

A Logistic Regression Approach to CoIL Challenge 2000

Corey Arnouts¹, Adam Douglas¹, Jason Givens-Doyle¹, & Michael Silva¹

¹ MS in Data Science Students CUNY School of Professional Studies

Author Note

Correspondence concerning this article should be addressed to Corey Arnouts, 119 W 31st St., New York, NY 10001. E-mail: Corey.Arnouts@spsmail.cuny.edu

Abstract

A logistic regression based solution to the CoIL Challenge 2000 is described. The challenge consists of correctly identifying potential customers for an insurance product, and describing their characteristics.

Keywords: CoIL Challenge, Logistic Regression

Word count: X

A Logistic Regression Approach to CoIL Challenge 2000

Introduction

Businesses use data science to extract insights from data. It has many practical business applications. Identifying households to include in a marketing campaign is one application. One example using real world data is the Computational Intelligence and Learning (CoIL) Challenge. The CoIL Challenge competition was held from March 17 to May 8 in 2000. The challenge is to:

1. Identify potential customers for an insurance policy; and
2. Provide a description of this customer base.

In total 147 participants registered and 43 submitted solutions (Putten, Ruiter, & Someren, 2000). In this paper we set out to complete the first part of the COIL Challenge.

SUMARISE FINDINGS?

Literature Review

Participants used a variety of approaches in formulating their submissions including: Boosted Decision Tree (McKone & Stenger, 2000), Classification and Regression Tree (CART) (Simmonds, 2000), Classification Trees with Bagging (White & Liu, 2000), C4.5 (Rickets, 2000; Seewald, 2000), Evolutionary Algorithm (Koudijs, 2000), Fuzzy Classifier (János Abonyi, 2000; Kaymak & Setnes, 2000), Genetic Algorithms and Hill-climbers (Carter, 2000), Inductive Learning by Logic Minimization (ILLM) (Gamberger, 2000; Šmuc, 2000), Instance Based Reasoning (iBARET) (Mikšovský & Klema, 2000), K-Means (Vesanto & Sinkkonen, 2000), KXEN (Bera & Lamy, 2000), LOGIT (Doornik & Moyle, 2000), Mask Perceptron with Boosting (Leckie & Ferra, 2000), Midos Algorithm (Kroegel, 2000), N-Tuple Classifier (Jorgensen & Linneberg, 2000), Naïve Bayes (Elkan, 2000;

Kontkanen, 2000), Neural Networks(Brierley, 2000; Crocoll, 2000; Kim & Street, 2000; Shtovba & Mashnitskiy, 2000), Phase Intervals and Genetic Algorithms (Shtovba, 2000), Scoring System (Lewandowski, 2000), Support Vector Machines(Keerthi & Ong, 2000), and XCS (Greenyer, 2000).

The maximum number of policyowners that could be found was 238. The winning model (Elkan, 2000) selected 121 policy owners. Random selection results in 42 policy owners. The standard benchmark tests result in 94 (k-nearest neighbor), 102 (naïve bayes), 105 (neural networks) and 118 (linear!) policy owners. (Putten et al., 2000)

Methodology

Experimentation and Results

Discussion and Conclusions

References

- Bera, M., & Lamy, B. (2000). Kxen at coil challenge 2000. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/BERAPS~1.pdf>
- Brierley, P. (2000). COIL 2000 challenge: Characteristics of caravan insurance policy owners. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/BRIERL~1.pdf>
- Carter, J. (2000). Coil 2000 challenge submission: Genetic algorithms and hill-climbers. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/CARTER~1.pdf>
- Crocoll, W. M. (2000). Artificial neural network portion of coil study. Retrieved from
<http://www.liacs.nl/~putten/library/cc2000/CROCOL~1.pdf>
- Doornik, J. A., & Moyle, S. (2000). LOGIT modelling. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/MOYLEP~1.pdf>
- Elkan, C. (2000). CoIL challenge 2000 entry. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/ELKANP~1.pdf>
- Gamberger, D. (2000). Solution based on illm confirmation rule. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/GAMBER~1.pdf>
- Greenyer, A. (2000). Coil 2000 competition. The use of a learning classifier system jxcs. Retrieved from <http://www.liacs.nl/~putten/library/cc2000/GREENY~1.pdf>
- János Abonyi, H. R. (2000). A simple fuzzy classifier based on inconsistency analysis of labeled data. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/ABONYI~1.pdf>
- Jorgensen, T. M., & Linneberg, C. (2000). Subspace projections – an approach to variable selection and modeling. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/JORGEN~1.pdf>

