# DA Group Project

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## 1. Problem Statement

Auto-insurance companies are likely to make policy holders pay insurance irrespective of the driving track records. This increases cost of insurance of good drivers and reduces for bad drivers. XYZ Insurance has tried intervening in this regard with a model to predict if a policy holder will file a claim in the next year. However, the company is not satisfied with the precision and recall metrics of the previous model. Improved precision would mean lesser good drivers requiring to pay while improved recall would mean more bad drivers requiring to pay.

## 2. Objective

To build a classification model that predicts if a policy holder will file a claim in the next year.

## 3. Data and Methods

### 3.1 Data

The dataset contains 5,95,212 observations and 58 useful variables- one is outcome and the remaining 57 are potential predictors. The outcome variable, henceforth referred to as target, is binary- 0, if a policy holder has not filed a claim and 1, if the policy holder has filed a claim.

The dataset is, however, incomplete. While target has zero missing data, 13 of the potential predictors were found to have missing data. The prevalence of missing data among the 57 predictors is given in Figure 1. Also, as seen in Figure 2, 2 predictors have over 40 per cent missing data.

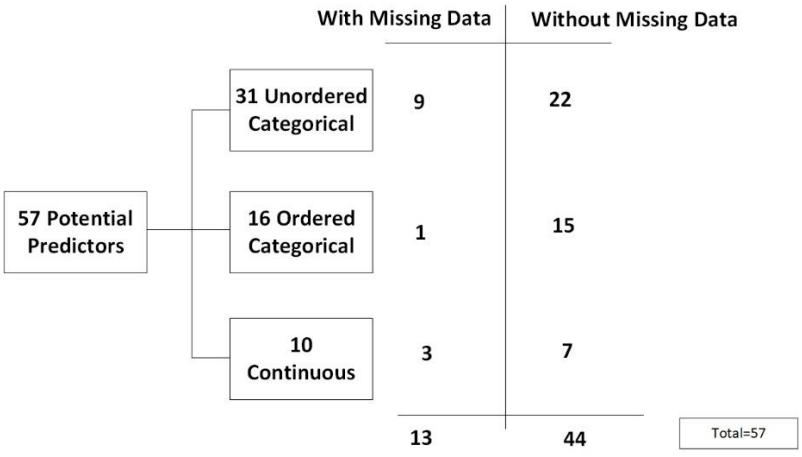



Figure 1 Prevalence of missing data in given dataset

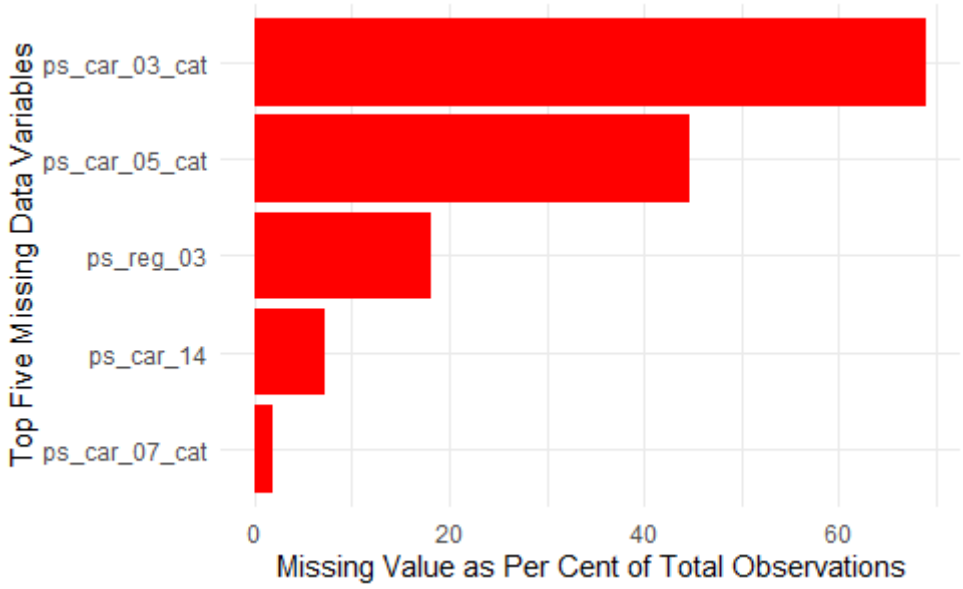



Figure 2 Top five missing data variables

The data is also imbalanced- 96 per cent are non-claimants and 4 per cent are claimants. The methods for handling these two issues as well as the modelling options are discussed in the next subsection.

## 3.2 Methods

***Handling Missing Data***

Three cases of handling missing data are considered, namely-

- Case A: Direct list-wise deletion (LWD); this leads to 79 per cent loss of observations
- Case B: Improvised list wise deletion, where LWD was performed after removing "ps-car-03-cat" and "ps-car-05-cat"; this leads to 25 per cent loss of observations
- Case C: Multiple imputation of predictors having missing data except "ps-car-03-cat" and "ps-car-05-cat" followed by LWD; this leads to 34 per cent loss of observations

***Dimension Reduction and Feature Selection***

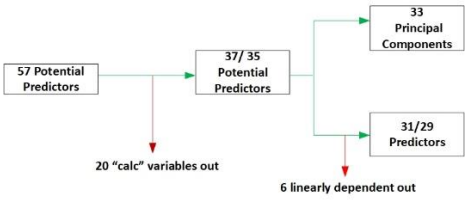



Figure 3 Screening and aggregation of predictors[12]

[1] The six excluded linearly dependent variables are `"ps_ind_10_bin", "ps_ind_11_bin", "ps_ind_12_bin", "ps_ind_13_bin'', "ps_ind_14'', ''ps_ind_09_bin"`

[2] Only for Case C, two more variables - "ps-car-03-cat" and "ps-car-05-cat"- are also removed. The reduced numbers are indicated after the slash symbol inside the boxes in the figure.

The variables identified in the first method are excluded from the whole analysis. The linearly dependent predictors from the third method are excluded from models that use original predictors.

***Classification Model Choices***

Logistic regression, elastic-net regression, gradient boosting and feedforward ANN were selected. Logistic regression is intended to serve as a baseline. The other three were selected because the corresponding R packages enables

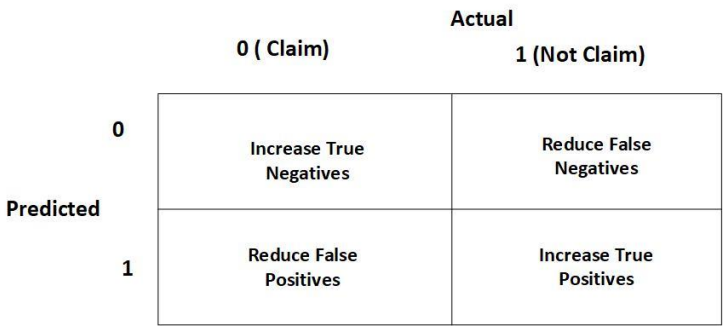
- In built model regularization to avoid overfitting
- Faster computational speed for large data (which is the case in hand)

KNN takes a longer amount of time to predict outcomes in large datasets and its value will depend on the size of the class. The predicted outcome will be biased towards the larger number of variables in the dataset. Naïve Bayes assumes that all features are conditionally independent, which may not be the case in real time data.

***Handling Class Imbalance***

Synthetic random oversampling of minority class (claimants) was done for building training data for logistic regression and elastic-net regression. Boosting and ANN have inbuilt features for dealing with class imbalance.

