



FIGHTING CORONAVIRUS THROUGH AI, DATA SCIENCE AND TECHNOLOGY

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Abstract: The coronavirus which started in 2019 and later named as COVID-19 is tackled with Artificial Intelligence (AI) and Data Science technologies. Researchers all over the globe have been working together on scientific breakthroughs and researches to develop and test potential vaccines, to predict hotspots of the disease spread, and to endorse strategies and planning with the WHO to find its cure and prevent its spread. People are wearing mask and staying at their home all day to avoid the deadly virus. Economists confirmed that the outbreak will negatively impact the global economy and disrupt the supply chain globally. Recession followed by depression is to be expected in the post-pandemic world. How can technology help us recognize the path of virus spread, How Artificial Intelligence is helping fight Coronavirus, How Big Data is playing a vital role in minimizing coronavirus outbreak, Are developed nations better equipped to handle such situations, How Top Tech firms are helping in curbing the virus spread and many more. The answers to these questions posed are addressed in a variety of sources. This research article briefs about how china and other affected countries are taking advantage of technology to fight coronavirus.

I. INTRODUCTION

On December 31, 2019, the WHO office located in China got informed about the first report of an unknown virus causing lung inflammation in Wuhan city, which is located in Eastern China where about 11 million people reside. The virus has infected more than 81,470 people in China and killed over 3,304. While china almost contained the virus, the outbreak had already gained pace around the world, especially in European countries and North America.

Outside of China, there have been over two million cases and counting. Over 330000 deaths have been recorded worldwide, [Ref.7]. Data is accumulated from national and international health departments around the globe to forecast its impact. More than 180 countries have reported cases of coronavirus in the world. Most of the developed nations like USA, France, UK, Spain, Germany, China, South Korea and Italy have witnessed the worst phase of this virus. In the USA alone, there have been over 1500000 confirmed cases and over 95000 deaths as on 21st May 2020.

II. ROBOTS TO THE RESCUE

Robots are used to minimize the outbreak of COVID-19, around the world. Robots are being used for sanitization and serving jobs that are observed as risky for humans. Drones are used to spray disinfectants in coronavirus affected areas in many countries. Delivering medical provisions and samples taken from patients are also being done by drones. Some of them are equipped with facial recognition to keep a check on citizens not wearing a face mask.



Fig. 1. A robot is used to take a temperature reading of a person in China. [Ref.3]

Many tech companies in China have developed such technologies to carry out contactless delivery of food and other necessities, spraying of sanitizers and performing basic diagnostic tests of COVID-19 as in Fig. 1, to limit the physical contact with customers and people.

Pudu Technology a company based in Shenzhen, which manufactures robots for the hotel industry, is reported to have deployed its robots in more than 60 hospitals all over China to help medical staff and to prolong the implementation of the no-contact policy.

MicroMultiCopter, a UAV manufacturing company, is deploying drones to carry test samples and conduct thermal imaging on a large radius to check for potential COVID-19 infected people in China.

III. AI as A HELPING HAND

Advanced AI has been used to spot similarities in coronavirus-related research and helping with the diagnose of the disease and accelerate the evolution and deployment of a vaccine.

Using deep learning-based models like MT-DTI to predict the firmness of bounding between a specific molecule and a target protein. Atazanavir an antiretroviral medication used to treat and prevent HIV/AIDS is highly expected to block and bind a key protein on the outside of SARS-CoV-2. Three other anti-viral has been detected by the model that can bind the virus.

A company which discovers drugs for treating diseases through AI called BenevolentAI is has equipped its AI-powered data graph system to combat coronavirus.

Such technology can intake and analyse thousands of scientific publications and biomedical studies to find links between genetic and biological properties of disease and the structure and function of drugs.

Top e-commerce giant Alibaba, states that its latest AI-powered live scanning system can recognise coronavirus infected people with up to 94% precision. It is proclaimed that it's a charitable foundation, will donate \$2.15 Million towards the development of the vaccine.

Chengdu, a city in China, has equipped their outbreak control personnel with a very high-tech and smart helmet as in Fig.3, that can spontaneously measure and analyse passer-by's temperature, within a 5-meter radius. The helmet will raise an alert on detecting fever. This technology is proving out to be a good sensor for detecting the infected people.

