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# Intelligent Breath Analyzer System using Machine Learning Approach

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**Abstract**
We propose DeepBreath, a deep learning model which automatically recognized people's psychological stress level (mental overload) from their breathing patterns. Using a low cost Microphone, we track a person's breathing patterns as temperature changes around his/her nostril.
First of all, instead of creating handcrafted features to capture aspects of the breathing patterns, we transform the uni-dimensional breathing signals into two dimensional respiration variability spectrometer (RVS) sequences. Finally, a data augmentation technique, inspired from solutions for over-fitting problems in deep learning, is applied to allow the CNN to learn with a small-scale dataset from short-term measurements Finally, the dataset of labeled thermal images will be open to the community**.** This review presents and discusses a new frontier for fast, risk-free and potentially inexpensive diagnostics of respiratory diseases by detecting volatile organic compounds (VOCs) present in exhaled breath. Ideas regarding the improvement of Microphone and the further planning of work flow are also discussed The other part discusses diverse Microphone that have been developed and used for the detection of respiratory diseases In this project using microphone we predicted that the person has a Covid-19 positive or not .In this project ,we have make such type of App ,in which first we take some sample of covid-19 that we stored the data in the App for analyze. When any person started breathing the sensor of the microphone sensor the breathing pattern and matches with the given input data whichever already stored in the App using machine learning. And after comparis it shows us that the person is suffering from covid-19 or Not. In this our App is working. The occurrence of asynchronous breathing (AB) during mechanical ventilation (MV) can have detrimental effect towards a patients recovery. Hence it is essential to develop an algorithm to automate AB detection in real time . In this study a method for AB detection using machine learning ,in particular Convectional Neural Network CNN is presented and its presented and its performance in identifying AB .
**Keywords**: Machine Learning, Corona Virus, Asynchronous Breathing

## 1. INTRODUCTION

Breathing is a central aspect of our whole being and is one of our most vital functions.[1] A disordered breathing pattern can be the first sign that all is not well, whether it be a mechanical physiological or psychological dysfunction.[1] It is essential, therefore, that breathing is considered in all physiotherapy assessments. Breathing practices historically span many centuries, philosophies and cultures. [2]Breathing is an important physiological task in living organisms. For humans, this process results in air containing oxygen being inhaled into the lungs, where gas exchange occurs across the alveolar-capillary membrane (1). Carbon Dioxide is excreted as part of the process, in the air released through the nose or mouth. The entire process from the inhalation to exhalation is known as a breathing (or respiration) cycle. [2]Respiratory rate is a vital sign used to monitor the progression of illness and an abnormal respiratory rate is an important marker of serious illness these studies have shown respiratory rate to be better than other vital measurements such as pulse and blood pressure in

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discriminating between stable patient sand patient at risk. [3]Using changes in respiratory rate measurements patients could have been identified as high risk up to 24hours before the event with a specificity of 95% . This paper aims to review the literature on contact and non-contact methods of respiratory rate monitoring, [4]including two methods currently being developed by our unit. Our modern society suffers from psychological stress. [2]Finally, our third contribution lays in the type of sensor used. Typically used technology for breathing tracking requires to wear Microphone.[3]
Despite our approach to automatic stress detection is Microphone independent, in this paper we investigate it through the use of a low-cost mobile thermal Microphone which was first investigated in and is still quite an underemployed sensor in affective computing. [4]In this project using microphone we predicted that the person has a Covid-19 positive or not .[6]In this project ,We have make such type of App ,in which first we take some sample of covid-19 that we stored the data in the App for analyze.[5]

When any person started breathing the sensor of the microphone sensor the breathing pattern and matches with the given input data which ever already stored in the App using machine learning. And after comparision it shows us that the person is suffering from covid-19 or Not .[6]The android phone will capture breathing data using device micro phone. This microphone data will be compared with standard covid-`19 and non covid-19 breathing patterns with the help of machine learning classifier.
The classifier will provide the output as covid-19 infected or not,[7] and the patient can be treated as per requirement. You will use Android studio IDE to create an Android application and name it as Audio Capture under package .Modify src/MainActivity.java file to add Audio Capture code. Modify layout XML file res/layout/activity_main.xml add any GUI component .Modify AndroidManifest.xml to add necessary permissions.[8] Run the application and choose a running android device and install the application on it and verify the results. [10]The Android multimedia framework includes support for capturing and encoding a variety of common audio and video formats. You can use the APIs if supported by the device hardware.[9]
Android uses a file system that's similar to disk-based file systems on other platforms. The system provides several options for you to save your app data:

**App-specific storage:** Store files that are meant for your app's use only, either in dedicated directories within an internal storage volume or different dedicated directories within external storage. Use the directories within internal storage to save sensitive information that other apps shouldn't access.[7]

**Shared storage:** Store files that your app intends to share with other apps, including media, documents, and other files.

