Specific Features and Trends in the Field of Application of Artificial Neural Networks in Marketing

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Abstract: Purpose: The purpose of the article is to demonstrate the applied capabilities of neural networks in relation to the up-to-date task of marketing - predicting the effectiveness of buying a banner space for retargeting. Design/methodology/approach: The authors evaluate the development of neural networks, which are more and more involved in people's lives. They are becoming an essential tool in modern marketing, as well. The article considers the history of the development of neural networks and identifies the prerequisites for their wide use. The effectiveness of the use of neural networks in solving the tasks of a marketer in the following subject areas was evaluated: marketing analysis, the formation of ideas and strategies, content creation, automation of technical work and work with clients. The influence of neural networks and digitalization of marketing leads to the fact that for the marketer it is no longer important whether it is "a consumer or a person" as such. Findings: Modern marketing has been shown to increase its effectiveness with the help of neural networks. However, neural network marketing, considering all its advantages, has several disadvantages. The authors identified the following: the impossibility of creating new approaches by neural networks, the content of unpredictable cognitive distortions by neural networks. As a result of the use of neural networks, marketers will become less in demand, and their work will become significantly accelerated and simplified. Therefore, for marketers to remain competitive, it is necessary to study related areas. Originality / value: An example of the effective use of neural networks in marketing is the retargeting of site visitors through advertising sites. The neural network selects and estimates the price for displaying an advertising banner based on basic functions and preliminary deep training. The neural network presented in the article offers optimal solutions, evaluating a significant number of factors.

Keywords: marketing, artificial neural network, marketing strategy, example artificial neural network, retargeting in marketing.

INTRODUCTION

Neural networks are becoming an essential tool in the work of employees and the business. According to studies by Oxford Martin School, which was conducted back in 2013, almost half of the tools of all employees and workers will be automated by 2030. One of the factors of this trend is the use of neural networks that make decisions based on a large amount of data. Neural networks can perform many tasks related to decision making yet today. Furthermore, often their solutions are cheaper and of a higher quality. As stated by German Gref, the head of the largest bank in Russia - Sberbank, that the bank ceases to hire lawyers who do not understand the interaction with a neural network. Speaking to students of one of the regional universities, he openly stated that the quality of their statements of claim is much lower than those prepared by the neural network. Employees must now already understand neural networks to be competitive. A neural network is one of the examples or an attempt to create artificial intelligence. However, this is not yet artificial intelligence in the classical understanding. The work of a neural network is causally related to such a concept as machine learning. This is a field of knowledge that studies approaches to the construction of algorithms that help neural networks to learn independently. A mechanism is created in the neural network that itself seeks methods for finding a solution and does not offer a ready-made mechanism for developing solutions.

The neural network is arranged according to the type of the human nervous system. Its main feature is the desire for self-learning through previous experience. As a result, repeatedly, a neural network implements increasingly high-quality solutions and makes fewer mistakes. For the first time, neural networks were mentioned in the works of Warren McCulloch and Walter Pittsom back in 1943. They proposed the concept of a neuron, a basic component of a neural network. Already in 1958, Rosenblatt created the first working neural network. Subsequently, neural networks were forgotten for a long time, because other algorithms and mechanisms performed with better results (Deliana & Rum, 2017). Further, the first wave arose in the 1990s with the massive development of the IT sector and the spread of the Internet. However, the actual attention for the neural networks has been earned only since 2010. The problem of neural networks was the lack of computing capacity and the lack of sufficient databases for training.

In 2010, an image database appeared, which at that time contained 15 million images in 22 thousand categories (Paschen et al., 2019). It exceeded all then available bases and became the basis for creating neural networks, and most importantly - for their training. Neural networks faced the task of learning. The traditional method of training neural networks turned out to be not effective. It affected only the last layers of the network - the reverse encryption method. This problem was solved almost simultaneously by three groups of scientists (Luiz & Kun-huang, 2015). In 2006, the following solutions were presented: network pre-training using a Boltzmann machine, where each layer was trained independently. The second solution is to use an ultra-precise neural network for image recognition. The third solution is a cascading auto-encoder that affected all layers in a deep neural network.

