

Chapter 49

Diagnosis of Angina Using Neuro–Fuzzy Technique

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ABSTRACT

The majority of people will suffer heart attacks (Dr. A. Abdul Jallel, Personal communication, December 10, 2005). To confirm the disease, patients need to undergo tests like ECG, treadmill, etc., which cost money and time. After heavy expenses and large duration only, they come to know whether they are affected by a heart attack or another disease. To help the people, it is planned to give a suitable solution by an emerging technology called “Neuro-Fuzzy.” The main objective of this chapter is to identify the symptom called “angina,” which is severe chest pain prior to a heart attack. With various symptoms like location of pain, radiation of pain, precipitation of pain, duration of pain, cholesterol, smoking, family history, angina can be diagnosed. After the diagnosis, it is possible to know angina’s severity, and based on it, a biopsy is recommended for the affected people.

1. INTRODUCTION

As a statistical point of view, about one fifth of the deaths in India are due to coronary heart disease (Krishnan, 2012). It may further be extended as one third of all deaths by the year 2020. About 17.5 million people in the world currently have heart disease and 7, 95,000 people are expected to have a serious heart attack every year and an estimated 30% of this population has one or more risk factors for heart disease (Krishnan, 2012). Most risk factors for heart related diseases are related to lifestyle and environmental factors. Over the past decades, rates of heart related diseases have declined in both men and women as they quit smoking and improved dietary habits. They have also been minimal changes in other risk factors such as smoking, sedentary behavior and blood pressure control. Some of the risk factors cannot be changed like age, gender and genetics. By maintaining a healthy life style environment, these effects can be a modifiable.

The risk for heart disease increases with multiple risk factors such as unhealthy cholesterol, diabetes, obesity, smoking and hypertension. With reference to a survey made in the year 1999, it is found that

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men and women of all ages who had none of these risk factors had a risk of dying from heart attack that was between 77% and 92% (Henry, Alex & Samuel, 2008). Conversely, from a recent study report, it is also found that, the patients with a healthy life style significantly reduced their risk for heart attack. Healthy life style means that patients should follow dieted food with low fat, stress management, no smoking, necessary aerobic exercises.

The proposed chapter deals about the diagnosis of ‘angina pectoris’ or simply ‘angina’. It is the common symptom of coronary artery disease which is also simply known as chest pain. It can further be described as a discomfort, heaviness, pressure, aching, burning, fullness, squeezing, or painful feeling due to coronary heart disease. Many times, it can be mistaken for indigestion.

The causes of angina include obstruction of the coronary arteries. (National Heart, Lung and Blood Institute [NHLBI], 2013). Angina is caused when blood flow to an area of the heart is decreased, impairing the delivery of oxygen and vital nutrients to the heart muscle cells. When this happens, the heart muscle must use alternative, less efficient forms of fuel so that it can perform its function of pumping blood to the body. The byproduct of using this less efficient fuel is a compound called lactic acid that builds up in the muscle and causes pain. Whenever the blood supply to the muscles of the heart is restricted, there will be a chest pain or discomfort which will further leads o heart attack.

With the help of various symptoms such as Location of pain, Radiation of pain, Precipitation of pain, Duration of pain, Cholesterol, Smoking, Family History, the angina can be diagnosed. With the severity of the angina, the possibility of heart attack can be identified and biopsy can be recommended for further treatment. The main objective of the proposed work is to diagnose the angina by an intelligent technique ‘neuro-fuzzy’ logic which is the hybridization of Neural Networks and Fuzzy Logic is used. This structure models the nonlinear relation between angina symptoms and resulting test scores as well as the degree of fuzzy belonging of the symptoms to all categories of angina simultaneously (Fazeli, 2008).

2. BACKGROUND OF ANGINA

Angina is a severe chest pain or discomfort that occurs if there is no enough oxygen-rich blood to the area of the heart muscle. It can be felt like pressure or squeezing in the chest portion. The pain can also be felt in other portions of the body such as shoulders, arms, neck, jaw, or back. Sometimes angina may be considered as a discomfort due to indigestion.

As per the physician’s statement, angina is not a disease and it is a symptom of an underlying heart problem. It is usually a symptom of Coronary Heart Disease (CHD), a most common type of heart disease in adults. If a waxy substance called plaque builds up on the inner walls of the coronary arteries, there is a possibility of the symptom of CHD. The coronary arteries do the duty of carrying oxygen-rich blood to the heart.

A normal artery with normal blood flow is shown in Figure 1 and from which the inset image shows a cross-section of the normal artery. An artery with plaque buildup is shown in Figure 1(B) and from which the inset image shows a cross-section of an artery with plaque buildup.

Plaque narrows and stiffens the coronary arteries. The narrowing of the arteries in CAD is caused by a process called atherosclerosis. People with atherosclerosis have a build-up of a substance called plaque inside the wall of their arteries. Plaque is made up of fat, cholesterol, clot, calcium deposits, and

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