

# Impact of Machine Learning in Digital Marketing Applications

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**Abstract**—The devastating Covid 19 pandemic has shifted priorities in the business world to accommodate the new normal that the pandemic has caused. Digital marketing has become a necessity for corporations to keep up with the evolving needs of consumers. With the help of the emerging technologies, corporations have begun embracing tailored digital marketing applications that aim to attract and retain more consumers. The techniques or applications used by businesses to improve their marketing performance are consolidated and supported by artificial intelligence applications. In this study, we examine the significance of the marketing field and machine learning, as well as marketing techniques, artificial intelligence, and machine learning algorithms. As a result of the examinations, it has been shown how machine learning techniques and algorithms facilitate marketing processes, increase the profitability of businesses and it is very difficult to realize digital marketing without machine learning algorithms.

**Keywords**— marketing, machine learning, unsupervised learning, e-commerce

## I. INTRODUCTION

The advancement of technology enables humans to adapt to all conditions, find solutions to problems, and implement new ideas more quickly. Countries with robust economies invest more in technology and enjoy the benefits. Even though many scientific disciplines are involved in the production of a product, it is well-known that production alone is insufficient to achieve success and income, highlighting the importance of the marketing field. As a result of the epidemics troubling the modern world, consumers prefer online shopping more than ever, and businesses enjoy the benefits of artificial intelligence in digital marketing. In the study, how digital marketing machine learning algorithms improve marketing processes and add value to businesses is included.

## II. THE IMPACT OF THE PANDEMIC ON DIGITAL MARKETING

The Covid-19 pandemic, which began recently in 2019, has profoundly shook the economies of nations, and many businesses have altered their business practices. A few months after the onset of the pandemic, in the second quarter of 2020, the IMF reports that the global GDP (Gross domestic product) decreased by more than 4.9%, meanwhile international trade decreased by 3.5%, and more than 300 million full-time jobs were lost.[1]. Due to the fear of the epidemic and the mandatory quarantine decisions of consumers, online shopping has increased, and

businesses have adopted a work-from-home model to combat the effects of the new pandemic. In this process, some businesses were forced to close for economic reasons, and others ceased or reduced their risky investments, resulting in production losses [2]. With the advancement of technology and e-commerce platforms, the communication between consumers and sellers has improved. As a result, the online shopping behavior of consumers has shifted and provided consumers numerous benefits including exclusive discounts and special offers [3]. In the United States, online shopping has increased by 65 percent as a result of consumers' reluctance to physically shop at stores and markets during the COVID-19 pandemic [4]. With the advantages of online shopping, businesses have begun to use technology's capabilities more intensively; companies that use technology correctly and consciously have maintained their existence in the race. With the outbreak of the pandemic, the internet has strengthened its position as a technology hub where millions of people can continue working, shopping, and sharing, and marketing strategies have begun to integrate artificial intelligence more effectively. As shown in the graph below (fig-1), global e-commerce retail sales continue to rise each year.

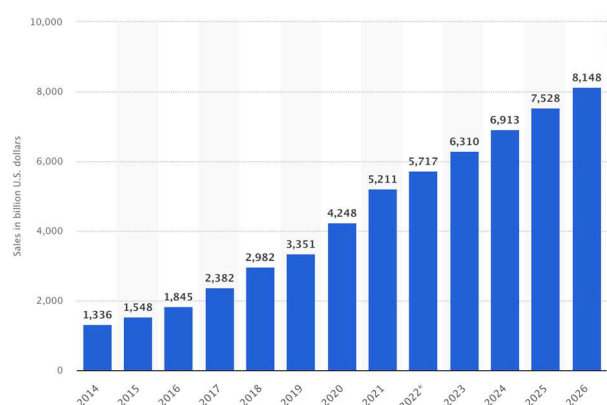


Fig. 1 -Retail e-commerce sales worldwide from 2014 to 2026 (in billion U.S. dollars - Statista.com )

Behind e-commerce marketing applications, multiple artificial intelligence techniques are utilized. Researchers attribute the prevalence of artificial intelligence in marketing applications to the emergence of big data, the rise in computing power, and the development of artificial intelligence techniques and technology [5].

