**Project Synopsis: Respiratory Disease Classification Using Lung Sounds with CNN**

**Introduction**

The Respiratory Disease Classification project aims to leverage the Respiratory Sound Database, compiled by research teams in Portugal and Greece, to develop an automated system for classifying respiratory disorders based on lung sounds. This project focuses on utilizing Convolutional Neural Networks (CNNs) to analyze digital recordings of respiratory sounds and classify them into specific respiratory conditions.

**Purpose of this Project**

The primary objective is to create a robust and accurate system for automated diagnosis of respiratory disorders, such as asthma, pneumonia, and bronchiolitis, through the analysis of lung sounds.

**Project Scope**

The project encompasses the utilization of machine learning, particularly CNNs, to process the extensive Respiratory Sound Database, containing 920 annotated recordings from 126 patients. The scope extends to the classification of respiratory cycles, including crackles, wheezes, and combinations of both, to identify potential disorders.

**Overview of the Proposed System**

The proposed system involves the implementation of a CNN model trained on the Respiratory Sound Database. The model will analyze digital recordings to identify distinctive patterns associated with different respiratory conditions, providing an automated and efficient means of diagnosis.

**Advantages of this Project**

- Early and accurate diagnosis of respiratory disorders.

- Non-invasive and cost-effective method for screening.

- Utilization of digital recordings allows for real-world simulation and diverse scenarios.

**Different Modules and Functionalities**

1. Data Preprocessing

- Cleaning and preparing the Respiratory Sound Database.

- Segmenting recordings into respiratory cycles.

- Augmenting data to enhance model generalization.

2. Feature Extraction:

- Extracting relevant features from respiratory sound recordings.

- Identifying key characteristics associated with different respiratory conditions.

3. Model Training

- Implementing a CNN architecture suitable for respiratory sound classification.

- Training the model on annotated data for accurate disease classification.

4. Testing and Validation

- Evaluating the model's performance using a separate test set.

- Validating the system's accuracy, sensitivity, and specificity.

5. User Interface

- Developing a user-friendly interface for inputting and analyzing new respiratory sound recordings.

- Displaying the classification results to healthcare professionals.

**Technology Stack**

- Programming Language: Python

- Deep Learning Framework: TensorFlow

- Data Processing: NumPy, Pandas

- User Interface:Django (web-based interface)

**Proposed System**

- CNN-based respiratory sound classification model.

- Real-time classification of respiratory disorders.

- User-friendly interface for healthcare professionals.

Includes modules for User, Doctor, laboratories:

**User Module**

* Registration and Authentication: Allows users (healthcare professionals, patients, or researchers) to register and authenticate themselves.
* Access Control: Defines different levels of access based on user roles, ensuring the confidentiality of patient data and restricting certain functionalities to authorized users.
* Uploading Respiratory Sound Recordings: Enables users to upload new respiratory sound recordings for analysis by the system.
* Viewing Results: Provides users with access to the classification results of uploaded recordings.

**Laboratory Module**

* Data Management: Allows laboratory staff to manage and organize the respiratory sound database, including adding new recordings, updating annotations, and ensuring data integrity.
* Quality Control: Implements measures for quality control, flagging recordings that may require manual review or additional annotations.
* Data Export: Facilitates the export of curated datasets for research purposes or sharing with other healthcare institutions.

**Doctor Module**

* Patient Management: Enables doctors to access and manage patient profiles, view historical respiratory sound recordings, and monitor changes over time.
* Prescription Integration: Integrates with electronic health records (EHR) systems to provide doctors with a comprehensive overview of a patient's respiratory health and aid in treatment decisions.
* Communication: Provides a secure communication platform for doctors to discuss cases, share insights, and collaborate with other healthcare professionals.

**Existing System of this Project**

As of now, there may not be an existing system with the same specificity in respiratory sound classification using the provided database. Traditional methods often rely on manual analysis by healthcare professionals, making this proposed system a significant advancement in automating the diagnosis of respiratory disorders.

This project stands to contribute to the field of respiratory health by providing an innovative and efficient tool for early detection and classification of respiratory diseases based on lung sounds.