

Artificial Intelligence in Healthcare during Covid-19 Pandemic

R. John Martin
Faculty of Computer Science &
Information Technology,
Jazan University, KSA

Fathe Jeribi
Faculty of Computer Science &
Information Technology,
Jazan University, KSA

S.L. Swapna
Department of Computer Science
Hindusthan College of Arts and
Science (Autonomous), India

ABSTRACT

The use of data engineering and analytics is at the forefront of efforts to combat the current Covid-19 pandemic. Cloud-based data analytics platforms are being inducted to handle the Covid-19 data in order to deal with the SARS-CoV-2 virus pandemic that is currently underway. The entire world has been experiencing serious difficulties in dealing with the situation because of the lack of clarity surrounding the virus's origin and clinical characteristics. Despite the fact that the world is doing everything it can to obtain certain facts about the disease, much information about the SARS-CoV-2 virus is still unknown and uncertain. The scientific community around the world has used a variety of analytical and statistical approaches to uncover the unknown and uncertain properties of the SARS-CoV-2 virus, which is currently under investigation. This paper reviews the most appropriate artificial intelligence (AI) based healthcare applications that are currently being used, as well as their significance in dealing with the Covid-19 pandemic.

General Terms

Artificial Intelligence, Healthcare

Keywords

AI, IoT, Healthcare, COVID-19, SARS-CoV-2, Data Analytics

1. INTRODUCTION

COVID-19 is likely to be the first infectious diseases pandemic to spread in our hyper-connected universe. It has evidenced to be a phenomenon that affects all sorts of our society in a significant and rapid manner. Besides the many containment measures implemented to limit transmissions, such as border closures and the implementation of lockdown periods, the World Health Organization (WHO) reported 489 million reported cases and also more than 6 million deaths in 235 countries at the end of 1 April 2022. The cumulative infected cases and the death toll are provided in Figure 1 (Courtesy: kff.org). Due to the rising demand for health services, deep concerns about health care capacity have arisen, particularly in disadvantaged states. The COVID-19 emergency has given a huge boost to the development of new prototypes and the improvement of existing models in order to achieve promising results in areas like infection tracing [1] or prediction of its spread and the impacts of preventive measures [2].

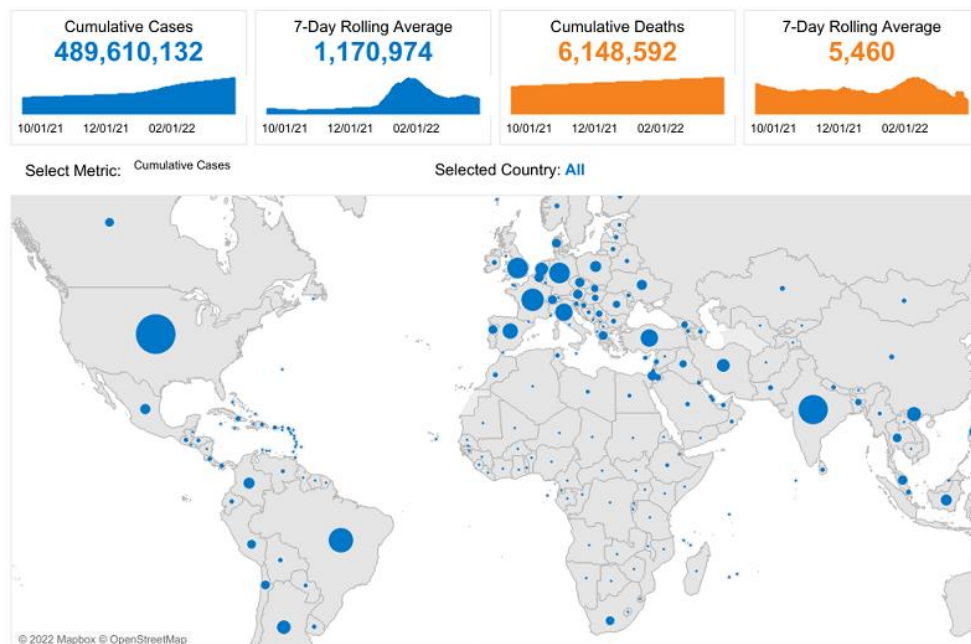


Fig. 1: Confirmed Covid-19 cases and mortality (Cumulative)

As a result of the establishment of well-structured information technology (IT) departments to solve medical and research challenges around the world in the last several decades,

academic healthcare centers have had a favorable impact on medical care quality [3]. However, digital transformation is not a panacea for all healthcare problems; many factors of

using IT, such as safety, organization, and the environment, must be considered before implementation can be accomplished. Nonetheless, IT has tremendous promise for creatively resolving and responding to the issues that high-risk scenarios pose to society. The fight against the COVID-19 pandemic is greatly aided by information technology [4]. Many advances in medical treatment have resulted from the fight against the pandemic with the assistance of technical resources that are fully implemented in the hospitals. The use of artificial intelligence for various clinical and non-clinical practices has greatly helped in managing this COVID-19 pandemic.

