Ai-Powered Real-Time Fever Detection System with Face Recognition in Covid-19 Screening

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Abstract

The rapid growth of COVID-19 across the world is developing an enormous stress on the global healthcare systems which is due to the fact that the vaccine has not been successfully developed yet. In this crisis time, many of the technology driven organizations across the globe are putting the huge efforts along with healthcare organizations, to provide the various novel technological based solutions. Few of the companies have developed the advanced modules like AI-driven detection cameras for the simultanuous temparature screening of many people at a time. For instance, the AI based Fever Detection Cameras from IN Depth can prevent the contamination of any viral kind of disease such as COVID-19 by detecting the rise in the temperature of every individual. Such systems can take the advantages of AI technology and provide the data analytics for the detection and assessment of rise in body temperatures. An AI-driven system made using the combination of thermal imaging module and visible sensors can become a very potential tool to determine the fever in the human body.

This system can provide the screening of 30 people per second at the safe distance with seamless and very fast assessment. It also provides the extreme image and scenario search features, along with gender, age, expressions, goggles, moustache, masks and no masks, etc. Also, it can support the most 3rd party scene analytics to provide the very rich features or scenarios like safe social distance practice, coughing/sneezeing identification, voice and face recognition for key-less entrance system, etc.

1. Introduction

In December 2019, in Wuhan, China new novel Betacoronavirus virus was observed which is officially named by the International Committee on Taxonomy of Viruses (ICTV) as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), causing coronavirus disease 2019 or COVID-19 [1]. And after that it rapidly affected various continents. According to World Heath Organization (WHO) as on 20th April 2020 COVID-19 has affected 208 countries of the world with infected cases above 2 million and caused over 1.5 lacks deaths. The spread of the coronavirus is changing continuously, and even hourly. WHO is profoundly concerned the exceptional quick worldwide spread and seriousness of the virus, and by obliviousness and inaction of certain nations. Thus, WHO reported the COVID-19 can be portrayed as a pandemic [2-3].

The COVID-19 is a profoundly transmittable and pathogenic viral disease. Genomic examination uncovered that SARS-CoV-2 is phylogenetically identified with serious intense respiratory disorder like (SARS-like) bat infections, in this way bats could be the conceivable essential supply. The middle wellspring of birthplace and transfer to people isn't known, notwithstanding, the fast human to human exchange has been affirmed broadly. There is no clinically endorsed antiviral medication or immunization accessible to be utilized against COVID-19. As on today hardly any wide range antiviral medications have been assessed against COVID-19 in clinical findings. There is no accessible antibody against COVID-19, while past immunizations or methodologies used to build up an immunization against SARS-CoV can be

powerful. Despite the fact that various countries and agencies are working on finding the effective medicine which can be useful for the prevention and cure of the COVID-19 no effective vaccine and medicine is produced yet[4]. To reduce the harm related to COVID-19, foremost important thing is to control the worldwide spread of the infection. It is fundamental to constrain human to human transfer so as to diminish optional contaminations among close contacts and social insurance workers and to forestall transfer intensification occasions and further global spread. All exertions are being made to sluggish the spread of the disease so as time will be there to readily plan social insurance frameworks and to grow convenient diagnostics, therapeutics and antibodies [5].

According to latest report of WHO, in China AI and data analysis is playing a key role in the response to the COVID-19. As COVID-19 is new kind of disease spreading globally for the first time, It is unclear in the manner it will affect the lifestyle and working style. By seeing the present work of AI it seems that AI may help in fighting the virus and its impacts.

AI is intelligence displayed by machines, in contrast to intelligence shown by humans and animals. Standard definition says it is the study of intelligent agents, which is any device that studies the given data and takes actions in achieving its desired goals. In other ways AI is used to describe machines that ape cognitive functions such as learning and problem solving which are generally human associated. Data analysis refers to the process of analyzing data and uncovers hidden and valuable information using non conventional method .These kind of methods advances accuracy and scalability as compared to conventional standardized methods. AI is one such advance method and it has been identified as a significant development with respect to the role it can play in various application fields such as public health related disciplines [6]. Till now applications of AI and deep learning are argued to be useful tools in assisting diagnosis and treatment decision making for various diseases [7-11].

2. Available AI Based systems for COVID-19

Since the COVID-19 is spreading so rapidly, those dealing with it on front line need precise devices to help them personality and treat influenced individuals with maximum speed. There are already AI- powered solutions deployed in the world, and more such AI tools will come in near time as many public and private sector institutions are working on it. Though there are many technical gaps and uncertainties in the epidemic management techniques, AI does offer potential for concerned parties to fill these gaps with the use of enormous amount of data. Different research foundations and ventures across world are effectively streamlining AI techniques and processing power for COVID-19 control.

A robotized entire genome sequencing and investigation stage has been set up so as to advance fast and precise infection detection. Case evaluation utilizing AI frameworks for COV1D-19 giving adequate exactness with maximum efficiency. Phonetic interface frameworks and discourse perceiving robots are habitually utilized in social insurance settings to give astute direction and services. In certain networks and open places, with such frameworks requirement for staff to play out some normal undertakings is minimized, for example, temperature estimation, as this is done consequently and precisely through a mix of profound learning, picture acknowledgment innovation, and infrared imaging sensors. Automatic phone dialing system is utilized to lead phonetic confirmation with discussion on content such as, health condition, contact and travel history etc so that occupant's health conditions can be effectively investigated.

While the world is as of now confronting the COVID-19 virus, overall information sharing and innovation correspondence is the present need to both make and dispatch a worldwide, human community health crisis reaction chart, and viably contain the general wellbeing crisis. With an open artificial intelligence based

stage, with epidemiological database combination and thorough inclusion around the world, it is easy to sustain against COVID-19. Right now, world can collaborate all the more intently so as to adequately react to the basic emergencies that face the entirety of humankind [12].

There are different ways in which people are making use of machine learning designs to detect or to fight against the COVID-19 virus. Below are the present applications of AI used in china and world to fight against COVID-19. The simple way to detect the coronavirus with AI is temperature sensing system implemented with cameras and thermal sensors. An AI system introduced by Baidu which is a Chinese Company uses an infrared sensor and AI to forecast people's temperatures is being used in China's Railway Station.

Fig. 1. AI based coronavirus affected person detection in China [13]

According to BlueDot, with natural language processing (NLP) to process the message of hundreds of thousands of sources to scan through news and public statements about the health of humans or animals they recognized the emergence of high rates of pneumonia in China nine days before the WHO. Metabiota a U.S based company has given the estimates about the risk of a disease spreading. For this predictions company have used the factors like virus symptoms, mortality rate and the treatment availability [13]. Some of the companies have prepared the chatbots for the collection of the data as symptoms and travel, contact and special population risk. After screening the Moderate and high-risk patients move into clinical intakes for appointments, during which the chatbot collects health information submitted directly to the hospital system via integration with their scheduling systems in preparation for the visit.

Fig .2. Present AI based application to fight with COVID-19

A. AI based Covid-19 Detection

From the beginning only China is making use of AI and big data as part of its response to the disease where they are using AI for tracing contacts to monitoring the spread of disease and management of priority populations [14]. But scientists and academic researchers are working on other forms of AI as well.

Some researchers from various Chinese universities designed COVID-19 virus detection system using the deep learning algorithms and they claim that system has 95% accuracy. The system is trained with CT scans of 51 patients infected with COVID-19 and more than 45,000 random CT scan images. The designed system showed a performance similar to radiology specialists with improved efficiency. This model has potential to improve early diagnosis and treatment, and thus contribute to the control of the pandemic.

A portable surveillance device called FluSense powered by machine learning algorithm is invented by researchers from University of Massachusetts Amherst. The device is able to detect coughing and crowd size, then analyze the data to monitor flu like illnesses and its trends. The FluSense platform processes a low-cost microphone array and thermal imaging data with a Raspberry Pi and neural computing engine. This model is a representation of the power of combining artificial intelligence and edge computing, where data is to be gathered and analyzed at the data's source. The use of such technologies in larger public spaces may enlarge the scope of forecasting the seasonal flu and other viral respiratory outbreaks, such as the COVID-19 [15].

