

Auscultation AI Analysis App

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Abstract

Remote patient monitoring remains a challenge for both patients and their caregivers. For people who deal with health concerns such as respiratory conditions, post-surgery recovery, and other medical issues, it is important to keep a close eye on the state of their health, especially when flare-ups arise. Building a platform that allows patients to monitor their conditions from home, while having diagnostic and outreach tools available provides patients with resources to be more aware of their own physical health, while reducing unnecessary clinical visits and giving medical professionals the tools to assist their patients over distance. The system will implement and compare machine and deep learning techniques using existing public digital auscultation datasets (e.g. ICBHI 2017). The application will run on a web-based interface that features audio uploads, audio preprocessing, trained classification models, visualization dashboards, and automated physician reporting. This project demonstrates how digital auscultation can practically be applied to remote care systems to the advantage of both the patient and the physician.

Keywords

Remote patient monitoring; Machine learning; Digital auscultation; Patient-user application

Introduction

Remote patient monitoring is an important corner of the clinical operation scope. Before March 2020, most remote healthcare systems were underutilized and held back by regulations in place. Once the global crisis that was COVID-19 forced its grip on the world, these services began to become a necessity to support the health of the general population. Among this emerging industry, there remains a corner that is effective, but currently underutilized in practice. This would be remote monitoring via digital auscultation. As the digital stethoscope has evolved, it has reached the ability to produce results that are nearly 1:1 in quality when compared to analog stethoscopes. This paved the way for utilization of digital stethoscopes for scientific research, data analysis, remote monitoring, and accurately recorded auscultation.

This project aims to cultivate a concept that this remote monitoring practice can be applied to an automatized process that allows the patient to perform their own digital auscultation, receive insights, and make informed healthcare decisions with their physician.

This system would be accomplished by leveraging machine and deep learning techniques to properly train a model that can effectively classify lung sounds to identify certain symptoms and present them to the patient in a digestible and insightful manner. This project does not serve to replace clinical diagnosis, but to serve as an additional tool vulnerable patients can use to monitor their own health.

Capstone Goals

Technical Goals

The primary goal of this project is to demonstrate competency in machine and deep learning practices as well as full-stack development by creating a functional remote patient monitoring system. In this process we will learn how to successfully leverage machine and deep learning to train a model to successfully classify lung sounds. We will gain valuable first-hand experience in software design, managing various requirements, gauging project scope, and making informed decisions about system architecture.

Alongside this, we will also sharpen my knowledge of UI/UX to learn what application formats are user-friendly and intuitive for the targeted audiences. This project will also evaluate the feasibility of the fundamental concept, remote auscultation.

Personal Goals - Hayden

This project strongly resonates with my desire to gain experience in the field of healthtech. Having direct experience working in healthcare as a patient sitter, I strongly believe

achieving a successful capstone will assist me in strategically opening doors in the data analysis and health care industries. I also find the medical field to be especially motivating as implementing and bringing more attention to underutilized practices can help improve the way medical professionals treat patients and can net a positive for the workplace of the physician, and the physical health of the patient. I am intrinsically motivated to commit myself to this project as it will aid me in learning how to create software that can benefit the lives of those who use it.

Personal Goals - Jared

This project will be a good learning experience on architecting a backend and a UI/UX. Writing software that solves a problem that I am initially unfamiliar with will be a good exercise- because it is exactly the kind of thing that happens in a real world workplace. Combining these with using machine learning will look good on my portfolio and further my future.

Literature Review

Customized Spectro-Temporal CNN Feature Extraction and ELM-Based Classifier for Accurate Respiratory Obstruction Detection

Published 19 June 2025, Current version 9 July 2025

Accurate prediction of lung conditions remains a challenging task because of the limited resources when it comes to dataset availability, noise obstruction, computing power,

patient variability, and differing clinical standards. This study implemented deep learning techniques (CNN) to distinguish respiratory diseases with 97.5% accuracy.

StethAid: A Digital Auscultation Platform for Pediatrics

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Digital auscultation supported by artificial intelligence is an emerging technology that can be used to help interpret auscultated sounds. The goal of this study was to develop a digital auscultation platform for pediatric medicine to be used for telehealth and AI-assisted auscultation. The platform consists of a wireless digital stethoscope, mobile applications, customized patient-provider portals, and DL algorithms. The platform was deployed in 4 different children's hospitals and will be utilized to build the first and largest pediatric cardiopulmonary datasets (as of publication). The deep learning algorithms associated with the study achieved a wheeze detection sensitivity of 83.7% and a specificity of 84.4%.