The second section of this paper introduces the concept of healthcare AI. Section three examines the various applications of AI in the COVID-19 epidemic from a historical perspective. Finally, section four concludes with a discussion on the significance of the offered applications.

2. HEALTHCARE AI

Artificial intelligence (AI) is progressively being used in healthcare as it becomes more prevalent in modern business and everyday life. Artificial intelligence has the potential to

help healthcare providers in a variety of ways, including patient care and administrative tasks. The majority of AI and healthcare technologies are useful in the healthcare industry, but the strategies they assist can be rather different. While some studies on artificial intelligence in healthcare claim that AI can perform just as well as or better than humans at specific processes, such as diagnosing illness [5], it will be a long time before AI in healthcare replaces people for a wide range of medical tasks. Precision medicine is the most commonly used use of traditional machine learning in the field of artificial intelligence in healthcare. For many healthcare organizations, being able to forecast which treatment techniques are likely to be successful with patients based on their makeup and treatment framework is a big step forward. The bulk of AI in healthcare applications that use machine learning and precision medicine requires data for training with a known end result. NLP tools that can understand and classify clinical documents are a prominent use of artificial intelligence in healthcare. NLP systems can evaluate unstructured clinical notes on patients, providing invaluable insight into quality, technique improvement, and improved patient outcomes [6]. Fig. 2 illustrates the different dimensions and application domains of healthcare AI.

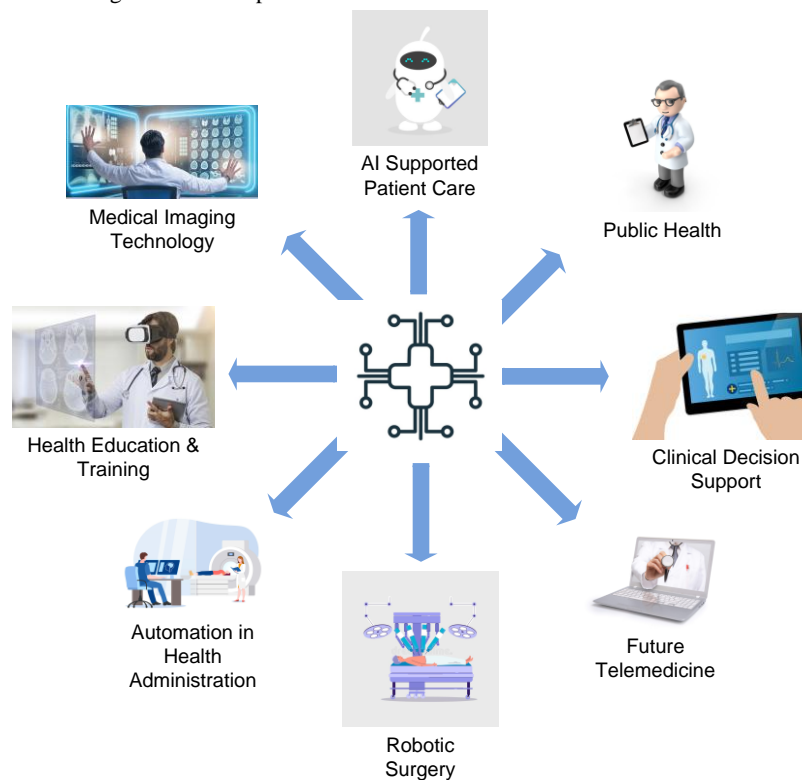


Fig.2: Healthcare AI

For the past few decades, disease diagnosis and treatment have been at the heart of artificial intelligence (AI) in healthcare. Early rule-based systems had the ability to diagnose and treat diseases accurately, but they were not widely adopted in clinical practice. Artificial intelligence offers a wide range of administrative applications in the healthcare industry. In comparison to patient care, the application of artificial intelligence in a hospital setting is less revolutionary. However, artificial intelligence has the potential to save both time and money in the healthcare administration. The most daunting challenge for artificial intelligence in healthcare is not determining whether the technologies will be smart enough to be useful, but rather

seeing that they are adopted into routine clinical practice [7]. It is possible that doctors may gravitate toward tasks that require specialized human abilities, such as those that require the highest level of cognitive functioning. Perhaps the only healthcare providers who will fail to realize the full capabilities of artificial intelligence in healthcare are those who refuse to engage with it.

