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PROJECT

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GROUP 3

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PRESENTATION AGENDA

1

- Project Overview
- Business Problems
- Key Insights

2

- Data overview
- Challenges on Modeling

3

- Two Step Modeling Approach
- Step 1
- Step 2

4

- Customer Segmentation and Retention Strategies
- Next Step

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PROJECT OVERVIEW

The primary objective

- Analyze factors influencing customer retention
- Develop predictive models that can help identify at-risk customers
- Set strategies ideas to improve retention rates.

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BUSINESS PROBLEM

Can the likelihood of a customer canceling their auto insurance be estimated?

Additionally, can we determine the specific type of cancellation they will choose, such as midterm or flat cancellation?

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KEY INSIGHTS

MODEL

Performance: LightGBM showed the highest accuracy on Test set.
Precision = 0.84 for renewals
0.82 for cancellations
AUC = 0.705

Feature Engineering: Created 5 new features that capture the data better and reduce dimensionality for improved model performance.

AS BUSINESS

Customer Segmentation: Identified four distinct customer segments with varying loyalty levels and retention needs.

Targeted Retention Strategies: Developed tailored strategies for each segment to improve retention rates and customer satisfaction.

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DATA OVERVIEW AND MODEL CHALLENGES

1 Data Cleaning and Enhancement

- Before Cleaning: 264,963 rows by 54 Columns
- After Cleaning: 264,963 rows by 57 Columns
- Removed 2 variables, created 5 variables

2 Preparing for Modeling

- Label Encoding
- Checking correlation between variables
- Checking correlation with STATUS

3 Unbalanced Classes:

- STATUS:
  - 0 = Not Cancelling - 84.6%
  - 1 = Mid-Term Cancellation - 8.2%
  - 2 = End-Term Cancellation - 7.3%

4 Balancing Techniques

- SMOTE
- Downsampling

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MODELING APPROACH

Divide the target into two steps

STEP 1 — Predict customer cancellation (Class 0 or Class 1 and 2)

STEP 2 — Predict mid-term and end-of-term cancellations probabilities (Class 1 or Class 2)

Metrics: We focused on precision because it helps accurately identify real cancellations and minimize false positives in predicting customer cancellations. ROC-AUC was used too as the data imbalace was severe

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CHOOSING OUR FEATURE SELECTION METHOD FOR STEP 1

- Recursive Feature Elimination
- Principal Component Analysis
- Feature Importance ranking
- No classifier Feature selection
  - Correlation with STATUS thresholds and correlations with other variables

The best method for feature selection that we found was **Feature Importance Ranking**

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FINDING THE BEST MODEL TYPE: STEP 1

We tested different models on the full dataset to choose the best model

- Random Forest
- XGBoost
- LightGBM

We found that **LightGBM** had overall higher accuracy and better predictive power than the other models

LightGBM had 68% precision for cancellations on the full model

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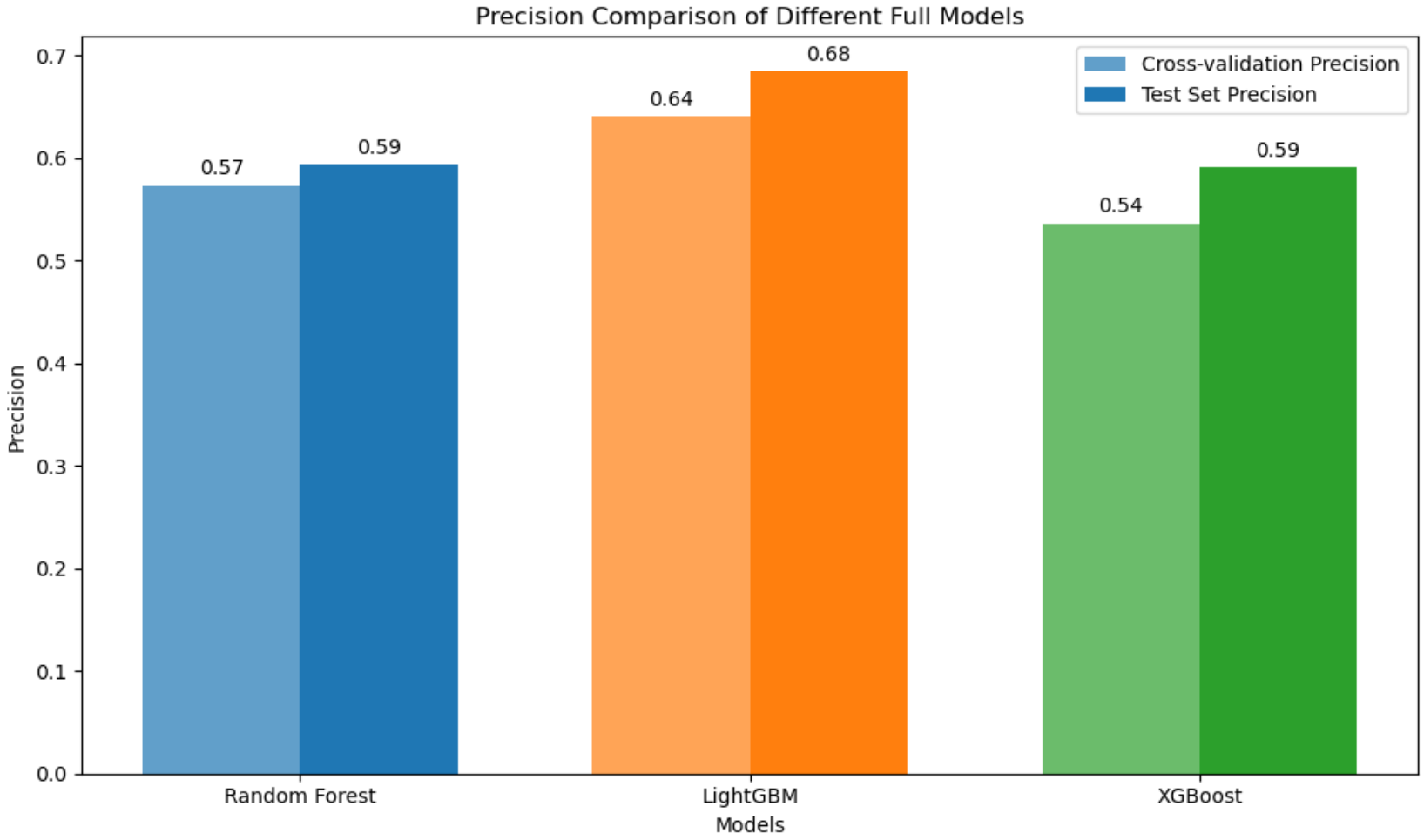
COMPARISON OF DIFFERENT STEP 1 MODELS ON THE FULL DATASET



