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COUGH SAMPLE DETECTION AND DISEASE IDENTIFICATION USING AI

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ABSTRACT

For many illnesses, the most prevalent symptom is a cough. Diseases of the respiratory system complicate human existence. Coughs can be of numerous varieties. The diseases that cause cough symptoms can be identified by determining the type of cough. AI technologies are necessary for diagnosing illnesses. A promising technology that helps with data analysis and outcome prediction and ultimately ensures people's well-being is artificial intelligence (AI). We can say that AI algorithms can identify and locate several known diseases, such as pneumonia, pulmonary edoema, asthma, TB, COVID19, and other respiratory diseases, using cough symptoms. This work offers new opportunities, challenges, and methods for identifying respiratory illnesses through the use of various techniques and algorithms, additionally for creating and developing more effective treatments.

1. INTRTODUCTION

Coughing is a most frequent symptom of several illnesses, including COVID-19, bronchitis, asthma etc. Coughs come in two varieties: wet cough and dry cough. Every respiratory ailment has a distinct cough sound, which makes it possible for doctors to identify the patient based only on the sound of their cough. Corona virus is the deadliest disease which caused 208,112 deaths and devastated life in 213 countries and ice-lands. The losses are increasing daily.Worldwide vaccination campaigns are underway, and the only real way to stop the highly contagious COVID-19 virus is to quarantine and test the population as soon as possible. Additionally, the government is using more AI tools to assist physicians in anticipating and identifying the different illnesses, particularly in the last two years when the COVID turned into a global health crisis and there weren't enough hospitals or vaccines to treat patients properly. Because respiratory infections can be fatal, it's critical to find accessible and affordable solutions to manage them. Apps and tools based on computer-aided detection and AI tools are widely used these days as a result of the increased interest in data-driven processes and intelligent software. With their increased ability to support physicians, medical practitioners, radiologists, and other healthcare professionals with patient examinations and precise diagnosis, these intelligent medical software systems are set to revolutionize the incredibly advanced and interconnected healthcare industry. Thus, artificial intelligence widely contributes to the healthcare system's increased cost effectiveness, personalisation, accuracy, and proactiveness. None of the surveys particularly according to AI based cough detection method, the majority covered AI-based detection and diagnostic techniques based on different tools. To overcome the shortcomings of the earlier articles, we carried out a survey paper. The findings from the survey papers are shown below:

• Describe the symptoms and features of the diseases.

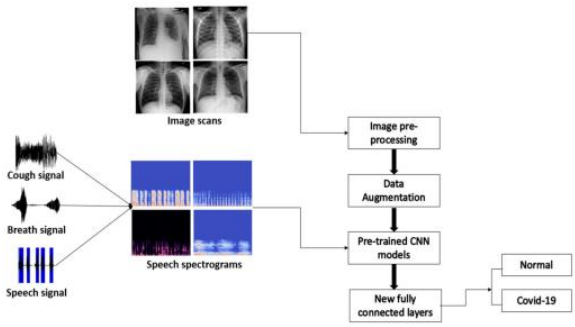
•To give a summary of the most recent methods for diagnosing the breath based diseases associated with the cough sounds.

• To give attention to the opportunities and problems facing the industry.

• Offering the fixes for it.

2. METHODOLOGY

This survey offers many methodologies that have been employed in various literature reviews to provide more effective ways to identify and diagnose various lung disorders, such as COVID-19, TB, pneumonia, and so on. With a few codes and several algorithms, machine learning models and artificial intelligence algorithms assist us in diagnosing illnesses. Additionally, several apps use cough samples to identify the illness.

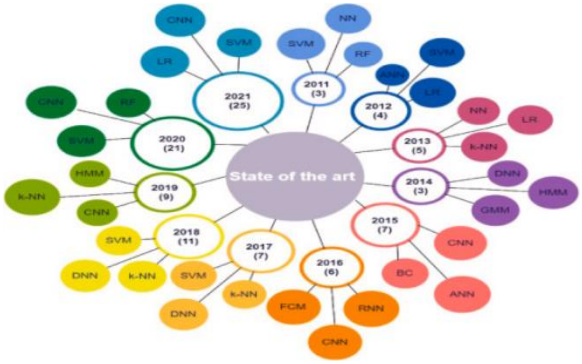


Methodology

This technology uses scanned images, which go through image pre-processing, image processing, data augmentation, and data collection.Trained CNN models then process the collected data, and connected layers connect through various illness kinds, such as normal or COVID-19. Similar to how voice spectrograms are connected to CNN models which were trained on enormous image datasets, audio signals such as cough, breath, and speech signals are connected to them. Next, they are connected to new completely layers.

