Capstone Project: Insurance Company Benchmark

Literature Review

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CIND820 Big Data Analytics Project

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1. Introduction

A Norwegian insurance company was interested in a machine learning solution to find best customers to market its caravan insurance product. Without sending mass email to all customers, it is cost effective for the company to identify best possible customers who will buy caravan insurance and sell the product only for those.

1.1. Statement of the Problem

The main research question:

Can you predict who would be interested in buying a caravan insurance policy and give an explanation why?

Following tasks will be performed in this analysis.

- Predict which customers are potentially interested in a caravan insurance policy.
- Describe the actual or potential customers; and possibly explain why these customers buy a caravan policy.

Additional Research questions

- How Caravan Insurance ownership does varies across different demographic areas, and can we create distinct profiles of Caravan Insurance customers based on sociodemographic data?
- predicting a customer's likelihood to purchase Caravan Insurance based on their sociodemographic characteristics
- What frequent associations can be identified in the product ownership data?

1.2. Background

The data was supplied by Sentient Machine Research. https://www.smr.nl/

This dataset is offered in a competition 'CoIL Challenge 2000'. The CoIL Challenge was a datamining competition organized by the Computational Intelligence and Learning Cluster, a network of excellence sponsored by the EU. It was held in the period of March-May 2000, in total 43 solutions were submitted.

2. Literature Review

Several articles were reviewed to gather efforts made by previous researches analysing this dataset.

Charles Elkan (2000), the first price winner of the completion in the prediction task used Naïve base algorithm and identified 121 caravan policy holders among its 800 top predictions.[2] Elkan has identified the strongest single predictor of having a caravan insurance policy is having a single car insurance policy where the contribution is high (level 6), or having two car policies[1] He has derived some attributes and used Boosting model.

I am planning to use Naïve base and derive some useful attributes. I will aim to identify similar amount or more of caravan policies.

I read through the article from YoungSeong Kim and W.N. Street.(2000)., the winners of the description task of the modelling competition [3]. They have used a combine method of artificial neural networks (ANNs) for prediction with evolutionary search for choosing the predictive features. The feature subset uses Evolutionary Local Search Algorithm (ELSA).They have considered distribution of each feature, normalized to the size of smaller one and a Chi-square test performed to see if the distributions were significantly different. They also conducted a search for simple association rules that would predict the purchase of a caravan policy. They have concluded contribution to the car policy is the strongest predictor.

In my research, I will use apoyri algorithm to run basket analysis.

In his article Alexander K. Seewald. (2000). explains use of Python weka package in predicting caravan customers. He explains after removing duplicates and removing low information attributes, he could increase the accuracy of the model [4].

I will also use weka package in Python in predicting caravan customers.

References:

[1] Charles Elkan. (2000). COIL CHALLENGE 2000 ENTRY. 1 - 2

http://www.liacs.nl/~putten/library/cc2000/ELKANP~1.pdf

[2] Charles Elkan. (2013). Magical Thinking in Data Mining: Lessons From CoIL Challenge 2000. 1 – 5 Article 10.1145/502512.502576

https://www.researchgate.net/publication/2368301_Magical_Thinking_in_Data_Mining_Lessons_From_CoIL_Challenge_2000

[3] YoungSeong Kim and W.N. Street.(2000). CoIL Challenge 2000: Choosing and Explaining Likely Caravan Insurance Customers.

http://www.liacs.nl/~putten/library/cc2000/STREET~1.pdf

[4] Alexander K. Seewald. (2000). CoIL Challenge 2000 Submitted Solution.

http://www.liacs.nl/~putten/library/cc2000/SEEWAL~1.pdf

3. Data and Information

Dataset: **Insurance Company Benchmark (COIL 2000).** This data set used in the CoIL 2000 Challenge contains information on customers of an insurance company. The data consists of 86 variables and includes product usage data and socio-demographic data

Dataset can be found in this link :

https://archive.ics.uci.edu/dataset/125/insurance+company+benchmark+coil+2000

TICDATA2000.txt: Dataset to train and validate prediction models and build a description (5822 customer records). Each record consists of 86 attributes, containing sociodemographic data (attribute 1-43) and product ownership (attributes 44-86).The sociodemographic data is derived from zip codes. All customers living in areas with the same zip code have the same sociodemographic attributes. Attribute 86, "CARAVAN: Number of mobile home policies", is the target variable.

