A MODEL TO ANALYZE THE IMPACT OF COVID-19 IMPLEMENTING DATA SCIENCE TECHNIQUES

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ABSTRACT: *Background: Current technology like Artificial Intelligence (AI), IoT, data analysis, and pattern recognition must be embraced to manage and counter emerging diseases to provide healthcare services. As decisive technology, we plan to assess the role of data science in the understanding, planning, and management of COVID-19 (corona-virus) and other pandemics. The present global pandemic challenges of COVID-19 have exceeded the provincial and radical limits, concepts, spiritual, social, and educational limits. The data science healthcare system, enabled through an interconnected network, is useful to properly monitor COVID-19 patients. This technology increases patient satisfaction and reduces the hospital readmission rate. Contributes to COVID-19 are the science and technology industries which comprise data science, machine learning, and Data Science.*

Objective: The objective of this work is to discover various aspects of modern techniques used to combat COVID-19 crises at different scales, including the processing of medical images, monitoring of diseases, predictions, computational biology, and medicines.

Methods: The database relating to modern technology has been searched gradually for COVID-19. Furthermore, the information extracted will be briefly reviewed by evaluating various aspects of modern COVID-19 pandemic technology.

Keywords: Data Science, COVID-19, Pattern Recognition Algorithms

1. INTRODUCTION

Viral pandemics pose a grave threat. The first one is not COVID-19 and not the last one. Yet we're gathering & sharing what we know about this virus, like never before. Thousands of researchers worldwide are collaborating to analyze data and find solutions. We would like to shed light on their findings and demonstrate how the usage of machine learning is helping us:

- Find who is at greatest risk;
- Patients who diagnosed,
- Faster development of the drugs,
- Finding current medicines which can help
- Predict disease outbreak,
- Recognize viruses effectively,
- Chart of where viruses originate, and
- Predict another pandemic.

1.1. To determine who is at greatest risk from COVID-19

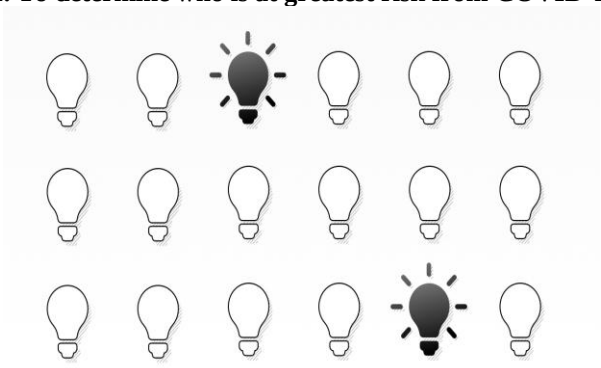

Figure 1: COVID-19 Patient Finding

Data science has proven invaluable in many spheres of risk prediction. Data science is potentially important in three main ways, with explicitly medical risk.

- **Risk of infection:** What is the chance of having COVID-19 for a specific person or group?
- **Intensity threat:** Which are the risks for severe COVID-19 symptoms or complications causing a single patient or community to undergo hospitalization or intensive care?
- **Risk Outcome:** How much is the risk that specific treatment for a person will be ineffective, and what are the chances of his/her death?

Data science can help in the prediction of all 3 risks. Although much COVID-19-specific data science research is still too early to be acquitted and produced, early experimental results are very convincing. We can also consider how machine learning can help in the risk prediction of COVID-19.

1.1.1 Detecting an infection risk

Statistical data show that significant risk factors which find the likelihood of an individual contracting COVID-19 are:

- Age
- Conditions which prevail
- Hygiene behaviors
- Social assistance habits
- The number of interaction between humans
- Interactive frequencies
- Climatic spot
- Socio-economic condition.

Research is only in its early stages on the danger to the present pandemic. E.g. DeCapprio et al. have used machine learning to create an initial COVID-19 vulnerability index. Preventive measures like social distancing, washing hands, and wearing masks can reduce overall risk. With the collection of more related data and results from ongoing research are produced, we are likely to have more practical machine learning applications for prediction of infection risk.

