Hybrid Tree-based Models for Insurance Claims

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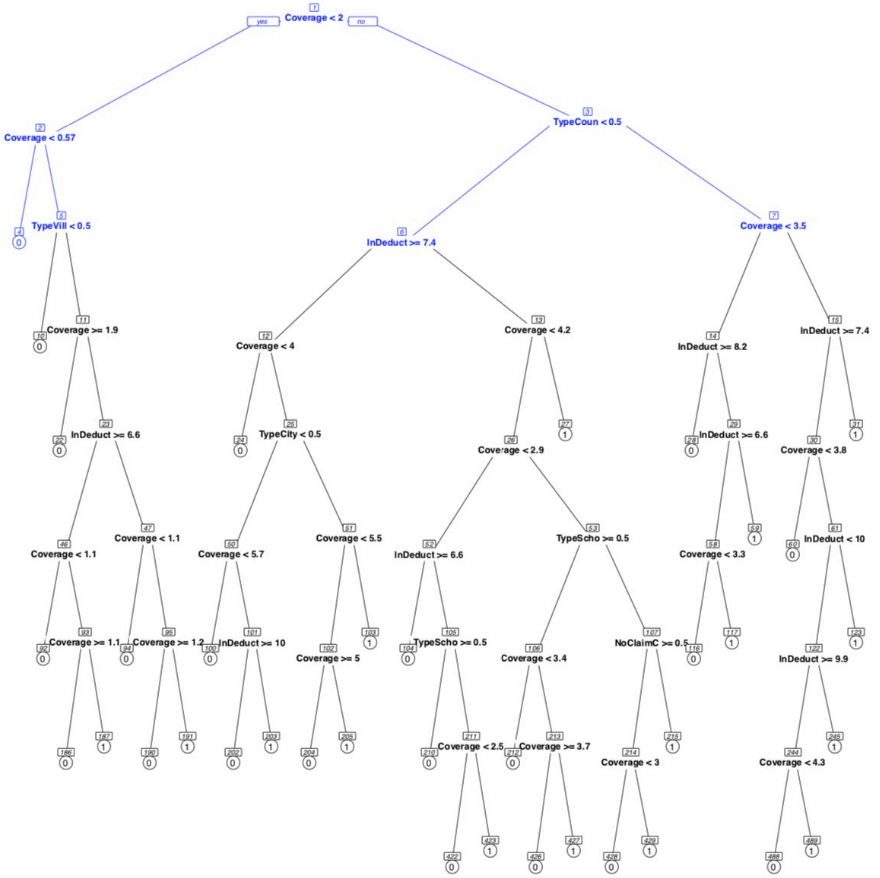
Short-term insurance and traditional approaches

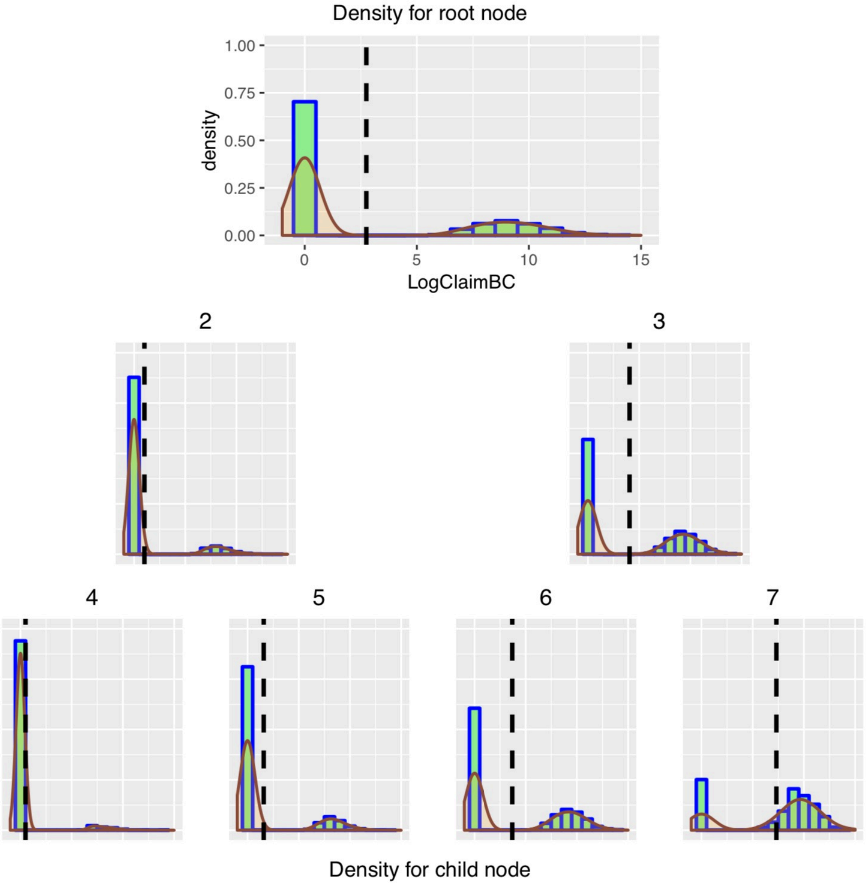
- Insurance datasets feature information about claim frequency and severity for each policy or observation.
- For most insurance claims datasets, there is typically a large proportion of zero claims that leads to imbalances that cause inferior prediction accuracy of traditional approaches.
- The two-part framework uses the Poisson-gamma approach.
  - Overlooks the internal connection between the low frequency and the subsequent low loss amount.
- Tweedie GLM (parsimonious)
  - Constant scale, or dispersion, parameter causes the mean increases with its variance.