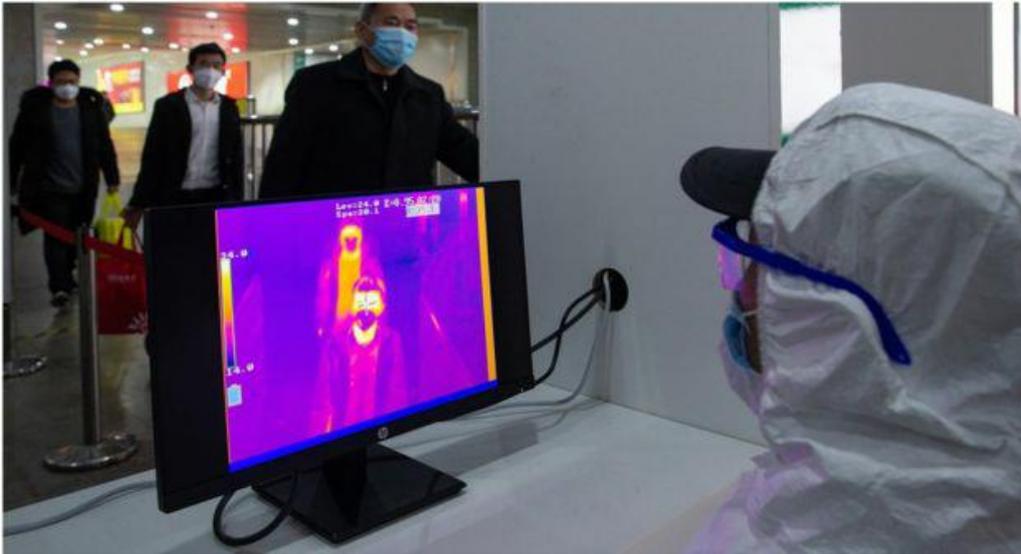


Fig. 2. Thermal cameras being used to take a temperature reading of people. [Ref.3]

DeepMind a Google's subsidiary is experimenting on certain properties of the novel coronavirus. They are utilising data built on genomes (an organism's complete set of DNA and genes) to figure out the protein structure of the organism. They have deployed their Alpha Fold System to make predictions of many proteins that may be correlated SARS-CoV-2, the virus causing COVID-19. DeepMind claimed that it may guide researchers and scientists to understand how the coronavirus functions and penetrates the human body, which will eventually be useful to develop a vaccine or a cure.



Fig.3. A tweet reporting the use of high-tech smart helmets to detect potential Coronavirus patient. [<https://twitter.com/globaltimesnews/status/1234886255277674503>]

AI algorithms derived from Chest X-rays to give insights in coronavirus study and its symptoms (Fig. 4). This can be a great help in programs like massive scanning of patients and detection of COVID-19. The main aspect of AI in terms of averting epidemics is its scale and speed. According to Polyamine, "The speciality of AI to sense situations instantaneously makes it an essential tool to fight such an outbreak. AI technologies can accurately process and analyse thousands of scans within minutes or even seconds".