B. AI for survival prediction in severe COVID-19 cases

The group of researchers in China developed a new system which is used for the prediction of survival rates of COVID-19 virus infected people and claimed that it is having more than 90% accuracy. They have used the clinical data for from one of the hospitals in Wuhan, China. Some researchers have also designed the AI system which uses multiple CNN models for the classification of CT images and calculate the COVID-19 infection probability. During the study, researchers claimed that the CNN based system is able to predict with 86.7% accuracy the difference between COVID-19, influenza-A viral pneumonia, and healthy cases. The system is designed with deep learning where it is trained with 219 CT scan images from 110 patients with COVID-19 and chest CT scans of influenza patients and healthy people [16].

C. AI for Drug Development

From the Day 1 of COVID-19 outbreak AI has already played a vital role. AI has power to help the scientist community to support in the race to find a vaccine. AI has been previously used by scientist to find the vaccine for the other viral viruses and results were good. In drug development process there are two ways in which AI can support. The first way is components suggestion for a vaccine by analyzing viral protein structures and second way is to help researchers scour countless important research papers at an extraordinary pace.

Vaccines help human body to produce the defensive white blood cells and antigens. The main role of vaccine is to stimulate an immune response system of human body. United States has started the trials on the vaccine targeting Covid-19. AI is useful in accelerating the development of such vaccine preparation in many ways.

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Proteins are essential part of viruses and are made up of a sequence of amino acids with unique 3D shape. After understanding the shape, researchers and scientists can develop drugs which work with such unique shapes of protein. But if done manually this process takes indefinite time as examining all probable shapes of a protein before finding its unique 3D structure is not that easy. So here AI plays important role of performing the automated analysis of the scientific literature and by connecting the dots between studies AI will help in identifying hypotheses, suggest experiments and treatment.

Researchers at Flinders University in South Australia have developed a way to use artificial intelligence to create a turbocharged flu vaccine. Computer program names as Smart Algorithms for Medical Discovery (Sam) is used for vaccine creation. The researchers have used Sam to experiment with existing drugs known to work and those that failed and they claimed that drug developed would work in parallel with the available flu vaccination to increase its effectiveness [17].

Only a properly trained AI will have the ability to explore these patterns and choices so that it can then actually predict where the virus is likely to go next. So this information can be used to get it to design a vaccine that predicts against future flu viruses rather than past ones, which would then solve the problem of strain mismatch. The first fully AI-developed vaccine was produced in Australia in 2019. The fully AI based drug development will change the medical industry in many ways and will help in reduction in the time and money required to develop these drugs.

D. AI for Forecasting

The researchers, scientists, governments bodies and health care providers from the globe are working together to track, respond to and prevent the spread of disease. Health experts are working on advanced analytics and artificial intelligence efforts can be minimized to prevent further infection. AI is helping in forecasting the risk of COVID-19 and that is proven by some of the AI driven systems used throughout the world in tackling this virus outbreak. Many startups in china developed the devices for forecasting the spreading of this virus and one such AI driven startup is Bluedot which successfully detected a cluster of abnormal cases of lung infections in Wuhan in December 2019 and precisely made the prediction about where virus might spread. Use of Robots for the applications such as disinfecting hospital rooms, moving food, and delivering telehealth consultations have played crucial role in reducing human interaction. AI is being used by scientists to map and track spread of virus infection, to diagnose it, to predict mortality risk, and many more [18].

Without any doubt its fact that AI society has played crucial role to fight Covid-19. AI systems with facial recognition features are helping scientists at the first line of control in fighting with Covid-19 and future outbreak. With these AI based applications it has made clear that the potential for future innovation cannot be overlooked.

Data analytics have proved to be useful in combating the spread of disease and with access to ample data about population's health and travel information. This amount of data is useful in mapping and predicting disease path. The feature of Machine learning to study large amounts of data and provide hidden information can lead to deeper facts about diseases and allow scientists to take better decisions throughout the evolution of an outbreak.

