Artificial Intelligence in Action-Against COVID-19

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ABSTRACT

Purpose: This paper targets in emphasizing the role of Artificial Intelligence (AI) and its importance to find solutions against COVID-19 outbreak .This study identify the potential of AI and its applications in various areas, also highlight challenges and issues associated with the diagnosis of the infected patients, and finally come up with suggestive approaches for treatments and control.

Design/Methodology/Approach: In this paper, we searched for SARS COVID-19 data for medical literature and statistics between 20 January and 21 May 2020 from various trusted websites. We characterized the role of AI in the health industry, its importance in different purposes like for detection of areas, tracking ,prediction, providing cloud based data to researchers, assisting in diagnosis of disease and developing vaccines by studying its underlying structure of protein of virus using various algorithms. Suggestive approaches for treatments and control followed by special measures for old aged and diabetes patients also discussed along with future scope of machine learning in prevention of pandemic.

Findings: The present study reveals that Artificial intelligence has been extensively used in almost every area of the health industry. Talking about companies like (https://www.metabiota.com/), (https://bluedot.global/) used AI for parsing data and providing alerts .Additionally, Proximity Tracing, Symptom tracker, mobile apps are making use of deep learning in one or the other way. Thus, we need to provide training, useful information and resources to health department in an appropriate manner, which makes them easy to accelerate the process of diagnosis and treatment of COVID patients.

Originality/Value: It is believed that the information collected here will help researchers and health departments to drive for the solutions against COVID-19. At present, no vaccine has been found to keep from COVID-19, however, legitimate technology, information, and safety measures can assist every single individual to fight against that pandemic of sickness.

Paper type: Theme Based Paper

KEYWORDS COVID19 | SARS-CoV-2 | Artificial Intelligence | Machine Learning | Tracking and Prediction | Diabetes

Introduction

SARS-CoV-2 is the novel corona virus which causes the infectious disease COVID-19. A cluster of pneumonia cases was reported by officials in Wuhan City, China, in December 2019. Ex post facto investigations done by Chinese authorities have identified the onset of symptoms of the virus in human cases in early December 2019. COVID-19 is the disease that spread very rapidly resulting in a pandemic, affecting now nearly more than 210 countries.

The virus is transmitted through respiratory droplets causing the cough, cold, and in severe cases pneumonia or even death. Around 5,213,083 confirmed cases and a death toll of 334,989 and 2,093,820 recovered cases have been reported till May 22, 2020, worldwide. India is one of the listed countries which is affected by COVID19[5]. Indian statistics of COVID 19 indicate 119,419confirmed cases, 3599 deaths, and 48,957 cases have been recovered and the data is still in progress.
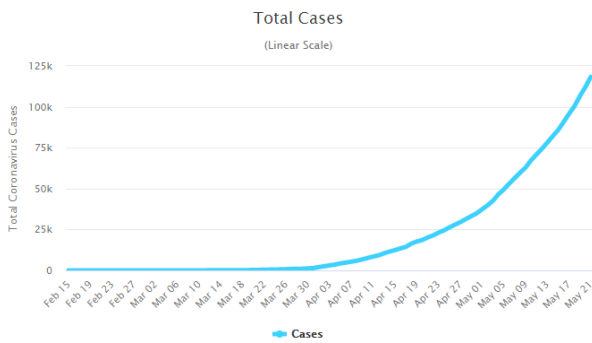
Fig. 1: Total number of cases of COVID-19
in INDIA till 21.5.2020

Coronavirus is still evolving every day and to figure out the limit of expansion is yet undetermined. It has no such vaccine or treatment to halt the situation. However, the positive thing is that COVID 19 is generally a mild sickness and approximately 97% of the people who are attacked by the virus are recovered and survived. Around 80% of the cases begin with symptoms likeflu and can recover at home with proper quarantine and isolation needs.

