Will 80% of Medical Laboratory Technologist disappear in the future?[1]

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Abstract

"In the future, 80% of doctors will be replaced by advanced technology." It has been talked about for a long time. When I first heard this story, people said it was ridiculous. But now that AlphaGo has won the Go match against Lee Se-dol, and many global companies have come up with a variety of services and products based on artificial intelligence, the story has become no more than ridiculous. In other words, it is beginning to come true. Artificial intelligence technology is already widely used in manufacturing and service industries. This spread of artificial intelligence is sure to usher in an era of great change in our future. And it is safe to say that it is the "medical world" where the biggest changes will be made. So how on earth does artificial intelligence replace medical personnel? If replaced, where would you stand out? In order to understand this, we must first be familiar with deep learning, which is the basis of medical artificial intelligence. And as the fourth industrial revolution gradually approaches reality, various occupational groups are becoming meaningless, as in the preceding industrial revolution, and in this paper we will learn about the impact of this situation on the medical community.

Keywords: Fourth Industrial Revolution, Artificial Intelligence, Deep Learning, Medical Artificial Intelligence, Medical Laboratory Technologist

JEL Classification Code: J53, I12

1. Principles of Medical Artificial Intelligence

1.1. Differences in artificial intelligence, machine learning, and deep learning

What is the artificial intelligence that replaces 80 percent of doctors? How can this technology replace a doctor? To understand this properly, it is important to fully understand the differences between artificial intelligence, machine learning, and deep learning and similar concepts. The table shown below outlines the correlation between artificial intelligence, machine learning and deep learning.
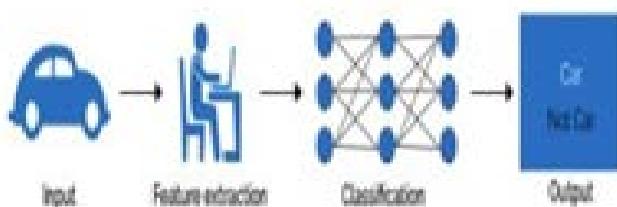

Figure 1: Correlation of artificial intelligence, machine learning, and deep learning

As you can see from the table, the three concepts are made up of relationships. First of all, before explaining their correlation, it is said that the concept of artificial intelligence is actually divided among scholars and experts. So I'm going to have to define artificial intelligence here as the level of intelligent processing or such technology. (Intellectual processing here means processing what is seen in images rather than processing in addition or black-and-white conversion.) Machine learning is an area of artificial intelligence that creates a model in which machines lead to an answer to a problem, and deep learning is an area of machine learning.

So what is the difference between artificial intelligence and machine learning? Artificial intelligence is divided into traditional, rule-based artificial intelligence, not machine learning and machine learning, and the difference between the two is whether they learn on their own. Rule-based artificial intelligence (mechanical, software, etc.) such as factory machines and expert systems is a reliable implementation of procedures designated by experts, and machine learning refers to self-learning about the output method if you inform the input value of any data and the corresponding output value of the data using methods devised in the process of learning people. In other words, machine learning refers not to carrying out a specified task in a procedural manner, but to finding a method by oneself and producing results for the performance of a given task.
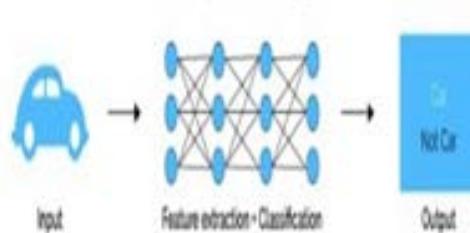
Deep learning is the same in terms of self-learning like machine learning, but it is different in that it does not learn information about output values and even learns characteristics for classification itself.

Deep Learning's Deep Learning is called Deep Learning because it has more data than machine learning, and the intermediate processing process is deeper. Because you have to find and learn its own characteristics, you have to spend more data than machine learning in the first place, and you need more intermediate processes. In other words, deep learning is more dependent on data than advanced artificial intelligence and machine learning. To illustrate this by schematizing it as follows.

Source: Baek (2017).

Figure 2: Machine learning processing process

Source: Baek (2017)

Figure 3: Deep Learning processing process

1.2. Deep Learning

So what's the principle of deep learning, unlike other artificial intelligence, that you can learn on your own? Deep Learning is basically a method developed from an artificial neural network that describes how the human brain processes information. Artificial neural network is a technology that allows machines to learn in a multilayered structure through artificial neural network that mimics human neural network. And it was deep learning that applied this multilayered method to the machine. In other words, artificial neural networks are made like actual human neurons, giving them arbitrary criteria to judge information and allowing them to process information.

For example, in the case of a preceding machine running, unlike showing a computer a variety of cat pictures, telling the computer, 'This is a cat,' and then allowing it to judge a cat as 'a cat' when looking at a new cat picture, Deep Learning refers to having the intelligence to look up a variety of cat pictures, learn about a cat, and then see a new one, and then decide to be a cat.

