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Organization of Work on the Prevention of Common Colds and Infectious Diseases with the Involvement of ICT

[1*]Albina M. Batyrbekova, [2]Aleksandr A. Piskunov, [3]Amir R. Mutalibov, [4]Zagra M. Abdulaeva, [5]Aisa V. Nigdyrova, [6]Leisan R. Ramazanova

[1,3,4,5]Federal State Budgetary Educational Institution of Higher Education «Astrakhan State Medical University» of the Ministry of Healthcare of the Russian Federation,414000

[2]I.M. Sechenov First Moscow State Medical University (Sechenov University) Trubetskaya St. 8/2, Moscow, 119991, Russian Federation

[6]Federal State Budgetary Educational Institution of Higher Education ‹Chuvash State University named after I. N. Ulyanov›. Short name: FGBOU VO ‹CHSU named after I. N. Ulyanov›. Legal address: 15 Moskovsky Ave., Cheboksary, 428015, Chuvash Republic, Russia

ABSTRACT

The article discusses the features of the organization of work on the prevention of colds and infectious diseases with the involvement of ICT. The author notes that due to the recent massive spread of coronavirus infection, specialists considered it necessary to turn to the potential of information technologies for the purpose of prevention, as well as providing timely necessary assistance to patients. The Internet of Things (IoT) is one of the most effective paradigms in an intelligent world in which artificial intelligence (AI) technologies, such as cloud computing and big data analysis, play a vital role, for example, in preventing the spread of a virus, the COVID-19 pandemic.

Artificial intelligence and 5G technologies are developing by leaps and bounds, further strengthening the intellectual capabilities and connectivity of IoT applications, and traditional IoT is gradually being upgraded to become more powerful AI + IoT (AIoT). Their use is optimal, for example, from the point of view of remote screening and diagnosis of patients with COVID-19.

Artificial intelligence technologies based on machine learning and deep learning have recently significantly upgraded medical equipment and changed the workflow with minimal contact with patients, so medical professionals can make clinical decisions more effectively, providing the best protection not only for patients, but also for specialists themselves

Corresponding Author: batyr67890@mail.ru

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INTRODUCTION

The 2019 coronavirus disease was officially named COVID-19 by the WHO in February 2021. Since the first confirmed case of COVID-19, researchers in more than 30 countries and regions of the world have been actively looking for ways to control and treat of COVID-19. As the most modern and popular technology in the 21st century, the IoT system can implement data informatization, remote control, as well as intelligent control and monitoring via a real-time network.[1] Therefore, it is very important to apply the technology of the Internet of Things with artificial intelligence (IoT and AI) in clinical medicine, especially in the context of work on the prevention and control of the COVID-19 pandemic. The IoT and AI system for COVID-19 control is important not only for patients, but also for the public. People can use wearable devices to independently monitor and record their breathing rate, heart rate, daily body temperature and other physiological indicators to make their own decisions. Even in a state of isolation, they can also quickly learn about changes in their vital signs. What is even more remarkable, the use of IoT and AI at the forefront of clinical practice can accelerate the development of modern intelligent medical care, such as remote screening, intelligent diagnostics and remote intensive care, so this is perceived as a big breakthrough in traditional pandemic prevention and control.

Remote screening makes it unnecessary to screen a large number of people in emergency departments, thereby reducing the likelihood of infection with viruses. Intelligent diagnostics can help solve the problem of low speed and low accuracy of manual reading of image scanning reports. As an auxiliary method, intelligent diagnostics can help doctors at the forefront quickly determine whether patients are infected with COVID-19, isolate patients first and take treatment measures. Remote intensive care is applied to patients who have already been infected with COVID-19.[2] Even after these cured patients leave the hospital, doctors can use 5G technology, Wi-Fi or other third-party mobile devices to find out about changes in their vital signs, and then offer those relevant suggestions and advice that can be seen as part of the development of telemedicine.

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In addition, in conditions of shortage of medical personnel or equipment, telemedicine can help to solve this problem to a certain extent, eliminating mutual contact of people and the possibility of cross-infection. IoT and AI not only plays an important role in clinical treatment, but also facilitates the management of public society. From the basic agricultural/industrial chain to the creation of intelligent infrastructure, IoT and AI can help the entire human society to resist the new coronavirus with its own characteristics. As the pandemic gradually comes under control, more and more enterprises, large or small, are using IoT and AI technology to resume their work and production, trying to get rid of the dilemma caused by the pandemic. On the other hand, more and more countries and regions are using 5G and robots to fight pneumonia caused by COVID-19.

The purpose of the study is to consider the features of the organization of work on the prevention of colds and infectious diseases with the involvement of ICT.

