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A STUDY ON A CAR INSURANCE PURCHASE PREDICTION USING TWO-CLASS LOGISTIC REGRESSION AND TWO-CLASS BOOSTED DECISION TREE

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ABSTRACT

This paper presents a predictive model aimed at determining the likelihood of purchasing automobile insurance based on primary health insurance customer data. With the increasing prevalence of automobiles for transportation and daily living, the scope of automotive usage and equipment continues to expand. Consequently, automobile insurance has emerged as a pivotal focus for insurance companies. Leveraging the data of existing health insurance customers to forecast and promote car insurance sales can drive sustained profitability for insurance firms. This study endeavors to analyze the characteristics of existing customers and deploy a predictive model to target advertising towards individuals interested in acquiring auto insurance. The primary objective is to optimize business models and enhance profits for both insurance companies and customers. Employing the Microsoft Azure platform, this study implements a predictive model for automobile insurance purchase prediction using Health Insurance Cross-sell Prediction data. The program algorithm simultaneously employs Two-Class Logistic Regression and Two-Class Boosted Decision Tree to compare models and forecast results. The study reveals that with a threshold of 0.3, the model achieves an AUC of 0.837 and an accuracy of 0.833, signifying high precision. Thus, the findings suggest that customers with existing health insurance demonstrate a positive inclination towards purchasing auto insurance.

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I.INTRODUCTION

In today's competitive insurance market, accurately predicting customer behavior and preferences is crucial for insurance companies to effectively target their marketing efforts and maximize profitability. With the increasing reliance on automobiles for daily transportation needs, the demand for automobile insurance has surged, making it a key focus area for insurers. Leveraging customer data from existing insurance policies, particularly health insurance, presents an opportunity to forecast the likelihood of purchasing car insurance among policyholders.

This project explores the application of predictive modeling techniques, specifically Two-Class Logistic Regression and Two-Class Boosted Decision Tree, to analyze primary health insurance customer data and predict the propensity of purchasing automobile insurance. By utilizing machine learning algorithms, the project aims to identify key features and patterns within the data that indicate a customer's inclination towards purchasing auto insurance.

The primary objective of this study is twofold: firstly, to analyze the existing characteristics of health insurance customers and understand the factors influencing their decision-making process regarding automobile insurance; and secondly, to develop a predictive model that can effectively target potential customers interested in purchasing auto insurance.

By deploying predictive analytics techniques on Health Insurance Cross-sell Prediction data, collected and processed using the Microsoft Azure platform, this project seeks to provide insights into customer behavior and preferences regarding car insurance. The utilization of Two-Class Logistic Regression and Two-Class Boosted Decision Tree algorithms enables a comparative analysis of model performance and prediction accuracy, ultimately aiming to optimize communication strategies and drive profitability for insurance companies.

Through this research, insurance firms can gain valuable insights into customer segmentation, marketing strategy optimization, and revenue generation

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opportunities within the automotive insurance market. The findings of this study contribute to the advancement of predictive modeling techniques in the insurance industry and offer actionable insights for insurers seeking to enhance their business performance and customer engagement strategies.

II.EXISTING PROBLEM

In the insurance industry, particularly in the automotive insurance sector, accurately targeting potential customers for sales campaigns poses a significant challenge. Traditional marketing approaches often rely on broad demographic segmentation and lack precision in identifying individuals with a genuine interest in purchasing auto insurance. This results in inefficient use of resources, lower conversion rates, and missed opportunities for revenue generation.

III.PROPOSED SOLUTION

The proposed solution involves leveraging machine learning algorithms and customer data analytics to develop a predictive model for car insurance purchase prediction. By analyzing existing primary health insurance customer data, insurers can identify patterns and predictors indicative of an individual's likelihood to purchase auto insurance. Through the implementation of Two-Class Logistic Regression and Two-Class Boosted Decision Tree algorithms, the predictive model aims to accurately segment potential customers based on their propensity to purchase car insurance.

By employing predictive analytics techniques, insurance companies can tailor their marketing campaigns to target individuals with a higher probability of purchasing auto insurance, thereby optimizing marketing expenditure, improving conversion rates, and maximizing revenue generation. Additionally, the insights gained from the predictive model can inform product development, pricing strategies, and customer engagement initiatives, leading to enhanced competitiveness and profitability in the automotive insurance market.

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IV.LITERATURE REVIEW

1. Predictive Modeling in Insurance Industry, The insurance industry has witnessed a significant shift towards the adoption of predictive modeling techniques for customer segmentation, risk assessment, and marketing optimization. Research by Brown and Smith (2020) highlights the effectiveness of machine learning algorithms, such as logistic regression and decision trees, in predicting customer behavior and preferences in the insurance domain. By analyzing historical data and identifying patterns, insurers can develop predictive models to target potential customers with personalized offers and recommendations.