The artificial intelligence "AlphaGo" is also a program created using deep learning technology to play South Korea's Lee Se-dol against The game of go in February 2016. Deep learning programs themselves played go with each other, learning the principles of go and learning the numbers according to the situation. As such, deep learning is characterized by thinking and learning on one's own like a human.

1.3. Advantages and weaknesses of deep learning

The advantage of Deep Learning is that it can learn a vast amount of data in a short time. In other words, it takes much less time to create specialized machines through deep learning than to cultivate experts in one field. As I said in the previous example, it is easy to understand, considering the great nation of Lee Se-dol and AlphaGo, who were 34 at the time of the Great Depression, and the close race with AlphaGo, which is less than a year old, shows how fast Deep Learning's learning time is.
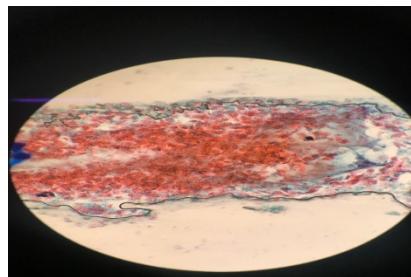
The downside is that it is faster than humans, but compared to rule-based algorithms, data learning itself requires a long time. Also, the downside is that deep learning requires more and better data.

2. Utilization of Medical Artificial Intelligence

At present, deep learning is already applied to many parts of our society. And perhaps it's the medical community that has the biggest presence of double-dip learning Artificial intelligence is currently being used in a variety of ways in the medical community, which has gone from reading a patient's disease and recommending a treatment method instead of a doctor to further predicting the disease in advance, it said. I looked into how these artificial intelligence help doctors as well as medical laboratory technologist in their work and how they will be affected by their future career as medical laboratory technologist.
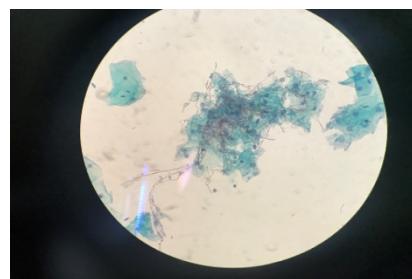
2.1. Use of Artificial Intelligence in Pathology

First, it is the use of artificial intelligence in pathology. Artificial intelligence stands out in the pathology department, where clinical pathologists provide directions for treatment before diagnosing it. Pathology is the place where the diagnosis is final and confirmed by analyzing tissue or cell samples taken from patients. What you see in the picture below is a sample of a patient in the actual pathology department.
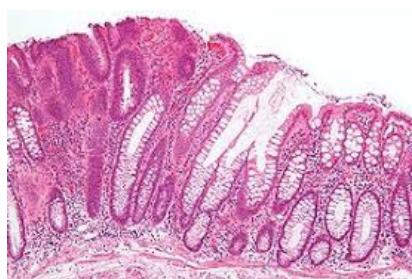

Source: Own

Figure 4: Peripheral hypertrophy of the uterus

Source: Own

Figure 5: lactobacill

Source: Dxline (2019)

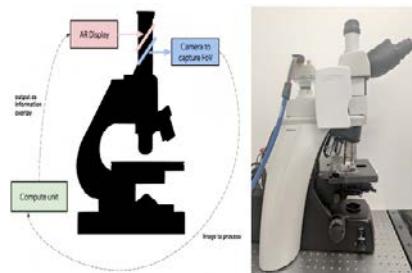**Figure 6:** A benign tumor

As it appears, Medical Laboratory Technologist distinguish between normal and abnormal cells. Then find out what kind of abnormal cells are. After finding out what kind is, determine whether or not a tumor is present by segmenting it and report it to the doctor by determining whether it is malignant or benign, or how serious it is. And

the doctor will determine the treatment method based on the clinical pathologist's reading. The Medical Laboratory Technologist conclusion in health care is considered an absolute correct answer. In other words, reading accuracy with pathology is very important because, based on the diagnosis, all care and treatment decisions are made.

