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Applications of digital technologies to combat against the pandemic coronavirus –COVID-19

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Abstract--Coronavirus (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The spread of COVID-19 seems to have a worst effect on the human health and global economy. The world is confronting an existential worldwide emergency - the episode of a novel Covid. This pandemic situation made the development of various digital technologies to bout against major diseases and clinical issues. These digital technologies comprise incorporate the internet of things (IoT) with cutting edge media transmission; huge information investigation (BDA); man-made reasoning (AI) that utilizes machine learning and deep learning; and block chain innovation [9]. They are exceptionally related: IoT is generally utilized in emergency clinics and centers that encourages the foundation of a profoundly interconnected advanced biological system. Big data analytics handle large real time data set that is used by AI with machine learning and deep learning systems to understand healthcare trends, perform risk associations and predict the actual outcomes. This is enhanced by block chain innovation, a back-connected information base with cryptographic conventions and an organization of disseminated PCs to ensure that information are secure however recognizable and are available in different physical areas, with changed calculations. We investigate the possible use of these novel advancements to upgrade the two conventional general wellbeing systems for taking care of COVID-19: (1) observing, reconnaissance, identification and counteraction of COVID-19; and (2) relief of the effect on medical care in a roundabout way identified with COVID-19 [4].

Keywords---IoT, big-data analytics, AI, machine learning, deep learning, block chain, SARS-CoV-2.

Introduction

Coronavirus disease 2019 (COVID-19), is a new strain that spreads like a forest fire and had put the world nations into an emergency state. With the quantity of instances of COVID-19 expanding differently, nations influenced with COVID are making each significant undertaking to utilize cutting edge innovations to follow and check its flare-up. One of the favorable circumstances we have today in the fight against COVID is the accessibility of significant level advancements. The distinctive computerized innovation are accessible to grow constant expectations and backing medical care experts and government leaders with brightness they can use to foresee the effect of the COVID.

With the various and assorted datasets gathered by cell phones, IoT can have a lot more applications during a scourge. IoT is utilized to deal with certain parts of the COVID-19. The World Health Organization (WHO) has likewise said that AI and BD is playing out a huge part to check the spread of COVID-19. Fast advancement of computerized symptomatic frameworks dependent on man-made consciousness (AI) [22] and ML not exclusively can add to expanded demonstrative precision and speed however will also protect medical services laborers by diminishing their contacts with COVID-19 patients (Fig. 1). A profound learning (DL) based investigation framework is worked for robotized location and checking of COVID-19 patients after some time [10]. Block chain technologies offer extraordinary potential in numerous COVID-affected situations. With block chain we can share any transactional information, real time, between relevant nodes in the chain, in a secure and absolute fashion. In this paper we are reviewing the applications of different technologies for combating against the coronavirus COVID 19. This paper gives a system to the utilization of advanced technologies in pandemic administration and reaction, featuring ways embraced and coordinated computerized technologies for pandemic arranging, reconnaissance, testing, contact following, isolate, and medical services [31]. With legitimate reconciliation of innovations, scientist, specialists, government, academicians can establish a superior environment to battle with this malady [1].

COVID 19

COVID 19 raised attention internationally in December 2019, when the Wuhan, Hubei province, China, became the centre of an outbreak of pneumonia of unknown cause COVID-19 is a severe acute respiratory infection caused by a strain of the Sarbeco virus subgenus SARS-CoV-2. It is the seventh Corona infection known to contaminate people [11, 12]. The clinical introduction is a respiratory contamination with manifestation seriousness going from a mellow regular cold-like disease to an extreme viral pneumonia prompting intense respiratory trouble condition that is conceivably lethal [13].

The coronavirus is transmitted from a tainted individual to another through nearness contact without security [14]. Later information recommends that the

infection might be airborne and have a minimal lifetime [15]. Accordingly, two principle components of COVID-19 transmission are respiratory and contiguity. Respiratory beads are created when a contaminated individual shows respiratory indications (for instance, sniffing, hacking, and so on., Fig. 1), whence an individual in close contact is in danger of being presented to conceivably infective respiratory beads [11]. These beads may likewise arrive on surfaces, where the infection could stay feasible; subsequently, the contaminated individual and his/her quick environment can fill in as a wellspring of transmission, which is known as contact transmission [16].

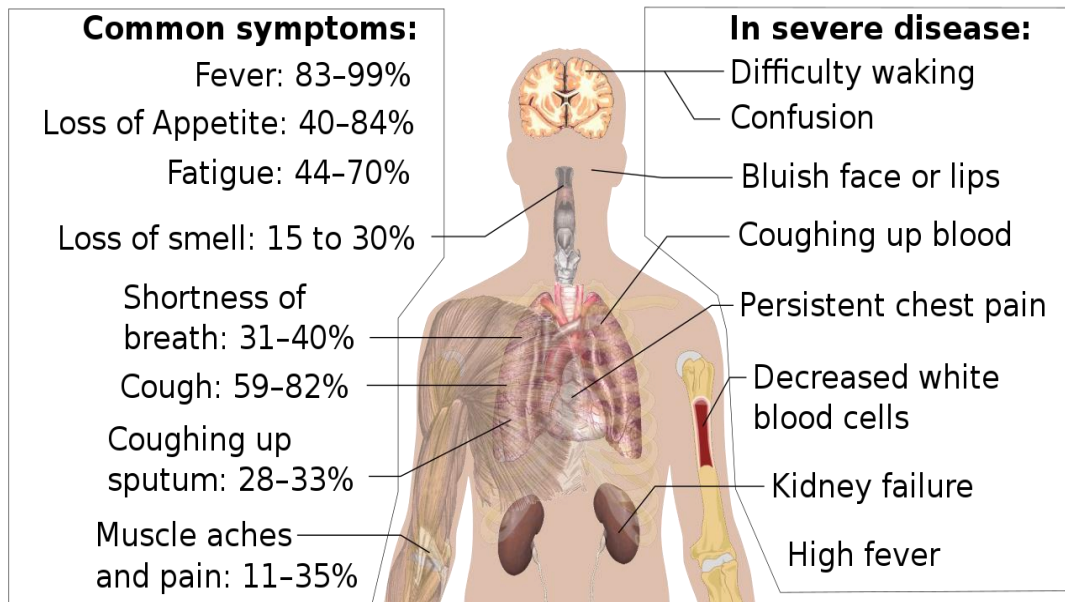


Fig.1: Symptoms of COVID 19 [26]

Regular indications of COVID-19 incorporate fever, hack, windedness and customarily the contamination forms into pneumonia. It might likewise cause serious complexities for individuals with feeble resistance frameworks, the older, and the individuals with prior persistent maladies, for example, malignancy, diabetes, and ongoing lung illness [17]. Hence, both the World Health Organization (WHO) and the Center for Disease Control (CDC) have set up that early discovery and regulation of this infection are important to effectively reduce the spread of this pandemic [18].

The World Health Organization proclaimed the episode a Public Health Emergency of International Concern on 30 January 2020 and a pandemic on 11 March. As on October 13 2020, 37.8 million total cases were reported across the world, with 1.08 million deaths and 26.3 million recoveries [27]. Regular indications incorporate fever, hack, exhaustion, windedness or breathing challenges, and loss of smell and taste [28]. While the vast majority have gentle manifestations, a few people create intense respiratory misery disorder (ARDS) potentially encouraged by cytokine storm [29], multi-organ disappointment, septic stun, and blood clots [Refer Fig.2]. The brooding period may extend from one to fourteen days [30]. The efficient approach to reduce the spread is to give the knowledge to the public

individuals about its symptoms, the mode of spread, illness it causes and the precaution measures we should follow [25]. As of today's date there few medicines that are still under review process and there is need for analysis of their side effects too. Fig.2 shows the confirmed cases in all over the world.

