New normal medical advances with advanced technology The key is contactlessness and future prediction

June 25, 2020   Reading time: 12 minutes

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Healthcare workers are struggling at the forefront in response to the new coronavirus. In the United States, in order to assist them, the rapid introduction of devices and services that enable contactless and remote diagnosis and confirmation of the patient's condition. In addition to the introduction of non-contact technology for the new normal life, we have also begun to work forward by analyzing big data on the infection status of patients and new coronas.

Medical workers working in hospitals are at the greatest risk of the spread of the new coronavirus. With no silver bullet or vaccine developed, the supply of medical masks and protective clothing is inadequate. In fact, people who are not infected are rushing to accelerate the confusion at the scene.

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There is an active movement to solve these situations by utilizing technology and networks. Not only the medical staff but also the patient has the merit that the disease can be judged early. By using the collected big data, governments and medical institutions will be able to respond proactively by predicting the spread of infected areas.

Is it possible to catch the signs of the spread of new corona infection as soon as possible? Sansa startup Kinsa is working on it by analyzing big data coming from smart thermometers.

Originally, Kinsa used data from smart thermometers to predict the spread of influenza virus infection. If the number of users with abnormally high body temperature rises rapidly, it is predicted that an influenza outbreak may occur in the area. In Japan and other countries, there are efforts to make predictions based on prescriptions for influenza drugs at hospitals. On the other hand, Kinsa's method has the advantage that it can be caught early before going to the hospital.

Using the alert system that Kinsa was building with the flu, Kinsa set out to predict a new corona with researchers at Oregon State University. The method is like this. The company can understand the relationship between body temperature and influenza based on the big data it has accumulated so far and its predictive analysis. On the other hand, since March 2020, there has been a dramatic increase in events that deviate from the conventional forecasts. We decided to understand it as an “abnormality” including the effects of the new Corona. The trend of spread of influenza infection is grasped by an index called Disease Transmission Rate (Rt), and the spread of infection including new corona is defined as abnormal Rt.

**Derivation of correlation between abnormal heat generation and new corona**
Real-time trend of abnormal Rt in Arizona (green). It has exceeded the forecast value (purple) after the economy resumed (source/kinsa)

For example, in Arizona, the home waiting order was eased in the middle of May 2020, but the real-time abnormal Rt due to the data coming from the user’s smart thermometer suddenly increased compared to the abnormal Rt predicted from the data. I understand that

Changes in abnormal Rt data (green) and new corona-related deaths (red) collected at Kinsa in New York City. It can be seen that there is a high correlation with the number of deaths 18 days later (Source/Kinsa)

In addition, the New York City data showed that the index of abnormal Rt surged after March 15, and gradually decreased toward mid April. Comparing this data with the number of deaths related to the new corona in New York City, it can be seen that it matches the trend after 18 days. Statistically, the chance of this correlation happening by chance is less than 1%.
Situation of abnormal Rt considered to be highly related to infection with new coronavirus

The user’s smartphone app can check the abnormal Rt status, which can be said to be an early alert for the new Corona, in county units. A county is an administrative district in Japan that is larger than a city and smaller than a prefecture.

As of June 19, most recent anomalous Rt has been reported only in some parts of Florida. The screen above is as of March 21, when the new corona infection spread rapidly. You can see that there are alerts all over the United States, especially in New York, California and Florida. In addition to these abnormal Rt, you can also check the spread of influenza infection from your smartphone app.

Expand data by distributing it to local communities free of charge

Kinsa’s smart thermometer has two types of products that you can measure with your armpit or ear. The Kinsa site sells for $29.99 and $49.99, respectively. Although they are sold at around $20 and $40 at mass retailers such as Best Buy in the US, they are almost sold out.
In the case of armpit, measurement is completed in about 5 seconds, and then about 15 types of symptoms such as cough, headache, and respiratory condition are selected. Depending on such fever and symptoms, consultation with a doctor and recommendation such as urgent treatment are required.

Medical data is associated with privacy issues, but Kinsa’s information is only about temperature, general area, and symptom information, so privacy issues are unlikely to occur. Users also have the advantage of sharing alert information.

Kinsa has not announced the number of sales of smart thermometers, but as the number of users increases, the accuracy of prediction will increase. The company accepts applications for each administrative district, such as a city, and is working to distribute smart thermometers to students in the school district free of charge.