Neural networks are already actively used in various fields: finance, commerce, industry, security. Insurance companies use neural networks to determine the conditions for customer insurance. A lot of basic data about hospital visits, diseases and various operations helps the neural network with this. In commerce, neural networks use global retailers. For example, Amazon sells 35 percent of its products on recommendations

(Metcalf et al., 2019). Wall-Street Journal uses neural networks to attract readers, and its audience has grown 10 times over the past 5 years. Neural networks are already used to predict promo offers for individual products. The accuracy of sales volumes, which is based on previous history and training of neural networks, can reach 87 percent (Lavrinenko & Tinyakova, 2018). Neural networks are actively beginning to be used in industry. They help in the process of smelting steel from scrap metal. Neural networks determine its composition and necessary additives.

METHODS

Neural network marketing can help a marketer solve problems in the following areas (Figure 1):

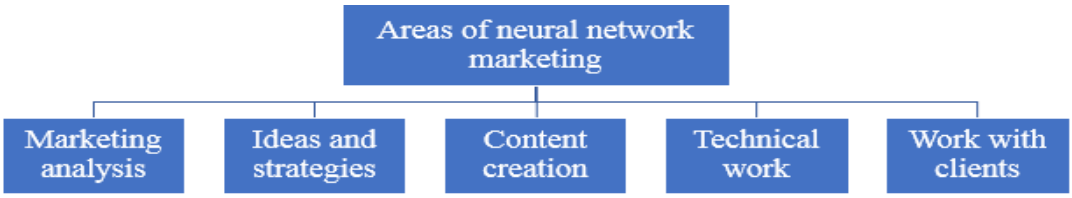

Figure 1: Areas of neural network marketing Source: developed and compiled 1. Marketing analysis.

The analysis includes an evaluation of the actions of competitors, the effectiveness of advertising campaigns and their interrelations, as well as an analysis of the target audience. The existing services for evaluating competitors' actions so far collect only quantitative indicators. They do not create interconnections between things that “work” and why things are effective, they do not reveal the reasons. Interaction with data takes a lot of time for a marketer, therefore automation, the use of neural networks can greatly simplify the task. Marketing will change when the rudiments of a service appear, which in reality will be able to determine the interrelations between the text used in advertising and consumer’s response actions, to tell the level of the interconnection between color and behavior, to determine the most effective strategy, to indicate what should be avoided. Now, the concept of the target audience is quite vague. It is impossible to determine reliably why some people buy some goods, other consumers buy others, what people dream about and what they avoid (Lavrinenko & Tinyakova, 2014). The problem is that people themselves cannot answer these questions. Here, neural networks can only partially help the marketer in solving this task.

IDEAS AND STRATEGIES

Any strategy is based on analysis. Neural networks will not be able to offer any creative strategy or something completely new, to rise to a higher level. Neural networks offer effective strategies based on conducted research. This will be one of the best solutions that has ever been applied or has been used (De Tienne & De Tienne, 2017). A neural network will undoubtedly contribute to raising the level of low or cheap marketing. Where there is not enough money for a full-fledged high-quality creative specialist, there a neural network will help the business with creative ideas. However, at a high level of marketing, marketers will often ignore the recommendations of neural networks, creating

and implementing their own ideas and strategies, which will lead to new Creative solutions

CONTENT CREATION

Neural networks are gradually replacing journalists. First, it concerns news items. A news item is an easy form of presenting content. Most of today's news uses the same structure: an attractive headline, the main one in the first paragraph, which reveals the content, interesting details are described below. At the very end, news reporters add information about those people, events and objects that were mentioned in the news. Writing news is a fairly simple process, but a lot of time the news editor spends on finding information that will be interesting to the appropriate audience, checking the reliability of the sources, analyzing the confirmation and additional information takes a lot of time. On average, a news editor writes 8-12 items per day. It should be noted that Associated Press began using the Wordsmith platform, which can compose over 2000 news items per second. Of course, the items received are still moderated and edited by real people, but over time, most news items will be written by neural networks. Marketers will soon be freed from the routine work associated with the formation of content; this will be done by neural networks. It is only a matter of time. In the future, the marketer will have only the most creative activity, which only the high-level marketers will be able to perform.

