Sudan University of Science and Technology

College of Engineering

Department of Biomedical Engineering

A Project Submitted in Partial Fulfillment for the Degree of

B.Sc.in Biomedical Engineering

Heart Sound Analysis Based on DSP

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Abstract

PCG (phonocardiogram) plays very important role in heart function analysis. It is a weak biological signal with the strong noise . The biomedical signal recordings are so complex and non-stationary that they are also affected by different kinds of noise making their interpretation quite difficult. In this research we propose algorithm to extract heart sound components based on wavelet transform and de-noise technique increase the precision of the detection process. A proposed algorithm include data were analyzed with aim to find a suitable feature subset for automatic classification of heart sound. The signals are evaluated in our experiments on 28 signals . The proposed algorithm reaches high accuracy by compaired with respect to the diagnosis established by the clinicians.

مستخلص الدراسة

اشارة صوت القلب تلعب دور هام في تحليل وتشخيص وظائف القلب، وهي اشارات حيوية ضعيفة جدا لها ضجيج قوي وعملية تسجيل اصوات لقلب هي عملية معقدة وغير ثابتة وهي تتاثر ايضا بانواع مختلفة من الضجيج مما يجعل من الصعب تفسيرها وتشخيصها بصورة جيدة. في هذا البحث تم اقتراح خوارزمية لاستخراج مكنونات صوت القلب اعتمادا على تقنية تحويل المويجات (WT) وازالة الضجيج وذلك لتحسين عملية الكشف والتحديد الخوارزمية المقترحة يتم فيها اختبار 28 اشارة بهدف استخلاص خصائصها لاستخدامها في التصنيف التلقائي لاصوات القلب. الخوارزمية المقترحة وصلت الى دقة جيدة وذلك بمقارنتها مع التشخيص الاساسي للاشارات المرجعية

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Abbreviations

Abbreviation	Description
A2	Atrial Septal Component .
ADC	Analog To Digital Convertor.
db	Daubechies .
DWT	Discrete Wavelet Transform .
ECG	Electrocardiogram .
FFT	Fast Fourier Transform .
FT	Fourier Transform.
M	Mitral Area.
P2	pulmonary Stenosis .
PCG	Phonocardiography .
S1	First Heart Sound .
S2	Second Heart Sound .
S3	Third Heart Sound .
S4	Forth Heart Sound .
SVD	Singular Value Decomposition .
T	Tricuspid Area .
USA	United State American.
WT	Wavelet Transform .

General overview

.1 1.1 Introduction:

Auscultation is a technique in which a stethoscope is used to listen to the sounds of a body. The structural defects of the heart are often reflected in the sounds the heart produces. Physicians use the stethoscope as a device to listen to the patient's heart sounds and make a diagnosis. They are particularly interested in abnormal sounds, which may suggest the presence of a cardiac pathology and also provide diagnostic information.

Changes in frequency may be interpreted as changes in intensity. In the presence of high-frequency sounds, the ear may be unable to detect low-frequency ones which follow immediately. Recent advances in data recording technology and digital signal processing have made it possible to record and analyze the sound signals from the heart. However, for computer analysis of the acoustic signals from the heart, it is essential that different components of heart cycle can be timed and separated.

Recent advances in information technology systems, in digital electronic stethoscopes, in acoustic signal processing and in pattern recognition methods have inspired the design of system based on computer processing.

.2 1.2 Problem Statements:

Determination of heart conditions by heart auscultation is a difficult task and requires special training of medical staff.

Using acoustic stethoscope is not efficient because of its limited sensitivity to human ear that make evaluation of cases differ between physicians according to their experience.

This true is despite the availability is computerized training modules that provide a caustic and visual display of heart sounds.

.3 1.3 Objectives:

The main purpose of this research is to perform computer-aided heart sound analysis to give support to medical doctors in decision making.

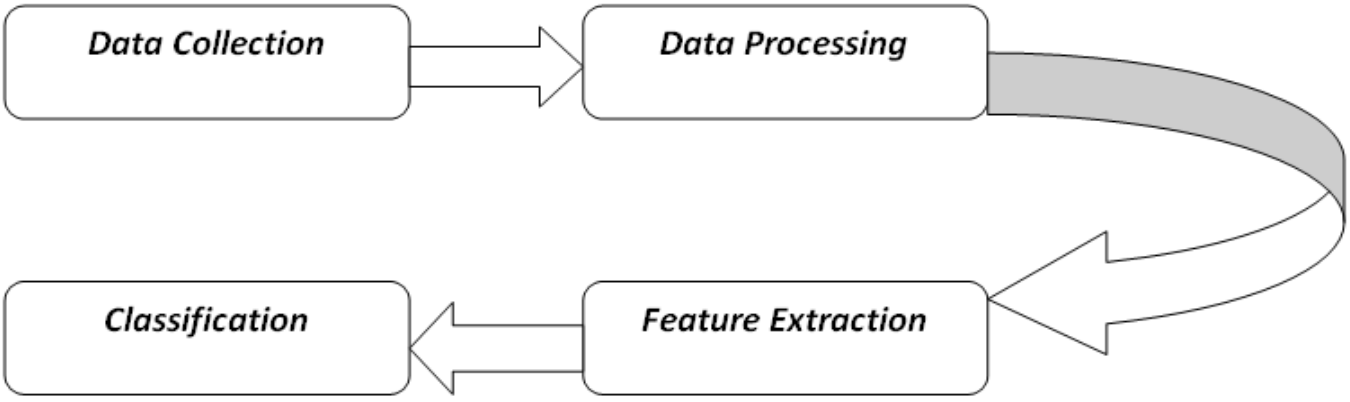
1.3.1 1.3.2 Specific Objectives:

1. Detect heart sounds characteristics.
2. Classify heart sounds into normal and abnormal cases.
3. Improve the diagnosis Capabilities of auscultation and Get automatic system to help the physician in the diagnosis.

.4 1.4 Methodology:

The proposed method is based on wavelet transform (WT) method and is developed to locate the heart sound components in the heart sound signal accurately to improve the computation precision of feature parameters of heart sound signal.

Finally from the extracted features it will be possible to assess the cardiac functions of the patient (normal or abnormal). Figure below show the method steps:



(Figure 1.1: Block diagram illustrate research stages).

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.7 1.5 Thesis Layout:

This research project contains five chapters organized as follows:

1. Chapter one consists of brief introduction and general overview.
2. Chapter two consists of theoretical background and literature review.
3. Chapter three consists of proposed method for heart sound analysis.
4. Chapter four consists of results, discussions and evaluate the gated results.
5. Chapter five consists of conclusions and recommendations.