CAS PREDICTIVE MODELING CASE STUDY DETAILS

Case Overview

You head up the pricing function for Alpha Beta Gamma (ABG) Insurance, a regional personal lines carrier interested in expanding their business by increasing their penetration in the renter's insurance market. In the past few years, ABG began selling a renter's insurance product covering dormitory dwellings to college students. **The CEO has asked to see an outline of a newly developed pricing strategy for current and new Dormitory Insurance business.**

Company Background

As ABG has been selling the Dormitory policy, the company was able to capture claim and policy data related to the various coverages of the Dormitory policy. When the company initially launched the program, a very basic rating plan was launched, and it charged every customer the same premium. Now, as ABG collected more data points, the firm is in a position to update its pricing algorithm, in order to charge a more statistically accurate premium for each customer.

For current (or in-force) customers (or policyholders), ABG has information which will be provided to you related to prior claims (loss history) as well as certain additional (demographic) information that is collected each year via an underwriting questionnaire.

The information provided should be used to help you identify and segment policyholders according to their risk level. The dataset provided contains a complete list of information available (or variables) for each potential policyholder. Below is a sample of the types of information provided:

- Student's 'year' of study (freshman, sophomore, etc.)
- Dorm location (on/off campus)
- Distance to campus
- Greek (fraternity/sorority) versus not
- Etc.

Your goal is to develop a predictive model which uses both claim history and other demographic data provided to determine the actuarially-sound price for each policyholder.

Relevant Industry Information

Predictive Models

Predictive models optimize the use of available data to enhance underwriting and pricing decisions, predict customer behaviour, and improve risk selection. Within Canada, Generalized Linear Models are widely utilized and accepted as the modeling method of choice for insurance pricing. These pricing models can then be further supplemented with underwriting models utilizing advanced machine learning algorithms, such as Random Forest or Gradient Boosting Machines.

For the consumer, the (often) automated pricing and underwriting decisions from these models provide a consistent and objective outcome with a quicker turnaround time, thus shortening the time to policy issuance and improving the overall customer experience. Property and Casualty (P&C) insurers are progressively expanding their use of predictive models, both in pricing and underwriting.

Insurance Coverage Provided:

Renters insurance generally covers the following:

Personal Property Protection

This coverage safeguards policyholders' valuables such as furniture, electronics and clothing. It covers the loss of belongings if they're stolen or damaged. The basic policy offered by ABG for dormitories covers up to $10,000 of personal property.

Renters insurance might also include:

Additional Living Expenses

If a covered loss makes the dorm (or home away from home) uninhabitable, Renters Insurance (and theDormitory Insurance offered by ABG) will help pay for increased living costs. This might include things such as a temporary place to live or other costs incurred while living in the temporary location (such as reasonable meal expense).

Liability Protection

Liability Insurance helps protect policyholders against financial uncertainty that can arise if someone sues for damages after being injured on the property. The liability protection offered by ABG's dormitory policy is limited to $500,000.

Guest Medical Protection

Guest medical coverage, included in most residential insurance policies, provides protection if someone incurs medical expenses from an injury suffered at the insured property, regardless of who is at fault. The guest medical protection offered by ABG's dormitory policy is limited to $150,000.

Exposures generally not covered by renters' or standard homeowners' policies:

- Acts of terrorism and biological or nuclear events
- Pandemics
- School property
- Flood, earthquakes (offered as separate policies or as endorsements in certain areas)
- Intentional acts

Insurance Product Structure:

For purposes of this exercise, the rate will be defined as the actuarially determined price per unit of exposure for a given risk. The rate will usually include an amount to cover expected loss, the expenses associated with the policy, and some expected underwriting profit.

For the Dormitory Insurance product, all four of the above-mentioned coverages are provided for each policyholder, and each coverage will have a stand-alone rating algorithm. The simple rating scheme will begin with a "base rate", which is the price charged for an "average" policyholder.

Underwriters have assigned three rating tiers to each individual policy based on underwriting expertise: Preferred, Standard, and Non-Standard. Base rates will vary with each tier. Also, within each rating tier, there may be additional factors that can be applied to the base rate to increase or decrease the base rate within that tier. For example, whether the insured property is sprinklered is correlated with the property's loss potential.