TECHNICAL WORK

Interaction with various services, setting up and optimizing websites, implementing advertising campaigns is a wide range of tasks that are performed or controlled by a modern marketer. There may exist a huge range of highly specialized professions: a targetologist, optimizer, or contextologist (Tinyakova et al., 2018). The separation or specialization of marketers is caused by the fact that modern systems and services are quite complex, diverse and constantly changing. The current level of neural networks has created additional problems for marketers under these specializations. Search and social networks have neural networks to help (Leong et al., 2018). Marketers must use ordinary services, customizing their work, imagining how the neural networks of search and social systems work. However, no one can say for sure how search engine algorithms work. This situation arose for two reasons: neural networks do not explain their decisions, and neural network developers protect their initial parameters. In the future, the neural networks on the side of the marketer will simplify the interaction with neural networks of search engines, perhaps in the future services based on neural networks will set up advertising campaigns and promotion only on the basis of a story about products and services, and the service itself will select the necessary target audience (Hew et al., 2019). But these are the possibilities of the distant future. Although the IT sector is developing at a significant pace.

WORK WITH CLIENTS

Interaction with clients does not directly affect the basic tasks of marketing but is an integral part of it. Marketing has it not enough to create or develop a product that is needed for the appropriate target audience. The marketer must still sell the product or service to the customer. Now there are more and more services appearing: autofunnels,

chat bots that use neural networks to one degree or another (Chang & Chen, 2015). But not everything is so rosy. Such automated systems can work when there is a large flow of incoming request orders. On the other hand, if the management of a premium client is entrusted to a neural network, then a client of this level may refuse to interact with the company. Neural networks are now actively learning to recognize not only the speech of customers, but also his mood. For example, networks are created that can recognize signs of depression in a client's speech. In the future, neural networks will be able to replace full-fledged sales departments.

RESULTS

The development of neural networks has also affected advertising. Let us consider the possibility of using neural networks for advertising in RTB networks for retargeting. That is, we want to buy a place for our advertising on any advertising platforms, so that the visitor, by clicking on the advertisement, returns to us. Targeting and retargeting is different: in the first case we predict the audience, and in the second - we repeatedly show our advertising banners to those who have already visited our site, bought something or simply followed the link earlier. For retargeting, the RTB network can be used, which is fully automated and several advertisers are struggling to show their ads to a visitor on another site. As an advertiser, we need to determine whether to bid and participate in the so-called auction, as well as what price should be set. For this purpose, we need a service that will make such decisions, basing on the calculated likelihood that a visitor from another site will want to return and buy our product or use our services. A similar evaluation can be called a "tendency to buy." To solve this problem, we will use a neural network and deep training which will help the company make a forecast. We will take the website of an online car dealership as an example. Our neural network consists of many neurons and connections between them. Below is a neural network that includes a small number of neurons. The network will contain tens of thousands of neurons and the connections between them (Figure 2).

