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ARTIFICIAL INTELLIGENCE AND COVID-19 PANDEMIC

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Abstract

Bioinformatics is an interdisciplinary field of biology and computer science concerning biological data and understanding its methods of collection, classification, storage and analysis. Large and complex data sets,revolving often around DNA and amino acid sequences, are viewed from computational point of view. Molecular biologists make use of bioinformatics when analysing various protein sequences, biomolecules and biologic systems, etc. There are several disciplines under bioinformatics that are raised as research and thesis issues and problems, but the most significant ones are the fusion of computer science and molecular biology. Due to production of huge amounts of biological data, bioinformatics has a high scope of setting trends in machine learning in future.

Keywords: *Bioinformatics · Applications · Research Challenges · Future of bioinformatics · Biological Data Set*

INTRODUCTION:

Bioinformatics is an intriguing fusion of biology, computer science, information engineering, mathematics and statistics. It conceptualises around biological data and queries which are analysed and solved using mathematical and statistical techniques, software tools and particular algorithms. This idea of modelling of biological systems is the reason why bioinformatics is also termed as "computational biology".Most often, the biological data that is input is the form of molecular biology that is macromolecular structures, genome sequences, and the results of genomic experiments. The computational techniques that are made use of, to resolve this data, include sequence and structural alignment, database design and data mining, macromolecular geometry, etc. In other words, the first and foremost aim of bioinformatics is to make use of machine learning and data science to solve and simplify the issues and challenges noticed in biological systems and processes. With constant generation of tremendous amounts of biological data, machine learning has made it easier to predict sequences of DNA and RNA strands, count the number of nucleotides in a single human genome, and several other complex tasks which seem nearly impossible to accomplish if meant to do manually.With rapid advancements in development of drugs, diagnostic tools and vaccines, bioinformatics is definitely set to make new trends in future encouraged by the introduction of Artificial Intelligence.

Artificial Intelligence is an approach of replicating how a human brain thinks, learns, decides and works when analysing complex data. The objective of this intelligence is to be able to successfully make a computer, or a robot, imitate a human's way of reasoning, learning, problem-solving, perception and the ability to move and manipulate objects. AI in the field of Bioinformatics is a recently induced art and has already set a few recent trends. The two major categories of AI are 1) Machine Learning and 2) Deep Learning. With the use of these extensive and advanced learning, it is easier to analyse, process and categorise the huge amount of biological data to produce a logical conclusion, in a considerably less time. Several AI algorithms are generated which help in discovery of vaccines for diseases, silicon structure prediction for cancer (*in silico*), molecular dynamic simulations, design of active novel compounds for neurological disorders, and many more. These methods have shown a comprehensive impact on not just the present and future of bioinformatics, but also on biotechnology, pharmacology and medicine. The advanced algorithms of AI have helped in drug discovery and vaccine development for the increasing rate of mutations in microbes and viruses. AI also played a major role in the development of the Covid-19 vaccine. The *in silico* methodology was used to carry out a breakthrough on the corona virus' biological sequence which later on helped in the development of diagnostic tool with the help of reverse transcription polymerase chain reaction (RT-PCR). This research paper focuses on how Artificial Intelligence (AI) was involved with Bioinformatics in the making of the Covid-19 vaccine.

THEORY:

6.3% of the people living in India have already been vaccinated for the deadly virus that has infiltrated the world since 2019 and 13.1% people across the globe. David Smith, an associate VP of virtual medicine at UMass Memorial Health Care explained that Artificial Intelligence can be used to study and learn about the mutating patterns of the virus in a more real time which will help to understand where the curve of the pandemic growth needs to curbed first and also the distribution logistics of the vaccine so that most people are vaccinated in the least time. Matthew Putman, an AI expert and CEO of Nanotronics, pointed out that with new types of variants gradually coming to light, it is difficult for humans to do reprogramming as quick as possible with the tremendous amount of data. Hence, artificial intelligence agents are brought in to deal with this to keep up with pace, which is required. With people being more open to AI, it has been used from diagnosis to drug development, from forecasting the disease's spread to monitoring and surveillance of the population. Using AI was vaccine rollout, Putman said that it will definitely come handy in the near future after the first round of dosing since the blueprints would have been created which will be useful for mass inoculation. Researchers can use Artificial Intelligence to grasp data about how the Covid-19 virus is mutating time to time and how effective each vaccine to be able refine vaccines regularly and develop new ones before complete development of additional strains.

