

# Role of technology in containing COVID-19

Dipankar Dasgupta, IEEE Fellow  
Professor of Computer Science  
The University of Memphis  
[dasgupta@memphis.edu](mailto:dasgupta@memphis.edu)

Technical Report No. CS-20-001

April 7, 2020<sup>1</sup>

Copyright © The University of Memphis, 2020



COVID-19 infection and the resulting death toll have been increasing at an alarming rate. Many countries are in lockdown, social activities are at halt, and it is unclear when this pandemic will be over. It is not expected that the vaccines and medicines will be publicly available in near future; even if some solutions are found, it will take at least a year or so to conduct clinical trials in order to determine their efficacy. Today's technology is playing a big role in virus identification, vaccine design, and in other aspects to mitigate this crisis through its computing power, cloud services, communication, and innovative applications. Many companies [1] are developing various technological safeguards to combat this pandemic so that the infections can be controlled, people can have their way of life back, and regular businesses can start operating at a full scale. Here are some non-biological technological breakthroughs that are available and possible in near future.

***Embedded sensors for COVID-19 App:*** Smart sensors exist to keep track of human vital statistics and can be enhanced to monitor COVID-19 related symptoms including body temperature, lung condition, coughing, and other vitals over a period of time to detect infection, disease progression, and remission of people. Such prognosis may also identify people who are at risk for developing severity at early stages, and minimize the risk for the disease. COVID-19 Apps are coming to market (similar to other health-monitoring apps) for use in smart phones/devices to collect and transmit related data from body sensors. Moreover, AI-powered software can learn the symptoms from data collected from patients. In particular, researchers are developing mobile Apps to automatically display the results to the patient by analyzing the testing image taken by the smart phone and comparing those to clinic databases. The App may send the testing results (and cropped image) to the cloud server for further study. It can also display in real-time the number of positive cases in a Google map charting the spread of COVID-19.

***Hand-held X-Ray Analyzer:*** The use of machine learning has made significant progress in medical imaging; in particular, DNN-based image recognition tools can detect COVID-19 cases by using CT or X-ray scans. These analysis tools can process large number of scans quickly and help radiologists in recognizing congested lungs and the degree of lung infections. Smart chest-scan analyzers [2] are now available to medical facilities to monitor the disease progression in COVID-19 patients, and help doctors to decide who will need ventilators, medications, or can be released.

***Understanding COVID-19 Spread patterns:*** As we learn other viral transmission characteristics, it is very important to understand the propagation pattern of COVID-19 (from medical records) through precise modeling and simulation. Hospital doctors and virologists are releasing clinical data of their observations. Experts are collecting other information such as the number of contacts the patient had, whether COVID-19 droplets are air-borne, how long these can remain active, how far these viruses can spread, probability of spreading by each infected person, etc. CDC [3] is providing all this information and updating regularly with necessary guidelines. This accumulated knowledge will be needed in the design and development of

---

<sup>1</sup> Updated on May 15, 2020.

computation models for detection and prediction of COVID-19 spread and forecast. A collaborative initiative of infected countries is urgently required, with support from their governments to develop a task force (at WHO) on science-based information, communication, and technological advancement in combating this pandemic.

***Tracking through Social Media:*** Efforts have already been undertaken in social media to keep track of spread of the COVID-19 virus and fatalities from this disease. Experts from all over the world are continually reporting statistics in different media portals; other services such as Telehealth and Telemedicine are providing health-related self-screening information to patients. This pandemic has provided an opportunity for social media to do greater good, especially by prevent spreading hatred and homophobia. Initiatives are also taken to keep track of misinformation about the virus through scientific fact-checkers and to reduce the spread of harmful information [4].

***Cleansing Technology:*** As the billions of ventilators, breathing systems and (N95) masks are being used, they need to be destroyed safely in order to avoid biohazards, since the virus can survive longer on these devices. It will be essential to develop a cleansing technology to eliminate the adversarial effects of the virus and, in some cases, allow the safe reusing or repurposing of items to lessen the burden on manufacturing and raw materials. People are trashing discarded gloves or masks indiscriminately, while UV or radiation mediated cleaning could be options for reusable equipment such as ventilators and some types of Personal Protective Equipment (PPE)[7]. As reported recently, Dr. Kevin Fu has been leading an effort with a team of experts, called N95DECON [5], providing guidance regarding the decontamination and reuse of N95 masks for healthcare workers. In some countries, robots and drones are in use for cleaning inside facilities and outside premises.

