iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** III **Month of publication:** March 2023

DOI: https://doi.org/10.22214/ijraset.2023.49585

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue III Mar 2023- Available at www.ijraset.com

Application of Machine Learning Algorithms in Online Marketing

Adarsh Vardhan Srivastava[1], Mr. Lokendra Singh Umrao[2], Mr. Dilip Kumar[3]
[1, 2, 3]*Institute of Engineering and Technology, Dr. Ram Manohar Lohia Avadh University, Ayodhya*

Abstract: ***AI has been able to advance beyond simply carrying out the duties that were put into it thanks to machine learning algorithms. Prior to ML becoming widely used, AI applications were exclusively employed in corporate and enterprise settings to automate simple operations. This covered activities like simple rule-based classification or clever automation. This meant that the domain for which AI algorithms could be used was limited. With machine learning, however, computers were able to go beyond carrying out their programming and started growing with each repetition. Machine learning is used by marketers to identify trends in website user behavior. This enables them to immediately optimize advertising offers and forecast users' future behavior. This paper highlights the application of machine learning in online marketing.***
Keywords: Machine Learning; Artificial Intelligence; Online Marketing; Algorithms

I. INTRODUCTION

Artificial intelligence is transforming several industries. Brands operate in a variety of sectors, from retail and banking to technology and artificial intelligence. Artificial intelligence is now being used by brands to interact with their audience. Incorporating conversational advertising into their everyday life is an experiment [1-5]. As machine learning advances, AI is opening up the possibility of hyper-personalization through customized product recommendations, intelligent content recommendations, and ideas for customer help. The way digital marketers connect firms to their audiences is changing as a result.

Finding the right customers and reaching them with the correct message at the right time is the key to marketing success. This can sometimes be done by conducting market research to learn what people are concerned about from a cultural and societal perspective, as well as by looking at macro-level information about the target market, such as age group, income, and education level. If you want your audience to read your message, it is essential to separate the information and organize it into something you can give to them. Artificial intelligence can help in this situation [6-11]. The use of artificial intelligence in content distribution is growing. It helps by identifying topics that are likely to garner interest and presenting content with extreme focus in those areas.

In customer relationship management, AI is crucial. Through the numerous communication channels that customers utilize, businesses can gain real-time insights into how they engage. Users can automatically assign problems to the appropriate support group before choosing the best course of action using statistical models. Through automated procedures, chatbots may provide expertise, which is a very efficient way to expand the clientele. Analysed consumer data to discover which prospects have the greatest chance of becoming clients, and then help businesses foster these alliances.

Since artificial intelligence (AI) has the capacity to build simulation models and modify buying processes through recommendations and predictions provided by machine learning technology, many brands have used AI to communicate with their target market. For instance, Amazon uses AI to make product recommendations based on past purchases, page hits, and queries. AI is being applied more and more in the world of digital marketing. 84 percent of marketing organizations, according to Forbes, are integrating or expanding their use of AI and machine learning in 2018, showing that marketers are quickly realizing the potential of this technology.

II. UNDERSTANDING MACHINE LEARNING

With the use of machine learning (ML), which is a form of artificial intelligence (AI), software programs can predict outcomes more accurately without having to be explicitly instructed to do so. In order to forecast new output values, algorithms for machine learning use previous data as input. Machine learning is frequently used in recommendation engines. Business process automation (BPA), predictive maintenance, spam detection, malware threat detection, and fraud detection are a few additional common uses [12-18]. Machine learning is significant because it aids in the creation of new goods and provides businesses with a picture of trends in consumer behaviour and operational business patterns. A significant portion of the operations of many of today's top businesses, like Facebook, Google, and Uber, revolve around machine learning. For many businesses, machine learning has emerged as a key competitive differentiation.

Machine learning algorithms can be trained in a variety of ways, each with its own benefits and drawbacks, as with any method. We must first examine the types of data that each kind of machine learning consumes in order to comprehend the benefits and drawbacks of each type. Labeled data and unlabeled data are the two types of data used in machine learning. Although labeled data includes both the output and input parameters in an entirely machine-readable pattern, labeling the data initially takes a significant amount of human effort. Only one or neither of the parameters are present in machine-readable form in unlabeled data. This eliminates the requirement for human work but calls for more difficult fixes [19-23].

