Using Audio Spectral Features and Machine Learning for Breathing Pathology Detection

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***Abstract*—We will use audio waveform signatures to determine whether breathing pathologies can be distinguished. More specifically, we will determine breathing audio features and use machine learning algorithms to develop diagnostics for respiratory diseases. We will be tuning previously developed machine learning algorithms based on neural networks and will provide comparative results in terms of performance, confusion matrices, and computational complexity. Moving forward, we need to identify an open-sourced database that we can utilize to conduct this study.**

Index Terms— breathing pattern audio, machine learning, neural networks, spectral features

I. Introduction

Chronic respiratory diseases can cause significant morbidity, mortality and is currently affecting hundreds of millions of people [1]. Respiratory diseases can be caused by infection, smoking tobacco, or by breathing in irritants such as secondhand tobacco smoke, asbestos, and air pollution [2]. Being able to detect and evaluate breathing patterns is important in understanding a patient's physiologic status, recognize abnormal respiratory patterns, and prevent further progression of respiratory condition [3]. There are several types of breathing patterns that clinicians look for including apnea, tachypnea, dyspnea hypernea, and hyperventilation.

Audio signals produced by the human body have been shown to be a useful and indicative biomarker for diagnosing and assessing disease. In particular, machine learning has proven to be a beneficial tool in classifying audio signals for diagnosis and monitoring of several diseases [4]. A previous research study has created a diagnostic tool for screening respiratory infections using convolutional neural networks (CNNs) on coughing audio to diagnose bronchitis, bronchiolitis and pertussis [5]. Human audio sounds such as wheeze, crackle, stridor, breathing, and speech audio have also been used to classify respiratory sounds [6].

Our goal is to implement several neural network architectures, including CNNs, to create an algorithm that will cluster audio signals and detect respiratory conditions through classification. Figure 1 outlines the general steps that will be taken in order to achieve this.

The ability to use audio signals as a means of diagnosing patients provides an opportunity to create quick, non-invasive and affordable diagnostic solutions for clinicians and patients. Utilizing machine learning in the diagnosis of respiratory ailments could also potentially allow clinicians to make early-detection diagnosis and thus start treatment earlier for better disease management. If proven successful, incorporating this technology into remote applications could significantly aid clinicians in telemedicine appointments and care.

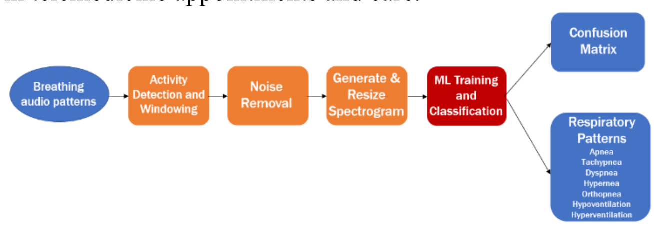

Figure 1: *Flowchart of steps demonstrating proposed process for predicting respiratory patterns from breathing audio patterns.*

Acknowlegdement

The REU supplement is funded by the NSF Award 1659871.

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