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Analysis of the Status of Artificial Medical Intelligence Technology Based on Big Data*

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Abstract

The role of artificial medical intelligence through medical big data has been focused on data-based medical device business and medical service technology development in the field of diagnostic examination of the patient's current condition, clinical decision support, and patient monitoring and management. Recently, with the 4th Industrial Revolution, the medical field changed the medical treatment paradigm from the method of treatment based on the knowledge and experience of doctors in the past to the form of receiving the help of high-precision medical intelligence based on medical data. In addition, due to the spread of non-face-to-face treatment due to the COVID-19 pandemic, it is expected that the era of telemedicine, in which patients will be treated by doctors at home rather than hospitals, will soon come. It can be said that artificial medical intelligence plays a big role at the center of this paradigm shift in prevention-centered treatment rather than treatment. Based on big data, this paper analyzes the current status of artificial intelligence technology for chronic disease patients, market trends, and domestic and foreign company trends to predict the expected effect and future development direction of artificial intelligence technology for chronic disease patients. In addition, it is intended to present the necessity of developing digital therapeutics that can provide various medical services to chronically ill patients and serve as medical support to clinicians.

Keywords : Big data, Medical artificial intelligence, Health cloud, On-site diagnosis inspection, Digital thraphy.

Major Classification Code : Artificial Intelligence, Analysis of Helth Care Markets, Computational Techniques Simulation Modeling

1. Introduction

1.1. Medical AI Status and Prospect

As the complexity of medical data increases, the demand for artificial medical intelligence to improve the quality of medical services is increasing. Medical intelligence is changing from a programmed rule-based system to disease diagnosis and treatment support based on literature and image data. There is this indicates that the treatment

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paradigm has changed from the method of medical treatment based on the knowledge and experience of doctors through medical intelligence to the method of receiving the help of high-precision medical intelligence based on data. In order to handle and analyze huge amounts of information, artificial intelligence technology is becoming more and more important (Lee et al., 2020).

IBM launched Watson Health in the U.S. to help clinicians make decisions about the treatment direction of cancer patients by analyzing specific patient information and providing recommendations and evidence based on priorities for various treatment methods by applying it to cancer patient care It provides a platform that provides Intel is supporting the healthcare sector with data-driven insights and artificial intelligence (AI) by introducing a range of tools and solutions that simplify artificial intelligence (AI) deployments. In Korea, as well as introducing IBM Watson-based artificial intelligence service and Gachon University Gil Hospital using artificial intelligence 'Watson' to treat cancer patients, domestic medical start-ups with artificial intelligence technology are attracting attention recently, and Vuno is an artificial intelligence medical service. The device was commercialized and listed on the KOSDAQ, and Lunit has partnered with Fujifilm, GE Healthcare, and Philips to promote the AI medical device business. and increasing influence.

Therefore, medical intelligence in the future will be subdivided based on precision medicine that reflects individual characteristics with a paradigm shift from document and image-centered disease diagnosis intelligence to preventive intelligence such as early diagnosis and complications prediction intelligence centered on hospital clinical big data.

Medical service based on medical intelligence technology for the prediction and prevention of patients' disease, a new paradigm, is changing to medical intelligence that applies new technologies such as more advanced and explainable artificial intelligence technology to solve the limitations and problems of existing medical intelligence. It is expected to develop in this way.

1.2. Health Cloud Status and Prospect

In order to provide a variety of medical services to doctors and patients using clinical big data, it can be said that the establishment and advancement of the medical information system is essential for hospitals. Artificial intelligence (AI) and deep learning are entering the mainstream of clinical medicine (Stead, 2018).

With the recent rise in the importance of medical big data, the demand for cloud utilization of hospital information systems has increased exponentially due to the increase in hospital information system construction costs.

Amazon and IBM are strengthening GPGPU support to accelerate the performance of their IaaS cloud services. Due to the limitations of virtualization technology based on GPGPU support, cost-performance efficiency is not high. Amazon, Microsoft, IBM, and Google have launched Machine Learning as a Service (MLaaS) services in the form of machine learning APIs so that users can focus on machine learning without the burden of infrastructure management. Large hospitals such as MD Anderson Cancer Center in the US, Memorial Sloan Kettering Cancer Center, and Cleveland Clinic are promoting medical intelligence services based on the IBM Watson platform, and large corporations such as Naver and Kakao are entering the medical cloud business in Korea (Park et al., 2021).