**Preferences:** Store private, primitive data in key-value pairs.

**Databases:** Store structured data in a private database using the Room persistence library.
The hardware abstraction layer (HAL) provides standard interfaces that expose device hardware capabilities to the higher-level Java API framework. The HAL consists of multiple library modules, [10]each of which implements an interface for a specific type of hardware component, such as the camera or bluetooth module. API makes a call to access device hardware, the Android system loads the library module for that hardware

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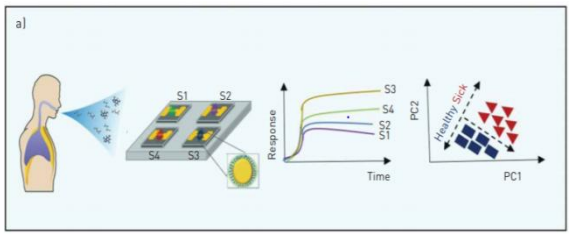


Figure 1: Infographic

For devices running Android version 5.0 (API level 21) or higher, each app runs in its own process and with its own instance of the Android Runtime (ART). ART is written to run multiple virtual machines on low-memory devices by executing DEX files, a bytecode format designed specially for Android that's optimized for minimal memory footprint. Build tools, such as d8, compile Java sources into DEX bytecode, which can run on the Android platform.[7]

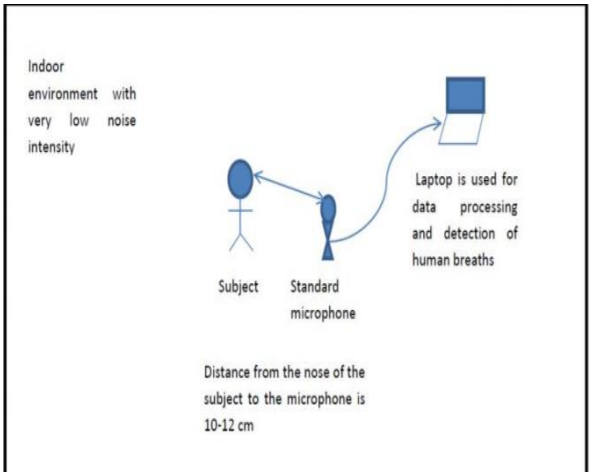


Figure 2: Experimental Setup

## 2. LITERATURE REVIEW

1.Human Breath Detection employing a Microphone Author : Divya S. Avalur, s2082330,Published : August 30, 2013.they proposed a technique supported non-contact approach for determining the breaths which involves less equipment and also incur low installation and maintenance costs. The proposed hardware consists of a customary microphone (usually connected to PC/laptop) and a laptop with a particular standard configuration. The breath of a theme matter is recorded using the microphone and is further processed using breath detection and analysis algorithm which they developed.

2.Convolutional Neural Network for Breathing Phase Detection in Lung Sounds Author: Cristina Jácome 1,†Cristina Jácome 1,†, Johan Ravn 2,†, Einar Holsbø 3 Juan Carlos Victor Maria de Borbon y Borbon Victor Maria de Borbon y Borbon Aviles-Solis 4 Hasse Melbye 4 and Lars Ailo Bongo 3,*, Published: 15 April 2019,MDPI Journal.This review paper show that convolutional neural network with spectrograms because the features is employed for breathing phase detection. this could be the first deep learning algorithm developed to identify breathing phases supported spectrogram image representation and using such an oversized lung sounds dataset (>1200 files).

3.Sensors for detecting pulmonary diseases from exhaled breath Author: HossamHaick, Technion Israel Institute of Technology, Haifa, Published : May 13 2019,@ERSpublications.This review presents and discusses a current frontier for fast, risk-free and potentially inexpensive diagnostics of respiratory diseases by detecting volatile organic compounds (VOCs) present in exhaled breath. One part of the review is also a didactic presentation of the overlaying concept and also the chemistry of exhaled breath. the alternative part discusses diverse sensors that are developed and used for the detection of respiratory diseases

4.Respiratory Pattern Recognition from Low-Resolution Thermal Imaging Author :Salla Aario1 , Ajinkya Gorad1 , Miika Arvonen2 , and Simo S¨arkk¨a1 ?Published:European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning. Online event, 2-4 October 2020 In this paper, they have presented an algorithm to trace the nostril locations and extract the temperature signal employing an occasional resolution thermal camera. they have also shown how the breathing patterns are often automatically classified supported this information.The results suggest that it's possible to identify various breathing patterns remotely employing a thermal camera.