But what happens if a Medical Laboratory Technologist makes a wrong judgment and wrong treatment when he does something important? Not all Medical Laboratory Technologist can judge cells and tissues on the spot and report them to the doctor. Among they, only those with a cell pathogen certificate can diagnose and report samples to a doctor. However, studies have shown that because they are human beings, there are errors or inconsistencies in reading in the process of seeing and judging tissue with the eye through a microscope. Also, the discrepancy among they is quite high. So, with the help of artificial intelligence in these areas, too, you will be able to make more accurate diagnoses without making mistakes.
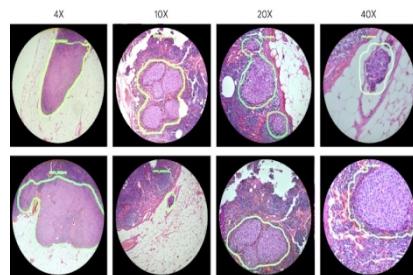
Studies show that when slides of about 100 patient samples are given, artificial intelligence can detect slides with cancer very efficiently. However, it is said to be less accurate than high sensitivity, which means that even if it is not cancer, it may be mistaken for cancer. However, because of its high sensitivity, there has never been a case in which cancer is not considered to be a cancer, so if you work with a human Medical Laboratory Technologist, it is expected that the two will have tremendous synergy because they have different strengths in different areas. For example, artificial intelligence can first read a large number of slides to select a possible cancer and even select a candidate location for that slide. Based on these findings, further readings by human Medical Laboratory Technologist and physicians will then be able to read a large amount of information and provide more accurate treatment in a short period of time

And a good example of artificial intelligence that can be used in pathology departments was Google's Pathology Artificial Intelligence, which announced an artificial intelligence pathology microscope using augmented reality technology at its annual academic conference in 2018. Movies like "Iron Man" show a screen that overlaps various information about enemy and enemy weapons into the main character's field of vision in real time, using augmented reality technology to make artificial intelligence a natural "without changing existing processes" when reading pathologic tissue using an optical microscope.

Source: Choi (2018)

Figure 7: Artificial intelligence pathology microscopy using augmented reality announced by Google

Source: Choi (2018)

Figure 8: High cancer potentials shown by augmented reality microscopes.

When Medical Laboratory Technologist look at pathology tissue under existing optical microscopes, the pathological tissue that enters its field of vision is analyzed quickly with deep learning, showing the areas most likely to be cancer in near real time overlapped with contours, Heat map, arrows, and text. In particular, the results are updated with 10 frames per second, so the reader shows the results almost in real time, with no gastrointestinal effects, even when moving the slide position or changing the magnification of the lens.

Until now, cells and tissues should have been observed by adjusting the magnification of the microscope, but augmented reality microscopes show real-time areas where there is a high probability of cancer in the reader's field of vision without a cumbersome process. Using these technologies will greatly reduce the barriers to accepting artificial intelligence in many ways in the Medical Laboratory Technologist's existing reading process In addition, they can look at the microscope as they usually do without special education, making it easier and more accurate.

The study only demonstrated information about the location of suspected cancer sites, but says more diverse information could be sent to optical microscopes in the future.

For example, cancer can vary in size, location of similar dividing cells and total number of cells, and quantitative analysis of bio markers such as progesterone receptors or P53s and CD8. Therefore, if these functions are implemented in an augmented reality microscope, it is thought that they will be easy to adopt in the field and will be more useful, as they will allow Medical Laboratory Technologist to reduce work to do or prevent mistakes, rather than just melt naturally into the reading process. In addition, if tissue needs to be read during surgery, or if rapid reading is required, such as reading fluorescence samples, the use of these microscopes will have tremendous time-saving effects. Thus, for such medical artificial intelligence to be widely used in the field of care, it is necessary to consider medical staff not only in this way, but also in terms of ease of use and user experience.

2.2. The Application of Artificial Intelligence in Diagnosis and Testing

2.2.1. The Application of Artificial Intelligence in the Physiological Laboratory

The second is the use of artificial intelligence in physiological parts. In menstrual parts, clinical pathologists mainly work to measure the electrocardiogram, echocardiogram and brain wave of patients, with the use of artificial intelligence being the most prominent in dual electrocardiograms, it said. An electrocardiogram is a graphic recording of the potential associated with the heartbeat on the body's surface, and besides the standard 12-lead electrocardiogram, there are also motor load ECGs and ECGs during activities. ECGs are typically most commonly used in diagnosing arrhythmia and coronary heart disease.
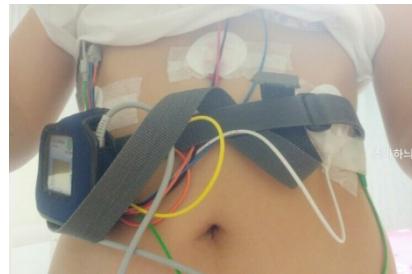
An arrhythmia is known to be caused by an irregular heartbeat and 80 percent of sudden cardiac deaths caused by sudden cardiac arrest. One of the biggest causes of this fatal ventricular arrhythmia is the ventricular hypertrophy, in which the heart develops abnormally fast. Therefore, it is certain that more patients will be able to survive if the ECG not only diagnoses these ventricular hypertrophy but also predicts it beforehand.

And in 2017, researchers at Seoul Asan Medical Center said they have learned data from 52 patients and 52 normal patients who had ventricular hypertrophy on an artificial neural network to develop artificial intelligence that can predict ventricular tachycardia an hour earlier. However, since it is not yet widely used, it will be of great help in predicting and preventing people's ventricular hypertrophy if it is developed and made available in real life as well.

