## International Journal of Applied Dental Sciences

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# Application of artificial intelligence in prevention and detection of Covid- 19

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**Abstract**
Artificial intelligence (AI) and its applications have assisted in many areas of COVID-19 and are playing a very crucial role in its management. The present article mentions usefulness of Artificial intelligence in detection and management of cases of COVID- 19.

**Keywords:** Artificial intelligence, covid- 19, world health organization

## Introduction

World Health Organization (WHO), its co-operating clinicians and various national authorities around the globe fight against these pandemics to date. Since the first Covid-19 (Coronavirus) disease case confirmed in China December 2019 Wuhan District, the outbreak continues to spread all across the world, and on 30th January 2020 WHO declared the pandemic as an international concern of public health emergency. The novel Coronavirus (SARS-CoV-2) disease spread on more than 185 countries infecting more than 7,145,800 individuals and causing 407,067 deaths by June 09, 2020 [1].

Laboratory confirmation of SARS-CoV-2 is performed with a virus-specific RT–PCR, but the test can take up to 2 days to complete. Chest CT is a valuable component of evaluation and diagnosis in symptomatic patients with suspected SARS-CoV-2 infection. Nevertheless, chest CT findings are normal in some patients early in the disease course and therefore chest CT alone has limited negative predictive value to fully exclude infection, highlighting the need to incorporate clinical information in the diagnosis [2].

The COVID-19 pandemic has resulted in over 3 million cases worldwide. Early recognition of the disease is crucial not only for individual patient care related to rapid implementation of treatment, but also from a larger public health perspective to ensure adequate patient isolation and disease containment. Chest CT is more sensitive and specific than chest radiography in evaluation of SARS-CoV-2 pneumonia and there have been cases where CT findings were present before onset of clinical symptomatology. In the current climate of stress on healthcare resources due to the COVID-19 outbreak, including a shortage of RT–PCR test kits, there is an unmet need for rapid, accurate and unsupervised diagnostic tests for SARS-CoV-2 [3].

## Artificial intelligence

Artificial intelligence (AI) refers to a field of computer science dedicated to the creation of systems performing tasks that usually require human intelligence. Artificial intelligence (AI) and its applications have assisted in many areas of COVID-19 and are playing a very crucial role in its management. It is probably for the best that humans have an additional source of intelligence to confront this pandemic [4].

Artificial Intelligence is the study and development of approaches that imitate human intelligence. The technique has been successful in a variety of fields including fraud detection, computer vision, online advertising, robotics, automatic drivers, etc. With its success in areas like disease diagnosis, treatment, patient monitoring, drug discovery, epidemiology, etc., there is a great hope that Artificial Intelligence can be a vibrant area of research to tackle the

challenges human faces currently [5]. It is argued that AI will be key to supporting clinical and academic studies of covid-19 and future crises. For example, at the beginning of the outbreak, China initiated a set of actions against the spread of the virus, by adopting a set of AI-based technologies. In this effort, they explored implementation of ideas like the use of facial recognition cameras to track infected people, drones to disinfect places, robots to deliver food and medications, etc. There are different fields of applications for which AI approaches are adopted to manage the effects of the disease [6].

## Clinical application
AI and ML technology are used to improve the accuracy of prediction for screening both infectious and non-infectious diseases. The relation with health care begins with the evolution of the first expert system called MYCIN developed in 1976. MYCIN was designed to use 450 rules collected from a medical expert to treat bacterial infection by suggesting antibiotics to the patients. Such an expert system serves as clinical decision support for clinicians and medical experts. Recent studies evident on the prospect of ML and AI technology for the various pandemic outbreak, it supports healthcare experts in various communicable diseases [7].

