Chapter 1
Predicting Lung Disease Progression Using Deep Learning on Pulmonary Function Test Data

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ABSTRACT

Indeed, asthma, chronic obstructive pulmonary disease (COPD), and pulmonary fibrosis are major health issues among people worldwide. Early diagnosis and accurate predictions of illness progression are essential for their management and treatment. Pulmonary Function Tests (PFTs) are valuable physiological tests reflecting lung function and disease severity changes over time. In this article, we show a deep learning approach to predict developments in lung diseases by PFT data. Our model is based on temporal patterns and characteristics from PFT readings that enable early diagnosis and prognosis for lung diseases. Unfortunately, due to

DOI: 10.4018/979-8-3373-4571-0.ch001

a specific PFT dataset, collecting representative data for model training is always a challenge. Meanwhile, we address various sources of access to PFT datasets from public repositories through partnerships with healthcare institutions or data-sharing platforms. Once sufficient data is collected, we plan to perform preprocessing, develop deep learning models, and evaluate their effectiveness regarding lung disease development prediction.

INTRODUCTION

Diseases of the lungs like COPD, IPF, and asthma are among the leading causes of stress given to a global health system. These ailments among others bring out a progressive decline in the efficiency of the lung, which translates into a considerable income loss in the quality of life for the patients, as the death rates are high due to worsening and taut lung functions. Early diagnosis and prognostic assessment of disease progression become mandatory for effective treatment of lung disease, leading to timely therapy and individualized therapy. Pulmonary function tests provide a much-needed quantitative analysis of the volume and flow of air through the lung to diagnose and follow-up lung diseases. But the standard methodologies to interpret PFT data generally fail to understand the varied, complex, and non-linear features of the illness progression.

The emergence of deep learning, which would be classified under machine learning, as is evident with its inherent capabilities in pattern identification and prediction, turned out to be an ideal solution to the problem. It is expected that deep learning architectures such as Long Short-Term Memory (LSTM) networks would serve the purpose very well in handling sequential data in terms of capturing the temporal features of the data making them ideal for analyzing time-series kinds of data like PFT results. Using deep learning techniques, researchers and physicians could build predictive models that would make it possible to produce a more detailed and accurate prognosis of the development of lung disease.

IMPORTANCE OF EARLY DETECTION AND PREVENTION

By definition, early detection and accurate prediction are crucial stages in the development of any lung disease. Some reasons include: