Medical Insurance Costs Prediction Using Explainable AI

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Abstract: *This research presents an intelligent medical insurance cost prediction system leveraging machine learning techniques to enhance pricing transparency and decision-making in the healthcare insurance sector. The system is designed to estimate individual insurance charges based on user-specific attributes including age, gender, BMI, number of dependents, smoking status, and residential region. Traditional cost estimation methods often rely on broad statistical assumptions and lack adaptability to individual factors, leading to inaccurate pricing and customer dissatisfaction.*

To address these limitations, the proposed model integrates advanced ensemble algorithms such as Random Forest and XGBoost, chosen for their ability to handle non-linear relationships and feature interactions efficiently. The workflow includes thorough data preprocessing, correlation analysis, and performance benchmarking using key metrics like R²-score and Mean Absolute Error (MAE). XGBoost demonstrated superior performance in predictive accuracy, making it the core model of the deployment phase.

A user-friendly web application is developed using Flask, allowing real-time user interaction with the model. Users can input their personal data and receive immediate, data-driven cost estimates. This solution not only aids consumers in financial planning but also offers insurance companies a scalable tool for dynamic risk assessment and premium calculation.

This work contributes to the development of intelligent financial tools in the healthcare sector and underscores the impact of machine learning in predictive analytics. The proposed system is modular, scalable, and adaptable for integration with broader health informatics platforms..

Keywords: XGBoost, Random Forest, machine learning, Flask application