



The Role of Artificial Intelligence In E-commerce, Marketing And Business Management

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Abstract

Artificial intelligence is becoming more advanced day by day and affects different aspects of our lives. Artificial intelligence can now be used in most businesses. Artificial intelligence technologies offer powerful tools to increase productivity, streamline work tasks, and improve service quality. In e-commerce, artificial intelligence is used to achieve a better customer experience, efficient supply chain management, and search for new ways to reach and provide services to customers while keeping costs low. Machine learning and deep learning are two of the most widely used methods of artificial intelligence. There are thousands of artificial objects in this world that have vital applications; Among them, we can mention the artificial heart, artificial hands and feet and many other things which, although they are made by humans, are very helpful. And now, along with all other artificial things, artificial intelligence has been created. People, businesses and government organizations use these models to predict and learn from data. Currently, machine learning models have been developed for the complexity and variety of data in various industries. This article discusses the applications of machine learning and artificial intelligence in e-commerce, marketing management and finance. Sales growth, profit maximization, sales forecasting, inventory management and security are some of the main applications of artificial intelligence and machine learning.

Keywords: Artificial intelligence; machine learning; deep learning; electronic commerce; Forecast

Introduction

In today's digital age, businesses are faced with vast amounts of data. This data, commonly known as big data, holds valuable insights that can drive business growth and increase customer satisfaction. However, the sheer volume, speed, and variety of this data make it impossible for humans to analyze it manually. This is where artificial intelligence comes into play. AI-based analytics tools use advanced algorithms and machine learning techniques to extract meaningful patterns and insights from customer big data. In general, the applications of artificial intelligence for analyzing big data can be categorized as follows:

- Processing a large amount of data in a short time and with high accuracy
- Considering things that may be hidden from human sight
- In-depth analysis of customer behavior, preferences and insights
- Analysis and decision making in real time and not falling behind other competitors
- Predicting the behavior of customers and the market
- Reducing risk by detecting fraud such as unusual patterns, suspicious activities, etc. (See Figure 1).

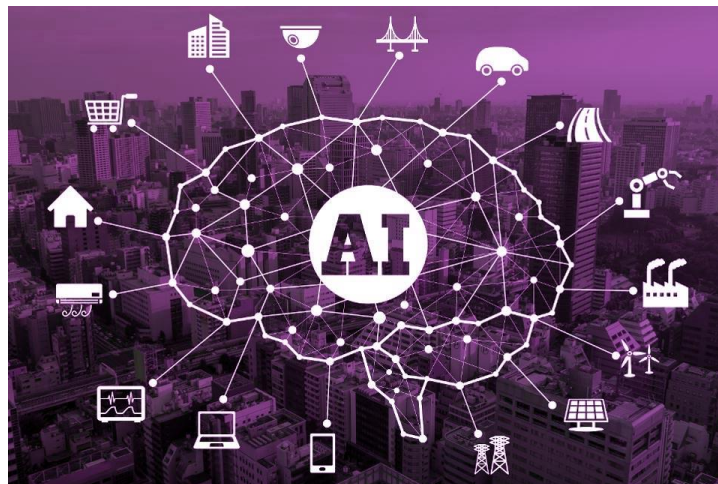


figure 1. Applications of artificial intelligence

Artificial intelligence has also revolutionized customer support by providing faster, more efficient and personalized solutions. These intelligent systems can handle a wide range of questions, solve common problems, and have meaningful conversations with customers and provide quick and accurate answers. [1]

Using natural language processing (NLP) and machine learning algorithms, AI-based customer support systems can understand and interpret customer queries, provide relevant information or direct them to the appropriate department. The good thing about AI is that it continuously learns from customer interactions and improves its skill over time. Machine learning and deep learning are two of the most widely used methods of artificial intelligence. These models are trained on data and used for prediction by individuals, companies and government agencies.

This article presents the applications of machine learning and artificial intelligence in e-commerce, business management and marketing.

Advantages of using artificial intelligence in customer support

Applying artificial intelligence in customer support brings many benefits to businesses. First, AI systems significantly reduce response time and can explain everything clearly to customers. This increases satisfaction and creates brand loyalty. In addition, AI-based support tools enable scalability, as they can handle an increasing volume of customer requests without the need for additional human resources.

Artificial intelligence and machine learning techniques

Machine learning is the most important technique of artificial intelligence. The relationship between machine learning and artificial intelligence is shown in Figure 2. This section covers prominent machine learning techniques.