## BlueDot
One of the earliest detection of COVID-19 with AI was done with BlueDot, a Canadian company. BlueDot not only detected the spread but also predicted the spread of virus to various cities. The United Nations Educational, Scientific and Cultural Organization (UNESCO), in collaboration with International Research Centre for Artificial intelligence (IRCAI) launched 'coronavirus watch', which provides live updates related to COVID-19. Similarly, China has used AI to predict and forecast the spread of COVID-19. Pandemic control and detection of cases AI has been used in various countries for checking temperature using AI enabled infrared cameras; tracking cases and their contacts with facial recognition and smartphones; and tracking the GPS location and itinerary of infected person through mobile phones [8].

## ML and AI technology in SARS-CoV-2 screening and treatment
Early detection of any disease, whether it is infectious and non-infectious, is critically an important task for early treatment to save more lives. Fast diagnosis and screening process helps prevent the spread of pandemic diseases like SARS-CoV-2, cost-effective, and speed up the related diagnosis. The development of an expert system for health care assists in the new order of identification screening and management of SARS-CoV-2 carrier by more cost-effective compared to the traditional method. ML and AI are used to augment the diagnosis and screening process of the identified patient with radio imaging technology akin to Computed Tomography (CT), X-Ray, and Clinical blood sample data [9].

## Generic Machine Learning
In order to build a more accurate diagnosis model for covid-19 based on patient symptoms and routine test results, machine learning algorithms are used with data from 151 published studies. The work reports correlation between being male and having higher levels of serum lymphocytes and neutrophils. According to this study, covid-19 patients can be clustered into subtypes based on serum levels of immune cells, gender and symptoms. The XGBoost model is used in this work which achieves sensitivity of 92.5% and specificity of 97.9% [10].

## Pandemic control and detection of cases
AI has been used in various countries for checking temperature using AI enabled infrared cameras; tracking cases and their contacts with facial recognition and smartphones; and tracking the GPS location and itinerary of infected person through mobile phones. AI enabled chatbots are providing information related to COVID-19 to millions of people [11].

## AI technology in SARS-Cov-2 contact tracing
If employed thoroughly, this process can break the transmission chain of the current novel coronavirus and suppress the outbreak by giving a higher chance of adequate controls and helping reduce the magnitude of the recent pandemic. In this regard, various infected countries come up with a digital contact tracing process with the mobile application, utilizing different technologies like Bluetooth, Global Positioning System (GPS), Social graph, contact details, network-based API, mobile tracking data, card transaction data, and system physical address. The digital contact tracing process can perform virtually real-time and much faster compared to the non-digital system. All these digital apps are designed to collect individual personal data, which will be analyzed by ML and AI tools to trace a person who is vulnerable to the novel virus due to their recent contacted chain [12].

## SARS-CoV-2 prediction and forecasting
A new novel model, that forecast and predicting 1-3 to 6 days ahead of total Covid-19 patient of 10 Brazilian states, using stacking-ensemble with support vector regression algorithm on the cumulative positive Covid-19 cases of Brazilian data was proposed, thus augmenting the short-term forecasting process to alert the healthcare expert and the government to tackle the pandemic [13]. Recent studies suggested a novel model using a supervised multi-layered recursive classifier called XGBoost on clinical and mammographic factor datasets. After applying the model, researchers found out those three significant key features (high-sensitivity C-reactive protein, lymphocyte and lactic dehydrogenase (LDH)) of the 75 features clinical and blood test samples result to be the highest rank of 90% accuracy in predicting and assessing Covid-19 patient into general, severe and mortality rate [14].

## Telehealth algorithms
Artificial telehealth systems are very useful during the pandemic as they can people receive the services they require from home which in turn helps curb the spread of the virus. In some work AI approaches have been used to develop artificial telehealth algorithms. In, a novel AI-based approach is proposed for covid-19 infection risk assessment in virtual visits. The algorithm uses a natural language processing algorithm that performs on data collected through telehealth visits. In, a natural language processing algorithm is proposed to provide free preliminary healthcare education, information and advised to covid-19 patients. The system provides preventive measures, home remedies, interactive counseling sessions and healthcare tips for clients [15].

