CHAPTER 3

A STUDY ON ACUTE MYOCARDIAL INFARCTION
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This chapter reviews the recent trends in the study of the Coronary Heart Disease (CHD), the risk factors that lead to CHD, relevance of the study of Acute Myocardial Infarction (AMI), data collection, basic idea of the case-control study, preparation for data analysis such as feature selection, risk calculation, normalization of data and so on. The proposed Neuro-Fuzzy Decision Tree Rule Learning (NFDTRL) model, discussed later in this study, is developed as a medical decision support system for the early detection of the possibility of getting Coronary Artery Disease.

3.1 Introduction

The World Health Organization (WHO) defines CHD or ischemic heart disease as ‘the cardiac disability, acute or chronic, arising from reduction or arrest of blood supply to the myocardium in association with disease processes in the coronary arterial system’ [121]. WHO reported that worldwide, an estimated 17 million people die of cardiovascular diseases (CVD), particularly 7.2 million CHDs including heart attacks and 5.5 million strokes, every year [122]. Most of these deaths are in developing countries and a substantial number of this mortality can be attributed to tobacco smoking, which increases the risk of dying from CHD and cerebrovascular disease 2-3 fold. Acute Myocardial Infarction, generally, CHD is the single most important cause of death and, more importantly, the single biggest cause of premature death in modern, industrialized countries [121]. CHD covers a spectrum of diseases including angina pectoris, acute coronary syndromes, myocardial infarction, ischaemic cardiomyopathy with chronic heart failure, and arrhythmias and/or sudden death, usually related to acute arrhythmias [123]. Coronary Artery Disease (CAD) is one of the potential health hazards in India with more and more people getting affected by it
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[124]. If unchecked at initial stages, it might lead to angina pectoris (chest pain) or myocardial infarction (heart attack) or even sudden death.

A heart attack or a sudden death is a direct consequence of atherosclerosis of the coronary arteries [125]. Atherosclerosis is the scientific name for the process of hardening of the coronary arteries. It is a slowly developing process in which cholesterol and other fatty substances are deposited in the walls of the arteries. It begins from early childhood by depositing of cholesterol and other fatty substances (fatty plaques) in the walls of arteries [126]. Aging blood vessels is a continuous process of hardening the arteries and progresses throughout the life of an individual [126]. With time, these fatty plaques grow in size and harden, which may lead to narrowing of the coronary arteries. When the coronary arteries become narrowed, the amount of oxygen reaching the heart muscle may not be enough to meet its demands [127]. If blood flow is completely blocked in the artery by a plaque or a blood clot forming within the narrowed artery, the heart muscle supplied by this artery does not receive any blood and starts to die. This leads to a heart attack. The blockage of the artery can occur as the result of a gradual build up of cholesterol within the artery over several years. Arteries that are narrowed by the atherosclerosis cannot deliver enough blood to maintain normal function of the parts of the body they supply.

The human heart is only the size of a fist, but it is the strongest muscle in the human body. Blood is pumped out from the left chambers of the heart. It is transported through arteries of ever-decreasing size, finally reaching the capillaries in all the tissues, such as the skin and other body organs. Heart pumps blood through the blood vessels thereby delivering oxygen and nutrients to all parts of the body. Although the heart is bathed in blood, it cannot receive its own nutrition from the blood it is continuously pumping. For its own oxygen and nutrients, the heart depends on blood from three arteries known as the coronary arteries which arise from the aorta. The coronary arteries include the right coronary artery (RCA) and the left main
coronary artery (LMCA) which in turn divides into two branches: the left anterior descending coronary artery (LAD) and the left circumflex coronary artery (LCx). The LMCA is the most important artery of the heart supplying almost 70-80% of the heart’s muscle. Of this the LAD accounts for approximately 50% of the heart’s blood supply, and the LCx for 20-30%. The remaining 20-30% of the heart’s blood supply comes from the RCA. An occlusion of the LMCA is almost always fatal. The LAD blockage is very serious, which results in severe damage to the heart. Occlusions of the RAC and LCx, or smaller side branches of any of the coronary arteries are usually less dangerous and result in a heart attack of variable size and severity, depending on the size of the artery which is blocked.

