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An intelligent approach for detection of covid by analysing Xray and CT scan images

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Abstract – *Coronavirus is a disease caused due to the coronavirus infection. This virus came into existence at end of 2019. It's also called as COVID-19. COVID-19 stands for CO- corona, VI-Virus, D-Disease & 19- 2019.This virus is mainly transmitted by the infected person when he/she sneezes, coughs and exhales. The daily life of humans is affected by this coronavirus. Over the globe ,people's daily lifestyle and their health as well as economy's are affected. As Covid-19 is currently a disorder that is spreading in a completely everyday place, and until now there is no single shot effective vaccine against coronavirus . The coronavirus contamination is causing all over disruptions. The World Health Organization declared the coronavirus as global pandemic. More than 165 million people are affected by this infection and 3.5 million people lost their lives. This infection mostly affects the lungs. To overcome the Disease the testing should be increased in mass scale. In conventional system we cannot know whether is there is person affected by covid (coronavirus) until the RTPCR test or rapid antigen test is done. It may take several hours to get the report whether the person is positive or negative. In severe cases just because of delay the victim may get prone to severe health condition. The proposed system will overcome all the disadvantages and will make the covid detection efficient.*

***Key Words*: RTPCR, COVID-19, Pandemic, Infection, antigen**

1. INTRODUCTION

Since December 2019, the pandemic Coronavirus has taken over the whole world. This virus was firstly reported in Wuhan, china. Since then, it got spread worldwide. Large number of people are losing their lives. The increasing number corona virus infected people are because of the time taken by the traditional methods of detecting the coronavirus infection. The RTPCR test can take around 24-48 hours to generate the report. Till the time the person gets diagnosed he can affect more people, Thus he is not only affecting himself , he is affecting others too. This creates a chain reaction like process.

The symptoms of coronavirus are distress in breathing, fever, cough, stomach ache, body pain, weakness etc. If the infection is severe, it can cause pneumonia.

This virus has spread very quickly in large context of the world. Many counties are facing the collapse of the healthcare system due to heavily infected victims. There is absolute shortage of the test kits of RTPCR and antigen kits as well. Many countries don't even have the kits which will last for a week. In such conditions this proposed system can play very important role. Due to the shortage of the test kits

the prices of the kits are sky high, not all the countries can afford to buy the kits. If the coronavirus infection is detected in early stages the workload of frontline workers (doctor, Nurses, Police, etc.) reduces a lot and the victim's chances of death gets reduced. Detecting the infection earlier makes it easier to track and isolate the suffering person.

X-ray's and CT Scans are the two very common medical imaging practices. These are used to diagnose and check the severity of an infection. Both of these have their advantages and limitations.

One of the methods to detect coronavirus infection is CT (Computed Tomography) scan. By taking the chest CT Scan of the lungs, It can detect whether the person has been infected with the coronavirus or not. This is one of the most accurate method but it's not economically efficient. Its tends to be one of the most expensive method. However, chest x-rays are cheaper than a chest Computed Tomography scans and can get the work done.

X-rays is one of oldest technique to detect the fractures, bones etc. It also allows to diagnose the lungs therefore it's also useful for detection of coronavirus. Since they are fast as well as inexpensive in nature this method can be used by the countries which are facing the test kit shortages.

We can't stop the coronavirus to spread yet we can find a way to avoid it. As indicated by the statistics, an enormous number of individuals lose their life since they don't get exposed to quick diagnosis on time. This project presents a method to diagnose the coronavirus infection in quick time just by providing the x-ray's or CT scans to the system. This is a python flask-based system consisting of web application. At the point when the person uploads his chest x-ray image or CT scan image in the system, he will get the result in no time. Whether the person is having coronavirus infection or not is decided by the CNN module. The response time of the proposed system is too little, within a couple of moments the report is generated, hence it helps in saving the lives of a large number of

people. In this paper we propose a system which can detect and classify between the coronavirus infected x-ray and normal x-ray's as well as the CT scans.

