A quick literature review on the utilization of Artificial intelligence in meeting the challenges of COVID-19 pandemic

Abstract

This article aims to determine the role of Artificial intelligence (AI) in this current Pandemic of COVID 19. Artificial intelligence is playing a pivotal role in the health care sector by bringing many advantages to both practising clinicians', patients, and society. Currently, the world is facing many challenges due to COVID 19 Pandemic causing severe social and economic disruption resulting in recession, unemployment, social isolation and extreme burden on health care services, and high mortality across the globe. A quantitative methodology is used, and a quick literature review is done using electronic database search engines including- PubMed, Google Scholar, and Scopus. Keywords used for this data research included, 'Artificial Intelligence and COVID 19'; COVID 19 Artificial intelligence'. The results have shown the power of decision making in Artificial intelligence using massive data and algorithms is already helping to meet the challenges of COVID 19 – screening, detection of COVID 19 transmission dynamics, prediction, tracing, clinical diagnosis, recovery, morbidity and mortality, containment, mitigation of outbreak, treatment, vaccination development and protection of health care workers. Artificial intelligence is a transformational force in the medical field. Its role is promising for early disease detection, real-time surveillance, diagnostics, treatment, disease containment, development of vaccination, and Telemedicine for the current pandemic of COVID-19. Artificial Intelligence will help us in the future to meet many challenges in a timely fashion through future prediction of pandemics making stakeholders worldwide well prepared to deal with epidemics and pandemics in a systematic and organized manner avoiding economic turmoil and unnecessary morbidity and mortality.

Introduction

COVID -19 Pandemic has jeopardized human life all over the world. To date, confirmed cases of COVID 19 are 5,232,428 with mortality of 335,636[1]. Its economic and social impact will continue even when the pandemic is over. The whole world is looking for solutions to control the COVID 19 Pandemic. Artificial intelligence which mimics human intelligence and augments human capabilities and functionalities has already been playing a significant role in this pandemic helping many stakeholders such as Government's, pharmacies, supply chains, banks, and healthcare professionals. It is helping to meet many challenges of COVID 19 pandemic at different levels which includes clinical, molecular, and societal applications [1]. Artificial Intelligence is a powerful tool for health care planning, policymaking, and has the capability for an accurate forecast of COVID 19 transmission dynamics [2]. Data mining algorithms can be used to determine the incidence and predict outbreak trends [3]. However, it is argued that AI has not played a significant role in COVID 19 Pandemic yet, which is both due to the lack of data or mega data [4]. Hence, there is a need for extensive Human AI interaction and transparency when it comes to data privacy and public health.

Methodology:

1 https://www.worldometers.info/coronavirus/

A quantitative methodology is used by using electronic search engines to establish the role of artificial intelligence role in the COVID 19 pandemic. Data was collected using three popular search engines – Google Scholar, PubMed, and Scopus. The keywords used for the search were, 'Artificial intelligence and COVID 19; Artificial intelligence COVID 19'. Duplicate articles were excluded.

Results

According to the literature review, AI has been used extensively in seven domains. These are summarized below in figure (1)