Immediate judgment from face images from hospitals, airports, and homes

Binah.ai, an Israeli healthcare startup Binah.ai, is working on a remote medical examination using the facial image recognition and analysis function of artificial intelligence (AI). We are also collaborating with external parties on a project to estimate the possibility of infection with the new coronavirus from the analysis of each indicator.
Binar AI has developed a service that estimates biological information such as heartbeat from face images.

The Binar AI app uses smartphones and tablets to process videos showing the user’s face with AI. It is a service that can remotely manage indicators such as heart rate and blood oxygen saturation, which are important for managing patients with the new coronavirus. From the video, we grasp the slight change in the light reflection on the skin and estimate each index.

Specifically, the heart rate can be examined at 7 seconds, blood oxygen saturation at 10 seconds, respiration rate at 30 seconds, and heart rate variability at 45 seconds. It is possible to estimate the mental stress level in 90 seconds.

According to Binar AI, sales of this service have almost doubled since the new Corona infection spread. In addition to telemedicine in medical institutions, there is a demand for identifying potentially infected persons in public facilities such as hospitals and airports. The US Food and Drug Administration (FDA) approval is in the process of getting in 2020.

Currently, a remote hospital to obtain biometric information at a general hospital in Montreal, Canada, and a healthcare service utilizing AI in the United States Quality Care Metrics is a new corona using biometric information. It is said that they are in the process of trialing each of their infection determinations. Blood oxygen saturation is an important index in new corona infections.

Binar AI announced in January 2020 that it will partner with Japan’s SOMPO Himawari Life Insurance Co. Ltd. to develop an app for monitoring stress situations. Similarly, the heart rate and the like are estimated from face image data taken by a smartphone or the like.

**4-legged robot on the triage site**

On the other hand, the use of robots is expanding for the purpose of making contactless at medical sites.
One of them is Boston Dynamics, a US company affiliated with the SoftBank Group, which handles the quadruped robot "Spot." We have developed applications to support people who work in tents for triage that determines priorities such as treatment of patients and temporary facilities in parking lots.

Since the beginning of March 2020, the number of inquiries from the hospital increased rapidly in order to control the infection of the new corona, so it was decided that the hospital's requirements would be carefully examined and provided over the next several weeks.

Spot was deployed in April 2020 at Bringham and Women's Hospital in Massachusetts. A tablet device is attached to the top of the Spot, and it is assumed that the medical staff will make a video call with the patient.

The company has released the improved robot hardware and software for medical use as open source. For example, it can be used by a wheel-running robot of another company. In fact, it is said to work closely with Clearpath Robotics, a Canadian company that handles the robot.

Boston Dynamics will be expanding its sensor capabilities to capture and estimate body temperature, respiratory rate, pulse rate and oxygen saturation. In addition to measuring body temperature with a thermal camera (infrared camera), we aim to understand the respiratory rate. A person is photographed by a visible light camera and the movement of the pulse is captured to estimate the pulse rate. Regarding oxygen saturation, we are evaluating several measurement methods. In addition, we are also considering installing a sterilizer such as an ultraviolet lamp to use it for sterilizing medical facilities.

Until now, the purchase of Spot was limited to some customers, but it started selling to the public on June 16, 2020. The price is 74,500 dollars (about 79.70 million yen). Currently only available in the United States.

Robo carrying a sample in the hospital

Since the facilities of general hospitals in the United States are large, it takes a great deal of time to carry documents and specimens necessary for work. Savioke, a startup that deals with service robots, focused on this point. Since it can operate
24 hours a day, 365 days a year, there are also cost advantages including personnel costs.

![Sabi Oak service robot operating in a US hospital (Photo/Company)](image)

The service robot of Sabi Oak has a material storage area of about 20 liters at the top. You can also unlock the lock after interacting with the user on the display and authenticating. Hutchinson Health Care, a Minnesota general hospital, uses the outpatient's new corona test specimens to bring to the lab. In March 2020, there is a track record of operating the transportation of goods at a hotel in Silicon Valley, which was used for accommodating new corona patients.

According to Sabi Oak, the number of inquiries from medical institutions is increasing due to the spread of the new corona infection. Macnica is an agent in Japan, but the number of inquiries from companies that want to realize contactless services is increasing.

**AR display connects the scene and the doctor**

Taking advantage of the new Corona disaster, there is also an active movement to utilize AR (augmented reality) and MR (mixed reality) technologies that overlay digital information in the physical space. Of these, head-mounted displays (HMDs), which are worn like goggles, are increasingly used.

