

# An Optimized Model for Estimation of Coronary Artery Calcium Score Using Intelligent System

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**Abstract --** In past decades, cardiovascular diseases are the one that causes most deaths in the world. The more Coronary Artery Calcium Score (CACs) is, the higher the risk of a heart attack. Therefore, CACS is important for the determination of the risk of heart attack. We will make use of Intelligent System to determine the CACS. For this purpose, we collect different parameters like BP, BMI, Calcium Score etc. from UCI Machine learning repository which will be used for learning purpose to predict CACS. From the predicted CACS, we will apply fuzzy logic which will help to define the ranges in more detail. These ranges will define the risk of heart attack.

**Indexed Terms:** Artificial Neural Network (ANN); Coronary Artery Calcium Score (CACs); Fuzzy Logic

## I. INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of deaths in the world. In 2006, one of every six deaths in the United States was attributed to coronary heart disease (CHD). The National Ambulatory Medical Survey data show that patients with a primary diagnosis of CHD comprised approximately 79.7 million visits to physician offices, emergency departments, and outpatient clinics.

The estimated direct and indirect cost of CHD for 2010 is \$177.1 billion. Due to the enormous economic burden, in addition to the morbidity and mortality associated with CAD, various studies have been undertaken to identify a diagnostic test that could risk-stratify patients for the presence or absence of CAD, especially in those who are at intermediate to high risk according to other scales, such as the Framingham Risk Assessment score (FRS). Approximately 50% of patients with clinical CAD present initially with sudden death.

The amount of calcium deposits in the coronary arteries is an important biomarker of cardiovascular disease. Coronary calcium has traditionally been

Quantified as an Agatston score using ECG-synchronized cardiac CT. A normal coronary artery should have no calcifications. The correlation of CAC and the presence of atherosclerosis have been demonstrated by various histopathology studies. Numerous studies have shown plaque burden to be a better determinant of future coronary events. Myocardial perfusion scintigraphy (MPS) and stress echocardiography are invaluable in the diagnosis of obstructive coronary disease, but cannot be used to estimate total plaque burden. Non-contrast cardiac computed tomography (CT) imaging serves as an anatomic, non-invasive test to visualize the presence of calcified plaque. 12-14 Contrast multislice cardiac CT angiography can detect calcified plaques, non-calcified plaques, and mixed plaques.

## II. METHOD USED

### A. Dataset Used in Study:

In this study, the body mass index, smoking, fasting blood sugar, cholesterol, blood pressure and CACS score of 312 patients (152 female, 160 male) of whose ages vary between 29 and 77 years (mean 45.56 years) obtained from UCI Machine learning repository were used. When we examined the dataset, it is seen that the average body mass index of the patient is 31.12 and the mean coronary artery calcium score is 246.23.

### B. User Input Data:

In the scope of the study, user enter the data in the UI and that data is been transformed to Predict heart risk. To reflect the gender data to the feature vector, "1" for male patients and "0" for female patients were chosen. In the study, 312 patient's data were used for ANN training purpose.

C. Artificial Neural Networks (ANN):

Artificial neural networks are a computational tool, based on the properties of biological neural systems. Back propagation ANN was used in this study. Back-propagation ANN is an artificial intelligence algorithm consisting of an input layer, hidden layer and output layer. The neural network itself is not an algorithm, but rather a framework for many different machine learning algorithms to work together and process complex data inputs. Such systems "learn" to perform tasks by considering examples, generally without being programmed with any task-specific rules.

D. Fuzzy Logic:

Fuzzy logic is a form of many-valued logic in which the truth values of variables may be any real number between 0 and 1. It is employed to handle the concept of partial truth, where the truth value may range between completely true and completely false. If then rule is applied in fuzzy logic. If Calcium Score is high then define it in Ranges through Fuzzy Logic.

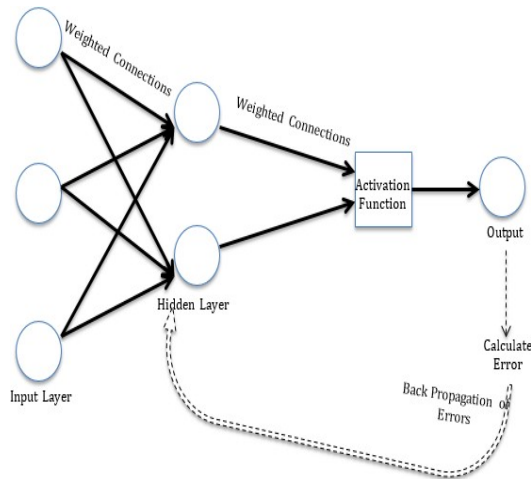


Fig. 1: Back propagation error signal

Back propagation error signal helps to give the accurate results through learning.

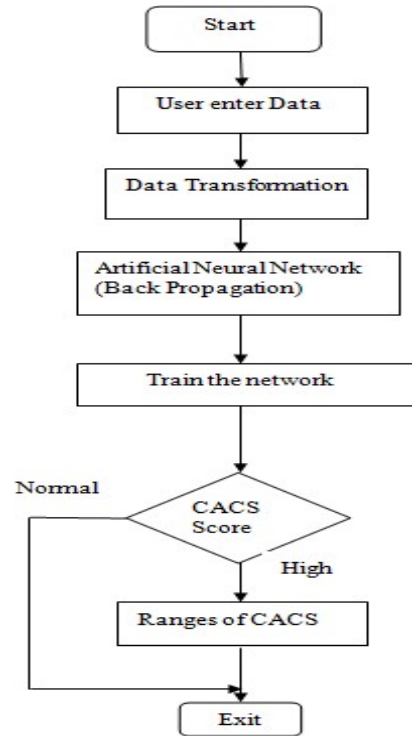


Fig. 2: Flowchart of system

III. PROPOSED SYSTEM

A. Experiments:

In this study, an intelligent system is proposed to estimate the Agatston coronary artery calcium score class without need for measurement. The system that we proposed consist a dataset and will make use of Intelligent System to determine the CACS. For this purpose, various data like body mass index, smoking, fasting blood sugar, cholesterol is collected from UCI machine repository which will be used for learning purpose to predict CACS. The most commonly internationally recognized scoring unit for testing is the "Agatston" scoring. From the data of body mass index, smoking, fasting blood sugar, cholesterol related to 304 patients, 304 feature vectors were created as described previously. The Agatston coronary artery calcium score class was then estimated using these feature vectors.

#### IV. CONCLUSION

The results obtained with the proposed estimation system show that Agatston coronary artery calcium score is strongly correlated with body mass index, age and gender moreover the increase in more parameter like smoking and Diabetes will help to predict more accurate results. Thus, the application is convenient and easy to use. The best part of system is that it is cost effective. The application estimate the Coronary Artery Calcium Score Considering the parallelism between coronary artery disease and coronary artery calcium score, it is understood that there is a relationship between input parameter such as Age, Gender, Height, Weight, Smoking and coronary artery disease. There is also a strong association between Weights i.e. Obesity and coronary artery disease. One will not need to access internet for estimation of Coronary Artery Calcium Score.

#### V. FUTURE SCOPE

It is evaluated that with the proposed system in this study, the use of other classifier structures such as deep learning instead of ANN may increase the success rate.

Mobile Application can be created for mobile users. By increasing dataset of medicines field some suggestion of medicines can be given to user.

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