LightGBM had a better performance using all variables.

CV = 0.64

Test = 0.68

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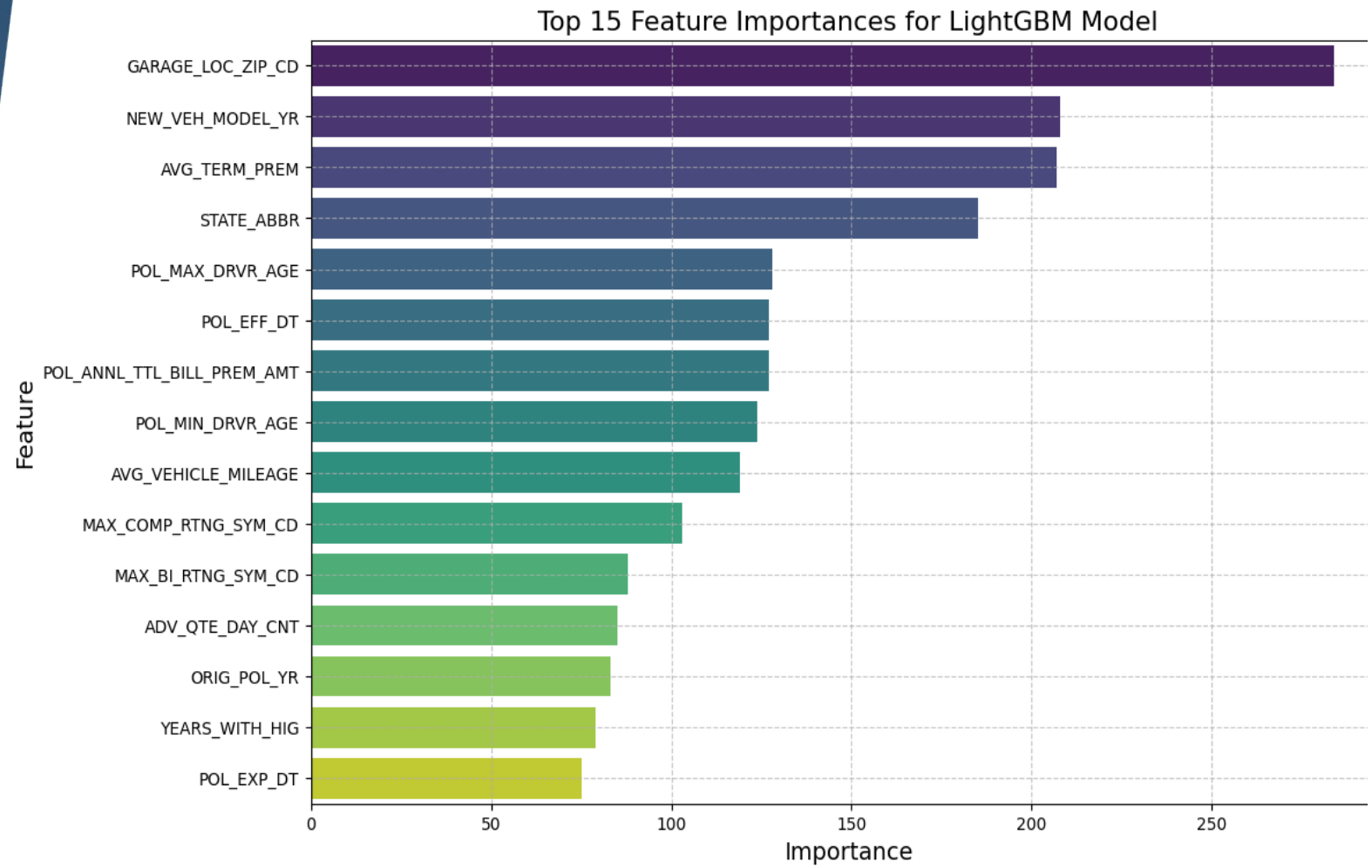
FEATURE IMPORTANCES