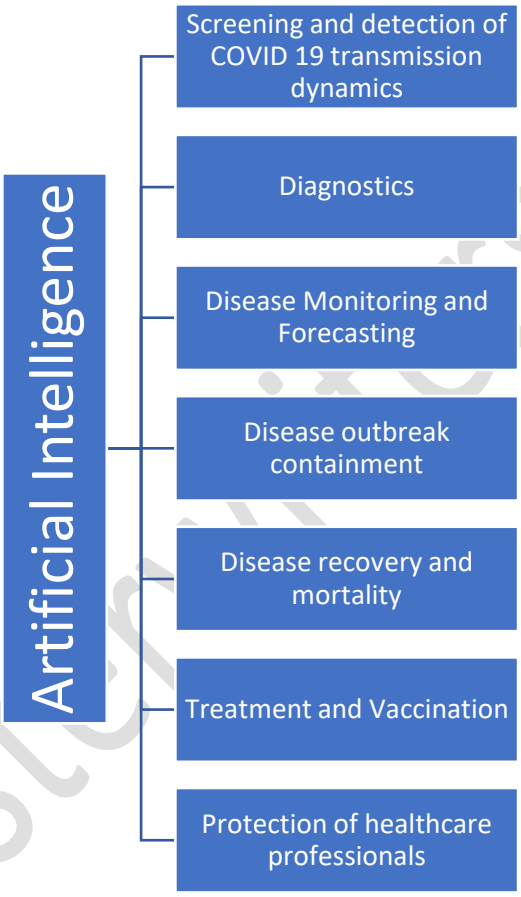

Figure (1): Summary of Artificial intelligence usage in COVID-19 pandemic

a) Screening and detection of COVID 19 transmission dynamics

AI is being used for screening, detection, prediction, and tracking of COVID 19 [5]. Tracking and screening help to quarantine the suspects and slow down the spread of the disease. A mobile phone-based online survey which can collect recent travel history and symptoms and signs of COVID-19 can be used for screening and early detection where AI framework can categorize them into no risk, minimal risk and moderate risk enabling high-risk patients to be quarantined earlier limiting the spread of disease [6]. It also helps in the decision making of the locked-down of that region which helps in the timely preparedness of logistics and supplies, enabling resources to be managed in a well-organized and systematic manner avoiding chaos. An example of this is the development of the 'Ehteraz' smartphone application endorsed by

Ministry of Interior of Qatar enabled with Global Positioning System and blue tooth technology to spread awareness among the public regarding personal protection in order to restrict outbreak; helps in tracking positive cases and informs users if they have been in contact with positive cases[2]. The health profile (COVID-19 status) of service users is displayed in four colours. These include -red signifying a person with a positive COVID-19 test, yellow denoting a person who is in quarantine, grey denoting a suspected case (showing signs and symptoms) or a person who had been in contact with a positive COVID-19 person and green denoting a healthy individual or a person who had tested negative for COVID-19 shown in Figure (2).

Figure (2) Source: https://www.qatarday.com/blog/information/everything-you-want-to-know-about-ehteraz-app/73632

b) Diagnostics

Artificial intelligence-based mobile application (AI4COVID 19) is being able to distinguish COVID 19 cough from other reasons of cough with 90% accuracy and is likely to get better as more data flows in [7].Therefore , it can be employed for early disease diagnosis. Due to COVID 19 Pandemic, there is tremendous pressure on radiologists. Artificial intelligence can interpret CT images of COVID 19 patients within 20 seconds, with 96 % accuracy improving diagnostic efficiency and reducing human errors [8]. This helps to reduce pressure on the Radiologists and helps physicians to make a prompt diagnosis.

Additionally, AI has been used for accelerated, scalable, and highly accurate classification of COVID 19 genome [9]. Recently, AI has provided real-time clinical support decisions as it was found that mildly raised ALT, myalgias, and elevated HB were most predictive of the development of ARDS with an accuracy of 70-80 % according to historical data of COVID 19 patients from two hospitals at China [10]. Hence, AI is an essential tool in augmenting physicians' roles to save lives by improving diagnostic accuracy, disease classification and making evidence-based clinical decisions.

c) Disease Monitoring and Forecasting

AI can help in data mining collected from public health surveillance, real-time epidemic monitoring, forecasting, regular updates of situations in organizations, and real-time utilization of this information by hospitals [11]. (AI) can predict where COVID 19 virus will emerge next and is used for diagnosis and monitoring of COVID -19 [12]. This helps in not only the preparedness of logistics but also the detection of vulnerable patients (High-risk groups) at risk of being infected with COVID-19. Virtual consultations in primary and secondary care can be used to monitor these patients regularly for any deterioration and psychological support. AI software has been employed to facilitate CT diagnosis, helping to classify COVID 19 disease into severity categorization [13]. Further, AI tools can be developed for patient monitoring to prioritize patients for ICU allocation [14].

d) Disease outbreak containment

AI is a powerful tool that can aid in the containment and mitigation of the spread of COVID -19 in countries such as Nigeria where it is impossible to stop human to human interaction [15]. Various data dashboards have been developed for prediction and tracking of COVID 19, giving a global overview of the pandemic enabling visualization of infection spread in real-time [4]. An example of such a dashboard is that of the World Health Organisation, which enables users to visualize global infected cases and mortality (Figure 3 and 4). This application accounts for confirmed cases, deaths over time, case comparison by country, territory and area.