3. Issues in Implementing Powerful AI

A. Lack of Available Acute Data

Despite all good features of AI, it is far from becoming a major solution in fighting Covid-19. The fact is that AI model training is becoming more time consuming due to the increase in data needed to achieve higher accuracy levels. Also AI based models require large amounts of acute data to be effective, and that data is currently unavailable in wider scale. If data is available then also human opinion is important to carefully analyze AI's pattern recognition. As far as COVID-19 prevention and detection is concerned researchers want maximum accuracy in detection. To have maximum accuracy AI tool needs so much amount of data which is of different type's i.e multimodal data. If less amount of data is given for the training of AI model it will result in severe consequences. Another issue is how to integrate the available data, because data received for COVID-19 is from different countries with different people of various age groups.

Another problem about data is data acquisition and storage. Many AI systems depend on sensor data as its input and validation of AI needs large amount of data. Irrelevant and noisy datasets may affect the analysis and accuracy of system. AI shows best accuracy with good amount of quality data. With good quality data algorithm becomes strong and performs well. The AI system fails badly when enough quality data isn't fed into it. With small input variations in data quality having such profound results on outcomes and predictions, there's a real need to ensure greater stability and accuracy in Artificial Intelligence. Furthermore, in some industries, such as industrial applications, sufficient data might not be available, limiting AI adoption.

B. Data Privacy

The COVID-19 chatbots reviewed are as inconsistent about data handling and collection as they are with sources of information. Clearstep says that its chatbot doesn't collect information that would allow it to identify a particular person. Furthermore, all data the chatbot collects is anonymized, and health information is encrypted in transit .

For LifeLink's part, it says that all of its chatbot collects only data that is symptoms and travel/contact/special population risk. Based on it patients with Moderate and high risk are transferred into clinics for appointments, during which the chatbot collects health information submitted directly to the hospital system via integration with their scheduling systems in preparation for the visit. IPsoft is a bit vaguer about its data collection and storage practices, but it says that its chatbot doesn't collect private health information or record conversations or data. Quiq also says that it doesn't collect personal information or health data. And Drift says that it requires users to opt-in to a self-assessment and agree to clinical terms and conditions. While companies normally dislike to disclose their internal development processes for competitive reasons, greater transparency around COVID-19 chatbots' development might help to achieve consistency in the bots' responses. A collaborative approach, in tandem with disclaimers about the chatbots' capabilities and limitations, seems the responsible way forward as tens of millions of people seek answers to critical health questions.There's a genuine and present requirement for training arrangements that guarantee individuals in danger get treatment quickly. Chatbots can be a good solution, but problematically, there are disparities in the way these chatbots source and handle data, which could in the worst case lead to inconsistent health outcomes.
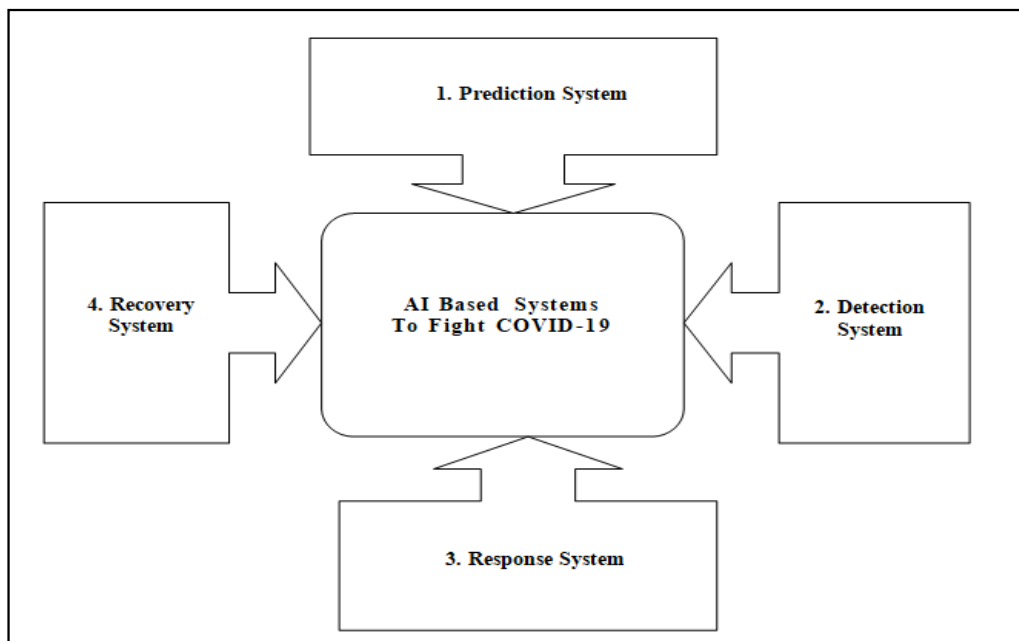
4. Block Diagram and Description of Proposed system

