CustomerLife
Statistics for modelling customer life in an insurance company

Innovation area: Finance/Insurance

Key Innovator: Kjersti Aas

Partners: Gjensidige, NR, UiO

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Scope:

New statistical methods for innovative understanding and prediction of customer behaviour for the insurance industry.

Results in 2012 and plans:

The insurance business is based on having fundamental knowledge and behavioural understanding about the customers as a group, but also on the individual level. For many insurance products, pricing, that is risk premium estimation, is done according to individual characteristics. Car insurance is a classical example, where premiums are based on characteristics of the driver and car. Products may have a loyalty component in order to strengthen the customer relationship. In order to maintain or increase market shares products needs to be modernised, following customer demands, in a strongly competitive market.

In this project our aim is to obtain knowledge about the mechanisms that regulate the customer relationship in an insurance company. We introduce new statistical methods and instruments for an innovative understanding and prediction of customer behaviour for the insurance industry. This allows new commercial strategies for pricing, marketing, churn prediction, fraud detection and risk management.

1. Modelling car insurance claims using random effects

The traditional model for claims in car insurance is a Poisson model with fixed effects. This model does not take the individual claim history directly into account, and policy holders with identical covariates will have the same premium even though their claim histories may differ. By including random effects, we use observations from several years for each policy holder and

estimate their random effect. Policy holders with a high random effect have more claims than expected from their covariates, and similarly policy holders with a small random effect have fewer claims than expected. We have shown that this is useful to Gjensidige for ranking purposes, and for predicting high risk policy holders with more claims than expected from their covariates. This year a paper will be submitted, and the project will be finished. We do not plan to continue working on this dataset, but the aim for 2013 is to present the results to Gjensidige and show them how they could implement and use our findings.

2. Soft fraud

We aim to detect insurance fraud among private customers, and to develop an alternative framework that improves over the method currently in use. The dataset from Gjensidige consists of many explanatory variables and the fraud status is checked for a subset of the customers. The challenges include censored data, few fraud cases and a large set of explanatory variables. We will consider three distinct modelling paradigms, two statistical and one from the machine learning arena. The two statistical approaches involve either constrained likelihood estimation (lasso or ridge regression) or a hierarchical model employing Bayesian model averaging. We will contrast these approaches to cutting-edge methods in classification from machine learning, ultimately building a weighted ensemble system of classifiers that potentially incorporates the statistical procedures. These methods will be compared to the model used by Gjensidige today. If the new model shows improved predictive performance, it can be incorporated into Gjendsidige's practices.

3. Frailty models for time to defection for corporate car insurances

We have applied frailty and shared frailty models in order to study the time to cancellation of individual car insurances, also accounting for measured and time varying risk factors. The frailty term models variations in risk due to unobserved risk factors, and may be dependent within groups of cars. The project was part of Marion Haugen's PhD project, and a paper has previously been submitted to Insurance, Mathematics and Economics, but rejected. In order to resubmit to another journal, some more work must be done.

Papers:

Günther, Clara-Cecilie; Tvete, Ingunn Fride; Aas, Kjersti; Borgan, Ørnulf: Modelling and predicting customer churn from an insurance company. Scandinavian Actuarial Journal, 2011; doi: 10.1080/03461238.2011.636502.

Haugen, Marion; Moger, Tron Anders: A frailty analysis of time to defection for corporate car insurance data, submitted 2010.

Scheel, Ida; Frigessi, Arnoldo; Hammer, Hugo; Storvik, Bård: A Bayesian strategy for ranking customers by individual unobserved estimated risk factors, submitted 2010.

Technical reports:

Dimakos, Xeni; Storvik, Bård; Vårdal, Jofrid: Kundelojalitet i PVK/BIL NL. NR-Note, SAMBA/51/08, 2009.

Günther, CC; Aas, K. Model for prediction of client churn. NR-Note, SAMBA/58/12, 2012.

Günther, CC; Løland, A. Store poissonmodeller. NR-Note, SAMBA/33/12, 2012.

Günther, Clara-Cecilie; Tvete, Ingunn Fride; Aas, Kjersti; Borgan, Ørnulf: Modellering av kundeavgang. NR-Note, SAMBA/10/10, 2010.

Hobæk Haff, Ingrid; Wilhelmsen, Mathilde; Dimakos, Xeni: Uførhet. NR-Note, SAMBA/01/08, 2008.

Orskaug, Elisabeth: Storskader. NR-Note, SAMBA/59/10, 2010.

Wilhelmsen, Mathilde; Dimakos, Xeni: En studie av sammenhengen mellom makroøkonomi og forsikring. NR-Note, SAMBA/41/07, 2007.

STOR-i, Lancaster: visit and industrial training day