Symptoms are not instant in this disease, it usually begins nearly 3-7 days after exposure. In certain people, it can take up to fourteen days for symptoms to appear. Around 15-17% of cases come under the severe category, where symptoms of cold, cough, tiredness, and breathing problems are found and around 3-4% can end in critical illness like pneumonia or even death. This is increasingly normal in individuals who have other medical issues, especially the elderly of age>60, those experiencing cardiovascular malady, interminable lung sickness, and hypertension. Also, p**eople with diabetes come under high-risk categories if they get the virus thus requires special sick day treatment as compared to the general patient.**

In current scenario, there is an urgent need for technology to fight against COVID-19. AI is one such solution to solve many problems that could ascend to tackle the situation and control the number of cases rising every day. Also, it requires machine learning algorithms to classify and analyse the data resulting in accurate predictions of the spread of the virus. In this paper, our objective is to emphasize the use of AI to prevent this pandemic outbreak of the virus.

The paper is divided into following sections: Section 1 covers Introduction, Section 2 covers the role of AI and its importance in different purposes like for detection of areas, tracking, prediction, providing cloud-based data to researchers, assisting in the diagnosis of disease and developing vaccine by studying its underneath structure of the protein of virus using various algorithms, section 3 includes Suggestive approaches for treatments and control followed by Special measures for old aged and diabetes patients. Finally, section 4 covers the conclusion and future scope.

Artificial Intelligence in Health Industry

Artificial Intelligence is anall-encompassing branch of computing science to create systems that can function independently and intelligently just like humans. It comprises of neurons, structured like of human brain to copy intelligence. It works in a similar fashion of learning from experiences, thus helps in prediction based on previous reports generated. Artificial intelligence offers various benefits over conventional approaches used in clinical data analysis. AI can combine the bulk of data in a fast and efficient way and can perform repetitive processing, which enables the software to recognize patterns and features in the dataset. The demand
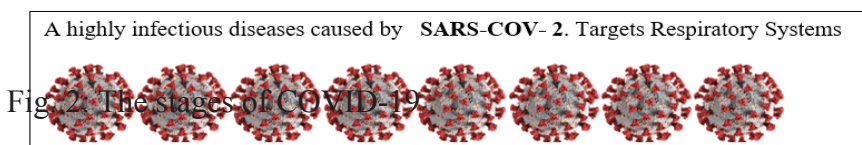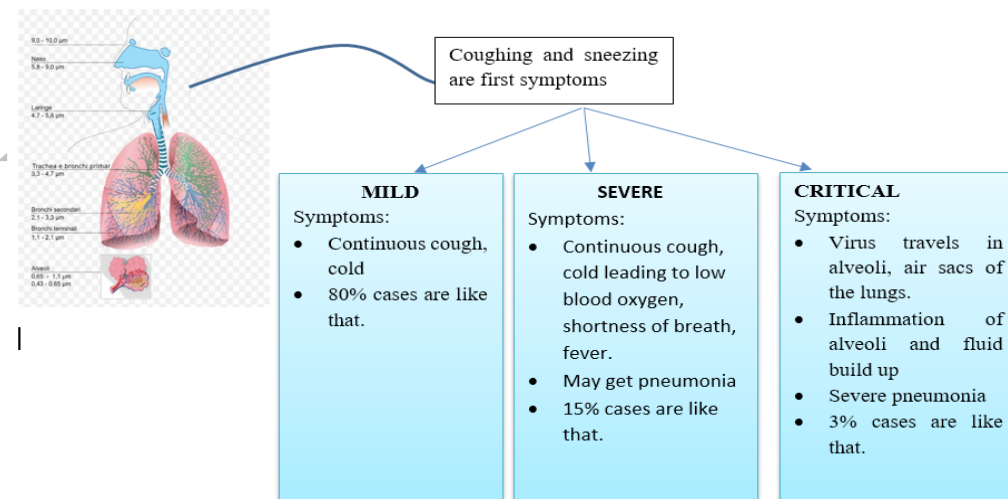

