Comparing Machine Learning and Conventional Statistical Techniques In Claims Models

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Agenda

- Claims Triage Models
- Beyond GLM: Regression Models
- Beyond GLM: Machine Learning models
- Case Study
- Conclusions

Claims Triage Model

Objectives:

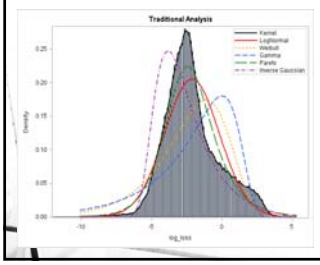
- Identify claims that have the potentials to blow up
- Allocate claims resources efficiently
- Manage claims to mitigate the loss

Challenges for model development:

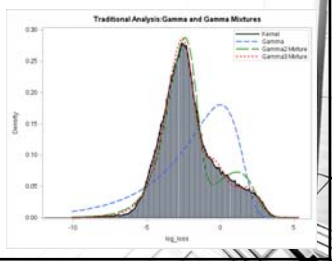
- Time stamps of variables
- Empirical loss distributions are different from exponential family
- Many possible interactions
- Unobserved heterogeneity
- Model validation and benefit quantification

WC Loss Distribution

Common-used distributions do not fit WC loss data well



Need mixtures to fit WC loss data better



Claims Triage Models: Beyond GLM

- Regression Models
  - Finite mixture models, double GLM, quantile regressions
  - Generalized mixed model (random and fixed effects)
  - Elastic nets, LASSO, Ridge
- Machine Learning Models
  - Support Vector Machine
  - Neural Networks
  - Random Forests
  - Gradient Boosted Trees (GBM)

Claims Triage Models: Beyond GLM

Case study to appear at the presentation.

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Questions?

Mixed Effects Model Resources

General Sources

- Predictive Modeling Application in Actuarial Science Vol. 1 (Chapters 7, 8, 9, and 16): http://instruction.bus.wisc.edu/jfrees/jfreesbooks/PredictiveModelingVol1/index.htm
- http://www.ats.ucla.edu/stat/mult_pkg/glmm.htm

Mixed Models in R

- https://cran.r-project.org/web/packages/lme4/vignettes/lmer.pdf
- http://lme4.r-forge.r-project.org/lMMwR/lrgprt.pdf
- http://rpsychologist.com/r-guide-longitudinal-lme-lmer

Elastic Net Resources

General Resources

- An Introduction to Statistical Learning (Ch. 6): http://www-bcf.usc.edu/~gareth/ISL/
- The Elements of Statistical Learning (Ch. 3): http://statweb.stanford.edu/~tibs/ElemStatLearn/

Fitting Elastic Nets in R

- http://web.stanford.edu/~hastie/glmnet/glmnet_alpha.html

Neural Network Resources

General Resources:

- The Elements of Statistical Learning (Ch. 3): http://statweb.stanford.edu/~tibs/ElemStatLearn/
- http://mi.eng.cam.ac.uk/~mjfg/local/i10/i10_hand4.pdf
- http://neuralnetworksanddeeplearning.com/chap1.html

Neural Networks in R

- https://journal.r-project.org/archive/2010-1/RJournal_2010-1_Guenther+Fritsch.pdf
- http://datascienceplus.com/fitting-neural-network-in-r/
- http://bicorner.com/2015/05/13/neural-networks-using-r/

Decision Tree Resources

- Gradient Boosting:
  - Greedy Function Approximation: A Gradient Boosting Machine: https://statweb.stanford.edu/~jhf/ftp/trebst.pdf
  - https://cran.r-project.org/web/packages/gbm/gbm.pdf
- XGBoost (extreme gradient boosting)
  - https://xgboost.readthedocs.io/en/latest/
  - https://cran.r-project.org/web/packages/xgboost/xgboost.pdf
- Random Forest
  - Random Forests: https://www.stat.berkeley.edu/~breiman/randomforest2001.pdf
  - https://cran.r-project.org/web/packages/randomForest/randomForest.pdf