TICEVAL2000.txt: Dataset for predictions (4000 customer records). It has the same format as TICDATA2000.txt, only the target is missing. Participants are supposed to return the list of predicted targets only. All datasets are in tab delimited format. The meaning of the attributes and attribute values is given below.

TICTGTS2000.txt Targets for the evaluation set.

Python will be used to perform analysis and Google Collab will be used to run Python script. Majority of time in this research will be spent on cleaning and understanding of data variables. Tableau will be used in profiling dataset and visualizations.

4. Exploratory Data Analysis

Complete exploratory data analysis can be found in this Github link.

https://github.com/manohariw44/TMU-Big-Data-Analytics-Capstone-Project/blob/d8539adaffffa6296d62935007c45ca18813fd4d/Pandas%20Profiling%20Report%20%E2%80%94%20Variable%20profile2%20-%20no%20duplicates%20.html

Link to correlation matrix

https://github.com/manohariw44/TMU-Big-Data-Analytics-Capstone-Project/blob/7bab4943c5656927af865cb47f91ddb3787deccb/corr_matrix_all%20attributes.png

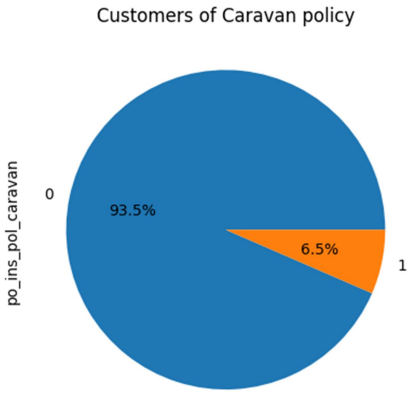
In the data cleaning stage, 602 duplicate records were removed.

These attributes were dropped from the data frame as all entries were 0.

'po_ins_pol_agri_machines', 'po_ins_pol_lorry',

po_no_ins_pol_agri_machines', 'po_no_ins_pol_lorry'

There is small proportion (6.5%) of success targets in the validation dataset.



target	# records
0	4880
1	340
	5220

6.5%

5. Approach

Initially I will spend some time in cleaning the dataset. I will prepare exploratory data analysis report, examine attributes and clean further by dropping attributes providing low information gain. I will combine some attributes meaningfully and derive new attributes.

The training dataset has small number of targets (6.5%) equal to 1. I will use proper sampling method to avoid over or under fitting. Using k fold cross validation method, I will split

Training dataset into k sample files and use k-1 files as the input files and validate with the last file. Then evaluate the model. I will choose the model with high accuracy. I will also check precision and recall in choosing the final model.

I will use Naïve Bayes algorithm for prediction task. I will also use algorithms sklearn, Decision Tree, Random Forest, Balanced Random Forest, logistic regression and k neighbors. Then results of these models will be compared (accuracy, precision and recall will be examined) and select the best algorithm to predict caravan insurance customer.

For the description task, I will use apoyri and k-means algorithms to run basket analysis.

Modelling steps.

Step1 - Data Collection

Read dataset in Collab notebook.

Step 2 - Data Preparation

- ∞ Wrangle data and prepare it for training
- ∞ Clean that which may require it (remove duplicates, correct errors, deal with missing values, normalization, data type conversions, etc.)
- ∞ Visualize data to help detect relevant relationships between variables or class imbalances (bias alert!), or perform other exploratory analysis
- ∞ Split into training and evaluation sets

Step3 - Choose a Model

I will few algorithms to train model:Naïve Bayes, Decision Tree, Random Forest, Balanced Random Forest, logistic regression and k neighbors.

Step4 - Evaluate the Model
I will run the model on evaluation dataset and evaluate model using matrices accuracy, precision and recall.

As the training dataset has small success target values (target = 1), I will use k fold cross validation to avoid over/under fitting.

Step5 - Parameter Tuning

In this step of hyper parameter tuning, I will tune the model for improved performance using

features that give best results.

I will do steps 3 – 5 iteratively over different algorithms, using different features and note down accuracy, precision and recall from each model. Then I will choose the best performing algorithm.

I am planning to use programming languages and tools in this research as follows.

Task	Tool/package/ library
Data profiling, visualisation, feature engineering	**Python** : pandas, numpy, matplotlib, seaborne, pandas profiling **SAS** **Tableau** **R**: ggplot2, caret
Classification model	**Python**: sklearn, python-weka-wrapper3, pandas numpy, matplotlib, graphviz **R**: ISLR, class, fpc, cluster
Association rules	**Python**: weka, numpy, pandas **R**: ISLR, class, fpc, cluster