

PRINCIPLES OF TRANSDUCER DEVICES AND COMPONENTS

Edited by

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Chapter 32

WAVELET ANALYSIS OF THE ECG SIGNALS FOR THREE COMMON HEART DISEASES IN JORDAN

JALEL CHEBIL, JAMAL AL NABULSI

32.0 INTRODUCTION

The electrocardiogram is a common diagnostic tool used to monitor heart activity and can provide information about the cardiovascular problems. An automatic detection of the ECG traces can be valuable aid in the diagnosis process. The wavelet transform has proven to be an important tool in the analysis of biomedical signals, and the ECG in particular. This paper proposes a method for the classification of various types of ECG signals using wavelet transform. The method is developed based on the ECG data collected at different local hospitals in Jordan. The data include normal ECG records from healthy people and abnormal ECG signals taken from patients with common heart diseases in Jordan such as right atrial hypertrophy, left atrial hypertrophy and hypocalcaemia.

The electrocardiogram (ECG) is a surface measurement of the electrical potential generated by electrical activity of the heart muscle in dependence of time. The mechanical activity of the heart is linked with its electrical activity. An ECG is therefore an important diagnostic tool for assessing heart function. This importance comes from the simplicity and the richness of information about the functionality of the heart that could be obtained from the ECG waveform. The study of the electrical signal produced by current flow, in the form of ions, inside the heart chambers can provide a great deal of information on the normal and pathological physiology of heart activity [1].

An ECG is composed of heartbeats that are repeated periodically. Each individual heartbeat is comprised of a number of distinct cardiological stages, which in turn give rise to a set of individual features in the ECG waveform. These features represent either depolarization or repolarization of the muscle cells in particular regions of the heart. In each heart beat several waves and intervals can be recognised [2]. The shape and duration of these waves and intervals characterise cardiovascular diseases such as arrhythmia, ischemia, right atrial hypertrophy (RAH), left atrial hypertrophy (LAH), hypocalcemia etc [3], [4].

In the last decades, the wavelet transform has proven to be a valuable tool in many application areas for analysis of non-stationary signals such as the biomedical signals, and the ECG signal in particular [5]. The wavelet transform provides a time-frequency representation of the signal, and thus permits the inspection of characteristic waves of the ECG signal at different scales with different resolutions. In this study we present a method for the classification of various types of ECG signals using wavelet transform. The method