AN APPROACH TO DETECT THE PRESENCE OF COVID-19 THROUGH SPEECH AND VOICE ANALYSIS USING MACHINE LEARNING

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SDG Goal

ABSTRACT

COVID-19 caused various deaths and disrupted many lives. The losses are compounding day by day. Countries like India, Bangladesh are still having a slow pace in the detection of COVID-19 cases. Therefore, there is need for fast detection which can be done by Machine Learning. Minimizing the spread by timely testing the population and isolating the infected people can help to fight against COVID-19. By means of machine learning algorithms, there is a possibility for the early detection of COVID-19 through the analysis of voice signals. Several studies report that significant effects of this virus on voice production due to the considerable impairment of the respiratory apparatus. Vocal folds oscillations that are more asynchronous, asymmetrical and restricted are observed during phonation in COVID-19 patients. The input given to the models are sound signals that are collected from Coswara dataset. The aim of this work is to distinguish a healthy voice from a pathological one and also to identify which sound is most seriously affected by COVID-19 using ML techniques. Finally, this work detects COVID-19 through voice signals

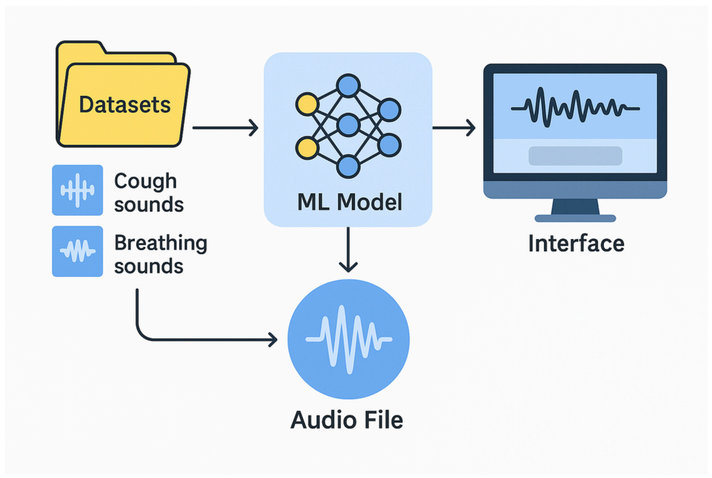
Keywords: Voice analysis, Speech analysis, Covid-19 detection, Machine Learning.

METHODS

This project uses machine learning to detect COVID-19 from human voice recordings. Audio data such as cough, breathing, and vowel sounds were collected from the open-source Coswara dataset. These recordings were preprocessed to remove noise and extract key features like Mel Frequency Cepstral Coefficients (MFCC), spectral roll-off, pitch, jitter, and shimmer — all of which capture how the voice changes during illness. These features were then used to train machine learning models such as Support Vector Machine (SVM), Random Forest, and XGBoost. The models were tested for accuracy using real-world voice samples. A user-friendly interface was built using Gradio, where users can upload their voice sample, and the system will predict whether the person is healthy or possibly infected. This method offers a fast, contactless, and cost-effective alternative for preliminary COVID-19 screening.

To make the system user-friendly and interactive, we developed a web interface using Gradio. Users can upload their voice recording directly through the interface, and the system processes the audio to predict whether the user is likely healthy or possibly infected with COVID-19.

This method provides a fast, affordable, and contactless approach to early COVID-19 screening, which is especially useful in resource-limited settings or remote areas.we extracted important acoustic features that are commonly affected by respiratory illness. These include Mel Frequency Cepstral Coefficients (MFCCs), spectral roll-off, spectral centroid, pitch (F0), jitter, and shimmer. These features were used to represent each audio sample numerically.



