Chapter 2
Introduction to Heart

ABSTRACT

This chapter provides an introduction to the heart and the importance of detecting heart problems based on heart signals. It explains details about electrocardiogram signal and 4 common heart disorders including supraventricular tachycardia, bundle branch block, anterior myocardial infarction (Anterior MI), and inferior myocardial infarction (Inferior MI).

2.1 OVERVIEW

Heart is an important organ in the body, for pumping the blood throughout the human body. The heart generates signals, which hide information in their structure. This signal information is very useful to physicians for heart disorder detection, but is not easily perceived by them. Therefore, it is necessary that signals be decoded to be useful for interpretation by specialists. The interpretation process is sometimes easy when it only involves visual inspection of the signal. However, there are signals whose complexity is high due to the heart disorders, which affect the decoded form of signals. Automated methods can assist specialists in accurate diagnosis and therefore, automated heart signal processing becomes a reliable tool for finding important information that is hidden in the signal (Adlam and Hampton, 1997).

An important issue in designing an analysis method for heart disorder diagnosis and avoiding the risk of overlooking useful information of the heart signals is to have the knowledge about the physiology of the human body. Early use of computers in the medicine area was limited to the automation,

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but this goal has been changed over the years, because specialists must be responsible for the taken diagnosed disorders. Nowadays, the automated system goal is to help physicians for better decision making (Fitzgibbon et al. 2002).

An emphasis of the book is noise removal as the heart signal is usually corrupted with noise from various sources, including machine malfunction, electrical noise from elsewhere in the body, respiration and muscle contractions (Behbahani, 2007). The noise consists of low-frequency and high-frequency components such as baseline wander and powerline interference, respectively (Karl et al., 2004). The recorded signal is distorted in a way that it could be difficult to perform any automatic diagnosis. The next sections present explanation on the function of the heart, the electrocardiogram, objectives, aims and contributions of this research work.

2.2 HEART FUNCTION

The heart is an organ in the human body for providing blood and oxygen. It is divided into 2 halves containing four chambers, as shown in Figure 1. As seen, left and right atria are upper chambers, while the left and right ventricles are the lower chambers. There are fibrous, non-conductive tissues for joining the atria to the ventricles to keep the ventricles electrically isolated from the atria. In addition, the heart contains veins called the superior and inferior vena cava for receiving the oxygen-poor blood into the right atrium. In order to pump the blood to the lung, the right atrium and the right ventricle cooperate together. The blood is forced into the right ventricle by the right atrium. In order to oxygenate the blood, the right ventricle then pumps it to the lungs. The oxygen-enriched blood received from the lung by the left atrium and the left ventricle circulates to the rest of the body (Adlam and Hampton, 1997).

Regular electrical impulses in the heart are spontaneously generated by the node called heart Sinoatrial (SA). The electrical impulses help the heart conduction system to initiate the contraction of the myocardium. In the heart function, there is a process called depolarisation that is because of the propagation of an electrical impulse to through the heart tissue. The depolarisation of the heart muscles causes generation of a strong ionic current (Silver, 2002). The generated current provides a voltage drop by flowing through the resistive body tissue. The electrical impulse flows to the atrial myocardium as a result of atrial depolarisation. The electrical impulse is