

# **Research on the Future Distribution Industry Using Artificial Intelligence**

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## **Abstract**

Artificial intelligence has begun to be applied to various industries such as manufacturing, medical care, and transportation, and the distribution industry is one of the fields where artificial intelligence is applied at the forefront. In retail, artificial intelligence can be applied in virtually any area where businesses need to make strategic decisions, such as store location selection, staff recruitment, sales forecasting, and inventory management. Artificial intelligence will also change the shopping environment perceived by consumers. This shift can be seen in the shopping search and purchase process, shopping site design, and the rise of artificially intelligent robots serving as skilled salespeople. These AI-led changes can be summarized as reading and adapting to customers minds, and are expected to fundamentally change the future of the distribution industry. Considering the rapid development of artificial intelligence technology, domestic retailers are far behind, so it seems that more attention and investment in the field of artificial intelligence will be needed in the future.

## **Keywords**

Artificial intelligence, AI, Distribution Industry, deep learning and future industry

## **1. Introduction**

Today, the 4th Industrial Revolution is an era of "virtual physical systems" (Cyber-Physical Systems) in which things are automatically and intelligently controlled by integrating the real and the virtual, and one of the core new technologies is exactly Artificial Intelligence (AI). (Kim 2016) Artificial intelligence has begun to be applied in various industrial fields such as manufacturing, medical care, and transportation. For example, in the medical field, IBM's artificial intelligence, Watson, has been working with the world's best cancer hospital, the Memorial Sloan-Kettering Cancer Center (MSKCC) in New York, USA since March 2012, and MD Anderson Arm. Since October of the same year, the center has been conducting research aimed at deriving accurate cancer diagnosis and optimal treatment methods. Currently, it has been introduced not only in the United States but also in Japan and South Korea, where it is being used for treatment and diagnosis of cancer patients. (Website Jang 2016) Artificial intelligence is applied in various fields such as industrial robots, autonomous vehicles that recognize roads and traffic conditions, and translation that understands human natural language. is one. It is still in its infancy, and artificial intelligence is expected to change the landscape of the industry itself and radically change the shopping experience of consumers in the distribution industry. The history of artificial intelligence is shown in Figure 1 below. (Website 2021) In this paper, we will look at the development of artificial intelligence and how it will change the distribution industry.

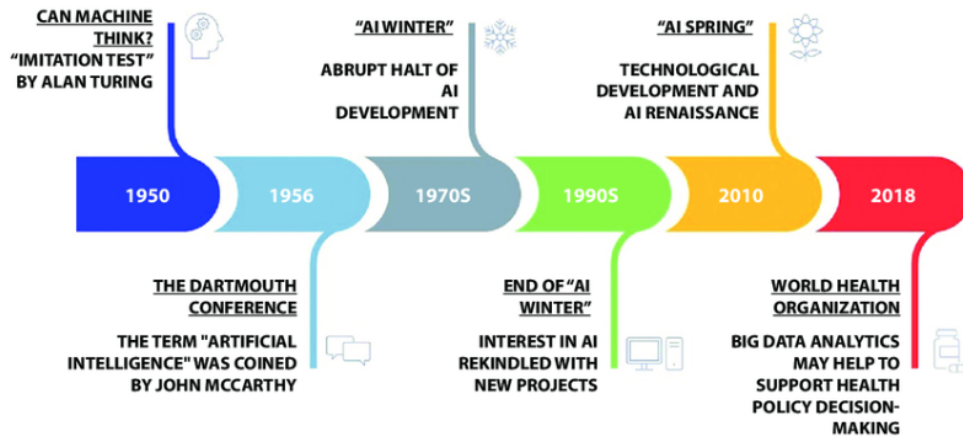


Figure 1. History of Artificial Intelligence

## 2. Body

### 2.1 Current State of Artificial Intelligence Technology Development

Research and development on artificial intelligence is mostly done by global IT companies such as IBM, Google, Microsoft, Apple, and Facebook. The company acquired a startup that possesses artificial intelligence technology and established a related business organization while focusing on developing artificial intelligence technology.

IBM's artificial intelligence Watson beat the human champion on the American quiz show "Jeopardy" in 2011. Since then, Watson has been applied to various industrial fields such as manufacturing, medicine, finance, and education. Airbus, an aircraft manufacturer, has introduced Watson in its production process to understand the degree of wear and replacement cycle of the hundreds of millions of parts required for aircraft, and is using it for maintenance. (Website Yu 2016) And hospitals in various countries such as the United States, Japan, and South Korea are using Watson for cancer diagnosis and treatment methods, and it is also being used to predict weather and future climate change. Watson has also been applied to the development of artificially intelligent robots. IBM co-developed Robotics and Pepper with Japan's Softbank and French Aldebaran, and hotel chain Hilton with Robotics and Connie, also of France's Aldebaran. This artificial intelligence robot is equipped with natural language processing ability and can naturally converse with people, and is used to serve customers at shopping stores, pizzerias, hotels, etc.