LightGBM feature selection technique was used for selecting the best 15

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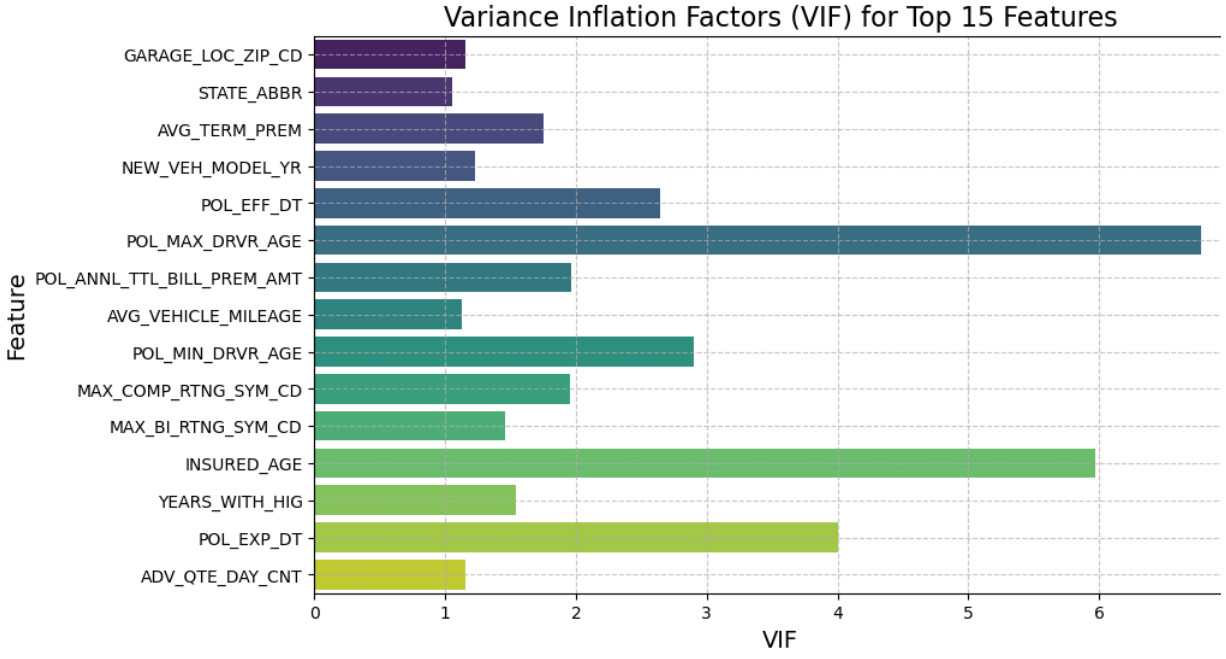
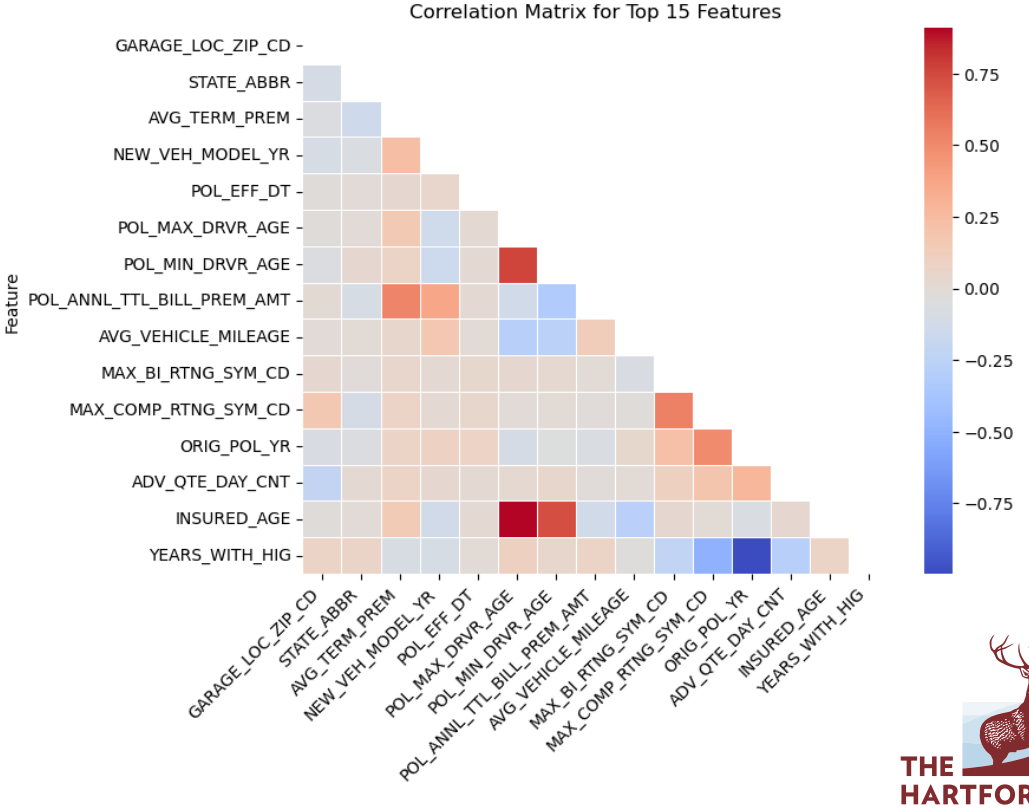
CORRELATION AND VIF