1.2 Predicting who could develop a serious case

When a person got infected from the COVID-19 virus, the risk of complications, or the need for advanced medical care is predicted. Some people have only minor symptoms, while

some have serious symptoms like acute respiratory distress syndrome (ARDS), lung disease, or which causes death. It is impossible to monitor and treat everyone having mild symptoms closely. But if severe symptoms are likely to develop then it is much better to start treatment early.

In machines, materials, and continuous researchers, machine learning can predict both the risk of developing ARDS and the risk of death by looking at initial symptoms and the likelihood of ARDS. Researchers realize that research is limited: "The size of the dataset is a clear limitation of this study; 53 patients with some missing values and limited severity spectrum". But the study lays the significant foundation for implementing a machine learning algorithm once more data become available.

1.3 Predicting of treatment outcomes

An extension of the severity forecast predicts the outcome of the treatment, which generally predicts life and death. Obviously, with other signs, it would be helpful to know about the chances a patient will survive. Besides this, bitter truth needs to be accepted that not all patients receive the same care. If we can guess the effects of various types of treatment, doctors are more effective in treating patients. Machine learning is not COVID-19 specific, and machine learning is used to forecast clinical outcomes in epileptic patients as an example. Researchers used machine learning to forecast the response to cancer immunotherapy. Because COVID-19 therapies continue to develop, machine learning will likely take time to predict results for different treatments.

2. Covid-19 Diagnosis from Patient Screening

If a new pandemic occurs, it is difficult to diagnose individuals. Large-scale testing is difficult, and testing will probably be costly, particularly at the outset. Also if the same symptoms suggest several other potentially milder diseases, someone with COVID-19 symptoms can be very worried that they have contracted the disease.

A simpler, quicker, and cheaper method would be useful in collecting more data on a wider scale rather than taking the medical sample of each patient and waiting for the return of ong, costly testing results. Such data may be used for further study, screening, and triage of patients.

Promising areas of study include the use of data science to support COVID-19 diagnoses:

- Using facial scans for symptoms such as if the patient is suffering from fever,
- Using wearable devices such as clever watches, the patient's restful heart rate scans for tell-tale trends
- The use of machine-based, self-reported symptoms to track patients.

3. Methodology

Emerging pathogens are big concern for the health of public. It is particularly true for viral conditions which can be easily transmitted and have exponential spread rate. The novel corona virus (SARS-CoV-2) detected in Dec. 2019 led to large quarantines preventing further expansion, including major towns, villages, and public spaces across the globe1–3 As of June 26, 2020, reported circumstances of approximately 9,581,803 in 25 countries suggested confirmed cases in the World Health Organisation, including 4,89,182 COVID-19 deaths.

To minimize the time necessary to consider a person for investigation for COVID-19 and their speedy segregation, we propose to gather the history of travel along with the more specific signs and symptoms using an app-based online analysis. These statistics can be used for the initial selection and timely recognition of possible COVID-19 cases. Data Science system can process multiple data points, based on which the suspects can be segregated into different risk stages. The cases with maximum risk probability can then be quarantined quicker, to lower the chance of virus spread (Table 1).

Appendix 1 specifies the measures implicated in gathering information from all respondents irrespective if they are infected or not. Appendix 2 states the AI algorithm that identifies the probable cases and alarms the respondent as well as the health clinics for immediate health check-ups. In the case of the respondent's unwillingness to visit the health center the mobile health vehicles will check for the viruses and door-to-door evaluation will be carried out after they receive an alarm from the health department. If there are no instant signs of virus infection, the respondent should be notified of no current COVID-19 risk with an AI-based health alarm cab. Figure 1sums up the data collection findings and highlights potential events.

Before proceeding for the Health Check Recommendations for coronavirus (HCRC) and No Health Check Recommended for Coronavirus (NCRC) for patients with no significant symptoms, the information regarding signs and symptoms recorded in phase 5 of the algorithm should be gathered.

3.1 Data collection algorithm by survey based on mobile phone

1: Collect the data about the location of the respondent's stay or from where he participates in a survey based on a mobile phone.

