

# Special Issue “Fighting COVID-19: Emerging Techniques and Aid Systems for Prevention, Forecasting and Diagnosis”

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Since its emergence at the end of 2019, the pandemic caused by the COVID-19 virus has led to multiple changes in health protocols around the world. This event has also given a major boost to the development and evolution of techniques and systems to aid in the prevention, forecasting and diagnosis of this disease.

All these advances, beyond being applied to COVID-19 itself, have a broad impact on the systems developed for other diseases.

This special issue aims to collect and present cutting-edge work on the evolution and trend of COVID-19, the application of Machine Learning-based techniques for disease diagnosis (either through images or time series), experimental studies related to the virus, and systems focused on helping to contain and prevent the spread of the virus.

A total of 18 articles in various fields related to the topics listed above are included. Of these, the vast majority (17 articles) are research articles, while the remaining one is a literature review.

The papers presented will be briefly described below (sorted by publication date):

- Civit-Masot et al. [1] present a novel diagnostic-aid system based on a Convolutional Neural Network classifier to distinguish between Healthy, Pneumonia and COVID-19 patients using pulmonary x-ray images. The work obtains high accuracy results and provides one of the first imaging diagnostic-aid systems for COVID-19 in the world.
- Duran-Lopez et al. [2] provide another Deep Learning classifier system based on x-ray pulmonary images (in this case for two classes: healthy and COVID-19), with the novelty of a pre-processing mechanism and heatmap visualization.
- Hernández-Orallo et al. [3] evaluate the effectiveness of recently developed contact tracing smartphone applications for COVID-19 that rely on Bluetooth to detect contacts, studying how they work in order to model the main aspects that can affect their performance, including precision, utilization, tracing speed and implementation model.
- Rezaei and Azarmi [4] develop a hybrid Computer Vision and YOLOv4-based Deep Neural Network model for automated people detection in crowds in indoor and outdoor environments using common CCTV security cameras.
- Kozioł et al. [5] present a susceptible-infected-recovered epidemic model for predicting the spread of COVID-19, studying the impact of fractional orders of the model derivatives on the dynamic properties of the proposed model.
- Rahmadani and Lee [6] predict the spread of COVID-19 among populations and regions by providing an expansion of the susceptible–exposed–infected–recovered compartment model that considers human mobility among a number of regions.
- Born et al. [7] present a novel lung ultrasound dataset for COVID-19 alongside new methods and analyses that pave the way towards computer-vision-assisted differential diagnosis of COVID-19 from the US.
- Muñoz-Saavedra et al. [8] try to answer the following question: When training an image classification system with only two classes (healthy and sick), does this system extract the specific features of this disease, or does it only obtain the features that



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differentiate it from a healthy patient? In an attempt to answer this question, they analyze the particular case of COVID-19 detection.

- Ben Jabra et al. [9] propose an improvement for a diagnosis-aid system for COVID-19 detection using Deep Learning techniques with x-ray images, including a majority voting phase.
- António et al. [10] use data-science tools to explore the relevant open data published for all countries from the moment the pandemic began and across the first 250 days of prevalence before vaccination started, in order to identify territories with similar profiles of standardized COVID-19 time dynamics.
- Satu et al. [11] develop a cloud-based machine learning short-term forecasting model for Bangladesh, in which several regression-based machine learning models were applied to infected case data to estimate the number of COVID-19-infected people over the following seven days.
- Lombardi et al. [12] investigate an epidemic spread scenario in the Lombardy region by using the origin–destination matrix with information about the commuting flows among 1450 urban areas within the region, in order to model the epidemic spread over the networks related to work, study and occasional transfers.
- Shah et al. [13] propose an autonomous monitoring system that is able to enforce physical distancing rules in large areas round the clock without human intervention.
- Akbari et al. [14] use computed tomography scans to investigate the effectiveness of active contour models for the segmentation of pneumonia caused by the COVID-19 disease as a successful method for image segmentation.
- Rehman et al. [15] propose a framework for the detection of 15 types of chest diseases, including COVID-19, via a chest X-ray; they increased the number of classes found in previous diagnostic-aid research.
- Byeon [16] includes a feature-selection process in an AdaBoost classifier, increasing the classification accuracy for predicting high-risk groups of COVID-19 anxiety as a result.
- Kamis et al. [17] analyze the spread of COVID-19 cases in the United States from 13 March 2020 to 31 May 2020 in order to obtain highly accurate models focused on two different regimes, namely lockdown and reopen. They model each regime separately.
- Essam et al. [18] analyze COVID-19 Arabic conversations on the platform Twitter in order to detect new cases and prevent the spread of the pandemic.

Although submissions for this Special Issue have closed, research in the field of systems to aid disease diagnosis, control and prevention continues to address the many challenges we face today, such as the early detection of various cancer diseases or the detection and control of monkeypox.

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