International Journal of Cardiovascular Research

Editorial Announcement A SCITECHNOL JOURNAL

Techniques for phonocardiogram signal analysis and efficiency assessment

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Received date: October 04, 2021; **Accepted date:** October 18, 2021; **Published date:** October 25, 2021

Introduction

The vibrations produced by the heart valves closing cause cardiac sounds. There are at least two: the first occurs when the tricuspid and mitral atrioventricular valves close at the start of systole, and the second occurs when the aortic and pulmonary valve semilunar valves close at the end of systole. Phonocardiography is a technique for detecting and recording sub audible sounds and murmurs in the heart. The stethoscope, on the other hand, does not always catch all of these noises or murmurs and does not keep track of their recurrence. The capacity to quantify the noises emitted by the heart provides information not available through more advanced tests and is crucial for understanding the effects of particular medicines on the heart. It's also a good way to keep track of how a patient's condition is progressing.

The primary function of a stethoscope is to perform a primary test to ensure the health of the heart. The people with abnormal heart beats need to be sent to cardio logical clinics. Today's medical technology is geared on cost savings, reduced diagnostic costs, and the preservation of human health. As a result, we require cutting-edge stethoscopes. When faced with specific conditions, adding the ability to diagnose heart aberrant sounds and providing the essential information about heart function may assist professionals to make smart decisions. We've seen attempts in recent years to identify problems just by listening to the heart and capturing the noises it makes.

So far, a large number of activities have been completed. Certain traits are present in each batch of heart disease data. The University of Michigan database, which is based on the first and yoganathan sounds, is the most reliable database in the study of heart sounds. yoganathan conducted the first frequency research on the sound of the heart on the first and second sounds, using the fast Fourier transform technique for heart beat analysis and analyzing the frequency peaks of the heart beats. Later on, Rangayan estimated the frequency spectrum of the second sound of the heart applying parametric methods in short periods of time and figured out the healthy heart from the ill heart with regard to the related spectrum disturbance. Things analyzed the heartbeats of persons who had Aortic valve illness using the transform part-wave approach. Innocent murmurs have a mean frequency of 79 Hz and a standard deviation of 4 Hz, according to the researchers. Shan simulated the sounds of the heart using the second order spectrum approach. He also employed parametric second order spectrum estimation techniques to evaluate and classify the audio data.

Heart Disease

The goal of the present research is to introduce a method which categorizes the heart disease automatically with high precision and validity. A new strategy for classifying heart illness based on cepstral coefficient and Mel criteria using a Support Vector Machine classifier has been developed.

The discovery of the PCG signal drew researchers' attention to this field. Even from a heuristic standpoint, hearing the heart sound using a stethoscope, which is nothing more than listening to the PCG signal generated by the heart when transporting blood from one chamber of the heart to another chamber, is something that the cardiologist does while studying the condition. Blood flows from the heart to the lungs, then back to the heart and to various sections of the body. The heart sound is produced by the flow of blood at a given pressure and volume.

Non-stationary impulses with a frequency of 10 KHz make up phonocardiogram signals. Although the ECG signal has been examined to a greater extent, it is ineffective in detecting heart illness because it focuses on the electrical behavior of the heart, but cardiac defects are mostly caused by changes in the geometry of the chambers. This change in the heart's shape causes the heart to produce an unnatural sound, which is used to detect heart abnormalities. These noises give the cardiologist crucial information to diagnose the condition.

The difficulty of the endeavor can be compared to the skill that a cardiologist requires possess in order to effectively identify the ailment. By consistently working in the field of cardiac systems for a long period, a skilled cardiologist arises. This is where a new cardiologist might make a mistake. Because of the doctor's incapacity to hear the sound accurately, his perseverance, and his experience, there is always the possibility of incorrect disease detection. They may not be able to handle the situation due to a lack of knowledge and skill, and the patient will be referred to a more experienced and qualified cardiologist. Although they possess the theoretical knowledge required curing the ailment, this is insufficient.

Only the doctor's skill, together with his or her experience, can effectively and accurately recognize the ailment. This necessitated the development of a Decision Support System (DSS) that could assist doctors regardless of their experience or any adverse physical conditions, forcing researchers to work on a better method.

FPCG monitoring is a non-invasive technology that sends no energy to the fetus. The information provided through FPCG is similar to that obtained from pulse oximetry, MCG, ECG, and ultrasonography, among other modalities. Although FPCG has a great diagnostic potential, it is difficult to analyze because it has multiple time-varying components that are convolved in both time and frequency.

The SA node is responsible for generating electrical impulses in the heart. The impulses are sent from the SA node to the Atrio Ventricular node, which is immediately beneath the right atrium. Because the diameter of the fibers that carry the impulses is so small, there is a delay in transmission from the SA node to the AV node. The pressure in the atria rises during propagation, causing blood to be pumped into the ventricles. Later, the impulses are sent to the Bundle of His, also known as the AV bundle, which is a huge bundle of fibers.

This bundle is then separated into left and right bundles, forming the Purkinje fibers, which cover the majority of the ventricular region. As the impulses travel to the Purkinje fibers, they assist in the contraction of the ventricles, which squeezes the blood into the arteries. A cardiac cycle takes approximately 0.7-0.8 seconds to complete. Due to the volume of blood that the fetal heart can hold, the fetal heart cycle is usually shorter than that of adults.