

Data Science based Secure Healthcare Framework for COVID-19

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Abstract— this paper presents a brief introduction to data science role in healthcare applications especially for COVID-19. The corona virus or Covid-19 is a communicable disease a large family of viruses that causes illnesses ranging from the common cold to acute respiratory syndromes, but the current virus is a novel strain not seen before. Common symptoms of the novel corona virus strain include respiratory symptoms such as fever, cough, and shortness of breath, according to the WHO. The WHO has declared the corona virus epidemic as a global health emergency. When clinical and community sectors work synergistically, they can improve care and support patients better than either of these sectors could do alone. It is observed that the use of data science techniques is continuously assisting in managing world is Fighting Corona Virus. The proposed research is more effective disease diagnosis using big data analysis, artificial intelligent, machine learning and virtual reality.

Index-*COVID-19, AI, Big Data, machine learning, Wireless sensor Networks.*

I. INTRODUCTION

The corona virus is a large family of viruses that causes illnesses ranging from the common cold to acute respiratory syndromes, but the current virus is a novel strain not seen before. Common symptoms of the novel corona virus strain include respiratory symptoms such as fever, cough, and shortness of breath. The WHO has also declared it a pandemic after more than 11,30,967 confirmed cases and over 63,649 deaths in 208 countries as of 4th April 2020.

In general, big data refers to the voluminous and complex amount of data collected from sources like web, enterprise applications, mobile devices and digital repositories which cannot be easily managed by using traditional tools. Big data is not only about the large data size; rather, it is an act of storing and managing data for eventual analysis [2]. The significance of 3V's is Volume, Variety, velocity represents huge quantity of data from distinct sources that appears in numerous formats and handles the fast processing of data to promote the decision making process. The structured and unstructured data in healthcare field to assess the risk of disease. First, latent factor model to reconstruct the missing data from the medical records collected from a hospital in central China. Second, by using statistical knowledge, determine the major chronic diseases the structured and unstructured data in healthcare field to assess the risk of disease [3].

Deep learning methods, such as neural networks, are inspired by the multi-layered data processing structures of human brains, and have already proved their ability to the accuracy of human

experts when analyzing images. These pattern recognition tools can identify variations in individual pixels to better delineate. Application of wireless sensor networks in healthcare consists of wearable and implantable sensor nodes than can sense biological information and wirelessly transmit it over a short distance. They can effectively be used in healthcare for health monitoring, smart nursing homes, in-home assistance, telemedicine, and wireless body area networks [4]. Wireless Body Area Network (WBAN) consists of a number of heterogeneous biological sensors. These sensors are placed in different parts of the body and can be wearable or implanted under the user skin. Each of them has specific requirements and is used for different missions. These devices are used for measuring changes in a patient vital signs and detecting emotions or human statuses, such as fear, stress, happiness, etc. They communicate with a special coordinator node, which is generally less energy constrained and has more processing capacities. It is responsible for sending biological signals of the patient to the medical doctor in order to provide real time medical diagnostic and allow him to take the right decisions [5].

For Medicaid beneficiaries who face challenges such as homelessness or lack of transportation access, it can be difficult to take measures to protect against or receive treatment for COVID-19. Medical Home Network is leveraging an AI-based predictive analytics model to prioritize care management outreach to patients most at risk from the virus. The world is fighting with corona virus with artificial intelligence technology in various ways such as Virus research, Drug research and Healthcare Automation Process. The world manages the global medical emergency and fights the corona virus with data science, artificial intelligence, and big data. However, efforts by governments and health organizations are ongoing as it is difficult to control the corona virus. If an expertise in artificial intelligence, machine learning or data science helps the authorities fight COVID-19.

This research paper discusses about the improvement of health care under the utilization of data science based methods to develop Secure Healthcare Framework for corona.

