Abstract

The lung sound signals are used to diagnose different types of respiratory diseases in a non-invasive manner. The sound properties of healthy subjects differ from those of pathological subjects in terms of amplitude, time duration, spectral content, tonal quality, morphological complexities, etc. Traditionally, the clinical diagnosis of a respiratory disease is done through or starts with chest auscultation. Objective analysis of the lung sound, based on its physical characters and structural anomalies are still lacking despite several developments in electronics and audio signal processing. One of the major issues in this analysis is interference of the heart sound. The aim of this research is to contribute to the development of automated diagnosis of respiratory disorder by enhancement of lung sound (LS) information in acquired lung sound data and subsequent use of pattern recognition approach for identifying disease signature. A computer aided system or lung sound analyzer can assist physicians for the diagnosis of lung diseases in a better way and can also provide a facility for monitoring patients at home and primary health care center. In this work, first, a novel heart sound (HS) localization algorithm has been developed for estimating the region of primary HS components ($S1, S2, S3$ & $S4$) in lung sound signals based on Hilbert Transform (HT) and Heron's formula. This is a preprocessing step, useful for enhancement of LS signal before removing the heart sound interference. Subsequently, a new heart sound reduction method has been proposed for eliminating the heart sound interference from LS signal which is based on empirical mode decomposition (EMD) technique and missing value prediction algorithm. A new technique for classification of normal and adventitious lung sounds (whezees and crackles) is developed using EMD domain higher order statistical features (mean, variance, kurtosis and skewness) and artificial neural network (ANN). Finally, a lung status detection algorithm has been proposed for distinguishing the normal and pathological subjects by exploring the morphological characteristics of the LS signals with the help of an extreme learning machine (ELM). In addition, an image display method, suitable for medical practitioners, is presented for visual analysis of the morphological features of lung sound signal in order to diagnose the pathological and normal conditions of the lungs. The thesis also gives limitation of this work and few research direction as future

scope of this work.

Keywords: Empirical mode decomposition, extreme learning machine, filtering, Gaussian mixture model, heart sound localization, Hilbert transform, lung sound, morphological complexities, multilayer perceptron, power spectral density, pulmonary diseases, respiratory cycle, scaled conjugate back propagation, spectrogram, support vector machine