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Diagnosis of COVID-19 on Chest X-ray (CXR) Images Using CNN with Transfer Learning and Integrated Stacking Ensemble Learning

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Abstract

COVID-19 caused a pandemic outbreak, resulting in many deaths and severe economic damage since 2019. Hence, the diagnosis of COVID-19 has become one of the major fields of research. Although RT-PCR has excellent reliability and precision, it is time-consuming and laborious. Therefore, the chest X-ray was used as an alternative and reliable diagnostic tool for COVID-19. However, it requires a radiologist to analyze the X-ray images, which is limited by the availability of experts and time. Henceforth, many researchers deployed automated computer-aided diagnosis with deep learning neural networks to speed up the diagnosis of COVID-19 with high accuracy and reproducibility. This study applied six state-of-art convolutional neural networks (DenseNet201, MobileNetV2, ResNet101V2, VGG16, InceptionNetV3, and Xception) with transfer learning. An integrated stacking ensemble method was used to concatenate DenseNet201, MobileNetV2, VGG16, and Xception to produce a robust and accurate diagnostic model for COVID-19. The proposed ensemble CNN model in this study produced a test accuracy of 0.9725, sensitivity of 0.9749, and F1-score of 0.9724. © The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2024.

Author Keywords

Deep learning; Diagnosis of COVID-19; Integrated stacking ensemble; Transfer learning

Index Keywords

Computer aided diagnosis, Computer aided instruction, Convolutional neural networks, Deep learning, Transfer learning; Chest X-ray image, Deep learning, Diagnose of COVID-19, Diagnostics tools, Economic damages, Ensemble learning, Integrated stacking ensemble, Stacking, Transfer learning, X-ray image; COVID-19

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