

Artificial Intelligence Will Change Industries

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Deep learning is a kind of artificial intelligence (AI) that has rapidly become popular in recent years. By learning enormous amounts of data sets using a multi-layered neural network that imitates the human brain, the technology can execute natural language processing, image recognition and other various tasks with high accuracy. In the history of AI, deep learning has particularly gained the spotlight with its high performance in achieving different tasks including image recognition and natural language processing. This technology is also expected to be further improved and applied to a variety of fields.

Now, what do you feel about the above text after having read through it? The above paragraph is actually that automatically created by AI after I told it to "explain what deep learning is." You probably see the text as if it had naturally been written by a human being, grammatically correct, and properly describing the subject. Next, look at the image in Fig. 1. This is also a piece of graphic that I asked AI to create just with the keywords "automobile", "future", "night", and "Milky Way". Like this, images with a quality that can be compared favorably with

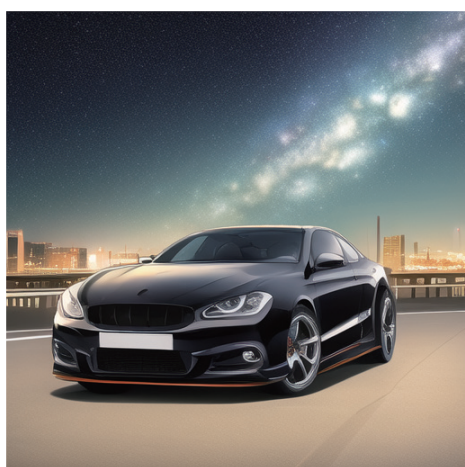


Fig. 1 Image drawn by AI

those drawn by human beings can be swiftly completed by AI in just several seconds.

Deep learning has been used not only in research and development (R&D) on natural language processing and image recognition, but also in R&D on speech processing. Familiar examples include voice commands to smartphones and voice interfaces of smart speakers. Furthermore, some have tried to apply deep learning to signal processing or data analysis. These applications have started to be introduced in chemical, medical, and mechanical industries.

Now let me expand on the meaning of the words "Artificial Intelligence", "deep learning", and "Machine Learning" as shown in Fig. 2. First, artificial intelligence (AI) means to artificially implement intelligence at a level equivalent to or even higher than human intelligence. AI covers various fields ranging from fundamental research to application engineering, including the development of humanoids and computer based Igo and Shogi. "Machine learning" is one AI approach. For implementing human learning mechanisms and functions on a computer system, machine learning pursues appropriate

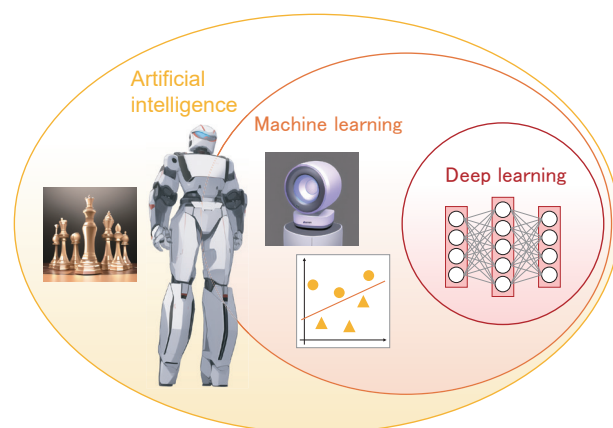


Fig. 2 Artificial intelligence, machine learning, and deep learning

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mathematical models and their algorithms as well as their application. Machine learning is also related to the above mentioned natural language processing, image processing, and speech processing as well as statistics. “Deep Learning” is a type of machine learning that uses a “deep neural network (DNN)” as a mathematical model.

It is in just the last decade that deep learning has rapidly advanced. This was achieved with the proliferation of the Internet and the higher performance of computers, which allowed collection of large amounts of data and high-speed processing of the collected data, although deep learning models themselves had been proposed since olden times. With a focus on industrial applications of deep learning, the following introduces several examples.

Efforts have arisen to implement “Anomaly Detection” to automate and optimize inspection of industrial products or status monitoring of manufacturing machinery.¹⁾ With this technology, computers can judge products OK or not OK just by scanning their images, thereby enabling systemization of inspection tasks by humans that are quite individual skills. This may eventually alleviate the lack of labor caused by the low birthrate and aging society. Manufacturing machinery can be installed with microphones and vibration sensors for continuous monitoring of operating status, which allows the detection of signs of failures or the performance of machinery maintenance at optimal timings. Plant owners can expect higher availability of production equipment and lower maintenance cost.

Detecting human errors or potentially dangerous tasks in the assembly process will improve product quality and help create a safer work environment. In addition, collecting and analyzing information about employees’ tasks and the traffic line of moving machines and then conducting a PDCA (Plan, Do, Check, Action) cycle to develop and execute an improvement plan will probably improve operations and their efficiency. These efforts are called “Service Engineering”. R&D related to such service engineering is underway by leveraging AI technology.²⁾ Concrete examples of R&D include an analysis of images captured by monitoring cameras to notify any misoperation or dangerous tasks and an analysis of information obtained from employees’ wearable sensors to identify any issues.

Deep learning has the problem that its mathematic models are likely to be a black box and people cannot exactly know the information or logic used by computers

in making decisions. Then, to inform people of the behavior of AI, an effort called “Explainable AI (XAI)” has gained attention from the viewpoint of application to industry and medicine.³⁾ In a deep learning model for image analysis for instance, the parts of the image focused by the computer in making decisions can be disclosed. Another example is a system to analyze information obtained from many different sensors that is designed to be able to calculate the importance of each piece of information. Furthermore, an attempt is widely underway that will effectively use the findings obtained for developing new industrial products or projecting the effectiveness of drugs.

Promoting these effective uses of AI described above in industry should enhance the possibility of technical innovation and new business development. To do so, “Digital Transformation (DX)” is a must to digitize all information at the site, connect the digital information with AI technology, and establish a new information utilization means in the whole business flow. During the COVID-19 pandemic, we were physically separated from our workplace and became acutely aware of the necessity of DX for online meetings and teleworking as well as for information exchange with sites or among employees. Beyond DX lies AI. Toward the age of living under or even after the pandemic as well as to be able to respond to the world’s dramatically changing circumstances, I believe that we need to use AI as much as possible.

References

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