***Key Selected Performance Metrics***

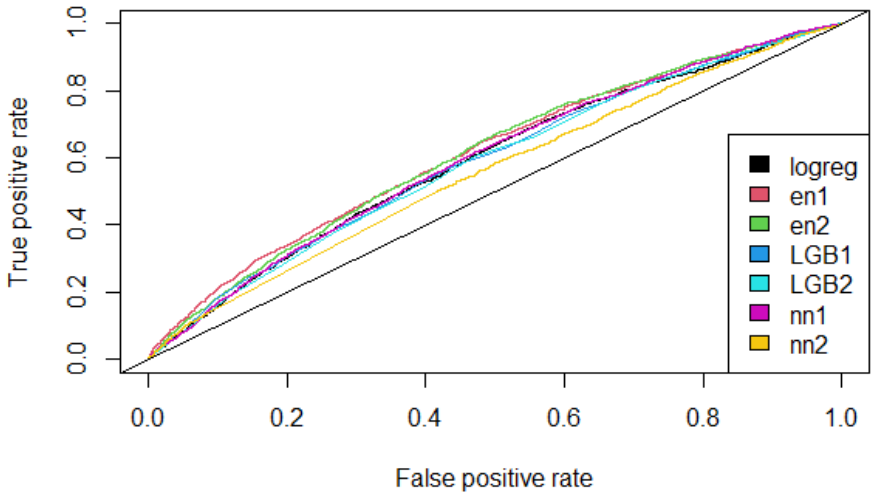


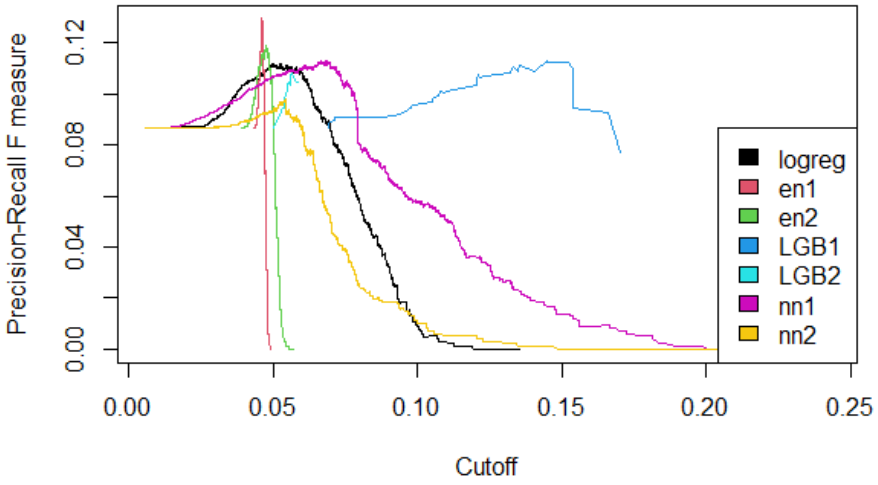

Model Selection Criteria

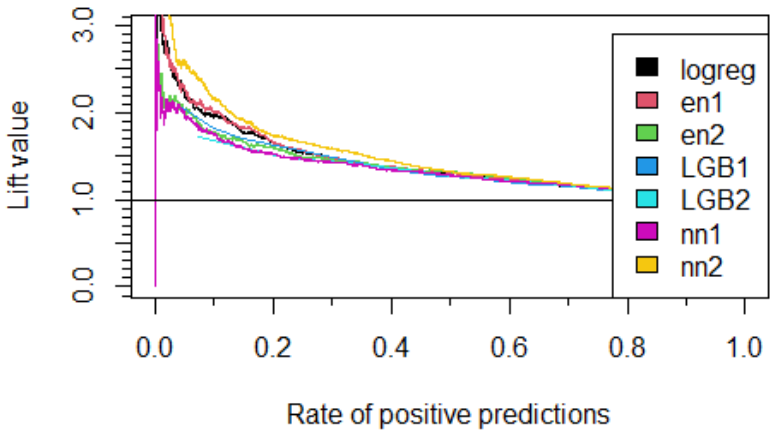
| Metric | Priority | Interpretation | Conflicts |
|---|---|---|---|
| Binary Log Loss | (High Priority) | Lower is better | |
| Gini=2*Area Under ROC curve-1 | (High Priority) | Nearer to 1, better it is | |
| Lift | (High Priority) | Higher than 1, the model is more than “no-model” | |
| Precision | (Medium Priority) | Higher it is, the better it is | With recall |
| Recall | (Medium Priority) | Higher it is, better it is | With precision |
| Accuracy | (Low Priority) | Higher it is, better it is | With the above two |

# 4. Findings

## 4.1 Case A



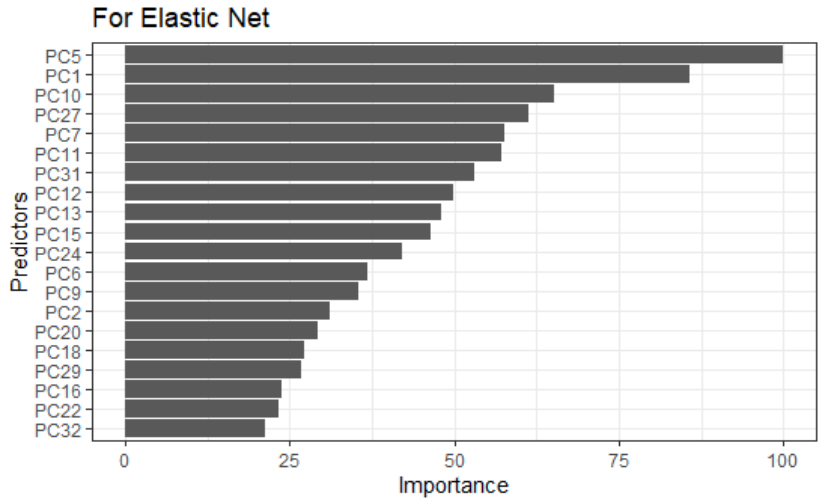



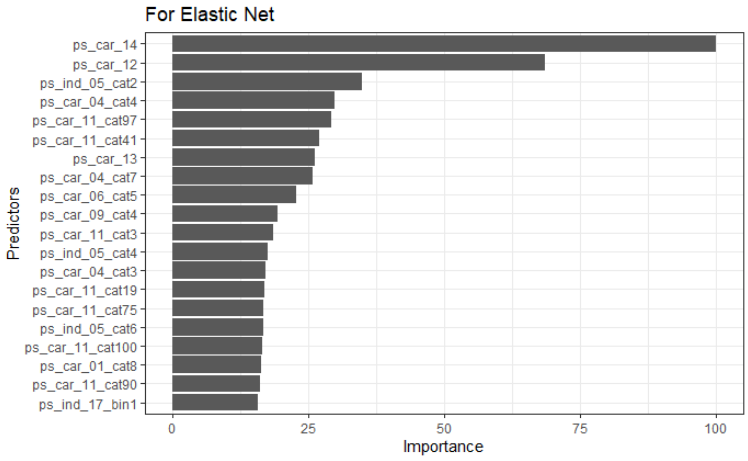
***Model Performance***

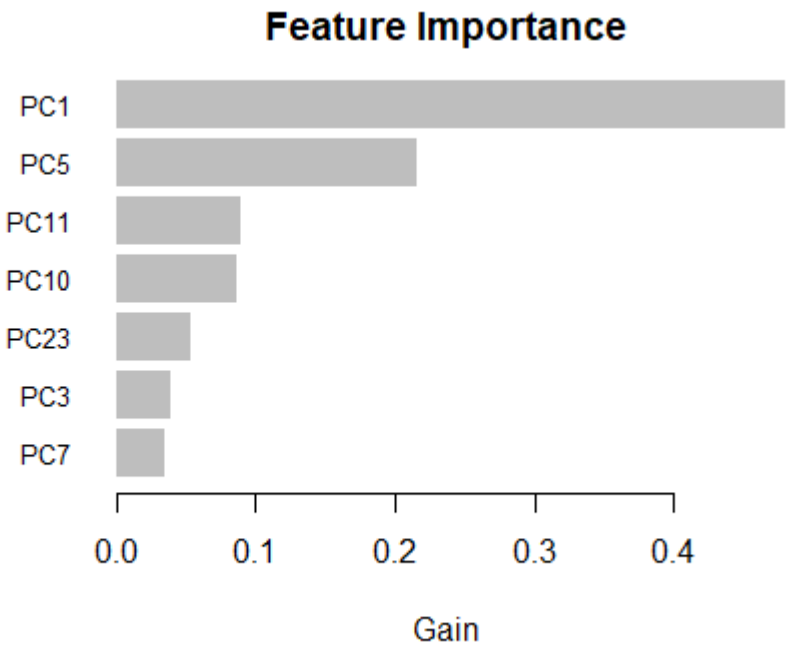
| Using PC | Logistic regression | | Elastic-net regression | | Gradient Boosting | ANN |
|---|---|---|---|---|---|---|
| | UB | B | UB | B | | |
| Training log loss | 0.18 | 0.67 | 0.18 | 0.67 | 0.18 | 0.18 |
| Validation log loss | 0.18 | 0.67 | 0.18 | 0.67 | 0.18 | 0.18 |
| Gini measure | 0.22 | 0.21 | 0.23 | 0.21 | 0.20 | 0.21 |
| Selected cut-off | 0.060 | 0.595 | 0.046 | 0.592 | 0.058 | 0.067 |
| Precision | 0.078 | 0.080 | 0.074 | 0.080 | 0.077 | 0.069 |
| Recall | 0.304 | 0.304 | 0.337 | 0.232 | 0.250 | 0.299 |
| Accuracy (%) | 80.5 | 84.3 | 78.1 | 84.56 | 82.86 | 78.6 |

