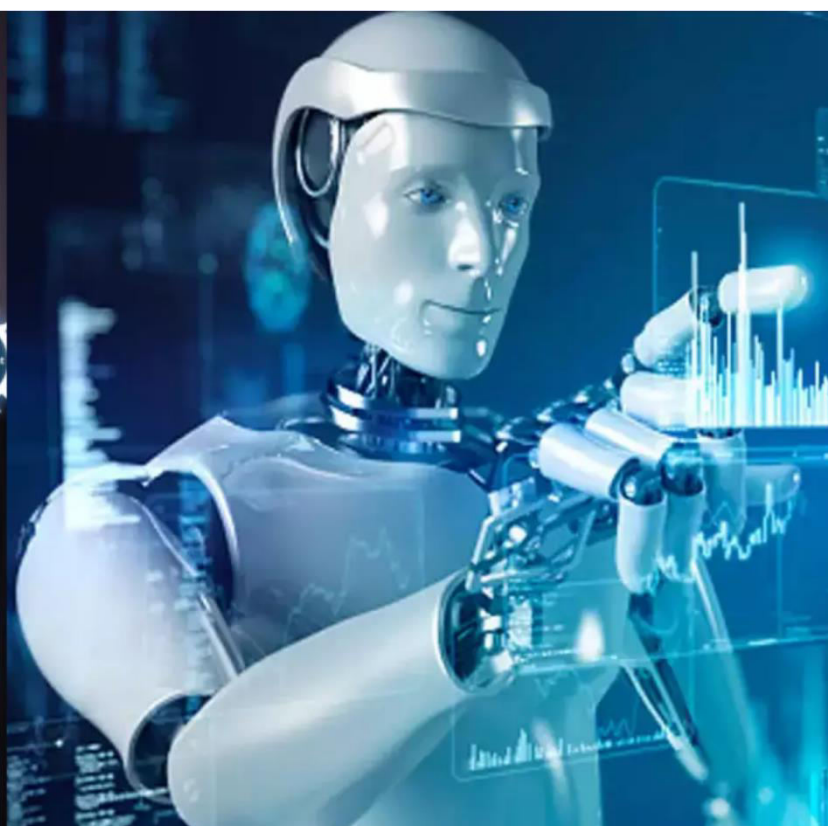




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Cardiac Arrest Prediction using Machine Learning Technology

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ABSTRACT: Cardiac arrest takes place when the heart suddenly stops working. It is an acute crisis that necessitates immediate medical attention. Predicting cardiac arrest in advance can greatly improve patient outcomes through facilitating early intervention. This project seeks to build a machine learning (ML) system to forecast the probability of cardiac arrest in patients based on their medical data. The system We will consider such parameters as blood pressure, heart rate, oxygen, and other medical parameters. to identify patterns and warning signs that can indicate a greater risk. The model will be trained on historical patient data employing sophisticated machine learning techniques to effectively forecast future heart issues. The project is to experiment and contrast various ML techniques such as decision trees, random forests, and neural networks, to determine which provides the most precise forecasts. The primary goal is to assist physicians and medical specialists have a way to recognize high-risk patients early on so that preventive measures and lowering the frequency of cardiac arrests in hospitals or other health care facilities. This Technology can alter the way we track patients to make care more proactive. and assist vulnerable individuals to survive for longer.

KEYWORDS: Cardiac Arrest Prediction, Cardiovascular Disease, Machine Learning, Predictive Modeling.

I. INTRODUCTION

Cardiac arrest is a critical situation in the modern world due to the unhealthy lifestyle and poor health of this age. Cardiac arrest is highly risky because it does not show long-term symptoms. Rather, it occurs suddenly, and then sudden cardiac arrest occurs, which is usually fatal. Cardiac arrest occurs when the heart suddenly stops beating, cutting off vital organs from blood organs. The rate of death due to cardiac arrest is very high, 70-90%, since there is no technology that can foresee its occurrence in advance [1] Cardiac arrest is becoming a top health issue in the current society, mainly because of the declining health and life-style routines of the younger generation. Its abrupt and instantaneous onset makes it even more dangerous, with the overall effect being an instantaneous cardiac arrest, which is lethal in most cases. In the event that cardiac arrest takes place, the heart ceases beating immediately, and as a result, the supply of blood to essential organs like the brain and lungs is immediately cut off. The survival rate is tremendously low, with mortality rates between 70-90% [2] That is why we have designed a project that predicts cardiac arrest in advance. Our strategy consists numerous factors like age, sex, height, weight, blood pressure, cholesterol and glucose levels, smoking habit, drinking behaviour, history of cardiovascular disease, and body mass index (BMI).

II. LITERATURE SURVEY

[1] Real-time machine learning model to predict in-hospital cardiac arrest using heart rate variability in ICU in this paper author states that forecasting in-hospital cardiac arrest in patients admitted to an intensive care unit (ICU) enables fast interventions to enhance patient outcomes. Using electrocardiogram (ECG)-based heart rate variability (HRV), we developed and verified a machine learning-based real-time model for in-hospital cardiac arrest predictions.

[2] Predicting survival and neurological outcome in out-of-hospital cardiac arrest using machine learning: The SCARS model in this paper author states that Clinical management in emergency rooms could be improved by a prediction model estimating survival and neurological outcome in patients experiencing out-of-hospital cardiac arrest. Investigated

all out-of-hospital cardiac arrest (OHCA) cases in Sweden from 2010 to 2020 using the Swedish Registry for Cardiopulmonary Resuscitation.

[3] Type 2 Diabetes and Causes of Sudden Cardiac Death in this paper author states that in recent years, type 2 diabetes melitus has been on increasing frequency. A major contributing cause to sudden cardiac death in type 2 diabetes is a reduced tissue insulin sensitivity. Systematic Review and Meta-Analyses (PRISMA) preferred reporting items

[4] Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes in this paper author states that with an eye toward the integration of machine learning (ML), artificial intelligence (AI), and big data technologies to revolutionize healthcare systems and raise health outcomes, the book "Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes" It emphasizes how these technologies affect clinical practices, patient care, and healthcare administration.

[5] Clinical Predictive Models of Sudden Cardiac Arrest: A Survey of the Current Science and Analysis of Model Performances in this paper author states that using the Tufts PACE (Predictive Analytics and Comparative Effectiveness) CPM Registry through February 1, 2020, a systematic review of the literature revealed 81 distinct CPMs of SCA and 62 subsequent external validation studies. methodical investigation of new SCA CPMs and accompanying validations. Included already discovered SCA CPMs from the Tufts PACE (Predictive Analytics and Comparative Effectiveness) CPM Registry.

[6] Cardiac Arrest: The science and practice of resuscitation medicine in this paper author states that book "Cardiac Arrest: The Science and Practice of Resuscitation Medicine" is an all-inclusive source on the subject of cardiac arrest and resuscitation. It addresses the scientific, clinical, and pragmatic elements of cardiac arrest control.

[7] Artificial Intelligence in Cardiology: Present and Future in this paper author states that this review summarizes the emerging advancements of artificial intelligence in cardiovascular medicine. Natural Language Processing

[8] Effect of Yoga based Lifestyle Intervention on Coronary Artery Disease Patients in this paper author states that this research was developed to investigate the influence of yoga-based lifestyle intervention on patients with coronary artery disease (CAD). This research was performed in two phases. Phase one involved the planning and preparation needed for the counseling components as well as the recruitment of participants, and phase two included the implementation of the counseling, the collection of data, follow up, and then data analyses.

[9] Outcome prediction of out-of-hospital cardiac arrest with presumed cardiac aetiology using an advanced machine learning technique in this paper author states that outcome prediction for patients with out-of-hospital cardiac arrest (OHCA) has the possibility to detect patients who could have been potentially saved. Advanced machine learning techniques have recently been developed and employed for clinical studies. In this study, we aimed to establish a prognostication model for OHCA with presumed cardiac aetiology using an advanced machine learning technique.

[10] Artificial Intelligence in Predicting Cardiac Arrest: Scoping Review in this paper author states that this study aims to explore the use of AI technology in predicting cardiac arrest as reported in the literature. A scoping review was conducted in line with the guidelines of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) extension for scoping reviews. Scopus, ScienceDirect, Embase, the Institute of Electrical and Electronics Engineers, and Google Scholar were searched to identify relevant studies.

III. PROPOSED METHODOLOGY

PROBLEM STATEMENT

Cardiac arrest is a leading cause of death worldwide, with survival rates below 10% to 30%. The aim is to develop a machine learning model to predict occurrence of cardiac arrest in patients based on real time health data. The goal is to identify key risk factors and provide early warning to healthcare providers, enabling timely interventions to prevent cardiac arrest and improve patients outcome

FLOWCHART

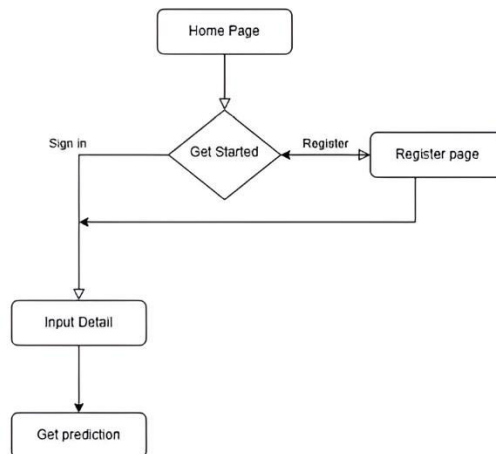
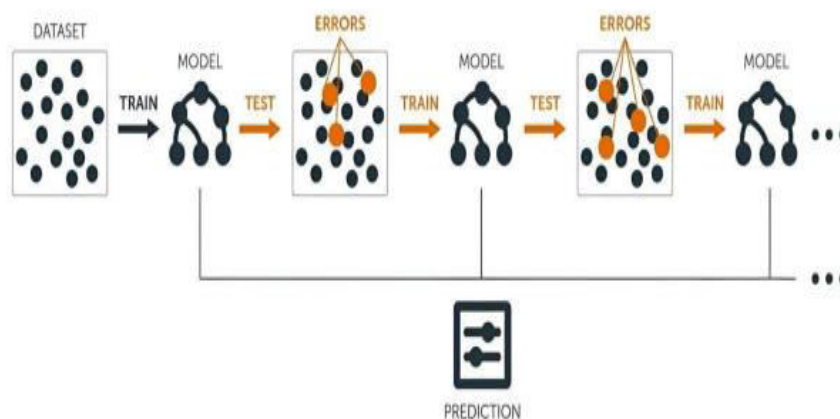


Fig: System Flow Chart

GRADIENT BOOST ALGORITHM

Steps:

1. Start with a model and predict it using a constant, for example, a target mean.
2. Estimate residuals (errors) for the current model.
3. Develop a weak learner (in this case a decision tree) for residuals.
4. Determine step size (how much the new tree will be added).
5. Change the model by scaling the tree and adding it to the current model.
6. Repeat the process of steps 2-5 for pre-defined iterations or until achieving convergence.



DATASETS USED

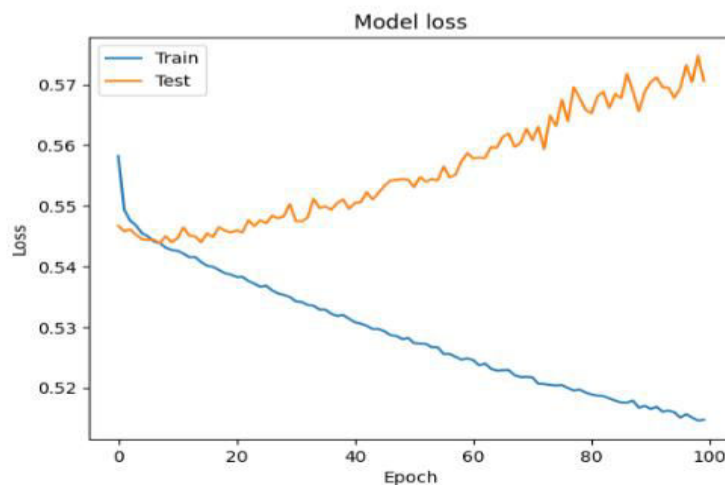
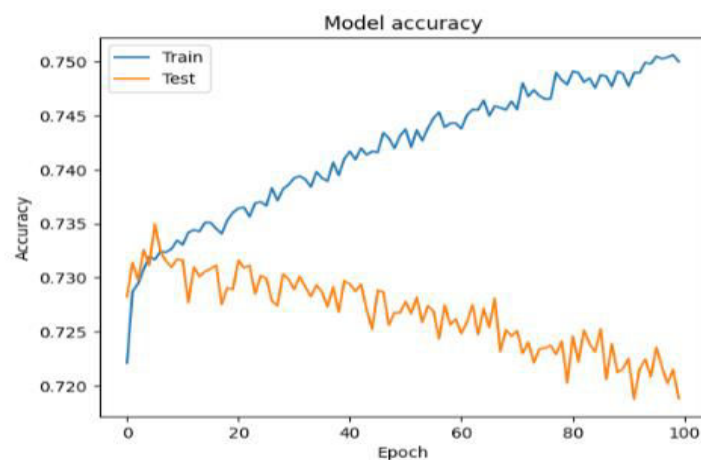
<https://www.kaggle.com/datasets/arjunaar2789/diabetes-prediction-dataset-2020> [1]

<https://www.kaggle.com/datasets/mannatpruthi/diabetes-dataset> [2]

<https://www.kaggle.com/datasets/sulianova/cardiovascular-disease-dataset> [3]

IV. RESULTS

Tests	Accuracy
Logistic Regression	0.72
Linear Regression	0.72
Random Forest	0.71
Gradient Boosting	0.73
K-Nearest Neighbors	0.69



V. CONCLUSION

By anticipating who is at risk of cardiac arrest, the machine learning-based cardiac arrest prediction project improves patient care. The ML model developed functions as an early indication, allowing medical personnel to take preventative measures by looking at key health indicators including heart rate, blood pressure, and oxygen saturation. By contrasting and comparing algorithms, it was discovered that choosing the right model is essential for making predictions that are accurate and trustworthy. This can be used in hospitals to improve patient monitoring, lower emergency room visits, and ultimately save lives. The model's effectiveness will increase with further research and testing using actual data, which will help create better healthcare solutions.

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