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COVID-19: The Internet of Things and Health

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The COVID-19 pandemic has inspired a range of Internet of Things (IoT) and AI innovations to help stop the spread of the virus. This is a Health and Wellbeing sector-specific edition of COVID-19: IoT and Cybersecurity looking at the use of AI in healthcare.

Past editions are found on the PETRAS website.

It usually takes 3 to 5 years to bring a new drug to the market, and 1 to 3 years to repurpose an existing one, but it can take an AI only weeks to suggest a drug for a given disease. The speed and efficiency of such an AI depends on the quality and amount of data is being fed into AI algorithms.

The pandemic has demanded fast and reliable solutions for finding treatments and vaccines. A number of AI platforms around the world accepted the call to aid with drug repurposing, designing new drugs, finding new vaccines, offering new or faster ways to diagnose COVID-19 or to help mine the COVID-19 literature.

Drug repurposing

The fastest way to find medicines for a new virus is to repurpose those that are already on the market, as sometimes drugs which are developed to treat one disease are found to work for multiple diseases.

The UK-based start-up BenevolentAI used its drug discovery platform to identify drugs that stop the

Overview

- AI can increase the pace of: drug repurposing, designing new drugs, finding new vaccines, offering new or faster ways to diagnose COVID-19, and help mining the COVID-19 literature
- The speed and efficiency of AI depends greatly on the quality and amount of data being fed into AI algorithms
- The quality of data is not just about accuracy but also about biases, replicable results and burden of evidence

progression of the COVID-19 disease, targeting the "cytokine storm" and reduce its inflammatory effects. The platform identified "baricitinib", an anti-viral and anti-inflammatory drug that was used for the treatment of rheumatoid arthritis. Eli Lilly, the owner of the drug, announced in April 2020 the start of a large randomized trial for baricitinib in COVID-19 patients, and partial clinical results released in July show positive results[1].

Another UK-based company, Healx, used its AI platform for rare diseases to find drug combinations for the treatment of COVID-19 patients with co-morbidities. Results were expected initially in May to be sent to clinical trials, but as of September no news has been reported on the findings of this platform[2].

A collaboration in February between Korean company Deargen, and universities Dankook (Korea), and Emory (US) used a pre-trained deep learning-based drug-target interaction model[3] to identify commercially available drugs that may act upon the virus, and identified atazanavir, an antiretroviral medication used for HIV, as a potential candidate drug against COVID-19[4].

Innoplexus, a global company headquartered in Germany, identified in March 2020 the potential of several drug combinations to treat COVID-19; such as Hydroxychloroquine combined with

Clarithromycin or Plerixafor, or Chloroquine combined with Remdesivir[5].

Other companies finding potential treatment drugs for COVID-19 among the existing approved ones are the Singaporean company Gero[6], Canadian biotechnology firm Cyclica[7], and the US VantAI[8 9].

Finding new drugs

Insilico Medicine, an AI company from Hong Kong, in collaboration with Nanome, Inc., a virtual reality (VR) start-up from California, have announced the discovery of 10 potential small molecule inhibitors targeting the protease of the COVID-19 virus (necessary for viral replication). The molecule inhibitors gave been generated by the AI and analysed closely in virtual reality by medicinal chemists[10].

The UK based Exscientia, a partner in CARE (Corona Accelerated R&D in Europe), Europe's largest initiative for COVID-19 therapy development, is reported as of August 2020 to be leading the small molecule drug design activities. Exscientia will use its AI platform to design and optimize new medicines that will later enter clinical trials[11].

Another collaboration, announced in March 2020, between the French AI company Iktos and the American SRI International, a research centre with a SynFini synthetic chemistry platform, will aim to discover drugs targeting viral endonuclease enzymes, involved in viral replication and host's resistance to infection[12].

Finding new vaccines

Covax-19™, the COVID-19 vaccine developed by Vaxine, an Adelaide-based biotechnology company, was not only developed using AI but will also employ Microsoft AI and Azure cloud capabilities to accelerate clinical testing. The cooperation with Microsoft's AI for Health will extend to finding a way to re-design future pandemic trials, to reduce the time needed to produce valuable results[13].

Managing the COVID-19 literature

The publications on COVID-19 have increased exponentially. *Nature* reports as many as 68,000 COVID-19 related publications in data repositories[14]. Finding the latest scientific information on the virus can be a daunting, time consuming task.

Notable research tools that employ AI in mining the COVID-19 literature are COVIDScholar[15], developed at the Lawrence Berkeley National Lab, which uses natural language processing (NLP) to guide the search of papers, and SPIKE-CORD[16], developed by the non-profit research institute AI2, which not only finds papers but also extracts information from them.

Diagnostics

Currently, used lab tests for COVID-19 via reverse transcriptase polymerase chain reaction (RT-PCR) can take up to 2 days. AI algorithms have been proposed to diagnose COVID-19 from images (lung X-rays or CTs) or even from sounds.

Two AI models located in the UK, one at Zegami in Oxford and another at Birmingham City University, aim to diagnose COVID-19 from lung X-rays. The Zegami AI can distinguish among images of COVID-19 infections, infections caused by viral or bacterial pneumonia, and images of healthy lungs[17]. DeTraC (Decompose, Transfer and Compose), Birmingham City University's AI, is a convolution neural network that detects COVID-19 from X-rays and can be trained using a relatively small number of images. The scientists at BCU made the technology publicly available as an open-source program[18].

Another AI at Icahn School of Medicine at Mount Sinai diagnoses COVID-19 based on more comprehensive information: CT scans and clinical information (white blood cell counts, age, gender and symptoms). The AI model had 84% sensitivity in determining the correct diagnostic compared to 75% sensitivity delivered by radiologists. It can provide a rapid diagnostic as lab tests can take 2 days and serve as a second opinion, customarily used in radiology diagnostics[19].

A Cambridge University research team developed an AI capable of detecting COVID-19 from sounds (coughing and breathing on a smartphone) with an 80% accuracy. Initial data came from the COVID-19 Sounds study app launched internationally in April 2020[20].

Patient monitoring

CurieAI, a spun-off from SRI Ventures, the corporate venture arm of SRI International

mentioned above, announced in August 2020 the launch of an AI-driven platform designed to assist in the therapy management of COVID-19 patients. The platform monitors the breathing pattern and respiratory distress of a patient given a certain course of treatment, and can give clinicians insights into the early detection of a deterioration in the patient's condition[21].

Limitations of AI

Despite its enormous potential of delivering fast and accurate discoveries, AI driven results depend on the quality of data supplied to them. But the quality of data is not just about accuracy (for example clear X-rays) but also about biases, replicable results and the burden of evidence. Andrew Boyd, who works with AI models at the University of Illinois at Chicago, unveils an important conundrum faced by scientists working with AI, as an AI can either "help us correct concepts faster or will […] help us perpetuate old ideas for a longer period of time"[22].

Endnotes

1 https://www.benevolent.com/news/clinical-data-vali-dates-benevolentais-ai-predicted-hypothesis-for-barici-tinib-as-a-potential-treatment-for-covid-19
2 https://healx.io/healx-using-ai-to-find-combination-drug-treatments-for-covid-19/
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