

The importance of AI for the timely detection, prevention and treatment of pandemic diseases such as COVID-19 in developing countries

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Coronavirus disease 2019 (COVID-19), which was first reported in Wuhan in December 2019, is now widespread with outbreaks reaching across the world¹. The hospital-acquired transmission rate of COVID-19 is about 41%², which is due to human-to-human transmission. Compared to COVID-19, SARS³ and MERS⁴ appear to have a lower morbidity rate and a higher mortality rate of $\sim 10\%$ and 37% , respectively.

Despite the high number of infections in the most developed south-eastern coastal provinces of mainland China, such as Zhejiang, they may exceed the mortality rate, as the global mortality rate of COVID-19 is about 3.4% ⁵, while lower mortality rates are reported for these areas. However, no deaths are reported in Zhejiang for 1171 confirmed cases and only four deaths are confirmed in Guangdong, with 1322 true positive cases (0.3%)^{6,7}. This is a clear evidence that mortality rates are directly related to the quality of crisis management.

In contrast to all the previous outbreaks and pandemics, there is one untapped hope that could make dealing with the COVID-19 pandemic possible after all, i.e. artificial intelligence (AI) and its related technologies. For example, bioinformatics can benefit from advances in generative AI⁸, machine learning can assist in accurate detection of the infection⁹, social media analysis can raise awareness and identify cases which are not reported by governments¹⁰, simulations based on reinforcement learning¹¹ can identify pandemic outbreak pace and magnitude and assist policy makers in their decisions.

The pandemic risk of COVID-19 results from several factors: (i) it is difficult to differentiate COVID-19 because the outbreak of the disease is associated with respiratory symptoms that are common to many other respiratory diseases such as colds and flu, which usually have a high prevalence during the cold season, (ii) COVI-19 is quite persistent and enjoys low temperatures, (iii) the transmission rate is quite high (41%), in almost 80% of cases patients do not show typical symptoms and they could be carrier and transmit the disease to others¹².

It has been estimated that there will be more deaths in developing countries, especially in countries with higher population density and lower hygienic index, and developed countries which has lots of international connections, which could contribute to an uncontrolled pandemic. Therefore, AI and its sub-branches could contribute to better management of the disease in these countries and could be beneficial in addition to human factors. Successful control of COVID-19, which has a high morbidity rate and resembles the primary symptoms of harmless respiratory diseases, depends on early diagnosis. A 14-day quarantine of false positive individuals leads to a heavy burden on health systems and ineffective disease management. Perhaps the first application of AI in a real struggle is to explore its true potential in the initial diagnosis of COVID-19 and the identification of subsequent outbreaks.

Fortunately, the first experiment in this area was promising, in which the initial diagnosis of the disease based on a 10-15 minute computer tomography (CT) showed a diagnosis rate of 81% and with the help of AI, the detection rate could be improved up to 90% within seconds¹³.

What AI can potentially do to win people's battle against COVID-19 is (i) early detection of the disease with a high degree of accuracy that can save time and lead to a good decision, (ii) avoiding unnecessary quarantine of healthy people, and (iii) early diagnosis of sick individuals that can prevent further transmission of the disease. Furthermore, taking into account the demographic factors of the patient, such as sex, age and lifestyle in each country, AI can help to predict the circulation of the disease in the country and the direct use of available facilities where they are most needed. It is also possible to identify high-risk groups, related professions and companies to prevent the spread of the disease. As a point-of-care device, AI can save time, costs, energy and many lives.

AI is highly valued in developing countries, which have fewer opportunities to deal with the disease than developed countries. It can lead to the right decisions being taken at the right time and in the right place, thus providing a fair and rational distribution of opportunities to control the virus in high-risk regions. This may make developing countries less vulnerable to deaths, but given the severe economic sanctions imposed on some countries, such as Iran, many nominated companies operating in the AI sector are reluctant to do so and stand still. The fight against COVID-19 in developing countries requires full support, and in the end the whole world will benefit from it.

We also believe that it is necessary to initiate open source projects. Just a few examples show how an open source device like a ventilator can save many lives, and there are some promising efforts in this direction, such as an open source platform for surgical robotics¹⁴. The same attitude is required for algorithms and applications. At the time of writing this article, there are several preprints explaining the use of a deep learning algorithm to identify COVID-19 from pneumonia^{15,16} but to our knowledge, none of them have been published as open source so that other developers can use these algorithms in their application to improve their COVID-19 detection rate, which is an unnecessary investment of time and energy in reinventing the wheel in this stressed situation where time is precious and crucial.

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