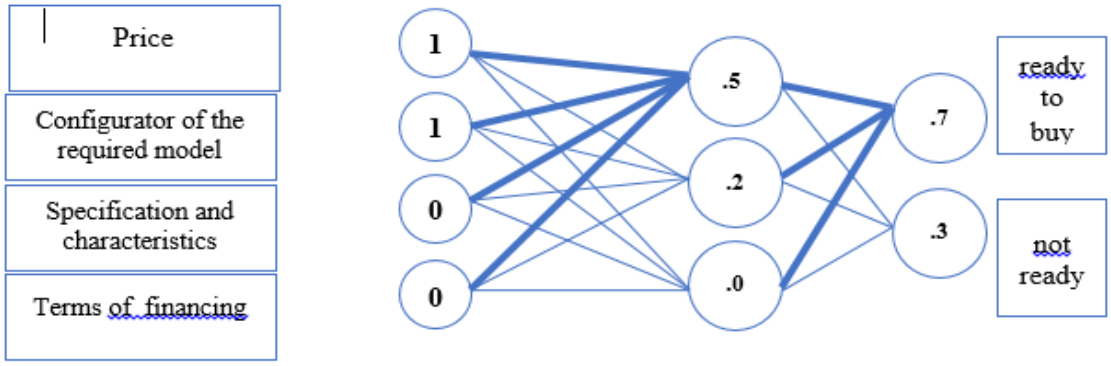

Figure 2. An example of a neural network in an RTB system Source: developed and compiled by the authors

To be able to predict consumers' buying tendency, we choose several certain functions that become important for the formation of electronic behavior of a user. To simplify the work, we choose 4 functions that describe the consumer visiting 4 pages of the site: prices; configurator of the required model; specification and characteristics;

terms of financing. As a result, the neural network will give out two options: 1. The site user is interested in a product or service or is already planning a purchase. Therefore, we need to show the ad; 2. The site user is not interested in the product or service or is not already planning a purchase. Therefore, we do not need to show ads. Network operation is shown in Figure3.

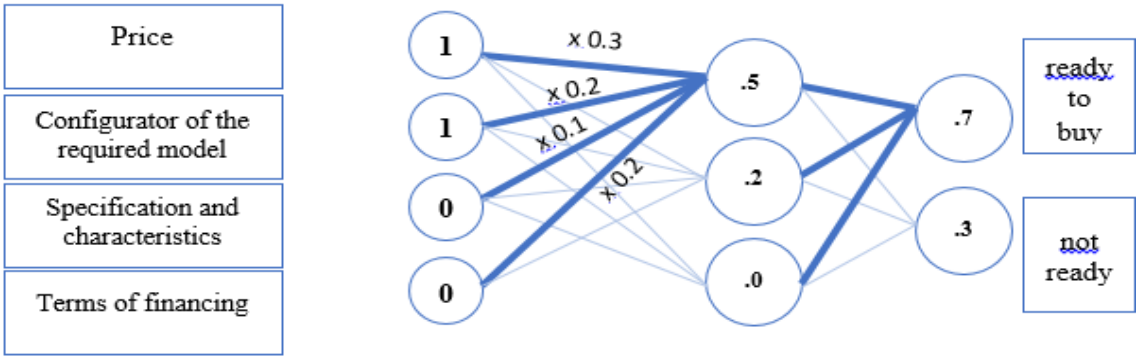

Figure 3. The functioning of the neural network in the RTB system Source: developed and compiled by the authors.

Each input can take only the values “0” or “1”. The value “1” or “Yes” is decrypted as the user visited the necessary page. Neurons in the middle add value to connected neurons, relying on weights. The process presupposes moving from left to right until we get the result described above. With an increase in the volume of initial information, the likelihood that the initial data is described reliably by a statistical population increases, which means that a neural network predicts user’s behavior. In the example considered above, the site user visited the indicated pages: “Prices”, “Configurator of the necessary model”, but ignored the other two pages. Focusing on the scales above, we get the answer "0.7 points", which means the willingness of the user to buy our product is 70 percent. The above mechanism is an untrained neural network. The task is to find adequate weight coefficients for all interrelations within the neural network. This is the purpose of training. For training, we post information into the neural network from several users with the initial decision to buy or with a refuse to buy. While learning, the neural network processes the information received and adjusts the weight for each neuron. After precisely determining the weights, the neural network will predict the results for each site visitor much more accurately.

