

# Federated Learning for COVID-19 Detection: Artificial Intelligence-Assisted Diagnosis from Unsegmented Chest Computed Tomography Scans

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## Abstract

**Background and Aim:** Coronavirus Disease (COVID-19), caused by the Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, is a highly infectious disease that has had a profound global impact. Reverse transcription polymerase chain reaction (RT-PCR) remains the gold standard for SARS-CoV-2 detection; however, chest computed tomography (CT) imaging plays a crucial role in identifying COVID-19-related lung abnormalities, particularly when RT-PCR results are negative or inconclusive. In Romania, the first officially recorded COVID-19 case was reported on February 26, 2020. **Material and Methods:** In this study, we developed a federated learning (FL) framework utilizing pre-trained deep learning models to detect COVID-19 from unsegmented chest CT images. We compiled a dataset of 2,230 axial chest CT images in lung window settings, categorized into three groups: COVID-19 (1,016 images), lung cancer and non-COVID-19 lung infections (610 images), and normal lung appearances (604 images). The COVID-19 images were sourced from our institution's picture archiving and communication system (PACS) and reputable public databases, including Radiopaedia, Radiology Assistant, Harvard Dataverse, and the COVID-19 common pneumonia chest CT dataset. Three clients, each with distinct datasets, participated in the FL process, enabling collaborative model training without direct data sharing. **Results:** The FL approach demonstrated promising results in classifying COVID-19 from unsegmented chest CT images. The centralized VGG-16 model achieved a training categorical accuracy of 93.90% and a validation accuracy of 79.00%. The proposed FL VGG-16 model attained a training categorical accuracy of 83.82% and a validation accuracy of 79.32%. **Conclusions:** These findings suggest that FL can effectively facilitate collaborative model development across institutions while preserving data privacy, offering a viable adjunct diagnostic tool to enhance COVID-19 detection and patient management.

**Keywords:** Federated Learning (FL); Coronavirus Disease (COVID-19); Computed Tomography (CT); Artificial Intelligence-Assisted Diagnostics; Early Detection.