One of the most fundamental varieties of machine learning is supervised learning. In this case, labeled data are used to train the machine learning algorithm. Even though precise labeling of the data is required for this method to function, supervised learning is incredibly effective when applied in the appropriate situations. A tiny training dataset is provided to the ML algorithm in supervised learning. This training dataset, which is a smaller portion of the larger dataset, gives the algorithm a general understanding of the issue, the solution, and the data points that need to be handled. The training dataset gives the algorithm the labeled parameters it needs for the task, and it shares many properties with the final dataset. In essence, the algorithm establishes a cause-and-effect relationship among the variables in the dataset by looking for relationships between both the parameters that have been provided. After training, the algorithm has a general understanding of the operation of the data and the link between input and output. The final dataset is then used to test this solution, and it learns from it in the same manner it learned from the training dataset. This implies that supervised machine learning algorithms will keep getting better even after being put into use, learning new relationships and patterns as it trains on fresh data.

The benefit of unsupervised machine learning is that it can use unlabeled data. This means that no human intervention is required to render the dataset machine-readable, enabling the program to function on much larger datasets. The labels in supervised learning give the algorithm the ability to determine the precise type of relationship existing between any two data points. Unsupervised learning, on the other hand, lacks labels to base its work on, leading to the development of hidden structures. The program interprets connections between data points in an abstract fashion without the need for human input. These hidden structures are what give unsupervised learning systems their flexibility. Unsupervised learning algorithms can adjust to the data by dynamically adjusting hidden structures rather than using a predetermined and stated problem statement. Compared to supervised learning techniques, this provides more post-deployment development.

Reinforcement learning directly mimics how people learn from data in their daily lives. It has a self-improving algorithm that adapts to new circumstances and learns from mistakes. Positive results are "reinforced" or encouraged, while negative results are "punished" or discouraged. Reinforcement learning, which is based on the psychology idea of conditioning, operates by placing the algorithm in a setting with an interpreter and a reward system. The output result from each iteration of the algorithm is provided to the interpreter, who determines whether the result is favourable or not. In the event that the program finds the right answer, the interpreter strengthens the answer by rewarding the algorithm. If the result is unfavourable, the algorithm must repeat the process until a better conclusion is obtained. Most of the time, the efficacy of the outcome is closely related to the reward system. The answer is not an absolute value in common reinforcement learning use cases, such as determining the shortest path between two points on a map. Instead, it adopts an efficiency rating with a % value. The algorithm gets rewarded more generously the greater this percentage value is. As a result, the software is taught to provide the best solution for the best reward.

III. APPLICATION OF MACHINE LEARNING

Machine learning (ML) is a subfield of artificial intelligence (AI) that enables computer systems to learn from data and improve their performance without being explicitly programmed. Machine learning algorithms have wide-ranging applications in various industries and sectors, including healthcare, finance, retail, manufacturing and entertainment [31-35].

Machine learning has revolutionized healthcare by enabling accurate diagnosis, personalized treatment, and better patient outcomes. ML algorithms can analyze large volumes of patient data, such as medical records, lab results, and imaging scans, to identify patterns and predict disease progression. ML models can also be trained to identify potential drug interactions and adverse effects, reducing the risk of medication errors. Machine learning algorithms are used extensively in the finance industry for fraud detection, risk assessment, and investment analysis. ML models can analyze large datasets of financial transactions and identify patterns that may indicate fraudulent activity. These models can also predict the likelihood of default on loans, assess credit risk, and help portfolio managers make informed investment decisions. Machine learning is transforming the retail industry by enabling personalized marketing, product recommendations, and supply chain optimization. ML algorithms can analyze customer data, such as purchase history and browsing behavior, to generate personalized offers and product recommendations. These algorithms can also help retailers optimize their supply chains by predicting demand and optimizing inventory levels.

Machine learning algorithms are also used in the entertainment industry to enhance user experiences and improve content discovery. ML models can analyze user preferences and behavior to generate personalized recommendations for movies, TV shows, and music. These models can also be used to create personalized playlists and recommendations for live events.

IV. RESEARCH OBJECTIVE

The research objective of this paper is to highlight the application of machine learning in online marketing, with a focus on how it is used by marketers to identify trends in website user behavior and optimize advertising offers. The paper aims to provide an overview of the advancements made possible by machine learning in this field and the impact it has had on the effectiveness of online marketing campaigns. Additionally, the paper may explore the challenges and limitations of using machine learning in online marketing, and potential avenues for further research in this area. Ultimately, the goal of this research is to contribute to a deeper understanding of the application of machine learning in online marketing and its potential to improve the effectiveness of marketing strategies.

