Myocardial Infarction:
A Machine Learning Approach

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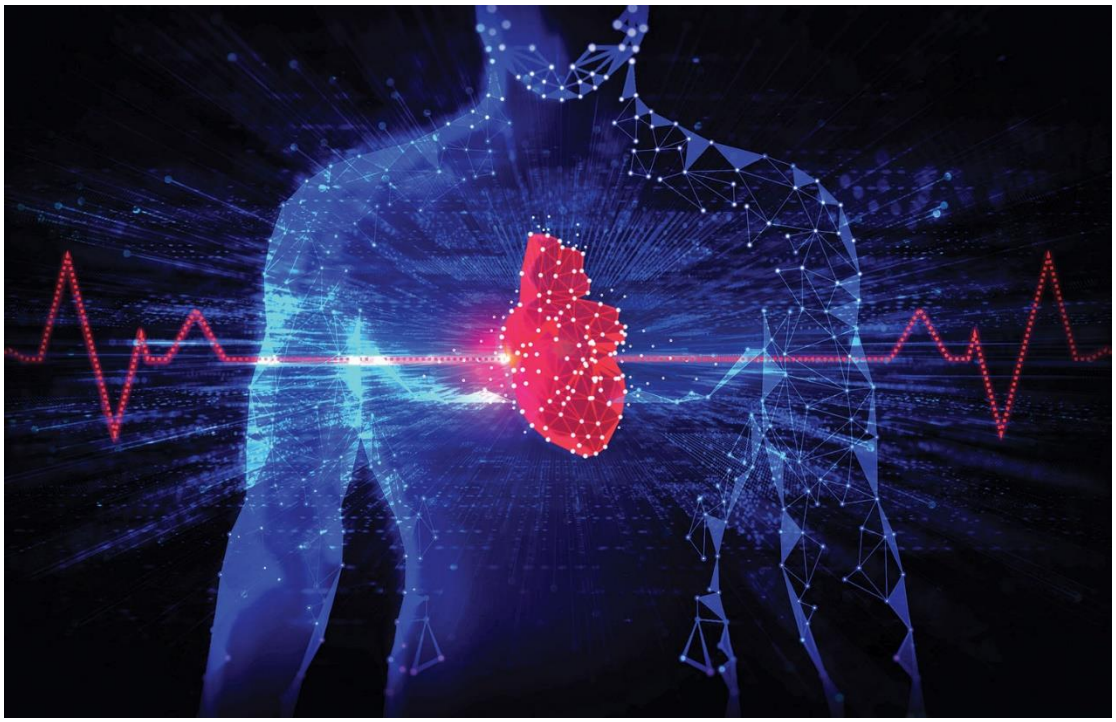

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Abstract

Purpose

Myocardial infarction (MI), commonly known as a heart attack, is one of the leading causes of morbidity and mortality globally.
MI occurs when blood flow to a part of the heart is blocked for a prolonged period, resulting in tissue damage. Therefore, early detection and intervention are crucial in mitigating its impact.

Studies highlight the importance of recognizing symptoms promptly and seeking medical help, as even a few minutes' delay can lead to permanent heart damage or death.

Various risk factors contribute to heart attacks, making early diagnosis of individuals at risk essential for preventive interventions.

The global prevalence of MI in individuals under 60 years old was found to be 3.8%, while in those aged over 60 years old, it was 9.5% according to a systematic review and meta-analysis. This highlights the significance of early diagnosis and intervention strategies for individuals at risk of MI.

The purpose of this study is early diagnosis of individuals at risk of experiencing a myocardial infarction in the future.

Problem statement

Identifying individuals at risk of myocardial infarction is challenging with current methods, potentially resulting in missed opportunities for early intervention and improved outcomes.

Introduction

Machine Learning

Machine learning, a subset of artificial intelligence, encompasses algorithms that enable computers to learn from data without explicit programming. By leveraging vast datasets encompassing diverse patient demographics, clinical parameters, genetic markers, and imaging modalities, ML algorithms have demonstrated promising capabilities in identifying intricate patterns and relationships that may elude conventional statistical methods.

Machine learning encompasses both supervised and unsupervised approaches for extracting insights from data.

Supervised learning uses labeled data to train algorithms to predict outcomes, such as the likelihood of myocardial infarction based on patient characteristics.

Unsupervised learning analyzes unlabeled data to uncover hidden patterns, like identifying distinct patient subgroups based on shared risk factors.
Both methods offer valuable tools for understanding and addressing myocardial infarction, aiding in early diagnosis and personalized treatment strategies.

UK Biobank

The UK Biobank is a large-scale biomedical database and research resource established in the United Kingdom. It contains detailed health and genetic information from over 500,000 participants. Participants undergo extensive health assessments, including physical measurements, biological samples collection (such as blood, urine, and saliva), and detailed questionnaire responses regarding lifestyle, medical history, and socio-demographic factors.

The primary aim of the UK Biobank is to improve the prevention, diagnosis, and treatment of a wide range of diseases and conditions.

Researchers worldwide use the data collected by the UK Biobank for conducting studies and research into the underlying causes and mechanisms of diseases, identifying risk factors, and developing new interventions and treatments.

Related work

Study	Link	Date of publication
Machine learning prediction of in-hospital recurrent infarction and cardiac death in patients with myocardial infarction	doi.org/10.1016/j.imu.2023.101443	January 2024
A predictive approach for myocardial infarction risk assessment using machine learning and big clinical data	doi.org/10.1016/j.health.2024.100319	March 2024

Solution description

Aims & Objectives

The objective of this research, employing machine learning methodologies, is to develop predictive models capable of assessing an individual's risk of experiencing a Myocardial Infarction. Through the analysis of diverse datasets, the aim is to facilitate early awareness and preparedness for potential treatment if necessary.

Stages

- Learning the dataset (UK Biobank)
    - Understand which features are relevant and which aren't.
    - Search for relations between features.
    - Visualize the data for deeper understanding.
- Data preprocessing
    - Handle missing values and remove duplicates.
    - Preform feature scaling and feature selection.
- Model selection
- Training the model
    - Train the model with the training set.
    - Hyper tuning with the validation set.
- Model evaluation
    - Evaluate the model with the test set.
- Draw conclusions
    - Does the model answers in a satisfying way on our objective?

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