumer data, however it contains difficulty to manage a comprehensive view of consumer behaviour and inconsistency in data sets contains challenges in using machine learning.

Issues regarding model complicity and improper data management also contain barriers in handling customer trust that contains impact in managing CLV. Dynamic consumer behaviour contains negative impact in including accurate CLV values that contains negative impact to manage appropriate calculation in using ML [22]. It contains issues in managing appropriate predictions about customer lifetime value and related working activities of the banking sector in maintaining customer services using ML. On the other hand, customer preferences are changing rapidly along with influencing different factors such as products and technological advancement and others [23]. It contains struggles for the banking sector in managing appropriate calculations about CLV to take further decisions. Improper calculation of CLV contains barriers in managing overall prediction of customer attention and related banking industry business service management to satisfy their consumers in the operating market.

Theme 4: Strategic implementation of ML for optimizing banking services and predicting customer lifecycle values

Machine learning processes allow banks to monitor consumer behaviour as well as identifying anonymous activity in real time that reduces probability of fraud from banking operations. In terms of CLV calculation in using ML, quality assurance process implementation is efficient in handling robust data management systems [24]. Inclusion of quality analytics of information helps to manage regular checking of data and information that include accurate data management and further calculation handling related to CLV values for the banking sector. This data quality monitoring strategy is also efficient in managing overall banking decisions regarding customer engagement handling that maintain overall innovation implication and business development. Encouraging collaboration between team members and customers is effective in understanding customer motivation related to their purchasing decisions from an organisation [25]. Development of this collaboration also needs based understanding that further helps to manage overall banking services and facility management to develop business processes in the operating market. On the other hand, banks should focus on interpretable models such as data analytics based on machine learning to get predictive output inclusion that helps to manage overall visualization business transparency [26]. This strategy includes insight into enhancing consumer trust and facilitate informed decisions regarding service taking processes from the banking sector that develop CLV values, and business growth opportunities in the market.

7. Conclusion

This present study has summarised knowledge regarding machine learning model inclusion to predict customer lifetime values in taking services as well as analysing customer motivation for a banking sector. Machine learning models help banks to include transformative approaches that enhance overall service optimization as well as consumer engagement. Along with leveraging Diverse information sources, it is possible to address behavioural patterns of customers within the banking sector in creating robust predictive models using machine learning. The Inclusion of this ML utilisation feature is also effective to handle customer insight in managing business profitability and high value maintenance for customers in managing overall business operational activity maintenance. However, challenges in predicting CLV have been noticed for complex value storing processes within the banking sector in managing further customer

service optimization process handling. Since, prioritising ML utilisation helps to manage more appropriate actionable insight in handling strategic objectives of the banking sector. It can be concluded that CLV prediction empowers the banks for enhanced consumer experience along with optimising long-term profitability that increase overall business landscape.

8. Future Direction

The future would have the opportunity to emphasise business directions to include predictive analytics using other technologies rather than machine learning in handling overall information analysis and CLV handling. Future research would have the possibility to conduct predictive models to handle customer lifecycle value within the banking sector along with managing banking service optimization. Lastly, the importance of innovation and data analytics within a country can be conducted in gaining more efficient knowledge about CLV on banking.

9. References

[1] Rahman, M. and Kumar, V., 2020, November. Machine learning based customer churn prediction in banking. In 2020 4th international conference on electronics, communication and aerospace technology (ICECA) (pp. 1196- 1201). IEEE.

[2] Miklosik, A. and Evans, N., 2020. Impact of big data and machine learning on digital transformation in marketing: A literature review. Ieee Access, 8, pp.101284-101292.

[3] Neha Yadav,Vivek Singh, Probabilistic Modeling of Workload Patterns for Capacity Planning in Data Center Environments (2022). International Journal of Business Management and Visuals, ISSN: 3006-2705, 5(1), 42-48. https://ijbmv.com/index.php/home/article/view/73

[4] Statista, (2024). Primary strategy of financial services companies for use of artificial intelligence (AI) and machine learning (ML) in 1st quarter 2023. https://www.statista.com/statistics/1446123/financial-services-strategy-for-use-of-ai-and-ml/

[5] Alkhatib, K. and Abualigah, S., 2020, April. Predictive Model for Cutting Customers Migration from banks: Based on machine learning classification algorithms. In 2020 11th International Conference on Information and Communication Systems (ICICS) (pp. 303-307). IEEE.

[6] Manzoor, A., M. Atif Qureshi, Kidney, E. and Longo, L. (2024). A Review of Machine Learning Methods for Customer Churn Prediction and Recommendations for Business Practitioners. IEEE access, pp.1–1.

[7] H. Kailash, K. Kanwar, S. Sonia and R. Kant, "Machine Learning Algorithms for Predicting Customers' Lifetime Value: A Systematic Evaluation," 2023 3rd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), Greater Noida, India, 2023, pp. 538-541.

[8] Bharath Kumar Nagaraj, Nanthini Kempaiyana, Tamilarasi Angamuthua, Sivabalaselvamani Dhandapania, —Hybrid CNN Architecture from Predefined Models for Classification of Epileptic Seizure Phases‖, Manuscript Draft, Springer, 22, 2023.

[9] Djurisic, V., Kascelan, L., Rogic, S. and Melovic, B., 2020. Bank CRM optimization using predictive classification based on the support vector machine method. Applied Artificial Intelligence, 34(12), pp.941-955.