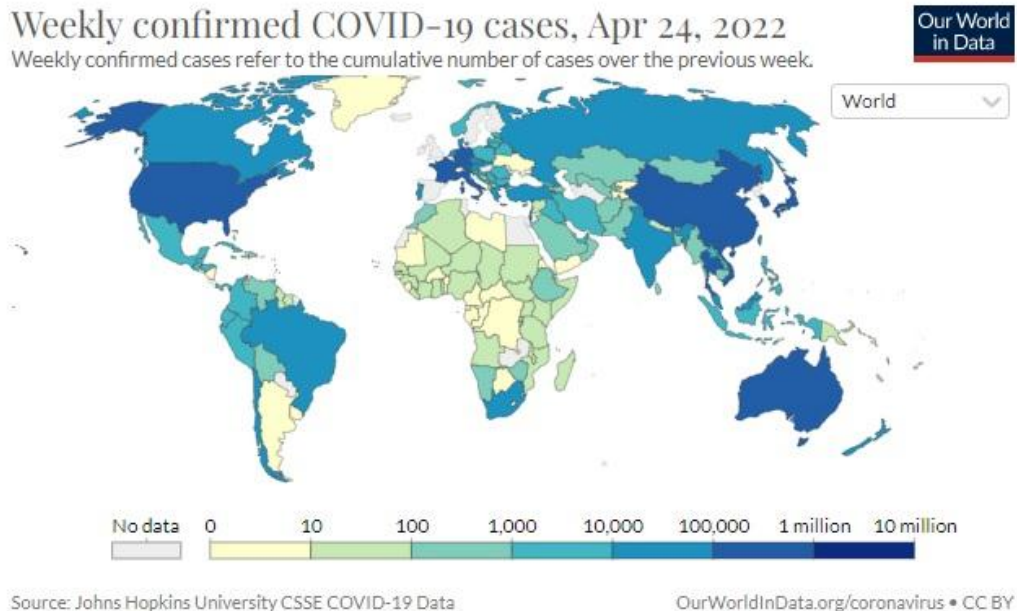


Fig.2: Confirmed cases per 100,000 population as of 22 April 2022. (Source-Wikipedia)

Role of IoT

IoT can be utilized to follow the source of an episode. Overlaying geographic information system (GIS) on IoT portable information from tainted patients can complete two things. IoT can likewise be utilized to guarantee tolerant consistence once the possibly tainted people go into isolation. General wellbeing faculty can screen which patients stay isolated, and which patients have penetrated the isolation. The IoT information will likewise assist them with finding who else might be presented because of the penetration.

Practical segments of IoT incorporates: information assortment, movement, examination, and storage. Sensors installed on mobile, robots, or health monitors will collect the data. At that point, the portable information is shipped off the focal cloud server for examination and decision making, for example, if a machine requires proactive support to forestall unforeseen breakdown or if a patient needs to come in for a check-up.

As talked about, the web of things make use of the networks that are interconnected for the compelling course and trade-mark of particulars. It likewise empowers the social labourers, regular folks, patients, and so on to be concerning the executive supporters for examining any issue and collaboration. In

this way, by taking the advantage of the IoT strategy in this novel COVID-19 pandemic, the viable follow-up of patients, just as the dubious cases, can be totally guaranteed [23]. Most of the population are known about the symptoms of COVID 19. By building up a very much educated network, the recognition of clustered community can be done profoundly. Scarcely, peculiar mobile- based application can likewise be developed so the indigent ones can acquire be gained in response. The correct announcing of the side effects and the recuperation must be revitalized to the supervisory body, for example specialists, doctors, guardians, and so on so the great move can be done to optimise the general isolation period.

The utilization of IoT in different application helps in satisfying the essential needs of mitigating impacts of COVID-19 epidemic. The IoT also has the ability to anticipate the forthcoming circumstance with the assistance of fitting the gathered information. Certain applications of IoT are implied for legitimate executive concern (administrators) of this epidemic. This in turn help the patients for proper checking of pulse, glucometer circulatory strain, and various exercises for customized examination. It deals with medical issue of mainly aged personalities. By using this Innovation, Medical care assurance agencies are able to distinguish extortion guarantee and provide straightforwardness in a complete framework. This improves patient's treatment process with productive presentation, furthermore support for supervisory tasks in complex cases [2].

