

## A SYSTEMATIC SURVEY - AN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING BASED HEART DISEASE DETECTION

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**Abstract** – All sections of the body benefit from improved blood circulation and purification. Heart Disease's are one of leading cause of death worldwide. The some recorded symptoms, including chest pain, difficulty breathing, a rapid heartbeat,. This data is regularly examined. Healthcare regularly assesses clinical datasets through expert learning and action. The healthcare department uses a computer-supported prediction method in the clinical field. The employment of AI, ML, and data mining techniques provide creativity and a plan to transform vast amounts of information into meaningful data. This review begins with an introduction to the heart condition and its current treatments. The most pertinent Machine Learning, AI, and Data Mining-based methodologies for these diseases predictions are also thoroughly analysed and briefly elaborated.

**Keywords**- Heart Diseases; Prediction; Machine Learning; Classification; Artificial Intelligence; Data Mining;

### 1. INTRODUCTION

Our paper's main goal is to educate audiences on the various methods used to forecast cardiac disease utilising AI, ML, and other tools. Because the heart is such an important component of our bodies, lives depend on its effective operation. Other human bodily organs like the kidney, brain, and heart will be impacted if the heart is not functioning properly. Heart disease risk is influenced by variety of factors. Heart's disease is currently the top cause of death worldwide. According to W.H.O., heart disorders are thought to be the cause of 12 million deaths worldwide each year. 17 million individuals died in 2008 due to heart diseases. Heart disease is to blame for more than 80% of fatalities worldwide. According to the WHO predicted that by 2030, over 23.6 million deaths would be attributable to heart disease. ML, AI and Data Mining techniques allow us to predict diseases with accuracy. A historical heart disease database can be used by IHDPS to detect and extract hidden information about heart disease.

It can respond to intricate questions about the diagnosis of heart disease, assisting analysts and practitioners in healthcare to make wise clinical decisions.[9]

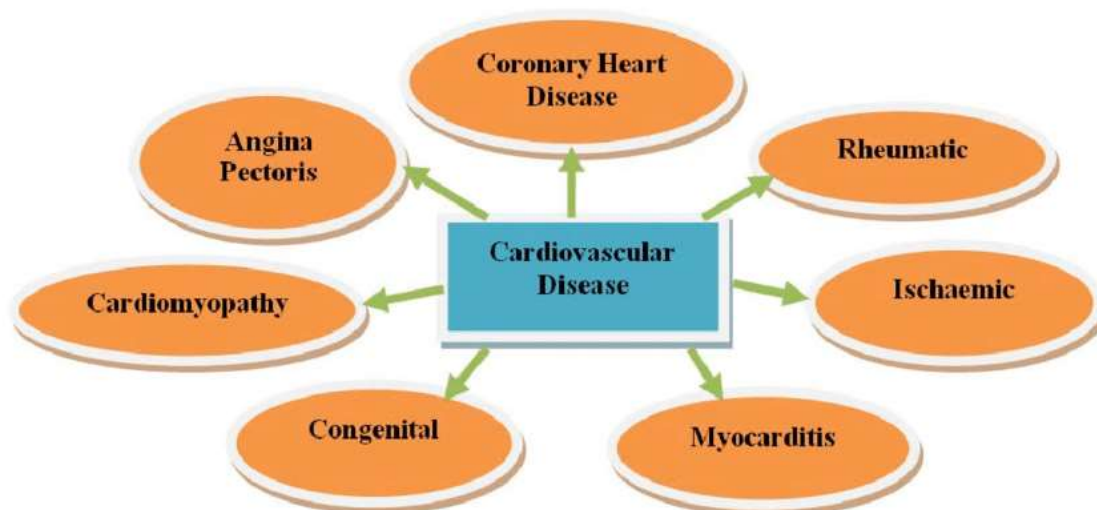
The heart is the most fundamental and physically demanding organ in our body. Blood is carried through veins in the heart in the circulatory system. As it delivers blood, oxygen, and other elements to various bodily regions, this muscular system serves a crucial role. If the Heart doesn't function well, it could result in major health issues, including death. It causes a number of diseases, disabilities, and fatalities. Hazard factors that can be changed include body weight, smoking, lack of exercise, etc. In the clinical field, disease diagnosis is crucial. Clinical dataset prediction using multiple inputs is an issue that is addressed by intelligent data mining systems. Systems for making decisions based on computer-based data and information can help carry out medical testing more cheaply. A comparative analysis of the various strategies available for precise and effective execution is necessary for computerised systems. Several cardiac illnesses are predicted in this research using data mining techniques that have just been published.[11]

The type of ailment that can result in death is heart disease. Heart disease is responsible for far too many deaths each year. The deterioration of cardiac muscle can lead to heart disease. Additionally, the incapability of Heart to pump blood can be used to characterise heart failure. Coronary artery disease is another name for heart disease (CAD). A lack of blood flow to the arteries can lead to CAD. The signs of heart illness, such as chestpain, high BP, cardiac arrest, hypertension, etc., can be used to diagnose the condition. There are numerous varieties of cardiac conditions, each with a unique set of symptoms. [2]

1) Disease in blood vessels, which causes chestpain, breathlessness, and neck and throat pain; and

2) Heart illness brought on by aberrant heartbeats, which causes discomfort, a slow heartbeat, and chestpain.

The most typical symptoms are discomfort, chestpain, shortness of breath, etc. Chestpain, shortness of breath, fainting are the most typical symptoms. Birth defects, high BP, diabetes, smoking, narcotics, and alcohol are all causes of Heart Disease. Heart's diseases can occasionally be accompanied by an infection that damages inner membrane and is noticeable by symptoms including fever, exhaustion, a dry cough, and skin rashes. Bacterias, Viruses, and Parasite are the causes of heart infections. Hypertension, Cardiac arrest, slow heartbeat, coronary artery disease, infection, heart failure, congenital heart disease, stroke-disease, and angina pectoris are few examples of different types of heart illness. There are currently too many automated tools, such as data mining, ML, DL, etc., to identify cardiac disease. Therefore, we shall give a basic overview of machine learning approaches in this work. Using machine learning resources, we train the datasets in this. There are certain risk variables that are used to make predictions about heart disease. Age, sex, BP, cholesterol level, diabetes, family history of coronary illness, alcohol use, smoking, heart rate, being overweight, and chestpain are risk factors.[1]



**Figure 1-** Types of Heart Disease

## **2. THE RISK FACTOR FOR HEART DISEASE –**

*Heart disease in the family:* Most individuals are aware that heart disease can run in families. That someone may be more susceptible to heart attacks, strokes, and other heart problems if they have a family history of heart disease.[3]

*Smoking:* Tobacco smoke is a key contributor to peripheral artery disease, heart attacks, and strokes. Heart and blood vessel disorders account for over 40% of all smoking-related deaths. After just one year of quitting smoking, a smoker's risk of having a heart attack significantly decreases.

*Cholesterol:* Heart disease risk factors include abnormal blood lipid (fat) levels. The bloodstream and all of the body's cells contain lipids, including the soft, waxy substance known as Cholesterol. Higher level of low density lipoprotein -LDL cholesterol and triglycerides, the most prevalent form of fat in the body, has been related to increased risk of heart disease.

*High BP:* It usually referred as HBP or hypertension, is a medical disease that is frequently misunderstood. Our blood vessel walls are more likely to become injured and stretched out of shape when we have high blood pressure. Increased risk of peripheral vascular disease, heart failure, renal failure, and suffering a heart attack or stroke

*Obesity:-*Anyone who weighs much more than their normal healthy weight is said to be obese, and the phrase is used to characterise their health condition. Anyone who is fat is at an increased risk of rising health issues like diabetes, high BP, Heart Diseases, and more.

*Lack of Exercises:* This increases the risk of coronary heart's diseases (CAD). Lack of exercise raises the risk for diabetes and high blood pressure, which in turn raises the chance for CAD.

## **3. LITERATURE SURVEY**

### *a. Heart Disease using ML-*

Numerous studies using various ML algorithms have been performed in medical centres in relation to these disease's prediction system. Heart Disease's Predictions using Hybrid ML method is strategy put out by Senthil Kumar Mohan et al. that aims to identify key components by utilising machine learning, enhancing the accuracy of prediction of cardiovascular diseases. Expectation model is built using several combinations of highlights and a few well-known arranging techniques. Authors develop a prediction model using a hybrid Random Forest (HRFLM) with Linear Model, which has accuracy of 88%. . They also received training on a variety of data mining techniques and expectation methods, including KNN, SVM, NN, LR, and Vote, which have recently gained popularity for their ability to identify and Heart's diseases predictions.

Nikhil et al. study on Prediction (Heart Diseases) by using ML Algorithm. This investigation provides an indepth analysis of Decision Tree Classifier and Naive Bayes used in evaluation. The results of certain studies that considered the application of predictive data mining technique on a comparable dataset show that Decision Tree outperforms Bayesian classification system. Heart Diseases Prediction using Machine Learning by Aditi Gavhane et al. The Neural Network Algorithm multilayer Perceptron (MLP) was employed in this paper's suggested system to train & test dataset. It has numerous levels in this algorithm, such as inputs, outputs, and hidden layers. These hidden layers connect each input layer node to the output layer nodes. Some weights are allocated to this link. Depending on the situation, the link between these nodes might be either feedforwarded or feedback.

Heart's Attack Prediction using Deep Learning was created by Abhay et al. In order to forecast the patient's likelihood of developing heart-related infections, this research suggests heart attack prediction system that uses DL Techniques with explicitly recurrent neural systems. Recurrent Neural Network uses the DL Technique in Artificial Neural Networks to perform a very innovative characterisation computation. The important framework modules and the associated hypothesis are covered in detail in the study. DL and data mining are used in their suggested model to get accurate results with the fewest errors. For the development of different kinds of Heart Attack Prediction platform, this research provides a framework and a point of reference. preliminary stage Machine Learning Techniques to Heart Disease by LakshmanaRao et al. Prediction that the risk factors for heart disease will increase. Therefore, it is challenging to distinguish heart illness. To determine brutality of cardiac disease in patients, several data mining and neural algorithms are used. The concept of CHD illness is perplexing, and because of this, the sickness needs to be approached cautiously. Failure to make an early identification may affect the heart or result in unexpected death. Additionally, from the viewpoint of medicinal science, data mining is employed to discover distinct types of metabolic machine learning, a method that enables the framework to benefit from prior information tests and models without being specifically personalised. ML makes reasoning reliant on historical data. Dr. Geetha S. and Mr. Santhana Krishnan, heart disease prediction using ML system. This document provides thorough information about coronary heart disorders, including its facts, types, and risk factors. Waikato Environment for Knowledge Analysis (WEKA), a useful Data Mining Tool for Bioinformatics Field, is the tool that is

employed. Heart's Diseases is predicted in this system using the three WEKA interfaces that are now available: Naive Bayes, ANN, and Decision Trees are the Data Mining approaches. Heart Illness Prediction Using ML Techniques is a plan put up by Avinash Golande et al., in which they uses few Data Mining methods to help authorities or medical professionals recognise heart disease. Three most common methodologies are Naive Bayes, K-Nearest, and Decision Tree. Packing computation, Part thickness, neural networks, straight Kernel self arranging guidance, and SVM are some other novel characterization-based methodologies used.