Fig. 2: The stages of COVID-19

of AI is increasingly prevalent in the health industry for risk assessment, providing assistance in treatment and diagnosis of the disease, using image recognition, speech recognition, and providesceaselessprospects to influence technology to deploy more precise, competent, and impactful interpolations at exactly the right instant in a patient's care. The greatest challenge to AI at present in healthcare areas is to ensure the adoption of information produced by the intelligence of machines in contracting the number of people infected with COVID-19. Today, the world is undergoing the pandemic of COVID-19 and every single person is looking towards the technology to do the magic. AI can soars to tackle the situation in various ways, it could be x-ray image processing, clustering of data, assistance, and treatment of disease, and even in developing the vaccine. It can act more precisely for developing vaccines by running complex algorithms by parsing big datasets, preprocessing the data, and identify the components of a vaccine by studying the structure of the viral protein of COVID19. Further, AI can provide tons of data in a precedent way to help medical researchers and identify the ways to prevent the attack of the virus on humans.
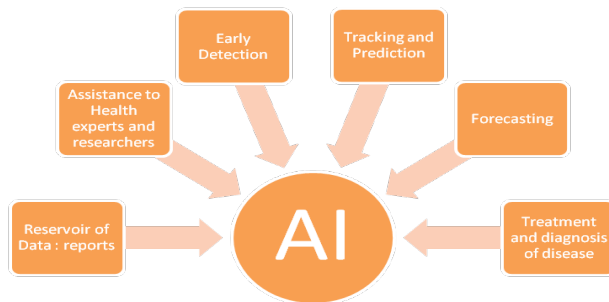

Fig. 3: Applications of AI to tackle the pandemic of COVID-19

Role of AI and its importance for different purposes:

Over the years AI has proved to be the most powerful tool to control and manage several areas that relate to the medical industry. Some of its functions which proved to be of the immense source of information are covered in this section like recognition of patterns, diagnosis, prediction, and providing reports which can assist researchers and medical gems to further perform new and meaningful discoveries.

Early detection of areas and providing alerts

On Dec 30, 2019 cluster of unusual cases were found in Wuhan, China which was first picked up by a company named BlueDot (**https://bluedot.global/**), an artificial intelligence platform that uses machine learning and deep learning to parsed data sud provided alerts. It also correctly identified the capitals that were close to Wuhan and used datasets like of global airline ticketing, to track the record of the infected person. Such companies use AI and collect information from thousands of resources, including media reports, public health statements from government organizations, global travel reports, livestock reports, and demographics of the population. Founder Kamran Khan BlueDot believes that this kind of service is not a replacement of human intelligence but to assist the team to its highest magnitude by locating and conceptualizing the spread of infection. Another benefit of using AI in alert providing when the entire world is busy in fighting against such pandemic it keeps track of any other major infectious disease spread like *Lassa fever* in West Africa, although it's not going to be pandemic however control is required to prevent the community.

Another one such company is Metabiota[16] (**https://www.metabiota.com/**) San Francisco based company, which uses AI, NLP and machine learning approach to track big data collected from different sources including biological, socioeconomic, political and environmental reports accurately anticipate the spread of infection in countries like Japan, Tokyo. Metabiota plays a vital role in investments and insurance companies, as they make predictions using these data which is of interest to the number of organizations to make better decisions during the outbreak of the virus.

Another innovation is done by an Indian Company, **Staqu** who launched a new thermal camera-based alert system named JARVIS. It will capture anybody having a temperature greater than 37°C examining heat directly through cameras and will provide alerts to identify and suspect carriers of the virus. The camera covers a range of up to 100 meters and can identify multiple people at one time. The company claims that the technology is functional and effective in places like malls, railway stations, bus stops, airports, and any other crowded locations for early detection and prevention of the spread of the virus. This AI-enabled alert system is powered with a Sensitivity ranging from -40 to 160C whereas the low sensitivity of -40 to 550C. Staqu is helping police forces to provide AI-enabled smart policing services and currently working with few states of India including Uttar Pradesh, Bihar, Rajasthan, Punjab, Haryana, and Telangana.

These predicting tools help in virus predictions and are shared online to succour researchers all over the world in finding a vaccine, and to improve their diagnosis.