V. MACHINE LEARNING METHODS USED IN ONLINE MARKETING

As part of their involvement in the HHS Opioid Code-a-Thon event, Mackey et al. [24] created and implemented a methodology employing machine learning to accurately measuring the marketing and sale of opioids by illicit online vendors via Twitter. The framework is showed in Figure 1. Over the duration of the Code-a-Thon, they gathered and examined 213,041 tweets that contained the keywords codeine, percocet, vicodin, oxycontin, oxycodone, fentanyl, and hydrocodone. BTM detected 692 out of 213 041 tweets, or 0.32%, as being related to the unlawful online promotion and sale of prescription opioids. They found 34 distinct "active" tweets after deleting duplicates and dead links. Of these, 44% (15/34) directed customers to illegal online pharmacies, 32% (11/34) referred to specific drug dealers, and 21% (7/34) were utilized by marketing affiliates. Numerous of these sellers also offered the "no prescription" sale of additional banned pharmaceuticals and illegal narcotics. The study's findings concur with those of earlier research that has pointed to social media sites like Twitter as potential distribution and sales channels for illegal opioids. In order to put these findings into practice, the authors also created a prototype framework for identifying, classifying, and informing the US Food and Drug Administration and the US Drug Enforcement Agency of illicit online pharmacy tweets that illegally sell prohibited narcotics. Furthering the development of products based on these techniques may enable proactive notification of law enforcement and regulatory bodies of unlawful opioid sales while also enhancing public safety in the internet environment.

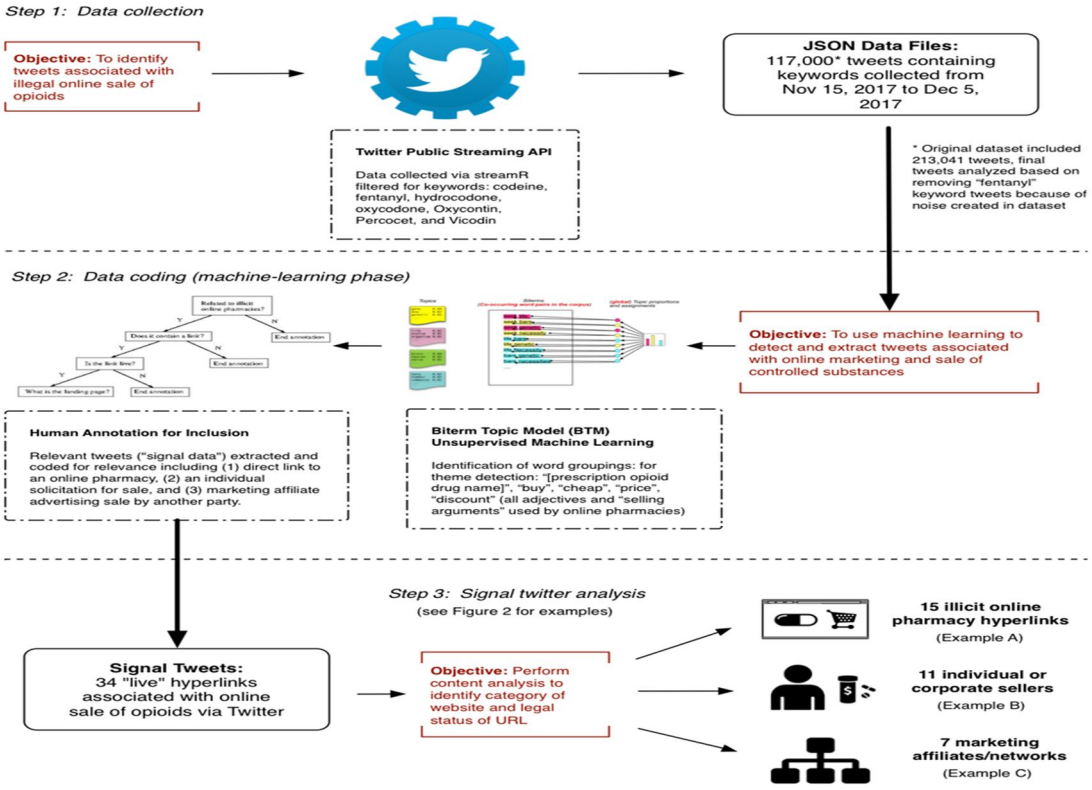


Figure 1: Framework implemented by Mackey et al. [24]