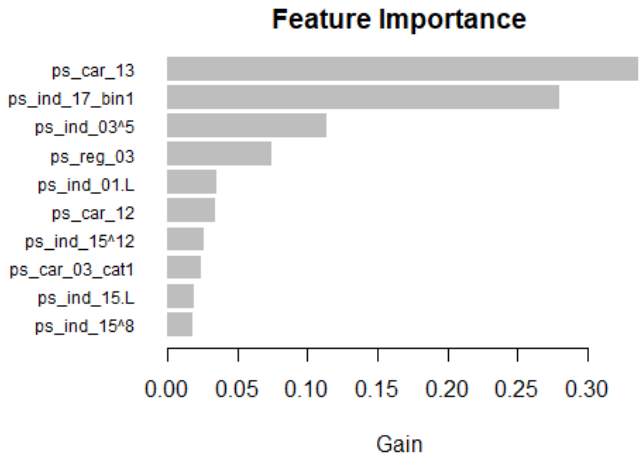
| Using original predictors | Logistic regression | | Elastic-net regression | | Gradient Boosting | ANN |
|---|---|---|---|---|---|---|
| | UB | B | UB | B | | |
| Training log loss | Memory Allocation Problem | | 0.18 | 0.66 | 0.18 | 0.17 |
| Validation log loss | | | 0.18 | 0.66 | 0.18 | 0.18 |
| Gini measure | | | 0.22 | 0.26 | 0.20 | 0.26 |
| Selected cut-off | | | 0.047 | 0.63 | 0.056 | 0.147 |
| Precision | | | 0.067 | 0.098 | 0.060 | 0.090 |
| Recall | | | 0.37 | 0.208 | 0.49 | 0.230 |
| Accuracy | | | 73.7 | 87.7 | 64.8 | 86 |

***Important Predictors ( see the most common predictors with high variable importance scores for each case; and then see the common important predictors among cases; for PCA, see factor loadings to see what makes up each factor)***

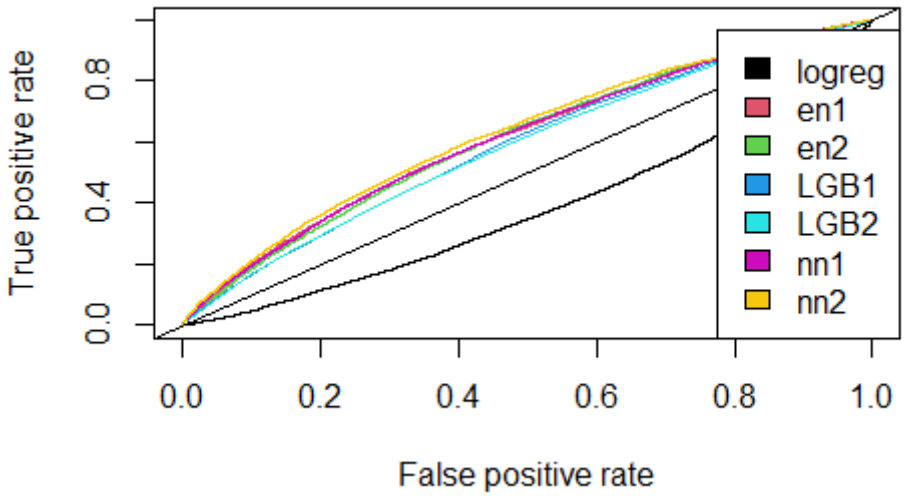


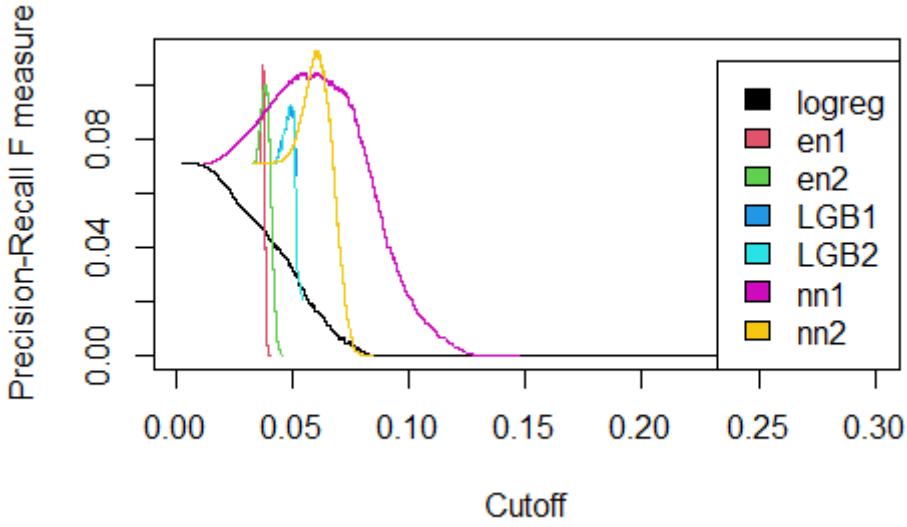

For Elastic Net
ps_car_14
ps_car_12
ps_ind_05_cat2
ps_car_04_cat4
ps_car_11_cat97
ps_car_11_cat41
ps_car_13
ps_car_04_cat7
ps_car_06_cat5
ps_car_09_cat4
ps_car_11_cat3
ps_ind_05_cat4
ps_car_04_cat3
ps_car_11_cat19
ps_car_11_cat75
ps_ind_05_cat6
ps_car_11_cat100
ps_car_01_cat8
ps_car_11_cat90
ps_ind_17_bin1
Predictors
0
25
50
75
100
Importance

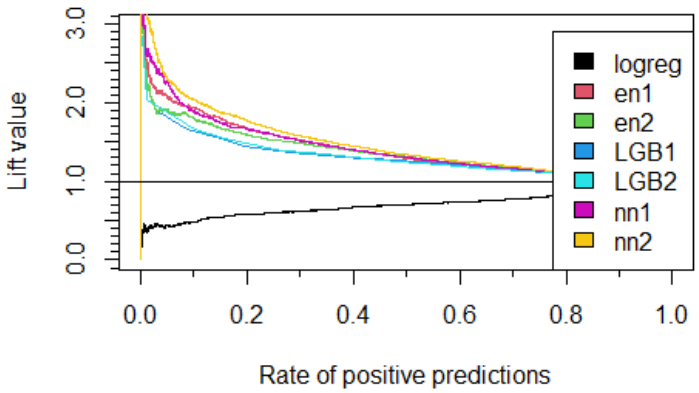

Feature Importance
PC1
PC5
PC11
PC10
PC23
PC3
PC7
0.0
0.1
0.2
0.3
0.4
Gain


Feature Importance
ps_car_13
ps_ind_17_bin1
ps_ind_03^5
ps_reg_03
ps_ind_01.L
ps_car_12
ps_ind_15^12
ps_car_03_cat1
ps_ind_15.L
ps_ind_15^8
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Gain