2: Collect the statistical records of the respondent on the basis of sex(S) (male-M, female-F, transgenders-T), race (R) (white-W, black-B, Hispanic-H, other-O) and age (A)

3: Recording the information about the respondent's last 14 days visit or stay in any of the countries that are affected by COVID-19. (Yes=Y / No=N);

4: Enquiring about the respondent's contact with any corona positive victim during the last 14 days? (Yes=Y / No=N)

5: Report the presence or absence and duration of signs and symptoms listed below

(a) Temperature (Yes=Y / No=N), if Y, then for how many days

(b) Cough (Yes=Y / No=N), if Y then for how many days

(c) Breath shortness (Yes=Y / No=N), if Y, then for how many days

(d) Fatigue (Yes=Y / No=N), if Y, then for how many days

(e) Formation of sputum (Yes=Y / No=N), if Y, then for how many days

(f) Body ache (Yes=Y / No=N), if Y, then for how many days

(g) Diarrhea (Yes=Y / No=N), if Y, then for how many days

(h) Pneumonia in either lung (Yes=Y / No=N), if Y,

(i) then for how many days

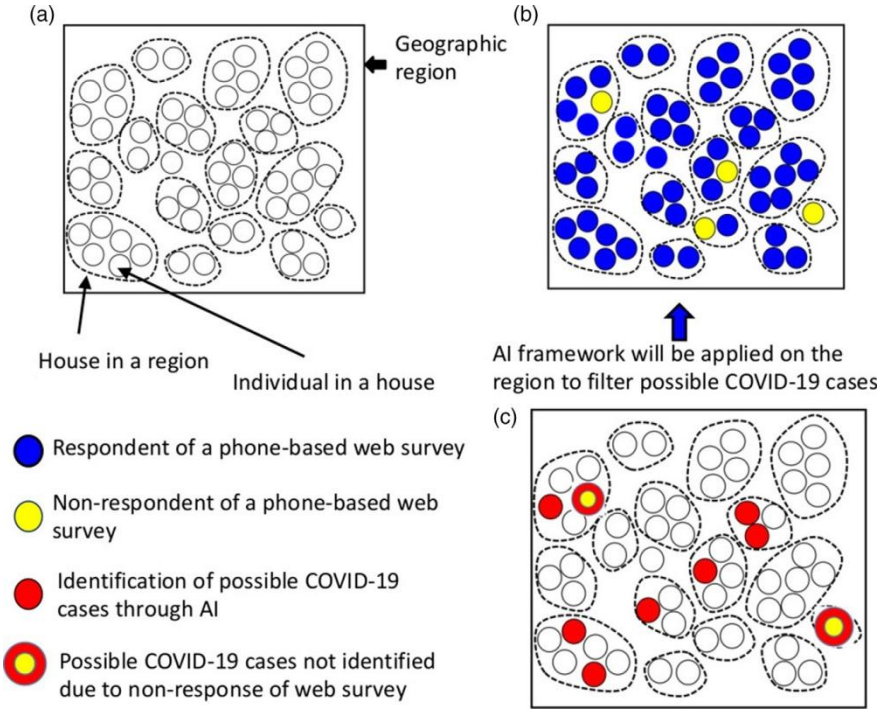

Fig. 2: Cycle of theoretical data collection and future COVID-19 detection. (a) a household area (e.g. district, province, village, or municipality). (b) Respondents and non-respondents for mobile web surveys. (c) Potential COVID-19 cases found amid respondents under survey and probable COVID-19 cases amongst non-commissioned respondents

6: Also record the details as per steps 1-5 listed above for all other people residing in the same locality or for those who could not directly participate in a web survey.

Requirements of data science and in-depth research can be useful methods for diagnosis and care decision making [32,33]. Several studies have supported data science model disease detection [25-28]. For health-related data collection, the use of cell phones [38-41] and web-based platforms [42,43] has been successfully tested. Also, our proposed algorithm can easily be expanded so that individuals with placid symptoms and signs can also be detected. Thus they should be functional to relevant and rapid results promptly. In addition to economic performance, the proposed model approach could aid in detecting and domineering COVID-19 in quarantine respondents because of the stretch of SARS-CoV-2.

3.2 Steps Involved in data collecting using a mobile phone

Based on a CDC Flow Chart to Classify and Measure Novel Coronavirus 2019, we've improved our data collection standards [31] and introduced additional variables to expand our efforts to identify infected and monitor the spread of coronaviruses.