The major types of heart diseases are Coronary artery disease, Ischemic heart disease, Vascular disease, Rheumatic heart disease, Congenital heart disease, and Cardiomyopathies. Myocardial Infarction (heart attack), the master killer of mankind continues to be the leading cause of death all over the world [122]. The treatment programs designed to alter and prevent the modifiable risk factors have probably contributed substantially towards the decline of death rate. According to Gupta [128], prevention of cardiovascular diseases calls for correction of modifiable risk factors by either correction of lipid blood disorders or on the lowering of blood pressure, giving up smoking, improving eating habits, more physical exercise and care of psychological factors. It is preferable to maintain a desirable body weight, exercise regularly, choose a low stress life style and undergo a periodic check up for blood pressure, blood glucose and blood cholesterol to prevent CHD [129]. An early detection of the coronary risk factors as well as the entire risk of CHD helps to choose a life pattern to reduce the modifiable risk factors.

3.2 Risk Factors of Coronary Heart Disease

The importance of underlying risk factors in the treatment and management of CHD can be captured in the following words of Kannel
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[130]: “Coronary disease does not really begin with crushing chest pain, pulmonary edema, shock, angina or ventricular fibrillation, but rather with the more subtle signs like a poor coronary risk profile”. A risk factor is something that may increase the chance of developing a disease. The term “risk factor” is widely used to describe those characteristics found in individuals that have been shown in observational epidemiological studies, autopsy studies, metabolic studies and genetic studies to relate to the subsequent occurrence of CHD [124]. Certain conditions and habits present more frequently in individuals who develop atherosclerosis than in general population. Factors that increase the risk of developing atherosclerosis and heart attacks are termed as the risk factors of CHD. In global terms, risk factor categories cover personal, biochemical, physiological and lifestyle characteristics [124]. Categorize such risk factors generally into two: modifiable and non-modifiable. Smoking, Hyperlipidaemia, diabetes mellitus, hypertension, obesity, physical inactivity and stress are belonging to modifiable risk factors; whereas advancing age, gender and family history of CHD are belonging to non-modifiable [131]. However, angina may be the first warning sign of advanced CAD, there may be other pre-warning signs, which are the occurrence of the risk factors.

3.2.1 Non-Modifiable Risk Factors

**Advancing Age:** Coronary heart disease increases with age in both men and women [124]. In women, CHD tends to occur after menopause, and rates are significantly higher than for other common diseases of aging [132].

**Male Gender:** At all ages, men are more likely than women to develop atherosclerosis and CHD [124]. Some scientists believe that this difference is partly due to the higher blood levels of high-density lipoprotein (HDL) cholesterol in women than in men. This gender difference discriminates the male and female as the risk factors. Epidemiological studies reveal that women are relatively protected against CHD while pre-menopausal and this protection is less evident in the postmenopausal years [133].
Family History: Coronary artery disease often runs in families. This may be due to genetic factors or the effects of shared environment such as similar diet, smoking habits etc. Individuals with a family history of coronary heart diseases have an increased risk of heart attacks [125]. Specifically, the risk is higher if there is a family history of early CHD, including a heart attack or sudden death before age 55 in the father or other first-degree male relatives, or before age 65 in the mother or other first-degree female relatives.

3.2.2 Modifiable Risk Factors

Hyperlipidemia: Hyperlipidaemia or cholesterol refers to a raised level of blood lipids. Cholesterol is a soft, waxy substance found among the lipids (fats) in the bloodstream and in all our body’s cells. Cholesterol and other fats cannot dissolve in the blood. Increased blood cholesterol level is related to an increased risk of CHD [125]. This can be caused by both genetic and life style factors such as diet. Coronary risk rises progressively with an increase in cholesterol level, particularly when the cholesterol level rises above 200 mg/dL. Less than 200 mg/dL is the desirable blood cholesterol, 200-239 mg/dL is borderline and greater than 240 mg/dL is high blood cholesterol.

High LDL: The cholesterol that is combined with low-density lipoproteins (LDL cholesterol) is the “bad” cholesterol that deposits cholesterol in arterial plaques. Thus elevated levels of LDL cholesterol are associated with an increased risk of heart attack [125]. Desirable value of LDL is less than 130 mg/dL, borderline is 130-159 mg/dL and high risk value is 160 mg/dL and above.

Low HDL: The cholesterol that is combined with high-density lipoprotein (HDL cholesterol) is the “good” cholesterol that removes cholesterol from arterial plaques. Thus, low levels of HDL cholesterol are associated with an increased risk of heart attacks [125]. In the average man, HDL cholesterol levels range from 40-50 mg/dL and in the average woman, they range from 50-60 mg/dL. HDL cholesterol less than 40 mg/dL is low
that puts a person at high risk for developing a heart disease [124]. Smoking, being overweight and being sedentary can all result in lower the HDL cholesterol.

**Elevated Triglycerides:** Triglyceride is a form of fat, which comes from food and is also made in our body. People with high triglycerides often have high total cholesterol, high LDL cholesterol and low HDL cholesterol level. Several clinical studies have shown that people with above-normal triglyceride levels have an increased risk of heart disease [125]. Normal value of triglyceride level is less than 150 mg/dL, borderline is 150-199 mg/dL and greater than or equal to 200 mg/dL is high risk.

**Elevated Lp(a):** Lipoprotein(a) or Lp(a) is the most powerful independent risk factor for the occurrence and recurrence of myocardial infarction and early death under 45 years of age [134]. Lp(a) is considered as a “deadly cholesterol” and potent atherogenic properties due to structural resemblance of its apoprotein Apo(a) to plasminogen, which may interfere with plasmin generation and therefore fibrinolysis. Recent studies have shown that Asian Indians have higher concentration of Lp(a) [135]. Normal value of Lp(a) level is less than 30 mg/dL.

**Smoking:** Tobacco smoke contains chemicals that cause damage to blood vessel walls, accelerate the development of atherosclerosis, and increase the risk of heart attack [125]. Smoking rapidly increases the heart rate and constricts blood vessels, while simultaneously reducing the blood’s capacity to carry oxygen. Epidemiological studies have shown that smoking is an independent and biggest, but modifiable risk factor of CHD [124] as well as sudden cardiac death. Several reports point out that smokers have twice or thrice the rate of mortality than non-smokers. Cigarette smoking acts along with other risk factors will greatly increase the risk of CHD. There is a strong, consistent and dose-linked relationship between cigarette smoking and ischemic heart disease.
**Hypertension:** Blood pressure is the pressure in the arterial system defined in terms of systolic and diastolic blood pressure. The systolic blood pressure occurs as the left ventricle empties into the aorta and the diastolic blood pressure occurs as the ventricle fills. High blood pressure adds to the workload of our heart and arteries. If high blood pressure continues for a long time, our heart and arteries may not function as well as they should [136]. Among the numerous risk factors associated with CHD, hypertension plays a major role given its high frequency and its physiopathogenesis. Coronary heart disease is the first cause of morbidity and mortality in hypertensive patients. The risk of heart attack increases several times when the high blood pressure exists with obesity, smoking, high blood cholesterol levels or diabetes. Blood pressure less than 120/80 mmHg is generally considered ideal; between 120/80 mmHg and 139/89 mmHg is border-line, and 140/90 mmHg or above is high risk, where the blood pressure is known as hypertension.

**Diabetes Mellitus:** Diabetes is a metabolic disorder, arising either due to relative or absolute deficiency of a digestive hormone called insulin, or due to inability or resistance of body-cells to use the available insulin [137]. Both of these insulin dependent (Type-I) and non-insulin dependent (Type-2) diabetes mellitus are associated with accelerated atherosclerosis throughout the body [15]. Type 2 diabetes is the most common form, usually appears in adults, often in middle age. Patients with diabetes mellitus are at risk for reduced blood flow to the coronary arteries and other organs of the body. This is associated with an increased incidence of ischaemic heart disease and with a tendency to diffuse coronary atheroma [137]. Insulin resistance is associated with obesity and physical inactivity and is also a potent risk factor for CAD. Diabetes mellitus is defined as a fasting blood glucose concentration more than 120mg/dL or antihyperglycemic drug treatment.

**Physical Inactivity:** An inactive lifestyle is a risk factor for coronary heart disease [124]. Long term physical activity is known to be important in maintaining ideal body weight and muscle mass. Several reports point out
that exercise also plays an important role in maintaining normal blood pressure and optimizing the lipid values. Thus, physical inactivity is considered as a risk factor.

**Obesity**: Obesity has been described as one of the most important avoidable risk factors for a number of life-threatening diseases like CHD and for serious morbidity [138]. Conditions of excess weight are well defined by the WHO using the body mass index (BMI) as a single measurement tool [139]. BMI is the ratio of the weight in kilograms and the square of height in meters that correlates strongly with total body fat content in most adults.

\[
\text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height (m}^2\text{)}}
\]  

Degrees of obesity are graded using the following classification: normal between 18 kg/m\(^2\) and 24.9 kg/m\(^2\), borderline between 25 kg/m\(^2\) and 29.9 kg/m\(^2\). BMI of 30 kg/m\(^2\) or above is considered as the obesity.

**Elevated Homocysteine**: Homocysteine is an amino acid formed during the metabolism of the essential amino acid methionine, the major methyl group donor in mammals [140]. It is the best predictor of CHD risk among other conventional risk factor in CAD patients. Usually, the amino acid is produced by the body as a by-product of consuming meat. A study [141] showed that high homocysteine levels in a population were associated with higher levels of cardiovascular disease mortality. Homocysteine level of 12 mmol/L (micromoles per litre) of blood plasma have been found as an increased risk of heart attack and other diseases, whereas the heart attack rate is three times as high as normal when it is 15 mmol/L or above [142]. Homocysteine can disrupt normal blood clotting mechanisms, increasing the risk of clots that can bring on a heart attack or stroke. The adverse effects of homocysteine lead to atherosclerosis.

**Stress**: It is widely believed that stress contributes to the development of coronary disease. However, there is very little evidence to support the
popular view that stress causes CAD, there is no doubt that stress can aggravate the symptoms of established heart disease [125].

### 3.3 Relevance of the Acute Myocardial Infarction Study

According to Lindsay [124], acute myocardial infarction is one of the most serious threats to life and so a major public health problem in India. Cardiovascular deaths in India are estimated to be 2.5 million per year [143]. WHO reported that this will be doubled by the year 2020 and will be the leading cause of morbidity and mortality both in men and women [143]. Clinicians and epidemiologists have long recognized the need for a screening test that detects CAD in its early stages. Many studies have documented the ability to halt or reverse the progression of CAD by modifying lifestyle [144] of each individual. Earlier disease detection would give physicians time to educate patients about preventive measures and offer therapies, thus reducing the chance of early death.

Risk factor profile, evaluation of exercise testing, and coronary angiography are the most common standard methods for the detection of CAD. An individual profile of risk factors method is used by physicians for early detection of the risk for CAD. Risk factor profiles are relatively inexpensive, understandable to patients, and may provide motivation to change life habits to prevent CAD. The exercise testing on a treadmill while monitoring the patient with an ECG provides a broad range of information about the physical function of the heart and lungs. Coronary angiography test uses x-ray images with a radiopaque contrast agent to visualize the lumen of coronary arteries. This test, considered the “gold standard” [145] for CAD diagnosis, accurately reveals the presence, location, and severity of arterial blockages and the functional status of the heart. Angiography is an expensive test. Researchers have continued to look for a non-invasive test for CAD that would be lesser expensive than coronary angiography. As a preventable disease [146] in some extent, one can decrease his/her total risk for developing a CAD by modifying his/her entire life pattern.
3.4 Case-Control Study

Case-Control study is a study in which the risk factors of people with a disease are compared with those without a disease. It is an epidemiological method that begins by identifying persons with the disease of interest (the cases) and compares their past history of exposure to identified or suspected risk factors with the past history of similar exposures among persons who resemble the cases but do not have the disease of interest (the controls) [147]. Cases and controls are compared with respect to existing or past attributes or exposures thought to be relevant to the development of the condition or disease under study [147]. The case-control method selects subjects on the basis of the presence or absence of the disease under study. In a hospital-based case-control study, all cases of the study disease admitted to a single hospital or network of hospitals are discovered during a specific period of time.

**Case Group:** In clinical practice the definition of “a case” generally assumes that, for any disease, people are divided into two discrete classes: the affected and the non-affected. It involves two distinct specifications: (1) establishment of objective criteria for the diagnosis of the study disease; and (2) a statement of eligibility criteria for the selection of individuals for study [147]. Eligibility criteria are established to restrict the study to persons who were potentially at risk of exposure. Such criteria should be applied equally to potential cases and controls.

**Control Group:** A “control” group is used to compare the history of exposure in the cases with that in individuals who are free of the study disease. Controls may be selected either from hospitals known as hospital controls or from community, the community controls. Hospital controls are persons admitted to the same hospital that of the patients admitted who are selected for study, but with a disease or condition different from that under study. The community controls or non-hospitalized controls are persons selected from the geographic area from which the cases arose. Since pairing
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requires at least one control per case, the minimum number of controls in this instance would result from a 1:1 ratio, rather than the use of multiple controls individually matched to each case [147].

