Classification of COVID-19 in Computed Tomography using Deep Neural Networks

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November, 2020

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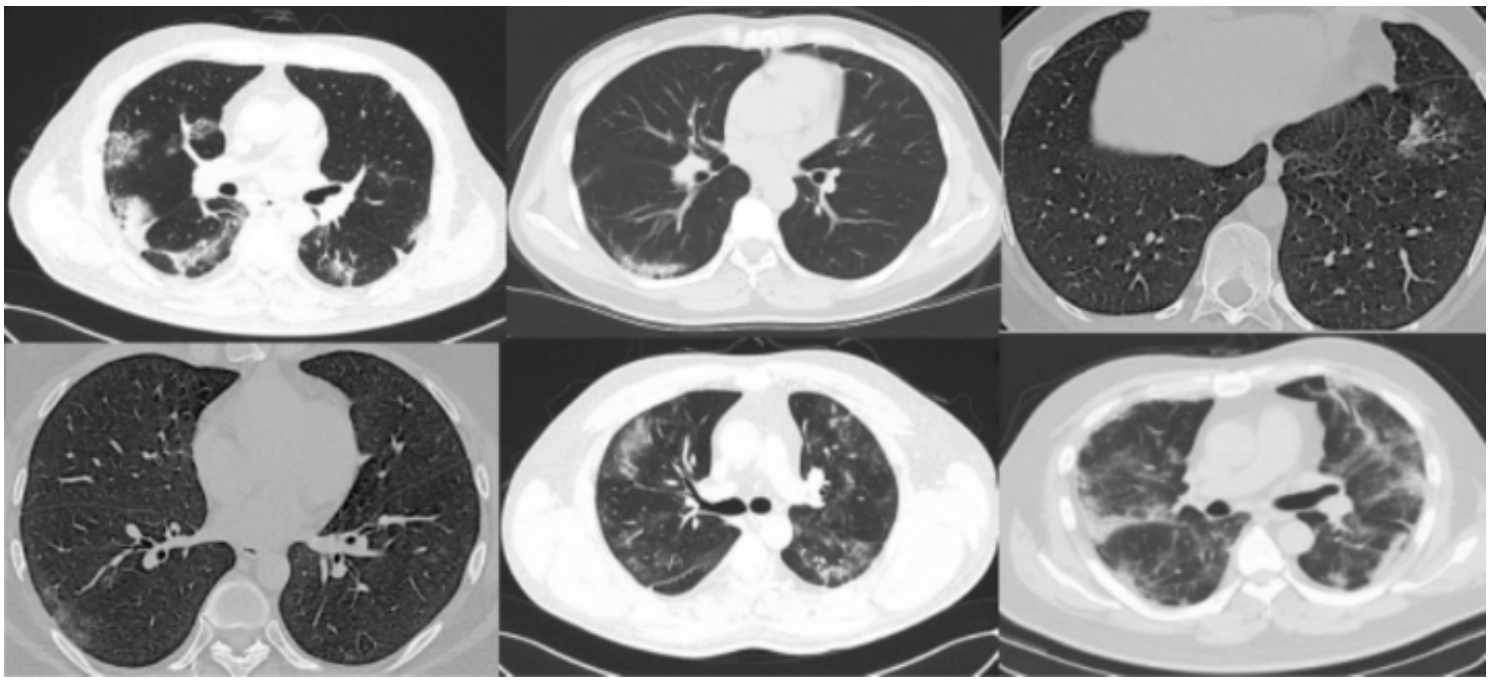
Introduction

- Deep learning in medicine is actively developing due to the large number of annotated images, increased computing power and development of new algorithms.
- The main methods for detecting the presence of the COVID-19 virus are Polymerase chain reaction (PCR) and Computing Tomography of chest scans. The advantage of CT diagnostics in the presence of a clinical picture is the speed of diagnosis and higher sensitivity compared to the reality of PCR diagnostics.
- In [1] "COVID-CT-Dataset: a CT scan dataset about COVID-19." (https://arxiv.org/pdf/2003.13865.pdf; reproducible) Zhao, Jinyu, et al. built an open-sourced dataset COVID-CT and using this dataset developed a baseline method.