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue III Mar 2023- Available at www.ijraset.com

This innovative method for creating a social media marketing plan makes use of the Waikato Environment for Knowledge Analysis, which was studied by Arasu et al. [25] as they used machine learning technologies to analyze social media data analytics (WEKA). We compare WEKA to other relevant algorithms and find that WEKA outperforms its rivals, particularly in terms of metrics like precision, recall, and F-measure, demonstrating that WEKA outperforms other methods. The proposed framework is shown in Figure 2.

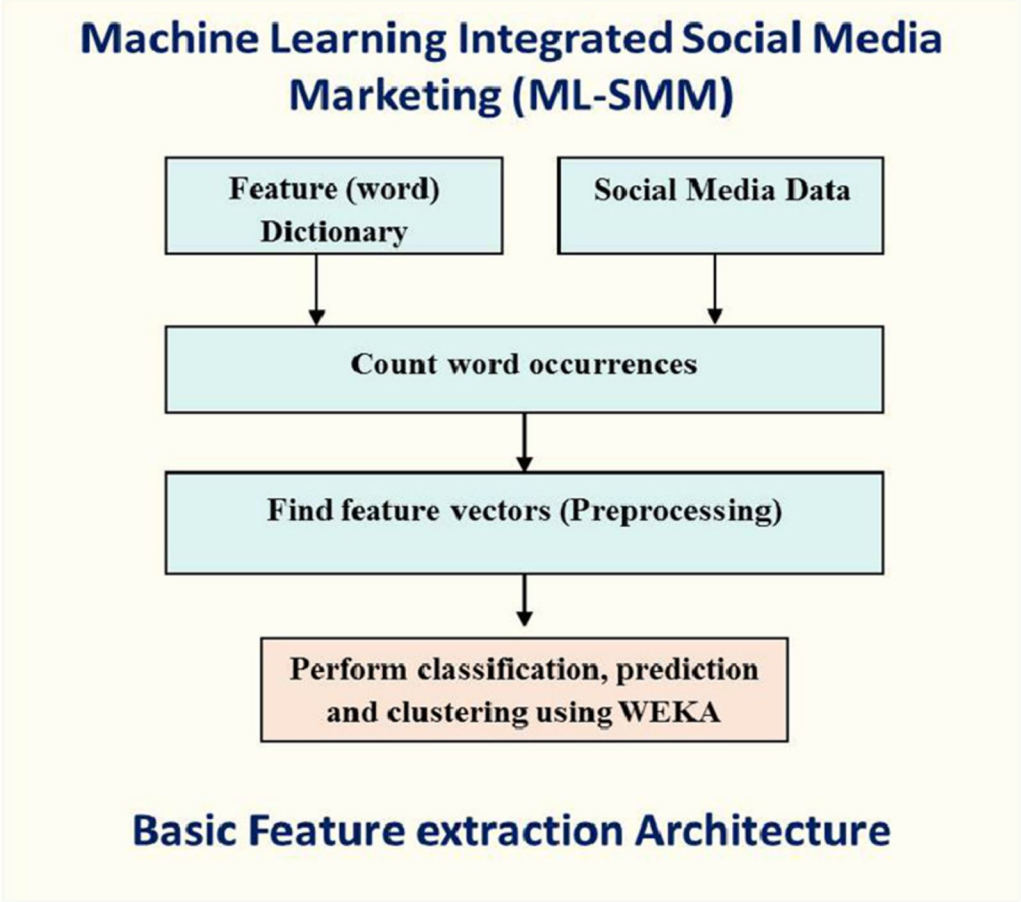


Figure 2: Framework proposed by Arasu et al. [25]

The trading of songbirds has been noted as a significant danger to wild bird populations, and the bird market has recently spread to internet marketplaces. The study investigated the application of machine learning models as a monitoring framework, created models for taxa identification, used the best model to comprehend the state of the market (taxa composition, asking price, and location), and carried out a survey to comprehend the seller profile. According to Okarda et al. [26], the machine learning models produced a high degree of accuracy when separating relevant advertising and identifying the taxonomy of songbirds. In order to anticipate the ad population, the Support Vector Machine (SVM), which was chosen as the best model, was applied.