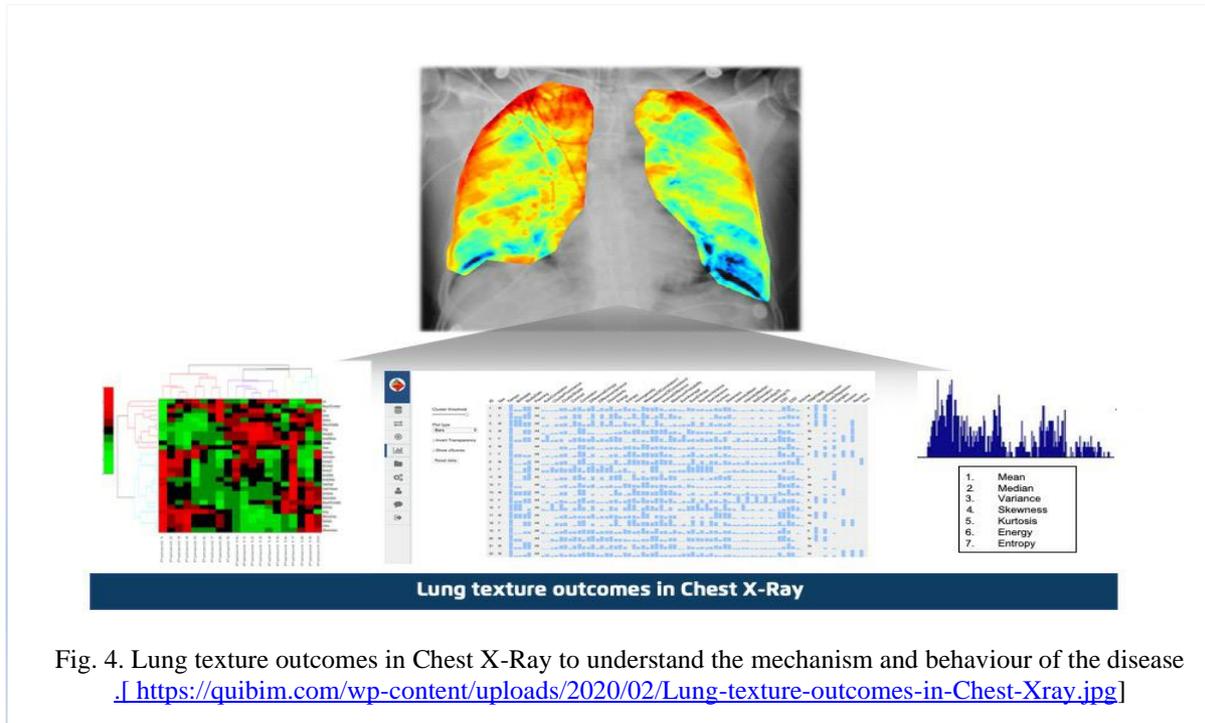


Fig. 4. Lung texture outcomes in Chest X-Ray to understand the mechanism and behaviour of the disease
[\[https://quibim.com/wp-content/uploads/2020/02/Lung-texture-outcomes-in-Chest-Xray.jpg \]](https://quibim.com/wp-content/uploads/2020/02/Lung-texture-outcomes-in-Chest-Xray.jpg)

China is using robots and drones to extend its redefined surveillance system. Facial recognition cameras are customary across China. People are scanned constantly for fever and individuals are identified who are not wearing masks and gloves, through these enhanced technologies. This is helping to keep a check on infected individuals and accomplish complete quarantines.

Sense Time, an advancing AI firm, says its contactless temperature alert software has been deployed at universities, railway platforms, tourist hotspots and recreational centres across China. The company also claimed that they have equipment that can identify the facial structure of humans, even if they are masked or wearing a cap, with a "high degree of accuracy". Therefore, smartphones and AI are also playing a vital role in tracking the outbreak of the coronavirus and hotspots of corona infected areas.

IV. SURVEILLANCE

Several firms have developed such applications which can track the spread of COVID-19. Through live location access, Bluetooth and other wireless signals they can monitor the movement and path of infected COVID-19 carriers and identify potential transmissions. It also helps citizens know the exact location of residential societies where coronavirus cases have been found so that they do not dare to go there and stay safe.

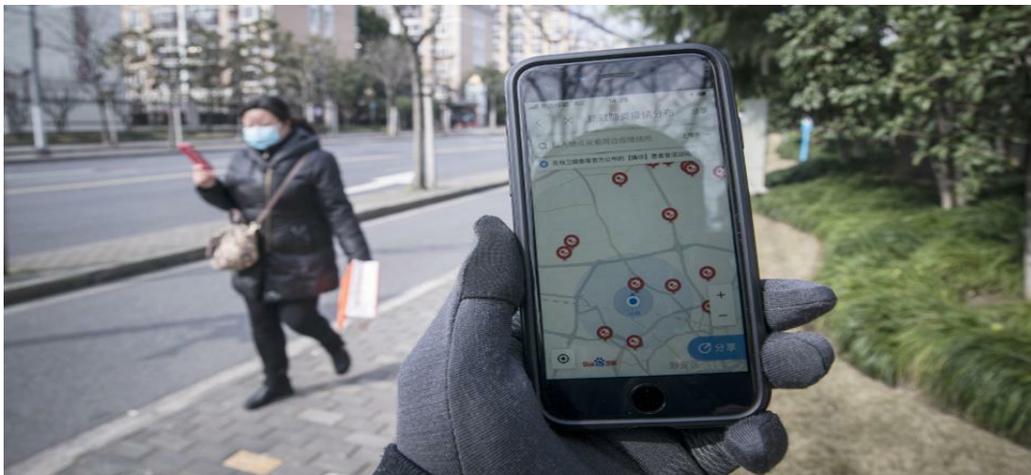


Fig. 5. The app shows the position on the map where corona-positive people have visited recently gone to
[\[https://specialsimages.forbesimg.com/imageserve/44299218/960x0.jpg?cropX1=0&\]](https://specialsimages.forbesimg.com/imageserve/44299218/960x0.jpg?cropX1=0&)

In South Korea, many applications (Fig.5) have been built by independent software developers that help track corona positive patients and indicate where they have visited. Just by a click, we can check whether we are at a safe location or not. We can also check if there are any associated cases of the fast-spreading virus in our neighbourhood.

