Designing of cluster algorithm for Phonocardiogram Data Analysis

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Abstract: Health care and technology has synced together via bioinformatics and in this study heart sound analysis is by clustering and analysis via filtering and power spectrum analysis. The system collects twenty six basic features from twenty three samples of heart sounds each distinct from another. The process is under jAudio processing environment and MATLAB. The results obtained are as discussed in this paper.

Keywords – PCG, Clustering, Normality analysis

I. INTRODUCTION

Phonocardiography is a diagnostic and study technique which creates a graphic record of Phonocardiogram (PCG) of the sounds produced by heart. The phonocardiogram supplements the information obtained by listening to the body sounds with stethoscope (Auscultation). Auscultation of heart sound (HS) signals plays a vigorous role in Cardio Vascular Diseases (CVD) early prevention and detection. By directly listening to HS with an acoustic stethoscope, it provides a cost-effective approach to inspect abnormality of HS signals. Pathological parameters related to heart can be found from heart’s activity which is considered as the basis of different heart diagnosis system.

A Phonocardiogram or PCG is a plot of high fidelity recording of the sounds and murmurs made by the heart with the help of the machine called phonocardiograph, or “Recording of the sounds made by the heart during a cardiac cycle.” The sounds are thought to result from vibrations created by closure of the heart valves. In healthy adults, there are two normal heart sounds often described as a lub and a dub (or dup), that occur in sequence with each heartbeat. These are the first heart sound (S1) and second heart sound (S2), produced by the closing of the atroioventricular valves and semilunar valves, respectively. In addition to these normal sounds, a variety of other sounds may be present including heart murmurs, adventitious sounds, and gallop rhythms S3 and S4. Visualization of Auscultation is Phonocardiogram.

II. BACKGROUND SURVEY

Modern trend of medical science is to setup advanced diagnosis system for different disease. Proper detection of pathologies can assure the proper diagnosis. For centuries, cardiovascular diseases (CVDs) remain the leading cause of death throughout and are very common in each and every part of the world. Therefore it requires more advanced heart disease diagnosis systems. Pathological parameters related to heart can be found from heart’s activity which will be considered as the basis of different heart diagnosis system.

The common heart activities are heartbeat rate, electric signal produced by the heart during a cardiac cycle and heart sound. The appropriate analysis and interpretation of all this parameters help to make a suitable heart diagnosis system. In this contest so many electronic instruments are being used to detect and analyze the heart sound signal and the ECG signal. Magnetic resonance imaging (MRI) technique, Cardiac Computed Tomography (CCT) and Electrocardiogram (ECG) techniques are being used to get an image of the heart and information related to cardiac valves activities showing many heart disease symptoms.

But all the above techniques require sophisticated, expensive and cumbersome equipment so it requires experienced and trained specialist to handle the system and analyze the performance. However in some cases these results are not immediate and therefore these systems cannot be used in emergency purpose. Though the analysis of ECG signal does not require expensive equipment and results are immediate, it cannot be used in emergency use because it is a screening test.

Auscultation of heart sound (HS) signals plays a vigorous role in CVDs early prevention and detection. By directly listening to HS with an acoustic stethoscope, it provides a cost-effective approach to inspect abnormality of HS signals having potential pathological CVDs symptoms. But problem with acoustic stethoscopes is that the sound level is extremely low and there are some short comings in the heart sound analysis.

III. SYSTEM DESIGN

The proposed system consist of a dedicated system interference for providing the input modulation of heart sounds, the primary process is collection of input recordings from database and thus compute the features on feature extracting tool, J-Audio. The signal extracts 26 patterns of features and the best standard deviation
feature is opted. The features are clustered under K-Mean clustering and resultant is extracted for plotting the clustering graph. The centroid analysis is performed and thus the overall system modulation design is retrieved.

**Fig 1: Normal Heart Pulsation Graph**

MATLAB provides a platform where audio signals can be recorded, analyzed and played back. Digital audio signals can be easily represented in the MATLAB programming environment by means of vectors of real numbers, as also with discrete-time signals. The term discrete time refers to the fact that although in nature timeruns on a continuum, in the digital world we can only manipulate samples of the real-world signal that have been drawn on discrete-time instances. This process is known as sampling and it is the first stage in the creation of a digital signal from its real-world counterpart. The second stage is the quantization.

**Fig 2: System design**

**IV. RESULTS AND OBSERVATIONS**

The proposed system consists of data analysis and informatics extraction on a given data sample of heart sounds, the system computes the following results as shown below.

**Fig 3: Heart sound Magnitude graph.**

**Fig 4: Magnitude spectrum of Heart Sound**

The fetched results are under signal conditioning and the same are bio-informatically extracted under the ratio of system simulation with MATLAB Environment as shown below.

**Fig 5: Power Spectrum for Heart Sample**

The data clustering is successfully performed and heart normality is extracted and analyzed under a system reserve space for computation, the decision making is done based on clustered values.

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