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RESULT:

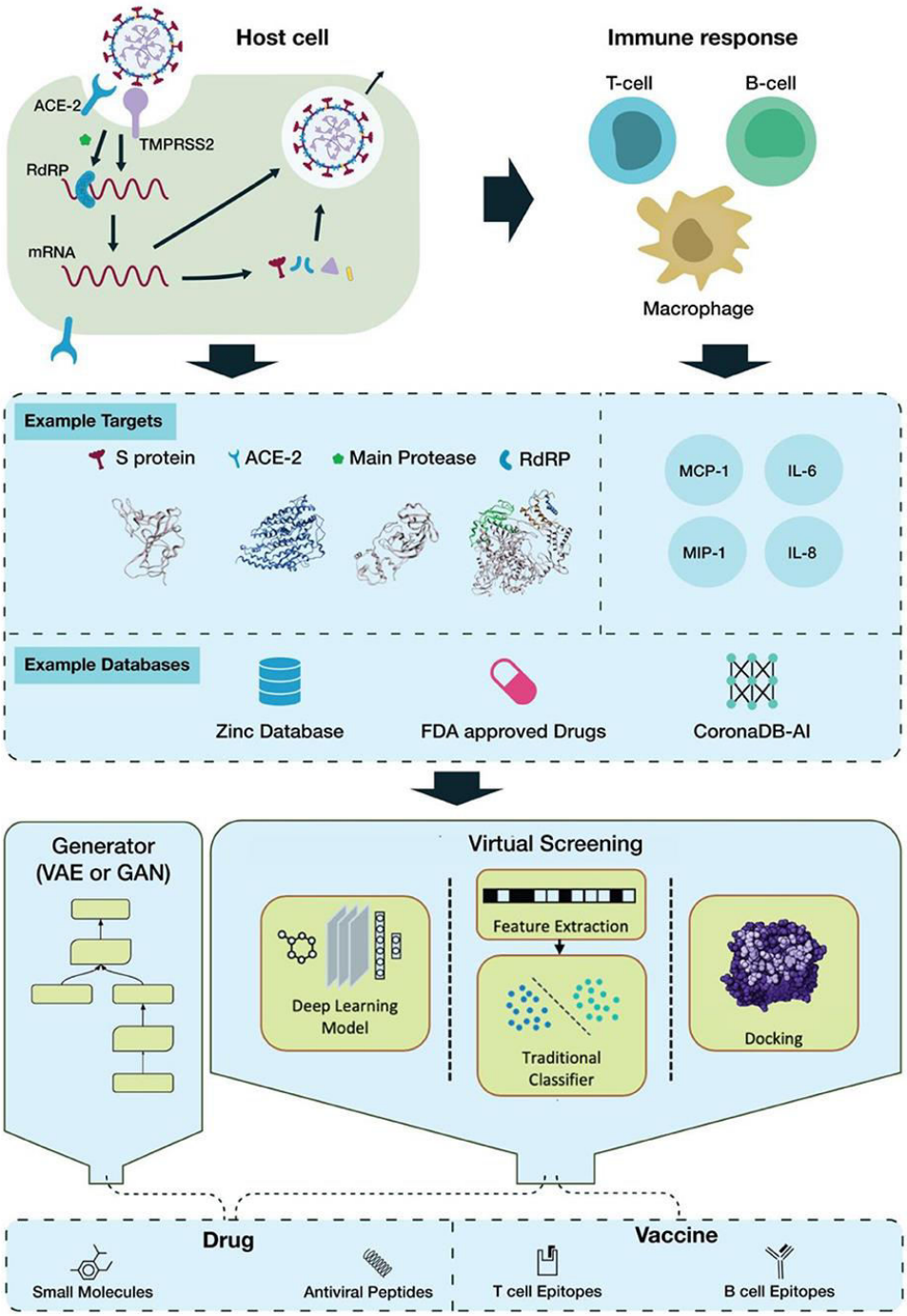

Fig 1. The pipeline of AI-based drug discovery and vaccine development for Covid-19

Several applications and techniques of Artificial Intelligence have been harnessed ever since the identification of the disease clusters, to monitoring of the cases, prediction of future outbreaks, diagnosis of Covid-19, lastly to drug discovery and vaccine development. AI was used to study the spread of the virus and develop early warning systems by extracting information from social media platforms, calls and news sites and provide useful information about the most likeable vulnerable regions. Using the approach of machine learning (ML), Bluedot was successful in tracking and giving a specific geographical location of the first Covid-19 outbreak. Then several mobile health applications had been created and introduced where a range of wearable devices including mobile phone and cameras were utilized to detect a possible occurrence of the corona virus by contact-tracing and efficient monitoring. Based on the data derived from monitoring the vital statistics and clinical parameters of a patient, AI techniques were used to obtain critical information which then helped in decision-making of prioritizing the need of the diagnostic tools like respiratory supports and ventilators. AI was employed to provide daily updates, store data and mark the trend analysis and chartthe course of treatment, thus giving an idea about the chances of recovery or the mortality in Covid-19.