3.5 Data Collection

Two sets of data known as “case data” and “control data” are collected for this study through the personal interaction with patients as well as controls. The CAD data are identified as the case data and the non-coronary artery disease data as control data. The former was collected from the patients who were admitted in Coronary Intensive Care Unit (CICU) of the hospitals mentioned in chapter 1 in a particular period. The latter is also collected under the clinical conditions from the people who have no CAD with the criteria of matching age and gender. All clinical tests such as lipid profile, diabetes mellitus, Lp(a) and homocysteine regarding cases and controls are performed in a fully automated Advanced Clinical and Research (ACR) laboratory, Trivandrum. Utmost care had given during blood sample collection and clinical test performance in order to prevent errors.

3.5.1 Study Population

Study population refers here is the population selected to study the disease of interest. Coronary artery disease patients who were admitted in the CICU after diagnosed the first occurrence of their CAD by the cardiologists are selected as the study population. This study identifies a set of 301 CAD patients, of which 244 men and 57 women, as cases whose age ranging from 21 to 75 years. None of the patients had a previous history of CAD. Blood sample of each patient after eight hours fasting is sent to the ACR laboratory for the clinical investigations. The clinical reports provided the measurements related to diabetes mellitus, HDL cholesterol, LDL cholesterol, total cholesterol, triglycerides, Lp(a) and homocysteine. Factors related to personal information such as family history of CAD, smoking status, diet related status, mental stress, status of physical inactivity, account of alcohol intake and the day-to-day life style are recorded by interview with
the patients as well as the bystanders who are closely related to the patients. Weight and height of the patient for computing the obesity and blood pressure in terms of systolic and diastolic are measured and recorded. The risk factors age and gender are also recorded. A total of 18 parameters are collected associated with each patient.

3.5.2 Control Population

Age as well as gender matching criteria is followed for the selection of controls for this study. As the case group represents a set of 301 patients, the same number of subjects is included in the control group. If any of the subjects is presented any disease other than CAD, it will not be the exclusion criteria of control group. For the selection of subjects in control group, the individuals from the community are chosen from the geographic area from which the cases arose. All the clinical examinations of the controls’ are also conducted in the same laboratory where the cases’ clinical tests are carried out. This helps to reduce the noise related to the instruments and the procedural accuracy of the lab technicians’.

3.5.3 Documentation of Patient Information

The research instruments needed for case-control investigations usually include record abstract forms and standard interviews or questionnaires [147]. In this study a questionnaire (given in Appendix B) is prepared with the help of experts working as research associates and cardiologists in different hospitals. The interview reports of the patients and relatives related to personal information of the patients, their life style, information related to mental stress, disease background, status of physical activity, diet status and socio-economic status along with the clinical reports are recorded in the questionnaires. These information are recorded by the researcher with the help of patients, relatives, physicians, hospital documents and clinical reports. In personal history such as mental stress, alcohol intake and diet status, the patients as well as the relatives were timid to disclose the
actual information in some cases, which led such attributes into imprecise. This situation compelled to exclude such attributes from the study.

We have kept all the recorded information related to data collection in confidential. It will not be disclosed or misused in any situation or for any personal interest.

3.6 Preparation for Data Analysis

3.6.1 Feature Selection

In the proposed study, only 12 risk factors of CAD are chosen from the group of the collected parameters. The risk factors identified here are Age (Age), Smoking (Smk), Obesity in terms of body mass index (BMI), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), HDL Cholesterol (HDL), LDL Cholesterol (LDL), Total Cholesterol (TC), Lipoprotein(a) (LPA), Triglycerides (TG), Homocysteine (HOM) and Diabetes Mellitus (DM). The information associated with these risk factors is used as the data set in the study. There are no missing values in these selected attributes. A patient record defined in terms of these different attribute values reveals the overall risk percentage for developing a CAD or an AMI.

3.6.2 Risk Calculation

In medical diagnosis, it is common to observe that different patients have the same disease with different symptoms. Hence, physicians often assign a weight to each symptom in order to specify the relative degree of importance of each symptom leading to the consequent (a disease), which shows that for a disease one symptom is possibly more important than another symptom [63]. In this aspect, CHD mortality could not be explained solely on the basis of the effect of a single risk factor [124]. When more than one risk factor is present, the effect of risk factors is multiplicative rather than additive; thus people having a combination of risk factors such as smoking, hypertension, diabetes mellitus and so on have the greatest risk of
A study on Acute Myocardial Infarction developing CHD [148]. This section computes the total risk of CAD related to the patients based on the multiple risk factors selected for the study.