Therefore, the medical cloud goes beyond the hospital information system, to the construction and utilization of medical big data, precision medicine and It is expected to become a basis for implementing digital healthcare by supporting medical intelligence, and supports a micro service structure that can be developed and operated efficiently by subdividing existing applications by function to facilitate application development, maintenance, and upgrade. It is expected to develop into a cloud that in addition, it is expected that major hospitals in Korea will build a Korean-style healthcare big data analysis platform and develop it as a medical service for the purpose of supporting the clinical treatment decisions of medical staff based on the results of big data analysis.

1.3. Status and Prospect of On-Site Diagnosis Inspection

Currently, the medical market is investing heavily in the development of biosensor technology that can acquire field-oriented disease and health information in real time from the existing hospital-oriented diagnostic technology through medical big data.

Care diagnostic tests, which were performed only in hospitals, using wearables and sensors, regardless of where the patient was outside the hospital, have been ongoing for a long time. As possible, biosensor research is being actively conducted. However, it is difficult to secure technologies such as accuracy and reproducibility required for commercialization of biosensors, so it can be said that there are only a few biosensors that have been successfully commercialized despite intensive investment and a lot of research and development.

Therefore, as non-face-to-face medical care is being discussed in earnest due to the COVID - 19 pandemic, point -of -care testing technology is expected to develop into fully automated and minimally invasive and non-invasive technology with enhanced user convenience. For this fully automated point-of-care diagnostic test, research on point-

of-care test technology that can measure and analyze blood genes and cells is underway, mainly in developed countries, and minimally invasive and non-invasive sensor technology (Frost & Sullivan, 2021). The non-invasive and non-collection sensor technology of breathing gas and sound eliminates the need for sample pre - processing and is easy to measure and use. It can be said that a lot of research is in progress focusing on invasive-based automation devices.

2. Artificial Medical Intelligence Market Trend and Prospect

Due to advances in artificial intelligence technologies across healthcare, AI tools cannot practically replace human doctors, but they can help doctors achieve better outcomes. One important support for these evolving AI tools in healthcare is the availability of healthcare big data (Manne & Kantheti, 2021).

Artificial intelligence (AI) aims to mimic human cognitive functions (Jiang, 2017). Artificial intelligence doctor technology related market is medical intelligence. It can be classified into clinical decision support system, which is the application area, the medical cloud market, which is the application area of the medical AI cloud platform, and the point-of-care examination device market. According to Bizwit Research & Consulting LLP, the clinical decision support system market size was recorded at about $ 4.15 billion in 2020 (Bizwit, 2022), Markets and Markets is expected to grow from $ 1.2 billion in 2020 to $ 1.8 billion in 2025 (Markets and Markets, 2020), According to TechNavio, the global medical artificial intelligence market is expected to reach $ 7.229 billion by 2023, growing at a CAGR of 28.44% from $ 2.068 billion in 2018 (Technavio, 2020) (see Figure 1).

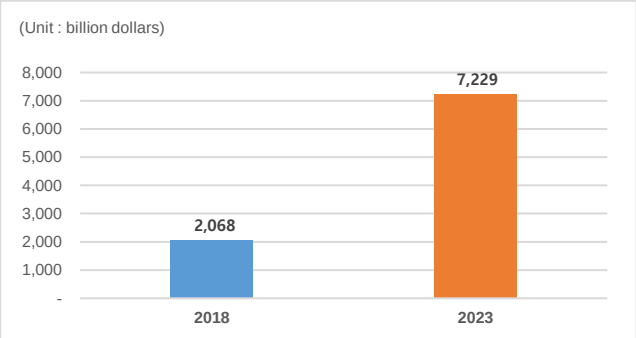

Figure 1: Global Artificial Intelligence (AI) Market Size and Forecast

Markets and Markets, the domestic medical artificial intelligence market is expected to reach $ 2.583 billion in 2026, growing at a CAGR of 45.2% from $ 275 million in 2020 (Markets and Markets, 2021). A total of 64 cases were received, and most of them are being used as an image diagnosis assistance system that analyzes and provides image data.

2015 to March 2020, a total of 222 AI medical devices were approved by the US FDA, a total of 240 EU CE certifications, and a total of 124 simultaneous US FDA and EU CE certifications.