In November 2015, Google released Tensorflow, an open source-based artificial neural network algorithm. Applies to services. Google Photos is an image recognition service that can distinguish cats, cars, human faces, places, etc. by analyzing a large number of photo materials, and 'RankBrain' can search even if you enter ambiguous keywords or sentences in the Google search window. A service that delivers results. 'Smart Reply' is a service in which Google's Gmail inbox understands the content of emails and creates appropriate and short replies by itself. (Website Kim 2017) And Google unveiled its artificial intelligence Go program as we know it in January 2016, winning a game against Isedor Knight in March.

Microsoft has developed Cortana, an artificial intelligence personal assistant that recognizes voice, and is working on the Adam project, an image recognition technology that recognizes objects in images and real-time language translation on Skype. Apple has also developed Siri, a voice recognition personal assistant. Siri recognizes the customer's voice, searches for desired product information, and is developing in a way that helps even individual schedule management. Facebook unveiled artificial intelligence technology that automatically recognizes users' faces in photos and attaches name tags to them, and recently released a chatbot, an artificial intelligence program that communicates with people. Amazon also launched Alexa, a cloud-based voice-recognition artificial intelligence that understands a person's speech style, intonation and context. (An 2016).

In Korea, Naver has been operating Naver Wrap since 2012, providing voice recognition search service and photo classification service, and applying deep learning technology to knowledge iN. NCsoft is developing AI-based games, and Kakao is using AI technology for its travel destination recommendation service and instant response search service.

In addition, he is promoting artificial intelligence research and development at universities and research institutes. However, despite the rapid development of artificial intelligence technology centered on global companies, the level of investment and technology related to domestic artificial intelligence is still quite insufficient. Of the KRW 605.3 billion invested in software over the past five years, investments related to databases and artificial intelligence accounted for only 3%, and the level of artificial intelligence computing is only 73.1 points when the US is the standard (100 points). (An 2016)

## **2.2 Artificial intelligence and changes in the distribution industry**

### **2.2.1 Application areas of artificial intelligence in the distribution industry**

In the distribution industry, artificial intelligence can be applied to almost all areas that require strategic decisions in distribution companies, such as store location, product display, sales item determination, personnel recruitment and personnel management, and inventory management.

#### **2.2.1.1 Selection of store location**

When a company seeks to open a new store, it conducts a long-term analysis to select a location.

However, artificial intelligence technology can make optimal site selection very quickly and efficiently. By inputting a variety of data such as sales volume, population, distance from competing stores, recent promotions and events, businesses can strategically decide when and where to open new stores. Artificial intelligence, which learns autonomously from such data, not only suggests the best candidate locations to open a new store, but also identifies the most important factors that contribute to the success of a new store, allowing each candidate to You can even explain why you chose the location.

US home interior distributor Kirklands has applied artificial intelligence to select optimal store locations and predict future sales with Experian. Expirion will start with a basic database of information on furniture, business entities, retailers, and shopping centers in the United States, and will open new stores by researching Kirkland's existing store location characteristics, store sales and performance, and customer data. Selected the best location. (Website 2018)

#### **2.2.1.2 Recruitment and Talent Management**

During special shopping events such as Black Friday in the United States, the number of customers surges, and ordinary human resources are not enough to handle them. In such a case, if the company does not fill the right human resources based on accurate data, it will rather allocate more employees, inefficiently waste money, or cause inconvenience to customers due to a shortage of employees.

In such cases, artificial intelligence can help companies determine the exact number of people they need to fill during the event and where to place their staff. By using data on the number of customers and sales during specific events in the past, marketing strategies, etc., it is possible to predict the number of customer visits and determine the number of employees based on this.

Artificial intelligence can be applied not only to recruiting employees during specific events like this, but to recruiting people in general. Hiring the right people for a company is an important factor that determines the results of a company, but it is very difficult to decide which candidates are the right people. Artificial intelligence learns data about existing hires and leverages new applicants' past performance and characteristics (background, past sales experience, past occupations, etc.) to help them maximize their potential. You can select new employees and know which areas and stores are suitable for each employee. In addition, artificial intelligence can be used to evaluate existing employees and manage human resources. Japan Oracle, an information technology (IT) company, is developing a system that allows artificial intelligence to advise on personnel transfers. This system determines the most suitable departments and positions based on data related to employees' careers and work performance.