### III. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Artificial Intelligence is software that mimics many characteristics of living things, such as seeing, speaking, moving, understanding, categorizing, and predicting. Artificial intelligence is not a single discipline. It includes subfields such as computer vision, natural language processing, expert systems, robotics, and machine learning. These fields can be used individually or jointly. Aside from computer science, artificial intelligence is also related to the natural and social sciences, such as mathematics, physics, biology, philosophy, sociology, and psychology.

Today, classification, prediction, clustering, and size reduction procedures frequently employ machine learning, one of the subfields of artificial intelligence. Four fundamental sub-techniques comprise machine learning: supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning. Evidently, digital marketing uses supervised learning, unsupervised learning, and neural network applications. Before discussing digital marketing applications, the techniques of artificial intelligence underlying digital marketing applications are described.

#### A. Machine Learning Techniques

a) *Supervised Learning* : Using labeled datasets, supervised learning is a machine learning technique. The majority of supervised learning applications involve classification and regression problems. After collecting data about a problem and transforming it into a dataset, a machine learning algorithm is trained by attempting to match (generalize) the observation values and classes contained in the dataset. Labels are class values that correspond. In classification problems, such as customer churn, categorical data may be present in data sets. However, since certain algorithms, such as artificial neural networks, can only process numerical data, these categorical data are converted into numerical values using an appropriate conversion method. The model was constructed using data-trained algorithms. In addition to being validated with test datasets, this model is applied to real-world problems. In classification problems, performance criteria such as accuracy, recall, precision, F1-score, ROC curve, and mean square error, root mean square error, mean absolute error, and R2 are used to evaluate the accuracy of the results obtained. These performance measures provide information regarding the model's accuracy. Due to the trained model's high precision, it provides precise predictions for new real-world problems. To achieve high rates of accuracy, datasets can be evaluated and processed by data scientists and a problem-specific domain expert. Support vector machines, Naive Bayes, k-nearest neighbors, decision trees, random forests, ensemble learning algorithms, neural networks, logistic regression, and linear discriminant analysis algorithms are the most important supervised learning algorithms. Classification problems with labeled data, such as customer churn, credit card fraud, image classification, and spam e-mail, and regression problems involving numerical predictions, such as market forecasting, population forecasting, and financial forecasts, utilize supervised learning algorithms. It would be incorrect to believe that a particular classification algorithm is correct. For this reason, problem-appropriate algorithms are utilized, and accuracy rates are evaluated based on performance criteria.

b) *Unsupervised Learning* : Unsupervised learning is a machine learning technique applied to unlabeled data sets. In the unlabeled dataset, there are no label values indicating which classes the observation values correspond to. Unsupervised learning algorithms are utilized for discovering unknown patterns in a dataset, as well as for clustering and size reduction problems. Customers are segmented using clustering algorithms, particularly in digital marketing. The K-Means clustering algorithm is the most popular clustering algorithm.

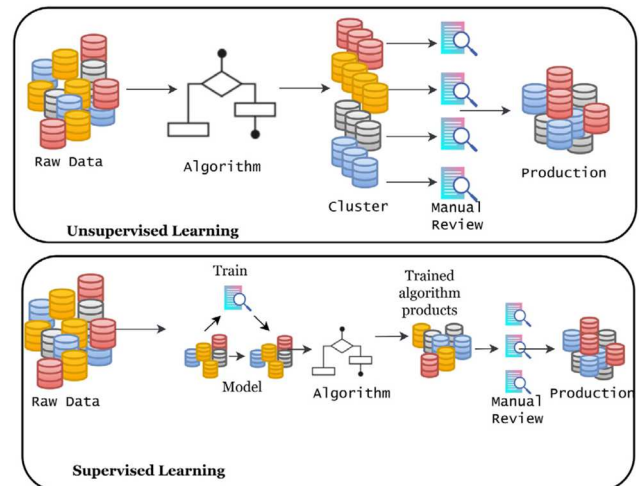


Fig. 2 - Supervised and unsupervised learning stages [6]