15 Best Variables Cleaning

- ORIG_POL_YR was removed for correlation.
- POL_EFF_DT and POL_EXP_DT Removed for VIF and high correlation.





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DATA ENHANCEMENT

- Create new variables that show important business statistics.
- Increased robustness
- Reduce the complexity of models and improve efficiency
- Ensure model accuracy

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FEATURE ENGINEERING FOR ENHANCED MODEL PERFORMANCE

NEW FEATURES

PREMIUM_CHANGE: Absolute change in renewal premium over two terms.

DRVR_AGE_DIFF: Difference between the oldest and youngest drivers on the policy.

BILL_PREM_DIFF: Difference between the total annual bill premium amount and the average term premium.

AVG_COMP_BI_RTNG_SYM: Average of comprehensive and bodily injury rating symbols.

VEHICLE_AGE: Age of the vehicle calculated from the model year.

Variables used to create new features were then removed to avoid multicollinearity

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STEP 1 FINAL MODEL FEATURE SELECTION

Original Features	New Features
BILL_PRE_DIFF	PREMIUM_CHANGE
VEHICLE_AGE	AVG_VEHICLE_MILEAGE
YEARS_WITH_HIG	ADV_QTE_DAY_CNT
STATE_ABBR	AVG_COMP_BI_RTNG_SYM
GARAGE_LOC_ZIP_CD	DRVR_AGE_DIFF

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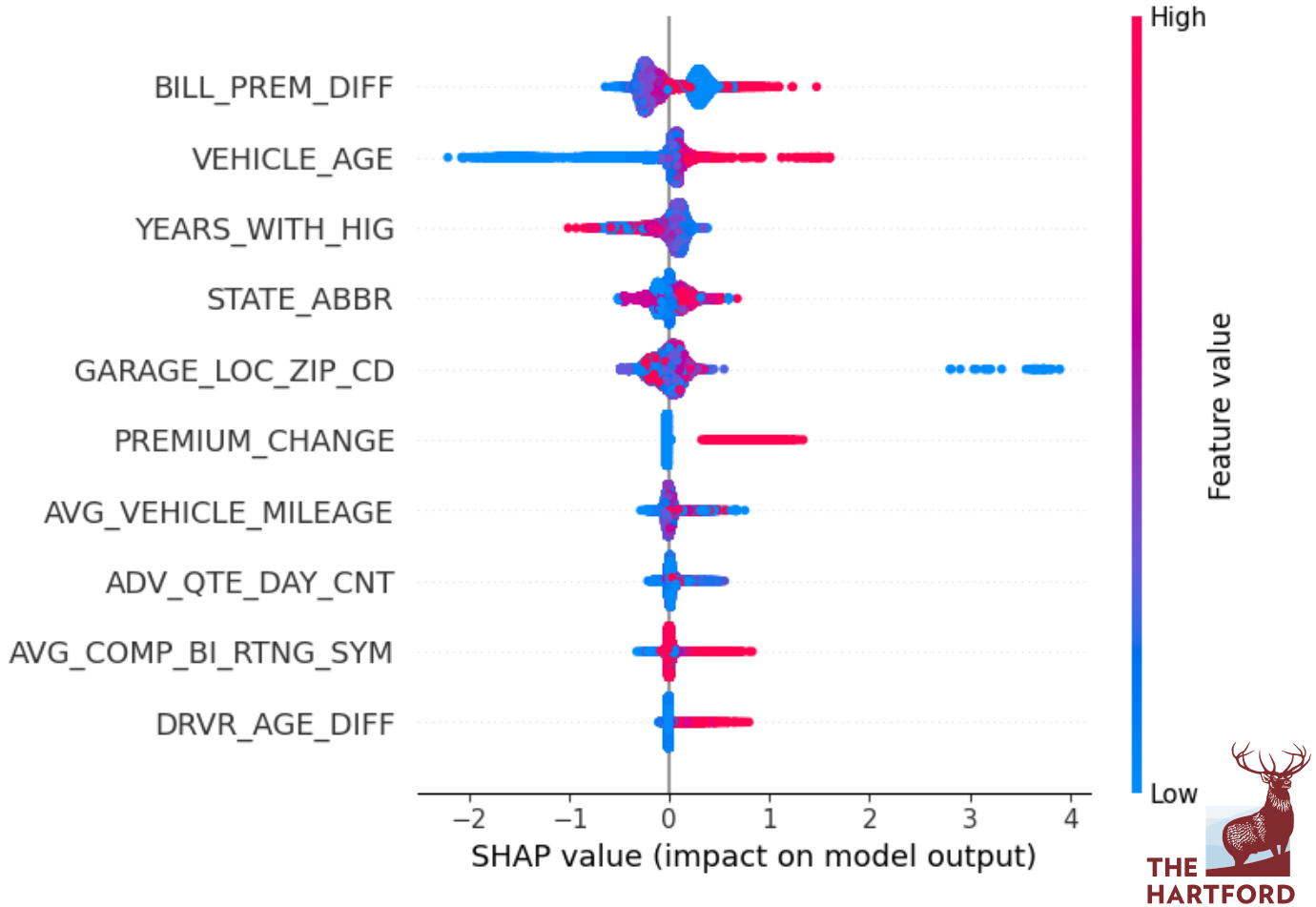
CHECKING SHAP VALUES FOR THE FIRST MODEL RESULTS