Hybrid Tree-based Models

- The first step is the construction of a classification tree to build the probability model for frequency.
    - Binary response variable: CART, C4.5, eneralized, Unbiased, Interaction Detection and Estimation (GUIDE), Conditional Inference Trees (CTREE).
    - Count response variable: piecewise linear Poisson using CART, SUPPORT, Poisson regression using GUIDE, MOdel-Based recursive partitioning (MOB).
- In the second step, we employ linear regression model at each terminal node to build the distribution model for severity.
    - Generalized Linear Models (GLM) with various families.
    - Regression with elastic net regularization.

Visualize the change of density with binary splitting





The prediction performance on LGPIF dataset

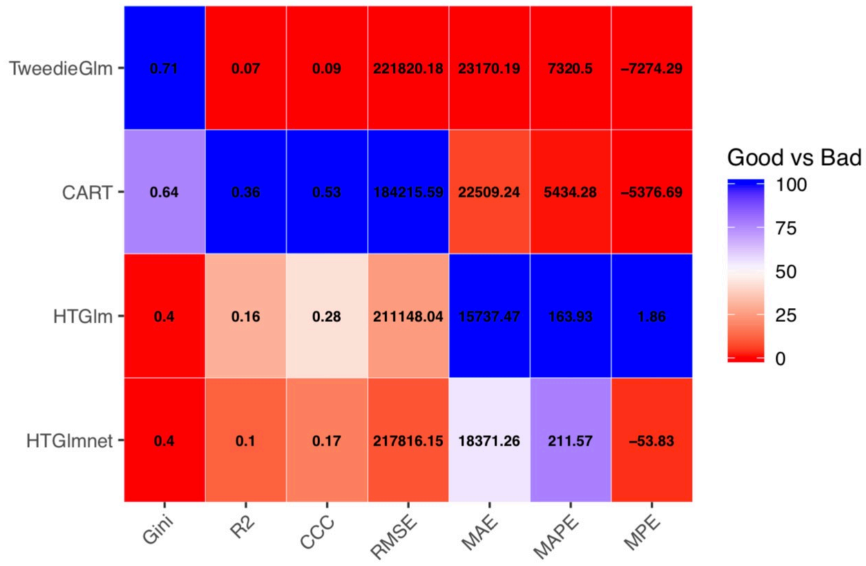


Figure 1: Model fitting.

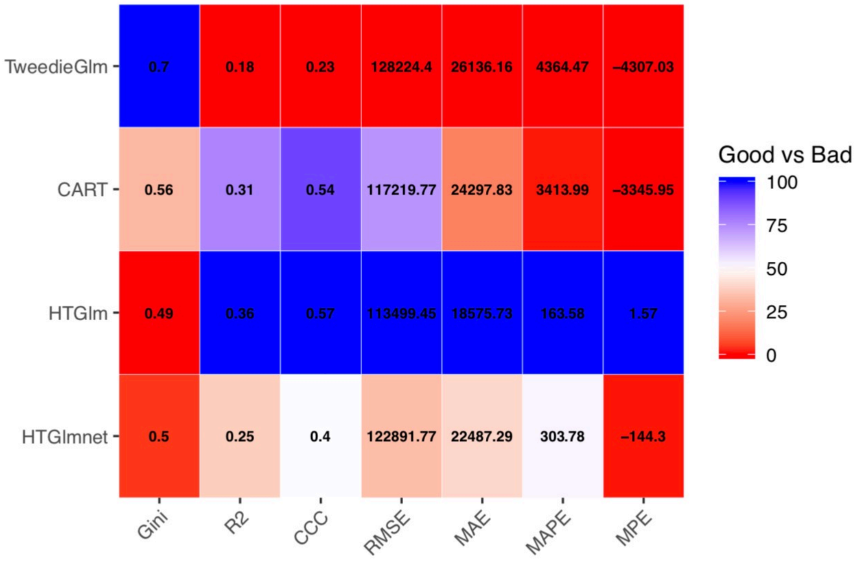


Figure 2: Model performance on test dataset.

- Compare Tweedie GLM, Regression Tree (CART), Hybrid Tree-based Model with simple GLM with Gaussian family (HTGlm), Hybrid Tree-based Models with elastic net regression (HTGlmnet) based on various validation measures.

Reference

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Thank you for your attention!