App Description

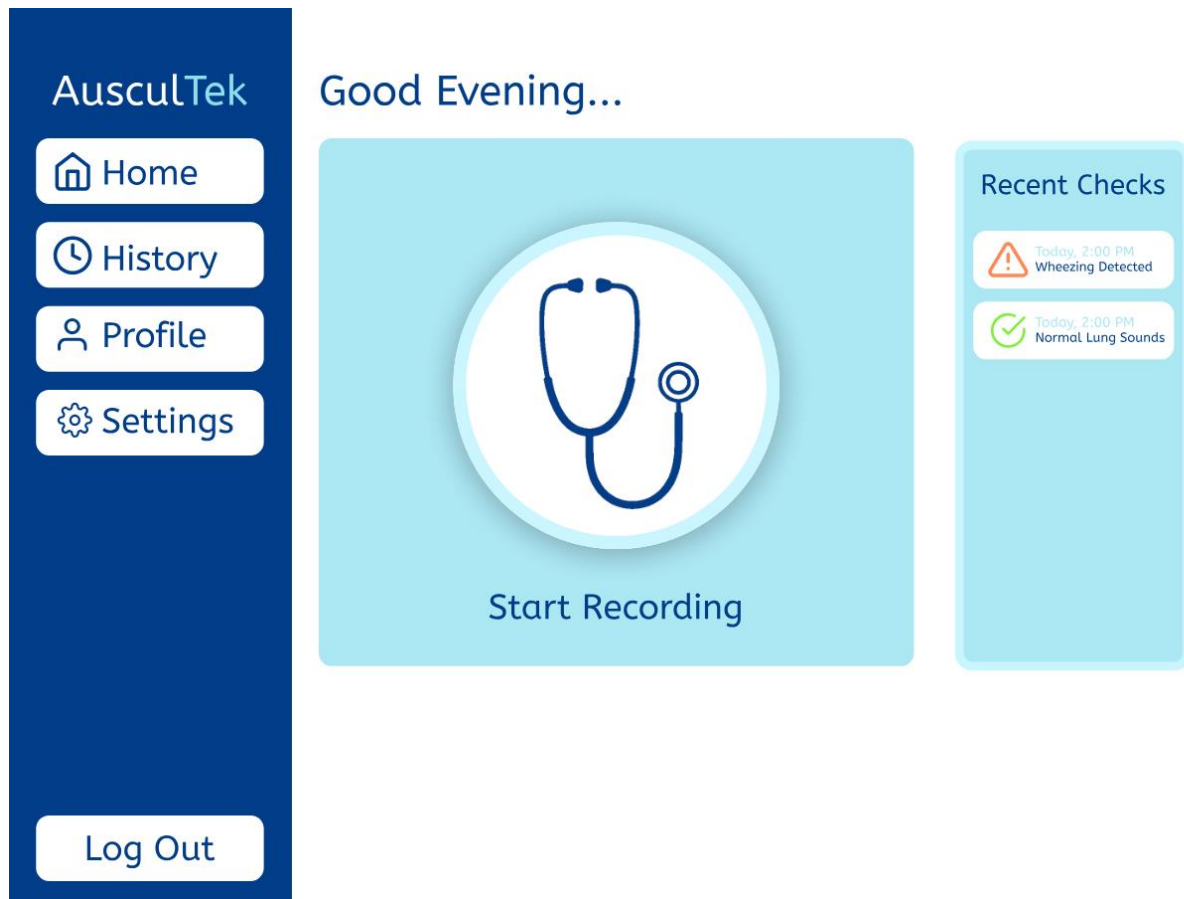
A summarized design of the system is as follows:

1. Patient uses digital stethoscope to perform recorded auscultation on either lungs or heart
2. The application provides a visual dashboard detailing respiratory activity. It also provides the user with possible symptoms associated with the recording. All

previous recordings and reports are stored in a database and can be used to generate summarized reports of trends over time.

3. The patient is given the choice to submit the generated report and audio recording to their medical professional via an automated email system
4. The medical professional reviews the report and audio
5. The medical professional flags the patient for a visit if they deem necessary

The more advanced systems of the app, like an automated physician outreach system, are still potential features given the developing status of the project. The minimum viable product (MVP) is a simple interactive web app that accepts audio uploads, preprocesses them, performs model classification, and returns what patterns are detected in the sounds. Here is a simple mockup of what the home page of the application may look like:



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