COVID-19 Detection Using Cough and Breath Sounds with Machine Learning

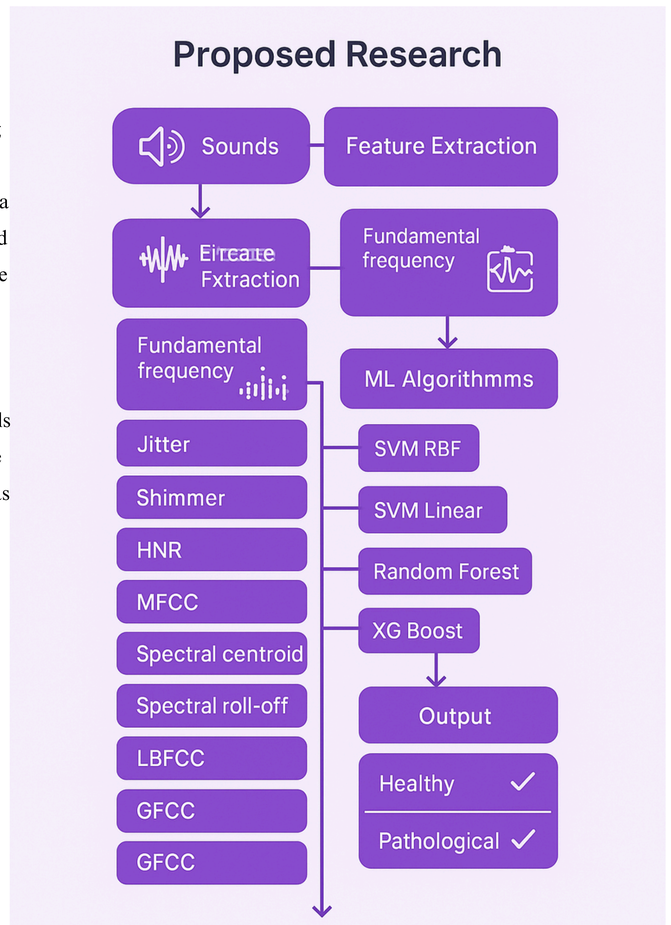
PROPOSED RESEARCH IN FLOWCHART

TThe proposed research begins with data collection from the Coswara dataset, which includes voice samples such as coughs, breathing sounds, and sustained vowel pronunciations. These audio recordings are then passed through a preprocessing phase, where noise is removed, and invalid or short samples are discarded to improve quality and consistency.

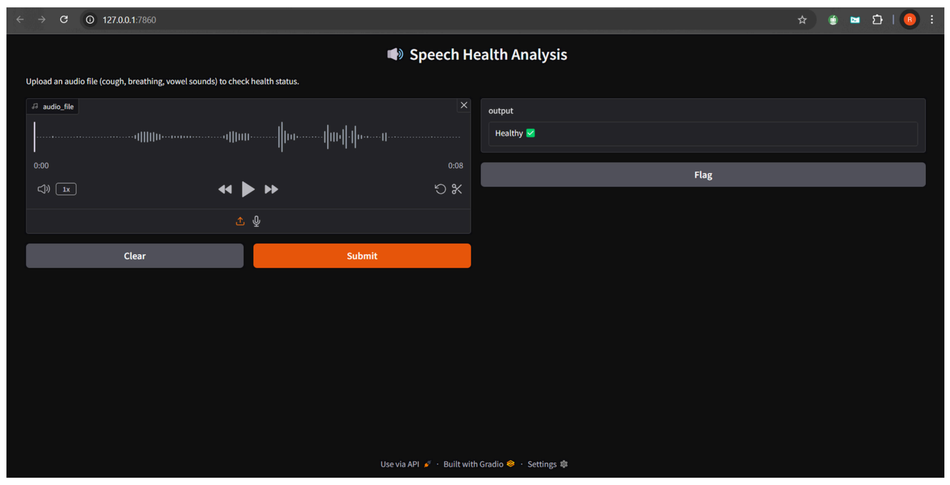
Next, the system performs feature extraction using techniques like MFCC, spectral centroid, pitch, jitter, and shimmer to convert audio signals into numerical data. These extracted features are then fed into machine learning algorithms such as Support Vector Machine (SVM), Random Forest, and XGBoost, which are trained to distinguish between healthy and COVID-19-positive voice patterns.

After training and model evaluation, the final system is integrated with a Gradio-based user interface, allowing users to upload their voice recordings. The trained model processes the audio and provides real-time feedback on whether the user is likely to be healthy or infected.