Market Insights Reports, the global healthcare cloud computing market size is projected to grow from USD 251.1 million in 2020 to USD 757.1 million in 2027, recording a CAGR of 17.1% during 2021-2027. In the market, the five largest companies, including Roche, Evotte, Hanaher, Thermo Fisher, and Siemens, account for 50.3 % of the total market. It is expected to reach $19.62 billion by 2025, and the shift to digital point-of-care tests, infectious disease tests, and pregnancy tests are expected to increase demand (Market Insights Report, 2021).

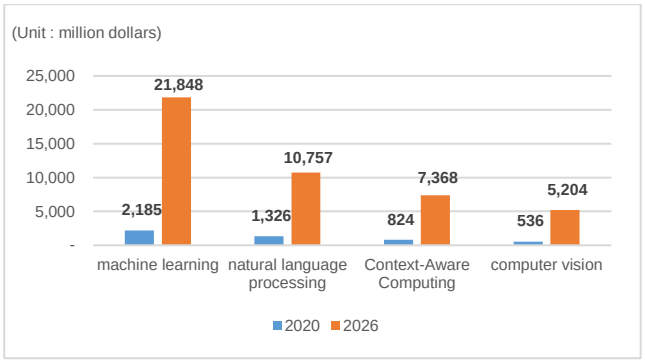

Figure 2: Global Artificial Medical Intelligence (AI) Market Size by Technology

3. Domestic and Foreign Company Trends

Big data is not just a means of improving corporate competitiveness but is also being used to enhance national competitiveness (Lee & Lee, 2013).

With the development of medical intelligence, the field of artificial intelligence health care can be classified into image-based, EMR -based, and literature-based classification based on the properties of data, and various medical services are being developed and provided.

Enlitic, an American medical image analysis company, develops an image diagnosis system that supports diagnosis through deep learning - based image processing. Body Tech Media, Humasys, Alere, Roche, Abbott, Danaher, Thermo Fisher Scientific, Siemens, etc. Many companies are participating in the development of medical services.

In some examples of these companies, Google Deep Mind has developed a diabetic complication called diabetic retinopathy using video-based artificial intelligence, and

JLK has developed a brain and prostate-related medical intelligence solution and developed an AI hub platform with various medical intelligence solutions. Lunet, which developed an artificial intelligence solution for chest X-ray diagnosis, is developing and commercializing medical intelligence to find lesions based on images such as AI solutions that help diagnose breast cancer.

The most urgent need for AI in biomedicine is in the diagnostics of diseases (Rong et al., 2020). Diagnosis support such as bone age measurement, gastric cancer pathology slide analysis, brain MRI -based Alzheimer's disease diagnosis assistance solution, lung cancer diagnosis assistance solution, etc. Medical intelligence is being developed and commercialized, and Coreline Soft is developing artificial intelligence solutions related to the chest, including lungs and heart, based on medical images such as CT images.

Utah, USA Intermountain Healthcare provides EMR - based, probability-based decision support services based on data stored continuously for more than 10 years. Literature and EMR, IBM Watson Health is currently in the process of building an artificial intelligence medical system in conjunction with medical insurance companies and CDSS - related companies with AI technology.

Overseas, Amazon, Microsoft, Google, IBM, etc. are providing machine learning and deep learning solutions and services based on high- performance cloud.

Based on on-site diagnostic test technology, private companies and universities are centered on biosensor, contact Google, Sensimed, Stanford University, and the University of Arizona, etc. are investing in on- site examination technology such as lens-type sensors, and are developing technologies that conveniently analyze diseases without user restraint, such as non-invasive blood sugar, smart contact lenses (blood sugar, glaucoma, etc.), respiratory gas analysis, etc. Research is being actively conducted on.

Accurately measure health information in the field, research is being conducted on measurement technologies with increased user convenience, such as urination and breathing gas - based measurement technology. Humasys manufactures and sells in vitro diagnostic devices.

4. Expected Effect

4.1. Technical Effect

Recent AI applications provide proof of concept for AI use in specialty medical practice, while projecting future utility in general medical practice (Miller & Brown,2018).

AI in medicine can be dichotomized into two subtypes: Virtual and physical. The virtual part ranges from applications such as electronic health record systems to neural network-based guidance in treatment decisions. The physical part deals with robots assisting in performing surgeries, intelligent prostheses for handicapped people, and elderly care (Malik et al., 2018).