2. LITERATURE SURVEY

Research conducted by Boran Sekeroglu1 and Ilker Ozsahin2 proposes an CNN based architecture for ensuring corona virus detection. The technology allows patients to test and diagnosis the covid in real-time, potentially saving time and effort for both patients and clinicians. This system uses chest Xray images to identify the covid infection. Further studies, based on the results obtained in this study, would provide more information about the use of CNN architectures with COVID-19 chest X-ray images and improve on the results of this study.[1]

A review paper by Rubina Sarki, Khandakar Ahmed, Yanchun Zhang, and Kate Wang focused on a methodology on DL to classify and detect the COVID-19 cases from x-ray images is introduced. the model is entirely automated and is capable of categorizing binary class with 100% accuracy using VGG16 and multi-class with 93.75% using a new CNN. Accuracy obtained by existing models and models used in this study is shown. The proposed models can address a shortage of radiologists in rural areas and used to classify chest-related diseases such as viral pneumonia and COVID- 19. The system implemented is fully prepared for testing with a considerably larger directory. The added benefit of CNN includes the automatic detection of most exclusionary features among the classes. Furthermore, the study used the limited sets of data from diverse sources to analyze system robustness through its ability to respond to real- world scenarios. [2]

A study by Arpan Mangal, Surya Kalia, Harish Rajagopal, Krithika Rangarajan, Vinay Namboodiri, Subhashis Banerjee, and Chetan Arora presented some initial results on detecting COVID-19 positive cases from chest X-Rays using a deep-learning model. they have demonstrated significant improvement in performance over other existing models. the only publicly maintained tool for classification of COVID-19 positive X-rays, on the same chest-xray-pneumonia dataset. The results look promising, though the size of the publicly available dataset is small. they plans to further validate our approach using larger COVID-19 X-ray image datasets and clinical trials. [3]

A paper Rachna Jain, Meenu Gupta , Soham Taneja and D. Jude Hemanth have have few characteristic findings in the lungs of patients with COVID-19 can be identified by chest X-rays. In this study, the SOM-LWL model is suggested for diagnosis and detection of the COVID-19 disease based on chest X-rays. The number of cases continues to rise exponentially as COVID-19 spreads across the world. To prevent crippling the healthcare system, the use of a tool that can help diagnose the disease in people by using an inexpensive and fast process is necessary. Within this context, the literature suggests that the diagnosis may be assisted by the use of data mining methods to classify pneumonia disease in chest X-rays. However, the issue is much more difficult when we look at chest images of patients suffering from pneumonia caused by multiple types of pathogens and attempt to forecast a particular form of pneumonia (COVID-19).We use resampling methods in the proposed method to counter the problem's inherent imbalance. In addition, the conceptual scheme includes 8 separate sets of features derived from the images that are evaluated separately and subsequently integrated in an early fusion design. In addition, exclusively and in a late fusion configuration, the prediction outputs are tested. The suggested schema also implements multi- class, unsupervised learning (SOM clustering) and supervised learning (LWL). To apply the diagnosis model in this application field, we have considered a prediction model called SOM-LWL. In future the quality of predication method in COVID-19 disease will be combined with optimization techniques using classification and regression algorithms.[4]

A paper by Elene Firmeza Ohata, Gabriel Maia Bezerra, João Victor Souza das Chagas recommends the early detection of patients with the new coronavirus is crucial for choosing the right treatment and for preventing the quick spread of the disease. the results show that the use of CNNs to extract features, applying the transfer learning concept, and then classifying these features with consolidated machine learning methods is an effective way to classify X- ray images as in normal conditions or positive for COVID-19. For Dataset A, the MobileNet with SVM (Linear) combination had the best performance, achieving a mean Acc of 98.462% and a mean F1-score of 98.461%. In addition, it was able to classify a new image in only 0.443 ± 0.011 ms, proving to not only be accurate but fast as well. it does not replace a medical diagnosis since a more thorough investigation could be done with a larger dataset. [6]

A study proposed COVID-19 patient screening based on the results of Chest Computerized Tomography (CT) and Chest Radiographs (X-ray) by the Manjurul Ahsan,1,* Redwan Nazim,2 Zahed Siddique,3 and Pedro Huebner1.In this they suggested and assessed six different deep learning models on a mixed dataset of CT scan and chest X-ray images for their ability to identify COVID-19 patients. Study revealed that a modified MobileNetV2 can achieve an accuracy of 95%.The findings of the proposed models should provide some insights to researchers and practitioners regarding the application for the screening of COVID-19 patients based on chest X-ray and CT-scan images. Next suggested steps are to build fully validated websites, applications to be used by end user on larger scale using MobileNetV2 models and generating many insights by taking paramers like (i.e., age, gender) and categorical (findings, health conditions) data.[10]

3. MATERIALS & METHODS

Dataset

This system contains separate datasets for CT scans and Xray's. the dataset is categorized in both coronavirus infected persons and healthy noninfected persons. Their age group is ranging from 18-60. All the images in the dataset were of various dimensions so they are sized to 224×224. In the dataset the images were in both front view and side view of the chest. Only front view images are used for classification.

a)Normal x-ray b) Covid19 x-ray

Fig. 1: examples of front view chest X-Ray images. (a) Normal chest X-ray image, (b)Coronavirus infected chest image.

