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An Artificial Intelligence Approach to Adjust Health Insurance Premiums

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Abstract: This paper presents a two-phase Artificial Intelligence (AI) approach for premium adjustment based on the health risk of policyholders in the health insurance industry. The first phase of the proposed algorithm is data preprocessing. The dataset consists of a list of candidate attributes (e.g., gender, age, marital status, etc.) which can determine the perceived health risk of policyholders. The list of attributes contains demographic, responsibility, and morbidity characteristics of the policyholder. Selection of the classifiers is based on their sensitivity to premium changes. In the second phase, Back Propagation Neural Networks (BPNN), Learning Vector Quantization (LVQ), Radial Based Function (RBF), Self Organized Map (SOM), and decision tree (C 4.5) algorithms are applied and compared to classify the policyholders. Generally, health risk assessment, classification of policyholders, and policy optimization are typical challenges in adjusting health insurance premiums. Excessive coverage and adverse selection are common results of non-classified or misclassified health insurance policies. In excessive coverage, the health insurance value is less than the premium, thereby leading to customer retention. On the other hand, in adverse selection, the health insurance value is more than the premium, thereby leading to insurer loss. Since the value of the health insurance is highly correlated with health risk groups, the health insurance premium is determined based on the policyholder's health risk. The objective of this study is therefore to select the most predictive set of attributes to precisely classify policyholders based on their health risk to offer a health insurance plan with the appropriate premium. In this study, the performance of several neural networks and a decision tree classification algorithm are examined and assessed to classify policyholders based on their health risk. Experimental results compared these algorithms according to their accuracy, sensitivity, and specificity rate. Results indicated that the neural networks algorithms outperform the decision tree algorithm, with the best algorithm being RBF with 25 cluster centers (Proto) and 15 neurons in hidden layer, with 91.41% accuracy, 40% sensitivity, and 100% specificity rate.

Keywords: Risk Factors, Risk Classification, Premium Adjustment