3. AI IN COVID-19 PANDEMIC

The healthcare industry has been looking for new technology solutions to monitor and control the spread of the coronavirus during this global health crisis. Artificial intelligence (AI) is one such technology that can track and monitor the spread of

this virus, identify high-risk patients, and aid in real-time infection control. It can also forecast mortality risk by thoroughly analyzing the patients' available data. AI can aid in the fight against this virus by providing population screening, medical assistance, notification, and infection control recommendations [8]. As an evidence-based medical tool, this technology has the ability to improve the COVID-19 patient's planning, treatment, and reported outcomes. The

technological contributions of AI for different applications during COVID-19 are depicted in Figure 2. With the AI application, doctors are not only focused on the patient's treatment but also on disease control. Symptom checking and test analysis are performed with the highest level of accuracy using AI. It also demonstrates that it helps in cutting down the number of steps in the entire process, making it more readily available in nature.

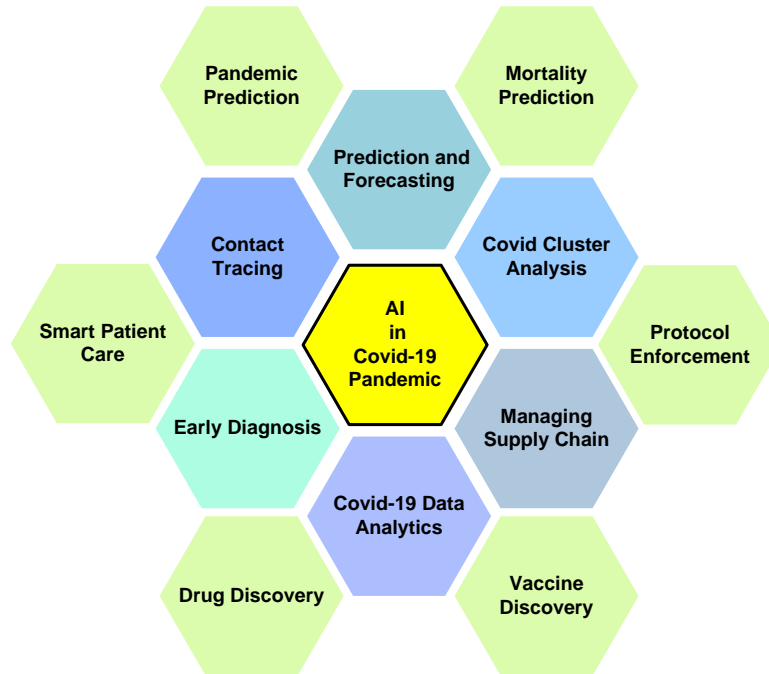


Fig.3: AI in Covid-19 Pandemic

3.1 Early detection and diagnosis of Coronavirus

In the early phases of the pandemic, there were no effective antiviral medications or COVID-19 vaccinations available. Hence, early detection of COVID-19 was paramount to isolating both symptomatic and asymptomatic cases. The use of artificial intelligence quickly identified irregular symptoms and signs, causing patients and healthcare authorities to become alarmed [9] [10]. AI contributes to more rapid decision-making that is also more cost-effective in nature. With the help of useful AI techniques, the process of developing new diagnosis and disease control mechanisms for COVID-19 cases was made easy. Artificial intelligence can assist in the diagnosis of infected cases using medical imaging methods such as computed tomography (CT) scans and magnetic resonance imaging (MRI) of organs [11].

3.2 Keeping track of the Covid-19 treatment

The Internet of Things (IoT) and Artificial Intelligence (AI) can be combined to create an intelligent platform that can automatically monitor and predict the spread of this virus [12]. It is also possible to develop a neural network to extract the visual characteristics of this disease, which would aid in the proper diagnosis and monitoring of those who are affected. It has the potential for providing day-to-day updates on the patients as well as providing solutions to be followed in the event of a COVID-19 pandemic outbreak.

