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DETECTION OF COVID-19 BY LUNG SEGMENTATION OF CT IMAGES

K.KALAICHELVI (Ph.D) , DEEPIKA.V, GLORIA.A, HARISHNI.M, KARTHIKA.R

Abstract— Currently, there is an urgent need for efficient tools to assess the diagnosis of COVID-19 patients. Diagnosis is a critical preventive step in Corona virus research which has similar manifestations with other types of pneumonia. CT scans and X-rays play an important role in that direction. However, processing chest CT images and using them to accurately diagnose COVID-19 is a computationally expensive task. Deep Learning techniques have the potential to overcome this challenge. In this paper, we present feasible solutions for detecting COVID-19 patients from CT lung images of such patients. This work proposes two optimization algorithms for feature selection and classification of COVID-19. The proposed framework has three cascaded phases. Firstly, the features are extracted from the CT scans using a Convolutional Neural Network (CNN) named Alex Net. Secondly, identification of infected and non-infected regions are done by using Infection segmentation network (Inf-Net). Lastly, classification is done by back propagation technique.

Keywords— Deep learning technique, CT lung images, Convolutional Neural Network named Alex Net, Inf-Net.

I. INTRODUCTION

Computed tomographic (CT) imaging has played an important role in assessing parenchymal abnormalities in lung diseases such as chronic obstructive pulmonary disease (COPD), and more recently, the novel corona virus disease (COVID-19). CT imaging is important for diagnostics as well as quantifying disease involvement and progression over time. CT-based disease quantification can be used for patient stratification, management, and prognostication. This image dataset consists of unenhanced chest CTs from 632 patients with COVID-19 infections.

The images were acquired at the point of care in an outbreak setting from patients with Reverse Transcription Polymerase Chain Reaction (RT-PCR) confirmation for the presence of SARSCoV-2. Patients presented to a health care setting with a combination of symptoms, exposure to an infected patient, or travel history to an outbreak region. All patients had a positive RT-PCR for SARS-CoV-2 from a sample obtained within 1 day of the initial CT. CT exams were performed without intravenous contrast and with a soft tissue reconstruction algorithm. The DICOM images were subsequently converted into N1fT1 format.

Chest CT images of a 29-year-old man with fever for 6 days. RT-PCR assay for the SARS-CoV-2 using a swab sample was performed on Feb. 5, 2020, with a positive result.

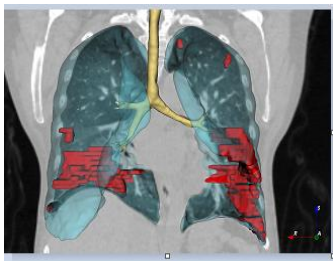


Figure 1 Covid-19 affected lung image

A. CONVOLUTIONAL NEURAL NETWORK (CNN)

CNN is of the well-regarded machine learning method sin the literature. One of the reasons of its popularity is due to the automatic hierarchical feature representation in recognizing objects and patters in images CNNs reduce the parameters of a given problem using spatial relationships between them. This makes them a more practical classifier

K.Kalaichelvi ME (Ph.D) , Assistant Professor , Department of Electronics and Communication Engineering , Anna University.
(Email ID : kalaish123@gmail.com)
Deepika.V, Department of Electronics and Communication Engineering , Anna University.
(Email ID : deepikavinayagam2503@gmail.com)
Gloria.A, Department of Electronics and Communication Engineering , Anna University.
(Email ID : gloriaasokan1999@gmail.com)
Harishni.M, Department of Electronics and Communication Engineering , Anna University .
(Email ID : harishnimahi@gmail.com)
Karthika.R , Department of Electronics and Communication Engineering , Anna University.

specially in image processing where we deal with a large number of parameters (pixels), rotation, translation, and scale of images.

B. IMAGE PROCESSING

An image processor does the functions of image acquisition, storage, pre processing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image. The following block diagram gives the fundamental sequence involved in an image processing system.