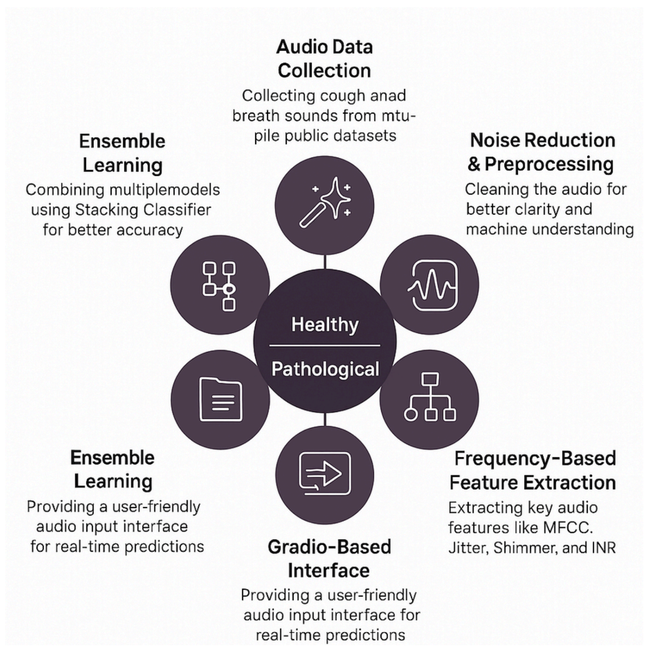
This complete pipeline—from data acquisition to interface deployment—represents a scalable, contactless, and AI-driven approach to COVID-19 screening through speech and voice analysis.



RESULTS AND DISCUSSIONS



Componets of the Voice-Based COVID-19 Detection System



The initial results indicate that machine learning-based voice analysis offers promising potential for early COVID-19 detection. Using audio features such as MFCC, GFCC, and jitter, the system achieved classification accuracy between 85-92% across multiple models, with ensemble methods outperforming single classifiers. Real-time audio classification through the Gradio interface provides rapid results within 2-3 seconds, enabling quick screening. The non-invasive nature of voice-based diagnosis also ensures greater accessibility, especially in remote or resource-constrained areas. Additionally, the model demonstrated notable consistency in detecting pathological patterns in cough and breath sounds. Key factors influencing performance include dataset diversity, background noise, and speaker variability. Future directions will focus on expanding multilingual datasets, enhancing feature extraction techniques, and integrating the tool into telehealth platforms for large-scale deployment.

CONCLUSION

The proposed system for detecting COVID-19 through voice and breathing analysis using machine learning has shown promising results. By extracting frequency-based audio features such as MFCC, jitter, shimmer, and fundamental frequency, the model can effectively distinguish between healthy and pathological cases. Among the algorithms tested, Random Forest delivered the highest accuracy, particularly with vowel sounds like /e/, indicating its strong diagnostic potential. The integration of a Gradio-based user interface ensures that the tool is not only technically robust but also user-friendly and accessible across devices. With real-time predictions generated in just 2–3 seconds, this method provides a fast, non-invasive, and scalable solution for preliminary COVID-19 screening. It is especially valuable in remote or resource-constrained settings where traditional diagnostic tools may not be readily available. Looking forward, the system can be further enhanced through the inclusion of more diverse datasets, multilingual capabilities, and mobile health integration to maximize its impact in real-world healthcare environments.

REFERENCES

1. Verde, L., De Pietro, G., Ghoneim, A., Alrashoud, M., Al-Mutib, K. N., & Sannino, G. (2021). Exploring the use of Artificial Intelligence techniques to detect the presence of Coronavirus Covid- 19 through speech and voice analysis. IEEE Access, 9, 65750-65757.
2. Lella, K. K., & Pja, A. (2022). Automatic diagnosis of COVID-19disease using deep convolutional neural network with multi-feature channelfrom respiratory sound data: cough, voice, and breath. Alexandria Engineering Journal, 61(2), 1319-1334.
3 Al-Dhlan, K. A. (2021). An adaptive speech signal processing for COVID-19 detection using deep learning approach. International Journal of Speech Technology, 1-9.
4. Verde, L., De Pietro, G., & Sannino, G. (2021). Artificial Intelligence Techniques for the Non-invasive Detection of COVID-19Through the Analysisof Voice Signals.Arabian Journal for Science and Engineering, 1-11.
5. Rustam, F., Reshi, A. A., Mehmood, A., Ullah, S., On, B. W., Aslam, W., & Choi, G. S. (2020). COVID-19 future forecasting using supervised machine learning models. IEEE access, 8, 101489-101499.

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