4. Significant Benefits For Covid-19 From Industry 4.0 Innovations

In this situation, industry 4.0 innovations can deliver better digital results to our everyday lives. Specific paybacks of Industry 4.0 innovations as foreseen by us for COVID-19 pandemic reduction can be as follows:

- Scheduling of COVID-19 operations.
- Giving a healthier service, not including the healthcare and other staff at risk.
- Precautionary object fabrication linked to this virus.
- Using a smart supply chain to have a medical portion of the time.
- The contaminated patient used robotic-based care to reduce risk to doctors.
- Virtual reality used for educational purposes.
- Cultivate a versatile counseling work environment.
- These emerging tools help people do day-to-day jobs during the lock-down.
- Provides multiple innovations using advanced manufacturing and digital technology.
- Researchers can use those technologies to identify unusual information on social and media platforms.
- Used for improved risk management and the emergence of this virus in global public health.

4.1 Industry 4.0 Remote Area technologies

Advancing emerging technologies offer telemedicine tools to better track and avoid this virus. Such systems identify any patient symptoms and notify medical personnel immediately during an emergency. Such technologies accomplish the remote health monitoring program quickly[34,35]. Sensors are used for sensing physiological data and providing the patients and doctors with valuable knowledge. Advanced computer technology tools are used to build improved access and a creative COVID-19 patient care approach. Online

innovations during the advent of the COVID-19 pandemic are beneficial for distance education, remote and online learning. It will have specific information available for exchanging feedback and documentation. Such tools aid in training and education processes in far-off areas during the lockdown [36,37]. They provide open educational tools, both interactive and various outlets.

4.1.1 Significant Industry 4.0 technologies that could help in COVID-19 outbreaks

Industry 4.0 techniques identify the COVID-19 signs, which aids in preventing the uncertainty regarding the disease and can also foretell about the risk of spreading the virus. It helps in following the possible health issues and probable signs of healing. Table 1 addresses essential Industry 4.0 technologies that aid in COVID-19 outburst [38-45].

Table 1 Significant Industry 4.0 innovations which can aid in outbreaks of COVID-19.

Sno	Technology	Description	How is it helpful
1.	Artificial Intelligence	AI is a strong technology that can be very helpful in evaluating the hazard of COVID-19 pandemic from infection and population screening. This is an application that enables computers to use huge data-based models for sample detection, computer vision, as well as natural language processing. The use of this technology is limited today because data are missing. The information available is also very noisy and redundant.	AI can envisage the outburst and can minimize or even halt the virus stretch. False information on the social media relating to the pandemic will subsequently be identified and erased with AI appliance. Using AI can be tailored for clinical trials for drugs and vaccines against this virus. It can be accustomed to build robots that can help to carry out sanitation work and carry out an online medical test on humans. CT scans can be created by the same and are requisite to diagnose virus-induced pneumonia. Another use of technology is to generate the necessary tools for the health structure.
2.	Internet of Things	The IoT is an integrated approach that has contributed to an exponential increase in digital development, asset organization, etc. This involves data compilation, processing, interpretation, and accumulation. Raw data is collected using sensors built into phones, robots, etc. The processed data is then submitted to the fundamental cloud repository for review and supervision.	The Internet of Things has been very effective in fighting COVID-19. For example, drones are used to monitor the following of quarantine and wearing masks. The technology can prove to help trace the source of an outburst. This can also be useful for epidemiologists to check for patient zero and to identify the contact individuals. The patients' observing quarantine can be monitored also it is possible to monitor patients who violate quarantine. Also, this system can support medical personnel with video monitoring of patients at home.
3.	Big data	Big data is an analytical method that is appropriate to follow and manage the stretch of COVID-19 worldwide. Its system will store a large number of patients with this disease. This method provides the source for a simple and fast-track decision-making assessment. This will help to save people's lives and recognize successful treatments quickly.	It can be very helpful in the study and prediction of the spread and effect of the coronavirus on humans. The COVID-19 trackers gather nearly actual information from the world and then send the same to the doctors dealing with epidemics, the scientists, and policymakers the newest information useful for making informed decisions to counter the virus.
4.	Biosensor	• Biosensors are basically used to convert the biological signals to electric signals. Several types of the major biosensors are electrochemical, optical, electronic, piezoelectric, thermal, gravimetric, pyroelectric biosensors. They are used in various areas including medical research, agricultural and oceanic industries, etc. They are safe and reliable. During the case of a biological conflict, they can be	For the current COVID-19 pandemic, biosensors can supply instruments that are simple to use, responsive, cost-effective, and can deliver high precision. The glucose monitor is a good illustration of a bio-sensor used in clinical research and disease diagnosis. A 1AX single-use biosensor patch is being created to track the symptoms of COVD-19 early detection and then. This patch will monitor the temperature, ECG trace, breathing rate, etc. in real-time.