[10] AboElHamd, E., Shamma, H.M. and Saleh, M., 2020. Dynamic programming models for maximizing customer lifetime value: an overview. In Intelligent Systems and Applications: Proceedings of the 2019 Intelligent Systems Conference (IntelliSys) Volume 1 (pp. 419-445). Springer International Publishing.

[11] Gadgil, K., Gill, S.S. and Abdelmoniem, A.M., 2023. A meta-learning based stacked regression approach for customer lifetime value prediction. Journal of Economy and Technology, 1, pp.197-207.

[12] Firmansyah, E.B., Machado, M.R. and Moreira, J.L.R., 2024. How can Artificial Intelligence (AI) be used to manage Customer Lifetime Value (CLV) A systematic literature review. International Journal of Information Management Data Insights, 4(2), p.100279.

[13] Shah, Hitali. "Ripple Routing Protocol (RPL) for routing in Internet of Things." International Journal of Research Radicals in Multidisciplinary Fields, ISSN: 2960-043X 1, no. 2 (2022): 105-111.

[14] Priya, G.J. and Saradha, S., 2021, February. Fraud detection and prevention using machine learning algorithms: a review. In 2021 7th International Conference on Electrical Energy Systems (ICEES) (pp. 564-568). IEEE.

[15] Ridwan, M.A., Radzi, N.A.M., Abdullah, F. and Jalil, Y.E., 2021. Applications of machine learning in networking: a survey of current issues and future challenges. IEEE access, 9, pp.52523-52556.

[16] Sobreiro, P., Martinho, D.D.S., Alonso, J.G. and Berrocal, J., 2022. A slr on customer dropout prediction. IEEE Access, 10, pp.14529-14547.

[17] Gadgil, K., Gill, S.S. and Abdelmoniem, A.M., 2023. A meta-learning based stacked regression approach for customer lifetime value prediction. Journal of Economy and Technology, 1, pp.197-207.

[18] Kalayou, M.H., Endehabtu, B.F. and Tilahun, B., (2020). The applicability of the modified technology acceptance model (TAM) on the sustainable adoption of eHealth systems in resource-limited settings. Journal of multidisciplinary healthcare, pp.1827-1837.

[19] Alharahsheh, H.H. and Pius, A., (2020). A review of key paradigms: Positivism VS interpretivism. Global Academic Journal of Humanities and Social Sciences, 2(3), pp.39-43.

[20] Okoli, C., (2023). Inductive, abductive and deductive theorising. International Journal of Management Concepts and Philosophy, 16(3), pp.302-316.

[21] Taherdoost, H., (2021). Data collection methods and tools for research; a step-by-step guide to choose data collection technique for academic and business research projects. International Journal of Academic Research in Management (IJARM), 10(1), pp.10-38.

[22] Asadi Ejgerdi, N. and Kazerooni, M., 2024. A stacked ensemble learning method for customer lifetime value prediction. Kybernetes, 53(7), pp.2342-2360.

[23] Palak Raina, Hitali Shah. (2017). A New Transmission Scheme for MIMO - OFDM using V Blast Architecture.Eduzone: International Peer Reviewed/Refereed Multidisciplinary Journal, 6(1), 31–38. Retrieved from https://www.eduzonejournal.com/index.php/eiprmj/article/view/628

[24] Raina, Palak, and Hitali Shah."Security in Networks." International Journal of Business Management and Visuals, ISSN: 3006-2705 1.2 (2018): 30-48.

[25] Mosaddegh, A., Albadvi, A., Sepehri, M.M. and Teimourpour, B., 2021. Dynamics of customer segments: A predictor of customer lifetime value. Expert Systems with Applications, 172, p.114606.

[26] Suh, Y., 2023. Exploring the Impact of Data Quality on Business Performance in CRM Systems for Home Appliance Business. IEEE Access.

[27] Arefin, S., Parvez, R., Ahmed, T., Ahsan, M., Sumaiya, F., Jahin, F. and Hasan, M., 2024, May. Retail Industry Analytics: Unraveling Consumer Behavior through RFM Segmentation and Machine Learning. In 2024 IEEE International Conference on Electro Information Technology (eIT) (pp. 545-551). IEEE.

[28] Jia, Y., Wang, Y., Yang, Y., Huang, J. and Xiao, J., 2023. Complex-Valued GMDH-Based Data Characteristic-Driven Adaptive Decision Support System for Customer Classification. IEEE Transactions on Systems, Man, and Cybernetics: Systems.

[29] Hitali Shah. Millimeter-Wave Mobile Communication for 5G‖. International Journal of Transcontinental Discoveries, ISSN: 3006-628X, vol. 5, no. 1, July 2018, pp. 68-74, https://internationaljournals.org/index.php/ijtd/article/view/102.

[30] Kumar, A., Singh, K.U., Kumar, G., Choudhury, T. and Kotecha, K., 2023, October. Customer Lifetime Value Prediction: Using Machine Learning to Forecast CLV and Enhance Customer Relationship Management. In 2023 7th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT) (pp. 1-7). IEEE.

[31] Olan, F., Suklan, J., Arakpogun, E.O. and Robson, A., 2021. Advancing consumer behavior: The role of artificial intelligence technologies and knowledge sharing. IEEE Transactions on Engineering Management.

[32] Zhang, Z., Al Hamadi, H., Damiani, E., Yeun, C.Y. and Taher, F., 2022. Explainable artificial intelligence applications in cyber security: State-of-the-art research. IEEE Access, 10, pp.93104-93139.

10.Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

11.Funding

No external funding was received to support or conduct this study.