c) *Clustering*: K-Means clustering algorithm is the most widely used clustering algorithm [7]. Clustering is the process of grouping data points based on their similarities and differences. Cluster algorithms utilize unlabeled datasets used in the unsupervised learning technique, as opposed to labeled datasets with classroom labels used in the supervised learning technique of machine learning, to identify the data points in the dataset and group the data. Among the numerous clustering algorithms, K-Means, Expectation-Maximization, and Hierarchical are notable. Clustering algorithms are extensively employed in customer segmentation [8]. In the K-Means cluster algorithm, the number of clusters is determined by providing a k value, a cluster center is chosen at random, and the cluster is formed by selecting the points that are closest to the center [7]. By calculating the square of the difference between the input values in the dataset and the central point, the points with the shortest distance from the central point form a cluster.

$$k = 4 \text{ (Number of Cluster)}$$

$$x = \text{randomly selected central point}$$

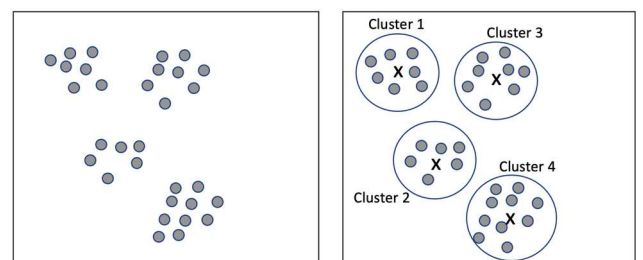


Fig. 3 - K-Means clustering example demonstration

d) *Artificial Neural Networks*: Artificial neural networks are algorithms used in supervised and unsupervised learning problems in machine learning,

simulating the human brain and nervous system's capacity for learning. Neural networks are comprised of artificial neurons that mimic nerve cells in the human brain and are composed of input layers, hidden layers, and output layers that produce the result [9].

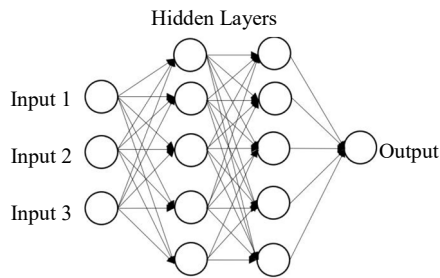


Fig. 4 - General structure of Neural Networks

e) *Natural Language Processing* : Today, natural language processing (NLP) is used in a variety of applications, including corrections in messaging applications within web-based translation services, online chatbots, and email spam filters. Natural language processing is a subfield of computer science, linguistics, and artificial intelligence that focuses on human-computer interaction and enables computers to understand the language, words, and expressions used by humans [10]. Natural language processing is a research and application area that is used in fields such as machine translations (such as google translate), text summaries, speech recognition, expert systems and researches how language is processed [11]. Natural language processing has an important place in applications such as product pricing and market forecasting using sentiment analysis on the web [12].

#### IV. DIGITAL MARKETING AND ITS USEFUL APPLICATIONS

In the competition between businesses, product quality alone is insufficient. For this reason, well-made analyzes with marketing techniques increase the competitiveness of businesses in order to get ahead. With the transition of commerce to more online shopping than in previous years, numerous digital planning tools are available assist businesses. Consumers' demographic and geographical information, the technologies they employ, and the amount of time they spend on web pages can be obtained and analyzed using these tools. The collected data can be analyzed with machine learning, prediction, classification, and clustering applications to obtain information about customers and their preferences, allowing businesses to tailor their marketing campaigns accordingly. The expansion of e-commerce has both advantages and disadvantages. While the like, share, and comment buttons used in social media applications such as Twitter, Instagram, and Facebook increase consumer interactions, they also allow businesses to track shared posts [13]. Fake applications that change the purchasing decisions of consumers and damage the reputation of companies have also taken their place, and machine learning techniques have been used to detect these fake attempts [13]. Artificial intelligence techniques and algorithms are frequently used in many marketing techniques and applications in digital marketing, such as marketing forecasting, chatbots, ad optimization, e-mail marketing, automated content creation and better customer service [14]. In addition,

