Analysis of Heart Sound for Automated Diagnosis of Cardiac Disorders.

Anushikha Singh, Malay Kishore Dutta
Department of Electronics and Communication Engineering, Amity University, Noida, India
anushikha4june@gmail.com,
malaykishoredutta@gmail.com

Carlos M. Travieso
Signals and Communication Department. IDeTIC
University of Las Palmas de Gran Canaria
Las Palmas de Gran Canaria, Spain
carlos.travieso@ulpgc.es

***Abstract*—Body auscultation one of the main common clinical diagnostic technique for assessment of cardiac disorders. This clinical method is cheap and effective and requires professional doctors to understand and interpret the heart sound for diagnosis of cardiac diseases. This paper presents basic analysis and comparison of heart sounds recorded from healthy and unhealthy subjects for automated screening of cardiac disorders. Some characteristics of heart sounds such as probability distribution of amplitude and frequency contents are quantified using signal processing to automate the diagnosis of cardiac disorders. Experiments were carried on the Heart sounds database created under National Institute of Health (National Center for Research Resources) and results are encouraging. The experiment results indicates enough discrimination between heart sounds from healthy and unhealthy heart sounds for automated screening of cardiac disorders using signal processing.**

Keywords—Cardiac Disorders; Body auscultation; Heart Sounds; Signal Processing.

I. INTRODUCTION

Cardiac diseases are leading cause of death in the worldwide and this situation is especially worse in developing countries because of shortage of medical professionals [1]. Automated and early diagnosis of cardiac disorders can be a possible solution to prevent mortality in rural areas. Clinically physical examination of human heart using auscultations via stethoscope is an easy, efficient and computationally cheap method but requires trained medical experts [2]. Signal processing based heart sound analysis may be a valuable initiative for automated diagnosis of cardiac disorders without the help of professional doctors. Heart sound analysis maybe of great helps in primary health centers for early diagnosis and screening of cardiac disorders. Some efforts have been made in this direction where body auscultations are being analyzed for early and automated diagnosis of diseases. P. Rajkumar et. al. [3] used Machine learning in lung sound analysis: a systematic review for analysis of different lung sounds and classification and the results are encouraging. Maglogiannisa et. al. [4] proposed machine learning based model for identification of heart valve defects from body auscultations. Jagadeesh Gogineni et. al [5] proposed algorithm for heart risk stratification using supervised classification for the prediction of classes with normal, first stroke, second stroke and end of life of patients. C. Jenefar Sheela et. al [6] developed a cardiovascular expectation framework to predict the sudden cardiac death using time and frequency of heart rate variability from ECG and SVM. W. C. Kao et. al. [7] proposed the model for automatic identification of heart valve disorder using phonocardiograph (PCG) signal analysis and reported results are motivating and encouraging. S. Zeeshan et. al. [8] developed a framework for analysis of acoustical cardiac signals. J. S. Sonawane et. al [9] had proposed an algorithm for prediction of coronary illness using Learning Vector Quantization (LVQ) neural network calculation. M. Gudadhe et. al. [10] developed an decision system for automated diagnosis of heart diseases based on artificial intelligence.

All these existing methods and reported results are encouraging and motivating to work on this direction. There is a space for more development in this field to develop efficient model for automated diagnosis of cardiac diseases from heart sounds. There is a need to explore the characteristics of heart sound to differentiate heart vibrations recorded from healthy and unhealthy subjects. This paper presents audio processing based heart sound analysis for discrimination between normal and abnormal heart sound for identification of cardiac diseases.

This main contribution of this work is discriminative analysis and comparison of heart sounds recorded from healthy and unhealthy subjects for automated screening of cardiac disorders. To understand and interpret the variations in heart sound for cardiac diseases some characteristics of heart vibrations such as probability distribution of amplitude and frequency contents are studied and analyzed to automate the screening procedure.
Further the paper is categorized as follows. Section II presents characteristic analysis of heart sound for diagnosis of cardiac disorders. Section III includes experimental results indicating variation between normal and abnormal heart sounds. Finally, section IV concludes the papers and possibility of future work.

II. HEART SOUND: FEATURE ANALYSIS

The blood flow pressure, opening or closing of heart valve and cardiac muscle contraction generates a vibration that propagates up through the tissues to the thorax, and is measured as heart sound. Murmurs are identified as abnormal sound that may indicate the presence of a heart problem. The turbulent blood flow in the heart system is the reason for

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