The usage of IoT creates an impact on decreasing medical utility cost and in improving the therapy result of the contaminated individuals. Consequently, this recent examination based exploration is endeavoured to investigate, talk about, and feature the common employment of the very much illustrated IoT theory by providing a point of view guide in handling the COVID 19 epidemic. IoT is useful for a tainted patient of COVID-19 to distinguish side effects and gives better treatment quickly. It is helpful for patient, doctor, specialist and clinical systems [1].

IoT gives a broad incorporated network to medical care to fight against COVID-19 epidemic. All medical gadgets are correlated with the web, and when there rises any emergence of acute situations, it naturally gives a notification message to the medical staffs. Affected cases can be nourished fittingly in a far off zone with very much related tele-gadgets. All the cases are handled cleverly by offering eventually reinforced assistance to the patient and medical care. IoT serves as a brilliant mechanism in screening the tainted patient. Also, in medical care, this mechanism is helpful to sustain the quality oversight besides real-time data. The utilization of a measurable dependent technique, IoT acquires a concern to foresee a forthcoming conditions of COVID infection. With suitable implementation of this new innovation, specialists, scientist, government and instructor can establish a healthier atmosphere to fight against this malady.

Role of Big data

As loads of patient information is being put away now, it is hard to break down each record and decide a way out to limit the infection. Here we make use of Bog Data. Big data is turning into a useful asset in breaking down these datasets and distinguishing designs that can help in COVID-19 identification and recuperation. With

comprehensive information catching capacity, BD can be utilized profitably to limit the danger of spreading this infection [5, 6].

The big data part in COVID-19 guide begins from the initial step – recognition. This is done by big data algorithm that pulled information from an assortment of sources. The algorithm investigated information from wellbeing records, airline information, government records, news reports and ailment networks to foresee the ascent of a disease. Big data tools can examine illness information and data about senior residents, who are in danger of contracting Covid. The algorithms and devices can find these individuals to the postcode level, remembering components, like weight or diabetes. These examination reports will recommend medical services habitats and emergency clinics where extra clinical offices, like beds will be required.

Big data part in COVID-19 guide is getting more apparent as associations, like, WHO, CDC and Microsoft are making dashboards dependent on it. These dashboards pull information from various nations and show affirmed cases, demises and localities. The dashboards can be utilized to plan datasets for enormous information models. The models can anticipate potential hotspots and caution the medical services specialists previously. Another critical big data measure utilized against COVID-19 is outbreak investigation. This contracts with the assortment and investigation of outbreak reaction information. Information including demises, affirmed cases, sketching individuals communicated with contaminated patients, populace densities, and substantially more are utilized to create models for the ailment. These models can anticipate highest disease rates and their effect. This innovation is utilized to store the information of a wide range of cases (tainted, recouped and lapsed) influenced by COVID-19. This data can be viably utilized for case findings and assisting with designating the assets for better assurance of general wellbeing [7, 8].

Role of Machine Learning

The large volume of COVID-19 data in overall medical clinics additionally require progressed machine learning techniques for breaking down customized restorative impacts for assessing new patients, for example, hospitalization forecast, which can give better attention to every patient as well as add to nearby clinical course of action and activity.

ML models, as an option in contrast to epidemiological models, indicated potential in anticipating COVID-19, as they accomplished for exhibiting different flare-ups. The machine learning study of genomic variations from asymptomatic, mild or serious COVID-19 patients can be performed to categorize and anticipate individuals dependent on their weakness or protection from potential COVID-19 disease, by which the ML model can likewise restore those ranked genomic variations, in their administrative task as significant highlights for useful and systematic investigations.