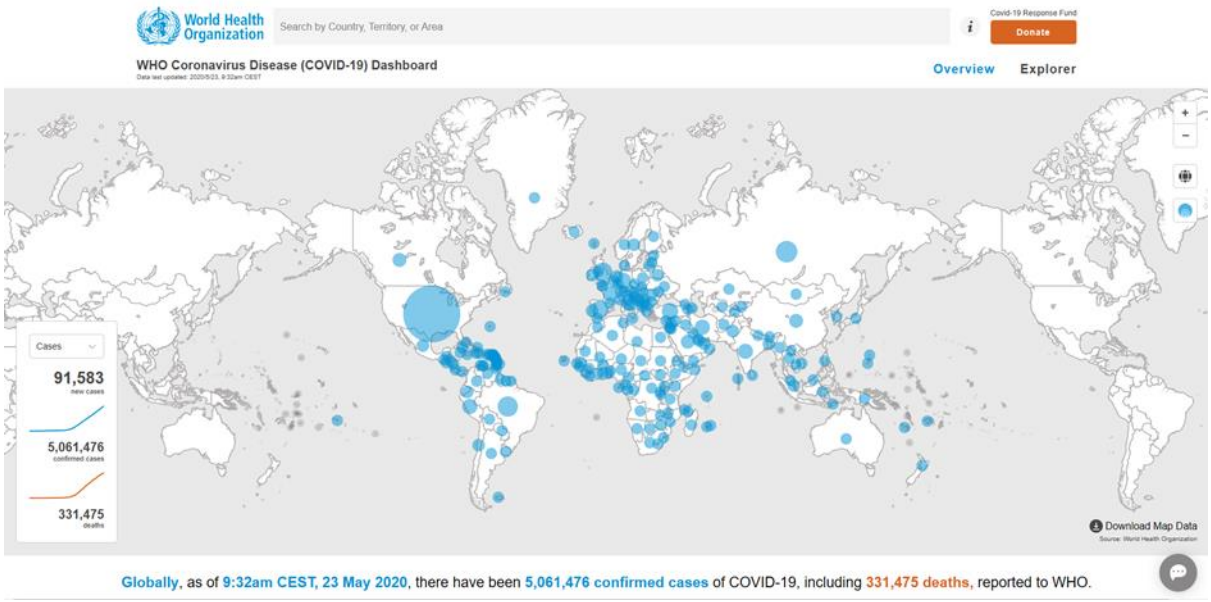

Figure (3): Global cases; Source: https://covid19.who.int/

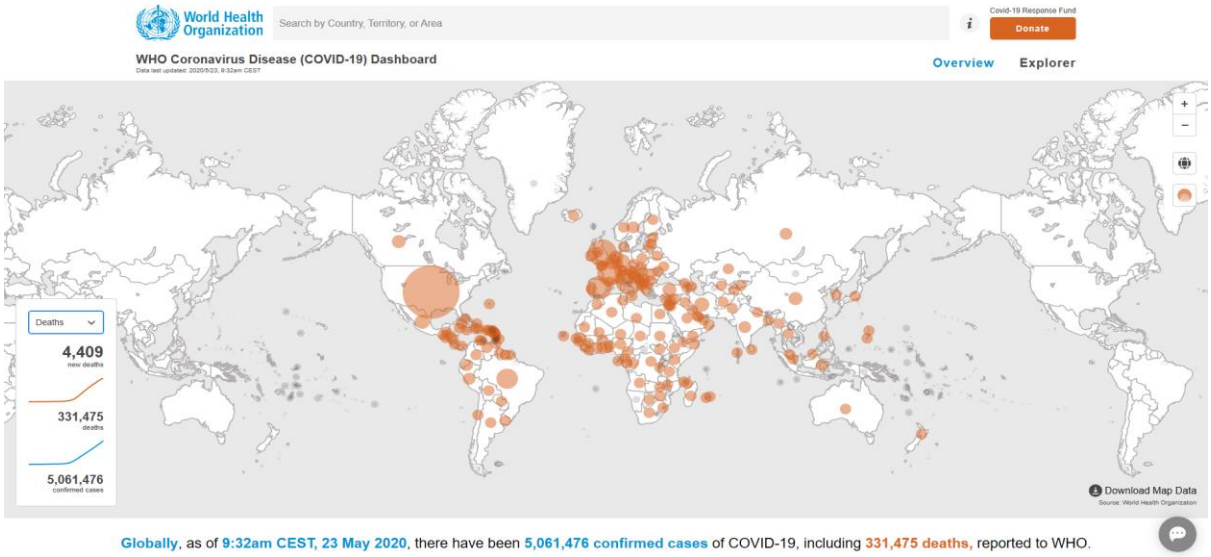

Figure (4): Global deaths; Source: https://covid19.who.int/

These dashboards have been helping Governments to monitor the disease, enabling them to prepare logistics in advance such as medical workforce, quarantine centres, diagnostic equipment, and availability of medicines. AI is also helping in supply chain management enabling delivery of Personal Protection Equipment on time, making them readily available for health care professionals helping in disease containment and preventing its spread.