## 4.2 Case B



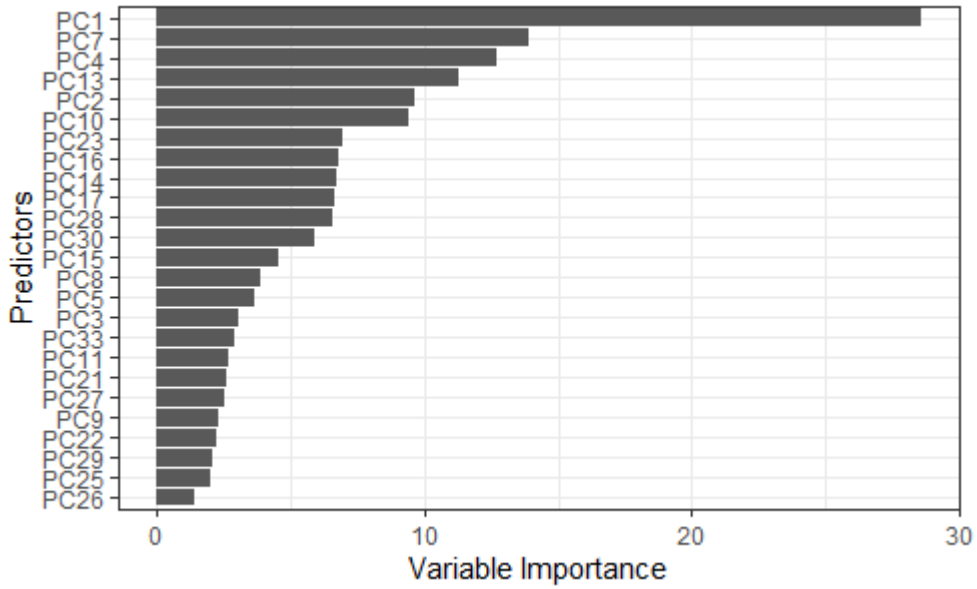



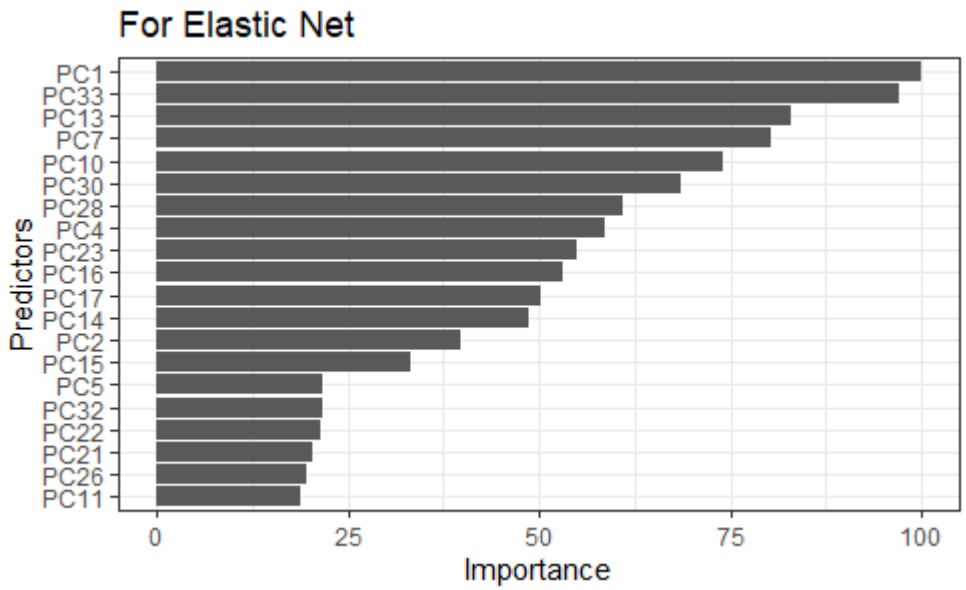

***Model Performance***

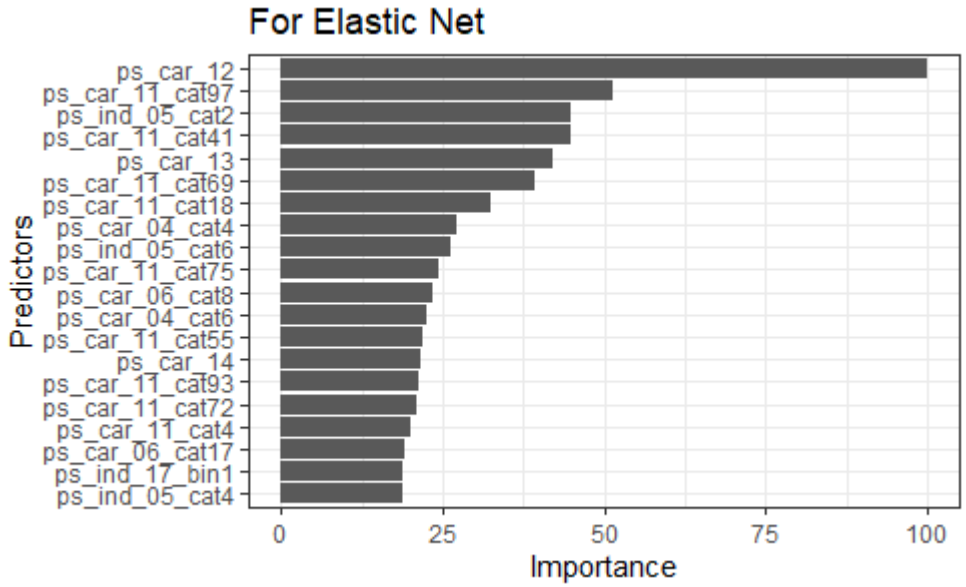
| Using PC | Logistic regression | | Elastic-net regression | | Gradient Boosting | ANN |
|---|---|---|---|---|---|---|
| | UB | B | UB | B | | |
| Training log loss | 0.15 | Memory Allocation Problem | 0.16 | 0.68 | 0.16 | 0.15 |
| Validation log loss | 0.15 | | 0.16 | 0.68 | 0.16 | 0.15 |
| Gini measure | -0.226 | | 0.23 | 0.23 | 0.18 | 0.23 |
| Selected cut-off | NC | | 0.037 | 0.516 | 0.049 | 0.455 |
| Precision | NC | | 0.063 | 0.065 | 0.057 | 0.067 |
| Recall | NC | | 0.233 | 0.28 | 0.233 | 0.240 |
| Accuracy | NC | | 79.8 | 82.4 | 82.9 | 84.7 |

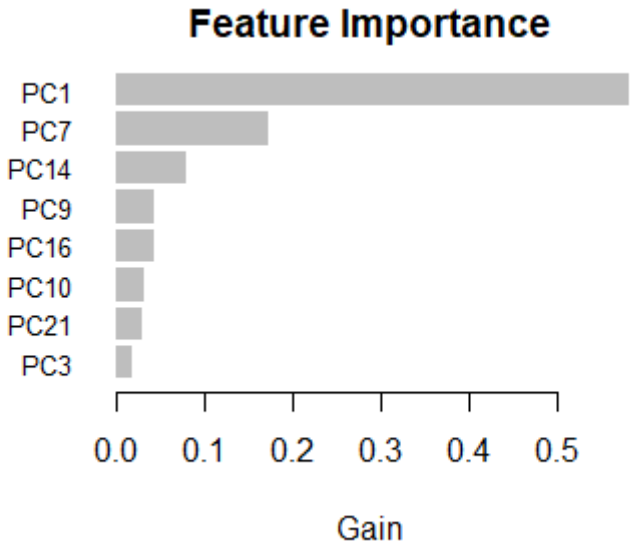
| Using original predictors | Logistic regression | | Elastic-net regression | | Gradient Boosting | ANN |
|---|---|---|---|---|---|---|
| | UB | B | UB | B | | |
| Training log loss | Memory Allocation Problem | | 0.16 | Memory Allocation Problem | 0.16 | 0.15 |
| Validation log loss | | | 0.16 | | 0.16 | 0.16 |
| Gini measure | | | 0.22 | | 0.17 | 0.25 |
| Selected cut-off | | | 0.038 | | 0.049 | 0.061 |
| Precision | | | 0.056 | | 0.057 | 0.073 |
| Recall | | | 0.397 | | 0.242 | 0.245 |
| Accuracy | | | 73.14 | | 82.4 | 85.6 |