Data

The dataset provided includes 10,000 policyholders with varying degrees of risk. The dataset is on a coverage level for each policyholder, and the claim history is provided for each policyholder and coverage. In addition to the claim history, there is additional information provided about each policy, including information about the dorm (unit safety features, location, etc.) and information about the policyholder (year of study, major, etc.).

Deliverables

Due to constraints, ABG Insurance can only focus on one coverage for repricing. Your job is to:

1. **Choose the coverage to prioritize for pricing.**
    - Explain the reasoning for your choice. What makes this coverage the most critical for repricing?
    - Considering the claims experience. Do you have any data that correlates well with this coverage's loss experience?
2. **Select relevant rating variables to be used in the pricing model for the coverage.**
    - The dataset contains a list of rating variables. Select and justify which ones should be considered for a pricing model. Consider their predictive power, potential correlation to claims experience, and practical application in the pricing process.
    - Are there ethical concerns with using any of these variables?
    - Can you think of any potentially important rating variables that ABG isn't currently collecting? If so, include them with a recommendation to consider collecting that data moving forward.
3. **Develop some recommendations to pass onto the pricing team.**
    - Use your remaining time to prepare anything that would help the pricing team develop a pricing structure for this data.
    - Assume that losses in the upcoming year will be like those from the previous year.
    - Some ways you could support the pricing team are:
        - Your pricing strategy should cover all expected claims costs.
        - You could provide high-level details and statistics about the dataset. (Build a report).
        - You could very well recommend one (or several) types of models that would be a good fit for this type of a pricing exercise.
        - For any ambitious teams out there, you may draft up an initial pricing structure (predictive model) to pass on for consideration.
        - What types of performance metrics or visuals would help us determine the quality and accuracy of a pricing model?

Your presentation should cover the following:

1. **Data & Inputs:**
    a. Talk about whether the data is appropriate for the task at hand.
2. **Modeling Methods:**
    a. Provide a description of the various statistical modeling techniques you decided to use. Discuss any assumptions you needed to make. If you used more than one statistical technique, explain your rationale for the final model you selected.
    b. How did you decide which variables to include in your model? Did you decide to include or exclude a variable on something other than statistical grounds? Why?
    c. Will you develop any type of pro forma or business plan recommendation for the CEO based on the outcome of your predictive model?
    d. Your presentation should be targeted towards your CEO but provide enough detail to validate your work at a high enough level to engage your audience.

Ethics

Ethics are a cornerstone of the insurance industry. It goes beyond adherence to legal and regulatory standards through a commitment to fair treatment and social responsibility. We understand that university students do not possess in-depth knowledge of insurance law. We encourage teams to consider the broader legal landscape and ensure that their proposed solutions align with basic principles of legality and ethical conduct.

Trust your instincts – if a solution feels ethical and seems like it should be legal, that's a good start. Spend a few minutes on the internet to see if your proposal is breaking rules of Canadian insurance regulation. If it still seems legitimate, then its good enough. If in doubt, please consider sharing your ideas with your mentor.

Glossary of Insurance Terms

Claim – A formal request by a policyholder to an insurance company for compensation for a covered loss or policy event. The insurance company validates the claim and, once approved, issues payment to the insured or an approved interested party on behalf of the insured

Coverage – The amount or type of risk or liability protection that is provided for an individual or entity by way of insurance services

Covered Loss – Types of accidents, losses, or situations for which an insurance policy will pay compensation

Customer – Current or potential insured/policyholder

Demographic - A type of information related to identification. Examples of common demographics include age, gender,race, location, etc. Not all demographic information may legally be used in rating.

In-force – Active policy

Insured/Policyholder – Party/parties covered by an insurance contract

Personal Lines – Personal lines insurance includes property and casualty insurance products that protect individuals from losses they couldn't afford to cover on their own. These types of insurance lines make it possible to do things such as drive a car and own a home without risking financial ruin.

Policy – Legal contract containing binding terms of insurance coverage

Risk – The hazard or chance of loss and/or the degree of probability of such loss

Underwriting – The process of evaluating the risk of insuring a home, car, driver, etc. to determine if it's acceptable for the insurance company to take the chance on providing insurance (or to help determine the appropriate class, rate, discounts/surcharges, etc. that would support the acceptability of the risk)

Variable – A quantity or function that may assume any given value or set of values