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TELE HEALTH INTERPRETATION OF COVID-19 PATIENTS USING ARTIFICIAL INTELLIGENCE

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***Abstract*—** Cough parameter is an important measure indicator for COVID-19 disease, spread by SARS COV-2 Virus and an indicator for 100 different diseases. Through coughing the virus can spread from person to person in very eager manner. For example, when an infected individual coughs, respiratory droplets containing the virus can be released into the air, which can affect the person who comes into contact these droplets. The collected samples of cough sound helps in better screening of COVID-19 patients and their health severity. In order to have transparency regarding normal cough sound and infected cough sound(COVID-19),the cough audio data samples are collected from patients around the world, so it become possible to differentiate between COVID-19 positive, negative results and severe cough. The proposed AI model using VGG-19 mainly recognise the patterns in cough categorize the patient type is COVID infected or disinfected. Determining the top 13 highlights using power-hungry sequential direct decision (SFS) calculations and a VGG-19 classifier arrives at 0.94. With the continuous measures taken to stop the wide spread of SARC-COV 2 virus infection wherever today, and against comparative sicknesses in our hypothetical arrangement, with its minimal expense and ease of use, can play a very crucial for pre-diagnosis and analysis. We believe that hacking sounds recorded on mobile phones, or a web interface can be used to measure COVID-19 would be easy way to monitor the patients remotely.

Keywords: Artificial learning, Neural Networks, SARC-COV 2 virus. VGG-19 model Classifier.

I. INTRODUCTION

People tend to underestimate the importance of respiration and respiratory health, and they fail to recognize that their lungs are vital organs at risk of infection and injury. Numerous elements can irritate respiratory conditions, for example, tobacco smoke openness either chief roundabout; weighty openness to air contamination occupational related messes ailing health and short birth weight, yet utmost usually through openness towards infections, for example, flu infection or the Covid-19. Creation of convenient in addition to exact finding is crucial for dealing as side effects of respirational sicknesses stay habitually the same as other symptoms type, which leads to misinterpretations in diagnosis. Respiratory data such as cough, sneezing, breathing and speech factors can also be tackled by machine learning algorithms. Motivated by the above, this paper proposes a semi-version of neural network i.e., deep learning approach to detect COVID-19 with just the sounds of breathing from a smartphone microphone or using a

web application. COVID-19 is an ideal candidate for rapid, no-cost, and easily distributed pre-screening tool, especially in countries in lockdown. The cough parameter is one crucial symptoms of COVID-19 and is an indicator of over 100 different diseases, and its effects on the respiratory tract are known to vary. For an example, the lung infection can limit or restrict the travel, which can affect the sound of a cough. Further, samples were collected using the cough tube to obtain cough samples that corresponded to COVID-19. The acoustic sound of coughing is produced with the aid of the reach of respiratory muscle tissue. Cough, through entire day in the form of a sound signal, will be the final outcome of the unexpected beginning of the glottis owing to the speedy exhalation from the lungs. In order to bifurcate the begin and end of cough, the two stages are common across all coughs. Coughs generally last between 400 and 500 milliseconds here we are mainly using 50 milliseconds. It should be taken account that the audio signal is complex a signal made up of several sound waves of a single frequency go together as a central distraction. As an example of a dehydrated cough is recognized by the absence of secretion or saliva. There is therefore a reaction from all three phases present in the dry cough signal.

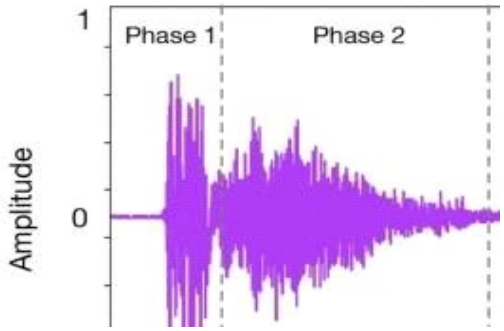

Fig 1 : An typical example of a cough sound structure

Where the sound is recorded, we only capture the emerging amplitudes of these many waves. The first phase of the pattern displays a burst of high energy, accompanied by a phase with reduced energy at higher frequencies. The cough sound mainly has 3-phases. When a cough sound in a wet form it has been observed there is more energy at higher frequencies observed in Phase-2. Often a wet cough may determine it to be symptoms of bronchospasm, asthma and pneumonia are formed with swelling and discharge of secretion and saliva into the lower extremities' germs caused by bacteria or viruses.

