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Hybridization of Manually Extracted and Convolutional Features for Classification of Chest X-Ray of COVID-19

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Abstract : COVID-19 is the most infectious disease these days, it was first reported in Wuhan, the capital city of Hubei in China then it spread rapidly throughout the whole world. Later on 11 March 2020, the World Health Organisation (WHO) declared it a pandemic. Since COVID-19 is highly contagious, it has affected approximately 219M people worldwide and caused 4.55M deaths. It has brought the importance of accurate diagnosis of respiratory diseases such as pneumonia and COVID-19 to the forefront. In this paper, we propose a hybrid approach for the automated detection of COVID-19 using medical imaging. We have presented the hybridization of manually extracted and convolutional features. Our approach combines Haralick texture features and convolutional features extracted from chest X-rays and CT scans. We also employ a minimum redundancy maximum relevance (MRMR) feature selection algorithm to reduce computational complexity and enhance classification performance. The proposed model is evaluated on four publicly available datasets, including Chest X-ray Pneumonia, COVID-19 Pneumonia, COVID-19 CTMaster, and VinBig data. The results demonstrate high accuracy and effectiveness, with 0.9925 on the Chest X-ray pneumonia dataset, 0.9895 on the COVID-19, Pneumonia and Normal Chest X-ray dataset, 0.9806 on the Covid CTMaster dataset, and 0.9398 on the VinBig dataset. We further evaluate the effectiveness of the proposed model using ROC curves, where the AUC for the best-performing model reaches 0.96. Our proposed model provides a promising tool for the early detection and accurate diagnosis of COVID-19, which can assist healthcare professionals in making informed treatment decisions and improving patient outcomes. The results of the proposed model are quite plausible and the system can be deployed in a clinical or research setting to assist in the diagnosis of COVID-19.

Keywords : COVID-19, feature engineering, artificial neural networks, radiology images
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