Disease Severity Classification Models Based on Artificial Intelligence for Hospitalized Patients with COVID-19

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Abstract

Introduction: The COVID-19 infection became rapidly a global public health problem due to its' high rate of transmission and rapid progress to severe forms. Thus, worldwide efforts were necessary to restrain the dissemination of the virus and to attempt to cease the pandemic. To achieve this, *artificial intelligence* (AI) and its' branches were of great use, whether it was *machine learning*, *data mining* or *machine vision*, these techniques were used to track and predict the spread of the virus, for diagnosis, prognosis, treatments, and drug developments. The aim of this study was to present a review of AI approaches for analyzing the COVID-19 pandemic. *Material and Methods:* Published work between July 2020 and July 2021 was analyzed, focusing on AI techniques for prediction and diagnosis in COVID-19 patients. Search queries were performed on various online databases such as ScienceDirect, SpringerNature, National Center for Biotechnology Information-PubMed, and different medical journals. Most relevant articles were withdraw using search terms like COVID-19, diagnosis, prognosis, mortality etc. *Results:* Whereas diagnosis is easy to provide through machine vision with high accuracy (98-99%), prediction is difficult to make due to lack of sample, relevant published work being based on experimental work. Several algorithms were applicated, out of which, *Artificial Neural Network* was of use both at machine vision, for diagnosis, and machine learning, for prognosis. Diagnosis of COVID-19 or prediction of mortality risk were analyzed using AI approaches mostly based on *Naive Bayes*, *Support Vector Machines*, *Decision Trees*, *AdaBoost*, univariate or multivariate logistic regression as well as their combination. The models for diagnosis included different clinical parameters, such as age, gender, prior medical conditions, smoking habits, fever, sore throat, cough, shortness of breath, loss of taste or smell, systolic blood pressure as well as lymphocytes, CRP, calcium, ferritin, potassium, eosinophils, haemoglobin. Prediction of mortality or critical events were derived considering the clinical parameters related to comorbidities, older age, higher respiratory rate, higher heart rate, CKD, lymphocyte, GFR, serum albumin, lactic acid, calcium, LDH, SpO2. Each approach was tested on different sample sizes, while the performance was reported in terms of area under the curve, accuracy, sensitivity, and specificity. *Conclusions:* The results obtained were consequent in the researched studies and, although there is a limitation for their use due to disparity of data and their prone of bias, they were of great use when it came to prognostication of COVID-19 pandemics and in diagnosis and treatment.

Keywords: COVID-19; Prognosis; Diagnosis; Mortality risk; Artificial intelligence; Machine learning; Machine vision