A. Prediction System

As the worldwide human populace develops and keeps on interacting with creatures, different doors open for infections that begin in creatures like COVID-19 that could make the transfer in people and continue its spread. Many countries have seen this scenario including the U.S. which have seen SARS and MERS infections and west African countries where in the 2018 Ebola emergency emerged.

The Centers for Disease Control and Prevention (CDC) estimated taht approx 75 % diseases in humans come from animals. Scientists consider that there are approximately 800,000 animal viruses still unknown that could infect mankind. As discussed earlier AI is being used by researchers to help them to predict virus hotspots from where new disease could emerge.

The innovation can coordinate information about known infections, creature populaces, human socioeconomics and social practices around the globe to predict outbreaks. Government and general health authorities can utilize this information to be proactive and find a way to forestall these sorts of outbreaks or at least they can make in advance preparation about it. If accurate and sufficient data is provided to the AI system it will help the human community to predict the origin and spreading of various viruses including COVI-19.

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              1. Prediction System


4. Recovery        AI Based Systems        2. Detection
  System           To Fight COVID-19          System


              3. Response System
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system can provide better detection system for an unusual disease compared to the traditional disease reporting system.

Due to the virus infection facial features such as duller skin, redder eyes, a droopier mouth and eyelids, a more swollen face, and paler skin and lips changes compared to the healthy person. It is important to train the AI systems to understand these features. AI helps in doing the analysis and decision making in the real time scenarios. AI can be a better detection system for viruses when the there is too much of data which cannot be easily handled by the humans. One such example is scanning system used at airport to scan multiple faces continuously. Scanning system may be temperature scanners to find sick individuals. Also if

trained with other data about the features of viruses an AI technology can identify people who are sick without fevers. The limitations of such systems are the privacy concerns of individuals. Developers and scientists are currently working on neural networks based systems that can analyze available big data to detect signs of illness before human can detect that too with better accuracy and efficiency. In such systems humans need to train the neural networks about the data what should be searched in the database [19].