5.Lung function, breathing pattern, and gas exchange in interstitial lung disease Author : S Javaheri, L Sicilian,Published: 1 February 1992. sease. 3 the foremost aim of this study was to figure out the relation between the pattern of breathing and gas exchange during steady state breathing at rest and ventilatory lung function in an exceedingly large group of carefully selected patients with proved interstitial lung disease.

6. Respiration Rate Monitoring Methods Author : Farah Q Al-Khalidi, Reza Saatchi, Derek Burke, Heather E Elphick, Stephen Tan, Published: 31 Jul 2011. during this paper a review of respiration monitoring approaches (both contact and noncontact) is provided. Concerns related to the patient's recording comfort, recording hygiene, and also the accuracy of respiration rate monitoring have resulted within the event of form of noncontact respiration monitoring approaches.

7. Respiration Rate Monitoring Methods Author : F.Q. AL-Khalidi 1 , R. Saatchi 1 , D. Burke2 , H. Elphick2 and S. Tan 1,Published : 31 Jul 2011.Respiration rate monitoring devices are going to be classified by sort of the way betting on the way of their use and their operation. during this review paper, they were grouped into contact and noncontact. This review has highlighted the advances made to boost the effectiveness of respiration monitoring. The potential for noncontact respiration monitoring is emphasised. Noncontact respiration rate monitoring devices have a certain advantage over contact methods, especially in children, as they cause least disturbance to the patient. Studies are still ongoing to supply more practical respiration monitoring devices. [11]

8. DeepBreath: Deep Learning of Breathing Patterns for Automatic Stress Recognition using Low-Cost Thermal Imaging in Unconstrained Settings Author : Youngjun Cho, Nadia Bianchi-Berthouze UCL Interaction Centre, Faculty of Brain Sciences University College London London, uk . employing an occasional cost thermal camera, we track a person’s breathing patterns as temperature changes around his/her nostril.[12]

9. Breathing Monitoring and Pattern Recognition with Wearable Sensors Author : Taisa Daiana da Costa, Maria de Fatima Fernandes Vara, Camila Santos Cristino, Tyene Zoraski Zanella, Guilherme Nunes Nogueira Neto and Percy Nohama . This chapter introduces the anatomy and physiology of the system, and so the explanations for measuring breathing events, particularly, using wearable sensors. Respiratory monitoring is critical including detection of apnea and measurement of rate. the automated detection of breathing patterns is equally important in other respiratory rehabilitation therapies.

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## 3. DISCUSSION

In the following subsections, we discuss the results of the current work.

i. We have demonstrated the approaches and evaluated the feasibility of detecting breathing phases utilizing acoustics breathing sounds recorded through microphone from various individuals .

ii. Mobile recording: It is fundamentally challenging to capture information from sound that is recorded with the help of mobile microphone ( nano devices).

iii. We discuss that the developed breathing detection model is able to perform real time detection smoothly with low latency on a smartphone.

iv. This software application will help us by showing quick result of test within a minute or less than that.

v. When any person started breathing the sensor of the microphone sensor the breathing pattern and matches with the given input data which ever already stored in the App using machine learning. And after compares it shows us that the person is suffering from covid-19 or not .The android phone will capture breathing data using device micro phone.

vi. One part of the review is a didactic presentation of the overlaying concept and the chemistry of exhaled breath. The other part discusses diverse sensors that have been developed and used for the detection of respiratory diseases.

We classified the breathing pattern into soft, mild and hard breath and also determine the number of breathing per second. Oxygen rate as well as body temperature is also we take as an input

## PROPOSED METHODOLOGY

There are different types of coronavirus tests that can be done:

- Swab Test – In this case, a special swab is used to take a sample from your nose or throat
- Nasal aspirate– In this case, a saline solution will be injected into your nose and, then a sample is taken with a light suction
- Tracheal aspirate– In this case, a thin tube with a torch, also known as a bronchoscope, is put into your mouth to reach your lungs from where a sample is collected.
- Sputum Test– Sputum is thick mucus that gets accumulated in the lungs and comes out with a cough. During this test, you're required to cough up sputum in a special cup or a swab is used to take a sample from your nose.