recommendation systems, customer segmentation, and social media marketing play a significant role in reaching the target audiences of businesses, thereby enhancing their performance and profitability. Taking into account the analysis, estimation, and categorization of the variety and volume of user-generated data, digital marketing applications rely on machine learning techniques and algorithms [15].

The applications used in the field of digital marketing that benefit businesses, as well as the artificial intelligence and machine learning techniques that support them, are listed below.

a) *Chatbots*: Chatbots are systems that utilize natural language processing (NLP), a subfield of machine learning and artificial intelligence, and converse on the internet, typically via text [16]. In a study conducted in 2019, it is stated that 30,000 chatbots were launched on messaging platforms such as Facebook in the USA alone [17]. Marketing-wise, the fact that well-programmed chatbots are available 24 hours a day, seven days a week, and that customer service representatives who are contacted by phone provide faster responses is crucial for customer retention. With the comments and feedback received in chatbots, businesses can operate according to the needs of customers, and by creating faster solutions to customers' problems, they can increase customer experience and improve customers' purchasing considerations by protecting their trust, social assets, and long-term relationships with them [18].

While chatbots improve customer relations and the customer experience, the underlying technology must be well-programmed, and the appropriate algorithms must be selected. There are two ways to develop chatbots: rule-based and machine learning [19].

- **Rule-Based Approach**: In this method, the customer's (or user's) questions are matched by the algorithms to the answers written by the programmer in advance, and since these patterns are predetermined, no new answers are generated [19]. This approach is limited to predetermined questions and answers.

- **Approach Based on Machine Learning**: In this approach, using artificial neural networks (ANN) and natural language processing (NLP) algorithms, not only the incoming questions but also the entire dialogue are considered, and no prior answer preparation is necessary [19].

Chiara Valentina Misischia et al. investigated the effect of chatbots on the customer in the categories of interaction, entertainment, problem solving, and improving service performance in their study, confirmed that chatbots are related to customer service quality, and drew attention to the potential of chatbots in customer service [20].

Jeong-Bin Whang et al. investigated the effect of chat tools and real-time visual information on the customer experience in their study. The availability of chatbots that send personalized messages to each customer, as opposed to chatbots whose responses are predetermined based on the questions asked, increases customer satisfaction. The results of the studies indicate that high-level, well-designed (programmed) chatbots enhance the customer's understanding of the products and their intent to purchase.

They discovered that well-designed chatbots are advantageous for businesses [21].

b) *Recommendation Systems* : Recommendation systems are online systems that employ machine learning techniques, determine target audiences based on users' data and website preferences, reviews, browsing and purchasing history, and recommend products, services, and content to users. In these systems, using deep neural network algorithms, which is a subfield of machine learning and is based on artificial neural networks, the preferences of millions of consumers and the matching of their desired products improve marketing performance [22].

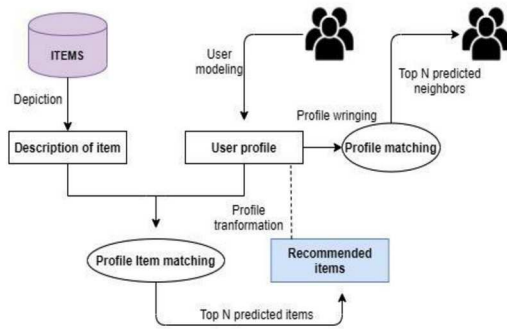


Fig. 5 - Basic recommender process [23]

Traditional collaborative filtering, clustering models and search-based methods are commonly used in recommendation systems [24]. Collaborative filtering and clustering algorithms such as K-Means are the methods that perform the recommendation process by eliminating the products previously bought and rated by similar customers after finding similar customers to recommend products that a customer has purchased and rated [24]. In the search (or content) based method, on the other hand, the recommendation system categorizes products with similar characteristics, not customers, and makes suggestions by filtering according to consumers' preferences [25]. These methods can be used separately or together.