II. LITERATURE SURVEY

A. Zhoukun Ling, Asymptomatic SARS-CoV-2 infected patients with persistent negative CT findings-2020:

The corona virus named as severe acute respiratory syndrome corona virus 2 SARS-CoV-2 has infected more than 75,000 individuals, and caused over 2000 fatal cases. A previous research reported a familial cluster of COVID-19 pneumonia. In this family, a 10-year-old child had no clinical symptoms, but showed ground glass lung opacification on CT, subsequently, the patient presented positive for the SARS-CoV-2 nucleic acid by real time polymerase chain reaction (RT-PCR). Therefore, these findings indicated the clinical symptoms were not essential components of SARSCoV- 2 infection.

B. Cleo Anastassopoulou, Lucia Russo Data-based analysis, modelling and forecasting of the COVID-19 outbreak - 2020:

As the number of infected individuals, especially of those with asymptomatic or mild courses, is suspected to be much higher than the official numbers, which can be considered only as a subset of the actual numbers of infected and recovered cases in the total population, we have repeated the calculations under a second scenario that considers twenty times the number of confirmed infected cases and forty times the number of recovered, leaving the number of deaths unchanged.

C. Daniel S. Kermany, Michael Goldbaum, Identifying Medical Diagnoses and Treatable Diseases by Image-Based Deep Learning- 2020:

Our framework utilizes transfer learning, which trains a neural network with a fraction of the data of conventional approaches. Applying this approach to a dataset of optical coherence tomography images, we demonstrate performance comparable to that of human experts in classifying age related macular degeneration and diabetic macular edema. We also provide a more transparent and interpretable diagnosis by highlighting the regions recognized by the neural network.

III. EXISTING SYSTEM

Background and aims Healthcare delivery requires the support of new technologies like Artificial Intelligence (AI), Internet of Things (IoT), Big Data and Machine Learning to fight and look ahead against the new diseases. We aim to review the role of AI as a decisive technology to analyse, prepare us for prevention and fight with COVID-19 (Corona virus) and other pandemics. Healthcare organizations are in an urgent need for decision-making technologies to handle this virus and help them in getting proper suggestions in real-time to avoid its spread. AI works in a proficient way to mimic like human intelligence. It may also play a vital role in understanding and suggesting the development of a vaccine for COVID-19.

IV. PROPOSED SYSTEM

CNNs alleviate the drawbacks of Feel Forward Neural networks and Multi-Layer Perceptons by using an alternative to matrix multiplication. We use this powerful method in this study due to the nature of COVID-19diagnosis from CT images and its high-dimensional nature a generally hold-out method and a few - fold cross-validation were used during the training phase.

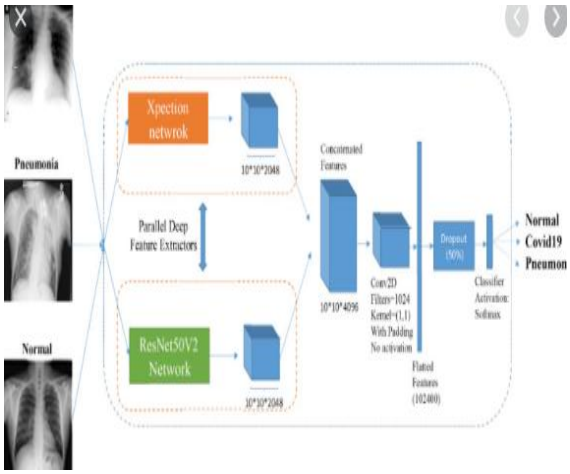


Figure 2 : COVID 19 Deep Learning System

In the hold-out method, while training is done by dividing the data into two parts as test and train, in -fold cross-validation, the data is divided into -folds, and the folds are trained times by shifting the testing fold in each training so that each fold is used in the test phase. It is used as a better method for model evaluation.

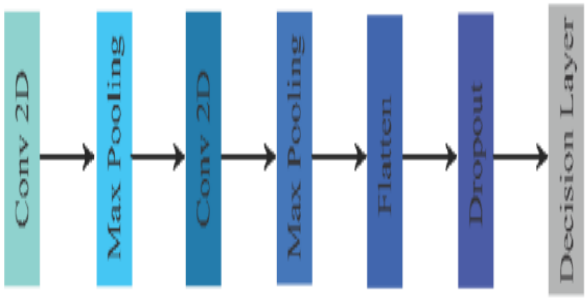


Figure 3: Layers Function

A. CONVOLUTION LAYERS

A CNN consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of convolutional layers, pooling layers, fully connected layers and normalization layers. Description of the process as a convolution in neural networks is by convention. Mathematically it is a cross-correlation rather than a convolution. This only has significance for the indices in the matrix, and thus which weights are placed at which index. A convolutional neural network (CNN or ConvNet) is one of the most popular algorithms for deep learning, a type of machine learning in which a model learns to perform classification tasks directly from images, video, text, or sound.