Machine learning (ML) is a new field of data mining that allows a computer program to make highly accurate predictions about customers without their explicit programming. These machine learning techniques are often divided into two types: supervised machine learning techniques that use labeled training data for inference (classification, regression), while unsupervised learning techniques use data Unlabeling is used to identify existing hidden patterns (clustering). [2]

The act of transforming an input set of samples P into a unique set of features Q , known as features or labels, is called classification. Classification techniques such as decision tree classification, Bayesian classification and artificial neural networks, nearest neighbor classification, random forest and support vector machines have various applications. Each strategy is based on the learning algorithm it uses. We will briefly discuss each of these cases.

Decision tree

Decision tree is one of the most basic and simple classification systems used to solve classification problems. Decision trees are powerful algorithms used for both classification and regression tasks. They are widely used in various fields due to their simplicity, interpretability and ability to manage numerical data and categorize. [3]

A decision tree can be thought of as a flowchart-like structure where each internal node represents a decision based on an attribute and each leaf node represents an outcome or predicted class label. A path from a root node to a leaf node is a sequence of decisions that lead to a final prediction. A decision tree is a type of supervised machine learning (Supervised Machine Learning) that is used for classification or prediction based on the answers to previous questions. This model is a form of supervised learning; This means that training and testing the model is done on the data set that includes the desired classification. This model may not always be able to provide a definite and clear answer. Instead, it provides data scientists with options to make informed decisions. Decision trees mimic human thinking. So data experts can usually easily understand and interpret the results.

Artificial neural network

The main philosophy of the artificial neural network is to model the processing characteristics of the human brain to approximate the usual computational methods with biological processing methods. In other words, the artificial neural network is a method that learns the knowledge of the relationship between several data sets through training and stores it for use in similar cases. [4]

Artificial neural networks (ANN) are modern computing systems and methods for machine learning, displaying knowledge and finally applying the obtained knowledge to predict the output responses from complex systems. The main idea of such networks is somewhat inspired by the way the biological nervous system works to process data and information in order to learn and create knowledge. The key element of this idea is to create new structures for the information processing system. This system consists of a large number of highly interconnected processing elements called neurons that work together to solve a problem and transmit information through synapses (electromagnetic communication). In these networks, if one cell is damaged, the rest of the cells can compensate for its absence and contribute to its regeneration. These networks are able to learn; For example, by applying irritation to the touch nerve cells, the cells learn not to go to the hot object, and with this algorithm, the system learns to correct its error. Learning in these systems takes place in an adaptive way, that is, by using examples, the weight of synapses is changed in such a way that the system produces a correct response when new inputs are given.

K nearest neighbor classification

K-Nearest Neighbor is a non-parametric method used in data mining, machine learning and pattern recognition. According to the statistics presented on the kdnuggets website, the k-nearest neighbor algorithm is one of the ten

algorithms that have been used the most in various machine learning and data mining projects, both in industry and in academia. This algorithm is used for statistical classification and regression. [5]

In both cases, K contains the closest training example in the data space and its output varies depending on the type used in classification and regression. In the classification mode, according to the specified value for K , it calculates the distance of the point we want to label with the nearest points, and according to the maximum number of votes of these neighboring points, we make a decision regarding the label of the desired point. Different methods can be used to calculate this distance, one of the most prominent of these methods is the Euclidean distance. In the regression mode, the average value obtained from K is its output. Since the calculations of this algorithm are based on distance, data normalization can help improve its performance.

Random forest

Random forest is a machine learning technique that is used to solve regression and classification problems and uses ensemble learning for this. Ensemble learning is a technique that many classifiers use to provide solutions to complex problems.[6]

As the random forest grows, it adds more random trees to the collection. Meanwhile, instead of searching for the most important feature while splitting a node, it searches for the best feature among a random subset of features. This practice leads to a wide variety that can generally provide a better model. Therefore, in the random forest, only a random subset of features is considered by the node splitting algorithm. Trees can even be made more random by using random thresholds for each feature, instead of searching for the best possible thresholds. A random forest algorithm consists of several trees called decision trees. The forest formed by the random forest algorithm is trained through the classification of cases or (Bagging Classifier). Bagging is a set meta-algorithm that increases the accuracy of machine learning algorithms.

Random forest does not have the limitations of decision tree algorithm. This issue is one of the important advantages of this machine learning technique. Another advantage of this strategy is that it avoids the overfitting problem if a sufficient number of trees are available. In addition, the random forest classification system can handle missing data and model classified data as well. [7]

Random forest classification system is used in medicine, finance, e-commerce and stock market. In banking, random classification system is used to distinguish between loyal and fraudulent customers. Random forest is used in medicine to discover the optimal combination of drugs and disease diagnosis based on past medical information of patients. In the stock market, a random forest classification system is used to watch stock activity and then detect profit and loss. Random forest may also be used to estimate user product suggestions in the field of e-commerce.