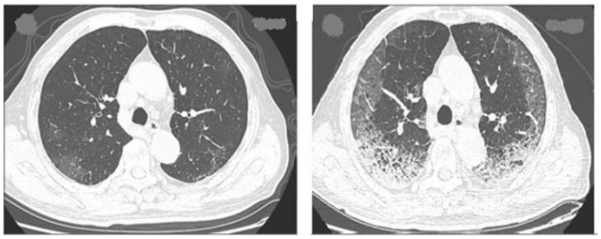

Fig.2 : View of Lungs CT Scans

The noise present in the images have to be removed by the filters, here in the proposed system 2d gaussian filter is used.

CNN

The CNN stands for Convolution Neural Network. It is a class of neural networks which are mostly used to do image recognition, image classification etc. they provide high accuracy for image classification and recognition. These are neural networks with some mathematical operation in between their layers called convolution.

Convolution neural network (CNN) can be classified into:

1. Input layer

Input layers are connected with convolutional layers that perform multiple tasks such as padding, striding, the functioning of kernels, this layer is considered as a building block of convolutional neural networks.

2. Convolutional layer

The convolutional layer's main aim is to extract the features from images and learn all the features of the image which would help in object detection techniques.

3. Pooling layer

The Pooling layer is accountable for reducing the size of the Convolved Feature. This is to decrease the computational power required to process the data. Furthermore, it is useful for extracting dominant features which are rotational and positional invariant, thus maintaining the process of effectively training of the model.

4. Fully connected layer

Fully Connected layers in neural networks are the layers which has all the inputs from one layer are connected to every activation unit of the next layer. In most popular machine learning models, the last few layers are full connected layers which compiles the data extracted by previous layers to form the final output. It is the second most time consuming layer.

5. Output layer

The output layer in a CNN is a fully connected layer, where the input from the other layers is flattened and sent so as the transform the output into the number of classes as desired by the network

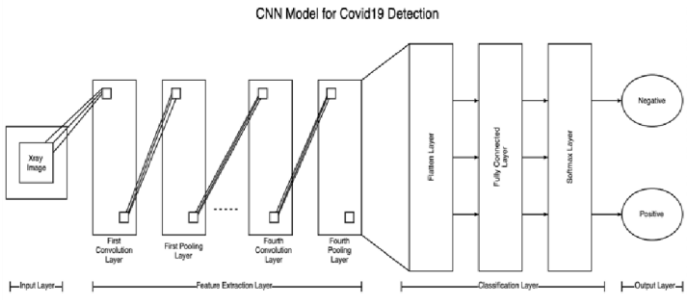

Fig. 3: CNN model proposed for system.

A multiple layered CNN model architecture is deployed for the important feature extractions from the x-ray images for the classification of coronavirus infection.

Web Interface using flask

The model needs to be converted into HDF5 format to be used in web interface. a webapp developed with the simple UI to upload the x-ray image. The pretrained CNN model is loaded in flask. the model is then used to predict

if the victim is positive or negative using the x-ray image provided. The report is also displayed onto the next screen. system

4. METHODOLOGY

CNN Models:

These are the pretrained models that are trained with a huge amount of datasets for a specific task. Because of the very rapid contamination and limited availability of resources training the CNN models from the very scratch is a hard task . thus the pre-trained models comes in picture. They are used in most of the COVID-19 detection use cases which saves time. The pretrained models are bound to deliver highly accurate predictions. In real world scenarios for the medical purposes there's always advised to take second opinion. Keeping this in mind In this proposed system two models are used for predictions.

VGG

This is the research delivered by Karen Simonyan and Andrew Zisserman from the University of Ox-ford. VGGNet is a 16-layer CNN architecture having 95 millions parameters. VGG is trained on over one billion images (1000 classes). They increased the depth of the architecture by increasing the number of convolutional layers. The smaller kernels of size 3 × 3 were also helped to improve the performance. VGG 16 and VGG 19 are the two versions of VGG architecture trained using the ImageNet dataset

InceptionNet V3

The InceptionNet eliminates most of the demerits of other architectures. It has increased performance both in term of speed and efficiency. It is a 22-layered network with limited computational power. Also known as GoogleNet. Inception V3 is very much improved version of GoogleNet. It is achieved by adding kernel factorization and batch normalization with relatively low computational cost. This architecture deals no compromise with quality.

The proposed system consists of following modules.