Positive SHAP values indicate an increase in the predictive power of cancellation and vice-versa.

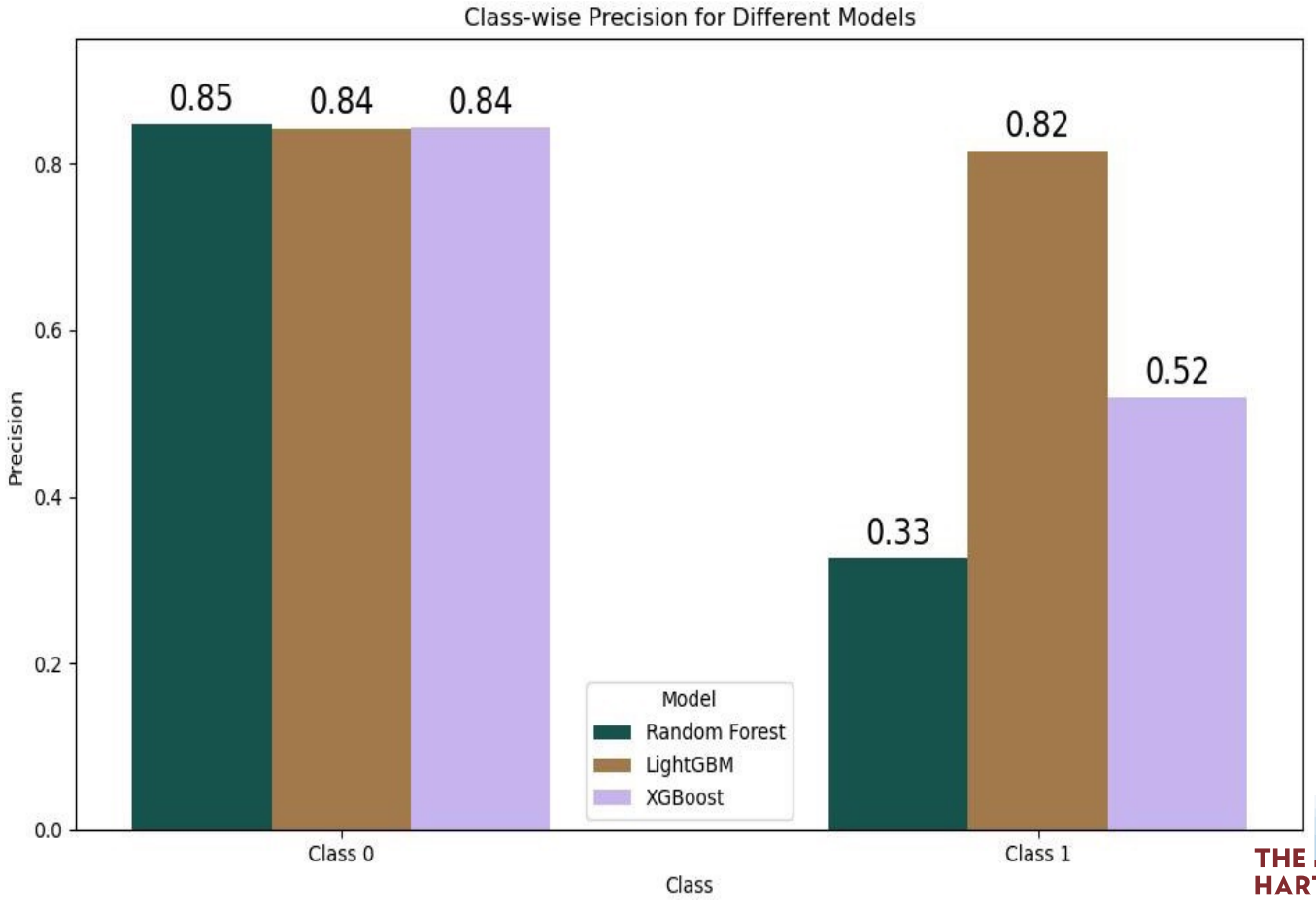
SHAP Values best features for predicting cancellations: BILL_PREM_DIFF, VEHICLE_AGE and YEARS_WITH_HIG



STEP 1 FINAL MODEL PERFORMANCE

Step 1 Final model Performance comparison of cancellations between models.