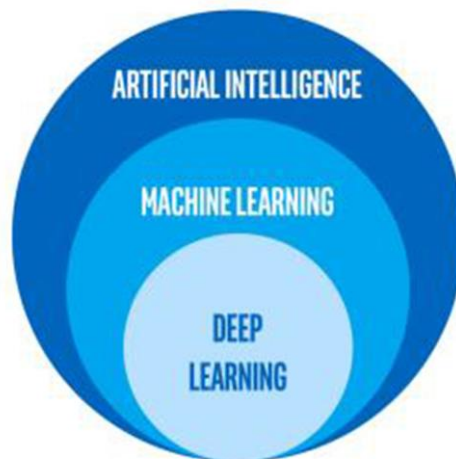


Fig 2. Relationship between Artificial Intelligence and Machine Learning.

Support Vector Machine

Support vector machine is a supervised learning model used for classification. This system has received a lot of attention in the classification department. [8]

Support vector machine (SVM) is one of the supervised learning methods used for classification and regression. The working basis of the SVM classifier is the linear classification of the data, and in the linear division of the data, we try to choose a hyperplane that has a higher confidence margin. [9] Solving the equation of finding the optimal line for the data is done by linear programming methods, which are well-known methods in solving constrained problems. Before the linear division, in order for the machine to be able to classify the data with high complexity, we move the data to a much higher dimensional space using the phi function. In order to be able to solve the problem of very high dimensions using these methods, from Lagrange's dual theorem to convert the desired minimization problem into its dual form, where instead of the complex function phi that takes us to a high-dimensional space, a simpler function We use the name of the kernel function, which is the vector multiplication of the phi function. Different kernel functions can be used, including exponential, polynomial and sigmoid kernels.

Clustering

In cluster analysis or clustering, the grouping of a set of objects is done in such a way that the objects in one group (called cluster) are more similar compared to other categories (clusters). It is the main task of exploratory data mining and is a common method of statistical data analysis used in many fields including machine learning, pattern recognition, image analysis, information retrieval, bioinformatics, data compression and computer graphics. [10]

The term clusters includes groups with small distances between cluster members, dense regions of the data space, intervals or special statistical distributions; Therefore, clustering can be done as a multi-objective optimization problem. The appropriate clustering algorithm and parameter settings (including parameters such as the distance function used, the density threshold, or the expected number of clusters) depend on one's setup of the data set and one's particular use of the results.[11]

Clustering in data mining is basically an unsupervised learning method. An unsupervised learning method is one in which a dataset consisting of unlabeled input data is used as a process to find the meaningful structure, generative features, and inherent groupings of a set of examples. Clustering is the grouping of objects based on similarity and dissimilarity between them. In simple words, the goal is to separate groups with similar attributes and divide them into clusters. In recent years, significant efforts have been made to improve the performance of existing algorithms. Due to the new needs to process very large data, the tendency to use generated clusters for business performance has increased. This leads to the development of pre-clustering methods such as bandcanopy clustering, which can efficiently process voluminous data.

Applications of artificial intelligence in e-commerce, marketing and business management

With its ability to analyze large volumes of data, predict and automate processes, artificial intelligence has revolutionized the way businesses understand, interact and target their customers. In this section, we examine artificial intelligence users.

Customer segmentation and targeting

A key aspect of effective marketing is understanding your audience and targeting them with personalized messages. AI algorithms can analyze customer data such as demographics, purchase history, and social media activity to segment customers into distinct groups based on their preferences and behaviors. This enables marketers to tailor their marketing campaigns to specific segments and deliver content relevant to each group.[12,13]

Prospective analysis

One of the applications of artificial intelligence in businesses is predicting the change in customer behavior. AI algorithms can identify patterns and predict outcomes by analyzing historical data. [14] For example, marketers can use artificial intelligence to predict the churn of certain customers. This way you can implement preventive measures to keep those customers.