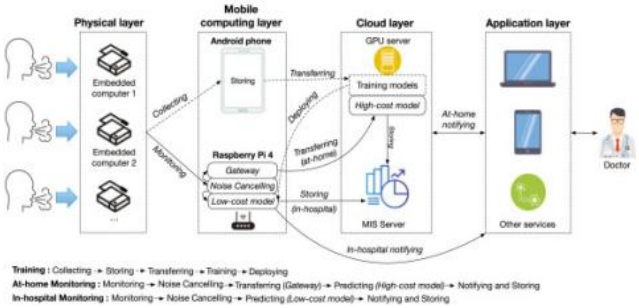
2.1 Predictive Modelling

Predictive modelling in healthcare was only source of the limited automated activities, like data cleaning and automated organization of health data, prior to the advancement of tools for AI, but it's not. Machine Learning approaches have proven to be capable of learning incredibly complex relationship in order to execute some medical-related decision-making. If the URL is invalid, the link will return. These sophisticated medical models are able to deciphering unstructured raw data and identifying patterns. Artificial Intelligence has promising results in supporting clinicians during the decision-making process. These features have garnered a lot of interest and inspired researchers to examine how well the ML models work in the medical field domain.



2.1 Predictive modelling

2.2 AI Monitoring System



2.2 AI Monitoring System

As shown in figure 2.2, it has a microphone and an embedded computer. Based on the Adafruit Raspberry Pi Zero W, the embedded computer was driven by a 3.700 mAH 3.7 V rechargeable lion battery from EEMB, as illustrated in a and b. The smartphone doesn't need to be recharged for more than 10 hours thanks to the battery. As seen in b and c, the computer was delivered in a plastic box made by a 3-D printer. The Micro Shure BETA 98H/C microphone that was utilised has a three-meter (10-foot) high-flex cable attached. In this investigation, our devices were worn on the upper arm using a specific strap to record breath sounds, as illustrated in d. The high-flex cable makes it simple to secure and change the microphone location. To record breath sounds, patients can pull and position the microphone 1-2 cm away from the subject's lips. While not as efficient as placing directly on the trachea or thorax skin, our approach is more comfortable, less prone to movement interference, and allows for an extended monitoring duration. Additionally, we created a module that runs on the embedded device and records breath sounds at an 8 kHz sampling frequency and 16 bits of sampling size. Regrettably, coughing is a frequent sign of more than a dozen different illnesses unrelated to COVID-19 that are brought on by bacterial respiratory infections. A number of non-respiratory illnesses can also induce coughing. Differential pathomorphological changes brought on by COVID-19 in the breath based system: As per the recent study, individuals infected with COVID-19 have specific early lung pathological indications even before to the beginning of the COVID-19 symptoms, including fever, dry coughs and breathing difficulties.Vascular congestion, clusters of inflammation containing fibrinoid material and evident alveolar damage with alveolar edoema and proteinaceous exudates in alveolar gaps with granules are examples of early histological abnormalities. Reactive alveolar epithelial hyperplasia and fibroblastic proliferation (fibroblast plugs) were markers of early organisation..

2.3 Formulating hypotheses and coming up with a workable plan for their validation that is informed by pertinent clinical data

Is COVID-19 cough unique enough to yield AI-based diagnosis? Cough is a most common symptom for a several respiratory diseases caused by either bacterial or viral respiratory infections apart from COVID-19. Many other than respiratory conditions can also cause cough. Different pathomorphological alternations in respiratory system caused by COVID-19 are mentioned as : According to a recent study, individuals infected with COVID-19 have specific early lung infections indications even before the onset of COVID-19 symptoms, including fever, cough, and difficulties in breathing etc. Early detection of abnormalities include vascular congestion, fibrinoid substances and multinucleated gaint cells in inflammatory clusters , and proteinaceous exudates in alveolar gaps with granules. Early organisation was indicated by fibroblastic proliferation which is also called fibroblast plugs and reactive alveolar epithelial hyperplasia.