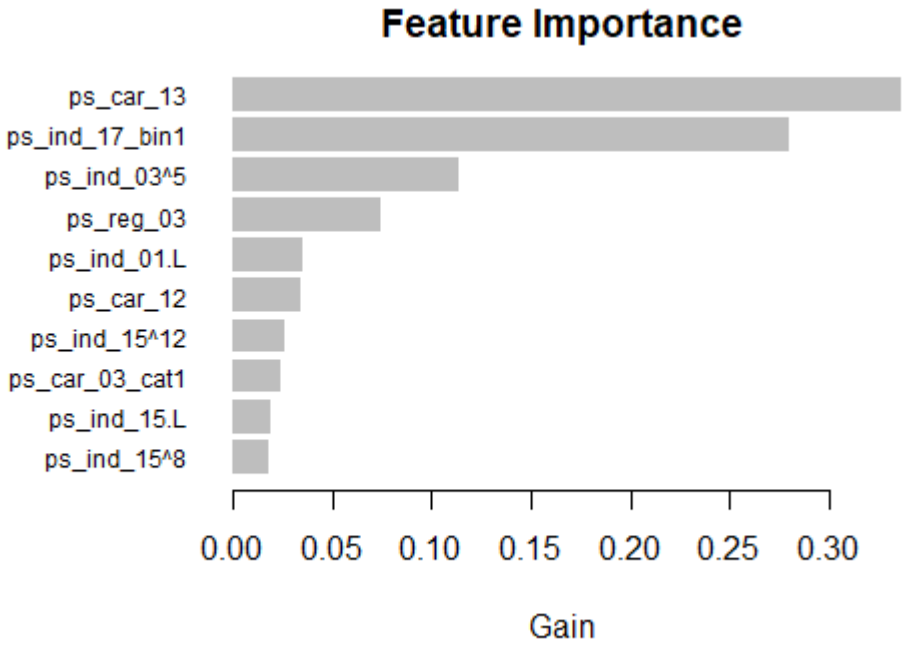
***Important Predictors***



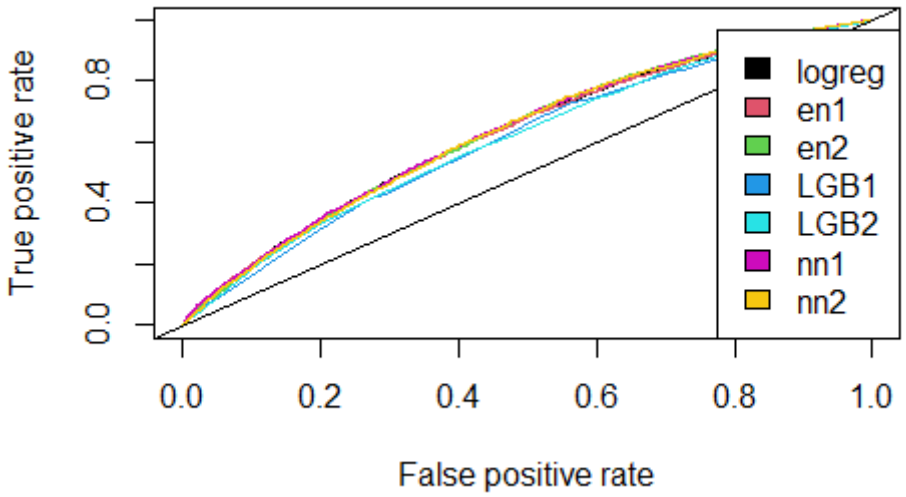

For Elastic Net
Predictors
PC1
PC33
PC13
PC7
PC10
PC30
PC28
PC4
PC23
PC16
PC17
PC14
PC2
PC15
PC5
PC32
PC22
PC21
PC26
PC11
0
25
50
75
100
Importance

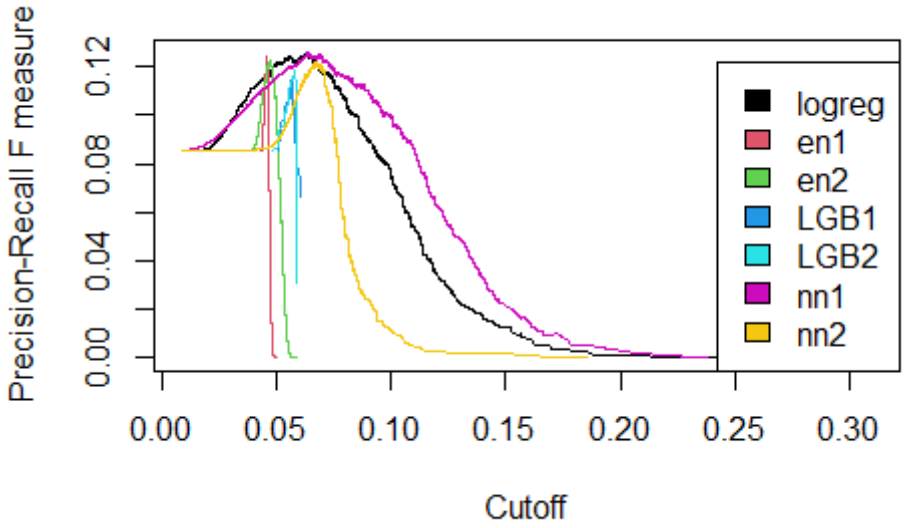

For Elastic Net
Predictors
ps_car_12
ps_car_11_cat97
ps_ind_05_cat2
ps_car_11_cat41
ps_car_13
ps_car_11_cat69
ps_car_11_cat18
ps_car_04_cat4
ps_ind_05_cat6
ps_car_11_cat75
ps_car_06_cat8
ps_car_04_cat6
ps_car_11_cat55
ps_car_14
ps_car_11_cat93
ps_car_11_cat72
ps_car_11_cat4
ps_car_06_cat17
ps_ind_17_bin1
ps_ind_05_cat4
0
25
50
75
100
Importance

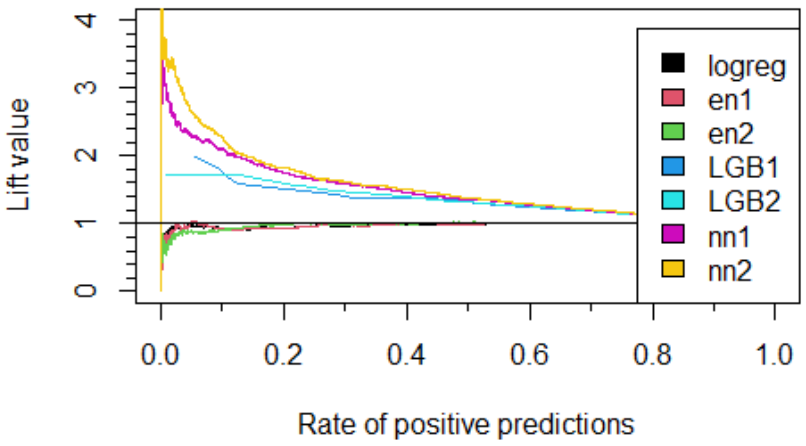

Feature Importance
PC1
PC7
PC14
PC9
PC16
PC10
PC21
PC3
0.0
0.1
0.2
0.3
0.4
0.5
Gain


Feature Importance
ps_car_13
ps_ind_17_bin1
ps_ind_03^5
ps_reg_03
ps_ind_01.L
ps_car_12
ps_ind_15^12
ps_car_03_cat1
ps_ind_15.L
ps_ind_15^8
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Gain

4.3 Case C


True positive rate
0.0
0.4
0.8
0.0
0.2
0.4
0.6
0.8
1.0
False positive rate
logreg
en1
en2
LGB1
LGB2
nn1
nn2


Precision-Recall F measure
0.00
0.04
0.08
0.12
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Cutoff
logreg
en1
en2
LGB1
LGB2
nn1
nn2