II. BREAKOUT OF COVID-19

The spread of the corona virus began in November 2019 in southern China. The deadly corona virus led China and now the rest of the world to a phase of mass destruction of human life. There were 81,054 cases and 3,761 deaths in China as well as in India around 4,281 cases and 111 deaths up to 6th April, 2020. The world was not ready to fight COVID-19 since it had not been discovered and researched before. There are currently 1,291,313 confirmed cases and 70,659 deaths from the corona virus COVID-19 outbreak as of April 06, 2020, 15:13 GMT. The implementation of control measures to be considered in health care emergency under COVID-19 as described in table 1.

Table1. How to implement infection control measures in health care setting [9]

When caring for ALL patients	Apply standard precautions routinely in all health-care settings for all patients. Standard precautions include: hand hygiene; use of personal protective equipment (PPE) to avoid direct contact with patients' blood, body fluids, secretions (including respiratory secretions) and non-intact skin.
When caring for patients with cough or other respiratory symptoms	Droplet precautions prevent large droplet transmission of respiratory viruses. At triage, recognize patient with ARI, give the patient a medical mask and place the patient in separate area. Use a medical mask if working within 1-metre of the patient. Place patients in single rooms, or group together those with the same etiological diagnosis.
When caring for patients with clinically suspected	For patients with suspected MERS-CoV infection that require hospitalization, place patient in an adequately ventilated single room away from other patient care areas. Droplet and Contact precautions prevent direct or indirect transmission from contact with contaminated surfaces or equipment
When performing an aerosol generating procedure[10] in patient with COVID-19	Ensure that healthcare workers performing aerosol-generating procedures (i.e. aspiration or open suctioning of respiratory tract specimens, intubation, cardiopulmonary resuscitation, bronchoscopy)

III. WSN BASED DETECTION SYSTEMS FOR DIAGNOSING COMMUNICABLE DISEASE LIKE CORONA

Community, Communicable or infectious diseases are those spread through people, animals, foods, surfaces or the air. When communicable diseases occur, we identify them, isolate them and work with our local health care providers to stop them from spreading.

The potential of computer science of integrating with various other branches of science with the technology of computer machine has changed the various trends in human life by providing the health is one of the service providers [6]. Cloud computing allows the doctors to provide a good health facilities to the patients who are not able to visit hospital on regular notes and also in the rural areas where doctors are not able to visit. Body Area Networks (BANs), wireless broadband communications and Cloud computing can inherit various advanced mobile healthcare services that benefit both patients and health professionals. Specially, they enable the development of a system to perform remote real-time

collection, dissemination and analysis of medical data for the purpose of managing chronic conditions and detecting health emergencies. COVID-19 is a communicable disease chronic disease which People may be sick with the virus for 1 to 14 days before developing symptoms. The most common symptoms of corona virus disease (COVID-19) are fever, tiredness, and dry cough. Most people (about 80%) recover from the disease without needing special treatment. The new way of providing health care is the electronic health service which allows the patient to get his/her health cared without visiting the doctors at the hospital. The following various detection systems that have been used for diagnosing the chronic disease like COVID-19.

A. WSN for the Prevention and Management control of COVID-19

The recommendations have been reviewed by experts in infection prevention and control (IPC) and other technical areas are Human-to-human transmission occurs mostly in health-care settings and, within communities, mainly in households. Close unprotected contact is needed for transmission which occurs via contact and droplet transmission. IPC strategies to prevent or limit infection transmission in health-care settings. Clinical triage including early recognition and immediate placement of patients in separate areas is an important measure for rapid identification and appropriate isolation and care of patients. The architecture of the application consists of three layers. It Include the following: early recognition and source control, administrative controls, environmental and engineering controls, and personal protective equipment. The Top layer is Administrative controls the prevention of overcrowding especially in the Emergency department; provision of dedicated waiting areas for symptomatic patients and appropriate placement of hospitalized patients promoting an adequate patient-to-staff ratio; provision and use of regular supplies. The second layer is Environmental and engineering controls include basic health-care facility infrastructures. These controls address ensuring adequate environmental ventilation in all areas within a health-care facility, as well as adequate environmental cleaning. Spatial separation (social distancing) of at least 1m should be maintained between each ARI patient and others. The third layer Personal protective equipment includes Rational, correct, and consistent use of available PPE and appropriate hand hygiene also help to reduce the spread of the pathogens. A health research module that endorses the assembling sensor data for exploring into the risk divisors tied in with corona. The potential of the system to pretend as a systematic approach to manage and prevent from corona attacks.