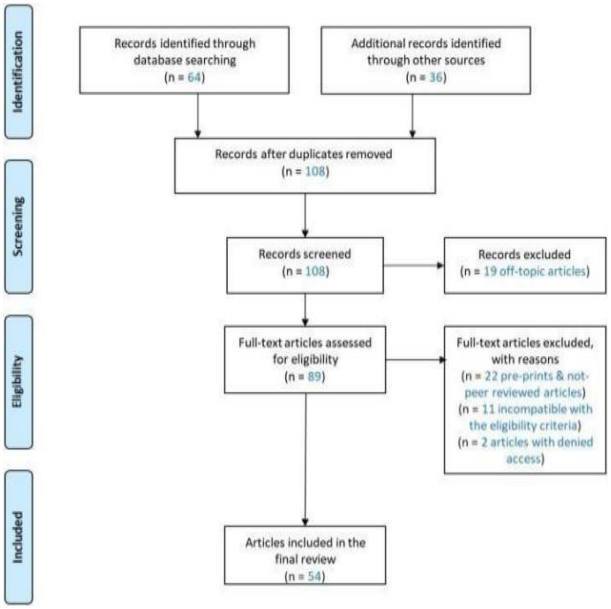
2.4 Description of data and practical viability of the solution with accessible data

Data utilized for the training to detect cough: We create a cough detector in the AI-engine to enable the AI4COVID-19 app to use in public spaces or locations where distinct background noises might be present. This cough detector AI can differentiate around 50 different common environmental noises and cough sounds by filtering the noises and coughs before the diagnosis. To train our detector, we use the ESC-50 dataset additionally to the cough and non-cough noises recorded from our own mobile application. The ESC-50 dataset is which is available publicly that provides an extensive range of human and environmental sounds. One freely accessible dataset that offers a vast array of ambient and human sounds is the ESC-50 dataset. Information utilised to train the COVID-19 diagnostic engine:

We gathered cough samples from COVID-19 patients, moreover those who had bronchitis and pertussis and other diseases, to train and evaluate our cough diagnosis system. Additionally, we gathered typical sounds of a cough from individuals in good health. As of this writing, we were able to train our diagnosis system using 247 normal cough samples, 70 COVID-19, 130 pertussis, and 96 bronchitis samples from various individuals.

2.5 Digital imaging, technologies and applications of Artificial Intelligence

Elsevier is one example of how Google Scholar serves as an umbrella server for a different databases. In terms of the diversity and reliability of multidisciplinary papers on COVID-19, PubMed and IEEE Xplore were equivalent. To offer an additional gateway for more publications related to technology, AI, and COVID-19, the FCHS learning centre database was utilized. Using particular qualifying standards, the retrieved literature cohort's candidature was established; articles that are composed in English papers with peer review and full text that were made available between March 2020 and September 2020 research and publications produced during the COVID-19 epidemic. Publications including COVID-19, artificial intelligence, and technology-related keywords. A secondary exclusion criterion, which included pre-print publications and articles awaiting peer review, completed the further stratification of articles. publications to which access is restricted. publications that don't fit the range of the research. articles without a revision schedule that includes the dates of submission, review, and publication. articles with biased or subjective opinions regarding the suggested review topic. Forty publications concentrating on artificial intelligence's contributions to the healthcare sector during COVID-19 were found through the secondary search. On September 5, 2020, phase three got underway, with the examination of IEEE Xplore and PubMed. According to statistics, the chosen data included two papers from the FCHS learning centre database, three pieces from IEEE Xplore, and twelve publications from PubMed.



2.5 Digital Imaging

3.FUTURE PLANS

Respiratory issues can range from a normal cold to emphysema. It is imperative to conduct additional study on these and other unidentified ailments to broaden extent of the current issues and illnesses. This gives us a wider fishnet, enabling us to identify and classify as many illnesses as we can. Since this is a relatively new technology, accuracy will increase with time and practice. Putting together a collection of coughs related to each condition is the next important step. Making it as easy as matching the cough sample of an individual now with an existing cough is the aim. We should be able to learn a great deal about the patient's respiratory health from it. It will possible for us to improve and organise the cough detection and diagnose system as we investigate and develop more sophisticated technologies.

4. CONCLUSION

The least we can do given the increased prevalence of respiratory illnesses, including COVID-19, is to determine the issue as soon as possible and take action to eradicate it while it is still minor in scope. It's always preferable to prevent than to cure. However, some medical diseases are quite subtle and don't manifest symptoms until they get to the point where they can't be treated. Therefore, developing technology such as this where a person's cough alone may identify issues and diagnose illnesses pertaining to the respiratory system will be essential.

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