Additionally, predictive analytics help optimize pricing strategies, forecast demand, and identify cross-sell and upsell opportunities.[15]

Content creation and personalization

Sometimes creating content can be time-consuming, but artificial intelligence can help people active in marketing in this field as well. Artificial intelligence algorithms can generate content based on pre-defined rules and formats. This content can include blog posts, social media captions, and product descriptions. In addition, AI-based personalization engines can dynamically create content tailored to customers based on their preferences, behaviors and purchase history. [16,23]

Marketing automation

Artificial intelligence automation can also be used in marketing. AI-powered tools can schedule social media posts, send personalized emails, saving time and giving marketers more time to focus on strategic initiatives and creative tasks. [17,21]

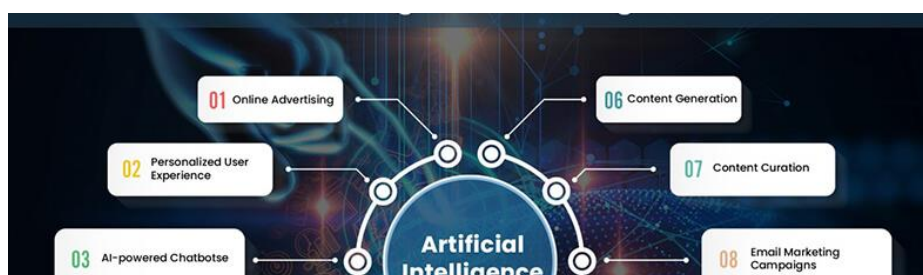


Fig 3. Important application of artificial intelligence in digital marketing

• Sentiment analysis

Monitoring and understanding customer sentiment towards a brand is critical to effective marketing. AI-based sentiment analysis tools can automatically analyze texts such as social media posts, customer reviews, and survey responses. In this way, it is possible to determine how customers feel about the service. This enables marketers to gauge public opinion, identify issues and problems, and respond to customer feedback. [18,19]

• ChatGPT intelligent assistant of administrators

In today's fast-paced world, managers face numerous challenges in advancing tasks, organizing information, and ensuring the smooth flow of responsibilities in an organization. Fortunately, advances in AI have led to the development of intelligent virtual assistants such as ChatGPT. With natural language processing capabilities, ChatGPT is poised to revolutionize office work by providing efficient support, streamlining processes and increasing productivity. One of the key roles of managers is to facilitate effective communication and collaboration between team members. ChatGPT can significantly improve these aspects by serving as a bridge between individuals, departments and even external stakeholders. Its ability to understand and answer questions allows managers to quickly obtain relevant information or guide others without the need for extensive searching or manual

intervention. In addition, it can simplify collaboration by providing real-time chat, instant messaging, file sharing, and task tracking in a secure environment. [20]

• Customer data management

E-commerce has a large amount of related data. Machine learning algorithms are capable of analyzing past data related to sales, human resources, marketing and customer buying patterns. These analytical results can help to maximize profit, maximize sales and optimize resources, and help e-commerce and financial business companies to finalize their products for a specific type of customer. [22,24]

• Recommendation systems

Machine learning algorithms are able to analyze past customer data regarding customer choices and behavior. These algorithms can effectively predict customer choices and offer the most suitable products to customers, it also helps financial and e-commerce companies to increase sales and customer satisfaction. [25]

Cybersecurity

Machine learning algorithms are able to detect vulnerabilities in the system and provide appropriate security solutions to maintain the security of the e-commerce platform. Financial companies also find suitable machine learning algorithms to detect fraud and prevent it. [26]

customer relation management (CRM)

CRM refers to processes that manage interactions between the company and potential or actual customers with the aim of increasing sales and increasing customer satisfaction. The data collected in this process helps business managers to make better decisions to guide their company.

In the past, employees used CRM to collect a large amount of data to collect data and serve customers. However, today, artificial intelligence is able to predict which customers will buy and how we can treat them better. Applications of artificial intelligence may help determine trends and plan activities. Be the basis of the latest trends. Advanced CRM can learn and improve over time with the help of machine learning techniques. [27]

• Sales

The sales process starts with the customer. Artificial intelligence can evaluate your company along with multiple sources and then suggest the most relevant customer acquisition possibilities. Price optimization with the help of artificial intelligence and machines may be in order to get profit. Machines and artificial intelligence may also help improve customer propositions and market portfolio analysis to improve sales. [28]

Conclusion

Artificial intelligence is transforming different parts of human life. Even the way businesses operate has been affected by AI. Many tasks can now be entrusted to artificial intelligence. Things that may take a lot of time from humans and eventually have human error. AI can help businesses through automation, data analysis, virtual assistants, cyber security, innovation, etc. All these applications can increase productivity, improve decision making and positive growth and increase profits. Deep learning and machine learning are two of the most popular artificial intelligence techniques. These models are used by individuals, companies and government organizations to predict and learn from data. Currently, machine learning models have been developed for the complexity and variety of data in different sectors. This article examines the use of machine learning and artificial intelligence in e-commerce, business management and finance.

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