• Tracking and prediction

AI is playing a pivotal role in the response to the Covid-19 pandemic. Several smartphone apps are launched which are used for tracking people infected with COVID-19. Throughout the world, from China, Italy, United States, UK, South Korea, Poland, India, and many other countries theses tracking apps have been downloaded by millions of people. In this section, some of the tracking apps are surveyed with their features which include national as well as international apps.

• Indian tracking apps

To fight against COVID -19 it is essential to bring all Indians together and track the record of every individual. Recently a major initiative was taken by the Ministry of Electronics & IT and has launched a mobile app called, 'AarogyaSetu', that will empower individuals to recognize and evaluate their danger of contracting coronavirus infection. The application will ascertain this dependent on their cooperation with others, using Bluetooth technology, machine learning algorithms, and artificial intelligence. This app serves four main purposes, it alerts users if they come in proximity to an infected person, it also informs users about relevant medical advisories, thirdly it is highly secured and is available in 11 languages on both popular operating systems, Android and iOS. Here is a brief outline of its working.
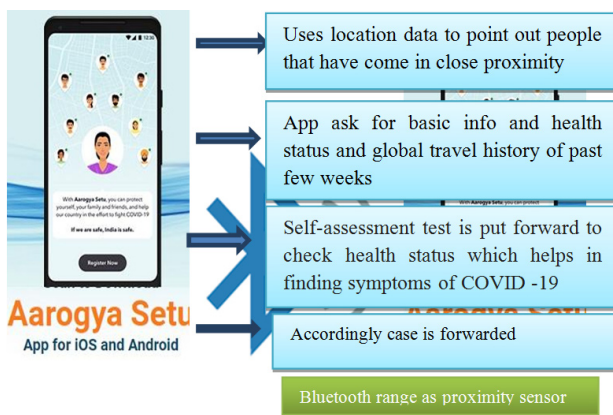

Fig. 4: Outline of working of Aarogya Setu app

In the Aarogya Setu application, a user can be identified by another COVID-19 infected patient with the spectrum of Bluetooth range as a proximity sensor. At the point when two cell phones with the application introduced in them come in one another's Bluetooth go the application will trade data. In the event that one of the clients is certain, the other individual will be alarmed about the chance of being contaminated. These potential cases are then told to the administration for additional testing. Another, AI-based application created by the specialists at the Indian Institute of Technology-Delhi to forecast the spread of COVID -19 in India. **PRACRITI - PRediction and Assessment of CoRona Infections and Transmission** in India is a mobile-friendly dashboard which predicts the spread of infections and transmissions in India and provides prediction report of viral cases in India. It is updated regularly covering all states, districts, and monitored regularly [5]. A key parameter in this app is to maintain R0 which is the basic reproduction number in COVID-19 and refers to the number of people to whom the disease spreads from a single infected person.

Another innovation is done by Defence Research and Development Organization (DRDO) to combat the race of COVID-19 by launching '**SAMPRAC**' to enable tracking people under quarantine. It stands for Smart Automated Management of Patients and Risks for COVID-19. It is an app that is installed only on the smartphones of COVID-19 patients. It works on server-side technology by the government authorities of the state for tracking purposes not for tracing. Thus, it requires minimal data, the only current location of the patient, and their photographs. An AI-based geo-fencing is done using automated face recognition from the period when the patients posted a selfie at the time of registration and subsequent files of selfie sent later by the patient. Based on images it can provide the information to the concerned health department and state officials on a color-coded map to depict containment zones and hotspots.

• International tracking apps

Other than that in the entire world AI has been exclusively used in tracking and prediction by each country. Some of the tracking apps developed outside India are discussed hereby.

• **Trace Together:** A famous cell phone application developed by GovTech, Singapore in collaboration with the Ministry of Health to track the infected patients with COVID-19 using Bluetooth-enabled cell phone and mobile number. It is a contact tracing application that utilizes Bluetooth to follow contaminated individuals and tell the individuals who were in nearness to them during the previous 15 days. The application doesn't gather information about GPS area or Wi-Fi/versatile system. At the point when two individuals utilizing the application are near one another, the two telephones will utilize Bluetooth to trade a Temporary ID. This Temporary ID is produced by encoding the User ID with a private key held by the Ministry of Health (MOH). It must be decoded by MOH and doesn't uncover your character or the other individual's personality. The application has been created by Developed by the Government Technology Agency (GovTech) in a joint effort with MOH, and it has become a model for some, other contacts following applications in different pieces of the world.

