SYNOPSIS

ON

COVID-19 DETECTION SYSTEM

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By

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1. Introduction [1]

Coronavirus (COVID-19) has been one of the most dangerous and acute deadly diseases across the world recently. Researchers are trying to develop automated and feasible COVID-19 detection systems with the help of deep neural networks, machine learning techniques, etc. In this paper, a deep learning-based **COVID-19 detection system called COV-VGX** is proposed that contributes to detecting coronavirus disease automatically using chest X-ray images. The system introduces two types of classifiers, namely, a multiclass classifier that automatically predicts coronavirus, pneumonia, and normal classes and a binary classifier that predicts coronavirus and pneumonia classes. Using transfer learning, a **deep CNN model** is proposed to extract distinct and high-level features from **X-ray images** in collaboration with the pertained **model VGG-16.** Despite the limitation of the COVID-19 dataset, the model is evaluated with sufficient COVID-19 images.

2. Project Objective [2][5]

By efficiently training through a relatively small image set, our fine-tuned models show high performance in the classification of COVID-19 pneumonia. Our conviction is that the proposed computer-aided diagnosis mechanism could outstandingly improve the diagnosis of COVID-19 cases. This is very helpful in a pandemic, especially when the available health resources do not match

3. Feasibility Study:

Recently, the food and drug administration (FDA) emergency approved volatile organic component (VOC) as an alternative test for COVID-19 detection. In this case-control study, we prospectively and consecutively recruited 95 confirmed COVID-19 patients and 106 healthy controls in the designated hospital for treatment of COVID-19 patients in Shenzhen, China. Exhaled breath samples were collected and stored in customized bags and then detected by high-pressure photon ionization time-of-flight mass spectrometry for VOCs. [1] Machine learning algorithms were employed for COVID-19 detection model construction. Participants were randomly assigned in a 5:2:3 ratio to the training, validation, and blinded test sets. The sensitivity (SEN), specificity (SPE), and other general metrics were employed for the VOCs based COVID-19 detection model performance evaluation. The VOCs based COVID-19 detection model achieved good performance, with a SEN of 92.2% (95% CI: 83.8%, 95.6%), a SPE of 86.1% (95% CI: 74.8%, 97.4%) on blinded test set. Five potential VOC ions related to COVID-19 infection were discovered, which are significantly different between COVID-19 infected patients and controls. This study evaluated a simple, fast, non-invasive VOCs-based COVID-19 detection method and demonstrated that it has good sensitivity and specificity in distinguishing COVID-19 infected patients from controls. It has great potential for fast and accurate COVID-19 detection. [2]

4. Methodology/ Planning of work

The proposed system COV-VGX extracts distinct features from chest X-ray images and develops two types of classifiers to predict coronavirus disease such as an automatic coronavirus detection multiclass classifier which takes an image and predicts whether the X-ray image is COVID-19 or pneumonia infected, normal cases, or not. Hence, the system proposes a binary classifier that decides between COVID-19 and pneumonia cases. After collecting the dataset from different sources, the dataset is preprocessed. Using transfer learning, pertained model VGG-16 is trained for the model evaluation. Few new layers are added with the base model to avoid the overfitting problem of training the model. [2]

Description of datasets

Many available datasets of X-ray images from normal people and pneumonia infection cases are identified.

Data augmentation helped the proposed model to perform better with exceptional features of the training images.

Convolutional neural network (VGG-16)

The features of the image are extracted through a series of convolutional layers.

