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Romanov Kim

Digital Marketing Director, Digital Marketing Agency Founder,

Romanov Agency

(Edmonton, Alberta, Canada)

STRATEGIES FOR USING NEURAL NETWORKS TO INCREASE ONLINE STORE CONVERSIONS

Summary. *This article explores advanced approaches to integrating artificial intelligence (AI) and neural network technologies into the e-commerce ecosystem, with the aim of radically increasing online store conversion rates. It reveals the mechanisms for implementing machine learning algorithms, which can deeply personalize the user experience. This includes customized product recommendations, predictive analytics of consumer behavior, and algorithmic dynamic pricing. Special emphasis is placed on customer service automation with smart virtual assistants, based on natural language processing. Additionally, computer vision technologies are used to implement visual product search, which helps reduce abandoned baskets and optimize the user interface. The study provides a factual analysis of how neural networks can help minimize abandoned baskets, optimize the architecture of the user interface, and significantly increase the lifetime value of customers. The conclusion is supported by the fact that the strategic use of generative and analytical AI transforms a traditional trading platform into a highly adaptable environment, providing businesses with a significant increase in transaction volume and a sustainable competitive advantage in the digital market.*

Key words: *e-commerce, neural networks, artificial intelligence, conversion enhancement, content personalization, machine learning, predictive*

analytics, dynamic pricing, recommendation algorithms, visual search, user experience, smart chatbots, behavioral analysis, sales optimization.

Relevance of the study. With the rapid digitalization of the economy and the constant growth of competition in e-commerce, traditional methods of customer retention and sales promotion are becoming less effective.

The relevance of this research is determined by the need to find innovative solutions to optimize the user experience. Neural networks are becoming a key factor in the technological transformation of the industry. The ever-increasing costs of attracting targeted traffic are putting businesses in difficult conditions, and maximizing the conversion rate is becoming a vital task for the successful development and scaling of the project.

Artificial intelligence and deep learning methods are opening up new horizons for trading platforms. They allow you to move from simple audience segmentation to hyperpersonalization in real time. This is achieved through accurate forecasting of consumer behavior, dynamic automation of pricing, and the formation of the most relevant product recommendations. The integration of neural networks into the work of online stores is becoming not just a fashion trend, but also an essential condition for maintaining competitiveness in the modern world.

The purpose of the study. The purpose of this work is to analyze and systematize strategies for implementing neural network technologies in digital platforms of online stores to improve the conversion rate. The research aims to identify the relationship between the use of specific machine learning models, such as visual search systems, predictive analytics, or generative conversational agents, and increased customer transactional activity. The practical objective of the work is to create a scientifically based algorithm for e-commerce companies that will integrate artificial intelligence tools into existing marketing funnels. This

will help reduce the number of abandoned baskets, increase the average receipt, and increase the value of each customer throughout their interaction with the company.

Materials and research methods. The methodological basis of the work is a set of general scientific and specialized methods used to analyze big data in the field of digital commerce. The research materials include the latest analytical reports from international consulting agencies on the state of the e-commerce market, as well as arrays of anonymized data on user behavior on online trading platforms. In addition, proven business cases of the world's leading retailers that have successfully implemented artificial intelligence technologies were reviewed.

The main research method is a systematic analysis of the functionality of neural networks, which is complemented by methods of deduction and generalization of best practices in using machine learning algorithms in retail.

Various methods have been used to assess the commercial effectiveness of neural network strategies, including customer path modeling, retrospective analysis of conversion rates, and statistical evaluation of the results of industrial A/B testing. When studying the work of recommendation engines and algorithmic pricing systems, the principles of predictive mathematical modeling were applied, which allowed us to obtain objective and reliable conclusions.

The results of the study. The use of artificial intelligence to increase conversions in e-commerce began at the turn of the 90s and 2000s. The largest platforms began to use collaborative filtering methods that mathematically determined the similarity between customers and offered products based on their joint purchases. Although these early recommendation systems used classical machine learning and statistics rather than multi-layered neural networks, they laid the foundation for digital commerce by demonstrating that basic personalization of the user experience directly affects sales growth and average receipt growth.

The full-scale implementation of neural networks in the architecture of online stores began between 2010 and 2015, which coincided with the technological boom in the field of deep learning.