- Kaymak, U., & Setnes, M. (2000). Target selection based on fuzzy clustering: A volume prototype approach to coil challenge 2000. Retrieved from <http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/KAYMAK~1.pdf>
- Keerthi, S. S., & Ong, C. J. (2000). Solution of the coil challenge 2000 task using support vector machines. Retrieved from <http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/KEERTH~1.pdf>
- Kim, Y., & Street, W. N. (2000). CoIL challenge 2000: Choosing and explaining likely caravan insurance customers. Retrieved from <http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/STREET~1.pdf>
- Kontkanen, P. (2000). CoIL 2000 submission. Retrieved from <http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/KONTKA~1.pdf>
- Koudijs, A. (2000). CoIL challenge 2000 submission for the description task. Retrieved from <http://www.liacs.nl/~putten/library/cc2000/KOUDIJ~1.pdf>
- Krogel, M.-A. (2000). A data mining case study. Retrieved from <http://www.liacs.nl/~putten/library/cc2000/KROGEL~1.pdf>
- Leckie, C., & Ferra, H. (2000). COIL challenge 2000 description task. Retrieved from <http://www.liacs.nl/~putten/library/cc2000/LECKIE~1.pdf>
- Lewandowski, A. (2000). How to detect potential customers. Retrieved from <http://www.liacs.nl/~putten/library/cc2000/LEWAND~1.pdf>
- McKone, T., & Stenger, C. (2000). COIL challenge 2000 submission. Retrieved from <http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/MCKONE~1.pdf>
- Mikšovský, P., & Klema, J. (2000). CoIL challenge 2000. Retrieved from <http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/MIKSOV~1.pdf>
- Putten, P., Ruiter, M., & Someren, M. (2000). CoIL challenge 2000 tasks and results: Predicting and explaining caravan policy ownership. Retrieved from

- <http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/PUTTEN~1.pdf>
- Rickets, P. (2000). CoIL challenge 2000 submission. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/RICKET~1.pdf>
- Seewald, A. (2000). CoIL challenge 2000 submitted solution. Retrieved from
<http://www.liacs.nl/~putten/library/cc2000/SEEWAL~1.pdf>
- Shtovba, S. (2000). Phase intervals and genetic algorithms based competition task solution. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/SHTOVB~2.pdf>
- Shtovba, S., & Mashnitskiy, Y. (2000). The backpropagation multilayer feedforward neural network based competition task solution. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/SHTOVB~1.pdf>
- Simmonds, R. M. (2000). ACT study report using classification and regression tree (cart) analysis. Retrieved from
<http://www.liacs.nl/~putten/library/cc2000/SIMMON~1.pdf>
- Šmuc, T. (2000). COIL 2000 challenge solution based on illm-sg methodology. Retrieved from <http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/SMUCPS~1.pdf>
- Vesanto, J., & Sinkkonen, J. (2000). Submission for the coil challenge 2000. Retrieved from
<http://liacs.leidenuniv.nl/~puttenpwhvander/library/cc2000/VESANT~1.pdf>
- White, A. P., & Liu, W. Z. (2000). The coil challenge: An application of classification trees with bootstrap aggregation. Retrieved from
<http://www.liacs.nl/~putten/library/cc2000/WHITEP~1.pdf>

Appendices

R statistical programming code.

```
# CoIL Challenge Source Code

library(tidyverse)

# Download the data sets from UCI if they are not present
url <- "https://archive.ics.uci.edu/ml/machine-learning-databases/tic-mld/"
files <- c("ticdata2000.txt", "ticeval2000.txt", "tictgts2000.txt")

for (file_name in files) {
  file_path <- paste0("data/", file_name)
  file_url <- paste0(url, file_name)
  if (!file.exists(file_path)) {
    message(paste("Downloading", file_name))
    download.file(file_url, file_path)
  }
}

# Read in the data
df <- read.delim("data/ticdata2000.txt", header = FALSE)

names(df) <- c("MOSTYPE", "MAANTHUI", "MGEMOMV", "MGEMLEEF", "MOSHOOFD",
               "MGODRK", "MGODPR", "MGODOV", "MGODGE", "MRELGE", "MRELSA",
               "MRELOV", "MFALLEEN", "MFGEKIND", "MFWEKIND", "MOPLHOOG",
               "MOPLMIDD", "MOPLLAAG", "MBERHOOG", "MBERZELF", "MBERBOER",
               "MBERMIDD", "MBERARBG", "MBERARBO", "MSKA", "MSKB1", "MSKB2",
               "MSKC", "MSKD", "MHHUUR", "MHKOOP", "MAUT1", "MAUT2", "MAUTO",
               "MZFONDS", "MZPART", "MINKM30", "MINK3045", "MINK4575",
               "MINK7512", "MINK123M", "MINKGEM", "MKOOPKLA", "PWAPART",
               "PWABEDR", "PWALAND", "PPERSAUT", "PBESAUT", "PMOTSCO",
```



```

"PVRAAUT", "PAANHANG", "PTRACTOR", "PWERKT", "PBROM", "PLEVEN",
"PPERSONG", "PGEZONG", "PWAOREG", "PBRAND", "PZEILPL",
"PPLEZIER", "PFIETS", "PINBOED", "PBYSTAND", "AWAPART",
"AWABEDR", "AWALAND", "APERSAUT", "ABESAUT", "AMOTSCO",
"AVRAAUT", "AAANHANG", "ATRACTOR", "AWERKT", "ABROM", "ALEVEN",
"APERSONG", "AGEZONG", "AWAOREG", "ABRAND", "AZEILPL",
"APLEZIER", "AFIETS", "AINBOED", "ABYSTAND", "CARAVAN")

eval <- read.delim("data/ticeval2000.txt", header = FALSE)
temp <- read.delim("data/tictgts2000.txt", header = FALSE)
eval$CARAVAN <- temp$V1
names(eval) <- names(df)

```