In order to automatically tag and categorize online news articles, Salminen et al. [27] examined three cutting-edge ML approaches for multilabel classification: Random Forest, K-Nearest Neighbor, and Neural Network. The best performance comes from a neural network, which achieves an F1 Score of 70% and offers acceptable cross-platform applicability on YouTube material from the same organization. 99.6% of unlabeled website material and 96.1% of unlabeled YouTube footage may be automatically tagged using the established approach.

The empirical trade-off between diagnostic and predictive skills was examined by Alantari et al. [28] by using a variety of techniques to quantify this key relationship. They combined techniques that have been used in the marketing literature in the past with techniques that are far less popular. They examined 25,241 products across nine different product categories and 260,489 reviews from five different review venues to determine generalizability. They discover that pre-trained neural network-based machine learning techniques, in particular, provide the most precise forecasts, while topic models like Latent Dirichlet Allocation provide more thorough diagnostics. The implemented framework is shown in Figure 3.

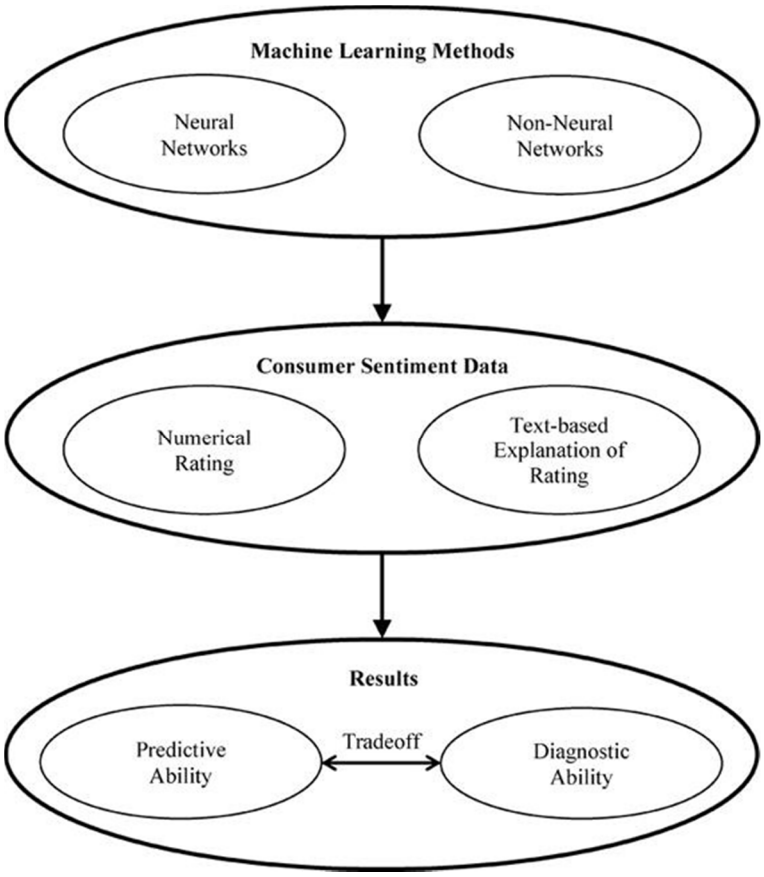


Figure 3: Framework used by Alantari et al. [28]

These machine learning techniques were compared by Falke et al. [29] to the analogous classical technique known as singular value decomposition. Latent Dirichlet allocation surpasses the replicated softmax model in the investigation, while the correlated topic model achieves the overall best performance. Both the replicated softmax model and the correlated topic model result in a more effective compression of online surfing data when compared to singular value decomposition. Singular value decomposition, however, is superior to latent Dirichlet allocation.

Khoa et al. [30] 's investigation of the influences of perceived risk, service quality, customer ethnocentrism, and trust on customer loyalty. The study objective was archived using a mixed-method approach. Based on the machine learning computation, which gained popularity and significant traction in the research community, the findings revealed that while perceived risk negatively impacted customer loyalty forward into domestic products on the e-marketplace in the Covid-19 pandemic, trust, ethnocentrism, and service quality positively affected customer loyalty. Based on the research's findings, certain important factors were also put out.

