Chapter 7
Explainable Artificial Intelligence for Diagnosis of Cardiovascular Disease

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ABSTRACT

Cardiovascular disease (CVD) is among the top causes of mortality in today's world; according to the World Health Organisation (WHO), 17.9 million individuals worldwide have died from this illness, leading to 31% of all fatalities. Through early detection and alteration in lifestyle, more than 80% of deaths due to CVD can be avoided. The majority of CVD cases are identified in adults; however, the risk factors for its beginning develops at a younger age. Various machine learning and deep learning algorithms have been utilized to diagnose and predict different types of CVDs, resulting in the development of sophisticated and efficient risk classification algorithms for every patient with CVD. These models incorporate explainability modalities which can improve people's comprehension of how reasoning works, increase transparency, and boost confidence in the usage of models in medical practice. It can help in optimising the frequency of doctor visits and carrying out prompt therapeutic along with preventative interventions against CVD occurrences.

1. INTRODUCTION

Cardiovascular Diseases (CVD) are illnesses which impact the heart and arteries of human beings (Singh & Bhushan, 2022). These illnesses may affect one or more parts of the cardiovascular system and/or

the vessels that carry blood. A person may be asymptomatic (not feeling anything at all) or symptomatic (physically experiencing the disease). As per the reports, CVDs caused the deaths of 17.9 million people worldwide in 2019, which represents 32% of the total number of fatalities and also, 85% of these deaths were triggered by heart attacks or strokes. The major cause of mortality (42.1%) attributed to CVD in 2019 was Coronary Heart Disease (CHD), and followed by Heart Failure (HF) (9.6%), high blood pressure (11.0%), stroke (17.0%), disorders of the arteries (2.9%), and other CVD (17.4%) (Salah & Srinivas, 2022). Also, cardiovascular ailments can be avoided by managing behavioural risk factors such as cigarette use, food habits and obesity, inactivity, and problematic alcohol intake. Figure 1 depicts the data of deaths caused by various chronic diseases in previous years (Elflein, 2022).

2. TYPES OF CARDIOVASCULAR DISEASES

Cardiovascular illnesses can take many different forms, which includes but is not restricted to (Bhushan et al., 2023):

Arrhythmia: Arrhythmia is an irregular heartbeat in which the heart beats too quickly, too slowly, or in an aberrant manner. It happens when the electrical impulses that control the heart's beat are interrupted (Mayo Clinic, 2023a). The heart possesses a unique electrical structure that coordinates contractions and ensures appropriate blood flow through the body. Heart injury, cardiovascular disease, hypertension, imbalances in electrolytes, stress, medicines, and certain substances such as alcohol, caffeine, or narcotics can all cause arrhythmia. Some arrhythmia has no known origin and can occur in individuals who are otherwise fit.

Figure 1. Deaths caused by various chronic diseases
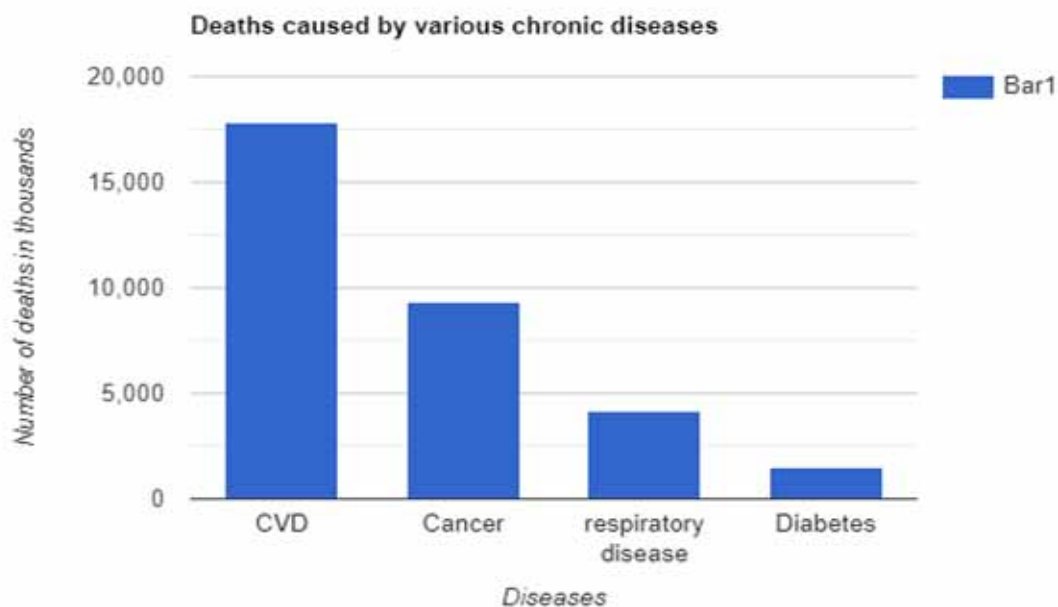
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