#### **2.2.1.3 Sales forecasting and inventory management**

Companies perform best when they strategize by accurately predicting which products will sell well, which promotions will work, and which marketing efforts will drive sales. Artificial intelligence analyzes and learns past sales data for each product, promotion, and marketing of the company, and can draw a future image of the company and analyze why such a figure appears. In other words, you can analyze which products and marketing strategies were successful, and why. Thus, businesses can now make optimized decisions through artificial intelligence to achieve desired results.

Accurate sales forecasts by artificial intelligence contribute to more efficient inventory management. Efficient inventory management is a very important issue for distribution companies. Overstocking slows turnover and reduces revenue, while understocking loses customers. Therefore, maintaining an appropriate inventory has a significant impact on the performance of distribution companies. For efficient inventory management, it must be possible to predict which product will be needed at which store and when. By using artificial intelligence to accurately forecast sales by store, distribution companies can solve the problem of proper inventory levels.

Japan's Softbank is using artificial intelligence to predict smartphone sales. Artificial intelligence is used to calculate the optimal inventory quantity for each store, taking into account the order performance of about 2,600 stores nationwide, store size and location, and season. SoftBank was able to reduce inventory by 10-20% as a result of trial introduction of this system in some stores, and it is aiming to reduce inventory by more than 20% after full-scale introduction. (Website Jo 2016).

eBay, which operates an online auction and shopping website, plans to use artificial intelligence to predict consumers' shopping habits and tendencies and predict sales based on that. In July 2016, eBay acquired Sales Predict, an Israeli startup that predicts sales based on artificial intelligence technology.

Sales Predict is a company that analyzes customer responses, identifies potential demand based on this, and supports sales expansion. (Website 2016).

Amazon's delivery prediction system is also an example of purchase prediction through artificial intelligence. This system analyzes the consumer's purchase history, search history, and purchase wish list, identifies in advance what product the consumer needs, and sends it in advance before the consumer purchases it. Amazon applied for a patent for this system with the US Patent and Trademark Office in August 2012, and received final approval for the patent in December 2013. (Website Dylan 2014)

## **2.2.2 Changes in the shopping environment due to artificial intelligence**

### **2.2.2.1 Changes in the shopping search and purchase process**

Image recognition and classification technology using artificial intelligence provides us with a new shopping experience. A representative example is the 'Visual Search Service' of Pinterest, a social media specializing in image sharing and search. When Pinterest users select a product (boots, table, plate, etc.) in the photo, this service provides various information related to the product as well as pictures of products similar to the product in question. In addition, by enabling automatic connection to websites that sell various products in the picture, product search leads to purchase. (Website 2016) Thanks to this artificial intelligence technology, we can search for and purchase a product by taking a picture of a bag someone is carrying on the way to work or a table that we accidentally saw in a booklet without knowing the product name or knowing where to buy it.

Changes in the shopping search and purchasing process due to artificial intelligence do not stop here. When trying to find the product we want in online shopping, we have to enter the appropriate search terms or browse through several pages of the shopping site. If the product you want to buy is specific and you know the exact product name, you can enter the product name, but if you want to buy a certain product vaguely, for example, a spring jacket, you have to go through several pages of the site. This is a process that has hardly changed since the inception of online shopping. However, artificial intelligence technology made possible by deep learning can greatly reduce these efforts by searching for and recommending products that customers want in consideration of various information such as the consumer's size, desired color, material, and design. 'Fluid Expert Personal Shopper', a shopping app recently launched by outdoor brand The North Face, is a shopping assistant that uses artificial intelligence. This is an app equipped with Watson, IBM's artificial intelligence. When a customer asks the app what product he wants, it finds the best product he wants. For example, when a customer is unsure which of the many spring jackets to choose, Watson asks questions such as 'Where do you wear the jacket?', 'When do you wear it?', 'What activity do you intend to do?' It is to find the product that is optimized accordingly. (Website Moon 2016) Recently, chatbots, which Google, Facebook, and Microsoft are paying attention to, are expected to lead changes in shopping search and purchasing environments by playing a similar role. In short, artificial intelligence reads the customer's mind and finds and recommends the desired product even though the customer himself does not know exactly.

### **2.2.2.2 Implementation of customer-customized shopping site**

Another change made possible by artificial intelligence that we will experience in the shopping process is that the design and content of shopping sites are presented more tailored to the taste of customers. There are many things to

consider when designing a shopping site, such as font size, messages and images, page order, and page layout. Until now, companies have chosen sites that maximize sales through A/B testing. (Website Nathan 2013) Since this method takes a long time, the design of the selected shopping site is maintained for a certain period of time. Therefore, even if users' tastes change, it is difficult to change the design of the site immediately. Sometimes a very small difference can make a big difference in sales, and existing testing techniques are not suitable to solve this problem.