Thanks to the use of convolutional neural networks, retail has made a real breakthrough in the field of product search. Unique visual search tools have been developed that allow users to upload photos of desired items and instantly receive a selection of similar products from the catalog. This significantly shortened the customer's journey from realizing the need to adding the product to the cart. At the same time, recurrent neural networks began analyzing the sequence of user clicks on the site. This allows them to predict the probability of performing a target action in the current session. This allows stores to activate various triggers in a timely manner, such as personal discounts, which significantly increases their attractiveness to customers.

In the period from 2015 to 2020, an important step took place in e-commerce – the integration of neural network models of natural language processing. Intelligent chatbots and virtual consultants entered the market, who could answer customer questions around the clock, help with choosing the size and configuration, and reduce the failure rate at an important stage of ordering. Algorithms have learned how to create predictive models that take into account hundreds of implicit features, including geolocation, device type, and microconversion history. This made it possible to dynamically change prices and create personal storefronts in real time.

Since 2022, the use of neural networks in retail has begun to change rapidly under the influence of large language models and generative artificial intelligence. Modern networks have moved from simple data analysis to instant creation of unique content.

Generative models automatically generate attractive product descriptions that boost sales. They create realistic photos of products in various interiors and on models of different physiques, saving money on studio shoots. Neural network

fitting technologies help reduce customer fear of fitting and reduce the number of refunds. Hyperpersonalized trigger mailings, created entirely by artificial intelligence, effectively return users to abandoned shopping carts, setting new standards for maximizing online store conversions.

Modern neural networks have taken personalization to a new level, allowing online stores to adapt to each visitor in real time, from the first seconds of their stay on the site. Deep learning algorithms analyze a user's digital footprint, including the history of their search queries, time spent on specific product pages, and previous purchases [3].

Based on this data, a unique dynamic showcase is formed, in which the location of products, recommendation blocks, and banners are constantly changing to best match the current interests of the client. Predictive models calculate the probability of purchasing a specific product category and offer related products using the Next Best Action algorithm, which makes the purchase process more convenient and increases the average receipt [6].

Traditional text search is rapidly giving way to intelligent algorithms based on Transformer architecture neural networks. These systems are able to understand the context and true intentions of users, which allows them to efficiently process even complex queries with typos, slang, and property descriptions, excluding situations where the search results are empty. At the same time, there is a significant increase in conversions due to visual search based on machine vision [2]. It is enough for the buyer to upload a screenshot from a social network so that the algorithm instantly finds identical or visually similar products in the catalog. This significantly reduces the time required to make a purchase decision, from the moment of interest to adding the product to the cart.

Another important step was the introduction of generative artificial intelligence into the process of mass enrichment of product cards. Large language models automatically create compelling and SEO-optimized descriptions, highlighting advantages for specific audience segments (Table 1).

Table 1

Integration of generative artificial intelligence (GAI) into an online store

No.	Indicator	Characteristic
1	Personalized recommendations	Using GAI to analyze customer behavior and provide personalized product recommendations can significantly increase the conversion rate and average order amount.
2	Chatbots and virtual assistants	Creating chatbots that can answer customer questions help navigate the site, and offer products based on their requests can be an effective tool for improving the customer experience.
3	Content generation	The automatic creation of product descriptions, product blogs, or SEO optimization articles can significantly speed up the process of adding new positions and improve search engine visibility.
4	Price optimization	The use of dynamic pricing algorithms that take into account demand, seasonality and competition will optimize profits and avoid unnecessary expenses.
5	Virtual fitting rooms	For clothing and accessories, the integration of augmented reality technology allows users to try on products virtually.
6	Marketing Automation	Using GAI to create targeted advertising campaigns and analyze their effectiveness, which will help reduce marketing costs and increase revenue.
7	Improved logistics	Applying GAI to forecast demand and optimize inventory management, which can reduce costs and improve customer service.
8	Review and feedback analysis	Using GAI to analyze customer reviews and identify key issues or preferences that will help improve the product range and quality of service.

Image generators are a powerful tool that allows you to present a product in various life situations and on models of different types without organizing real photoshoots. However, the most important tool for increasing conversions in online stores is neural network virtual fitting rooms [1]. Thanks to augmented reality technologies, customers can evaluate how clothes will fit their figure or try on furniture in their own interior through a smartphone camera. This removes the main fear of online shopping – the fear of making a mistake when choosing –

and significantly reduces the percentage of refunds. To reduce the number of abandoned baskets, stores are introducing advanced AI assistants capable of conducting deep, meaningful dialogue. New-generation chatbots provide round-the-clock advice on complex technical specifications, help select the exact size, and close objections at the checkout stage, preventing the client from leaving the site due to doubts.