A website in New Zealand is devoted to addressing the reports claimed by people about their neighbours for breaking coronavirus lockdown rules.

Alipay Health Code (an App) indicates each individual with yellow, green or red colour, based on whether they should be permitted into public spaces or isolated. It operates on big data to spot potential virus human transmitters, claimed by its builder Ant Financial. Now been deployed in more than 200 cities in China and now planned to be deployed across many other countries.

A similar app called "Aarogya Setu" was launched in India that gives updates on local and national COVID-19 cases to the user. This app uses location services and Bluetooth to depict COVID-19 positive cases that are likely to exist in a radius of 500m, 1km, 2km and 5km from the user. It also has a self-assessment feature to identify symptoms of COVID-19 in user. Its result is prominent as it was able to identify more than 3000 hotspots within two weeks of launch and prevent further spread of the virus.

V. PREDICTION SYSTEM

In 2008, Google started a system that attempts to identify outbreaks of flu using people's search queries. Researchers and companies are utilizing AI to correctly foretell the spread of disease. BlueDot, a Canadian technology firm uses tons of data collected from health departments to forecast public health risks which help to prepare strategies in advance before such outbreaks.

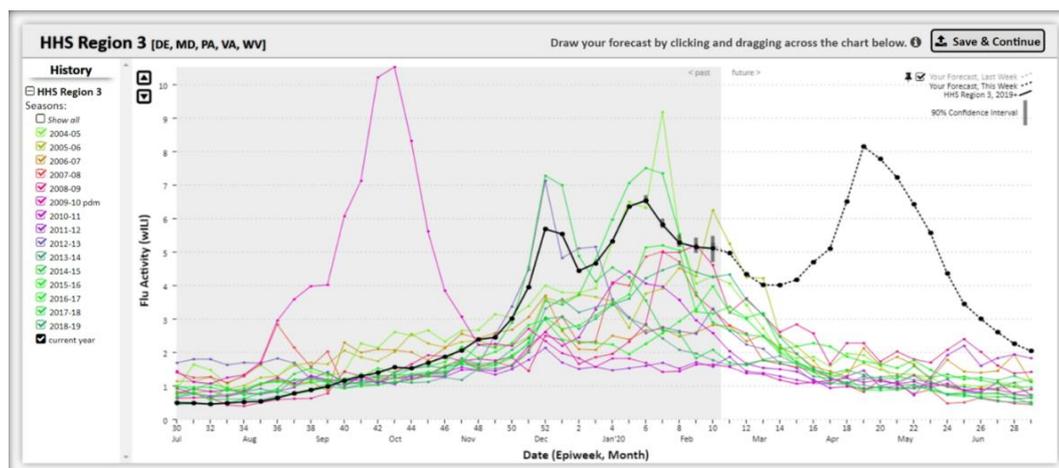


Fig. 6. Forecast of a region in the USA infected by a coronavirus. The black line indicates the peak level.

<https://www.vox.com/future-perfect/19/ai-predicting-coronavirus-spread-forecasting-covid-19>

Through natural language processing and machine learning techniques BlueDot has invented a system that does data-mining of about 200,000 studies in 68 languages every day to extract new information related to over 150 infectious and contagious diseases. They were the first to inform their clients about the coronavirus outbreak and its potential impact in the near future. To predict the spread of disease, they use data such as passenger's route information, tweets, social media, news reports and published articles.

Social media websites are playing a vital role in collecting data and creating awareness about COVID-19. Other types of data that can be accumulated and analysed to examine the spread of diseases are local purchases, internet surfing history, and corona related keywords in posts and texts.

Many social media information miners and experts have teamed up to combat coronavirus. Machine learning is used for data scraping of social media posts, news reports and data accumulated from health channels. A program is developed which indicates posts including keywords related to respiratory diseases and symptoms of coronavirus. Unlike doctors who can identify corona infected people only by concrete symptoms, these technologies can pick up signs and patterns that are hidden and that a human would not be able to notice.