VI. CHALLENGES IN RESEARCH DIRECTION

While the use of machine learning in online marketing has seen significant advancements, there are still several challenges that researchers in this field need to address. Some of these challenges include:

1) *Data Quality:* The accuracy and quality of the data used to train machine learning models is crucial to their effectiveness. Researchers need to find ways to ensure that the data they use is representative, unbiased, and of high quality.
2) *Data Privacy:* With the increasing concern for data privacy, researchers need to find ways to train machine learning models while protecting user privacy. This requires the development of techniques that can effectively anonymize data while preserving its utility.
3) *Model Interpretability:* Machine learning models can be highly complex, making it difficult to understand how they arrive at their decisions. Researchers need to find ways to make these models more transparent and interpretable so that marketers can better understand how they work and use them more effectively.

4) *Scalability:* As the amount of data generated by online marketing campaigns continues to grow, researchers need to find ways to develop machine learning models that can scale effectively. This requires the development of algorithms and systems that can process large volumes of data efficiently.
5) *Bias and Fairness:* Machine learning models can be influenced by bias in the data used to train them, which can result in unfair outcomes. Researchers need to find ways to develop models that are unbiased and fair, and that do not perpetuate discrimination.

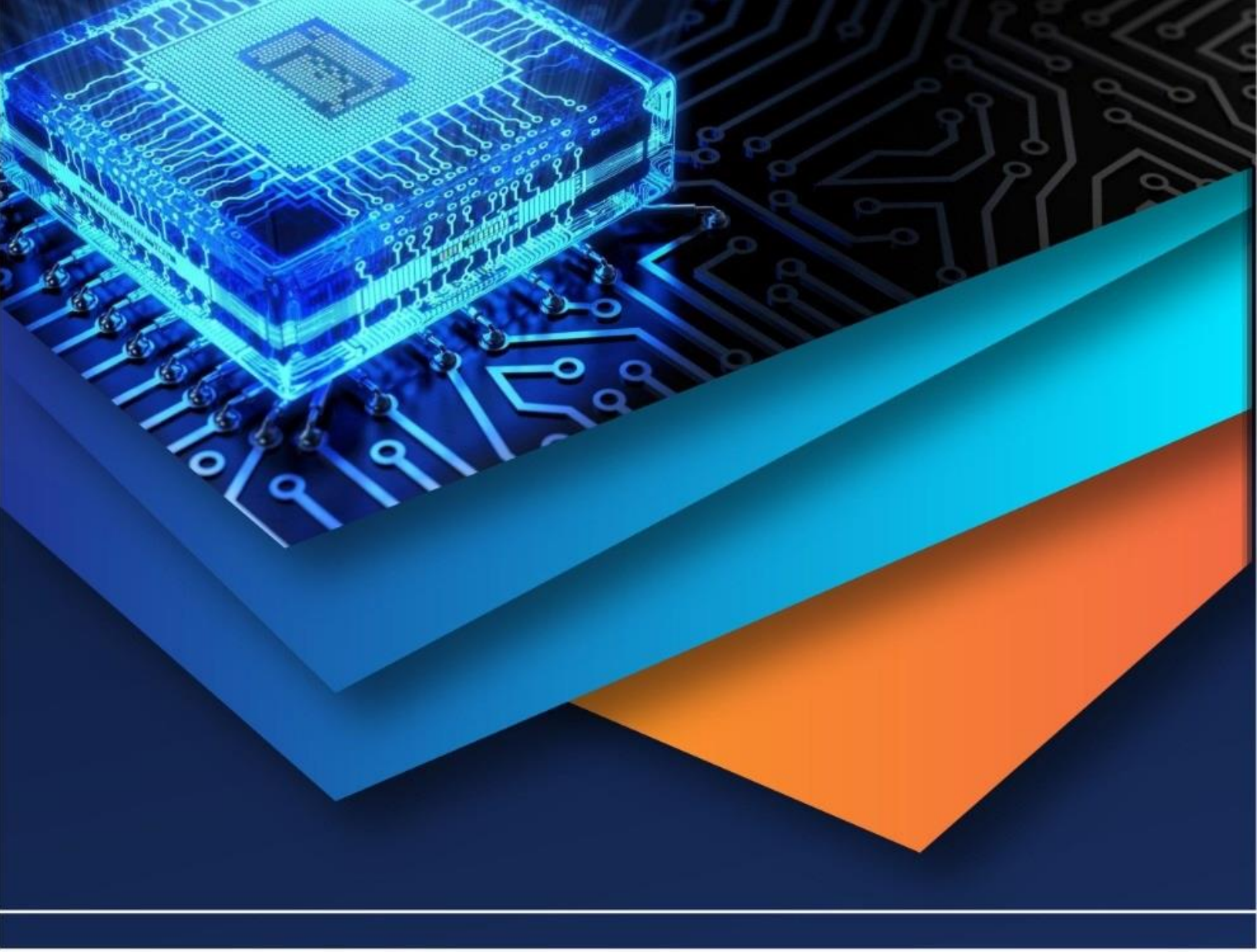
VII. CONCLUSION

In a word, machine learning empowers marketers to greatly enhance their decision-making through the analysis of massive data sets and the generation of detailed insights about the market, industry, social trends, and customer profiles. Organizations may deliver hyper-personalized offers, content, products, and services thanks to the ever-increasing processing capacity of computing systems and the expanding sophistication of machine learning algorithms for marketing. Automation of marketing with ML capabilities can help businesses cut expenses and free up marketers' time for duties with higher added value. Companies can generate customised offers at scale, have a lot greater understanding of customer characteristics, and have longer client relationships thanks to machine learning. Machine learning helps businesses to deliver content that resonates with clients and boosts their engagement thanks to developments in natural language processing and creation. Organizations may automate customer segmentation and find new, more effective customer groups with machine learning in digital marketing.

REFERENCES

[1] Winston, P.H., 1984. Artificial intelligence. Addison-Wesley Longman Publishing Co., Inc..
[2] Zhang, Z., Ning, H., Shi, F., Farha, F., Xu, Y., Xu, J., Zhang, F. and Choo, K.K.R., 2022. Artificial intelligence in cyber security: research advances, challenges, and opportunities. Artificial Intelligence Review, 55(2), pp.1029-1053.
[3] Stone, P., Brooks, R., Brynjolfsson, E., Calo, R., Etzioni, O., Hager, G., Hirschberg, J., Kalyanakrishnan, S., Kamar, E., Kraus, S. and Leyton-Brown, K., 2022. Artificial intelligence and life in 2030: the one hundred year study on artificial intelligence. arXiv preprint arXiv:2211.06318.
[4] Enholm, I.M., Papagiannidis, E., Mikalef, P. and Krogstie, J., 2022. Artificial intelligence and business value: A literature review. Information Systems Frontiers, 24(5), pp.1709-1734.