LightGBM results in:
Precision class
0 = 84, 1 = 82
ROC-AUC = 0.70



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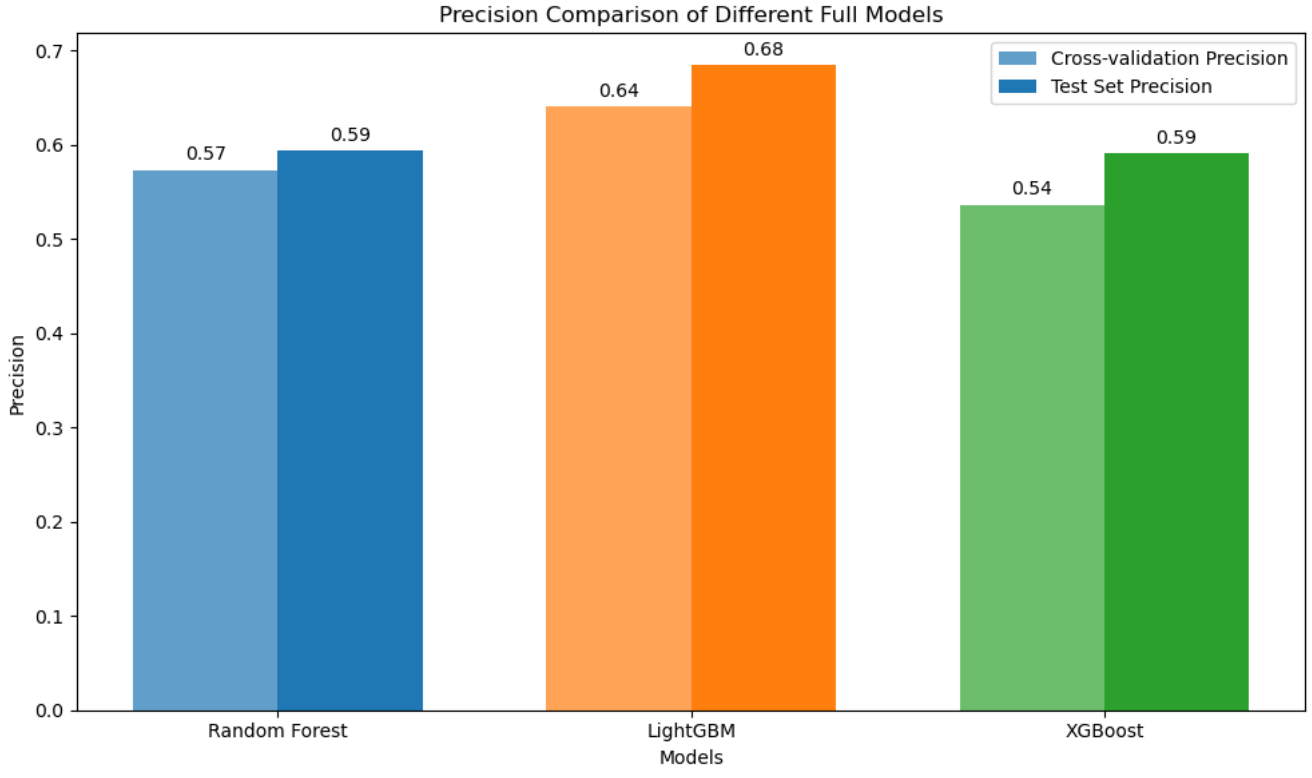
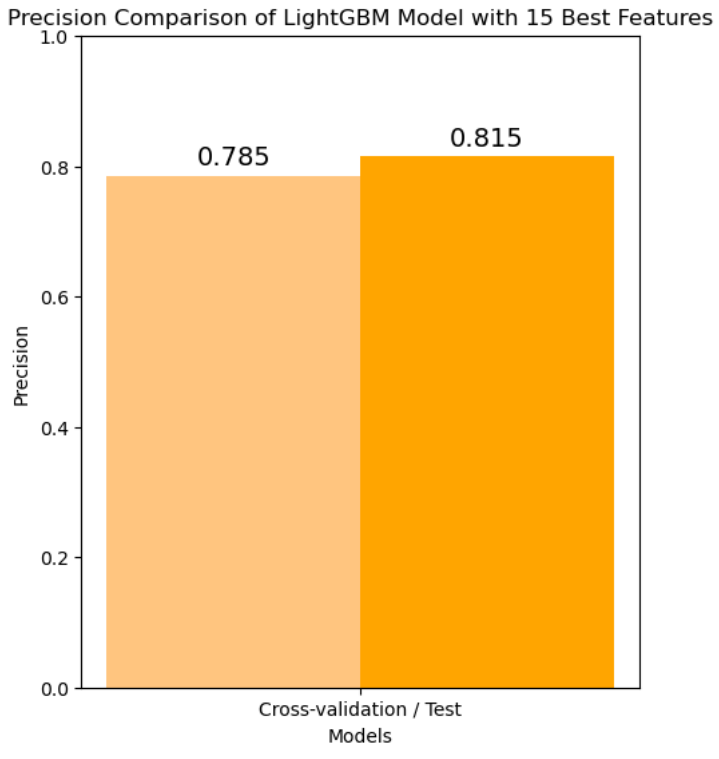
STEP 1 MODEL RESULTS ON THE TEST SET