Using transfer learning

Transfer learning is a method where a model trained for one classification problem is used in training for another classification problem. [4]

To evaluate the performance of COV-VGX, several performance metrics are used. Both the multiclass and binary classifiers are evaluated separately concerning accuracy, precision, recall, and F1-score. The metrics are evaluated separately for each class label. To evaluate these metrics, four basic terms are considered: true positives (TP), true negatives (TN), false positives (FP), and false negatives (FN). [2]

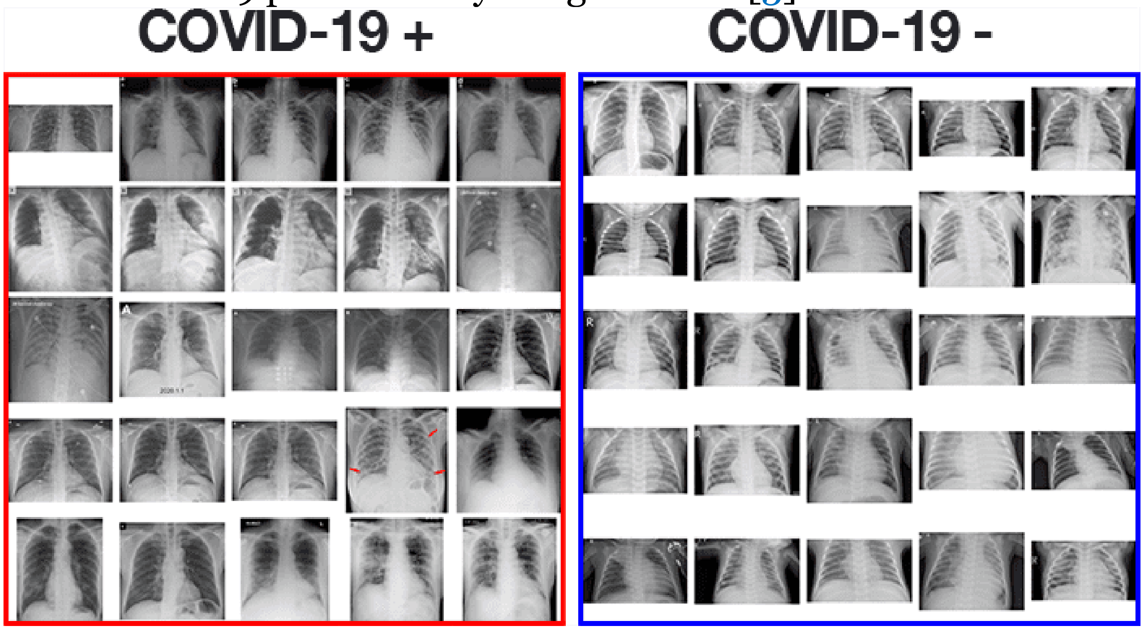
Accuracy=TP + TNTP + TN + FP + FN   0.0<Accuracy<1.0

Precision is equal to the ratio of the True Positive (*TP*) samples to the sum of True Positive (*TP*) and False Positive (*FP*) samples.

Recall is equal to the ratio of the True Positive (*TP*) samples to the sum of True Positive (*TP*) and False Negative (*FN*) samples.

F1 Score=2 × Precision × Recall Precision + Recall [5]

Our COVID-19 patient X-ray image dataset [3]



5. Tools/Technology Used:

5.1 Hardware Requirements

Internet Connection (5G)

5.2 Software Requirements

GPU (Graphics Processing Unit)
GOOGLE COLAB

6. References:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8445760
   [PubMed] [CrossRef] [Google Scholar]
2. https://link.springer.com/article/10.1007/s10044-021-00970-4
3. Dr. Joseph Cohen, a postdoctoral fellow at the University of Montreal.
4. https://pyimagesearch.com/2020/03/16/detecting-covid-19-in-x-ray-images-with-keras-tensorflow-and-deep-learning
5. https://www.frontiersin.org/articles/10.3389/fpubh.2020.00357/full

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1) Heading Font Size: 14

2) Content Font Size: 12

3) Font Name: Times New Roman

4) Line Spacing: 1.5”

5) Alignment: Left & Right both Justified

6) Margin: Normal (Top=2.54 cm, Bottom=2.54 cm, Left=2.54 cm, Right=2.54 cm)

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