II.RELATED WORK

Numerous learning's has been conducted to categorise and find out lung-associated illnesses in the work of AI. Liu et al [1] which involves endorsing a multilayer lung- primarily based pulse separation set of rules a perceptron network with Hilbert-Huang converting capabilities of analysis of non-invasive pulmonic diseases. The algorithm was tested by applying R.A.L.E. multi-layer data elements , the perceptron classifier also gained small variety accuracy is ninety-five percent. Azam et al. added a respiratory machine unusual patterns were discovered because of breathing sicknesses observing the use of 255 breathing cycles taken the usage of a phone underneath environmental guidance [3]. Their inspections confirmed ambient accuracy 75% use Support Vector Machine aimed at wheezing respiration sequences and whole

breathing sounds. The very small amount of artificial intelligence frameworks has been projected and / or upgraded to get respiratory problems. Flu Sense is one among the frameworks that records bio clinically available signals pertain to visual signs and symptoms of flu-based infections of patients who will be ready for hospitalization; it uses calorific camera, microphone and neuronic computation engine for displaying correction for human coughing sound in real time. In the work of Imran et al [4] COVID- 19 based on AI application , which can diagnose, and isolate COVID-19 cough into it, such as pertussis and bronchitis. The developers of an introspection application using inhaling thuds to diagnose Corona Virus disease have also proposed a similar tool, developed by Faezipour and Abuzneid [5].

According to the study, Artificial Intelligence(AI) based application that takes input as only inhaling sounds variations that can measure the patient's bronchi volume and oxygen utilization, and investigate normal health or ill-health cases, including COVID19. Moschovis et al [6]. In order to detect various respiratory illnesses that may occur among children, SMARTCOUGH-C 2 was used to collect and analyse cough sounds. Research has been conducted by Taquee and Bhateja [7] to evaluate the sound cough to classify respiratory disorders that are not COVID-19. Aykanat et al. [2] make a non-competitive proposal to distinguish recorded breathing sounds using a digital stethoscope. They recorded on this device 17,930 lungs were heard in 1,630 studies. Their results confirmed that through using convolution neural network (CNN) and support vector machines (SVM), they can distinguish breathing sounds very accurately [8][9][10].

III. THE PROPOSED SYSTEM

The main moto of our proposed system application is to investigate a Covid patient remotely using only a cough sound with deep learning. The aim is to create an automated application being capable of identifying many characteristics of coughing parameter for Covid-19 patients and determining the result for the patient to be either positive or negative. Various respiratory ailments, including Bronchitis, Tuberculosis, and Asthma have a profound effect on the pulmonary system, and therefore they are evident in the adjustments determined at the lungs through coughing and the cough patter varies for different respiratory diseases. Asthmatic coughs for example, exhibit different sound signatures pattern than those of non-asthmatic coughs.

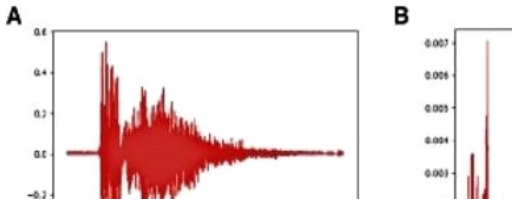

Fig 2.1 : Cough time-frequency representation analyses
(A) Cough signal (B) Power spectrum (FFT)

Alternatively, a study of cough stages found that dry cough was less intense than wet cough in the second stage. The cough sounds are found within a certain frequency for wet cough the frequency ranges from 0-750Hz range and dry cough ranges from 1500-2250Hz range. The first- rate and performance of the sound classification depends strongly on how accurately the feature extraction has been accomplished (see **Fig 2.1** & **Fig 2.2**). Voice

samples of coughing sound data had been accrued and pre-treated to log-mel spectrogram. Transmission studies with the use of VGG19 pre-skilled Convolution Neural Network (CNN) was completed with all voice modulation samples.

Fig 2.2 : (C)Spectrogram (D) MFCC

The VGG19 is widely used Convolution Neural Network (CNN) type, in particular to classify images at different levels and computer imaginative and prescient issues because of its detailed broad structure and excellent performance.

- ***Dataset Pre-processing & Feature extraction***

We are mainly using the Coswara dataset and zenodo public dataset. The vast majority of the subjects are from Asia, with 282 females and 889 males. Most of the voice recording is in zipped files. The pre-processed dataset, which was used for including extraction and classifier preparation and we mainly store them in individual directories and mapping the dataset with labels. Next we mainly combine the both dataset from Coswara and zenodo. Once the datasets are pre-processed, we move to feature extraction where we mainly extract the MFCC and Mel Spectrogram from the audio samples and save them in a separate path for training our model. The we mainly append the diagnosis into our dataframe. The extracted features will be stored in pickle format which mainly is the data model for our proposed architecture.

