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A Deep Learning Algorithm Uses Computed Tomography (CT) Images to Screen for Corona Virus Disease (COVID-19)

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Abstract— Covid-19 is the most common Diseases that cannot be ignored and cause death with late health care. Currently, CT can be used to help doctors detect the Covid-19 effected in lung in the early stages. In many cases, the diagnosis of identifying the lung effected by Covid-19 depends on the experience of doctors, which may ignore some patients and cause some problems. Deep learning has been proved as a popular and powerful method in many medical imaging diagnosis areas. In this paper, three types of deep neural networks (e.g., CNN, DNN, and SAE) are designed for detection of Covid-19 effected in lung calcification. Those networks are applied to the CT image classification task with some modification for the benign and malignant lung nodules. Those networks were evaluated on the LIDC-IDRI database. The experimental results show that the CNN network archived the best performance with an accuracy of 84.15%, sensitivity of 83.96%, and specificity of 84.32%, which has the best result among the three networks.

Keywords – Deep learning algorithm; computer tomography; corona; covid-19;

I. INTRODUCTION

A. *COVID Introduction*

- Beginning in December, 2019, a cluster of cases of pneumonia with unknown cause was reported in Wuhan, in the Hubei province of China.
- On Jan 7, 2020, a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 previously known as 2019-nCoV).
- Identified as the causative organism by Chinese facilities via deep sequencing analysis of patients' respiratory tract samples.
- SARS-CoV-2 has been shown to infect human respiratory epithelial cells through an interaction between the viral S protein and the angiotensin converting enzyme 2 receptor on human cells;
- SCARS-CoV-2 possesses a strong capability to infect humans.

B. *CT SCAN Introduction*

- CT stands for Computed Tomography.
- It uses computer and rotating X-ray machines to create cross-sectional images of the body.
- It provides more detailed information than normal X-ray images.

C. *Objective*

- To test and validate the existing methods.
- To develop an efficient model for CT images with Deep learning techniques(DNN).
- To explore statistical analysis and establish a comparative analysis of proposed modal and existing models for CT images.
- An CT image is a reconstruction from low-resolution images to high-resolution images
- To find the stage of covid -19 effected in lungs

D. *Existing System*

- Covid-19 is one of the dangerous and life taking disease in the world. However, early diagnosis and treatment can save life. Although, CT scan imaging is best imaging technique in medical field, it is difficult for doctors to interpret and identify the Diseases from CT scan images.
- Therefore computer aided diagnosis can be helpful for doctors to identify the Diseases cells accurately. Many computer aided techniques using image processing and machine learning has been researched and implemented.
- The main aim of this research is to evaluate the various computer-aided techniques, analyzing the current best technique and finding out their limitation

and drawbacks and finally proposing the new model with improvements in the current best model.

II. PROBLEM STATEMENT

- It decreases the diagnosis accuracy;
- Can't able to assist in Diseases detection at its earlier stage
- Increases the time of the radiologist in evaluation.
- Hard to implement in Neural network systems.

A. Proposed System

- The combination of Convolution Neural Network (CNN) and Long Short-Term Memory (LSTM) architectures are discussed for the detection of Covid-19 effected in lung using the Lung Image Database Consortium (LIDC) dataset. In Deep Neural Networks (DNN) we uses CNN that contains convolution and max-pooling layers only. The max-pooling layers output is fed to the LSTM layer.
- Detecting malignant lung nodules from Computed Tomography (CT) scans is a hard and time consuming task for radiologists. To alleviate this problem, Computer-Aided Diagnosis (CAD) systems have been proposed. In recent years, deep learning approaches have shown impressive results outperforming classical methods in various fields.
- They are divided into two categories—(1) Nodule detection systems, which from the original CT scan detect candidate nodules; and (2) False positive reduction systems, which from a set of given candidate nodules classify them into benign or malignant diseases. The main characteristics of the different techniques are presented, and their performance is analyzed. The CT lung datasets available for research are also introduced. Comparison between the different techniques is presented and discussed.

III. METHODOLOGY – DEEP NEURAL NETWORKS

- A DNN is an increase in the number of hidden nodes in a simple neural network. The neural network can be used to carry on the more complex input calculation The nonlinear should be used for each hidden layer, because if the activation function is linear, compared with the single hidden layer neural network, the depth of the hidden layer of the network does not enhance the ability to express.
- The processing part of the pulmonary nodule is decomposed into the DNN, so that different network layers can be used to obtain the characteristics of the pulmonary nodules with different sizes. There are also local extremum problems and gradient diffusion problems in the DNN.