• **Pan-European Privacy-Preserving Proximity Tracing:** Over 130 researchers, technologists, and specialists from eight European nations – including France, Germany, and Italy – partook in a non-benefit activity that built up an open-source application which investigates Bluetooth signals between cell phones to infected clients who have been in closeness to one another. The application briefly stores that scrambled information locally stores data temporarily, and if the user later found positive for COVID-19, it can alarm all those who have been around the infected individual in the former days, while keeping the identity of users protected.

- **C-19 COVID Symptom Tracker:** an app known as "zoe" developed jointly by D octors and scientists at King's College London joined hands to reduce the bombing of COVID-19 by helping researchers in several ways, to track the spread of virus spreading in different areas, providing alerts of high-risk areas in the United Kingdom, identifying high-risk individuals based on understanding symptoms provided by the user. But the major caveats with this app are they need to trust the public to provide correct symptoms in data, thus it is self-reporting and needs to provide sources of information in more advanced ways.

- **Covid Watch:** is an initiative taken by Stanford University which empowers people to protect from COVID-19 and their surroundings without disclosing their privacy. It works on the principle of tracking through Bluetooth signals by detecting users who have been in proximity for a few days and provides alerts if they found in contact with the infected person. The special features here are that it does not allow sharing the information of the individuals even at the government level, thus maintaining the privacy of every individual at maximum. Also, it has been among the first applications to follow an open-source convention for security safeguarding and decentralized Bluetooth contact tracing.

Other than that HaMagen, Israel app using AI for controlling the spread of deadly viruses. **Corona DataSpende is a** German smart watch app that uses health data like blood pressure, pulse rate and portrayed it on an online map that assists health authorities to locate the hotspots. Building applications and software's to meet the current need will keep rolling by researchers until they project specifically to reach the solution.

- ## Providing metadata for researchers

Global review proves that every country is providing dashboards and data to researchers in this fight, but providing data is not proving so meaningful due to various constraints like noisy data, outliers, inaccessible data.to overcome such problems AI also plays an important role in making data and other scientific inputs and reports in such a manner that could be used to substantiate existing reports and markdiscoveries. Mark Musen, professor of medicine and biomedical data science at Stanford, also commented that although huge data is available about the virus it requires to be more organized and accessible. Musen and his research team are working to make COVID data fairer in terms of its accessibility, interoperability, and reusability. For example data such as name, age requires standardizing variable names rather than providing any format. So many organizations are using technology developed at Stanford to improve available COVID data.

- ## AI in forecasting spread of COVID-19

Another major challenge comes is to forecast and predict the rate of spread of the virus. It is, in fact, more challenging than tracking and providing alerts. Researchers like Ryan Tibshirani, a professor of data science and machine learning, Delphi group making use of AI to develop forecasting models. His team is working on COVID datasets using machine learning algorithms to forecast the influenza rates. Although, long term forecastsmight be not so effective to overcome the outcomes of fast-changing policies, particularly in this disease as it is not like simple flu.

Diagnosis and treatment of COVID -19 using AI

AI plays a significant role in accelerating and organizing the process of diagnosis of COVID -19 patients. It is extensively used by the radiology and pathology department at some point for recognition of image by a machine. Recognition of text and speech are already engaged for tasks like communicating with the patient and capturing of clinical notes, and their usage will undoubtedly increase. Some of its applications related to diagnosis and treatment are discussed below.

Assisting in diagnosis and may help in developing vaccine

Recently, physicians and doctors are relying on AI to investigate CT images of COVID-19 positive cases.AI algorithms can help in the detection of infection on chest CT scans. Gozes et al., published on the 10thMarch 2020, reports a sensitivity of 98.2% and impressive specificity of 92.2% for their machine and deep learning-based thoracic CT algorithm. AI-based medical image analysis is of utmost importance if worked in the fast and ideal manner, however, in real live scenarios ease of accessibility of soft wares, trained professionals and many other factors may hinder the technology to invade fully.

