

DEEP LEARNING BASED DISCRIMINATION OF PHONOCARDIOGRAM SIGNAL WITH NORMAL HEART SOUNDS AND MURMUR: FEASIBLITY STUDY

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ABSTRACT

Phonocardiogram (PCG signal contains vital information regarding the heart condition of diagnostic importance. Several time series based algorithms are reported to obtain characteristic features of PCG signals to facilitate prognostication and diagnosis of various heart diseases, with limited accuracy in classifying various heart sounds. Recently, machine learning based classification of PCG signals is gaining importance that can enable discriminating normal and diseased heart conditions. In this work, it was hypothesized that a deep learning model can discriminate normal heart sound and murmur. 30 samples each of normal PCG and heart sound signals with murmur from Peter Bentley Heart Sounds Database sampled at 44.1 kHz were used for analysis. A 4th order Butterworth low pass filter with cutoff frequency at 200 Hz was used to remove high frequency noise as suggested by the database. The spectrum of each PCG signal was obtained to train a convolutional neural network (CNN model for classification. The dataset was divided into 60% training, 20% validation and 20% testing. Accuracy of 77% was achieved using the test data in classifying the PCG based on the spectrum. Validation of this technique with larger dataset is required. The results motivate the analysis and comparison of normal PCG's with different cardiac conditions for cardiac disease diagnosis.

Keywords — phonocardiogram, heart sound, PCG, deep learning, machine learning.

INTRODUCTION

A significant percentage of the global population today lives with cardiac disease. Although Ischemic Heart disease is the world's biggest killer (16% of the deaths worldwide), other cardiovascular diseases also account for considerable cardiac morbidity. [1-3] About 2.5% of the US population suffers from Valvular Heart Disease. [3] 2% of the cardiovascular deaths globally, are related to Rheumatic Heart Disease. [1] Cardiac auscultation is an essential part of the physical examination for the diagnosis