While there are several tests for the virus on the market, the most common is a nasopharyngeal swab, which involves extracting a viral sample from the nasopharynx — the space between the upper part of the throat and the very back of the nose — and analyzing those results in a lab. The only problem: Nobody likes to have their nasopharynx probed. Depending on who you ask, sticking a long, thin swab several inches deep into this chamber of secretions is surprisingly disagreeable, momentarily painful, or downright excruciating.

To overcome these pain and problems we are developing a Breathing analysis Application in which we can do our covid-19 test by our self and get result within few minutes. In this system , user have to fill some parameters like Name, Age, Temperature, SPO2 level, and there breathing pattern through there android mobile microphone. Our application will start analyzing the breathing pattern and the health parameters and give result instantly.

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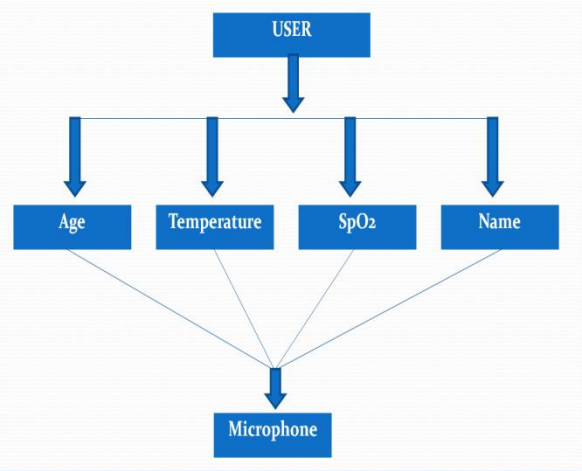
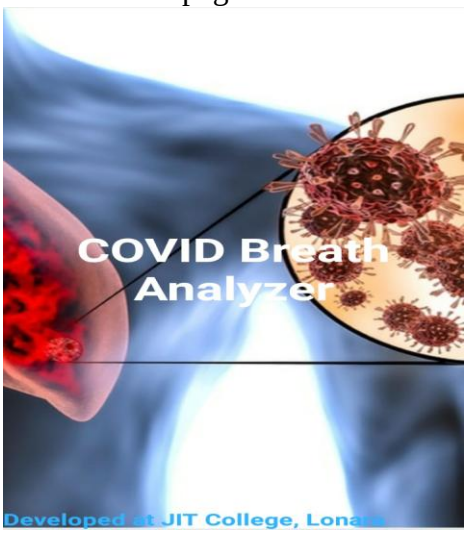



Figure 3:Data flow Diagram

We designed four layouts in our Breathing Analysis System.

- Each layout has its XML and Java codes to perform individual functions and programs.
- The first layout contains interface of home page.




Screen No 1:Home Screen

This figure shows the homescreen of the application “Covid Breath Analyzer” .This is the view of our homescreen.

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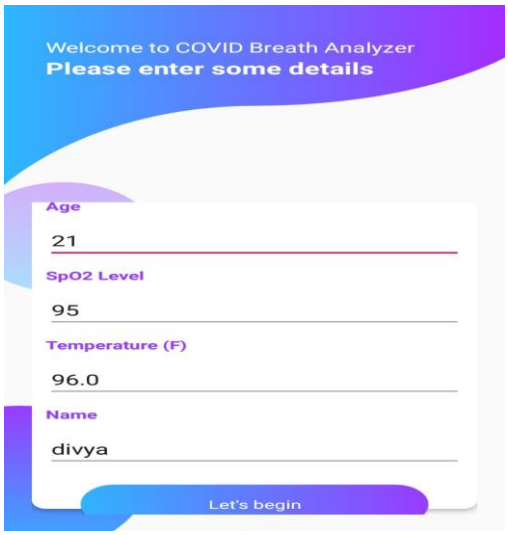
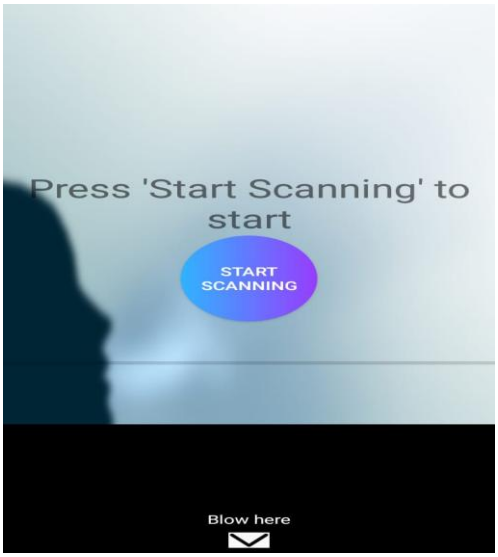



Screen No 2:User Input Screen

Secondly the user have to input some parameters as given below:

1. Temperature
2. spo2
3. Age
4. Name




Screen No 3:Blowing Screen

In the third module we are scanning the breathing pattern of user using microphone. Here the user have to blow in the microphone for scanning the breathing pattern.