Another ray of hope from our health experts is to invent the vaccine as early as possible. Again AI cannot replace human power but can accelerate the process by many folds. To develop vaccines researchers need to study the protein structure which is a sequence of amino acids in 3D structure. It is almost impossible to scan all possible shapes of the protein before getting its final unique structure. For the same, AI expedites the process and helps in identifying the structure of the protein. In January, **Google DeepMind introduced AlphaFold**, a forward-looking system that foresees the 3D structure of a protein-based on its chromosomal sequence. University of Washington's Institute for Protein Design also used various AI models to develop a model of 3D atomic-scale of the SARS-CoV-2 spike protein.

Table 1: Summary of the areas of applications of AI to fight against COVID-19

S.No	Name of the Application	Features	Country
Early detection of areas and providing alerts			
1	**Blue Dot**	• Used to map the spread of infectious diseases using machine learning and Natural language processing. • The key to BlueDot is big data collected from various sources and able to quickly process loads of information in frequent time intervals.	Canada
2	**Metabiota**	• Collects reports from big data and make predictions. • Organizations like insurance companies, corporate, stakeholders rely on these data for better decisions on the basis of reports generated.	San Francisco
3	**JARVIS**	• Thermal camera-based alert provide which captures the picture of a person having temperature greater than 37°C	India
Tracking and prediction			
4	**Aarogya Setu**	• Surveillance app using Bluetooth technology and artificial intelligence. • It continuously collects data using the location id of the user and crosschecks it with the government database to understand whether the user has come into contact with an infected person. • Follows serious data security privacy of the user.	India
5	**PRACRITI**	• Mobile-friendly console to predict and provide reports showing data of people infected, state-wise and district wise on a weekly basis.	India
6	**TraceTogether**	• Contact tracing applications based on Bluetooth technology and mobile sensors.	Singapore
7	**Pan-European Privacy-Preserving Proximity Tracin**	• It is also a tracking app to investigate information of people came in close contact with infected people by storing data on the server and runs machine learning algorithms for tracing contacts.	European countries: France, Germany and Italy
8	**C-19 COVID: zoe**	• Highly popular joint efforts of doctors and researchers to track the onset and progression of symptoms of the virus among people. • The app will help identify those at risk sooner on the basis of data feed by the userand help slow the outbreak of the disease.	United Kingdom
9	*Covid Watch*	• Uses Bluetooth signals to detect when users are in proximity to each other and alert them anonymously if they were in contact with someone. • It ensures high security without disclosing private information to process the data. • It is the first open-source safeguarding initiative against COVID-19.	California, U.S.
Providing metadata to researchers			
10	*CEDAR*(**Center for Expanded Data Annotation and Retrieval**)	• Workbench to provide a collection of Web-based tools and APIs that allows users to construct metadata templates. • Provides easy integration of scientific usabilityand applications on the web.	USA: Stanford university
Diagnosis of COVID-19			
11	Google Deep Mind introduced AlphaFold	• Predicts the three dimensional structure of a protein, based on its genetic sequence.	USA

4.2 Special measures for diabetes patients

Covid-19 is a deadly disease for which each one of us to prevent ourselves early following the guidelines provided by the Ministry of Health and WHO. It is highly important to remember that people suffering from diabetes and older age are more vulnerable to infection. Diabetes carries a high risk of morbidity and mortality as compared to normal patients. High insulin resistance and hyperglycemia promote impaired immune-response to infection due to increased synthesis of cytokines and stress in the oxidative process, resulting in macrophage activation. Poorly controlled glycaemic inhibit immunity against viral infection and also compromises the potential to fight against bacterial infection that occurred in the lungs. Numerous defects in immunity have been related to hyperglycaemias, even though the clinical significance is debatable in some situations. Some of the symptoms lowering down the immunity system after getting infected with the virus are listed below.

