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Faculty of Computers and Artificial Intelligence

Computer Science Department

2021/2022

**CS 396 Selected Topics in CS-2**

**Research Project**

Report Submitted for Fulfillment of the Requirements and ILO’s for Selected Topics in CS-2 course for Fall 2021

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* **Paper Details**
* Paper Name: Multi-Class Classification of Lung Diseases Using CNN Models
* Paper link : <https://www.mdpi.com/2076-3417/11/19/9289>
* **Project Description**

we propose a multi-class classification model that can cover a wider range of lung diseases by learning a total of five classes, from three lung diseases such as Viral Pneumonia, Bacterial Pneumonia ,Corona Virus, and Tuberculosis, to Normal which is the negative state.

# **Datasets for it** :https://www.kaggle.com/datasets/omkarmanohardalvi/lungs-disease-dataset-4-types

## **Training (**5 directories)

* Viral Pneumonia
* Bacterial Pneumonia
* Corona Virus
* Tuberculosis
* Normal

## **Testing (**5 directories)

* Viral Pneumonia
* Bacterial Pneumonia
* Corona Virus
* Tuberculosis
* Normal
* **Implementation details**

According to the paper:

first thing is that our data isn't augmented because it's already augmented

We have used EfficientNetB0 as a pre-trained model (Transfer learning):

It consists of taking features learned on one problem, and leveraging them on a new, similar problem. For instance, features from a model that has learned to identify motorcycles may be useful to kick-start a model meant to identify bicycles.

The most common incarnation of transfer learning in the context of deep learning is the following workflow:

1-Take layers from a previously trained model.

2-Freeze them, to avoid destroying any of the information they contain during future training rounds.

3-Add some new, trainable layers on top of the frozen layers.

They will learn to turn the old features into predictions on a new dataset.

4-Train the new layers on your dataset.

Fine Tuning:

A last, fine-tuning: which consists of unfreezing part of the model we obtained above,

and re-training it on the new data with a very low learning rate.

This can potentially achieve meaningful improvements,

by incrementally adapting the pretrained features to the new data.

Our Model:

This is EfficientNetB0 architectures in the following picture

We Freeze them, to avoid destroying any of the information they contain during future training rounds

Table

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Then Add some new, trainable layers on top of the frozen layers as shown in the following picture

Text

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**Optimizer:**

The optimizer used Lookahead as the wrapper and Nadam as the inner optimizer.

**Learning rate schedule:**

Learning was conducted for a total of 15 epochs. Warm Up was performed in which the learning rate was linearly increased from 0 to the initial learning rate until 4 epochs, which is almost 20% of the total epoch, and then proceeded to the initial learning rate until 4 epochs (Flat). For the remaining epochs, the learning rate was gradually decreased using the cosine annealing learning rate

* **Results**

**Before fine tuning:**

Chart, line chart

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**After fine tuning:**

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**Roc curves:**

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Description automatically generated A picture containing shape

Description automatically generated

A picture containing shape

Description automatically generated A picture containing shape

Description automatically generated

A picture containing text, sky, line

Description automatically generated

**Samples of our classes prediction**

A picture containing x-ray film, different

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**Recall, Percision, f1-Score :**

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**Confusion matrix: Calendar

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**Evaluation of our test data:**

**A screenshot of a computer

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