The approach of deep learning (DL) was harnessed to make a model named COVID-19 Detection Neutral Network, which was helpful in differentiating between Covid-19 and the community-acquired pneumonia. The RT-PCR results of COVID-19 were predicted using AI-based classifiers and the data was derived from the 16 simple parameters of complete blood profiles. The methodology of Vaxign reverse vaccinology was used to develop vaccines for the COVID-19. This machine learning platform depended on supervised classification models to create vaccine the fastest against a pathogen, something which the world has never witnessed before. Machine Learning was applied on identified genomic structures for fast and an accurate identification of SARS-CoV-2 genomes, which led to the first wave of Covid-19 in 2019.

To sum it up, there are seven significant applications of Artificial Intelligence that were helpful in the Covid-19 pandemic. All these are used to detect the cluster of cases and where in the future will the virus affect the most, based on the data collected and analysed from the previous batch of data.

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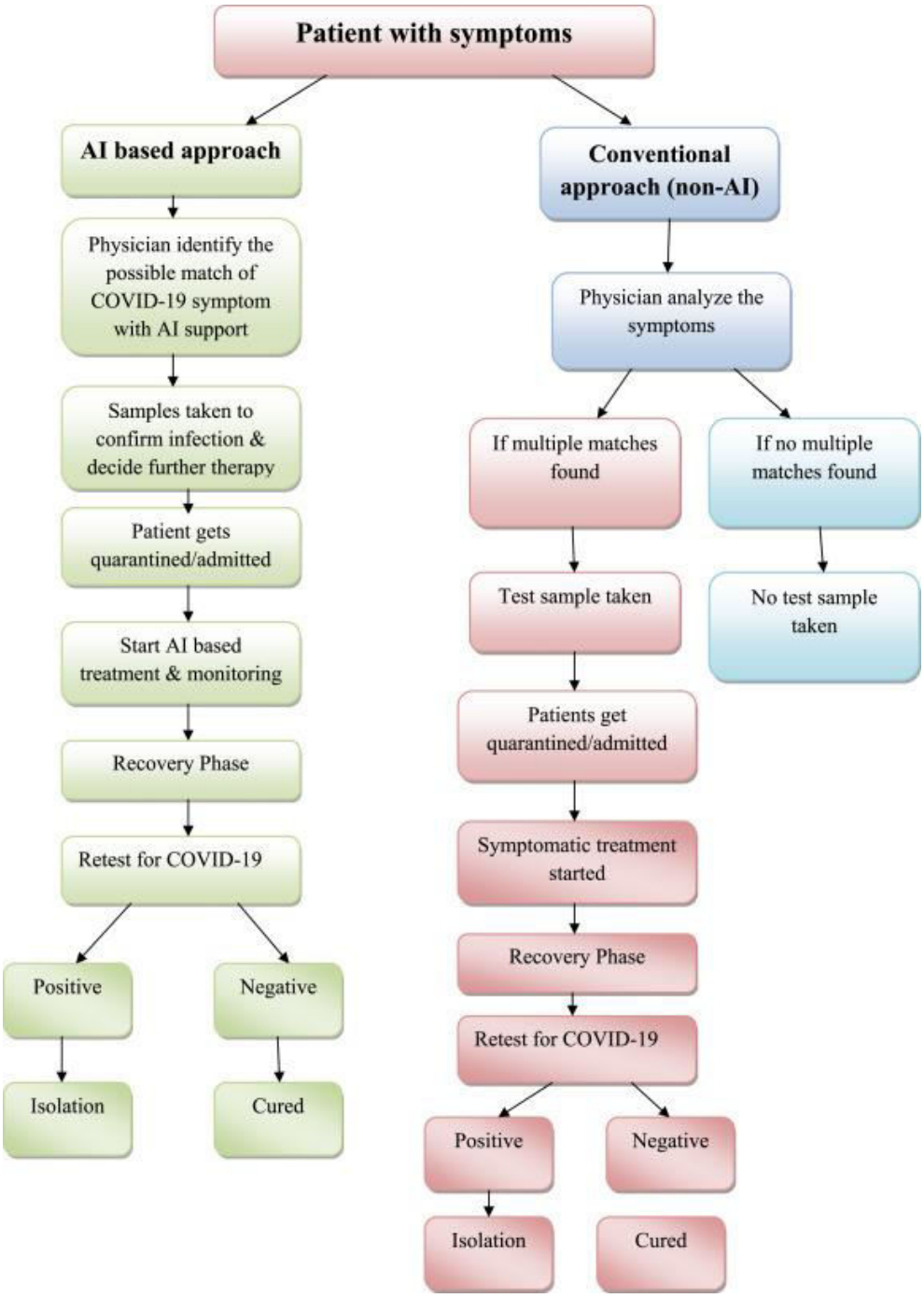

Fig 2. The seven significant applications of Artificial Intelligence (AI) used for COVID-19 pandemic

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DISCUSSION:

Covid-19 pandemic has become a global challenge affecting thousands of lives, healthcare centres and economy as well. As of lately, an average of 450 million samples were tested in India for the fight against corona virus, with an average of 410 million vaccines that were administered lately. With a spur in AI craze, AI techniques and tools have time and again helped on research of treatment rapidly analysing large volumes of research data. AI text and data mining tools can uncover the virus' history, transmission, and diagnostics, management measures, and lessons from previous epidemics. Several institutions have employed the deep learning approach to analyse old drugs and discover new ones that might help in Covid-19 treatment. Employing artificial neural networks and supervised learning methods has proven to be a vital game-changer when used for the purpose of virtual filtering and *de novo* design. AI technologies have proved to be a better alternative to infer epidemiological data at a faster rate than traditional methods of reporting health data. Dedicated platforms, news channels, social media trends study and analyse the real-time data on confirmed coronavirus cases, recoveries, and deaths, thus also making sure to find the origin of any false news of the same or rumours that might cause misunderstandings about the same, if any. Rapid diagnosis is harnessed to understand the spread of the disease at a rapid speed with the involvement of Artificial Intelligence. Population surveillance is being used to limit contagion in many countries and prevent the spread of the disease. Austria, China, Israel, Poland, Singapore and Korea have employed to using the Contact Tracing approach to make people aware of the approaching contact with the virus carriers and notify them immediately. Robots and drones are being positioned to be available for immediate help in the time of need in hospitals or healthcare centres for delivering food and medications, cleaning and sterilisation, aiding doctors and nurses, and performing deliveries of equipment. In general, Artificial Intelligence is the simulation of human intelligence that replicate human's tasks at a quicker pace and in a more accurate manner. It can read CT scans and identify clusters of pneumonia virus and rapidly comb through thousands of chemical compounds to identify promising drug candidates.

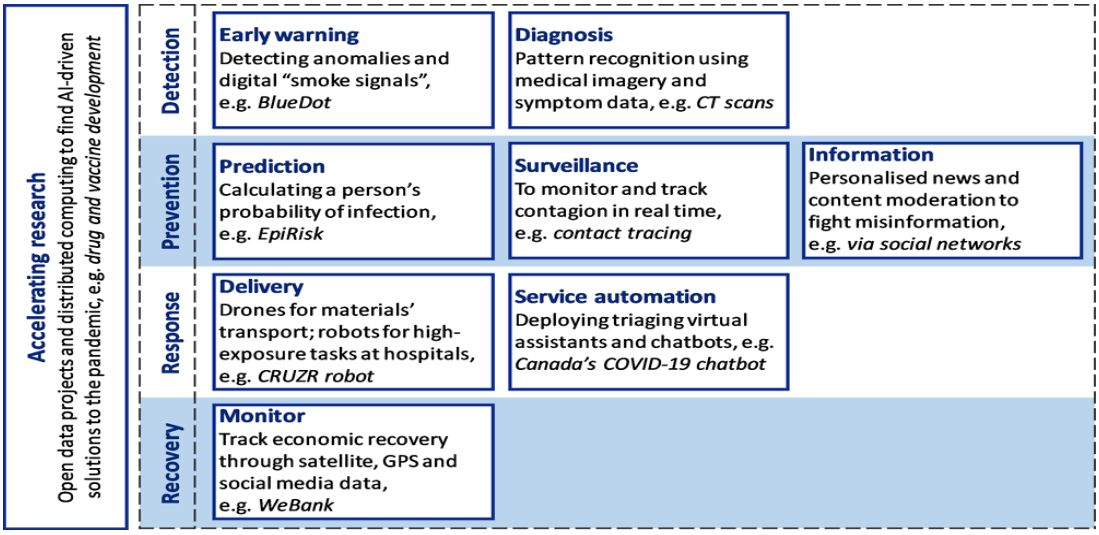

Fig 3. Using Artificial Intelligence to help combat COVID-19

CONCLUSION:

The four-pronged approach based on Detection, Prevention, Response and Recovery is guaranteed to help in getting rid of the Covid-19 virus. Due to its proficient way to replicate human intelligence, AI is in immediate need for handling the coronavirus and finding all possible ways to avoid its spread in real-time before it proceeds to bring a new Phase 3. It is urgent to update the progress in all fronts from surveillance and monitoring to prevention and treatment before the third outbreak. As the SARS-CoV-2 mutates yet again, it is extremely necessary to decrypt the molecular mechanism of this variant. In recent times, many coronaviruses are being speculated to most likely be found in animal reservoirs. As of now AI is way ahead of the human methodology in COVID-19 diagnosis and drug discovery and development. But before the situation worsens to the third phase, it is very important to bring in bigger datasets for AI model training to bring them to their full potential to be able to work efficiently for clinical and epidemiological data, computational resources, scalability, privacy and ethical concerns.

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