Neural network dynamic pricing, as shown in Figure 1, also enhances conversion efficiency.

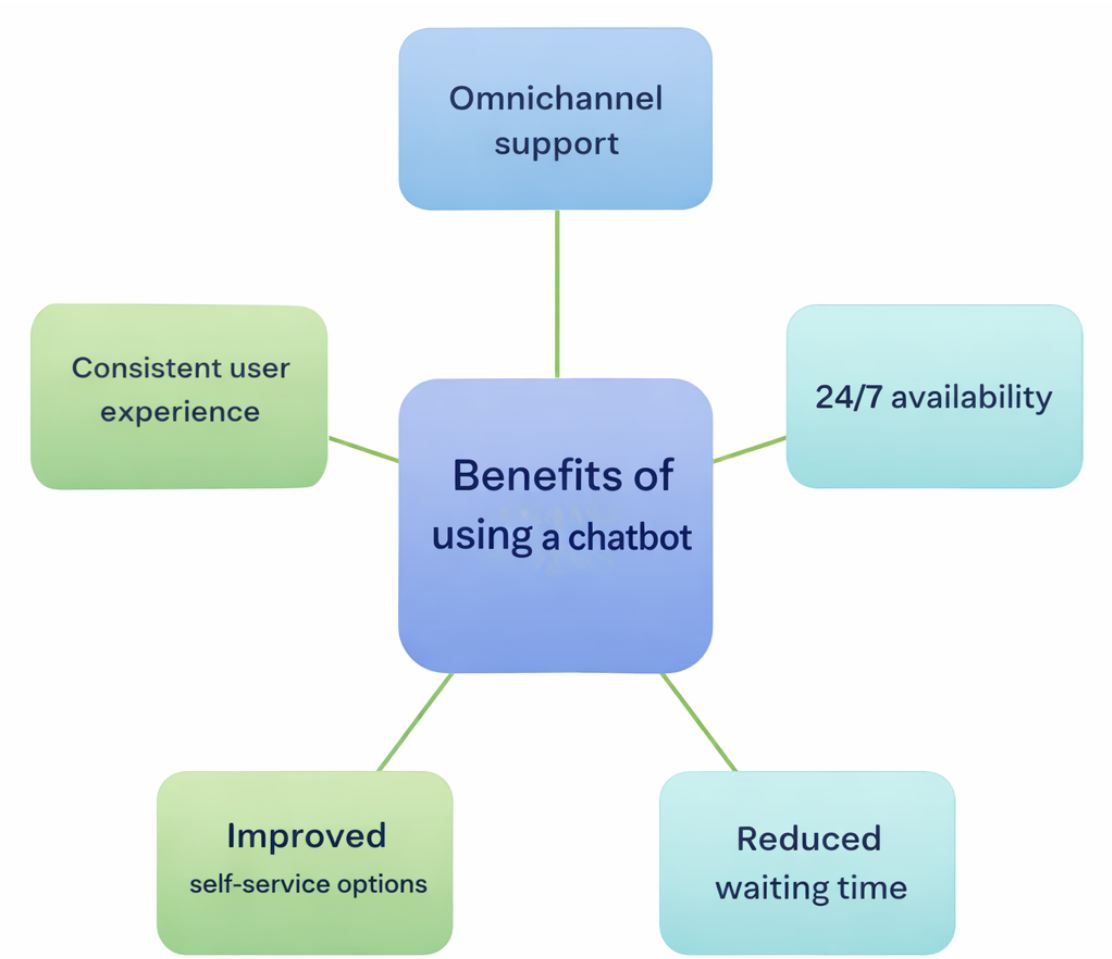


Fig. 1. Advantages of using a chatbot

Real-time machine learning models analyze a variety of factors, ranging from competitors' prices to the behavior of a particular visitor. If the system determines that the user is highly likely to leave the site without making a purchase, it can instantly offer a personal promo code or a time-limited discount

to encourage immediate order completion and maintain the profitability of the store [4].

However, it is important to note that the key problem of implementing neural networks in e-commerce is their strong dependence on the quality and volume of incoming information. Incorrectly, marked catalogs or incomplete purchase history can lead to the issuance of absurd recommendations that annoy users and reduce the likelihood of a successful transaction. This difficulty is compounded many times due to the "cold start" problem, when the system cannot offer a suitable product to a new visitor or promote a new product that has recently gone on sale.