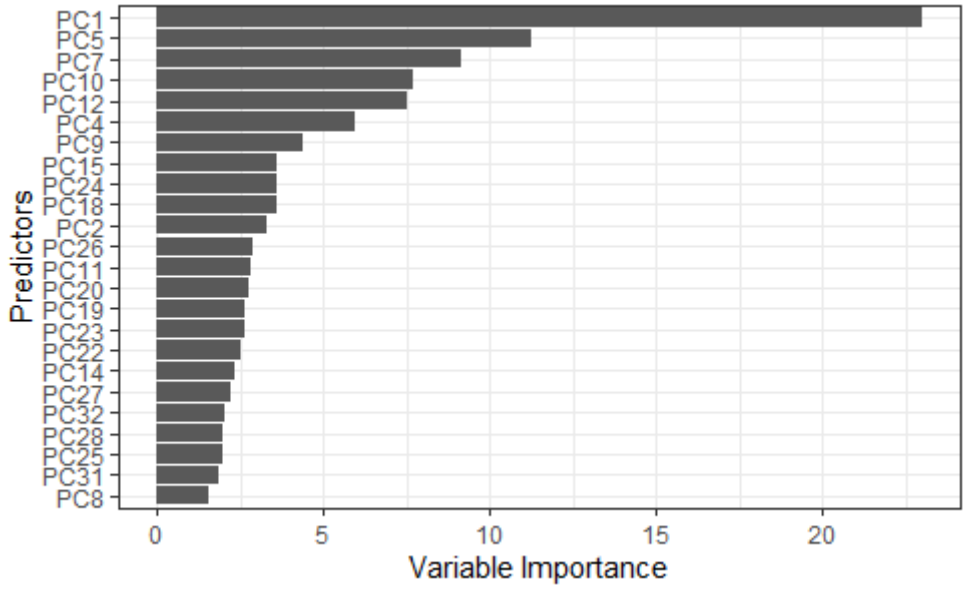

Lift value
0
1
2
3
4
0.0
0.2
0.4
0.6
0.8
1.0
Rate of positive predictions
logreg
en1
en2
LGB1
LGB2
nn1
nn2

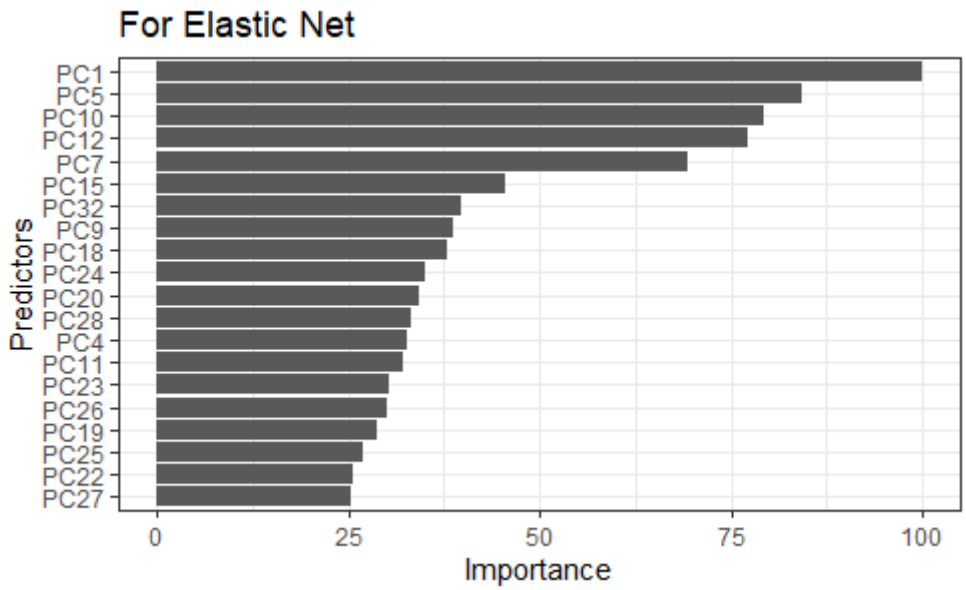
***Model Performance***

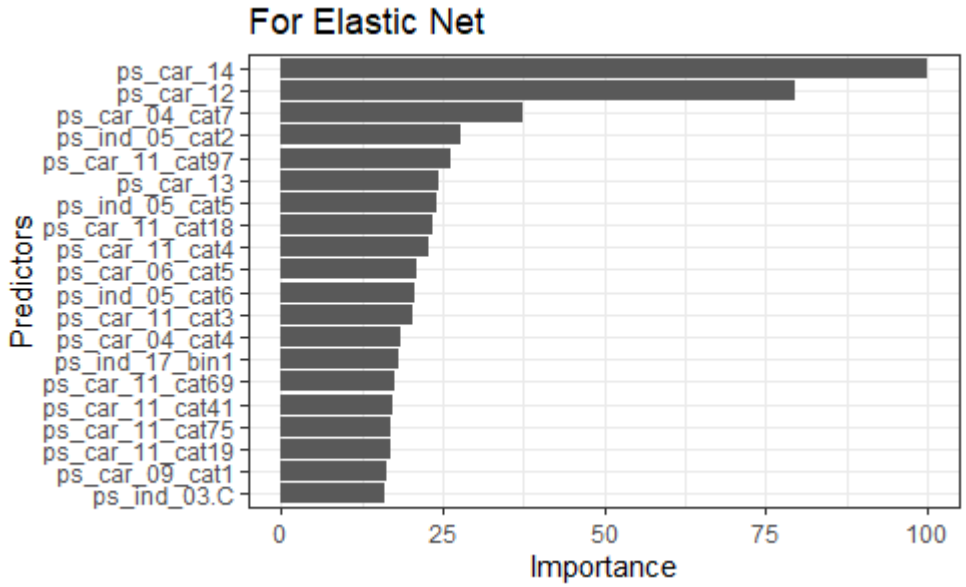
| Using PC | Logistic regression | | Elastic-net regression | | Gradient Boosting | ANN |
|---|---|---|---|---|---|---|
| | UB | B | UB | B | | |
| Training log loss | 0.18 | Memory Allocation Problem | 0.18 | Memory Allocation Problem | 0.18 | 0.18 |
| Validation log loss | 0.18 | | 0.18 | | 0.18 | 0.18 |
| Gini measure | 0.25 | | 0.25 | | 0.22 | 0.27 |
| Selected cut-off | 0.057 | | 0.045 | | 0.056 | 0.050 |
| Precision | 0.074 | | 0.060 | | 0.060 | 0.080 |
| Recall | 0.343 | | 0.529 | | 0.43 | 0.366 |
| Accuracy | 77.8 | | 63.3 | | 67.9 | 84.2 |

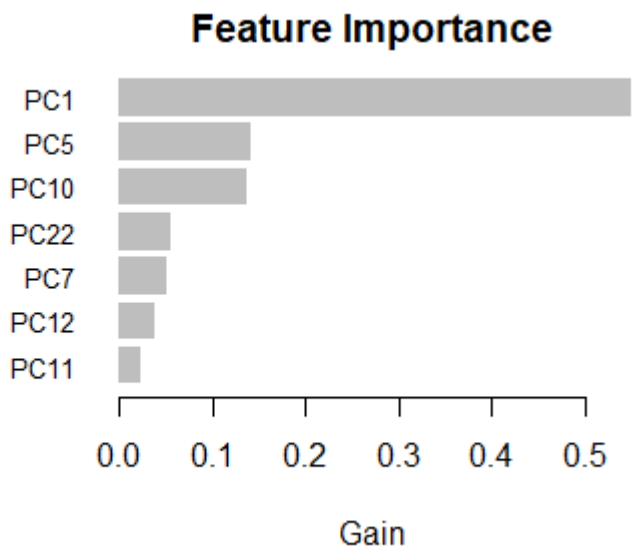
| Using original predictors | Logistic regression | | Elastic-net regression | | Gradient Boosting | ANN |
|---|---|---|---|---|---|---|
| | UB | B | UB | B | | |
| Training log loss | Memory Allocation Problem | | 0.18 | Memory Allocation Problem | 0.18 | 0.17 |
| Validation log loss | | | 0.18 | | 0.18 | 0.18 |
| Gini measure | | | 0.25 | | 0.22 | 0.28 |
| Selected cut-off | | | 0.046 | | 0.056 | 0.137 |
| Precision | | | 0.068 | | 0.064 | 0.10 |
| Recall | | | 0.468 | | 0.470 | 0.22 |
| Accuracy | | | 69.3 | | 67.2 | 87.8 |