C. Response System

When virus is killing tens of thousands of people every day, along with lost productivity, there is need of precise and efficient way to suppress such virus. The AI and ML can help to better understand the virus and find new ways to stop it. Once the disease is detected and identified, making timely decision to stop its impact and spread is very important and critical. In such response systems the AI can be trained with data such as travel, population and disease data to forecast in what way and how quickly disease can spread. One such response system was designed by the scientists in USA to stop the spread of Ebola outbreak. The response model designed was able to predict the exact county and hospital where an Ebola case was likely to be found. Such models can be useful in the response system of COVID-19.Fig below is the proposed AI based response system, where with the data set of phone numbers of infected people we can find the probable persons comes in contact with the infected people. The proposed model will be helpful to track the spread of virus within the time limit.
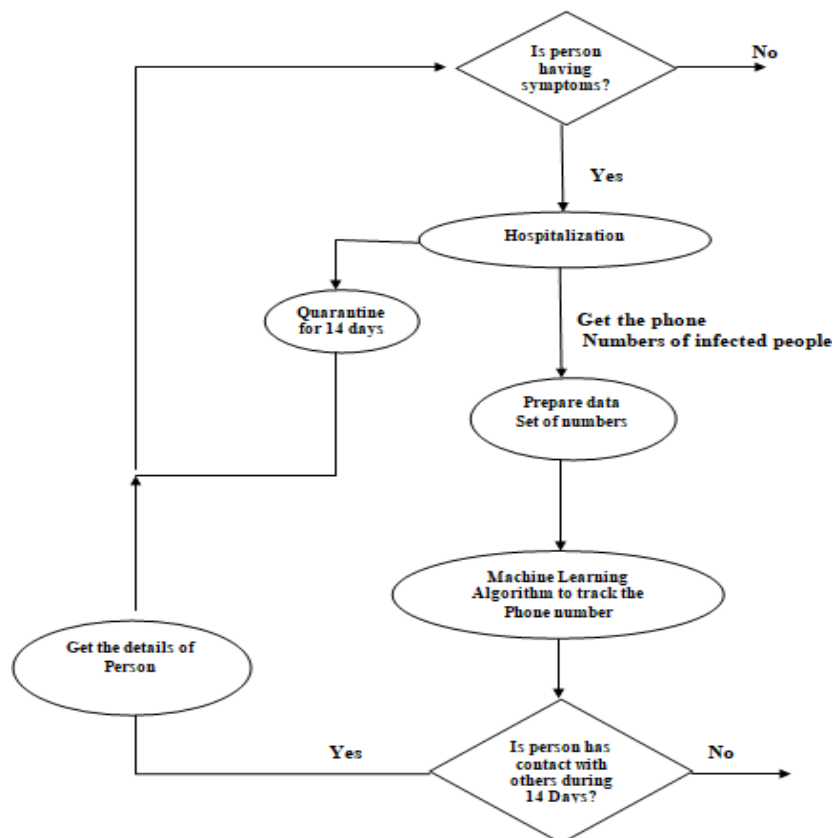

Fig. 4. Proposed AI based Response System

Use of AI for designing the response mechanism of disease can also improve the application of current treatment applications and accelerate the time needed to design new treatments. Many Radiologists are also using AI and machine learning systems to make superior treatment decisions based on medical imaging. If AI system is trained with chest X-rays data of COVID-19 patients then doctors can make faster and better

diagnoses. To develop new treatment and creating vaccines for new virus is time consuming process where many trials and error are required. In such cases AI can be helpful to perform multiple trial and error by exploring the data from similar kind of diseases and then can suggest the suitable medicine and vaccine.

Some researchers are using data like mRNA variations of metabolites and proteins of various patient samples which are exposed to the flu vaccine to train the AI algorithm. AI-related efforts have already revealed new information about the human immune response to the flu. The machine learning approach allows us to handle large volume of data, and then allows determining many components of immune response system [20].

D. Recovery System

After the end of any virus outbreak, to design the recovery system is very important part. The governments and health organizations should design such system with taking decisions about preventing such outbreaks in the near future. In such systems also AI and Ml can be used to test and validate policies, public health initiatives and response plans. This way AI can permits policy makers to conduct analyses about "what if" case that will allow them to take decisions that have an increased likelihood of being effective [21].

5. Conclusion

From the day one when COVID -19 virus was detected in Wuhan, China it had affected millions of lives causing physical and financial loss. Day by day cases infected by this virus are increasing throughout the world. Many scientists and organization along with WHO are working on finding vaccine and medicine for the COVID-19. As COVID-19 is being transferred from human to human very rapidly the best way to stop effect of COVID-19 is to stop its spreading as early as possible. To help to stop spreading of this virus artificial intelligence is playing important role but accuracy is not as required. There are many areas such as Prediction, Detection, Response and Recovery of COVID- 19 where AI can help scientists in stopping its rapid spread and effect. AI has provided solution to many a great problems so far as medical system are considered, but yet AI is not yet been impactful to fight COVID-19 due to lack of proper data. If accurate data is available to train the AI model then AI can be a good solution to prevent and detect the COVID-19 with great accuracy as proposed in the response system.

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