e) Disease recovery and mortality

AI has been used to monitor patients from the beginning of infection to complete recovery, helping to identify the clinical course of the disease. AI is helping to predict disease prognosis [4]. The clinical course helps to understand various factors that alter the outcome of the illness, such as – age, gender, co-morbidities. It has helped to study the epidemiological and clinical characteristics of the disease. Artificial intelligence can predict mortality by using biomarkers such as high CRP and lymphopenia with the change in the first four days of hospital admission of lymphocyte count that was associated with high mortality [16]. AI has been used to monitor mortality across the globe. It has helped to establish the cause of death, which could be due to multifactorial. These include demographic factors – such as elderly population, co-morbidities, or health system problems like lack of facilities and equipment. In future Governments can use this data to prepare themselves for emergency disasters.

f) Treatment and Vaccination

AI is being used for the development of treatment therapy for COVID -19 [17]. Various trials have been going on for treatment of COVID-19, and massive data has been collected worldwide on these treatment efficacies. Data analytics and Artificial intelligence are helping researchers to find drugs that are effective against COVID-19 using real-time diagnostics instead of standardized testing, which takes too much time. Artificial Intelligence has also been used in the development of vaccination against COVID 19 [5]. It is promising that shortly with the aid of Artificial intelligence, a vaccine is developed against COVID-19 at a fast pace within months which could have taken years due to the quick processing of data. In this pandemic of COVID -19, mental health issues are on the rise. Artificial intelligence is helping via digital mental health for vulnerable patients. Similarly, for contagious dermatological diseases,

Hospital Information systems can provide a clinical and academic platform via Telemedicine and Artificial Intelligence [18].

g) Protection of healthcare professionals

Psychological stress among front line healthcare professionals in Wuhan city of China was found to be higher than that of college students and of other medical staff in other cities of China in a survey study [19]. Mostly were worried about getting infection themselves or their families. AI reduces the risk of transmission to clinicians [12]. It improves the efficiency of clinicians by providing instant data of high-risk patients enabling virtual consultations with these patients protecting both patients and clinicians. Telemedicine is being used worldwide instead of face-to-face consultations during this pandemic saving front line staff from exposure as human to the human hospital-associated transmission of this virus is 41% as concluded in one of the studies from Zhongnan Hospital of Wuhan University [12].

Conclusion and Recommendations

Artificial Intelligence is playing a significant role in the current pandemic of COVID 19. From epidemiological monitoring, clinical course, disease classification, diagnostics, monitoring of treatment, and development of vaccinations, its role will grow more powerful as more and more data flows in. This will help Governments, clinicians, scientists, patients, the pharmaceutical and device industry to meet the challenges of COVID 19 Pandemic by the development of tools and strategies to minimize socio-economic disruption caused by the virus and be fully prepared to combat future pandemics. Its recommended that more investment should be made on technology to develop tools to aid patients and health care professionals. For instance, Robots should be designed to carry out swabbing and examination of COVID 19 patients which will reduce the risk of virus transmission to healthcare professionals.
Similarly, AI-based mobile software should be able to monitor COVID 19 Patients in Quarantine and alert physicians in case of deterioration. Further, device and mobile industries can develop AI-enabled software and tools which can assist patients and doctors such as recording vital signs and patients' examinations remotely. Mobile phones with AI-enabled software can remind people about social distancing and the use of masks and gloves when leaving homes. AI can be used to predict the financial impact of COVID 19, and Governments must utilize it to develop strategies to mitigate economic risks and unemployment. The medical field is witnessing adaption of technology at a swift pace, and new devices with AI are surfacing up.AI must be included in the medical curriculum. Medical staff should get training to develop necessary skills to adapt to new technology and be aware of its challenges -data privacy, legal and ethical ramifications.

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