B. WSN in the Monitoring Of Corona

A revaluation on glide paths to corona telemonitoring is required. The effectiveness of peak flowmetry and has used low power wireless sensor networks (WSN) which are paired with smart phone technologies in the novel COVID-19 management tool. The major objective is to keep the disease in a controlled manner with less effort required, lesser cost and evaluating patient's status objectively. WSN-s ensign of both corona initiations in the surroundings, and continuous supervising of physiological subroutines and Sensing modalities for acquiring respiratory function are presented. Signal accomplishment

requirements and signal swearing out of respiratory sounds are surveyed. The technique of wireless sensor network, the system becomes more convenient and reliable to use without settling of complex wired architecture. Sensors help us to sense the required data correctly for to make correct decisions for diagnosing disease.

C. WSN in diagnosis of Corona

Many a times the symptoms might misguide in the diagnosis of corona. The proposed method is grounded on using fever, cough sound and breathing to excerpt characteristics that aid in corona diagnosis. Addition to this author has proposed a hardware system for corona attack monitoring. The proposed system was carried out with wireless sensor network and performed by a self-developed computer program written in MATLAB using many cough sound samples of COVID-19 and non-COVID-19 patients. The main aim is to develop an easy and simple scenario for COVID detection for people who don't prefer complex architectures.

First, we used latent factor model to reconstruct the missing data from the medical records collected from a hospital. Second, by using statistical knowledge as presented in table1. The major chronic disease features are predicted by using convolution neural network (CNN)-based multimodal disease risk prediction algorithm using structured and unstructured data from hospital.

D. Data science in healthcare

Medicine and healthcare are two of the most important part of our human lives. Traditionally, medicine solely relied on the discretion advised by the doctors. There are several fields in healthcare such as medical imaging, drug discovery, genetics, and predictive diagnosis with the advancements in computers and in particular, Data Science, it is now possible to obtain accurate diagnostic measures. The data science has many applications in healthcare applications such as Medical Imaging, Genomics, Drug Discovery, Predictive Analytics, Monitoring Patient Health, Tracking & Preventing Diseases and Providing Virtual Assistance.

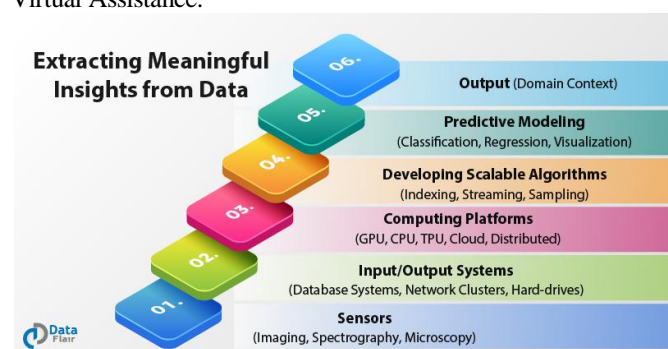


Figure 1: Extracting meaningful data elements for data science

IV. FIGHTING CORONA VIRUS USING DATA SCIENCE, AI, AND MACHINE LEARNING

The world is suffering from a pandemic, COVID-19. The epidemic of the deadly virus has presented humanity with the challenge of saving the lives of innocent people. To cope with such a critical condition that threatens the lives of millions of people, technology is the way to find the way to a cure-all. In

this article, we'll see how the world is Fighting Corona Virus using Data Science, AI, and Machine Learning.

Advancing tools and techniques

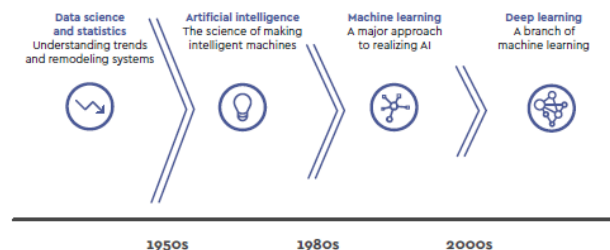


Figure2: Literature of Advancing tools and techniques

V. ROLE OF AI TECHNOLOGY IN GLOBAL HEALTHCARE EMERGENCY

The World Health Organization (WHO) has declared the pandemic an “emergency of public concern for public health”. Now the nations have started to fight COVID-19 with artificial intelligence and other technologies.