[5] Seshia, S.A., Sadigh, D. and Sastry, S.S., 2022. Toward verified artificial intelligence. Communications of the ACM, 65(7), pp.46-55.
[6] Ashok, M., Madan, R., Joha, A. and Sivarajah, U., 2022. Ethical framework for Artificial Intelligence and Digital technologies. International Journal of Information Management, 62, p.102433.
[7] Dohale, V., Akarte, M., Gunasekaran, A. and Verma, P., 2022. Exploring the role of artificial intelligence in building production resilience: learnings from the COVID-19 pandemic. International Journal of Production Research, pp.1-17.
[8] Vrontis, D., Christofi, M., Pereira, V., Tarba, S., Makrides, A. and Trichina, E., 2022. Artificial intelligence, robotics, advanced technologies and human resource management: a systematic review. The International Journal of Human Resource Management, 33(6), pp.1237-1266.
[9] Ghillani, D., 2022. Deep Learning and Artificial Intelligence Framework to Improve the Cyber Security. Authorea Preprints.
[10] Jaiswal, A., Arun, C.J. and Varma, A., 2022. Rebooting employees: Upskilling for artificial intelligence in multinational corporations. The International Journal of Human Resource Management, 33(6), pp.1179-1208.
[11] Ahmed, I., Jeon, G. and Piccialli, F., 2022. From artificial intelligence to explainable artificial intelligence in industry 4.0: a survey on what, how, and where. IEEE Transactions on Industrial Informatics, 18(8), pp.5031-5042.
[12] Martins, R.M. and Gresse Von Wangenheim, C., 2022. Findings on Teaching Machine Learning in High School: A Ten-Year Systematic Literature Review. Informatics in Education.
[13] Schölkopf, B., 2022. Causality for machine learning. In Probabilistic and Causal Inference: The Works of Judea Pearl (pp. 765-804).
[14] Murphy, K.P., 2022. Probabilistic machine learning: an introduction. MIT press.
[15] Brunton, S.L. and Kutz, J.N., 2022. Data-driven science and engineering: Machine learning, dynamical systems, and control. Cambridge University Press.
[16] Quinonero-Candela, J., Sugiyama, M., Schwaighofer, A. and Lawrence, N.D. eds., 2022. Dataset shift in machine learning. Mit Press.
[17] Chami, I., Abu-El-Haija, S., Perozzi, B., Ré, C. and Murphy, K., 2022. Machine learning on graphs: A model and comprehensive taxonomy. Journal of Machine Learning Research, 23(89), pp.1-64.
[18] Sullivan, E., 2022. Understanding from machine learning models. The British Journal for the Philosophy of Science.
[19] Wilmott, P., 2022. Machine learning: an applied mathematics introduction. Machine Learning and the City: Applications in Architecture and Urban Design, pp.217-248.
[20] Wu, X., Xiao, L., Sun, Y., Zhang, J., Ma, T. and He, L., 2022. A survey of human-in-the-loop for machine learning. Future Generation Computer Systems.
[21] Géron, A., 2022. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow. " O'Reilly Media, Inc.".
[22] Zhang, K., Khosravi, B., Vahdati, S., Faghani, S., Nugen, F., Rassoulinejad-Mousavi, S.M., Moassefi, M., Jagtap, J.M.M., Singh, Y., Rouzrokh, P. and Erickson, B.J., 2022. Mitigating bias in radiology machine learning: 2. Model development. Radiology: Artificial Intelligence, 4(5), p.e220010.
[23] Wang, Q., Ma, Y., Zhao, K. and Tian, Y., 2022. A comprehensive survey of loss functions in machine learning. Annals of Data Science, 9(2), pp.187-212.
[24] Mackey, T., Kalyanam, J., Klugman, J., Kuzmenko, E. and Gupta, R., 2018. Solution to detect, classify, and report illicit online marketing and sales of controlled substances via twitter: using machine learning and web forensics to combat digital opioid access. Journal of medical Internet research, 20(4), p.e10029.