		used for strategic assistance. This bio-sensor technology is innovative and can be used successfully as a wireless system in a multi-patient hospital setting.	
5.	3D Printing	3D printing has its face in the medical sector for the development of the personalized component from the digital CAD software data. This can easily replicate the earlier product version in less time and at a lower expense. It aids in designing and producing ventilator parts according to the necessary deficiency. This satisfies the need for the global supply chain by producing the necessary precautionary parts.	The technology can be helpful in applications for monitoring the spread of coronavirus disease. A face mask inherited with this technology can be used for scanning a large number of infected people in 30 minutes. The use of N95 masks and respirators is not environmentally friendly and can harm the environment. The newly created 3D NanoHack mask, on the other hand, is considered recyclable and reusable.
6.	3D Scanning	It is used in the material part of digital CAD data conversion. This technique is effective for reverse engineering processes. It is implemented in the medical field for the accurate measurement of the human body and its part. The output of 3D scanning is helpful in determining the shape and appearance of the actual world for data collection. Using this technique the collected data can be used to create the 3D model. In a variety of applications, these data can be used. 3D scanners also find their way in digital games and movie production.	3D scanning is a contactless technique that assists in COVID-19 scanning of the thoracic chest. A useful method for the identification and quantification of COVID-19 viruses. Many of the other uses of this technology are augmented reality, gesture tracking, robotic mapping, and industrial design.
7.	Cloud computing	It is a novel digital technology that offers computer system services on the Internet, including servers, storage, databases, networking, and intelligence. Its platform gives quicker creativity and versatile capital. The consequence is a decrease in running costs and an improvement in service quality.	In these times of social isolation in the context of COVID-19, people have continued to live digitally using applications such as zoom video, slack, Netflix, Microsoft Teams, and Google Cloud. The technique can be useful in various ways to combat COVID-19. Eg, Salesforce Care has implemented specially tailored solutions for healthcare providers who receive a significant number of COVID-19 requests.

5. SUMMARY

Industry 4.0 offers an automated resolution for specific production sectors and related areas. It involves a variety of processing and digital data technology to gather, distribute, accumulate, evaluate, and track information systems properly. Digital tools offer a revolutionary way to separate the infected person properly, reducing the high mortality risk, improving opioid development, treatment, and care processes. Using such devices, people act upon from their habitat; they learn a fresh bureau community, work hours, implicit offices, implicit meetings, and comprehensive printed correspondence. Industry 4.0 has distant operational capabilities via intelligent technology, that supports COVID-19 outbreaks. Through improved traffic control, transport management, and public health, this transition accelerates the digital transformation. Via telemedicine consultations, these emerging technologies make a practical clinic. Therefore, the physical crowding of patients in hospitals and clinics should be popular. Such systems monitor the patient 's record and avoid the patient from requiring redundant medical appointments.

6. Future Scope

In addition, the tools for Industry 4.0 will be used to accumulate confidential facts on our healthcare structure for another related pandemic such as COVID-19. The professionals, physicians, and staff who can influence the COVID-19 treatment line and other comparable pandemics or epidemics could adopt this revolution quickly. All medical equipment, procedure, and healing actions can be centralized. In the upcoming, the health diligence will nurture and need to

find their feet in digital technologies to generate elegant medical systems, thus the software platform software devices will, therefore, need to be changed to the latest. This revolution offers riotous excogitation that minimizes the effect of COVID-19.

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