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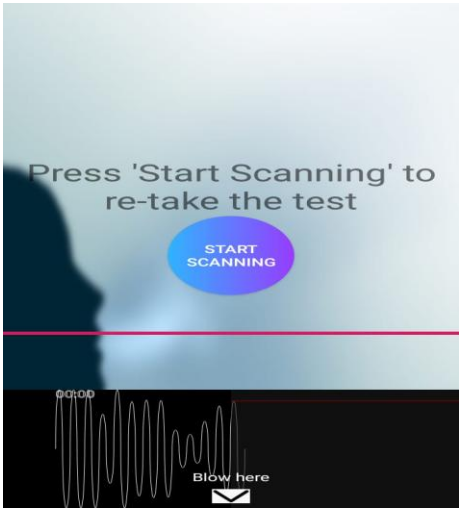
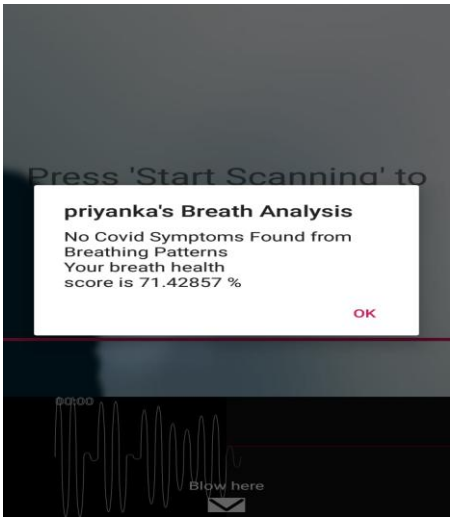



Screen No 4:Breathing Pattern

Here this layout shows the scanning pattern of breathing .We have to blow upto 18 seconds for the result to display.




Screen No 5: Result

The fourth layout is output result layout .Here you will get know whether the user is COVID Positive or Negative.

- Based on this, data analysis has been done that the user needs to go for testing or not.

## 4. CONCLUSION

The detection and analysis of breath is helpful in detecting different abnormalities in breathing. We proposed the Mobile Friendly Application for determining the breathing pattern. The proposed hardware consist of a standard microphone which is connected to our mobile phone with certain standard configuration. The breath detection is recorded using the microphone. We classified the breathing pattern into soft, mild and hard breath and also determine the number of breathing per second. Oxygen rate as well as body temperature is also we take as an input .As an immediate application we suggest the use our mobile friendly app. Using this we can save our time as well as many lives-both now and in future.

We can observe below the difference in the breathing pattern of Covid Positive and non-covid

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person.

Covid Positive person generally do not able to blow in that rate as the normal person can do,so we can observe the difference in their breathing rate and based on that we can diagonosis whether the person has infected with covid or not.

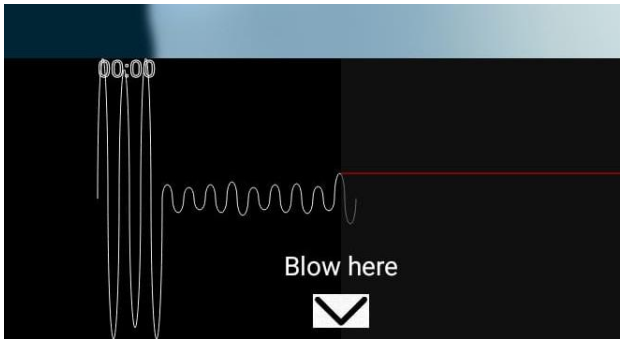


Figure 4 : Covid Positive breathing pattern graph

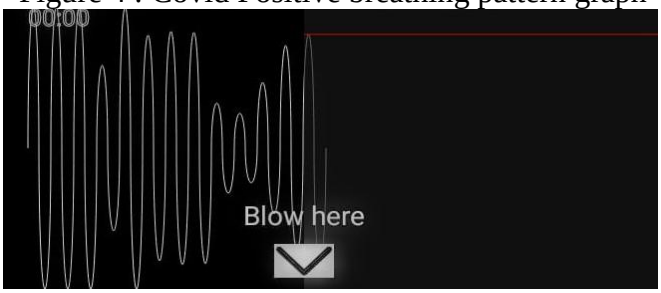


Figure 5: Non-Covid breathing pattern graph

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