However, by applying Evolutionary Algorithms (EAs), one of the artificial intelligence technologies, future shopping sites can be constantly optimized in a way that even small changes in customer tastes can be immediately reflected. In other words, in order to implement an optimal shopping site, not only the past user's selection information but also the current user's selections are immediately utilized, so that continuous optimization can be achieved. Just like the evolution of organisms according to the principle of survival of the fittest, the optimal site for the most success is continuously derived according to the changing circumstances.

These changes in the 4th Industrial Revolution are still in the future, but the recent example of an evolutionary algorithm used by Cosabella, an Italian lingerie company, along with Sentient, an artificial intelligence company, shows the beginning of it. Cosabella used evolutionary algorithms to test several alternatives for website design in a very short period of time, resulting in a 35% increase in sales. (Website 2016)

### **2.2.2.3 Emergence of artificial intelligence robots as proficient salesmen**

Artificial intelligence robots, which are already used in the manufacturing process or logistics work, are being introduced to offline stores, diversifying the shopping experience of customers. Robots are being used by several distribution companies, such as BestBuy, a home appliance store in the US, and Lowe's, a home center.

In September 2015, Best Buy introduced a robot called Chole to a store in Chelsea, Manhattan, New York, USA. This robot installed in the entertainment corner that sells records and DVDs was developed by Best Buy together with Par Systems, a robot solution company. In the entertainment corner where the entire wall is made up of glass shelves, Chloe, a robot shaped like a human arm, is installed, and customers can order products they want by manipulating nine touch screens installed in front of the glass wall. When an order comes in, the robot Chloe moves between the glass shelves to quickly find the product and deliver it to the customer.

In February 2015, Home Center Lowe's also introduced an artificial intelligence robot 'OSHbot' to its Orchard Supply Hardware store located in California. This robot serves to find the products customers want in the store and check the stock status. Oshbot is equipped with human face recognition technology, so when a customer approaches, it greets them first and asks what product the customer is looking for. When a customer searches for a product they need on the Oshbot's touchscreen, Oshbot guides the customer to where the product is located. Oshbot can speak various languages such as Spanish, Chinese, and Japanese, providing services that are difficult for ordinary employees to provide.

Artificial intelligence robots are used not only in these companies, but also in various distribution companies such as Japan's Aeon and home appliance store Yamada Electric. Artificial intelligence robots have developed to the point where they have the ability to understand the age, gender, and emotions of customers, and Pepper, mentioned earlier, is a representative example. Pepper can use facial recognition to determine the age and gender of its customers, and when someone touches its eyes and ears, its sensors detect this and then judge the person's mood. For example, if you touch yourself gently, you measure 'positive', and if you hit yourself hard, you measure 'negative'. After combining the feeling at this time with the experience so far, the endocrine system data is analyzed to judge customer emotions such as 'pleasure', 'stability', 'anxiety', and 'disgust', and recommend products that match them. (Retail Magazine 2016).

Artificial intelligence robots can still recognize human emotions only at a simple level, but as artificial intelligence technology continues to evolve, the future will come when robots can identify even the most detailed emotions of humans and recommend products.

## **3. Conclusion**

The application of artificial intelligence in the distribution industry is only at the beginning stage, and considering the speed of development of artificial intelligence technology, it is expected that the landscape of the industry will fundamentally change in the future. In a word, the ongoing changes in the distribution field can be summarized as

'reading customers' minds and adapting to them. As the shopping environment has changed from offline to online, consumers have been able to overcome the limitations of time and space to a large extent in shopping. Now, thanks to cutting-edge technologies such as artificial intelligence, the shopping process is moving toward a stage where true personalization can be achieved.

Anticipating the future changes that will be led by artificial intelligence, major IT companies in developed countries are making large-scale investments in the field of artificial intelligence and making efforts to lead technological change, and distribution companies are attempting to apply developed technologies to various fields.

Some distribution companies in Korea are also attempting to introduce these cutting-edge technologies. SK Planet and Lotte, which operate 11st Street, announced plans to introduce an automated chatbot service with natural language processing capabilities to provide customized services in product search and recommendation.

However, compared to major distribution companies in developed countries, the speed of AI application by domestic companies is still lagging behind, and more attention and investment are needed in the future. And in order for artificial intelligence to be widely applied in various industries such as the distribution industry, the IT field that develops these technologies must develop. Policy support needs to be provided so that an ecosystem can be established in which the industry developing technology and the industry applying it can develop together.

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