B. POOLING LAYERS

A pooling layer provides a typical down sampling operation which reduces the in-plane dimensionality of the feature maps in order to introduce translation invariance to small shifts and distortions, and decrease the number of subsequent learnable parameters. It is of note that there is no learnable parameter in any of the pooling layers, whereas filter size, stride, and padding are hyper parameters in pooling operations, similar to convolution operations.

C. MAX POOLING

The most popular form of pooling operation is max pooling, which extracts patches from the input feature maps, outputs the maximum value in each patch, and discards all the other values A max pooling with a filter of size 2×2 with a stride of 2 is commonly used in practice. This down samples the in-plane dimension of feature maps by a factor of 2. Unlike height and width, the depth dimension of feature maps remains unchanged.

D. FULLY CONNECTED LAYERS

Fully Connected Layer is simply, feed forward neural networks. Fully Connected Layers form the last few layers in the network. The input to the fully connected layer is the output from the final Pooling or Convolutional Layer, which is flattened and then fed into the fully connected layer. It connects every neuron in one layer to every neuron in another layer. It is the same as a traditional multi-layer perceptron neural network (MLP). The flattened matrix goes through a fully connected layer to classify the images.

AlexNet was primarily designed by Alex Krizhevsky. It was published with Ilya Sutskever and Krizhevsky's doctoral advisor Geoffrey Hinton, and is a Convolutional Neural Network or CNN. After competing in ImageNet Large Scale Visual Recognition Challenge, AlexNet shot to fame. It achieved a top-5 error of 15.3%. This was 10.8% lower than that of runner up. The primary result of the original paper was that the depth of the model was absolutely required for its high performance. This was quite expensive computationally but was made feasible due to GPUs or Graphical Processing Units, during training.

E. CNN ARCHITECTURES

Before exploring AlexNet it is essential to understand what is a convolutional neural network. Convolutional neural networks are one of the variants of neural networks where hidden layers consist of convolutional layers, pooling layers, fully connected layers, and normalization layers. Convolution is the process of applying a filter over an image or signal to modify it. Now what is pooling? It is a sample-based discretization process. The main reason is to reduce the

dimensionality of the input. Thus, allowing assumptions to be made about the features contained in the sub-regions binned.

A detailed explanation of this can be found at Understanding Neural Networks. A stack of distinct layers that transform input volume into output volume with the help of a differentiable function is known as **CNN Architecture.** (e.g. holding the class scores)In other words, one can understand a CNN architecture to be a specific arrangement of the above-mentioned layers. Numerous variations of such arrangements have developed over the years resulting in several CNN architectures.

F.ADVANTAGE

- High accuracy
- High sensitivity
- High specificity

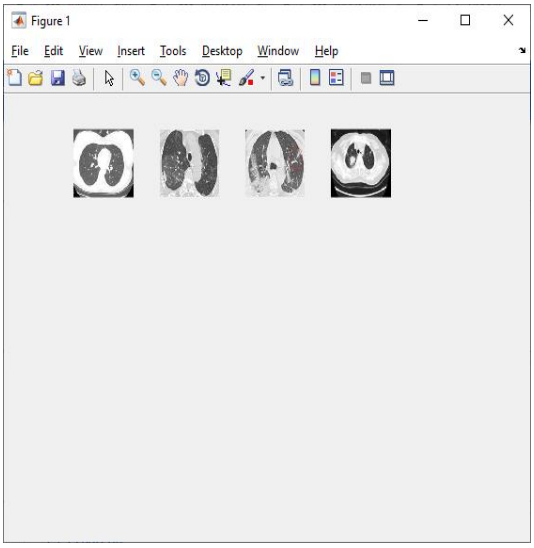
G.USAGE SOFTWARE USED

- MATLAB 2017 a

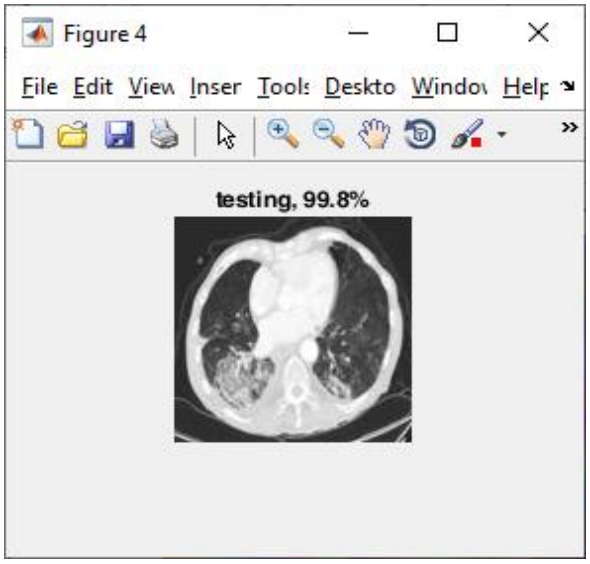
V. SIMULATION RESULTS

We trained the sample around 1261 total images its affected by the covid virus This data dataset consist of COVID and NON COVID Virus ,The image data store collected the sample dataset CNN layers are used for train and extract the feature samples values**.**

A. TRAINED SAMPLES

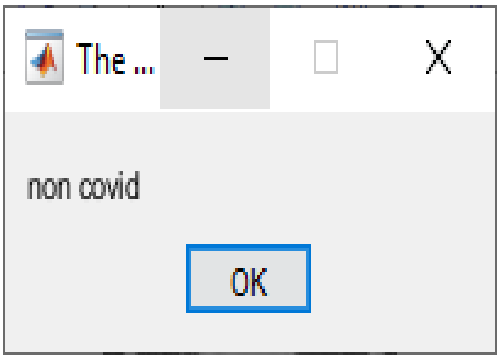


B. TESTING REPORT

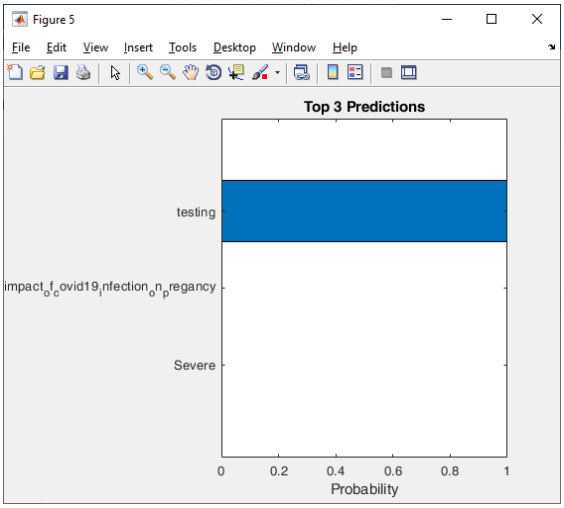


The resting result we give the testing image as given as input for tested input for provide the result of testing samples of image s.

C.RESULT



D.GRAPH RESULT



VI. CONCLUSION

We have proposed a novel COVID-19 lung CT infection segmentation network, named Inf-Net, which utilizes an implicit reverse attention and explicit edge-attention to improve the identification of infected regions. Moreover, we have also provided a semi-supervised solution, Semi-Inf-Net, to alleviate the shortage of high quality labelled data. Extensive experiments on our COVID-SemiSeg dataset and real CT volumes have demonstrated that the proposed Inf-Net and Semi-Inf-Net outperform the cutting-edge segmentation models and advance the state-of-the art performances. Our system has great potential to be applied in assessing the diagnosis of COVID-19, e.g., quantifying the infected regions, monitoring the longitudinal disease changes, and mass screening processing. Note that the proposed model is able to detect the objects with low intensity contrast between infections and normal tissues. This phenomenon is often occurs in nature camouflage objects.

FUTURE WORK

In future work we implemented the new part of deep learning algorithm for classification of COVID system and identify the stages of covid 19 system.

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