

Progetto Computational Intelligence and Deep Learning

Pietro Calabrese, Francesco Marabotto

December 2021

1 Proposal

1.1 Group members and MSc Degree

- Pietro Calabrese, MSc: AIDE
- Francesco Marabotto, MSc: AIDE

1.2 Brief description of the problem

Deep-learning (DL) methods in artificial intelligence (AI) play a dominant role as high-performance classifiers in the detection of the disease using chest X-rays. This is very important because chest X-ray data have been found to be very promising for assessing COVID-19 patients. The purpose of our project is to investigate the fine tuning of pretrained convolutional neural networks (CNNs) for the classification of COVID-19 using chest X-rays. If these pretrained networks provide better results than other more sophisticated CNNs, implementing AI-based tools to detect COVID-19 using chest X-ray data can be faster and more cost-effective.

This idea comes from the consultation of the paper <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7680558/>.

1.3 Properties of the dataset

The dataset we intend to use in our project is available at the following link: <https://www.kaggle.com/tawsifurrahman/covid19-radiography-database>.

This dataset is divided in four different classes:

- **COVID-19 data:** COVID data are collected from different publicly accessible dataset, online sources and published papers:
 - 2473 CXR images are collected from padchest dataset[1]

- 183 CXR images from a Germany medical school[2]
- 559 CXR image from SIRM, Github, Kaggle & Tweeter[3,4,5,6]
- 400 CXR images from another Github source[7]
- **Normal images:** 10192 Normal data are collected from from three different dataset.
 - 8851 RSNA [8]
 - 1341 Kaggle [9]
- **Lung opacity images:** 6012 Lung opacity CXR images are collected from Radiological Society of North America (RSNA) CXR dataset [8]
- **Viral Pneumonia images:** 1345 Viral Pneumonia data are collected from the Chest X-Ray Images (pneumonia) database [9]

References:

1. <https://bimcv.cipf.es/bimcv-projects/bimcv-covid19/#1590858128006-9e640421-6711>
2. <https://github.com/ml-workgroup/covid-19-image-repository/tree/master/png>
3. <https://sirm.org/category/senza-categoria/covid-19/>
4. <https://eurorad.org>
5. <https://github.com/ieee8023/covid-chestxray-dataset>
6. https://figshare.com/articles/COVID-19_Chest_X-Ray_Image_Repository/12580328
7. <https://github.com/armiro/COVID-CXNet>
8. <https://www.kaggle.com/c/rsna-pneumonia-detection-challenge/data>
9. <https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia>

1.4 Expected task(s) to be performed

The analysis is based on the classification of images, through the use of a CNN. We intend to use VGG-16, a CNN custom-made and ResNet50 networks to evaluate their efficiency and optimize them. Finally, we plan to make a comparison between the results we will obtain and those that have been achieved by the author of the paper.

Furthermore, we propose an an auxiliary classifier generative adversarial network based on GAN (generative adversarial network) for the detection of COVID-19.