## Blood test data
In, blood samples from 404 infected patients have been collected and machine learning techniques have been used to

identify crucial predictive biomarkers of the disease severity and predict the survival of patients. The blood and urine tests of covid-19 patients are analyzed to predict the severity of disease in. The authors use SVM to build a model and report that blood tests are more representative of the disease. In, a machine learning algorithm is used to find the risk factors for the disease. The authors report factors like blood type, vitamin D intake, smoking and obesity as major risk factors [16].

**CT scan and Deep Neural Networks Application**
Cluster of viral pneumonia occurrences in a short period of time can be an indicator of an outbreak. Rapid and accurate detection of viral pneumonia can be helpful for epidemic prevention. The evolution of viruses and emergence of new mutations, results in dataset shift, which limits the performance of classifications. In order to manage this, the task of differentiating viral pneumonia from non-viral ones is formulated in, into a one-class anomaly detection problem. This work proposes confidence-aware anomaly detection model which consists of a feature extractor, an anomaly detection module and confidence prediction module [17].

**New architecture**
Architecture of machine learning algorithms is important in their performance. Thus, many research study and develop new architectures for the algorithm. In, a multi-task pipeline with specialized streams in DNN is proposed to perform segmentation of CT scans. In order to classify covid-19 patients against pneumonia, in a method is proposed that first segments lung images and then feeds abnormal CT slices images into the EfficientNet B4 DNN. The output of this algorithm is then fed into a two-layer ANN so the slices are pooled together. A deep learning algorithm is proposed that consists of a pipeline of image processing algorithms which includes lung segmentation, 2D slice classification and fine grain localization. A semi-supervised learning approach is proposed in that is based on Auto Encoders. The algorithm first extracts the infected legions in chest X-ray image. Then a highly tailored deep architecture is used to extract the relevant features specific to each class [18].

**Improving the computational cost: Deep neural network algorithms are computationally expensive**
The focus of some works has been to develop methods that are less computationally costly. Despite their success, the standard deep-learning algorithms are computationally costly. In order to build a more efficient system, EfficientNet family of DNN, which are well-known for their high accuracy. The work also uses a hierarchical classifier which exploits the underlying taxonomy of the problem. The algorithm is used to perform segmentation on covid-19 CT images. A novel semi-supervised shallow learning network model comprising parallel quantum-inspired self-supervised network with fully connected layers is proposed for segmentation of CT images. The model is incorporated with a CNN model for feature learning [19].

**Transfer learning**
Transfer learning is a method in which the knowledge collected while solving a particular problem is used to solve a similar but not identical problem. This approach is particularly attractive when not enough data are available for training algorithms. Dense convolutional neural networks and transfer learning is used in to classify chest X-Ray images. A

transfer learning algorithm is proposed in which has three phases [20]. The authors use some well-known pre-trained architecture including ResNet18, ResNet50, ResNet101, and SqueezeNet. A classification algorithm based on transfer learning is proposed in which uses four state-of-the-art pretrained deep learning mode. The research uses VGG16, ResNet-50, Inception-v3, and Xception as backbone. A DNN is proposed in to identify covid-19 via X-Ray images. The research uses a transfer learning approach on Pruned EfficientNet-based model and is interpolated by post-hoc analysis for the explain ability of the predictions. In, a generative adversarial network (GAN) with deep transfer learning is proposed. In this method, first all the possible images of covid-19 that exist until the time of writing the research are collected and then GAN is used to generate more images [21].

**Vaccine and drug development**
The prediction of RNA structure of SARS-CoV-2 through AI was a major achievement.10 on similar ground, researchers are exploring the utility of AI for developing vaccine for COVID-19 infection. With AI, the various regions on the viral structure with antibody targets and cell presentation can be identified and used for the development of vaccine. Though in its initial stages, the developments seems interesting [22].

**Conclusion**
Artificial intelligence is useful in rapid screening and prediction process, contact tracing, forecasting, and development of vaccine or drugs with the more accurate and reliable operation against COVID- 19.

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