The extensive scope information of COVID-19 patients can be coordinated and dissected by cutting edge ML algorithms to realise the outline of viral spread, further improve analytic speed and precision, create novel viable restorative methodologies, and conceivably recognize the most liable individuals based on customized genomic and physiological attributes. Organic chemistry (e.g., ACE2

articulation level) and clinical information (e.g., age, respiratory outline, viral burden, and endurance) of COVID-19 patients with basic ailments can be examined by ML methods to deal with not just distinguish any dependable highlights for hazard expectation, yet in addition further perform hazard grouping and forecast for a reasonable readiness of progressing infection treatment and COVID-19 safeguard [10]. Thinking about the accessibility of just a modest quantity of working out information, it is normal that ML will be grown further as the reason for, or a segment of, future flare-up forecast models.

Role of Deep Learning

Deep learning gives an appropriate method for quick screening COVID-19 and discovering potential high-hazard patients, which might be useful for clinical asset advancement and early avoidance before patients show serious indications. Deep Learning methods have been on an ascent since the most recent couple of years and have totally changed the situation of many exploration fields. In COVID-19, human organ-lungs get contaminated and its conclusion absolutely relies upon the Lung X-ray [20]. And so, it is very clear to exploit pre-research information from lung picture exploration, which would be of extraordinary assistance to break down the COVID-19 picture data set and arrive at any reasonable result with the deep learning approach.

Particularly, in clinical field, picture data set, for example, retina picture, chest X-ray, and brain MRI furnishes promising outcomes with a comprehensive accuracy% by utilizing the deep learning procedures. Exercising the taken pictures with the impact of deep learning that will be an extraordinary guide to clinical specialists for distinguishing the COVID-19 patients.

Among different deep learning classifiers, specifically, the Convolutional Neural Networks (CNN) have been more viable in computer vision and clinical picture exploration jobs [19]. The aftereffects of CNN have confirmed its cogency in mapping of picture data to an exact and anticipated output. Since the lungs are the main mark of the infection, breaking down their progressions can give an obvious outcome of essence of the infection. It is likely to identify the COVID-19 cases at a quicker speed by noticing the highlights of tainted patients as dim or shadowy patches in the X-ray pictures of lungs.

The key segment in Deep learning research is the accessibility of preparing informational indexes. Information quality is of principal significance for a fruitful deep learning. Complexity of deep learning design is significant for some visual recognition applications [32]. Deep learning can possibly alter the computerization of chest radiography understanding. RT-PCR is the complete test for the finding of COVID-19; notwithstanding, CXR is a quick, viable, and reasonable test that distinguishes the potential COVID-19-related pneumonia. Deep Learning models prepared utilizing real COVID-19 cases can bring about better execution; though preventative estimates should be taken when deducing the routine of the deep learning models applied in this circumstance [33,34].

Role of Block chain Technology

The block chain is a pool of computing hubs that are associated in a distributed way and commonly check exchanges executed inside the network. Each block cryptographically seals a lot of exchanges cryptographically and is connected to the preceding block in order to shape a hash-based (cryptographic) chain of blocks [21]. In these tough period, the correct stabilization must be struck between data collection and assurance of confidentiality. Block chain can be utilized to both collect and organize patient information all the more productively, screen patients' activities to ensure social space, and secure their individuality at once. Block chain-empowered stages can help forestall these pandemics by empowering early prediction of plagues, optimizing drug preliminaries, and effect the board of flare-ups and treatment.

Block chain can be utilized for tracing general wellbeing information investigation, especially for irresistible illness episodes, for example, COVID-19. Block chain can help progress medicines quickly as they would take into consideration fast handling of information, consequently empowering early identification of indications before they spread to the degree of scourges. Also, this will empower government offices to monitor the infection movement, of patients, suspected new cases, and then some.