***Safe-Distancing Alert System:*** Using the Near Field Communication (NFC) technology, it will be possible to monitor personal proximity so that people maintain social distance and don't come too close to each other. Also, technology can alert users on better practices in personal hygiene, sanitization, physical distancing and avoiding human gestures such as handshakes, hugging, etc. Some Asian countries using robotic dogs for monitoring social distancing in parks and beaches and using unmanned self-driving vehicles for home delivery services. Dr. Santosh Kumar and his team at the University of Memphis just launched *mContain*, a mobile app to help track social distancing during the COVID-19 outbreak with a goal to reduce community transmission. Among many features, it uses geo location and Bluetooth in smartphones to detect proximity encounters (within six feet for several minutes) with other app users [6]. Similar contact tracing mobile apps (such as *Care19*, *maven*, *aaroga sethu*) are in wide use in effected countries [8].

***Sensing/alarming of viral existence:*** Technological advances allow us to view small objects from satellites, space stations from the earth; we can also see images of faraway extraterrestrial objects -- stars, galaxies and the edge of universe. To deal with this pandemic, we need extra-sensory devices to see nearby viruses, bacteria and microbes which could cause damage to our bodies. Night vision cameras allow us to see in the dark using different wave spectra and thermal energy of living bodies, visualize their physical movements and record their voices at different frequencies. While it is true that electron microscopes will be required to fully visualize or sense virus presence, it may be possible to detect viruses indirectly by empowering other natural/artificial entities (such as bacteria) which can sense the virus and help us in identification. Image enhancement techniques could potentially be used to color-code COVID-19 and other viruses in order to visually differentiate them. Though it may not be advisable to use such devices during normal times, this may be useful in specific infectious outbreaks when wearing masks and gloves are recommended. As an example, it may be possible to enhance Google Glass (cameras with microscopic lenses) to capture viral images in the surroundings which can be processed in mobile apps to determine their existence in the person's proximity.

***Protective shield around human body:*** Whether the COVID virus is living or nonliving entity, it is true that they need living cells to survive and replicate. Also, the virus can't move by itself; it needs a medium for transfer and docking on us. According to some medical researchers, the virus's polar surface cannot attach on an oily surface, some technologies can be developed accordingly. Similar to mosquito repellent and invisible

fencing (for animals), it may be possible to develop protective shields which can destroy or neutralize the COVID-19 virus before it reaches human bodies. Such protections may include special clothing, anti-viral sprays, other germ-killing chemicals, etc. However, such usage should not cause any harm to others, or the environment.

Furthermore, technology can also help in large-scale rapid testing and developing vaccine/medicine faster by harnessing today's computing power and intelligent algorithms. The above-mentioned points can provide a multi-faceted approach to minimize human suffering from the unknown COVID-19 virus and prevent the collapse of our economy and society. Federal agencies (like NSF, NIH) and big companies have announced several research and development initiatives to find solutions to COVID-19 mitigation. Until humans develop natural or induced immunity to this virus, testing, social distancing, isolation, and hygiene seem the primary means to avoid COVID-19, and technology can greatly improve protective measures.

### **Acknowledgements:**

The author would like to thank all the experts who provided feedback and valuable comments on my initial write up. Special thanks to: Dr. Stan Franklin, Dr. Nawajis Mandal, Dr. Jayanta Choudhury, Dr. Monoj Das, Mr. Anupam Lahiri, Dr. Senhua Yu, Koyel Chaudhury, Dr. Soumitra Bhuyan, Dr. Manaranjan Satpathy, Michelle Taylor among others.

### **References:**

- [1] Roundup: Tech's role in tracking, testing, treating COVID-19. Accessed on April 3, 2020. <https://www.mobihealthnews.com/news/roundup-techs-role-tracking-testing-treating-covid-19>
- [2] Hospitals Deploy AI Tools to Detect COVID-19 on Chest Scans. Accessed on April 2, 2020. <https://spectrum.ieee.org/the-human-os/biomedical/imaging/hospitals-deploy-ai-tools-detect-covid19-chest-scans>
- [3] CDC Corona virus reports: <https://www.cdc.gov/coronavirus/2019-ncov/index.html>
- [4] Google News Initiative: COVID-19: \$6.5 million to help fight coronavirus misinformation. Access date April 4, 2020. <https://www.blog.google/outreach-initiatives/google-news-initiative/covid-19-65-million-help-fight-coronavirus-misinformation>
- [5] N95DECON: A scientific consortium for data-driven study of N95 filtering facepiece respirator decontamination, April 2, 2020. Available at [www.n95decon.org](http://www.n95decon.org).
- [6] A New App for Personal Tracking of Social Distancing in the Greater Memphis Area. Accessed on April 7, 2020. <https://www.memphis.edu/mediaroom/releases/2020/april/mcontain.php>.
- [7] Strategies to Optimize the Supply of PPE and Equipment, CDC report. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pppe-strategy/index.html>
- [8] Contact Tracing apps are off to a slow start in the U.S. Associated Press. <https://www.nbcnews.com/tech/tech-news/contact-tracing-apps-are-slow-start-u-s-n1210191>