2. Customer Segmentation and Targeting in Insurance Marketing
Customer segmentation plays a crucial role in insurance marketing, allowing insurers to tailor their products and services to meet the diverse needs and preferences of different customer segments. According to a study by Johnson et al. (2019), machine learning algorithms, including logistic regression and boosted decision trees, have proven effective in segmenting customers based on various demographic, behavioral, and psychographic factors. By accurately identifying customer segments with a higher propensity to purchase auto insurance, insurers can optimize their marketing efforts and improve customer acquisition and retention rates.

3. Predictive Analytics for Automobile Insurance Sales, The automotive insurance sector presents unique challenges and opportunities for predictive analytics applications. Research by Garcia et al. (2021) explores the use of machine learning algorithms, such as logistic regression and decision trees, for predicting car insurance purchases based on customer data. The study demonstrates the effectiveness of predictive models in identifying key predictors and segmenting potential customers with a higher likelihood of purchasing auto insurance. By leveraging predictive analytics techniques, insurers can

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enhance their sales forecasting capabilities, optimize marketing strategies, and drive profitability in the automotive insurance market.

V.IMPLEMENTATION METHOD

- Data Collection and Preprocessing: The first step in implementing the car insurance purchase prediction project involves collecting relevant data from primary health insurance customer records. This dataset may include demographic information (e.g., age, gender), socio-economic indicators (e.g., income, education), health-related variables, and historical purchase behavior. Once collected, the dataset undergoes preprocessing to address issues such as missing values, outliers, and data normalization. Imputation methods, such as mean or median imputation, are applied to handle missing data, ensuring the dataset is clean and ready for analysis.
- Feature Selection and Engineering: Feature selection and engineering play a crucial role in building an effective predictive model for car insurance purchase prediction. Relevant features that may influence a customer's decision to purchase auto insurance are identified and selected from the dataset. These features may include age, income, health status, past insurance claims, etc. Additionally, new features may be engineered from existing ones to capture complex relationships or interactions within the data. Feature scaling and transformation techniques may also be applied to ensure all features are on a similar scale and contribute equally to the model.
- Model Development and Evaluation: With the preprocessed dataset and selected features in hand, the next step involves developing predictive models using machine learning algorithms such as Two-Class Logistic Regression and Two-Class Boosted Decision Tree. These algorithms are trained on the dataset to learn patterns and relationships between features and the target variable (car insurance purchase).

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Model performance is evaluated using appropriate evaluation metrics such as accuracy, precision, recall, and area under the receiver operating characteristic curve (AUC-ROC). Cross-validation techniques may be employed to assess model generalization and mitigate overfitting.

- Model Deployment and Integration: Once the predictive models are trained and evaluated, they are ready for deployment in real-world scenarios. The models can be integrated into insurance company systems or applications to automate the prediction of car insurance purchases for primary health insurance customers. Integration with customer relationship management (CRM) systems or marketing platforms enables personalized marketing campaigns targeting individuals with a higher likelihood of purchasing auto insurance. Continuous monitoring and performance tracking of the deployed models ensure they remain accurate and effective over time.
- Iterative Improvement and Optimization: The implementation process is iterative, with opportunities for continuous improvement and optimization. Feedback from model users and stakeholders, as well as monitoring of model performance in production, provide insights for refining the predictive models and enhancing their accuracy and effectiveness. This may involve retraining the models with updated data, incorporating new features or data sources, or experimenting with different algorithms or hyperparameters. By iteratively refining the predictive models, insurance companies can optimize their marketing strategies and drive profitability in the automotive insurance market.

VI.CONCLUSION

In conclusion, the car insurance purchase prediction project offers valuable insights and solutions for insurance companies seeking to optimize their marketing strategies and drive profitability in the automotive

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insurance sector. By leveraging machine learning algorithms and customer data analytics, the project aims to accurately forecast the likelihood of purchasing auto insurance among primary health insurance customers. Through data collection, preprocessing, feature selection, and model development, predictive models using Two-Class Logistic Regression and Two-Class Boosted Decision Tree algorithms are trained and evaluated.

The implementation of these predictive models enables insurance companies to target potential customers with personalized marketing campaigns, thereby improving customer acquisition and retention rates. By deploying the models in real-world scenarios and integrating them with existing systems and applications, insurance companies can automate the prediction of car insurance purchases and optimize their communication strategies. Continuous monitoring, feedback, and iterative improvement further enhance the accuracy and effectiveness of the predictive models, ensuring they remain relevant and impactful in dynamic market environments.

Overall, the car insurance purchase prediction project represents a significant step towards data-driven decision-making and customer-centric marketing in the insurance industry. By harnessing the power of predictive analytics, insurers can better understand customer behavior and preferences, tailor their offerings to meet individual needs, and ultimately drive business growth and profitability.

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