It is a method in which the patient and the medical staff at the site wear the HMD, and doctors and medical professionals at remote locations check the scene at the site and give various advice while exchanging video and audio.

The advice is displayed on the HMD in the field as an image, so you do not have to touch your PC or tablet. In addition, the number of medical staff in the field can be reduced, which leads to the saving of protective equipment. By utilizing it for online training, it is possible to increase the number of medical staff.
For example, Vuzix’s HMD for AR is used by Johns Hopkins University medical facility. Clinicians at the site are treating with the advice of another specialist in a remote location. At the School of Medicine, University of Louisville in Kentucky, USA, in addition to medical treatment in the medical field, trial use has begun for the purpose of education and training for medical learners.

Also, at the Thai Medical Research Institute (Chakri Naruebodindra Medical Research Institute, Mahidol University School of Medicine, Ramathibodi Hospital), it is used for communication between medical personnel who work in the negative pressure chamber where patients with the new corona and doctors outside the negative pressure chamber do. The number of health care workers near the patient can be reduced, and the time required for doctors and the like to prepare for entering and leaving the negative pressure chamber can be shortened.

**Use of MS HoloLens also progresses**

The “HoloLens” series, which is the HMD for MR of Microsoft Corp. (MS) in the US, has been increasingly adopted due to the support of medical treatment in remote and non-contact.

MS CEO (Chief Executive Officer) Satya Nadera gave a medical application at an online keynote speech at “CVPR (Computer Vision and Pattern Recognition) 2020” held in June 2020. Alex Kipman, known as the creator of HoloLens, also explained in an online keynote at the developer conference “Mixed Reality Dev Days” in May of the same year.
Example of using HoloLens in the medical field. A healthcare worker in a hospital room wearing a HoloLens seeks instructions from a remote doctor. The image on the left is a doctor in a remote area and the image on the right is on HoloLens (Image: A video capture of Microsoft's keynote video of "CVPR 2020") [Click image to enlarge]

At the medical site, a medical worker wearing HoloLens enters a hospital room where a new corona patient is hospitalized. Through HoloLens, a doctor at a remote location can check the condition of the patient and give advice to the medical staff. HoloLens on the site side displays instructions such as lines, circles, and letters drawn by the doctor.

In addition, the use of HoloLens has started in classes for medical students who are remote due to the influence of the new corona. For example, at Case Western Reserve University in the US, it was introduced in the anatomy class, and it had a high learning effect.

In addition, HoloLens will also be used in the manufacture of medical equipment. Introduced at Ford's plant in Oxford, England, where the production of ventilator was started. Experts familiar with the production of ventilators in remote areas give advice to workers on site.

In the United States, the spread of the new corona is about to reignite along with the economic resumption. There is concern about the second wave and future winter epidemics. To what extent can we avoid confusion in the medical field and suppress the spread of infection in such cases? The wisdom of medical and technology industries and startups is being tested.

[Feature] The contactless economy is coming

[1st] The arrival of the "contactless economy", new technology from the United States in the corona era
[2nd] Delivery Robo runs fast in the city of Silicon Valley, and
the 3rd major player has entered the cornerstone of the contactless economy. Then, take-off drone delivery, direct delivery of medicines and groceries
[4th] Walmart vs Amazon, make a contact to achieve non-contact
[5th] Robot demand surges in retail stores and e-commerce, and fried food is also easy
Grab
[6th] Evolutionary UV sterilization tech, introduced to share cars and floor cleaning robots
[7th] Clean contactless toilets without contact, develop toilet as a service
[8th] New normal era Completion of IoT home in Silicon Valley
<table>
<thead>
<tr>
<th>9th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolution of new normal medicine with advanced technology. The key is non-contact and future prediction.</td>
</tr>
<tr>
<td>10th</td>
</tr>
<tr>
<td>Real-world digital twin business is growing rapidly!</td>
</tr>
<tr>
<td>11th</td>
</tr>
<tr>
<td>Innovation in fitness and relaxation in the house</td>
</tr>
<tr>
<td>12th</td>
</tr>
<tr>
<td>Safe and satisfying food that is the “best entertainment”</td>
</tr>
<tr>
<td>13th</td>
</tr>
<tr>
<td>Strong and smart service to support life</td>
</tr>
<tr>
<td>14th</td>
</tr>
<tr>
<td>Overcome the new corona with intelligence</td>
</tr>
</tbody>
</table>