Login page

Login page is deployed for the authorised access. The user will get the access of the webapp with help of correct login credentials. This eliminates the probability of unauthorized access.

User index page

It's the homepage of the system. It shows the appropriate information on the screen and directs for further actions. It consists an input fields where the x-ray / CT scan needs to be uploaded in according to the availability.

Result Page

Further after the user uploads the x-ray or the CT scan the CNN Models processing is done and if it's more likely to be uninfected then probability in percentage is shown on the page by both VGG and Inception. it's found infected then the positive result is also shown.

5.TECHNOLOGY USED

All the various libraries and the technology used are as below.

Keras : it is a an open-source software library that provides a Python interface for artificial neural networks. Keras acts as an interface for the TensorFlow library.

NumPy : NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays

Pandas : pandas is a software library written for the Python programming language for the data manipulation and analysis. In particular, it offers data structures and operations for manipulating numerical tables and time series.

Flask : Flask is a python framework. It is used to deploy the web application. it does not need any particular tools or libraries

6. . IMPLEMENTATION AND RESULT

The web application is developed using python, flask, HTML, CSS. The web applications front end is developed with CSS.

This is a login page. The user needs to enter the appropriate credentials to move further.

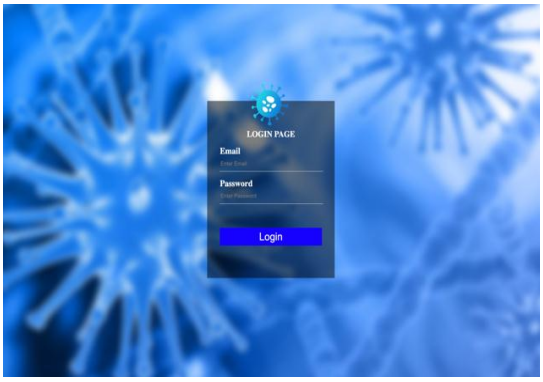

Fig.4: Login Page

The index page has information related to disease. Has two options either to upload a Xray or CT scan.

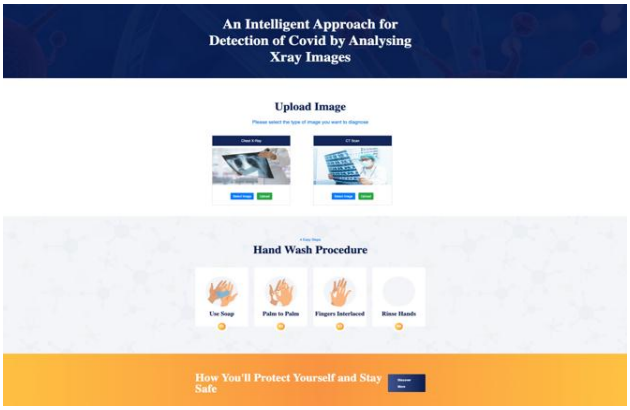

Fig.5: Index Page

According to the type selected the system will predict the probability in percentage of having the infection

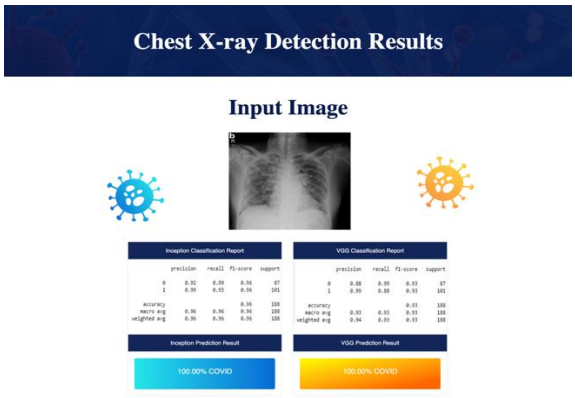

Fig.6: Result Page

7. CONCLUSION

We have proposed an intelligent approach for detection of Covid by analysing Xray Images or CT scan system that has the ability to identify coronavirus infection using xray pictures or the CT scans of chest of the victims. We have presented some early stage outcomes on detecting coronavirus positive cases from the chest x-rays or CT scans using convolution neural network models – VGG16, Inception. The system has proved to be very time saving. Early detection of the coronavirus is very critical for opting out the correct treatment and for to stop the growth of the coronavirus infection. This an intelligent approach for detection of Covid by analysing Xray Images system can be lifesaver at crucial times. The consequences are looking promising. If trained, the model with large amount of data the accuracy can be increased and can be rolled out for public use in mass scale.

8. ACKNOWLEDGMENT

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