Materials and methods. The article has conducted a study of sources within the framework of the topic under consideration for a number of recent years, comparative and analytical research methods have been used to systematize the material.

Results. Among the achievements of AI in the field of prevention and control of infectious and colds, it should be noted the emergence of the use of various sensors that are placed in various wearable devices. These devices can be placed on the patient's clothing. Wearable devices based on IoT and AI systems are used to measure COVID-19-related signs, such as respiratory rate and body temperature.[3]

Some authors suggest using a smart helmet with an installed thermal imaging system to automatically detect coronavirus through a thermal imaging system, thereby reducing the mutual contact of people. The positioning system is located in smart helmets. The system will automatically respond when a temperature above normal is detected. The location system module immediately marks and determines the geographical location by sending notifications to the specified smartphone via GSM. Thus, medical workers can receive timely data on people's body temperature.

Another group of scientists has developed a wrist-worn device that uses advanced digital signal processing algorithms to extract data on heart rate, oxygen saturation, body temperature, etc. Like smart helmets, wrist-worn devices can transmit processed data to an application or a designated third-party mobile port in a timely manner via mobile communication protocols. In particular, they have developed a special application for emergency patients that can be connected to a wrist device worn by a patient for timely monitoring of changes in patients' vital signs, which can serve as auxiliary information to help doctors take medical measures. judgments about patients. However, on the other hand, the disadvantages of this device limited its development, including the use of volatile memory, battery performance, and other factors.[4]

Another development in this area is the intellectual limbic system. It relies on wearable devices to detect those at risk of infection. The system uses wearable modules equipped with infrared sensors and pulse sensors to calculate body temperature and pulse rate in real time. Another non-portable module is placed in crowded places, such as airports and shopping malls. This module is used to monitor respiratory and blood pressure data in suspected patients. The two modules work and notify each other when a suspicious case occurs in any public place. However, it is difficult to guarantee that non-portable modules will be installed in public places where suspected patients have visited.

Wearable sensors provide a new way to detect COVID-19, which depends on recording changes in heart rate, breathing, cough and body temperature over a long period to determine coronavirus infection. These technologies, as well as data networks, are mainly based on Wi-Fi, 5G and Bluetooth technologies.

Wearable devices are widely used to monitor COVID-19, to measure the health status of potentially infected people and independently detect physiological changes during isolation. Wearable devices use GPS data to track location so that doctors can easily track a patient's condition.

Wearable devices such as smart watches can also be used to collect data tracking symptoms reported by people themselves to distinguish between negative and positive cases among infected people. Head-mounted devices for detecting and tracking COVID-19 symptoms can help identify breathing and heart rate problems using simple devices such as headphones and mobile phones. Wrist-worn devices can be used specifically for emergencies, for example, to prioritize and classify emergency patients.[5]

In the context of the COVID-19 pandemic, timely screening of infected people as early as possible is an important measure to prevent and control a pandemic. Indeed, manual verification is very slow, while remote verification technology can improve the speed and efficiency of verification. Therefore, it is necessary to develop remote inspection based on the IoT system.

In the literature, it is proposed to use a method based on facial recognition for the above purpose. The main function of this method is to remotely screen out suspicious patients using thermal imaging images, and then search for people who had close contact with them using a facial recognition system in order to isolate people in time and prevent the spread of the virus.

A portable scanner, proposed by other authors will introduce the collected ultrasound images of the lungs to the platform. After the data is processed by the platform, it classifies the data in the subspace network. This sequence of steps allows screening of patients with COVID-19. The classifier can be widely used in nursing homes with an adequate budget, completely avoiding the possibility of infection of elderly people who practically do not go to the hospital.[6]

Since a patient with COVID-19 often shows a fever symptom, the facial recognition system will also be used to detect the patient and alert the hospital platform via the Internet or mobile devices so that the patient can be isolated and further diagnosed.

In addition, some researchers propose a method for analyzing throat images and experimenting with a single training structure based on the Siamese network for recognizing pneumonia.

Wearable device technology can perform the task of remote screening. For example, a soft wearable device, which consists of a safer, softer and reusable wearable sensor, records data by measuring the tiny vibration created by heartbeat and breathing.

DISCUSSION

It is well known that X-rays and computer tomography are two standard methods for diagnosing COVID-19 using imaging. However, in the context of the outbreak of a new coronavirus, the use of computed tomography and X-rays may pose a danger to suspected patients and doctors due to cross-infection. On the other hand, only reading a large number of scanned images and manually drawing the contours of lung lesions will delay the diagnosis of COVID-19. Therefore, it is of great importance to develop an intelligent diagnostic system based on the IoT system, which can help doctors at the forefront in the joint fight against COVID-19.