The Heart diseases prediction using ML techniques proposed by V.V. Ramalingam et al., used machine learning algorithms and techniques on a medical datasets. In their study, they survey and evaluate the performances of several models based on such methods and methodologies. This study surveys numerous models built on these methods and methodologies and evaluates their functionality. Researchers are reported to be extremely interested in, based on supervised learning including SVM, KNN, Nave Bayes, Random Forest, Decision Trees and ensemble models to help healthcare sector and specialists in study of heart-related illnesses. This essay reviews many models that rely on these calculations and methodologies and evaluates their display.

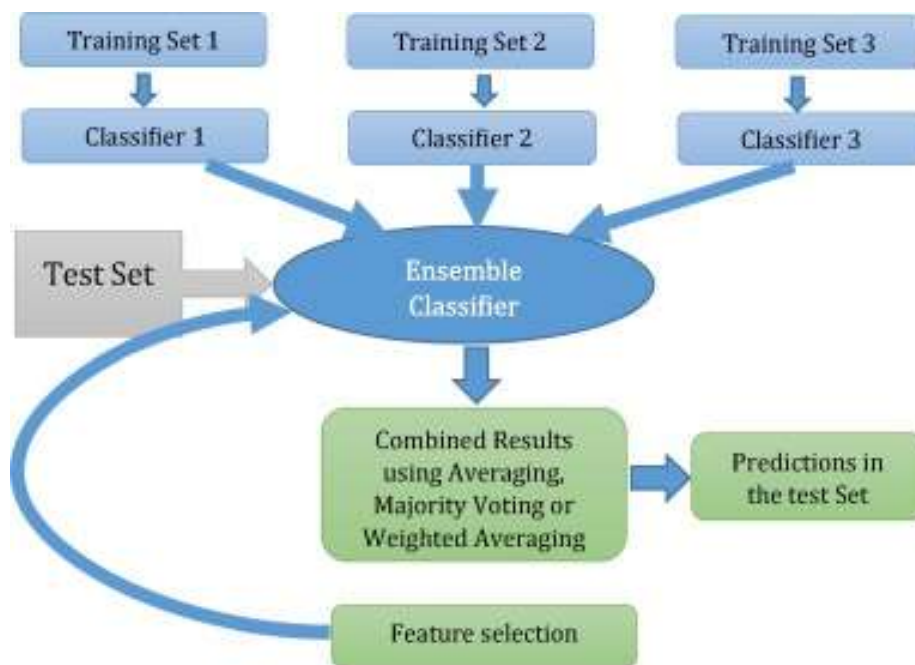
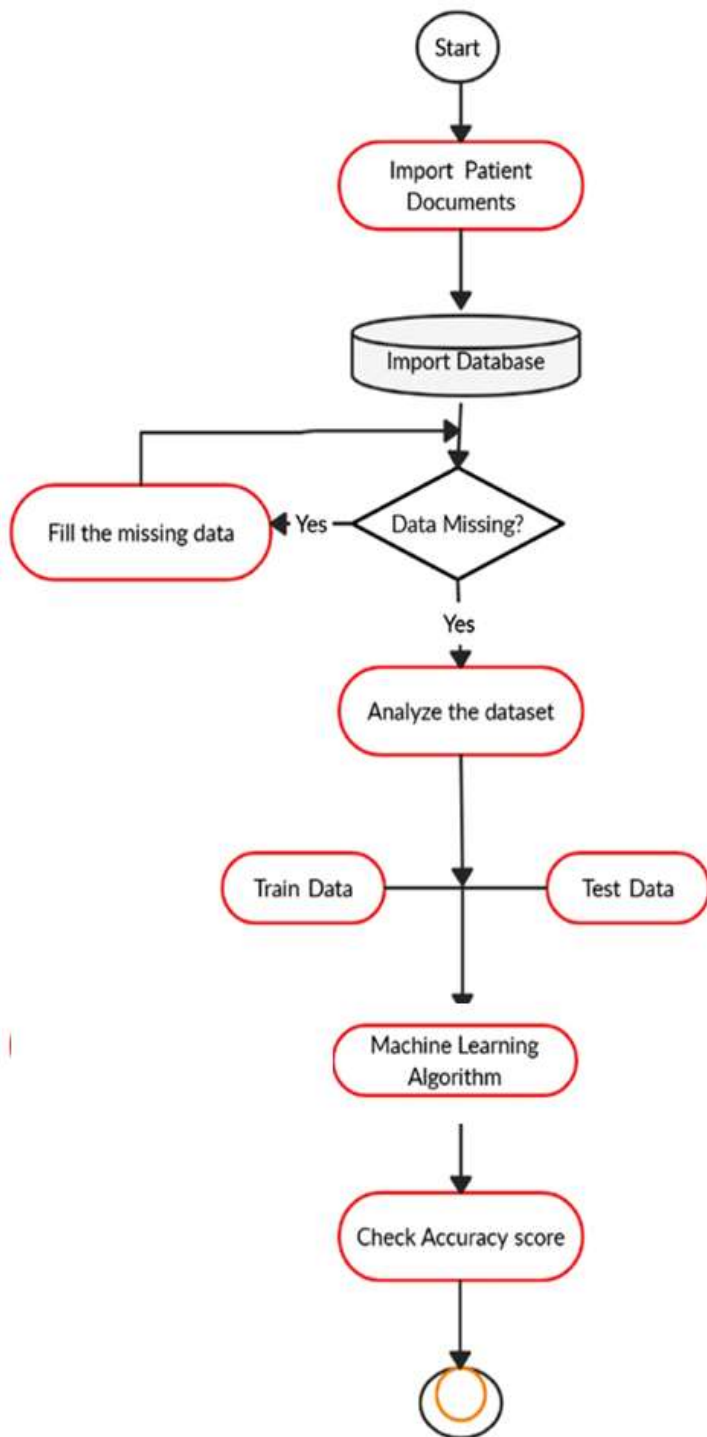
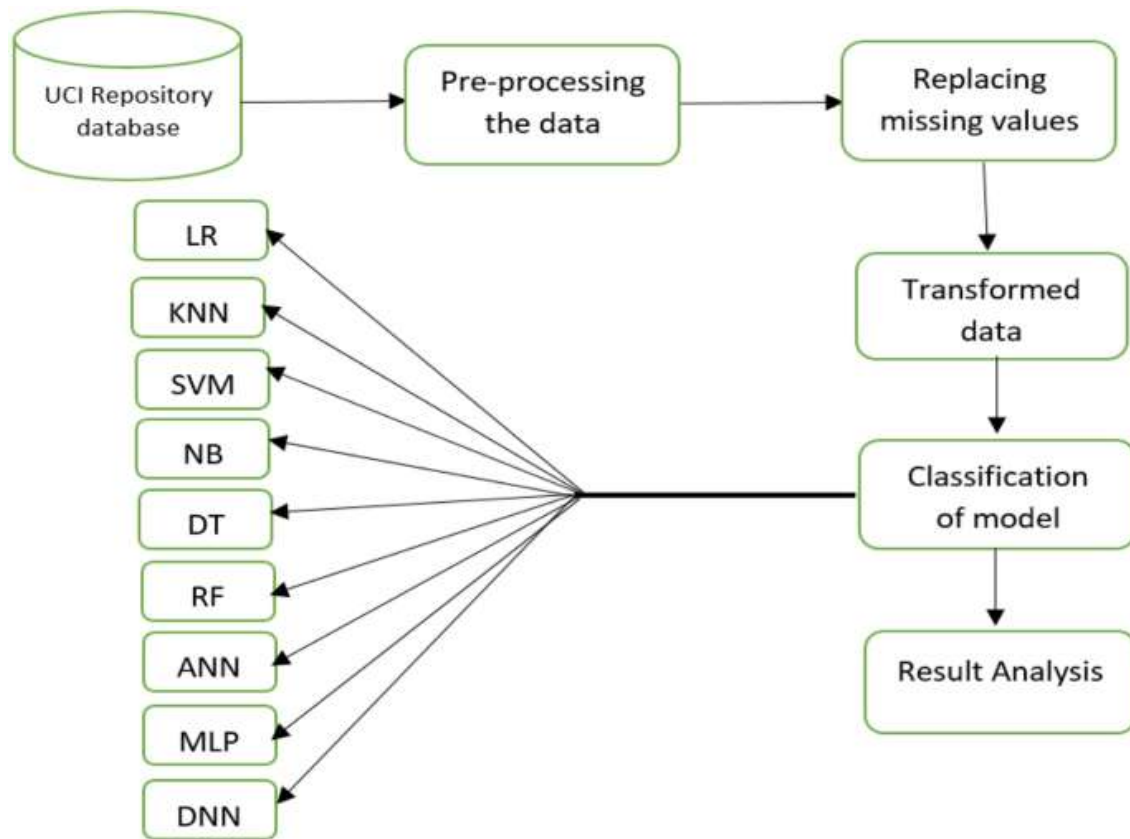


Figure 2- ML based Heart Diseases Prediction Model



**Figure 3-** Heart Beat Disease prediction using Machine Learning Flowchart



**Figure 4-** ML based Heart Diseases Prediction- A comparative study

*b. AI based Heart Diseases-*

According to R. Sun et al, an issue with the structure of heart that exists from birth are known as congenital heart disease (CHD). CHDs affect the valves, heart's wall, arteries, veins closed to heart, flaws may impede, divert, or entirely prohibit normal blood flow through the heart. Cyanosis (blue lips, skin, & fingernails), exhaustion, quick and short breaths, especially while feeding, poor blood circulation, as shown by swollen legs, belly, and area around eyes, are some of the more well-known symptoms of serious cardiac problems that can prove fatal if left untreated. The more severe CHDs are typically found later in the child's life and manifest as symptoms such as fast being out of breath and fainting during exercise, simply becoming tired, and swelling hands, feet, or ankles.

By M.A. Mari et al., additional signs of CHDs include a hammering heart and a weak pulse. A cardiac murmur is a whooshing, blowing, or rasping sound in the heartbeat. Heart disease is number one cause of mortality in humans in 2017, according to Murphy et al research's from United States and Centers for Disease Control and Prevention. Congenital cardiac disease currently accounts for a significant 30% to 50% of birth defect-related mortality in young children and babies. While CHD-related mortality in children and infants is allegedly declining, its prevalence in adults is rising.

#### 4. DISCUSSION-

Heart's diseases are major causes of deaths worldwide. However, their early diagnosis saves lives by helping to improve the patients' state of health. In order to help doctors identify heart disease earlier and assess heart disease risk factors, this analysis of articles concentrated on those that used Data Mining methods. In order to recognise the most precise classifiers and enable early detection of cardiac problems, this research examines many trials from numerous surveys. Every algorithm has produced a distinct outcome in a variety of circumstances. Further analysis shows that the predictive model for heart illness only achieves minimal accuracy; hence, more complicated models are required to improve the accuracy to predict early heart diseases. Future methodologies for highly accurate, low-cost, and simple early heart disease prediction will be proposed.

#### 5. CONCLUSION -

Heart's diseases are major cause of death worldwide. However, their early diagnosis saves lives by helping to improve the patients' state of health. We have outlined various AI algorithms for heart disease prediction. We looked at different AI and NL algorithms and tried to determine which is best by examining its properties. Every algorithm has produced a distinct outcome in a variety of circumstances. Further analysis shows that the predictive model for heart illness only achieves minimal accuracy; hence, more complicated models are required to improve accuracy to predict heart disease early. Future methodologies for highly accurate, low-cost, and simple earlier heart disease prediction will be proposed.

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