



RespiraSense

Project Proposal

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Abstract

Lung disease is one of the most commonly occurring health conditions that is significantly impacting lives of individuals and worsening their quality of life. This has prompted the need for more efficient, timely, and accessible diagnostic solutions. Artificial Intelligence (AI) is the answer towards making advanced healthcare more accessible to a broader population. In this project, we propose a web application catering to doctors and patients. Doctors will be able to detect respiratory diseases; namely Pneumonia, Covid 19 and Tuberculosis, while the patients will be able to make use of a doctor recommendation system and a chatbot to check their symptoms. Additionally, RespiraSense will also provide a platform to store medical information such as reports and test results securely. This will be achieved using a combination of Machine Learning (ML) and Deep Learning (DL) algorithms and utilizing advanced image processing techniques on medical imaging data, specifically chest X-rays. Overall, this user-friendly and accessible design aims to improve patient care by enabling timely treatment and easy integration into the healthcare system.

1. Introduction

According to the World Health Organization, in recent years, respiratory diseases have been the biggest contributor in the top 10 global causes of death [1]. Lungs are responsible for the crucial task of supplying oxygen to every cell of the human body. Therefore, any compromise to this role can lead to anything from mild respiratory discomfort to severe respiratory issues, causing life threatening complications. Additionally, identifying the symptoms of respiratory conditions can be challenging in some cases. However, with advancements in technology, AI models have emerged that can accurately detect lung diseases.

Technology has advanced to the point where a person's health can be accurately assessed using powerful AI algorithms. These types of applications are in high demand, as they can help detect lung diseases early on and provide valuable insights into a person's respiratory condition. Since Pneumonia, Covid-19 and Tuberculosis remain to be leading causes of severe respiratory illness, constructing a web application for them is a noteworthy idea to improve the health sector.

RespiraSense aims to develop a system that can extract critical information from chest X-rays. Since respiratory diseases cause a notable change in the lung structure, we can detect them using machine learning. The model will be able to analyze chest X-rays in real time, allowing it to classify the condition of the lungs and identify any signs of disease. In addition to this, users will also be able to store their medical information, and patients will be suggested to the nearest available doctors based on their diagnosed condition.

2. Goals and Objectives

The primary goal of RespiraSense is to provide a central hub for users to be able to identify potential risks and dangers to their lungs, to accurately detect and classify lung diseases, focusing on conditions identified through chest X-ray images. Our main objectives are:

- Combining different datasets containing chest X-ray images
- Training a model to correctly detect Pneumonia, Covid-19 and Tuberculosis
- Allowing doctors access to the diagnostic model
- Developing a web application for ease in use of the model
- Integrate a chatbot to assist users in assessing their symptoms
- Implement a doctor recommendation system
- Allow patients to securely store their medical information

3. Scope of the Project

RespiraSense will consist of a web application designed while keeping both doctors and patients in mind. The application will include a recommendation system to suggest the nearest doctors, a secure platform for storing medical reports and test results, and a chatbot to assist users with symptom checking.

Furthermore, the core diagnostic model will primarily use AI to detect lung diseases and be built using Keras with TensorFlow as the backend. To train the model we will be using a dataset of chest X-rays from Kaggle, then preprocessing the images in it for the machine learning model. The frontend will be built using the React.js library for a dynamic and responsive user interface. The MERN stack (MongoDB, Express.js, React.js, Node.js) will be utilized to manage the full-stack development, providing a robust structure for data handling, user management, and interaction.

Finally, testing will be conducted iteratively, focusing on the accuracy of the AI model. The responsiveness of the user interface and the overall functionality of the system will also be tested to ensure a user-friendly application and reliable final product.

4. Initial Study and Work Done so Far

As far as our research is concerned, several advancements have been made in the field of lung disease diagnostics using AI and machine learning. Deep learning models, particularly Convolutional Neural Networks (CNNs), have shown considerable promise in classifying chest X-ray images for diseases such as Pneumonia [3], COVID-19, and Tuberculosis [4][5]. Furthermore, recent studies have shown how knowledge distillation techniques can also be employed to simplify complex models and make them easier to integrate into web applications[7].

Our project addresses the challenge of diagnosing respiratory diseases even in early stages where traditional methods may fail. This can be due to limited availability in low income settings where the “disease burden” is highest[3]. Secondly, while disease detection and patient management has improved with technology, challenges still remain in applying these technologies effectively in healthcare and making them more accessible[6]. Additionally, mobile health applications have highlighted the importance of integrating user-friendly features such as symptom tracking and secure data storage to enhance disease management [2]. RespiraSense will aim to integrate these features in a web application.

Our target is to develop a comprehensive web application that not only utilizes advanced AI models for accurate disease detection and classification but also includes innovative features like a symptom checking chatbot, report tracking, and doctor recommendations into a single platform.

References

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