This innovation could help smooth out clinical supply chains, guaranteeing that physicians and patients can utilize the implements at whatever point they need them, and controlling tainted things from arriving at stores. Block chain stages can be utilized to screen pandemic material dispersion, gifts, help conveyance and different reactions in a quick and straightforward manner without the abuse of consumer information. Block chain can provide dependability, straightforwardness and security to clinical information. A few societies have been blamed for handling information during this pandemic, block chain can assist with them by giving straightforward and permanent clinical information. A block chain-based worldwide pandemic guide can be utilized to trace the spread of the infection, the quantity of contaminated residents and the quantity of recuperated residents.

Discussion of digital technologies

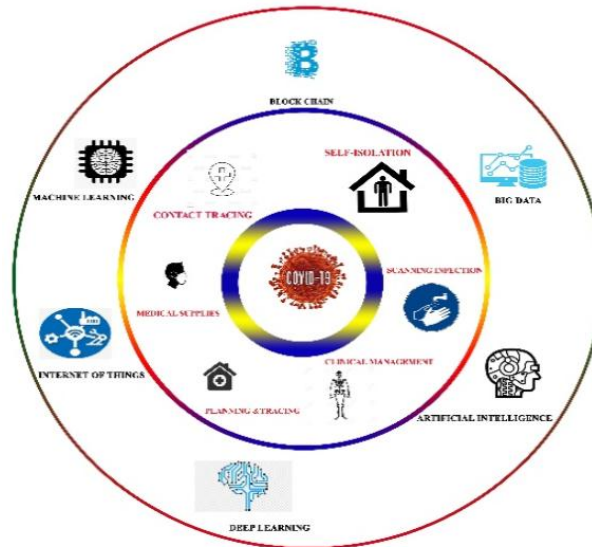


Fig.3 Digital Technologies to combat against COVID 19

Technology	Purpose	Method	Advantages	Disadvantages
IoT	Monitor corona patients and avoid spreading by smart tracing	Infrared Thermometer, IR Sensor, Smart Watch, Optical camera	Thermal Imaging, Operation of doors, lift,..., Heart rate detection, Face recognition	Decision cannot be made as real time data is unavailable
Artificial Intelligence	Tracking, identify high risk patients and real time control of infection	AI algorithms	Drug repurposing, Fast identification, High accuracy	Centralized collection of data is missing
Big Data	Provide storage capacity for extensive data of the population in a format that can be used efficiently for analysis and necessary action can be taken toward the	Data capturing and analysing capability	Identification at early stage & Contact tracing	Big and changing volume of data

	prevention of disease transmission, movement, health monitoring, and prevention system.			
Machine Learning	Outbreak prediction	Epidemiological models Optimization algorithms Support Vector Machine	Models outbreak cases High accuracy	Global models with generalization ability is not feasible Data of infectious people is challenging
Deep Learning	Classification of candidate region Infection Probability	Location Attention Classification Convolutional Neural Network Noisy/ Bayesian function DL visualization algorithm	More specific and reliable result Accurate and quick decision	Less reliable and slow detection
Block Chain	Contact Tracing Patient Information sharing	Decentralized computational architecture Smart Contracts Block chain powered UAVs and robots	Data security and privacy concerns Eliminate processing delays Sharing of data is easy Improves efficiency by reducing processing delays	Legal disputes Privacy and security issues Low transaction throughput

Conclusion

Innovation is essential in the battle against COVID and future pandemics. Along with having the option to help demonstrating endeavours and foreseeing the progression of a pandemic, BD, ML and other innovation can rapidly and successfully investigate information to help people on the forefronts sort out the best planning and reaction to this and future pandemics. Therefore, AI, BD and

other information driven innovations in the flow emergency can improve our comprehension of the sickness, expand admittance to medical services, and assist us with remaining associated information for a noble result.

The perspective of this paper gives a system for the utilization of advanced digital technologies in pandemic administration and reaction, featuring manners by which effective nations have embraced these advances for pandemic arranging, reconnaissance, testing, contact following, isolate, and medical care. Computerized technological innovation can encourage pandemic technique and reaction in manners that are hard to accomplish physically. This paper point out that a diversity of approaches are available but a unified approach has yet to be established. At last, the paper high spots extents that could help additional research consideration.

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