BURSA ULUDAG UNIVERSITY

FACULTY OF

ENGINEERING

Department of Industrial Engineering

How can we Utilize Machine Learning and Artificial Intelligence to Cope with the COVID-19 Pandemic?

Given that we are first-year engineering students in the Department of Industrial Engineering, in this academic poster, after reviewing and discussing the literature in English in our course Communication Skills that has been coordinated by Dr. Neslihan Onder-Ozdemir in 2020-2021 academic term, we set out to share snapshots from engineers' and doctors' recommendations to tackle the COVID-19.

The COVID-19 global pandemic has been described as a "crisis" and "threat" because of its considerable effects on individuals' health, the stability of infrastructure and economies worldwide.

van der Schaar, Alaa, Floto, Gimson, Scholtes, Wood, McKinney, Jarrett, Lio and Ercole (2021) have elucidated **the most five critical challenges, four of them are practical challenges, in responding to COVID-19** in the research article titled **How artificial intelligence and machine learning can help healthcare systems respond to COVID-19**, which has been published in the journal of **Machine Learning**.

van der Schaar et al. have noted that practical challenges we face during the COVID-19 pandemic include (i) managing limited healthcare resources, (ii) developing personalized patient management and treatment plans, (iii) informing policies and enabling effective collaboration and (iv) expediting clinical trials. The fifth challenge is research challenges and accounting for uncertainty. In addition to the five most critical challenges, van der Schaar et al. (2020) draw a map to show **how we can cope with these challenges using current machine learning (henceforth referred to as ML) and artificial intelligence (henceforth referred to as AI)**. Here, **we aim to focus on the practical challenges regarding managing limited healthcare resources, which took our attention the most.**

AI is the ability of a digital computer or computer-controlled robot to perform tasks [, which are usually carried out by humans because they require human intelligence and discernment,] commonly associated with intelligent beings.

AI is a broader concept. ML is an application of AI.

Firstly, we will define what AI and ML mean in light of the literature, given that these two terms often seem to be used interchangeably and they are significant for the topic we have addressed here.

ML, in AI (a subject within computer science), is defined as the discipline concerned with the implementation of computer software that can learn autonomously [and improve from experience without being explicitly programmed]. ML is an application of AI that provides systems the ability to automatically learn. In other words, we can give machines access to data and let them learn for themselves. ML focuses on the development of computer programs that can access data and utilize the data to learn for themselves.

We should note that we need clinical data and also a variety of diverse social data to cope with COVID-19. Data from electronic health records (EHR) can be linked to the multitude of "big data" (cooperation of all the materials and information produced by public institutions and the public, e.g., data from airlines and social media) belonging to human-to-human interactions.

How can we utilize AI?

van der Schaar et al. (2021) have stated that to deal with the scarce resources in hospitals, such as testing kits and staff, we can benefit from ML to combine various data sources for accurate predictions of risk to help reveal the social structures.

Indeed, ML is able to "learn" how an individual's features (risk factors, e.g., biological, behavioral, environmental and genetic factors) with a highlight on clinical and social information can be mapped into personalized predictions of risk (Alaa & van der Schaar, 2018). However, standard epidemiological approaches— such as the Cox proportional hazards model—cannot effectively combine data from different data sources and modalities (e.g., demographic, social and imaging).

Patients with COVID-19 may experience diverse adverse events. Thus, ML methods for assessing risks at the individual level– estimating the probabilities of a patient experiencing different adverse events and how these probabilities are changing over time—have shown enhanced prediction accuracy than conventional epidemiological methods (Alaa & van der Schaar, 2018).

All in all, AI and ML may have many benefits, such as identifying people who are at the highest risk of being infected by the novel coronavirus and different severity and characteristics among patients. The authors have argued that if we integrate AI and ML into local, national, and international healthcare systems, we can save lives.

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