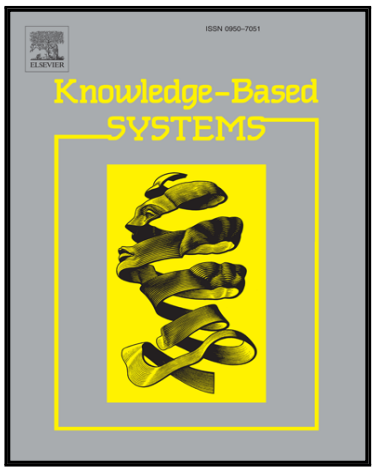

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PII: S0950-7051(16)30207-6
DOI: 10.1016/j.knosys.2016.07.004
Reference: KNOSYS 3592

To appear in: *Knowledge-Based Systems*

Received date: 12 March 2016
Revised date: 1 July 2016
Accepted date: 2 July 2016

Please cite this article as: Roohallah Alizadehsani , Mohammad Hossein Zangooei , Mohammad Javad Hosseini , Jafar Habibi , Abbas Khosravi , Mohamad Roshanzamir , Fahime Khozeimeh , Nizal Sarrafzadegan , Saeid Nahavandi , Coronary Artery Disease Detection Using Computational Intelligence Methods, *Knowledge-Based Systems* (2016), doi: 10.1016/j.knosys.2016.07.004

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***Abstract*—Nowadays, cardiovascular diseases are very common and are one of the main causes of death worldwide. One major type of such diseases is the coronary artery disease (CAD). The best and most accurate method for the diagnosis of CAD is angiography, which has significant complications and costs. Researchers are, therefore, seeking novel modalities for CAD diagnosis via data mining methods. To that end, several algorithms and datasets have been developed. However, a few studies have considered the stenosis of each major coronary artery separately. We attempted to achieve a high rate of accuracy in the diagnosis of the stenosis of each major coronary artery. Analytical methods were used to investigate the importance of features on artery stenosis. Further, a proposed classification model was built to predict each artery status in new visitors. To further enhance the models, a proposed feature selection method was employed to select more discriminative feature subsets for each artery. According to the experiments, accuracy rates of 86.14%, 83.17%, and 83.50% were achieved for the diagnosis of the stenosis of the left anterior descending (LAD) artery, left circumflex (LCX) artery and right coronary artery (RCA), respectively. To the best of our knowledge, these are the highest accuracy rates that have been obtained in the literature so far. In addition, a number of rules with high confidence were introduced for deciding whether the arteries were stenotic or not. Also, we applied the proposed method on two challenging datasets and obtained the best accuracy in comparison with other methods.**

***Index Terms*—Coronary artery disease, Support Vector Machine, Information Gain, Kernel Fusion, Feature Selection.**

I. INTRODUCTION

Data mining methods, which discover relations hidden in a dataset, are utilized in different fields, from banking to insurance. Classification is one of the methods creating a model based on a set of labeled data, in order to assign labels to a set of unlabeled data records [1].

Today, using different machine learning methods is common in disease diagnosis [2]. Some notable machine learning methods are: Decision Tree [3], Neural Networks, Bayesian Networks [4], and Support Vector Machine (SVM) [5-7].

The search for the causes of heart disease and accurate diagnosis with fewer complications and higher accuracy is still ongoing, using machine learning and data mining techniques [8, 9, 10, 11, 12]. Angiography is currently deemed the most accurate method for the diagnosis of coronary artery disease (CAD) [13, 14]. However, the invasive nature of this diagnostic modality has prompted researchers to seek less invasive methods with the aid of data mining. A patient has CAD if at least one of LAD, LCX or RCA arteries is stenotic more than 50%. Coronary arteries supply blood to the heart muscles. The two main coronary arteries are the left and right coronary arteries. The left coronary artery is an artery that arises from the aorta above the left cusp of the aortic valve and feeds blood to the left side of the heart. It typically runs for 10 to 25 mm and is then bifurcated into the left anterior descending (LAD) and the left circumflex artery (LCX). The right coronary artery (RCA) is an artery originating above the right cusp of the aortic valve. It travels down the right atrioventricular groove, towards the crux of the heart [15].

Data mining techniques have the capability to evaluate factors contributing to cardiac disease with high accuracy rates. The literature contains several studies on the diagnosis of CAD. Polat et al. [16] utilized clinical information, the Artificial Immune Recognition System (AIRS), and the K Nearest Neighbor (KNN) to present a system for CAD diagnosis and attained an accuracy rate of 87%. Kara et al. [17] opted for the Doppler Signal and the Neural Network to achieve optimum diagnostic accuracy for CAD. Babagolu et al. [18] employed the exercise test data and the Support Vector