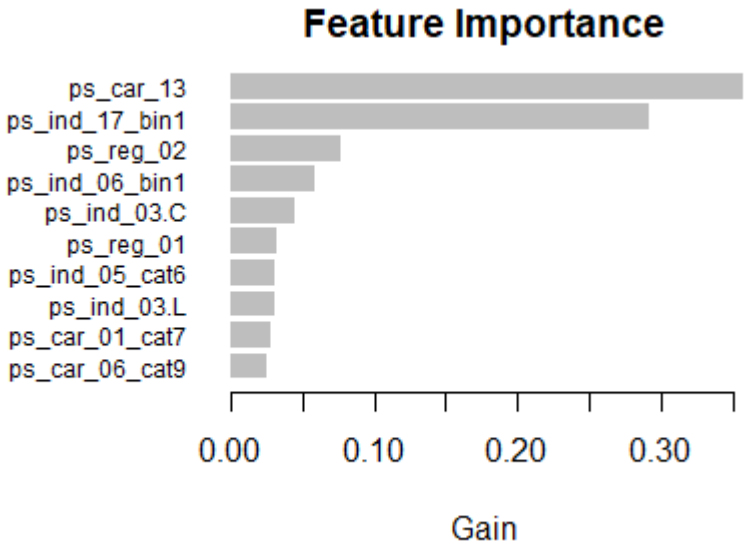
***Important Predictors***




For Elastic Net
Predictors
PC1
PC5
PC10
PC12
PC7
PC15
PC32
PC9
PC18
PC24
PC20
PC28
PC4
PC11
PC23
PC26
PC19
PC25
PC22
PC27
0
25
50
75
100
Importance


For Elastic Net
Predictors
ps_car_14
ps_car_12
ps_car_04_cat7
ps_ind_05_cat2
ps_car_11_cat97
ps_car_13
ps_ind_05_cat5
ps_car_11_cat18
ps_car_11_cat4
ps_car_06_cat5
ps_ind_05_cat6
ps_car_11_cat3
ps_car_04_cat4
ps_ind_17_bin1
ps_car_11_cat69
ps_car_11_cat41
ps_car_11_cat75
ps_car_11_cat19
ps_car_09_cat1
ps_ind_03.C
0
25
50
75
100
Importance



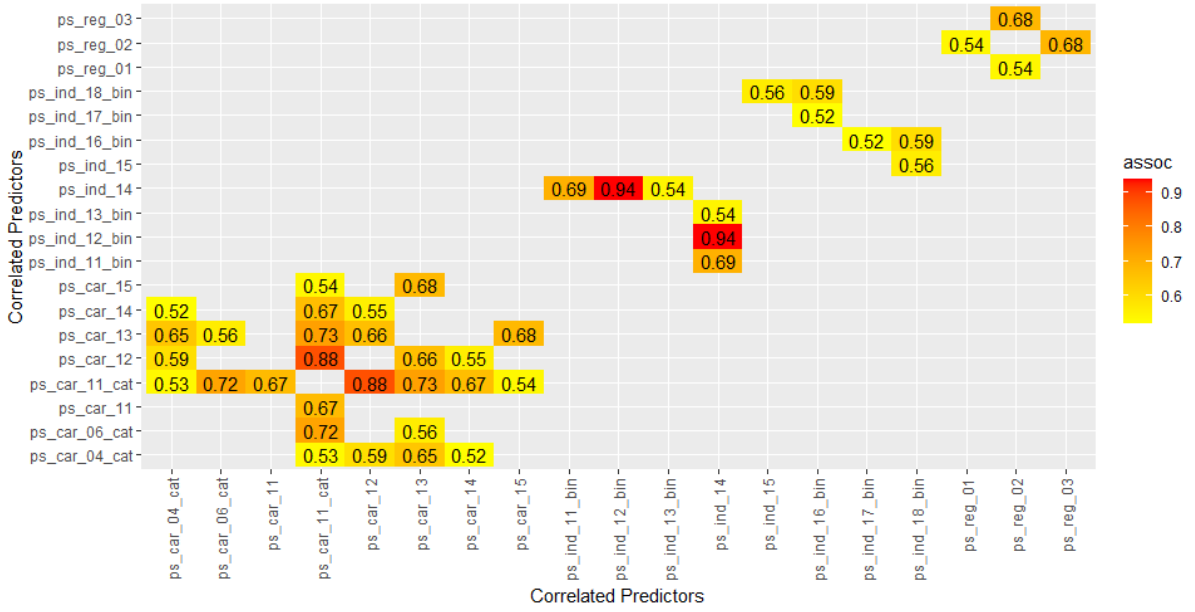




5. Recommendations

6. Limitations

# Appendix

| Key Package | Use |
|---|---|
| Caret | Step wise logistic regression<br>Parameter tuning of elastic-net |
| glmnet | Elastic-net modelling |
| Light GBM | Gradient Boosting |
| Keras | ANN |