- Inhibited lymphocyte proliferative response to different kinds of stimuli.

- Impaired monocyte/macrophage and neutrophil functions.

- Abnormal delayed-type hypersensitivity reaction.

- High glucose concentrations affect pulmonary epithelial cells which significantly increase influenza virus infection indicating that hyperglycemia may enhance viral replication. Thus faces difficulty in recovery as compared to the healthy person infected with COVID-19

They are required to maintain blood and glucose level at home. In any case, if the diabetic patient is infected with the virus then they should follow certain sick rules advised by WHO [20]. They should monitor their blood glucose, always remain hydrated, keep monitoring temperature, stay away from other members of the family, get sufficientrestocks for medications like insulin and take guidance on phone or mail from their practitioners on a regular basis for adjustments required in the diet.

How to fight from COVID-19.

We as responsible citizens of our country, need to adopt some easy and sensible in day-to-day life to avoid infection from the virus.

- Wash your hands much of the time with cleanser and water or utilize a liquor based arrangement, after every 30 minutes.

- Take a bath and change your clothes once you come back from public areas.

- Don't share food, devices, glasses, and towels.

- Avoid close contact with individuals who are sick.

- Keep away from someone who is suffering from cold,cough, and fever.

- If you suffer from respiratory symptoms, stay at home, and take necessary precautions to isolate yourself.

- At the time of sneezing or coughing, cover the nose and mouth with a tissue or hankie.

- Install the 'Aarogya Setu' app.

Conclusion

As the entire health industry seeking urgent solutions to halt the race of spread of COVID19. Crucial solutions are still to find to control the expansion of the virus. The major strength of AI is that it can be used for systematic analysis of the infection caused by the virus. It can predict and monitor the spread of infection based on current and previous data which may also contribute significantly to develop a vaccine for COVID19. However pitfalls coming up in implementing AI is due to lack of data, and sometimes data found with missing values, noisy and has outliers. To overcome these problems is a challenge for researchers and concerned health experts. Nonetheless, AI can ascertain viral load dynamics for the prevention and control of the pandemic. Thus a more comprehensive study on datasets is required to understand the pathogenesis of the virus, to put a crucial stop to the problem.

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Annexure 1

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Instances where selected sources appear:

Reviewers Comment

Reviewer Comment 1:
The paper is designed with a good structure and an interesting theme which is more than relevant in the present time of pandemic Covid-19. The findings of the papers have a social relevance by the means of highlighting the role of AI in tracking and prediction, detection of areas, providing alerts, measures for diabetes patients etc.

Reviewer Comment 2:
The paper has highlighted the role of AI in the times of corona virus pandemic along with some suggestive approaches for treatments and control followed by some special measures for old aged and diabetes patients. Along with that paper has also provided the cross-country analysis of the AI application in other parts of the world which is highly commendable. The authors have done a thorough reading of the facts and available data.

Reviewer Comment 3:
The paper emphasizes the role and potential of AI in the health industry. The authors have used the very updated facts and data from the various sources . Linkage of AI in the health industry is a contemporary concept itself and provides a greater scope for further research.

Editorial Excerpt

The article has 7% of plagiarism which is accepted percentage as per the norms and standards of the journal for the publication. As per the editorial board's observations and blind reviewers' remarks the paper had some minor revisions which were communicated on timely basis to the authors (Sofia & Sudhansh) and accordingly all the corrections had been incorporated as and when directed and required to do so. The comments related to this manuscript are noticeable related to "**Artificial Intelligence in Action-Against COVID-19**" both subject-wise and research-wise. This paper presents the role and potential of AI in responding against COVID-19 then recognizes their applications in struggling against COVID-19, it also highlights issues and challenges associated with the diagnosis of the infected patients, and in conclusion, comes up with suggestive approaches for treatments and control. The paper is well written and some important considerations are highlighted. Overall, the paper promises to provide a strong base for the further studies in the area. After comprehensive reviews and editorial board's remarks the manuscript has been categorised and decided to publish under "**Theme Based Paper**" category.

Acknowledgement

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