Governments in different countries are using all their efforts and strength to fight the corona virus. In this critical state of a global health emergency, man-made technologies are proving very useful. Nations around the world are installing different types of devices to combat COVID-19 using data science, artificial intelligence, and machine learning. This device integrates tools for artificial intelligence, science and data analysis, machine learning, heat sensors, and other technologies [11].

Due to the widespread use of the corona virus, it has become necessary to monitor traffic in public places such as airports, train stations, and other traffic hubs. It requires various monitoring tools that are equipped with artificial intelligence, machine learning, and thermal sensors. These tools can digitize 200 people per minute. In addition, they can recognize and report the body temperature when it is above 37.3 °. They can also be used to identify and quarantine suspects who may be positive for COVID-19.

The world is fighting with corona virus with artificial intelligence technology in various ways:

A. Virus research

In recent years, artificial intelligence has contributed significantly to research and development in the health sector. AI helps us process millions of virus test cases in less time than manual processing. It can recognize the disease and its consequences. Health scientists and researchers are currently working around the clock to fight COVID-19 using data science, AI, and machine learning.

B. Drug research

Health agencies and scientists are to be working on find the right vaccine or medication for COVID-19. AI comes into play in vaccine tests, researchers can also demonstrate the effectiveness of a drug and its consequences. If treated by humans, it would take more than 10 years and billions of dollars, which would be fatal in the current scenario. Artificial intelligence helps to process the large volume of drug data in many test cases in a short time.

C. Healthcare Automation Process

As the cases of COVID-19 increase rapidly, it is necessary to diagnose patients as soon as possible. In patients who are positive for COVID-19, the most common symptom is pneumonia. It is usually detected by a CT scan of the chest of a suspect patient. Given the limited number of medical resources, machines with artificial intelligence and machine learning can help doctors quickly and accurately identify the disease and monitor patients with greater care. To effectively combat COVID-19 using artificial intelligence, countries are automating their medical processes using machines that are equipped with AI at all entry and exit points.

VI. HOW BIG DATA AND DATA SCIENCE HELPS IN FIGHTING CORONA VIRUS

The main cause of the spread of the corona virus is the lack of early symptom information. This has resulted in a situation where people don't know they are affected. They travel from place to place without knowing that they are carrying the virus. Governments have now started collecting information about citizens, such as travel history and medical records. This has resulted in huge data on citizens being collected. The countries have already started to process this data with big data tools. To process the data of billions of citizens, redundancies have to be eliminated, the data scaled and structured for later use. This is only possible with the help of various important big data tools. The data representation from 1990 to 2018 is illustrated in figure 3.

After collecting and processing this huge data, government agencies analyze and view it. By analyzing the data and visualizing trends, data science helps governments estimate the extent of the disease's spread, the medical infrastructure to accommodate affected patients, and the budget required to do so. With these estimates, Data Science is helping governments make arrangements to spend medical facilities and capital on their citizens. This is very helpful in the fight against COVID-19 using data science.

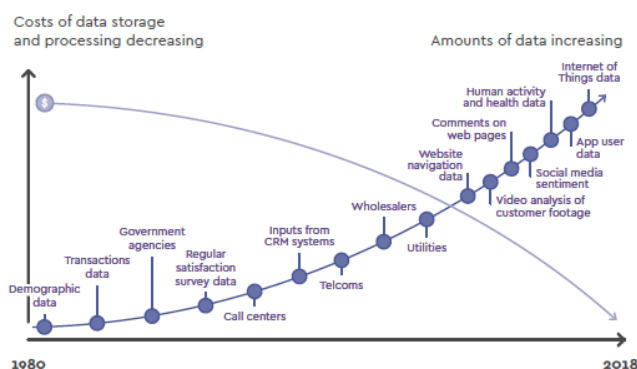


Figure 3: Data availability, storage and analytics approaches, 1990–2018

A. Data science is the tools for COVID-19

Data science refers to drawing insights from large and complex data sets. This includes collating, processing, analyzing and understanding the data. The term 'data science' covers the

methods, processes and systems used to do this. It encompasses both traditional statistical methods, applied to far larger and more complex structured and unstructured datasets are represented in hospital data sheets as shown in Table.1

Table 1. Item taxonomy in hospital data.

