

Artificial Intelligence for the Novel Corona Virus (COVID-19) Pandemic: Opportunities, Challenges, and Future Directions

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ABSTRACT

The COVID-19 outbreak has created havoc around the world and has brought life to a disturbing halt claiming thousands of lives worldwide with the infected cases rising every day. With technological advancements in artificial intelligence (AI), AI-based platforms can be used to deal with the COVID-19 pandemic and accelerate the processes ranging from crowd surveillance to medical diagnosis. This paper renders a response to battle the virus through various AI techniques by making use of its subsets such as machine learning (ML), deep learning (DL), and natural language processing (NLP). A survey of promising AI methods that could be used in various applications to facilitate the processes in this pandemic along with the potential of AI and challenges imposed are discussed thoroughly. This paper relies on the findings of the most recent research publications and journals on COVID-19 and suggests numerous relevant strategies. A case study on the impact of COVID-19 in various economic sectors is also discussed. The potential research challenges and future directions are also presented in the paper.

KEYWORDS

Artificial Intelligence, COVID-19, Deep Learning, Diagnosis, Machine Learning, Natural Language Processing, SARS-CoV-2, Treatment

INTRODUCTION

The world is facing an exceptional threat from the novel coronavirus, termed as coronavirus disease 2019 (COVID-19) by the world health organization (WHO), a pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus. SARS-CoV is alleged to be an animal virus from an as-yet-uncertain animal reservoir, perhaps bats, that eventually spread to other animals (civet cats). The COVID-19 outbreak originated in the Wuhan district of China (Hubei Province) and was declared a pandemic by WHO on March 11, 2020 (Wang L, et al., 2020). Since the outbreak, more than 0.7 million deaths have been reported spanning around 200 countries across the globe as per the statistics of WHO on Aug 2020 (WHO, 2020).

Clinical features of this virus range from the asymptomatic state (no symptoms) to multiple organ dysfunction syndromes (MODS) and acute respiratory distress syndrome (ARDS). The primary

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symptoms of COVID-19 include fever, dry cough, fatigue, dyspnea, increased expectoration, muscle pain or joint pain, sore throat, and headache. A small percentage of patients (5%) have shown the symptoms of nausea and vomiting. China CDC detailed the clinical features, outcomes, laboratory and radiologic findings of 44 672 laboratory-confirmed cases on February 14. Among the 965 (2.2%) people under 20 years age group, only one death was recorded (0.1%). The majority of the patients (77.8%) were aged between 30 and 69 years. Patients aged over 80 years had a case fatality rate (CFR) of 14.8%. Among the chronic disorders, patients with cardiovascular, diabetes, chronic respiratory disease, hypertension, and cancer were at increased risk and showed a high CFR (WHO,2020).

The impact of the COVID-19 outbreak has caused extreme distress all over the world. The number of COVID cases has been exponentially increasing, evoking the need for immediate measures to tackle the effects of this virus. The overworked healthcare systems that haven't produced vaccines for this pandemic and the shortage of resources to handle the outbreak have put the majority of the countries in lockdown.

Furthermore, section 2 provides brief details on AI application in COVID-19 and describes the prevalent machine learning and deep learning algorithms; section 3 illustrates a case study on the impact of COVID-19, section 4 discusses the potential research challenges and future directions, and section 5 concludes the paper. The motivation and organization of the paper are depicted in Fig.1. The main contribution of the study is:

1. Identifying the potential way of leveraging AI during COVID pandemic and its significant impact
2. Presenting the case studies on the impact of COVID in lifestyle, economic sectors, diabetic patients (as they are easily prone to various illness and organ disorders) and accelerating healthcare in AI revolution.
3. The COVID related data are widespread and have not been effectively managed, so a blockchain with edge computing-based secured framework for COVID data management is presented.
4. Identifying various sources of the COVID data for research purpose.
5. The major challenges and future directions for COVID 19 research are highlighted.

1. ARTIFICIAL INTELLIGENCE IN TIMES OF COVID-19

In this paper, we carefully explore the use of Artificial Intelligence in mitigating the impact of COVID-19. From the inception of Artificial Intelligence (AI), it has proved to be a milestone in technological advancement because of its capability to unravel complex problems. AI has contributed to deal with the COVID-19 ranging from screening and tracking the virus to predicting the current and future patients. It has the potential for the development of drugs and vaccines and lessens the workload of healthcare workers. Some of the actual and potential ways in which AI can help the authorities in effectively combating the COVID-19 pandemic are described in Table.1.

The data collected from application-specific sources (COVID related data) for the problem under research will be in a raw format. So data preprocessing techniques are applied to remove unwanted data, missing data to retrieve meaningful information. Furthermore, to improve the AI algorithms' performance, the relevant subset of data is extracted using feature selection methods (data normalization techniques). The relevant subset of features is split into the train and test data (70% and 30%, respectively). The training data is used for constructing the model by applying AI algorithms and learning through the experience from various evaluations. The model is evaluated using test data, and the model is trained based on the experience. The data visualization methods are then applied for viewing the prediction and classification results. The steps involved in AI with various applications of COVID is depicted in Fig. 2.

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