Full dataset prediction



Step 1 Final Model Prediction



LightGBM had a better performance using all variables and reached 0.82 on Test set using the 15 best variables for prediction.

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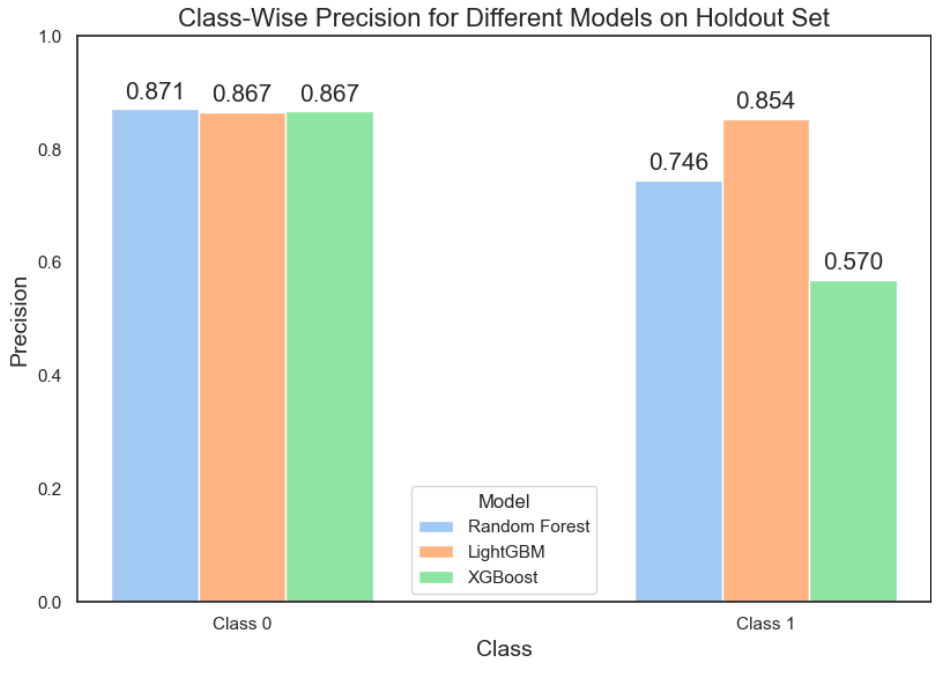
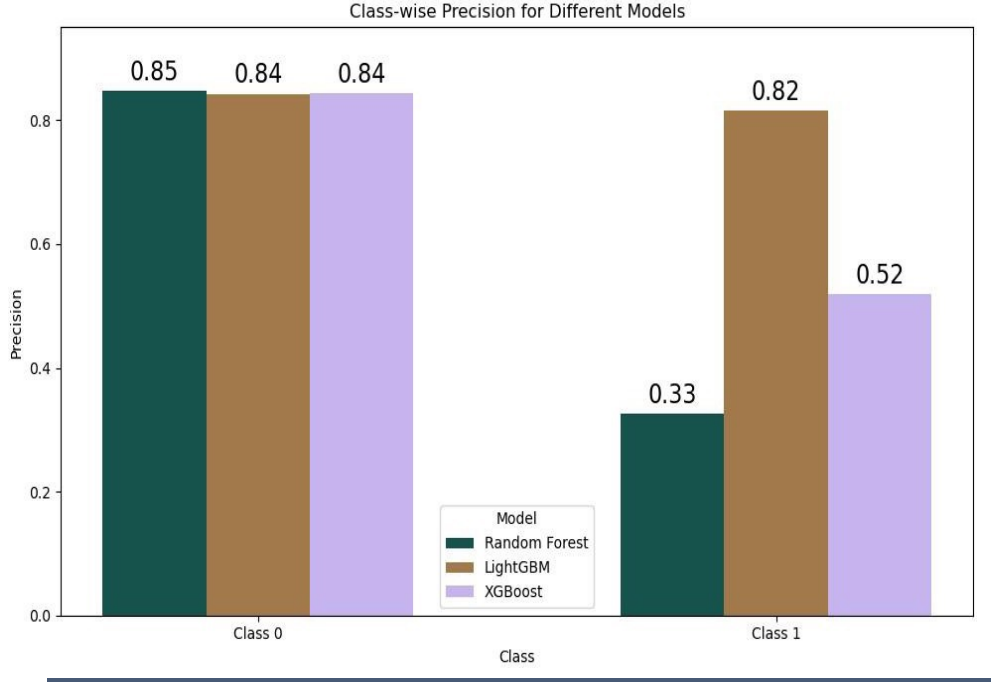
STEP 1 MODEL - HOLDOUT SET VS TEST SET