Due to the variety of consumer behavior on e-commerce websites in the present day, algorithms are shifting towards more personalized predictions. For example, 35% of Amazon's purchased products and 75% of Netflix's watched TV shows and movies are influenced by recommendation systems [26].

Afoudi Yassine proposed an intelligent recommendation system based on the demographic characteristics of the users in movie selection, combining the collaborative filtering technique and the K-Means clustering algorithm, one of the unsupervised learning algorithms [27].

In their study, Mohammed Fadhel Aljunid et al. developed the deep learning model, a subfield of machine learning, for a collaborative filtering-based recommendation system. Consequently, they demonstrated that the proposed deep learning method outperforms existing methods.[28].

c) *Customer Segmentation* : Market segmentation, or customer segmentation, is the process of dividing customers into groups according to demographic, geographic, behavioral and psychological characteristics in order to achieve the goals of businesses [8]. Thus, with

customer segmentation, businesses can focus on different customer groups in their initiatives such as advertisements, campaigns and price offers, and increase their marketing performance by improving their communication with their customers.

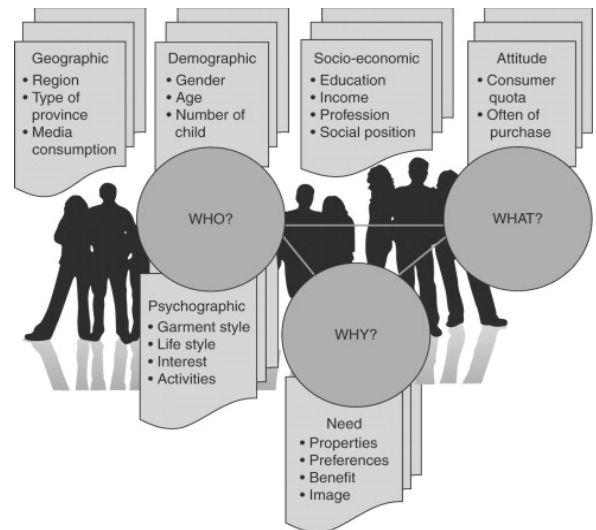


Fig. 4 - Sources for market segmentation [29].

Customers' online shopping habits are analyzed using web analysis tools such as Google Analytics and Adobe Analytics. Customer segmentation frequently employs clustering algorithms such as the K-Means cluster algorithm of the unsupervised learning technique, which is one of the machine learning techniques.

Yue li et al. conducted empirical analyses of customer behavior, preferences, and customer information for the Chinese grape market, as well as customer purchasing preferences, as part of their study on customer segmentation. As a result of the experiments, they demonstrated that the customer segmentation technique they employed was valid [30].

In their study, Ali Ahani et.al studied the market segmentation and travel choice prediction of travelers in SPA hotels with user ratings from the online travel agency TripAdvisor and a machine learning approach to textual data. They proposed the algorithm, Self-Organising Map (SOM), HOSVD, one of the unsupervised learning clustering techniques. As a result, they showed that this hybrid model is effective in segmentation. They showed that the proposed hybrid segmentation algorithm can process the data of other hotels and can be used in segmentation [31].

d) *Content Marketing* : Content marketing provides consumers with information that is valuable, interesting, and where they can find answers to their questions [32]. In addition to increasing the awareness of content production brands, it is also one of the pillars of social media marketing, mobile marketing, e-mail marketing, and other marketing applications for search engine optimization (SEO), which is essential for indexing websites. In his 1996 article titled "Content is King," Bill Gates, the founder of Microsoft, predicted that real money would be made on the internet in those years and emphasized the significance of content [33]. In digital marketing, it is quite difficult for

marketers to work with vague, unstructured content. Structured content is crucial for marketers and business decision-makers, and the classification algorithms of the supervised machine learning technique make it possible to label this content without human error [15].