- ***Proposed System Architecture***

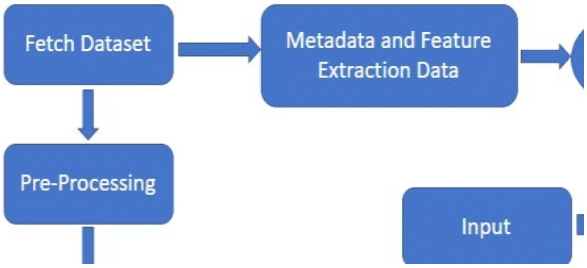

Fig 3: High level design of the proposed model

Isn the proposed system the use of VGG19 convolution neural network with pre-trained version is the most prominent. We are building a GUI that helps takes cough sound data as an input and process the sound data in our deep-learning model to understand the pattern of the cough and predict if the user is either suffering from Covid or not. We mainly try to extract all the features like MFCC and Mel Spectrogram from the cough data to train our model to get an accurate prediction for both pre-skilled transmission learning and model working. In order of transmission and retraining of VGG19, the outcome of the VGG19 was decreased and two dense layers of 64, 32 fully connected units, where each one of it added with normalization batch. Next, we are creating a pipeline for our model since the features

extracted are in different format. A 2D CNN layer was prepended the input of the pre-trained VGG19. The input layer of the full transfer learning model was 128 × 32 × 1 in dimension. So, in order to pass features to our model file it needs to be passed in a certain way.

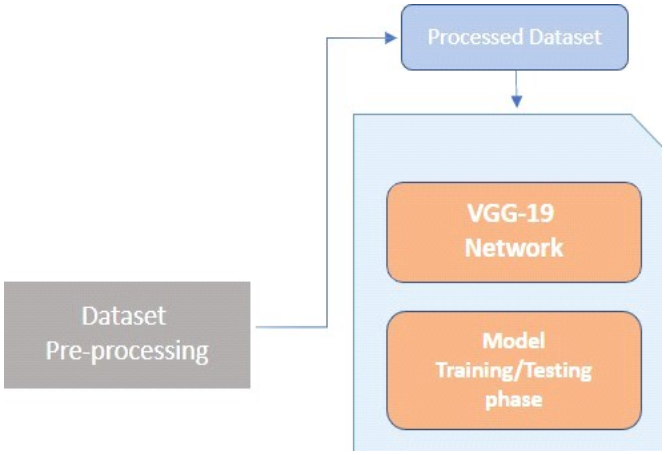

Fig 4 : Architecture of the proposed model

Whenever data is passed to our model, its sent it in batches. Data mainly flows in batches, in form of labels and in form of dimensions to our model file. Three-fold cross validation was used to assess the performance of the trained neural network for training we are mainly using vgg-19 model for real time prediction of the cough audio sample to predict if the patient is either suffering from Covid or not.

IV.RESULTS AND DISCUSSION

The proposed model is working as accepted without any model failures. The VGG19 classifier shows excellent performance, with accuracy of 0.94 and with a sensitivity of 93%. Sensitivity represents the model's ability to find the right fit studies with COVID-19 subjects. We have derived the ROC curve for our model file in the **Fig 5** with the true positive rate and false positive rate.

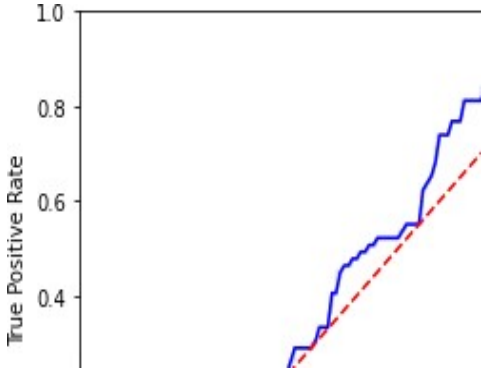

Fig 4 : ROC curve for our model

In view of the very unequal dataset we collected, we create a limited set that includes coughing for all participants with COVID-19 and the same number of non-infected people. Participants associated with age and gender, excluding medical history of voice- related conditions and without the symptoms of COVID-19.We can still improve the accuracy by using a larger

dataset with quality audio samples. So in the current paper we have built a python based GUI which mainly takes the audio file and it is passed to our trained model which mainly gives us the result whether the patient is infected with Covid or not.

V. CONCLUSIONS

The main purpose of this paper is to help people check whether they have COVID or not remotely by listening to their cough audio data. In terms of testing process for individuals, doctors & medical professionals will play vital role in addition to quality factors such as reliability and efficiency. Timely diagnosis is one of the critical indicators for evaluating such a system utilizing deep learning methods and dimensionality reduction lead to a fast classification and diagnosis. The proposed system is low-cost diagnostic tool, supported with AI. The lab- free device will be useful in many countries with limited resources. Furthermore, this system will facilitate the sharing of data and diagnoses between doctors and patients and increase the transparency of data between them. For the proposed system for the understanding of respiratory conditions and coughing patterns, machine learning algorithms applied to public large-scale datasets are the key to speeding up the realization of the proposed system.

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