CONCLUSIONS

The problem of neural networks and the current development of artificial intelligence is that it is impossible to make scientific discoveries only within the usage of a statistical approach and appropriate methods. In the words of Noam Chomsky, one of the greatest modern scientists, a linguist, philosopher and theorist: carrying out research with "raw data", the scientist will not discover anything new, will not arrive anywhere ... or an experiment with water, when they proved that water can turn into oak or something else. This all happened before Priestley proved the presence of nitrogen in the air, the theory of photosynthesis appeared, and so on. Scientists and researchers should understand that the experiment carried out before is quite correct, but if scientists do not

know what they are looking for, then statistics can lead them to the other way (Sitokina & Filatova, 2018). For example, if one transfers the array of data on tree growth to a powerful computer, if one conducts statistical research and eventually receives an approximation of what happened, this will lead the researchers even more to the wrong side. Another problem is that neuroscience and psychology lag the development of physics and chemistry. Now the development of neuroscience and psychology is at the level of physics of the last century, if compared. The disadvantage of a neural network is incomprehension, even the lack of knowledge on of how it makes decisions. After active attempts on implementing a vision of the effectiveness of the neural network, researchers, marketers and business asked a question: how does the neural network actually take a decision and why does it issue this particular decision, and not another?

The problem is that neither the users of the neural networks, nor the developers themselves, know what is happening inside a system. A neural network works on the principle of "black box". This causes several inconveniences. As a result, marketing needs a neural network, but also an affordable explanation of how this solution was received and why it is correct. There are already attempts to create a transparent or explainable artificial intelligence in which users can understand the algorithm of actions. In most cases, neural networks learn to recognize patterns, to generalize something according to certain signals. Such an activity always contains cognitive distortions, that is, erroneously recognizes non-existent patterns. A similar property of a neural network cannot be neutralized. If the neural network has several cognitive distortions, then they can be used not always for good purposes. For example, stop or change the route of an unmanned vehicle by showing it a specific banner. As a result, the disadvantages of neural networks are as follows:

1. Neural networks cannot make discoveries.

Neural networks cannot access new knowledge, move to a different level of work or “consciousness”; they cannot make scientific discoveries.

2. Neuroscience and psychology are a century behind the development of physics.

Neural networks are also lagging in their development. Therefore, the massive use of neural networks is possible after an in-depth study and understanding of neuroscience, psychology and what is happening in the human brain and neural network.

3. The neural network contains completely unpredictable cognitive distortions.

Given that neural networks are more statistically accurate, they are less prone to external distortions and bias. However, there is one “but.” People are predictably biased, and a neural network contains completely unpredictable cognitive distortions. In modern marketing, a person as such is not interesting to anyone. The new marketing paradigm is that neural network marketing is not interested in people, it is interested in digital traces. Only individual digital slices that can be efficiently and accurately generalized, predicted, which are packaged in context-sensitive volumes and transferred from one business to another. In modern reality, most of the digital footprints are still formed by a human being, however, soon leadership will be transferred to machines and things, that is, the era of the Internet of things will come. No one else will follow the person himself, the main emphasis will be on tracking the things that he uses. Neural network marketing creates a new digital reality. The only reason for its creation is to increase profitability at the expense of security in the future and the level of comfort. Digitalization of marketing is realized "by money, for money and for the sake of money."

Considering the use of neural networks, we understand that the work of a marketer will be greatly simplified and accelerated. As a result, one marketer will be able

to perform the work that several do. Routine and technical tasks will be shifted onto neural networks and services. As a result, marketers, like craftsmen or drivers, will not be in demand any longer. Increased automation will affect marketing as well as the appearance of unmanned vehicles affects drivers. For a while, there will be only one task that is in demand by business, and marketers will provide it: transferring business concepts to the concepts of consumer communications and creating a chain of meanings. Marketers will be in demand if they give a clear and understandable answer to the questions: why should we focus on this segment? Because of what will users be ready for a message about a product or service? In the future, this function will also be implemented through neural network marketing, and the profession of a marketer will be completely different. Marketers have only one choice: to study related areas, neural networks, to acquire new skills and improve their specifications. Only such marketers will remain in demand in the market. Neural network marketing will become the focus and will occupy a large part of the market for marketing services.

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