

# Development of Artificial Intelligence(AI) – based Preliminary Screening Tool for Detecting Novel Corona Virus Disease (COVID-19) from Computed Tomography(CT) Scan Images: An Investigation Study

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## **Abstract**

The novel coronavirus (CoVID-19) has been spread over 197 countries as of 10 April 2020 and affects nearly 15 Million people worldwide. World Health Organization (WHO) declared this virus as a pandemic disease in Feb 2020, and the total number of mortality due to CoVID increases to 89,915. Currently, CoVID has been conclusively diagnosed through molecular tests with a high success rate. But, due to the scarcity of sophisticated labs and materials to perform the molecular tests (polymerase chain reaction (PCR), and real-time reverse transcription-polymerase chain reaction test (RT-PCR)), rapid antigen tests (RAT) are preferred to speed up the diagnosis time. This clinical procedure to detect CoVID is invasive, requires more facilities and trained human resources (epidemiologist or viralist) and it's time-consuming. To circumvent these issues, this work aims to utilize the radio imaging method (chest Computed Tomography (CT) scan images) to diagnose CoVID-19 using artificial intelligence methods to achieve highly accurate results in a faster response. Because, chest CT scanning is economical, non-invasive, and shows accurate effects of CoVID-19 through high-resolution chest images compared to other imaging methods. This present work aims to utilize the four major open access chest CT scan image databases of CoVID-19, other viral pneumonia, and healthy for developing an intelligent preliminary screening tool for CoVID-19 detection. Three different types of approaches have been proposed to develop an intelligent CoVID-19 diagnostic tool using AI methods. Firstly, the chest CT scan images are pre-processed and followed by segmentation methods to extract a set of morphological features relevant to the ground-glass opacities and lesions such as size, area, density, depth, and width. These features are validated by using statistical tools such as the chi-square test, Wilcoxon rank test, and one-way analysis of variance (ANOVA) to test its significance with a probability value of  $p < 0.05$ . Finally, the statistically significant features are fed into the six different types of machine learning algorithms (K Nearest Neighbor, Random Forest, Decision Tree, Probabilistic Neural Network, Support Vector Machine, and Extreme Learning Machine) to detect CoVID-19 or normal or other viral pneumonia. Secondly, the pre-processed images are converted into binary images and fed into deep learning networks such as Convolutional Neural Network (CNN), Transfer learning based CNN, Residual CNN, and Inception network to classify the samples into either CoVID-19 or normal or other viral pneumonia. Thirdly, the morphological features extracted from chest CT scan images are normalized using the binary normalization method and fed into four different types of deep learning networks as mentioned above to detect CoVID-19. The performance of the machine learning algorithms and deep neural networks are assessed through different performance metrics. The methodology that gives the highest accuracy in detecting CoVID-19 will be deployed as a software prototype and will be validated by the clinicians for improving its performance by fine-tuning the methodology.