HOLDOUT RESULTS



The consistent performance across the test set and holdout set indicates that the model is not overfitting. ROC-AUC = 0.65

TEST RESULTS



The model showed a slightly better performance on the holdout set. ROC-AUC = 0.70

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STEP 1: 0THER APPROACHES

Techniques we tried to implement to improve our prediction results

Weighting
Increases other metrics at the cost of precision

SMOTE
No changes on classes precision

Lasso and Ridge regularization
Did not change precision

PCA
Class 1 was overestimated

Learning Rate Scheduler

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STEP 2 MODEL PREDICTION

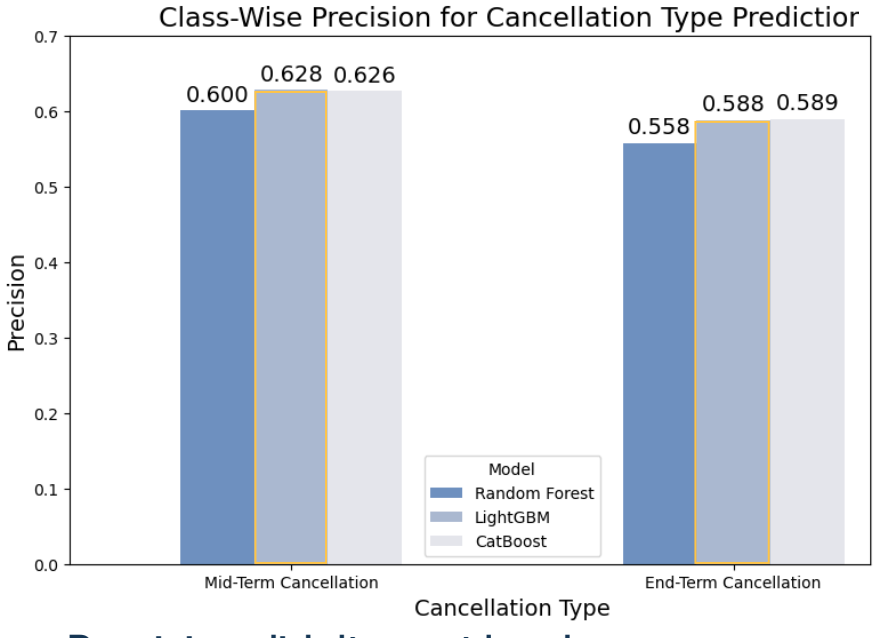
Target Variable Creation: Filtered out non-cancellations and used STATUS column for cancellation type.

Feature Selection: Used LightGBM, identified ZIP Code and Policy Effective Date as top features. Various feature selection techniques were applied, but none significantly improved model performance.

Challenges Faced: Insufficient data for minority classes, impacting performance despite various techniques.

STEP 2 Cancellation type model: Best results were achieved by 15 top feature importance selection using LightGBM classifier

STEP 2 Model Results



Precision didn't meet levels we found acceptable: Class 1: 63% Class 2: 59%

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CUSTOMER SEGMENTATION OVERVIEW

We focused on **3 KEY FEATURES** to divide the customers into **4 SEGMENTS**

'BILL_PREM_DIFF', 'VEHICLE_AGE' AND 'YEARS_WITH_HIG'

METHOD USED: KMEANS CLUSTERING

	Premium Difference	Vehicle Age	Avg Years with HIG
SEGMENT 0	Moderate	Older Vehicles	7+
SEGMENT 1	Very Low	Oldest Vehicles	6+
SEGMENT 2	Highest	Newest Vehicles	9+
SEGMENT 3	Relatively High	Relatively New	8+

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CUSTOMER SEGMENTATION VISUALS

	SIZE	CUSTOMER LOYALTY	STRATEGIES
SEGMENT 0	100,000+	HIGH (LONG TERM CUTOMERS)	LOYALTY PROGRAMS & CUSTOMER FEEDBACK
SEGMENT 1	100,000+	MODERATE (POTENTIAL FOR GROWTH)	ENGAGEMENT CAMPAIGNS & INCETIVES ON RENEWALS
SEGMENT 2	ABOUT 5,800	VERY HIGH	PREMIUM SERVICES & PERSONALIZED OFFERS
SEGMENT 3	AROUND 40,000	HIGH BUT NEEDS ENGAGEMENT	REGULAR CHECK INS & TARGETED DISCOUNTS

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NEXT STEPS

1

Gather More Data: Collect additional information on customers who cancel mid-term to better understand their characteristics and reasons for cancellation.

2

Integrate External Data Sources: Incorporate external data sources, such as economic indicators and competitor actions, to enhance the model's predictive power and provide a more comprehensive view of the factors influencing customer cancellations.

3

Continue the Development of Step 2 Model: Find and implement new techniques that could help increase the predictive power of the step 2 model.

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Thank you

QA