Abstract

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FUSI-CAD: Coronavirus (COVID-19) diagnosis based on the fusion of CNNs and handcrafted features

The precise and rapid diagnosis of coronavirus (COVID-19) at the very primary stage helps doctors to manage patients in high workload conditions. In addition, it prevents the spread of this pandemic virus. Computer-aided diagnosis (CAD) based on artificial intelligence (AI) techniques can be used to distinguish between COVID-19 and non-COVID-19 from the computed tomography (CT) imaging. Furthermore, the CAD systems are capable of delivering an accurate faster COVID-19 diagnosis, which consequently saves time for the disease control and provides an efficient diagnosis compared to laboratory tests. In this study, a novel CAD system called FUSI-CAD based on AI techniques is proposed. Almost all the methods in the literature are based on individual convolutional neural networks (CNN). Consequently, the FUSI-CAD system is based on the fusion of multiple different CNN architectures with three handcrafted features including statistical features and textural analysis features such as discrete wavelet transform (DWT), and the grey level co-occurrence matrix (GLCM) which were not previously utilized in coronavirus diagnosis. The SARS-CoV-2 CT-scan dataset is used to test the performance of the proposed FUSI-CAD. The results show that the proposed system could accurately differentiate between COVID-19 and non-COVID-19 images, as the accuracy achieved is 99%. Additionally, the system proved to be reliable as well. This is because the sensitivity, specificity, and precision attained to 99%. In addition, the diagnostics odds ratio (DOR) is 100. Furthermore, the results are compared with recent related studies based on the same dataset. The comparison verifies the competence of the proposed FUSI-CAD over the other related CAD systems. Thus, the novel FUSI-CAD system can be employed in real diagnostic scenarios for achieving accurate testing for COVID-19 and avoiding human misdiagnosis that might exist due to human fatigue. It can also reduce the time and exertion made by the radiologists during the examination process.