Common chest CT results in COVID-19 patients include opaque glass-like darkening, consolidation, and pleural effusion. By contrast, CT manifestations of the lungs are more often spotted or diffused shadows of "frosted glass" at an early stage. At the progressive stage, both lung diseases progress rapidly, multiple foci merge into large lamellar consolidations, and the density of lesions increases. In the absorption stage, the lesion area is somewhat reduced, the density is reduced, the shadow of the fibrous cord is visible.[7]

The prerequisite for intelligent diagnostics using X-rays and computed tomography is image segmentation. The purpose of segmentation is to separate the area or object of interest from the rest of the body for a fixed-point measurement. A group of specialists is developing a two-branch combinatorial network (DCN) for combinatorial segmentation and classification. A two-channel convolutional neural network is also proposed for the detection and classification of COVID-19 infections by highlighting global and local signs.

A separate group of researchers uses a neural network and digital image processing technology to develop a lightweight classification model based on the intersection attention mechanism, which combines early screening, lesion assessment, lesion segmentation and a histogram of the distribution of lung and lesion pixels. On average, it takes only 0.4 seconds for each person to make a diagnosis.

Another group of researchers offers a model based on CT image scanning for the diagnosis of COVID-19. In particular, it is a priority-based residual learning module (PARL) that trains the 3D-ResNet branch as a binary classifier for lung images. Its biggest advantage is that it can highlight the lesion area in the lung. Due to this advantage, this framework model can not only be widely used for the early intelligent diagnosis of COVID-19, but also be applied to other computer detection methods such as glaucoma and skin lesions in retinal fundus images. A model of intelligent auxiliary diagnostics is also proposed, which can quickly provide doctors with background information and increase efficiency during the prevention and control of the pandemic due to its extremely high sensitivity and reliability in small data based on the technology of transfer of training.

With intelligent diagnosis, patients with COVID-19 often have difficulty breathing, the cause of which is hypoxemia. Severe shortness of breath requires immediate oxygen treatment; otherwise, patients may suffer from cyanosis, a condition in which a lack of blood supply can lead to damage to various organs throughout the body. Severe patients may also have acute respiratory distress, respiratory failure, and other symptoms. Therefore, emergency departments and other important medical institutions should be equipped with the necessary respiratory protection equipment.

The literature describes the latest respiratory aids, such as oxygen therapy devices, ventilators. Oxygen in the therapeutic apparatus is necessary for the human body. When a person feels short of breath with oxygen levels below normal, he needs respiratory aids. Only timely use of respiratory aids can help healthcare professionals better diagnose and treat patients with COVID-19 and save more lives. However, existing respiratory products have many disadvantages. For example, if they are used for a long time, a lot of water mist will appear on the inner wall of the oxygen mask, which will affect the medical opinion about the patient from the medical staff. Meanwhile, if the water mist accumulates to a drop of water, a drop of water remaining on the patient's face will cause discomfort.[8]

To overcome these shortcomings, the scientists proposed using IoT and AI-based respiratory support equipment, which includes the main body and the intake pipe. The intake pipe is mounted on the main body, which is equipped with a mechanism to prevent fogging and detection. The function of removing water mists on the inner wall of the main body is implemented using a mechanism to prevent fogging. The biggest advantage of the device is that it can detect in real time if the trachea has stopped supplying oxygen, and at the same time can alert doctors. Not only can it monitor the user's breathing condition, but it can also show great practicality. It is believed that in the future, IoT and AI will be increasingly used in intelligent treatment.

COVID-19 is dangerous mainly because of its wide spread and complexity in treatment, so remote intensive care of patients is an excellent solution to avoid unnecessary contact between medical personnel and patients.[9]

Remote intensive care of coronavirus patients essentially embodies the development of a telemedicine system. In fact, this method can not only help solve the problem of shortage of intensive care personnel, but also reduce the mortality rate in intensive care units, as well as the cost and loss of healthcare. Remote intensive care patients, according to telemedicine, can rely on wearable sensor devices to track vital signs and conduct "pre-classification" based on pre-collected data. That is, the data of the detected symptoms are sent to the doctor so that the doctor can make the following diagnosis.