So how can artificial intelligence collaborate with Medical Laboratory Technologist here? Until now, when the patient comes to the sanitary inspection room, a human Medical Laboratory Technologist attached the ECG machine and directly viewed and interpreted the data to infer the disease from an abnormal ECG graph and reported the

disease to the doctor with a report However, if we collaborate with artificial intelligence, they can only attach an ECG machine in a proper location, and interpret it more accurately by artificial intelligence, not by human beings.

Also, to predict the above mentioned ventricular hypertrophy, we now had to attach a portable ECG machine called a 24-hour Holter to the body and write down what the patient did every hour, whether he ate or exercised, or climbed the stairs, so that internal clinicians could compare the ECG test sheets with the patient's written data and find out what caused the problem when the ECG came out.

Source: Naver (2019)

Figure 9: 24hour holter

However, looking at every ECG log recorded every second, minute and hour for 24 hours will surely make mistakes. And this is directly linked to the life of the patient. Thus, if a 24-hour Holter and Artificial Intelligence were to be combined, the Medical Laboratory Technologist would not have to make it cumbersome to compare the examination papers with the patient's records, but instead, artificial intelligence would analyze them to determine the abnormalities and their causes based on more accurate data than humans.

2.2.2. The Application of Artificial Intelligence in the Blood Laboratory

In blood parts, Medical Laboratory Technologist conduct blood tests and peripheral blood plasma tests to find out what a patient's disease is. Blood test is a test for checking the abnormalities of blood by taking peripheral blood and measuring the number of blood cells such as white blood cells, pigments, and platelets, and peripheral blood plasma test refers to a test method for thin spreading peripheral blood on a glass slide and observing it by dyeing and microscopy. The shape and number distribution of each blood cell are then determined and used to diagnose leukaemia.

The number of red blood cells, white blood cells, and platelets is measured first after the blood collected for blood testing. At this point, the ratio of red blood cells: platelets: white blood cells is 500:30:1, so the blood cells are measured to match this rate. (The Medical Laboratory Technologis must also take into account the type and normal range of white blood cells) but it is impossible for humans to count all hundreds or thousands of blood cells within a plate. Therefore, measure the approximate number by dividing the plate into quarters and multiplying by 4. And by simply counting the number of blood cells and determining whether the number of red blood cells, white blood cells, or platelets is within normal range, or if the number of white blood cells is excessive, we can predict the disease. During these blood tests, humans count blood cells with their eyes, count with their left hand, press the machine button and adjust the microscope with their right hand. This process is very easy to make mistakes. Therefore, when performing this procedure, a trained Medical Laboratory Technologist first checks the blood cells through a microscope and secondly a professional doctor comes to check the blood cells. Thus, if artificial intelligence is introduced into the blood part, this simple but long-lasting task will be able to be performed more accurately by artificial intelligence, not by human Medical Laboratory Technologist and doctors.

The following is the use of artificial intelligence in peripheral blood paint tests. Unlike the aforementioned blood tests, Medical Laboratory Technologist can detect abnormal blood cells through peripheral blood plasma tests and identify leukemia or various red blood cell-related diseases. And this process also requires us to distinguish between

normal and abnormal cells through a microscope, and if we introduce the augmented reality microscope that we talked about here in 4.1, we no longer need to adjust the scale of the microscope and look at each of the abnormal cells, but if we just look at the microscope, the artificial intelligence will self-examine the abnormal cells.

3. conclusion

"Artificial intelligence replaces 80 percent of doctors." That was the first remark made by Vinod Khosla in 2012. We should immediately stop training professionals in the imaging department. It's self-evident that Deep Learning will surpass a video specialist in five years," said Professor Jeffrey Hinton in his remarks in 2016.

The above two statements may have been heard once, even if they are not those in the medical profession or those attending medical schools. At first, I thought simply, 'Oh, in the future, a lot of doctors will be replaced by artificial intelligence.' However, as I read the book Medical Artificial Intelligence, I began to think more and more about clinical pathology and artificial intelligence. If artificial intelligence is introduced into the pathology department, it is thought that the first thing to disappear is not a doctor but a clinical pathologist of 80 percent or more. However good artificial intelligence is, it cannot rule out the possibility of an error. Therefore, under the current medical and regulatory paradigm, I think it is human to 'reference' the judgment of artificial intelligence and make final decisions.

Amid the fast-changing society of the four industrial revolution, Medical Laboratory Technologist are thought to be one of the white-collar workers who will lose their jobs due to artificial intelligence, just like blue-collar workers who were lost by the previous industrial revolution. Therefore, in order to survive in this society, we will have to find what only 'human Medical Laboratory Technologist' can do and develop our expertise in the work.

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