VI. AI SCAN READING AND DRUG DISCOVERY

Many biopharmaceutical firms are adopting AI to escalate drug discovery procedure, bring down research and development cost, lessen failure proportion in clinical trials and ultimately create a better drug. Due to access to vast data related to life science, many firms have started to implement AI as their speciality.

Deep learning, the technology that enables facial recognition and autonomous driving, can help to diagnose infected people quicker. It usually takes a few hours to get CT scan results by doctors, but through AI this process of medical imaging can be done much faster with much more efficiency. Although doctors still need to catch up with laboratory tests but saving time is critical when a virus spreads so quick. This proves how powerful AI is in disease detection and critically examine its symptoms.

Drug discovery, the technology which works through AI is very beneficial to find a cure. With its help, the researchers can determine the order of the four chemical building blocks - called "bases" of the coronavirus within weeks.

Exscientia Ltd. a company which combines the power of AI and human creativity to make safer and more sophisticated drugs available to everyone acknowledged on producing drugs much quicker than before. While it took years to develop a vaccine in the medieval age, nowadays with the aid of algorithms it can be reduced to just 12–18 months. In pandemic such as coronavirus, it is of great help.

Nanox, an Israel based top MedTech company has developed a portable automated X-ray technique that uses AI cloud-based software to recognise symptoms and help limit contagious outbreaks. It is also building such technology which will automatically scan and share tomographic images of the lungs to the database.

Most of the times mining scientific papers have proven to be useful. Through rigorous mining of such virus-related scientific papers, the hope is that AI will accelerate insights into the coronavirus by looking for more exquisite connections across data.



Fig.7. Medical workers are checking a patient's CT at Wuhan's makeshift hospital in China. [http://www.xinhuanet.com/english/2020-03/03/c_138839694.htm]

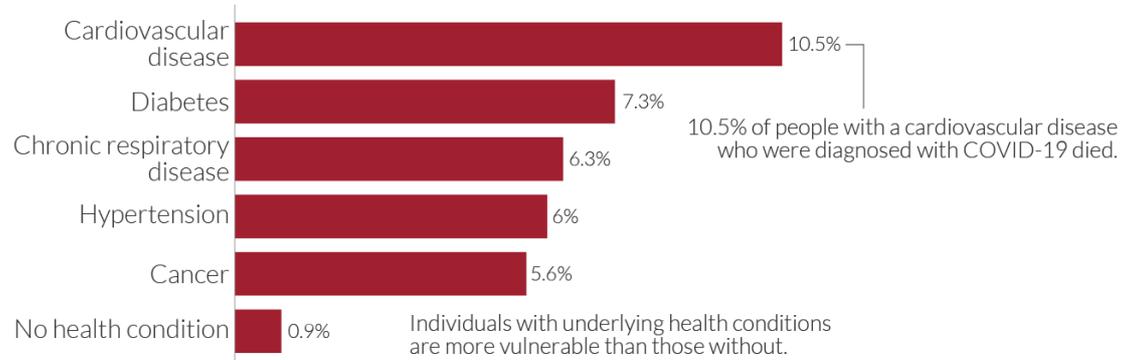
VII. SHARING DATA

Through Big Data many countries and firms are developing ways to identify an outbreak before it spreads. Shanghai is also taking advantage of big data to minimize its outbreak. Every worker in Shanghai must report their body temperature, recent travel history and any other information, which is then sent to a big data platform that which extract relevant information and analysis the data to prepare statistics to better understand the outbreak and its spread.

Coronavirus: early-stage case fatality rates by underlying health condition in China



Case fatality rate (CFR) is calculated by dividing the total number of deaths from a disease by the number of confirmed cases. Data is based on early-stage analysis of the COVID-19 outbreak in China in the period up to February 11, 2020.



Data source: Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. *Vital surveillances: the epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19)—China, 2020.* China CDC Weekly. OurWorldinData.org – Research and data to make progress against the world’s largest problems. Licensed under CC-BY by the authors.

Fig. 8. The chart here represents the death rate for populations within China based on their health condition. [<https://ourworldindata.org/coronavirus>]

Sharing data of COVID-19 cases in each country, the proportion of deaths and recovered cases, etc. will be critical to see whether measures taken by Govt. to slow down the spread are working or not (Fig 8). Facebook engaged with researchers at established universities and research centres such as Harvard University's School of Public Health. It's sharing data about people's activity like their travel history, their movement, tourist hotspots and high-resolution images of densely populated areas, which could help them forecast the spread of the virus and advise Govt. to do the needful to prevent it.