In their study, Nur Syakirah Ahmad et al. examined the influence of Social Media Content Marketing (SMCM) on brand health. Brand health is the evaluation of indicators such as the amount of time users spend on a website, repeat visits, social likes, subscriptions, and bounce rate in order to enhance the brand's growth and quality. The studies revealed the significance of content marketing for the brand values of companies and the need to emphasize this significance more [34].

Due to the low open rate of emails in email marketing, M. Paulo et al. used random forest, decision trees, neural networks, naive bayes, support vector machines, and gradient boosting to measure the quality of subject lines that encourage users to open emails. They compared the accuracy rates of various machine learning algorithms-based models. They utilized a dataset of 140,000 email subject lines for the study. Models incorporating the email open rate produced positive results, and random forest algorithms provided the highest rate of accuracy [35].

e) *Customer Retention* : One of the biggest challenges in marketing is retaining existing customers and ensuring the continuity of the customer experience. In a study, it is estimated that the technology investments that companies will make to improve customer experiences will be 641 billion US dollars in 2022 [36]. Today, there are a lot of software packages to manage customer relations. Customer relationship management (CRM) is making plans and determining strategies to acquire customers, retain customers, and achieve the goals of the business [37]. With customer relationship management (CRM) applications, analyzes related to sales, marketing and customer relations can be made and customer satisfaction can be classified by using classification algorithms such as support vector machines, k-nearest neighbors, artificial neural network, random forest, which are among the supervised learning algorithms of machine learning [38].

Seema Baghla used neural networks, support vector machine, Nave Bayes, random forest, and Adam deep learning techniques on a dataset of 11224 samples to estimate customer churn in e-commerce and observed that the random forest classification algorithm provided the highest rate of accuracy [39].

In their study, Sangho Yoon et al. used classification algorithms in machine learning to predict customer churn from Google AdWords advertisers and found that the tree-based ensemble algorithm (boosted tree and random forests) produced the most accurate results [39].

f) *Social Media Marketing* : Social media are online platforms where individuals communicate with one another, share their various activities, instant situations, feelings, and thoughts, and where businesses conduct market research and information gathering for their advertisements and campaigns. On social media platforms such as Facebook, natural language processing algorithms are used to analyze text-based product reviews, comments, tweets, and posts [40]. Similar to Instagram, machine learning image classification algorithms can be used to

examine and classify visually shared posts and products[41]. With thousands of new users joining social media and other platforms each year, the amount of data grows proportionally. In 2021, it is anticipated that Instagram will share 695,00 posts per minute, YouTube will upload 500 hours of content per minute, and online platforms will spend \$1.6 million USD per minute [42]. Prediction and classification of unstructured data using machine learning algorithms in such big data plays an important role in realizing the goals of enterprises.

In their study, Xia Liu et al. analyzed the effect of social media marketing activities on customer engagement by analyzing 3.78 million tweets from 15 luxury brands over a period of 60 months using natural language processing techniques. As a result, they demonstrated that social media content is directly proportional to the improvement of a luxury company's customer engagement [43].

According to Shui-Xia Chen, they proposed a model called RFFM to accurately predict customer purchasing preferences based on historical customer behavior data. This model eliminates data sparsity by combining factorizing machine (FM) and random forest (RF) algorithms from machine learning algorithms. The proposed method validated the model's applicability and validity in predicting customer purchase behavior [44].

## V. CONCLUSION

Businesses are compelled to generate new ideas in a constantly competitive environment due to the increasing popularity of e-commerce compared to previous years. To improve their customer experience, performance, profitability, and brand values, businesses use a variety of methods, such as advertising campaigns. As demonstrated by the digital marketing techniques discussed in this study, machine learning techniques, a subfield of artificial intelligence, are crucial to the success of digital marketing, and their significance is emphasized.

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