3.3 Contact tracing of the individuals infected with Coronavirus

AI can assist in determining the level of infections that are caused by this virus by identifying clusters and 'hot spots,' and it can successfully trace the contacts of the infected individuals as well as monitor their progress [13]. It has the ability to predict the course of the disease in the future as well as its likelihood of recurrence. Digital tools have been used by countries all over the world to help them analyze, track, and reduce COVID-19 infections. Many apps that use GPS or Bluetooth technology may be able to get into people's privacy and make too many false positives. Wearable gadgets are becoming more popular, and they could have a big impact on future healthcare, particularly when they're linked to IoT systems. Even though Bluetooth-enabled wearable devices have some drawbacks, they are more than made up for by larger benefits.

The use of online social networking (OSN) platforms to track down contacts is being used during the epidemic, which is a new strategy [14]. Traditional proximity techniques are used to detect contacts in real time, and OSN communities are also used to predict likelihood contacts in the near future, which allows for more accurate forecasting, because OSN communities have more information.

3.4 Forecasting of Covid-19 cases and mortality rate

The concept of predicting mortality prognosis during the COVID-19 pandemic is significant because it can help us

minimize illness death rates by revealing where and how to intervene. AI techniques can track and predict the nature of the virus based on the information gathered, social media, and media platforms, as well as the risks of infection and the likelihood of the virus's spreading. Furthermore, it has the capacity to forecast the number of coronavirus cases and deaths in any given region of the world [15] [16]. Artificial intelligence can assist in identifying the most vulnerable zones, people, and countries and taking appropriate precautions. COVID-19 mortality prediction model using clinical characteristics and co-morbidities in hospitalized patients may be effective in COVID-19 patient care. Machine learning and deep learning based frameworks are being adopted to forecast COVID-19 hospital mortality, find the most significant predictors from clinical, co-morbidity, and blood biochemical data, and identify high and low-risk COVID-19 survivors [17].

3.5 Covid-19 Drug and vaccine research and development

By analyzing the existing data on COVID-19, artificial intelligence is being used in drug research [18]. It is beneficial in the design and development of drug delivery systems. Because this technology is used in real-time drug testing, it saves time in situations where standard testing would take a long time. It also helps to accelerate the process significantly, which would otherwise be impossible for a human to accomplish. It has the potential to aid in the identification of beneficial drugs in the treatment of COVID-19 patients. It has emerged as a potent tool for the design of diagnostic tests and the development of vaccines [19]. AI aids in the development of vaccines and treatment options at a much faster rate than is currently possible, as well as the conduct of clinical investigations during the vaccine development process.

3.6 Easing healthcare workers' workloads

As a result of the sudden and vast rise in the number of patients during the COVID-19 pandemic, medical professionals are dealing with a tremendous amount of work. In this case, artificial intelligence is used to lighten the burden of health professionals [20]. In addition to assisting in the early diagnosis and provision of treatment at an early stage through the use of digital approaches and decision-making science, it provides the best training to clinical trainees and doctors in the area of this new disease. AI has the potential to improve patient care in the future and resolve more potential issues, thereby reducing the workload of doctors.

3.7 Prevention of Covid-19 Disease

AI can also provide updated information that aids in the prevention of covid-19 disease through the use of real-time data analysis. It can be used to forecast potential infection sites, the virus's influx, and the demand for beds and medical practitioners during this crisis [21]. AI is helpful for future virus and preventing disease, as it leverages previously trained data over data collected at various points in time. It identifies the characteristics, causes, and mechanisms of infection spread. In the future, this technology will be critical in the fight against other pandemics. It can act as a preventative measure and aid in the fight against a variety of other diseases. AI will be crucial in the future for providing more preventive and predictive healthcare.

4. DISCUSSION AND CONCLUSION

Artificial intelligence is a promising and useful technological advancement for detecting early coronavirus infections and monitoring the health of infected patients. By developing useful algorithms, it can greatly enhance treatment consistency and decision-making. AI is beneficial not only for the treatment of COVID-19-infected patients, but also for the proper monitoring of their health. It is capable of tracking the COVID-19 crisis at multiple scales, including medical, molecular, and epidemiological applications. Additionally, it is beneficial to facilitate research on coronavirus by analyzing available data. Artificial intelligence can aid in the development of appropriate treatment therapies, prevention strategies, and drug and vaccine discovery. Using artificial intelligence (AI) for clinical decision support, risk assessment, and early alerting is one of the most promising areas of research for this unique method of data analysis in the future. Due to the fact that AI will be used to power a new generation of tools and systems, it will change the face of patient care and exciting developments in the healthcare system, allowing doctors to be more aware of subtle nuances, more efficient in their care delivery, and more likely to be ahead of developing problems.

5. CONFLICTS OF INTEREST

The contributors do not have any conflicts of interest.

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