Data category	Item	Description
Structured data	Demographics of the patient	Patient's gender, age, height, weight, etc
	Living habits	Whether the patient habits, genetic history etc
	Examination items and results	Includes 682 items, such as blood sugar, urine, bile profile etc.,
Unstructured data	Diseases	Patients history of previous diseases
	Doctor's Records	Doctor's interrogation records etc.,

The data science refers to computers that can learn from data and interact with the human world. The goal is to give machines human-like cognition, meaning that they can 'think', and recommend actions based on that thinking, that they can predict outcomes and that they can learn. This can be characterized by four broad technologies:

A. Natural language processing (NLP)

Siri and Alexa, Twitter analytics and virtual assistants all perform NLP. Technology's ability to analyze human language, extract meaning and sentiment, and reply intelligibly is transforming our communication with each other and with machines.

B. Computer vision

At the heart of every self-driving car or number-plate recognition system, computer vision comprises the extraction of information from images

C. Machine learning

This comprises programs and tools that recognize patterns in data and make predictions based on those patterns – or that can learn from data. The distinctive feature is that the system must learn the mapping from input to output (for example, from a collection of test results to a diagnosis) by itself – it is not provided with an explicit preexisting model

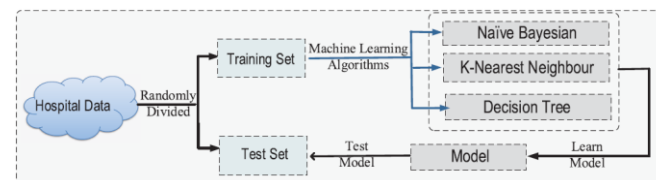


Figure 4: The three machine learning algorithms used in our disease prediction experiments.

SAS abbreviated for Statistical Analysis System is a software developed by SAS Institute that is mostly used for statistical modeling.

D. Robotics

This covers machines' physical navigation and interactions with the human world.

E. Diagnostics

Diagnostic tools and standardized methodology for data collection are critical to understand the epidemiology of the pneumonia outbreak and the risks. In the absence of known sequence, pan-coronavirus assays could be developed and used, as a health intervention or under a research protocol, for travel entry screening in neighboring countries and/or at entry point with people likely to have history of travel from the Wuhan province, especially in the context of the upcoming Chinese New Year's Eve.

VII. SURVEILLANCE STRATEGY

A surveillance strategy [12] should include animal testing component when relevant planning to upgrade the temperature detection system to include facial recognition technology. It was working on a solution that "integrates body detection, face detection and dual sensing via infrared cameras and visible light" to help staff working at hospitals, airports, railway stations and other commuted areas which are possible to virus spread and then swiftly identify people who have elevated body temperatures. Facial recognition and the real-name system will help us track down those who have potentially been exposed to the virus and effectively curb the spreading of the virus. In addition to the real-name system - which requires people to use government-issued ID cards to buy mobile sims, obtain social media accounts, take a train, board a plane, or even buy groceries - authorities also track people using some millions security cameras installed nationwide. Some of these cameras are equipped with facial recognition technology, allowing authorities to track criminal acts, including offences as minor as jaywalking. There are reports authorities are using this extensive surveillance system to keep tabs on people surrounded by the corona virus outbreak.