Consider a data set for the study consisting of a set of data with N patients and n risk factors \( \{r_1, r_2, \ldots, r_n\} \), known as the attributes. For calculating the total risk percentage of each patient, first assign a maximum risk grade (a positive value less than 10) to each attribute. These risk grades are decided after consulting with the medical experts how these risk factors affect a person to develop CAD. The risk grades \( (rg) \) can be varied in different attributes by considering their influence for developing CAD. Let \( \{rg_1, rg_2, \ldots, rg_n\} \) represent the risk grades related to the n attributes. For each risk factor, there is a normal range (either normal value or less than borderline) where the actual risk factor represents the normal status of the body. Suppose \( \{u_1, u_2, \ldots, u_n\} \) are the corresponding upper bound of the normal range (desirable value) of the risk factors. Let \( x_{ij} \) be an element of the database that represents the jth attribute of the ith patient. The risk grade of this element can be computed using the following expression.

\[
rg_{ij} = |x_{ij} - u_j| \times k_j
\]  

(3.2)

where, \( k_j \), the suitable weight for the jth attribute, \( 1 \leq i \leq N \) and \( 1 \leq j \leq n \), can be defined as

\[
k_j = \frac{rg_j}{\bar{x}_j - u_j}
\]  

(3.3)

where \( \bar{x}_j \) is the highest value of the jth attribute from the case data (always high risk value) and hence \( k_j \in [0, 1] \). Hence, the risk grade \( rg_{ij} \) lies in the interval \([0, rg_j]\). The total risk grade of the ith patient is the sum of j risk grades, a positive value that cannot exceed sum of \( \{rg_1, rg_2, \ldots, rg_n\} \).

\[
i.e., \text{TotalRiskGrade}_i = \sum_{j=1}^{n} rg_{ij}
\]  

(3.4)
where, \[ \sum_{j=1}^{n} r_{g,j} \leq \sum_{j=1}^{n} r_{g,j} \] (3.5)

Finally, the total risk (in percentage) of the \( i^{th} \) patient can be computed with the following formula:

\[
TotalRisk_i = \frac{TotalRisk_{Grade_i}}{\sum_{j=1}^{n} r_{g,j}} \times 100
\]

Here, the "TotalRisk" set is considered as the target output of the data set.

3.6.3 Data Normalization

The term "database" defined in the proposed study is an augmented data set of the input data set together with the target output. Let \( D \) be the database where the first \( n \) columns represent the input attributes and the \((n+1)^{th}\) column is the output attribute corresponding to each instance, which shows the total risk. The \( i^{th} \) instance of the database \((x_i', z_i)\) can be expressed as \((x_{i1}, x_{i2}, \cdots, x_{in}, z_i)\) where \( x_i \in \mathbb{R}^n \) and \( z_i \in \mathbb{R} \) for \( 1 \leq i \leq N \). In the database, all the attributes, both input and output, represent in numerical form but in different units. A normalization process modifies the database into a standard form within a uniform interval \([0, 1]\). In order to normalize the database, first sort the data set and then pick up the maximum and minimum values of the attributes. Normalization \((\text{norm})\) of the \((i,j)^{th}\) element of the database can be defined as

\[
\text{norm}(x_{ij}) = \frac{x_{ij} - \min(r_j)}{\max(r_j) - \min(r_j)}
\]

where \( r_j \) indicates the \( j^{th} \) attribute and \( 1 \leq j \leq n + 1 \).

3.6.4 Data Analysis

The proposed prediction model applied here for estimating the total risk corresponding to each instance (patient) is based on the neuro-fuzzy model to comprehend the possibilities of affecting CAD if the person having multiple risk factors. One can analyze and interpret the information content
of the database in view of the neuro-fuzzy concept and finally can develop a suitable computational model. A mapping is identified between the input and output variables. Method of data analysis is explained in Chapter 4.

3.7 Conclusion

"Heart attacks are preventable [146] and heart disease can be controlled" is an unquestionable fact to those who take care of their food habit and active life style in a certain extent. Actually, human body is designed for an active life that helps a person to live with minimum state of physical fitness, which is the pre-condition for healthy living and longevity [129]. This research aims to develop a computational method, which could be treated as a pre-detection technique to understand the possibility of developing a CAD in terms of the risk factors present in a person. The model, when developed in full, will help the doctors to get a clear indication of the occurrence of the CAD in people who undergo a regular medical check up. Early detection of a heart disease is a better approach rather than treating a heart disease in its severe disease stage. With this model, one can assess his/her risk index and make a plan to avoid potential problems of CHD in a considerable manner. Although one cannot do much with his/her non-modifiable risk factors, he/she can take utmost care to change his/her own lifestyle along with the modifiable risk factors to avoid the adverse situation.