Learning algorithms takes time and many interactions. In highly competitive conditions, this can lead to the loss of potential customers in the early stages. The situation is complicated by strict global privacy standards. Because of this, stores lose access to third-party cookies and cannot collect a detailed digital footprint for accurate targeting.

The integration of complex neural network models into online stores often conflicts with the key principle of high conversion – instant page loading speed. Features such as dynamic pricing, real-time personal storefronts generation, and visual search modules require significant server resources. If the architecture of an online store is not optimized, then artificial intelligence-based tools can slow down the site's response. Each additional second of waiting can lead to a significant increase in the failure rate, negating all the potential benefits of using smart algorithms.

In addition, the implementation and support of such systems are associated with high financial costs and the need to hire highly specialized specialists. This makes the technology inaccessible to many representatives of small and medium-sized businesses, whose marginality does not allow them to cover the cost of computing resources.

The use of generative artificial intelligence carries direct reputational and financial risks due to the tendency of large language models to hallucinate. Chatbots or automatic description generators are capable of creating fictitious product specifications, promising impossible delivery times, or providing incorrect operating instructions. This, in turn, leads to disappointed customer expectations, an increase in the number of refunds, and a decrease in audience loyalty.

At the same time, there is a psychological problem associated with excessive personalization. When the algorithm guesses hidden needs too accurately or reminds you of products that the client discussed offline, this can cause the user discomfort and a sense of surveillance. Instead of thanking them, they can leave the site, which directly affects the conversion rate.

We believe that the solution to these problems lies in the implementation of hybrid recommendation systems and the collection of zero-party data. Instead of just accumulating behavioral statistics, online stores should use interactive quizzes, onboarding, and surveys to directly find out the preferences of new visitors immediately after registration.

It is advisable to use content filtering algorithms for new products. In this case, the neural network does not analyze the sales history but text descriptions, tags, materials and images, automatically comparing the new product with already popular items in the catalog. With strict privacy restrictions and the rejection of third-party cookies, companies need to switch to using cohort analysis and federated learning technologies. This approach allows artificial intelligence to identify common behaviors among groups of users with similar interests without collecting confidential personal information.

To ensure that heavy analytical calculations do not slow down the download speed of the online store, technical teams should implement asynchronous script loading and microservices architecture. In this case, the basic content of the page will be rendered instantly, while personal AI

recommendations will be loaded into the background in a fraction of a second in specially designated blocks.

For companies with limited budgets, it is best to avoid creating their own resource-intensive models and instead integrate ready-made SaaS solutions and cloud APIs. These providers will take on the entire server load, freeing up the company's resources. Additionally, pre-caching can be used for typical behavior patterns, as well as the use of quantized AI models, whose weight is programmatically compressed for maximum performance without significant loss of prediction accuracy.

To avoid incorrect responses from chatbots and description generators, it is necessary to use RAG technology (Retrieval-Augmented Generation). This architecture reliably protects the neural network from receiving information from the Internet and forces it to search for answers exclusively in the synchronized product database (PIM system) of the store. This avoids making up non-existent characteristics and prices.

To reduce customer anxiety caused by excessive tracking, it is important to make the interface as transparent as possible. The user should be explained the logic of the recommendations using understandable markers such as "Similar to your recent purchases" or "Trend in your region." A mandatory element of trust is the presence of a recommendation reset button. This will allow the client to feel full control over their digital profile and perceive artificial intelligence as a useful assistant, rather than as an annoying observer.

Conclusions. The introduction of neural networks into the work of online stores is no longer an experimental innovation but is becoming an indispensable tool for ensuring competitiveness. Using artificial intelligence-based strategies completely changes the way we interact with customers. Instead of a static showcase that is the same for everyone, algorithms create a unique and adaptive experience for each user in real time. This directly affects key business performance indicators.

Neural networks provide seamless customer support at every stage of the sales funnel: from personalized visual content on the homepage to intelligent recommendations in the shopping cart. As a result, the probability of successful completion of the transaction increases many times.

In the long term, those companies that can find the perfect balance between technological efficiency and ethical use of their customers' data will dominate the e-commerce market. Artificial intelligence should become an invisible, but at the same time empathic assistant that anticipates the desires of customers without causing them to feel spied on.

The strategy of increasing conversion using neural networks is not a one-time task, but a continuous process of data collection, model refinement, and server architecture optimization. Smart investments in these technologies lead not only to immediate sales growth but also to a significant increase in customer lifetime value (LTV), lower transaction costs for content management, and create a solid digital foundation for business scaling.

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