[25] Arasu, B.S., Seelan, B.J.B. and Thamaraiselvan, N., 2020. A machine learning-based approach to enhancing social media marketing. Computers & Electrical Engineering, 86, p.106723.
[26] Okarda, B., Muchlish, U., Kusumadewi, S.D. and Purnomo, H., 2022. Categorizing the songbird market through big data and machine learning in the context of Indonesia's online market. Global Ecology and Conservation, 39, p.e02280.
[27] Salminen, J., Yoganathan, V., Corporan, J., Jansen, B.J. and Jung, S.G., 2019. Machine learning approach to auto-tagging online content for content marketing efficiency: A comparative analysis between methods and content type. Journal of Business Research, 101, pp.203-217.
[28] Alantari, H.J., Currim, I.S., Deng, Y. and Singh, S., 2022. An empirical comparison of machine learning methods for text-based sentiment analysis of online consumer reviews. International Journal of Research in Marketing, 39(1), pp.1-19.
[29] Falke, A. and Hruschka, H., 2022. Analyzing browsing across websites by machine learning methods. Journal of Business Economics, 92(5), pp.829-852.
[30] Khoa, B.T., Oanh, N.T.T., Uyen, V.T.T. and Dung, D.C.H., 2022. Customer loyalty in the Covid-19 pandemic: the application of machine learning in survey data. In Smart Systems: Innovations in Computing (pp. 419-429). Springer, Singapore.
[31] Mishra, A., 2020. Machine learning approach for defects identification in dissimilar friction stir welded aluminium alloys AA 7075-AA 1100 joints. Journal of Aircraft and Spacecraft Technology, 4(1), pp.88-95.
[32] Mishra, A., 2020. Machine learning classification models for detection of the fracture location in dissimilar friction stir welded joint. Applied Engineering Letters.
[33] Mishra, A., 2021. Supervised machine learning algorithms to optimize the Ultimate Tensile Strength of friction stir welded aluminum alloy. Indian J. Eng, 18, pp.122-133.
[34] Mishra, A. and Vats, A., 2021. Supervised machine learning classification algorithms for detection of fracture location in dissimilar friction stir welded joints. Frattura ed Integrità Strutturale, 15(58), pp.242-253.
[35] Sefene, E.M., Tsegaw, A.A. and Mishra, A., 2022. process parameter optimization of 6061AA friction stir welded joints using supervised machine learning regression-based algorithms. Journal of Soft Computing in Civil Engineering, 6(1), pp.127-137.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY