AI-SOLUTIONS FOR HEALTH RISK MAPPING IN RURAL PHC'S NETWORKS

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Artificial Intelligence, Machine Learning, Random Forest Algorithm, Primary Health Centres, Health Risk Mapping, Predictive Analytics, Decision Making, Public Health Planning.

Introduction:

Primary Health Centres (PHCs) are the backbone of India's rural healthcare system, providing essential services such as maternal care, immunization, and disease control to remote populations. They act as the first point of contact between rural communities and the formal healthcare system. Despite their critical role, rural PHCs face several challenges, including limited infrastructure, shortage of medical personnel, and inefficient data management practices. Most healthcare data is still handled manually, which makes it difficult to analyze and delays the early detection of diseases and health risks.

Artificial Intelligence (AI) and Machine Learning (ML) offer effective solutions to overcome these challenges by enabling data-driven healthcare management. By applying AI techniques to structured healthcare data, it becomes possible to analyze patterns, predict potential health risks, and identify vulnerable populations at an early stage. These technologies help shift healthcare from a reactive approach to a proactive and preventive model. As a result, high-risk areas can be identified in advance, allowing timely interventions, better resource allocation, and improved healthcare outcomes in rural PHC networks.

Objectives:

1. Collect and integrate data from rural PHCs, including patient health records, disease incidence, environmental, and demographic data.
2. Develop AI models to predict and classify health risks such as disease outbreaks, chronic conditions, and environmental health hazards.

3. Generate dynamic health risk maps for visualizing spatial distribution and trends of health issues across rural regions.
4. Support decision-making by providing actionable insights to healthcare providers and policymakers for targeted interventions.
5. Improve health outcomes through early detection and optimized resource deployment in rural healthcare networks.

Methodology:

1. Data Collection and Preprocessing: Gather health data from PHCs, along with environmental and socio-economic datasets; clean and preprocess the data for analysis.
2. AI Model Development: Use machine learning techniques (e.g., classification, clustering, regression) to identify patterns and predict health risks.
3. Risk Mapping: Integrate AI outputs with GIS tools to create visual maps highlighting high-risk areas within rural PHCs networks.
4. Validation and Testing: Validate model accuracy using historical data and test system usability with healthcare workers.
5. Deployment: Implement the AI-powered risk mapping platform accessible to PHC staff and health authorities for real-time monitoring and decision-making.

Result and Conclusion:

In conclusion, the proposed AI-Based Health Risk Mapping System provides an effective solution for improving healthcare management in rural PHCs by utilizing structured data and the Random Forest algorithm. The system enables early identification of health risks, supports data-driven decision-making, and enhances resource allocation through visual risk mapping. By combining machine learning with geospatial analysis, the project successfully shifts healthcare from a reactive approach to a proactive and preventive model. The implementation proves that advanced technologies can be adapted to low-resource rural environments to improve healthcare outcomes. Thus, the system contributes significantly to strengthening rural healthcare infrastructure and promoting efficient and timely health interventions.

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Future Scope:

1. The system can be expanded beyond individual PHCs to district and state-level healthcare networks for large-scale monitoring and improved public health planning.
2. Future development can include integration with government health platforms and schemes to enable better data sharing, policy implementation, and coordinated healthcare management.
3. A mobile application can be developed to allow ASHA workers and PHC staff to collect patient data and access risk predictions directly from remote rural areas.