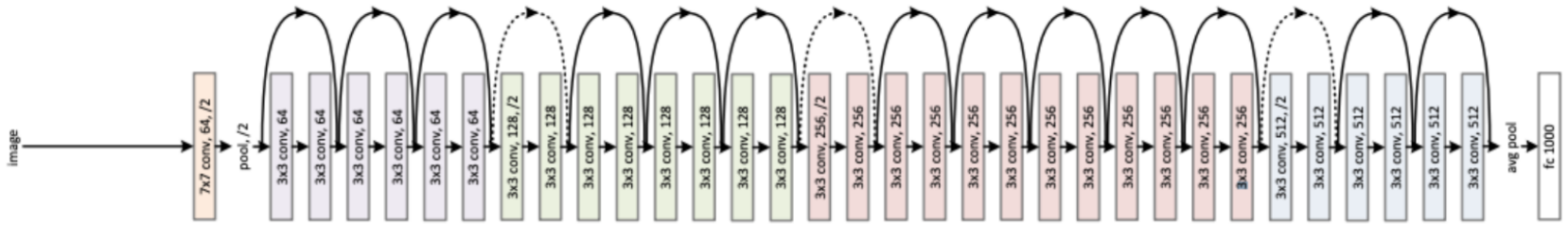
Dataset

- COVID-CT: 349 COVID and 397 Non-COVID CT images from 216 patients.
  Training set: 191/234 images
  Validation set: 60/58 images
  Test set: 98/105 images



Method

- Augmentations: each training image was resized to the shape of 256x256, randomly rotated by 90 degrees zero or more times and then transformed with random shift with a factor of 0.2 and random scale with a factor of 0.4.
- Model: we used the ResNet-34 architecture for classification of COVID images.

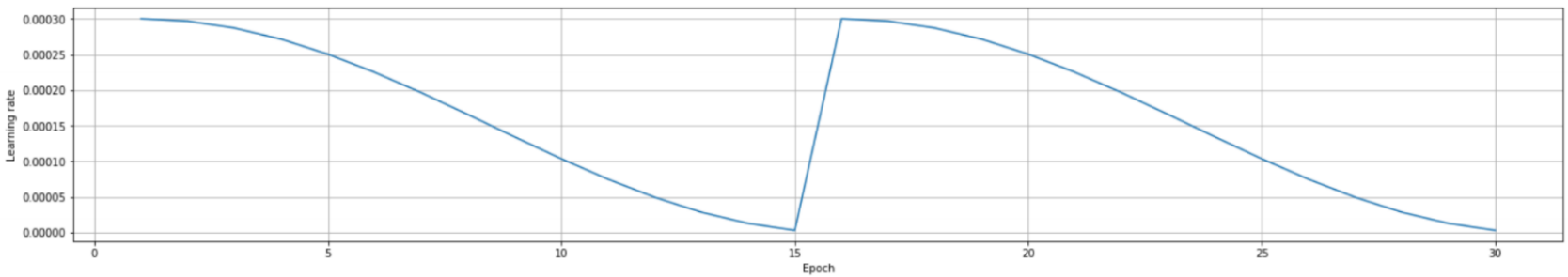


- Loss function: we used cross entropy loss.

$$CE(p, y) = -y \log(p) - (1 - y) \log(1 - p)$$

Method

- Optimizer: the weight parameters in the networks were optimized using Adam with an initial learning rate of 0.0003 and a mini-batch size of 16.
- Learning rate scheduling: learning rate of each parameter group was set by using a cosine annealing schedule



- Training process: the model was trained for 30 epochs.

Results

- Test set scores:

	Accuracy(%)	F1-score(%)
Our developed model	**84.7**	**83.7**
Classification model from [1]	79.5	76.0

Current work: new data

- COVID-19 CT Lung and Infection Segmentation Dataset (https://zenodo.org/record/3757476)
- MosMedData: Chest CT Scans with COVID-19 Related Findings (https://www.medrxiv.org/content/10.1101/2020.05.20.20100362v1)
- COVID-19 CT segmentation dataset (http://medicalsegmentation.com/covid19/)

Current work: model