Globally, respiratory diseases are the third-highest cause of death in the world, and asthma, lung cancer, chronic obstructive lung diseases, and acute respiratory infections cause more than 3 million deaths each year [1]. Respiratory diseasesare diagnosed through stethoscope or image-based methods such as CT and X-ray. In particular, non-invasive and real-time stethoscope is the most basic and important diagnostic method for respiratory disease screening and initial diagnosis at a minimum cost [2]. Diagnosis of lung disease through stethoscope is usually classified according to exist there is an adventurous sound. The adventurous sound is a representative sound that can predict lung abnormalities, and is divided into wheeze and crackle [3].

Since skilled medical personnel are essential to accurately interpret breathing sounds, unskilled interns and residents may misunderstand some breathing sounds. The respiratory-related diseases increased due to the spread of COVID-19, and as a result, the number of patients each medical staff had to deal with increased rapidly [4]. Therefore, there is a lack of professional medical personnel who can diagnose and monitor patients with respiratory diseases through stethoscope. Therefore, a diagnostic system that automatically analyzes respiratory diseases using artificial intelligence (AI) is expected to be of great help in resolving medical blind spots.

Since release of ICBHI public data on respiratory sound in 2017, many studies of machine learning and deep learning methodologies on respiratory sound classification have been actively conducted [5]. Early lung sound classification studies focused on classification studies through traditional machine learning methods. Jakovljevicé et al. [6] proposed a breathing sound classification methodology using hand-crafted feature extraction and hidden Markov models, and Serbes et al. [7] proposed a classification methodology using a machine learning support vector machine (SVM) model. Recently, deep learning has attracted a lot of attention as a breathing sound classification model along with a machine learning method, and has shown excellent classification performance. They extracted features for respiratory sounds with two-dimensional spectrogram images and compared the classification performance of respiratory sounds through convolutional neural network (CNN) [8] and recurrent neural network (RNN) [9] models.

In this work, we propose a simple yet effective model to classify optimal abnormal breathing sounds. Using HF\_LUNG\_V1 data [9], we extract characteristic information of lung sound through log Mel- spectrogram and MFCC method, which are effective speech data feature extraction techniques, and classify abnormal respiratory sounds through deep learning.

The composition and contents of this paper are as follows. Chapter 2 describes the preprocessing methodology for respiratory sound classification and recent research on deep learning network algorithms. Chapter 3 describes the data preprocessing and feature extraction used in this study. Chapter 4 describes the hyperparameters associated with the proposed model networks and experiments, and Chapter 5 describes the evaluation indicators used and the results for the performance of the proposed methodology. Chapter 6 provides conclusions and future research direction.

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