(1) preprocessing using intensity measure helps to locate small particles in an image such as node, speculation and angular margin;

(2) high detection and classification accuracy is established;

(3) removes noises that create false detection.

*A. **CNN network**:*

Existing CNNs always trained with large set of samples and having a tendency to minimizing the loss function by comprising various weights to capture all combination of different mappings

$$NL(\theta)= 1/N \Sigma \left\| F(x;\theta) - yi \right\|^2 \qquad i=1$$

where *xi* and *yi* denotes input and test images respectively, $\theta = \{W, B\}$ denotes the weights and bias components, *N* denoted the total number of samples used in training phase.

In general N is too large which makes the CNN networks extremely complex. However, in proposed framework only lesser number of samples are considered for training and generated information's are applied over the large sets of test image during validation. As a result the variety of end-to-end mapping is used based on information rate of given input image and information extracted via CNNs.

To attain the improved quality metrics, one-of the network systems are designed and examined at the equal facts. Here the proposed CNN network containing three convolution layers including the baseline network. Each layer constitutes of 64 channels and layer equipped with Rectified linear unit (ReLU) for feature activation. The input distorted image is interpolated to the same resolution as like test set model consider for experimentation. The influence of different elements used in CNN design (network depth, receptive area length and residual mastering) in overall SR performance is considered. Figure 2 indicates the basic steps involved in the proposed CNN Network.

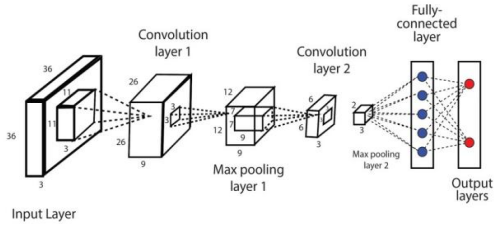
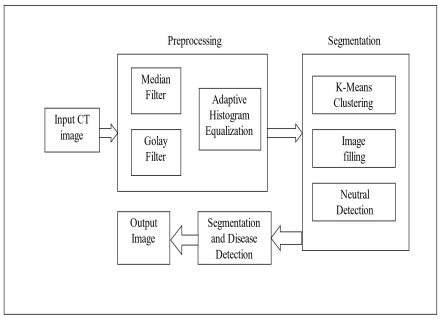


Fig:2 Architecture of CNN

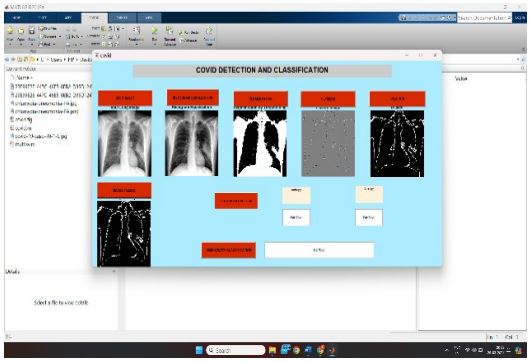
BLOCK DIAGRAM:

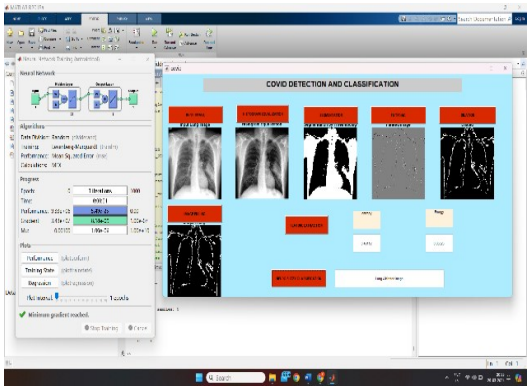


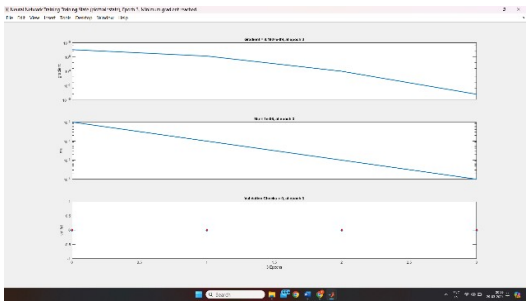
SOFTWARE REQUIREMENTS:

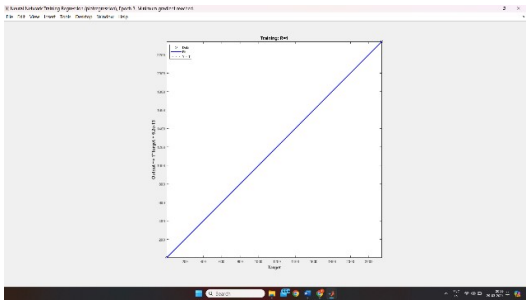
- MATLAB
- MATLAB is a proprietary multi-paradigm programming language and numeric computing environment developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages.

SIMULATION RESULT (Effected with Covid-19):









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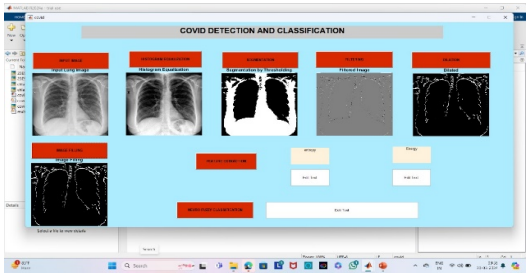

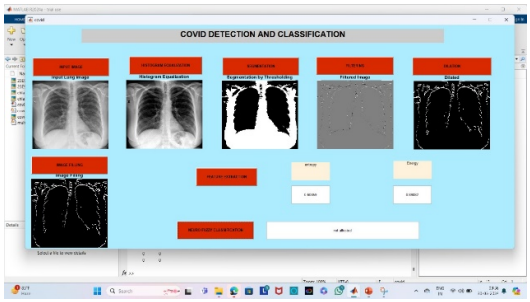

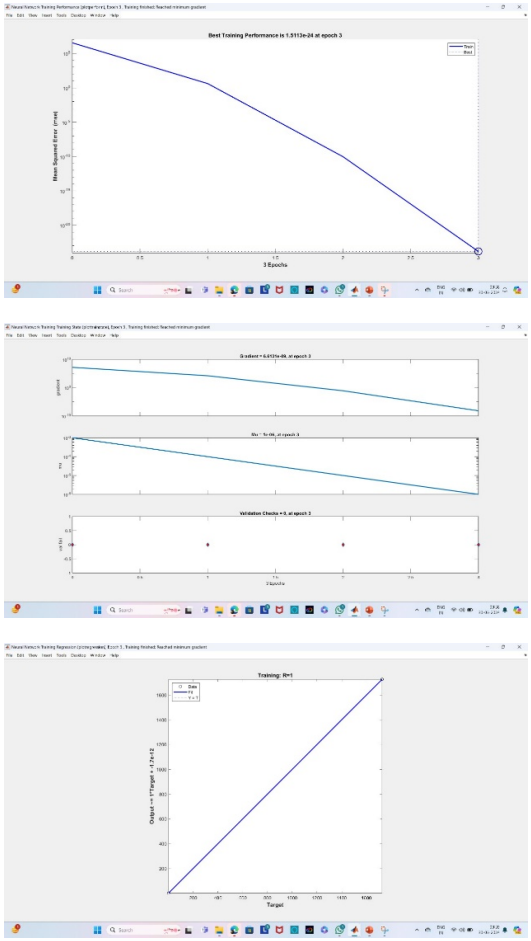

B. Advantages

- High detection and classification accuracy
- Removes noises that creates false detections
- High efficiency and detection
- State the stage of disease using CT scan images
- Easy to use this software to detect the disease in lunge

IV. CONCLUSION

In this study, we have proposed a deep learning based model to detect and classify COVID-19 cases from CT-scan images. Our model is fully automated with an end-to-end structure without the need for manual feature extraction. Our developed system is able to perform binary and multi-class tasks with an accuracy of 98.08% and 87.02% respectively. The performance of the developed model is assessed by expert radiologists and is ready to be tested with a larger database.

This system can be used in remote places in countries affected by COVID-19 to overcome a shortage of radiologists. We intend to make our model more robust and accurate by using more such images from our local hospitals.

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