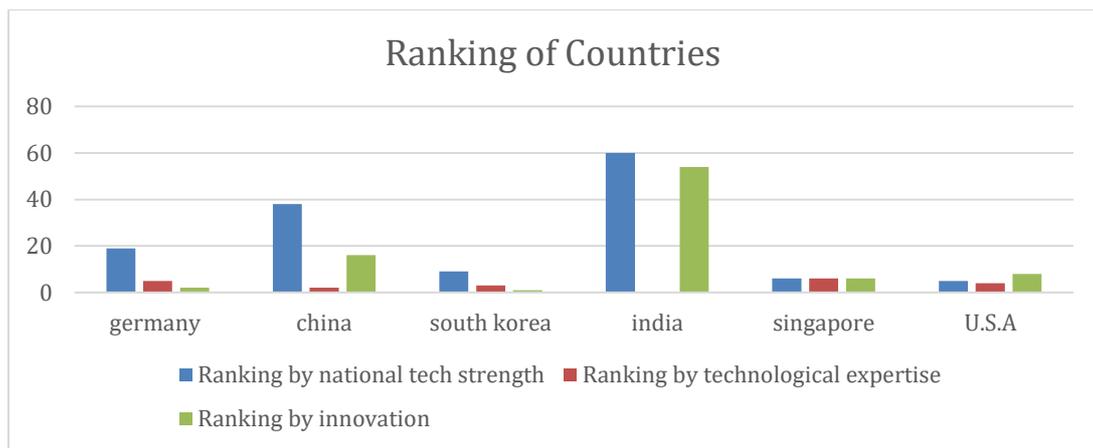


Fig. 9. The chart here depicts the ranking of various countries based on tech strength, technology expertise and innovation.

Table-I: Latest ranking is given to various countries based on different aspects and the technology implemented by them during coronavirus outbreak.

S.No.	Country	Ranking for Technological Expertise			Technologies Implemented
		Ranked by national tech strength (source: Global Finance)	Ranked by Technological Expertise (source: BAV Group)	Ranked by Innovation (source: Bloomberg)	
1.	Germany 	19	5	2	COVID-19 tracing application, advance testing kits, protection equipment and thermal scanning.
2.	China 	38	2	16	Location tracking, Alert system, Thermal scanning. Robots manning quarantine centres, hospitals, restaurants, etc. Drones used for live tracking and delivery of supplies. A. I equipped satellite used to map makeshift hospitals and hotspots. Mass surveillance tools such as CCTV cameras and drones to monitor people and live facial recognition.
3.	South Korea 	9	3	1	Smart detection and response system using advance technologies and equipment. Applications used to track infected person and monitor their movement using location data. Alert system to prevent further spread. AI used for diagnosing and classification of patients.
4.	India 	60	-	54	Using apps like Aarogya Setu to help people avoid COVID patients and reduce its impact. Ultraviolet disinfection at entry points.
5.	Singapore 	6	6	6	Applications used to for contact tracing and alert citizens, data stored in encrypted form in user's phone. Robots and drones used for surveillance.
6.	United-States-of-America 	5	4	8	Govt. in talks with giant tech companies to use location and movement data of citizens for tracking purpose. Deep learning and machine learning used to study coronavirus.

VII. CONCLUSION

In summary, there are many potentially impactful applications of machine learning to fighting the Covid-19, however, most are still in their early stages. Moreover, a lack of data sharing continues to inhibit overall progress in a variety of medical research problems. However, utilizing things like meta-learning, domain adaptation, while releasing restrictions to healthcare data, can allow Machine Learning to play an important role in containing/responding to both Coronavirus and future pandemics. Unfortunately, applications which help in surveillance also require a huge percentage of a country's population to install them in their phones and always have their location services activated. Many developed countries have utilised their technologies efficiently in this outbreak (Table. I & Fig.9) that have drastically reduced the number of Corona-positive cases which also proves the importance of technology and its growth in a country. Similar tactics and technologies must be implemented and studied further in other countries to pave the way in developing vaccine for coronavirus and model need to be followed in such pandemics. Also sharing daily data of coronavirus has created panic among the public. Privacy is also a major issue for applications accessing user's data. Although Covid-19's rapid spread globally is scary, it gives us a ray of hope knowing the boundary-breaking inventions, jaw-dropping technologies, cross-collaboration of our healthcare institutions, governments, citizens and tech firms.

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