The researchers suggest using a wearable sensor network system for remote intensive care of patients. LabVIEW software has developed a remote monitoring application in which the sensor node measures the patient's temperature and sends information via Wi-Fi or Bluetooth to a local server for data processing. If the temperature does not correspond to the norm, a notification is sent to the doctor. In this system, the doctor is the main server, and all patients receiving remote intensive care are subordinate servers. The doctor's

side is the main server, and the sides of patients receiving remote intensive care are subordinate servers. Thanks to the transfer of information between the subservers and the main server, doctors are informed about changes in the vital signs of patients. This is due to the fact that both diagnostics and monitoring are carried out on the doctor's personal mobile device.[10]

Thus avoiding indirect transmission and playing a huge role in remote medical monitoring of suspicious cases. Although remote intensive care for patients is a great prospect, for reasons such as government policy, its development is still limited.

CONCLUSION

Worldwide, the number of people affected by COVID-19 continues to grow, and to date, individual provinces of China are struggling with another outbreak of coronavirus infection. Therefore, it is necessary to take measures to monitor constantly the devastating consequences of the COVID-19 outbreak. Researchers are exploring the use of 5G, robotics and other technologies that they believe can help mitigate the adverse impact of the pandemic and accelerate the recovery of society.

As a fifth-generation mobile communication network, 5G has an extremely wide application in the current situation with the characteristics of low power consumption and high speed. The Internet of Things connects physical objects to the network and, finally, implements intelligence and automation, thereby freeing up a large amount of labor. These two popular technologies are also closely linked: 5G will accelerate the pace of entry into the IoT era. Once limited by the use of traditional mobile communications, IoT can now be implemented within 5G. In turn, IoT will become the main driver of 5G development.

The use of intelligent robots in the medical field can reduce the burden on medical personnel and reduce the risk of cross-infection. The combination of intelligent robotics and medical technologies can have great application prospects that drive social progress.

In the future, devices that are more intelligent based on IoT and AI will appear to combat pandemics, for example, the use of cloud technologies to integrate screening, diagnosis, monitoring, etc. COVID-19 and the use of integrated algorithms to predict the recurrence of a pandemic and take swift action. Most likely, a comprehensive infrastructure will be built that combines IoT, AI and cloud computing, which will be able to jointly fight diseases that pose a global threat.

Author Contributions

All authors contributed in reviewing the final version of this paper.

REFERENCES

1. M. N. Mohammed, N. Aslamiah Hazairin, H. Syamsudin et al. 2019 novel coronavirus disease (Covid-19): detection and diagnosis system using IoT based smart glasses. International Journal of Psychosocial Rehabilitation, vol. 24, no. 7, pp. 2296–2303, 2020.
2. L. Lonini, N. Shawen, O. Botonis et al. Rapid screening of physiological changes associated with COVID-19 using soft-wearables and structured activities: a pilot study. IEEE Journal of Translational Engineering in Health and Medicine, vol. 9, pp. 1–11, 2021
3. W. Tan and J. Liu Application of face recognition in tracing COVID-19 fever patients and close contacts in Proceedings of the 2020 19th IEEE International Conference on Machine Learning and Applications (ICMLA), IEEE, Miami, FL, USA, December 2020.
4. S.-H. Wang, S. Fernandes, Z. Zhu, and Y.-D. Zhang AVNC: attention-based VGG-style network for COVID-19 diagnosis by CBAM IEEE Sensors Journal, vol. 1, no. 14, 2021
5. Y. Jiang, H. Chen, M. Loew, and H. Ko COVID-19 CT image synthesis with a conditional generative adversarial network IEEE Journal of Biomedical and Health Informatics, vol. 25, no. 2, pp. 441–452, 2021.
6. Y.-H. Wu, S.-H. Gao, J. Mei et al. JCS: an explainable COVID-19 diagnosis system by joint classification and segmentation. IEEE Transactions on Image Processing, vol. 30, pp. 3113–3126, 2021.
7. N. Paluru, A. Dayal, H. B. Jenssen et al. Anam-net: anamorphic depth embedding-based lightweight CNN for segmentation of anomalies in COVID-19 chest CT images. IEEE Transactions on Neural Networks and Learning Systems, vol. 32, no. 3, 2021.
8. K. K. Singh and A. Singh Diagnosis of COVID-19 from chest X-ray images using wavelets-based depthwise convolution network. Big Data Mining and Analytics, vol. 4, no. 2, pp. 84–93, 2021.
9. Y. Zhang, X. Zhang, and W. Zhu ANC: attention network for COVID-19 explainable diagnosis based on convolutional block attention module. Computer Modeling in Engineering and Sciences, vol. 127, no. 3, pp. 1037–1058, 2021.
10. S. Yadav, S. Luthra, and D. Garg Modelling Internet of things (IoT)-driven global sustainability in multi-tier agri-food supply chain under natural epidemic outbreaks. Environmental Science and Pollution Research, vol. 28, no. 13, pp. 16633–16654, 2021.