

THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE PREVENTION OF CARDIOVASCULAR DISEASES

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Annotation: *This thesis discusses the application of artificial intelligence (AI) technologies in the prevention of cardiovascular diseases (CVD), highlighting their advantages in diagnostics, risk assessment, and early warning. It demonstrates how big data, machine learning, predictive models, and mobile health monitoring can improve the effectiveness of CVD prevention. The study also examines the prospects and limitations of applying AI in clinical practice.*

INTRODUCTION:

Cardiovascular diseases are among the leading causes of mortality worldwide. Millions of people suffer from these diseases each year. Traditional preventive measures often rely on subjective assessments, and diagnosis is frequently established at late stages. In recent years, the rapid development of artificial intelligence technologies has created new opportunities in many fields of medicine, particularly in the prevention of CVD. AI assists in accurate risk factor analysis, early detection of disease progression, individualized prognosis, and providing personalized preventive recommendations.

Relevance of the topic:

The use of AI technologies in cardiovascular disease prevention is highly relevant for several reasons:

1. High prevalence of the diseases: A large proportion of the global population belongs to the CVD risk group, and mortality rates remain high.
2. Challenges of early diagnosis: Many heart diseases progress asymptotically and are detected only at advanced stages.
3. Large volume of medical data: AI can analyze extensive datasets of ECG, CT/MRI scans, and laboratory results with high accuracy—beyond human capability.
4. Reduced preventive costs: AI-based predictive models significantly reduce treatment expenses through early warning.
5. Advancement of personalized medicine: AI facilitates the development of individualized preventive strategies for each patient.

Main part:

1. The role of AI in CVD prevention

AI algorithms perform the following tasks in assessing cardiovascular risk:

- modeling risk based on genetic, clinical, psychological, and laboratory indicators;
- early detection of arrhythmias through cardiac rhythm monitoring;
- predicting myocardial infarction risk via ECG analysis;
- monitoring population health indicators.

2. Application of machine learning (ML) models

ML algorithms—Random Forest, Gradient Boosting, Deep Learning, CNN, RNN—demonstrate high accuracy in detecting CVD. Examples include:

- analyzing ECG images using CNN to identify arrhythmia with 98% accuracy;
- predicting 10-year myocardial infarction risk through population-level big data analysis;
- real-time monitoring of heart activity via smartwatches and sensors.

3. The importance of mobile applications and IoT devices

In recent years, mobile applications integrating AI are increasingly used to monitor heart activity. They:

- continuously collect data from heart rate sensors;
- provide real-time alerts when anomalies are detected;
- offer recommendations and exercise programs;
- send emergency notifications when the risk of stroke or heart attack increases.

4. AI-based predictive models

High-accuracy statistical models allow the prediction of:

- the likelihood of developing arterial hypertension;
- the risk of ischemic heart disease;
- the probability of myocardial infarction or stroke;
- recurrence risks.

Such models help determine optimal preventive strategies.

5. Limitations of AI technologies

Several issues remain:

- data privacy and security concerns;
- some models function as a “black box” for clinicians;
- variability in data quality across medical institutions;
- lack of standardization of algorithms.

However, these challenges are being addressed, and the use of AI in medicine continues to expand.

CONCLUSION:

The use of artificial intelligence technologies in the prevention of cardiovascular diseases is highly valuable in early detection, accurate risk assessment, and the development of individualized preventive measures. AI reduces medical errors, lowers

treatment costs, and improves patients' quality of life. The future enhancement of AI systems is expected to bring a new level of effectiveness to CVD prevention.