Completed the mandatory quarantine, counted at least four CCTV cameras near populated area other ways using big data in this outbreak include tracking information on people's movements through their mobile phones and rolling out mobile apps that allow users to find out if they have come in contact with a confirmed corona virus carrier. For instance, mobile company can send numerous text messages to media outlets about people confirmed to have the virus. These text messages normally include information about a patient's travel history and could be as detailed as the seat he or she sat on while taking a specific train or even which subway train compartment they boarded at a specific time. In the early days of the outbreak, media outlets would post this information on social media, allowing people to find out if they had come to close contact with confirmed patients and then quarantine themselves if necessary.

The government has now rolled out a mobile app called "Close Contact Detector" to allow people to do this. Upon entry of personal identification details, users can scan a QR code to check whether they have been in close contact with someone infected and whether they are at a heightened risk. Meanwhile, some of them who have summoned their employees back are

requiring them to submit a "travel verification report" produced by telecom providers. After sending a message to his or her provider, a user will automatically receive a message that details all the cities they visited in the past 14 days and the recommended quarantine time based on the location-tracking system.

This epidemic has given the government a perfect excuse to drag out its massive surveillance system but such expansive data-collection has also created concerns among people who fear their privacy was severely compromised by this effort. It's incredibly important to make sure no information is leaked and all collected data should be deleted after use.

The researchers can use artificial intelligence & big data to tackle this deadly virus through social media, web and other data so that they can stop this virus from spreading. The government is working very hard to stop further spreading of this deadly virus using big data collection and artificial intelligence to curb potential infection to spread further.

The local companies must have developed apps that will allow the people to check whether they are traveling on the same sight or train in which the confirmed virus patients are present. According to the state-run Global Time, robots are used in public places to scold those travelers who don't wear masks in country.

The neighborhood committees are using sight and local data to keep a vigil on the latest travel reports. The National Health Commission (NHC) in an online statement to local governments that they are using big data technology to track the epidemic in real-time, review priorities (cases), and effectively predict. The government is also working on strengthening the information link between the departments of public, security and traffic. According to official reports, the government is calling on them to exchange trains, sight, communication, and medical data. The main focus of hospital authorities is looking for common symptoms for this disease i.e. fever to prevent further possible infection. The authorities are using thermometers in neighborhoods and in-office but while traveling; these methods can't be used so they are using AI and infrared cameras as the fever detection systems.

The researcher has developed a system using infrared and facial recognition technology that scans and takes photographs of more than 200 people per minute. It is much faster than existing thermal scanners at public places. If somebody having a body temperature of 37.3 (99 F) or higher, the system triggers an alarm that triggers a secondary check by authorized personnel. An AI company has to develop a similar system that is used in a local populated area. It wasn't easy to have a team of nearly 500 people working from home. All of them work around the clock and they are further stated that the team needed to optimize their models to effectively measure temperature when only the forehead was exposed. The technology companies has to be formed a kind of service to help disease by delivering medical supplies by drones to recording the spread of the corona virus from the nearest city. It is helping people to save against this disease. In some parts of the country/city, the citizens are asked to go through a QR code scanning to enter personal information, such as the phone number and address of their hometown. The residents are also asked to fill a form regarding the information about their ways of transport, like

license plates or sight numbers if they had traveled. The people are also questioned about their visit to corona affected countries, in case they had been in touch with someone from this most affected area. It requires a lot of staff to do follow up checkups of the majority by the local authorities in the country with the technologies like AI & Big Data may be the key to turning the tide.

VIII. CONCLUSIONS

The corona virus or Covid-19 is a communicable disease a large family of viruses that causes illnesses ranging from the common cold to acute respiratory syndromes. Common symptoms of the novel corona virus strain include respiratory symptoms such as fever, cough, and shortness of breath are studied as per the guidelines of world health organization. The WHO has declared the corona virus epidemic as a global health emergency, when clinical and community sectors work synergistically can improve care and support patients. It is observed that the use of data science techniques is continuously assisting in managing world is Fighting Corona Virus. The innovation lies in different techniques like masking encryption, activity monitoring, granular access control, dynamic data encryption and end point validation have been incorporated. The proposed research is more effective disease diagnosis using wireless sensor networks, big data analysis, artificial intelligent, machine learning and virtual reality.

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