INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact Factor: 6.078

(Volume 8, Issue 3 - V8I3-1187)

Available online at: https://www.ijariit.com

Review of COVID19 diagnosis using Artificial Intelligence

Vaibhav Dandage
vaibhavdandage@gmail.com
Padmshri V.B. Kolte College of Engineering Malkapur, Maharashtra

Manjiri Karande
manjiri.karande@gmail.com
Padmshri V.B. Kolte College of Engineering Malkapur, Maharashtra

ABSTRACT

Since last two years entire world is facing multiple COVID 19 waves. The disease spreads due to Novel Corona Virus 2019 and that's why the name of the disease COVID19. The virus is highly infective and spreads easily. The disease spread in entire world and now we are facing first pandemic of the 21st century. In this paper we are suggesting a noninvasive method which can be used easily by anyone to check whether they are having COVID19 or not. We are using a trained AI model to identify the input coughing audio file of a subject to diagnose whether they have been affected by COVID or not. As incubation period of the virus is nearly 2 weeks, we need to take it into consideration while performing the testing.

***Keywords*:** *Artificial Intelligence, COVID19, Corona Virus, AI Model, Machine Learning, MFCC*

1. INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease caused by the SARSCoV-2 virus. Most people who fall sick with COVID-19 will experience mild to moderate symptoms and recover without special treatment. In this review paper we are going to discuss how Artificial Intelligence Machine learning can be used to identify people infected with COVID19.

1.1 How COVID19 Spreads

The virus can spread from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak, sing or breathe. As the virus causing COVID19 spreads by air and all other direct contacts, it was a challenge to create such a methos which will stop the spread of virus during testing and will be swift. So, technology plays important role in that. Using AI and IISc Bangalore - Coswara Dataset, we are going to train an AI model and use it to do diagnosis of COVID19.

1.2 COVID19 Traditional Diagnostic Methods

There are many invasive, non-invasive methods which are used to diagnose COVID19 as below.
A] RT-PCR test. This test is called as molecular test, this COVID-19 test detects genetic material of the Corona virus using a technique called reverse transcription polymerase chain reaction (RT-PCR). A fluid from nostril of the patient is collected by a healthcare professional by inserting a long nasal swab.

B] Antigen test. This COVID-19 test detects certain proteins in the virus. Using a long nasal swab to get a fluid sample, some antigen tests can produce results in minutes. Others may be sent to a lab for analysis. A positive antigen test result is considered accurate when instructions are carefully followed. But there's an increased chance of false-negative results — meaning it's possible to be infected with the virus but have a negative result. Depending on the situation, the health care provider may recommend a RT-PCR test to confirm a negative antigen test result.

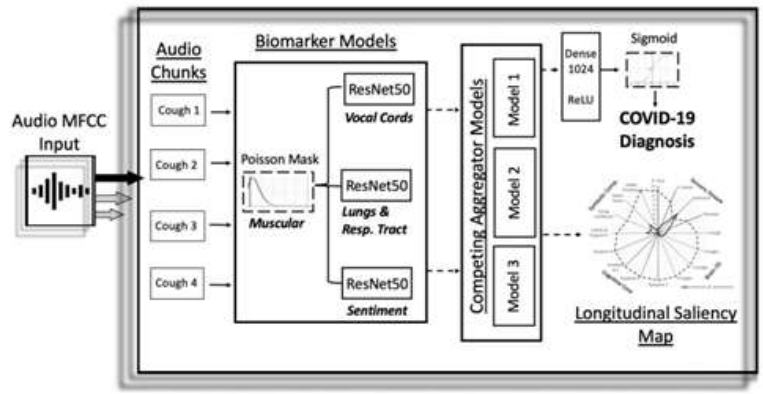
1.3 Limitations of Traditional COVID19 Diagnosis Methods

Traditional COVID19 methods are manual and need more time for diagnosis. Also, those need great amount of investment while considering on large scale population testing. There are chances of spreading virus during manual testing as it involves direct human contacts. So, the current method proposed in this paper will help to overcome it to great extent.

2. LITERATURE REVIEW

There has been extensive research to classify different audio signals using machine learning. There are various biomarkers and AI models used to diagnose different diseases using patient's audio recordings of vocal cords, coughing, breathing. While reviewing the literature we reviewed many papers published about audio processing using machine learning and different papers which use AI and patients coughing audio to diagnose their diseases. However, the major papers which we can say as base papers of this paper are as following.

One is the IEEE paper published by, Jordi Laguarta, Ferran Hueto, and Brian Subirana, about COVID diagnosis using AI model built upon Alzheimer's discriminator model which uses patients sounds to diagnose Alzheimer as shown in chart 4[1][7][9].



Overview architecture of the COVID-19 discriminator with cough recordings as input, and COVID-19 diagnosis and longitudinal saliency map as output. A similar architecture was used for Alzheimer's

Chart 4 – Overview Architecture COVID19 Discriminator Using MFCC Input

Also, we referred another paper, published by Quan Zhou1,Jianhua Shan1,Wenlong Ding1, Chengyin Wang1, Shi Yuan1, Fuchun Sun2, Haiyuan Li3 and Bin Fang-Cough Recognition Based on Mel-Spectrogram and Convolutional Neural Network, on website https://www.frontiersin.org/articles/10.3389/frobt.2021.580080/full

There are many papers available we referred to carry out this research called as CORD19[6]

Below table 1[3] shows different methods and their accuracy, which are used to diagnose COVID19 using Artificial Intelligence, Machine Learning and Coughing audio recording of the person.

Table-1[3]: Results

Methods	Random division recognition task				No-leakage division recognition task			
	Accuracy (%)	Recall (%)	Precision (%)	F1 Score (%)	Accuracy (%)	Recall (%)	Precision (%)	F1 Score (%)
Mel-spectrogram + CNN	98.18	99.18	99.28	99.23	95.18	93.33	100	96.55
Mel-spectrogram + BP	94.34	87.50	100	93.33	91.44	93.75	93.75	93.75
MFCC + CNN	97.43	88.88	100	94.12	94.04	100	88.88	94.11
MFCC + BP	96.12	97.19	93.87	97.19	93.45	90.91	100	95.23
MFCC + SVM	95.76	96.99	94.57	95.77	93.29	93.56	91.79	92.67
MFCC + K-means	52.93	42.86	53.09	47.43	50.34	42.44	44.96	43.66
MFCC + Naive-bayes	88.57	95.31	83.83	89.20	78.81	82.43	73.87	77.92
MFCC + LightGBM	95.73	98.46	93.29	95.80	89.89	88.17	89.38	88.77

3. METHODOLOGY

As shown below in Figure-1, the work-flow of our COVID-19 diagnosis using forced coughing and artificial intelligence is presented.

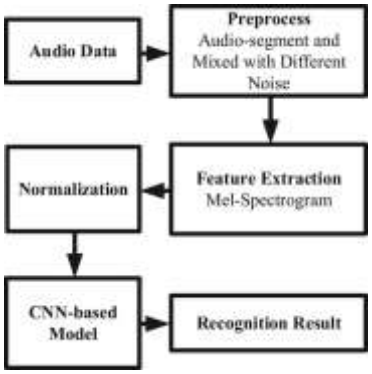


Chart -1 Flowchart of Process of COVID-19 diagnosis using forced coughing and artificial intelligence

In this workflow we are going to preprocess our data using librosa python library. Then this preprocessed data will be again used and MFFC features will be extracted from each coughing audio file. Then these MFFC features will be normalized and used to train a three-layer neural network. Then we'll integrate this trained neural network with our UI and any user can submit their coughing audio file as input and test themselves for the COVID19.

The core principle used here is that, each sound produces different structure in Mel-Spectrogram as shown below.
As each sound has different pattern in Mel-Spectrogram, we can use this to train our AI model, as shown in chart 2[3].

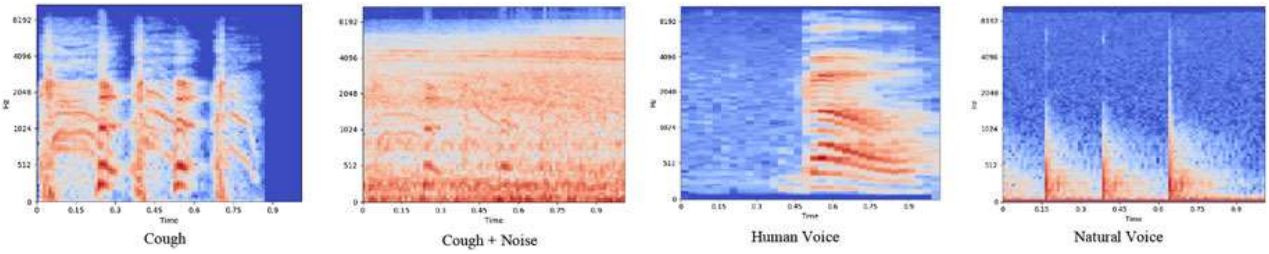


Chart -2 Mel Spectrogram of Different Sounds

As shown below in chart 3, the trained AI model can be used to classify different audio signal. There have been pre-proposed methods[7][8][9] for this type of audio classification.

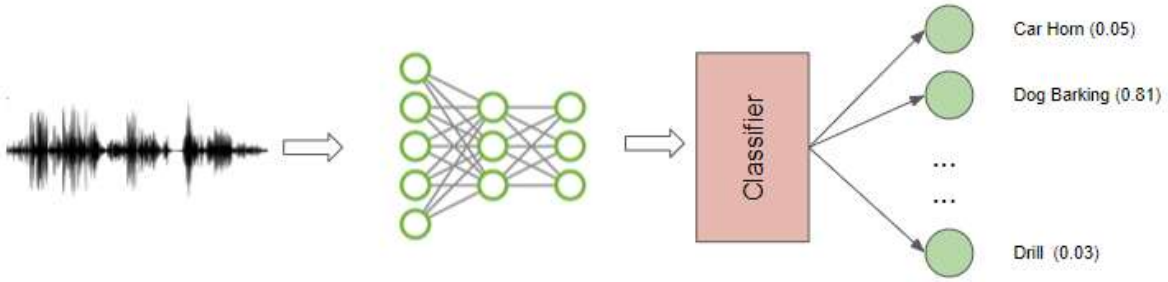


Chart -3 Flowchart to Classify Different Audio Recordings Using Artificial Intelligence

4. DATA AVAILABILITY & PREPROCESSING

In this proposed method to diagnose COVID19 patients using forced coughing recordings and Artificial Intelligence Machine Learning Model, there is need to collect the data, training AI model using the data and preprocess the data, which is explained in following points.

4.1 Data Availability

There was a project started by IISc Bangalore India, called as Coswara Project[2]. For which they developed a website https://coswara.iisc.ac.in/ where people can submit their information like forced cough recordings, symptoms if they have any, breathing sound. Which is recorded and made publicly available on website https://github.com/iiscleap/Coswara-Data . We have used this freely publicly available data to train our AI model.

4.2 Data Preprocessing

The audio data needs to be preprocessed before providing as input to train AI model. So we'll extract Mel Frequency Cepstrul Coefficient features also called as MFCC features from each coughing audio file. Then use these MFCC features to train our AI model. In chart you can see how different types of sounds have different patterns in Mel-Spectrogram.

5. CONCLUSION

In this project we created an artificial intelligence model which can be used to diagnose COVID19 patients by using their forced cough recordings. Although this methos will provide very good results there will be scope to add many more extensive measures for the accuracy improvement. Table 1[3] shows different methods and their accuracy which exists today.

6. ACKNOWLEDGEMENT

I express my gratitude towards my guide Prof. Manjiri Karande, PVBKCOE, Malkapur and HOD DCE Mr. Farfat Sir PVBKCOE, Malkapur who helped me in conducting this research.

7. REFERENCES

[1] Jordi Laguarta , Ferran Hueto, and Brian Subirana – "COVID-19 Artificial Intelligence Diagnosis Using Only Cough Recordings", IEEE OPEN JOURNAL OF ENGINEERING IN MEDICINE AND BIOLOGY, VOL. 1, 2020

[2] Arup Anupam, N Jagan Mohan, Sudarsan Sahoo, Sudipta Chakraborty, "PRELIMINARY DIAGNOSIS OF COVID-19 BASED ON COUGH SOUNDS USING MACHINE LEARNING ALGORITHMS", 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS)

[3] Quan Zhou1,Jianhua Shan1,Wenlong Ding1, Chengyin Wang1, Shi Yuan1, Fuchun Sun2, Haiyuan Li3 and Bin Fang- "Cough Recognition Based on Mel-Spectrogram and Convolutional Neural Network," https://www.frontiersin.org/articles/10.3389/frobt.2021.580080/full

[4] Ahmed Fakhry, Xinyi Jiang, Jaclyn Xiao, Gunvant Chaudhari, Asriel Han, Amil Khanzada, "Virufy: A Multi-Branch Deep Learning Network for Automated Detection of COVID-19"
https://arxiv.org/ftp/arxiv/papers/2103/2103.01806.pdf
[5] Md. Afzal Hossan, Sheeraz Memon, Mark A Gregory, "A novel approach for MFCC feature extraction", Publisher: IEEE
[6] Lucy Lu Wang, Kyle Lo, Yoganand Chandrasekhar, Russell Reas, Jiangjiang Yang, Darrin Eide, Kathryn Funk
Rodney Kinney, Ziyang Liu, William Merrill, etc. "CORD-19: The Covid-19 Open Research Dataset",
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7251955/
[7] MIT, "Artificial intelligence model detects asymptomatic Covid-19 infections through cellphone-recorded coughs"
https://news.mit.edu/2020/covid-19-cough-cellphone-detection-1029
[8] Feng Rong, "Audio Classification Method Based on Machine Learning", Publisher: IEEE
[9] Krish Naik, "Audio-Classification" – Published on – "GitHub"
[10] Longitudinal Speech Biomarkers for Automated Alzheimer's Detection - https://www.researchgate.net/figure/Impact-of-Poisson-mask-on-AD-performance-Baseline-is-a-ResNet50-trained-on-the-AD-task_tbl1_343728225