In various application fields by securing reliable artificial intelligence source technology based on clinical big data. Based on digital medical data, deep learning-based diagnosis and prediction technology is applied to the CDSS system to dramatically improve diagnostic performance compared to the existing rule-based system. With the development of medical HPC cloud platform technology that processes rapidly increasing medical data with high performance, it not only bridges the technological gap in high-performance computing for medical use compared to advanced countries, but also secures automated point-of-care diagnostic technology, allowing various biometrics derived from the human body.

Accordingly, it is possible to improve the accuracy of early diagnosis and prediction of diseases by accurately measuring various bio-information always derived from the human body and from time to time and analyzing the pattern of changes in the measured high-quality data.

4.2. Economic and Industrial Effects

Due to social demands due to the increase in population aging and chronic diseases, the 4th industrial revolution digital healthcare is being treated as an important connection in Korea.

It can contribute to fostering high value-added industries through the export of advanced medical software technology in the healthcare field to respond to an aging society, and contribute to the export of advanced medical software technology along with the medical information system by discovering personalized medical services.

In addition, AI technology is expected to be applied to almost all fields of healthcare by 2025 as the introduction of artificial intelligence technology in the healthcare field can improve medical service performance and reduce medical costs, and it is expected that treatment costs will be significantly reduced. It can be expected to create new growth engines through medical service innovation.

Through the development and commercialization of technology-intensive systems and services, we provide low-cost, high-quality solutions to AI / medical related SMEs to improve the level of medical service in small and medium-sized hospitals, and to improve the quality.

Advanced hospitals through the advancement of the role performance of medical institutions It may be possible to alleviate the bias phenomenon. Medical field -oriented IoT that creates high added value through convergence of various hospital services and data integration and

connection technologies by providing solutions, it can contribute to laying the foundation for the Hallyu wave of future healthcare through overseas export, and medical services of small and medium - sized hospitals by securing and disseminating high-performance medical cloud technology that allows small and medium - sized hospitals to jointly use high-performance computing environments. It will contribute to strengthening competitiveness, and it will be possible to support small and medium - sized hospitals so that they can easily utilize the infrastructure that can participate in the newly opened AI medical service ecosystem.

4.3. Social Effect

Medical IT convergence technology is emerging as a response strategy that can solve various social problems caused by aging (Kim & Han, 2020). Intelligence-based medical convergence technology that can effectively respond to the rapidly increasing demand for medical services due to the aging population, it improves the efficiency of medical services and alleviates the burden of medical expenses, thereby contributing to the improvement of the quality of medical services.

High- quality medical service without blind spots by inducing cooperation between regions and hospitals with cooperative medical intelligence as the effectiveness of disease improvement increases through chronic disease management through improved diagnosis performance and introduction of CDSS (Tat et al., 2020). By providing health care services, public health services are strengthened, public health is improved, and medical intelligence and on- site diagnostic tests are provided to support regular health management, thereby easing the burden of medical expenses, enabling daily life and lifelong health care even before the onset of disease. It can contribute to the arrival of a healthy 100 -year-old era and the realization of a healthy and vibrant society.

5. Conclusions

Artificial medical intelligence technology is an alternative that can solve problems such as increased burden of medical expenses, increased medical accidents and safety risks in intensive care units, decreased reliability of emergency medical services, decreased medical accessibility, and lack of medical personnel (Jeon & Lee, 2019).

In addition, it satisfies the desire to improve the quality of life through a healthy life and provides a solution that can keep up with the paradigm shift of medical service, which is changing from diagnosis and treatment to prevention and management of diseases (Kim, 2016).

Under the COVID-19 pandemic (global pandemic), the development of artificial intelligence (AI) technology is accelerating so that people around the world can use medical tools more comfortably, and the paradigm of the rapidly changing medical market provides us with various medical services.

Healthcare based on big data is being used for various purposes such as prediction and presentation of evidence as a solution to social problems and changes in a rapidly changing environment. (Cho & Kim, 2021).

Currently, the role of artificial medical intelligence through medical big data is focused on practical fields such as data-based medical device business and medical service technology development in patient status diagnosis and examination, clinical decision support, and patient monitoring. However, with the advent of the aging population, interest in developing AI-based elderly management systems and human recognition AI systems is gradually increasing.

This is evidence that a variety of digital therapeutics are being developed beyond the medical device industry and diagnostic test area, other than for the purpose of preventive treatment from diseases. However, as the application target is expected to gradually expand, the development of digital therapeutics through artificial medical intelligence is a task to be continuously challenged.

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