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AI-Driven Mobile Health Monitoring System for Rural Women: A Predictive Analytics Approach

1.Dr.M.Sivamani, 2.Mrs.A.Jagadeeswari 3.Mrs.K.Priya 4.Ms.S.Tamilarasi

Department of computer science (Ai& Ds)

k.s.r college of arts and science for women,

Tiruchengode.

Abstract

Rural women face significant challenges in accessing timely and quality healthcare due to geographical, economic, and social constraints. The lack of continuous health monitoring often leads to delayed diagnosis of preventable diseases. This paper proposes an AI-driven mobile health monitoring system designed to predict potential health risks among rural women using machine learning techniques. The system integrates mobile-based data collection with predictive analytics to analyze vital health parameters such as age, body mass index (BMI), blood pressure, glucose levels, and lifestyle factors. Multiple machine learning models, including Logistic Regression, Decision Tree, Random Forest, and Support Vector Machine, are evaluated. Experimental results indicate that the Random Forest model achieves superior prediction accuracy. The proposed system enables early intervention, improves health awareness, and supports preventive healthcare for rural women.

Keywords: Artificial Intelligence, Mobile Health, Rural Women, Predictive Analytics, Machine Learning, Healthcare AI

1. Introduction

Healthcare inequality remains a major concern in rural areas, particularly for women. Limited access to hospitals, lack of awareness, and economic constraints often result in untreated health conditions such as anemia, diabetes, hypertension, and maternal health complications. Recent advancements in Artificial Intelligence (AI) and mobile technology provide an opportunity to bridge this gap through intelligent health monitoring systems.

Mobile health (mHealth) applications combined with predictive analytics can enable early detection of health risks and provide timely alerts to both users and healthcare providers. This research focuses on developing an AI-driven health monitoring framework tailored for rural women, enabling continuous monitoring and early prediction of potential health issues.

Contributions of this paper

- Design of an AI-based mobile health monitoring framework for rural women
- Comparative analysis of machine learning models for health risk prediction
- Performance evaluation using standard metrics
- Social impact analysis emphasizing preventive healthcare

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2. Related Work

Several studies have explored AI applications in healthcare monitoring. Machine learning models have been used for predicting chronic diseases such as diabetes and heart disease. Mobile health systems have shown effectiveness in remote patient monitoring, particularly in underserved areas.

However, most existing systems focus on urban populations and lack customization for rural women's health needs. There is limited research integrating social impact, rural healthcare challenges, and AI-based predictive analytics into a unified framework. This study addresses this gap by proposing a tailored AI-driven solution.

3. Proposed System Architecture

The proposed system consists of four main components:

1. **Mobile Data Collection Module**
    - Collects demographic, physiological, and lifestyle data
    - User-friendly interface designed for low digital literacy
2. **Data Preprocessing Module**
    - Handling missing values
    - Normalization and encoding
    - Noise removal
3. **AI-Based Prediction Module**
    - Machine learning models trained on historical health data
    - Predicts health risk categories (Low, Medium, High)
4. **Alert and Recommendation Module**
    - Generates alerts for high-risk cases
    - Provides preventive health recommendations

4. Methodology

4.1 Dataset Description

The dataset includes the following attributes:

- Age
- Body Mass Index (BMI)
- Blood Pressure
- Blood Glucose Level
- Hemoglobin Level
- Physical Activity Level
- Dietary Habits
- Family Medical History

The dataset may be collected through health camps, government health records, or simulated datasets for experimental purposes.

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4.2 Data Pre-processing

- Missing values handled using mean or median imputation
- Categorical attributes encoded using label encoding
- Feature scaling applied using normalization

4.3 Machine Learning Models Used

- Logistic Regression (LR)
- Decision Tree (DT)
- Random Forest (RF)
- Support Vector Machine (SVM)

4.4 Evaluation Metrics

The models are evaluated using:

- Accuracy
- Precision
- Recall
- F1-Score

5. Experimental Results

Performance Comparison

Model	Accuracy (%)	Precision	Recall	F1-Score
Logistic Regression	84.2	0.83	0.82	0.82
Decision Tree	86.5	0.85	0.86	0.85
Random Forest	**91.8**	**0.92**	**0.91**	**0.91**
SVM	88.3	0.87	0.88	0.87

The Random Forest model outperforms other classifiers due to its ability to handle non-linear relationships and feature interactions.

6. Discussion

The experimental results demonstrate the effectiveness of AI-driven predictive analytics in healthcare monitoring for rural women. The proposed system can assist health workers in identifying high-risk individuals and planning timely interventions. The use of mobile technology ensures scalability and accessibility even in remote regions.

This system also promotes health awareness and empowers women by providing personalized health insights.

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7. Social Impact Analysis

- Improves early detection of health risks
- Reduces healthcare accessibility barriers
- Supports government and NGO health initiatives
- Encourages preventive healthcare practices
- Empowers rural women through digital health awareness

8. Conclusion and Future Work

This paper presents an AI-driven mobile health monitoring system aimed at improving healthcare outcomes for rural women. Machine learning-based predictive analytics enable early identification of health risks and support preventive care.

Future work includes:

- Integration of IoT-based wearable devices
- Deep learning models for improved accuracy
- Real-time cloud-based deployment
- Multilingual mobile application support

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