# Factor Loadings( DARKER SHADES INDICATE STRONG LOADING IRRESPECTIVE OF SIGN)

Factor Loadings

| Var | PC1 | PC2 | PC3 | PC4 | PC5 | PC6 | PC7 | PC8 | PC9 | PC10 | PC11 | PC12 | PC13 | PC14 | PC15 | PC16 | PC17 | PC18 | PC19 | PC20 | PC21 | PC22 | PC23 | PC24 | PC25 | PC26 | PC27 | PC28 | PC29 | PC30 | PC31 | PC32 | PC33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ps_car_01_cat | -0.197 | 0.066 | -0.053 | 0.210 | -0.016 | 0.069 | 0.096 | 0.047 | 0.077 | 0.105 | 0.093 | 0.017 | -0.026 | -0.032 | 0.001 | -0.067 | 0.251 | 0.254 | 0.173 | 0.190 | -0.337 | -0.076 | -0.292 | -0.506 | -0.341 | -0.256 | 0.148 | 0.000 | -0.027 | -0.011 | 0.032 | -0.004 | -0.028 |
| ps_car_02_cat | 0.330 | -0.012 | 0.011 | 0.076 | -0.029 | -0.034 | -0.062 | -0.110 | -0.007 | -0.052 | -0.060 | -0.019 | -0.028 | -0.019 | -0.022 | -0.069 | -0.031 | 0.092 | 0.035 | -0.040 | -0.024 | 0.004 | 0.001 | -0.057 | 0.303 | -0.156 | 0.622 | 0.385 | 0.071 | -0.261 | -0.242 | 0.086 | -0.010 |
| ps_car_03_cat | -0.087 | 0.099 | 0.284 | 0.221 | 0.094 | 0.218 | -0.297 | -0.034 | -0.012 | -0.110 | 0.052 | -0.011 | -0.065 | 0.077 | 0.245 | -0.011 | -0.092 | -0.008 | -0.060 | -0.138 | -0.111 | 0.195 | 0.262 | -0.059 | 0.069 | -0.291 | 0.080 | 0.043 | -0.014 | 0.607 | -0.028 | 0.026 | 0.005 |
| ps_car_04_cat | -0.325 | -0.035 | -0.047 | -0.262 | 0.060 | -0.037 | 0.006 | -0.050 | -0.068 | 0.054 | -0.067 | 0.000 | 0.005 | -0.038 | -0.091 | -0.004 | -0.100 | 0.008 | -0.007 | 0.038 | 0.025 | -0.005 | -0.033 | -0.060 | 0.264 | -0.143 | 0.159 | 0.271 | 0.267 | 0.046 | 0.681 | 0.106 | 0.017 |
| ps_car_05_cat | -0.039 | 0.106 | -0.309 | 0.053 | 0.055 | -0.040 | 0.031 | 0.051 | -0.136 | -0.203 | 0.107 | 0.130 | 0.059 | 0.055 | 0.238 | 0.151 | -0.051 | -0.109 | -0.009 | 0.251 | -0.678 | 0.077 | 0.050 | 0.162 | 0.190 | 0.283 | -0.011 | 0.076 | 0.102 | -0.009 | -0.028 | -0.022 | 0.001 |
| ps_car_06_cat | -0.164 | 0.015 | -0.091 | -0.092 | 0.003 | 0.023 | 0.017 | 0.079 | 0.087 | 0.337 | 0.062 | -0.346 | -0.155 | 0.126 | 0.135 | 0.423 | 0.123 | -0.072 | -0.109 | -0.466 | -0.143 | -0.045 | -0.006 | 0.201 | -0.247 | 0.088 | 0.274 | 0.091 | -0.036 | -0.034 | 0.011 | -0.028 | -0.007 |
| ps_car_07_cat | 0.010 | 0.052 | 0.039 | 0.098 | 0.087 | -0.091 | 0.101 | 0.336 | -0.203 | 0.240 | 0.406 | 0.073 | 0.160 | 0.085 | 0.105 | 0.263 | 0.111 | 0.436 | 0.142 | 0.117 | 0.293 | 0.179 | 0.239 | -0.053 | 0.197 | 0.094 | 0.002 | 0.027 | 0.027 | -0.025 | 0.003 | -0.003 | 0.009 |
| ps_car_08_cat | 0.090 | 0.026 | -0.421 | -0.090 | -0.038 | -0.272 | 0.096 | 0.060 | -0.025 | -0.020 | -0.004 | 0.122 | 0.087 | -0.081 | -0.139 | -0.121 | 0.093 | -0.014 | -0.018 | -0.153 | 0.133 | 0.046 | 0.032 | -0.091 | -0.266 | 0.092 | -0.090 | 0.435 | 0.212 | 0.478 | -0.140 | -0.023 | 0.012 |
| ps_car_09_cat | 0.010 | 0.007 | -0.114 | 0.039 | -0.094 | -0.023 | 0.020 | 0.191 | 0.071 | 0.287 | 0.134 | -0.213 | -0.668 | 0.058 | 0.129 | -0.415 | -0.257 | 0.021 | -0.003 | 0.232 | 0.026 | 0.042 | 0.022 | 0.055 | 0.054 | 0.067 | -0.078 | 0.084 | 0.037 | 0.015 | -0.025 | -0.022 | 0.001 |
| ps_car_10_cat | -0.018 | 0.016 | 0.081 | 0.056 | 0.032 | -0.006 | -0.076 | 0.020 | 0.080 | -0.084 | 0.336 | 0.478 | -0.474 | -0.211 | -0.467 | 0.282 | 0.053 | -0.113 | -0.156 | -0.107 | -0.051 | 0.021 | -0.006 | -0.035 | 0.052 | 0.003 | 0.025 | -0.031 | 0.000 | -0.023 | -0.007 | 0.014 | 0.006 |
| ps_car_11 | -0.048 | 0.024 | 0.135 | 0.145 | 0.011 | -0.027 | 0.113 | 0.375 | -0.051 | 0.120 | 0.133 | 0.170 | 0.317 | -0.100 | -0.180 | -0.312 | -0.496 | 0.043 | -0.023 | -0.259 | -0.178 | -0.119 | -0.118 | 0.204 | -0.126 | 0.044 | 0.214 | -0.083 | -0.081 | 0.037 | 0.057 | 0.028 | -0.001 |
| ps_car_11_cat | -0.081 | -0.025 | -0.066 | -0.085 | 0.001 | -0.139 | 0.064 | -0.128 | 0.179 | -0.361 | -0.201 | 0.035 | -0.217 | 0.074 | 0.034 | 0.169 | -0.338 | 0.678 | 0.125 | -0.190 | -0.042 | -0.032 | -0.004 | 0.073 | -0.062 | 0.012 | -0.065 | -0.062 | 0.033 | 0.006 | -0.058 | -0.013 | 0.003 |
| ps_car_12 | -0.364 | -0.011 | -0.105 | -0.252 | 0.048 | 0.003 | 0.013 | 0.011 | -0.076 | 0.083 | -0.006 | 0.020 | 0.032 | -0.025 | -0.037 | -0.031 | -0.043 | -0.042 | -0.018 | 0.033 | 0.013 | 0.028 | 0.037 | -0.039 | 0.077 | -0.097 | 0.009 | -0.046 | -0.075 | -0.002 | -0.489 | 0.671 | -0.016 |
| ps_car_13 | -0.403 | -0.022 | 0.199 | -0.123 | 0.066 | 0.089 | -0.030 | 0.002 | -0.024 | 0.012 | -0.030 | 0.025 | 0.007 | -0.003 | -0.018 | 0.012 | -0.057 | 0.032 | 0.006 | 0.092 | -0.003 | -0.003 | -0.017 | 0.022 | -0.016 | 0.089 | -0.142 | 0.077 | 0.083 | -0.098 | -0.014 | 0.059 | -0.009 |
| ps_car_14 | -0.349 | -0.026 | -0.074 | -0.269 | 0.052 | -0.004 | 0.018 | 0.011 | -0.090 | 0.080 | -0.028 | 0.035 | 0.051 | -0.041 | -0.070 | -0.030 | -0.096 | -0.048 | -0.031 | 0.015 | 0.009 | 0.022 | 0.028 | -0.088 | 0.198 | -0.194 | 0.092 | -0.025 | -0.046 | -0.006 | -0.363 | -0.718 | -0.015 |
| ps_car_15 | -0.131 | -0.004 | 0.444 | 0.131 | 0.044 | 0.167 | -0.146 | -0.039 | 0.072 | 0.033 | -0.035 | 0.004 | 0.053 | -0.018 | -0.041 | -0.025 | 0.044 | 0.065 | 0.035 | 0.065 | -0.010 | -0.057 | -0.090 | 0.095 | -0.153 | 0.327 | -0.140 | 0.466 | 0.348 | -0.117 | -0.217 | -0.076 | -0.008 |
| ps_ind_01 | -0.124 | 0.154 | -0.252 | 0.141 | -0.053 | 0.017 | -0.332 | 0.077 | -0.065 | -0.112 | 0.038 | 0.102 | 0.042 | 0.012 | 0.145 | -0.169 | -0.080 | -0.051 | -0.099 | -0.333 | 0.044 | 0.211 | 0.276 | -0.212 | -0.168 | -0.126 | -0.201 | 0.096 | 0.049 | -0.526 | 0.082 | -0.009 | -0.017 |
| ps_ind_02_cat | 0.017 | 0.030 | 0.001 | 0.231 | -0.026 | -0.207 | 0.025 | -0.213 | 0.008 | 0.180 | -0.079 | -0.086 | 0.097 | 0.089 | -0.101 | 0.399 | -0.556 | -0.174 | -0.184 | 0.321 | 0.095 | 0.164 | 0.016 | -0.245 | -0.204 | -0.010 | 0.020 | 0.076 | -0.044 | -0.013 | -0.019 | 0.010 | 0.004 |
| ps_ind_03 | -0.040 | 0.092 | -0.180 | 0.018 | 0.053 | 0.257 | -0.177 | -0.047 | -0.428 | -0.257 | 0.193 | -0.054 | -0.092 | 0.062 | 0.139 | 0.040 | -0.140 | -0.041 | -0.039 | -0.007 | 0.325 | -0.215 | -0.358 | -0.116 | -0.098 | 0.219 | 0.235 | -0.205 | 0.234 | 0.070 | -0.038 | -0.011 | 0.011 |
| ps_ind_04_cat | -0.030 | 0.036 | 0.093 | 0.266 | -0.023 | -0.483 | -0.047 | 0.165 | -0.002 | 0.001 | -0.004 | -0.159 | -0.003 | 0.027 | 0.055 | 0.104 | 0.041 | -0.117 | -0.018 | -0.147 | -0.041 | -0.216 | -0.242 | 0.018 | 0.264 | -0.315 | -0.234 | -0.156 | 0.452 | -0.014 | -0.124 | 0.030 | -0.005 |
| ps_ind_05_cat | 0.000 | 0.000 | 0.002 | -0.011 | -0.005 | 0.029 | -0.074 | 0.163 | -0.117 | -0.359 | 0.188 | -0.681 | 0.051 | -0.210 | -0.467 | 0.008 | 0.011 | 0.062 | -0.008 | 0.070 | -0.119 | 0.115 | 0.124 | -0.024 | -0.011 | -0.005 | -0.054 | 0.039 | -0.062 | -0.004 | 0.001 | 0.000 | 0.003 |
| ps_ind_06_bin | 0.225 | -0.033 | -0.010 | -0.227 | 0.022 | 0.386 | 0.263 | 0.291 | 0.205 | -0.106 | 0.048 | 0.014 | 0.035 | 0.054 | 0.082 | 0.154 | -0.147 | -0.091 | -0.070 | 0.025 | 0.003 | 0.021 | -0.024 | -0.085 | -0.043 | -0.243 | -0.115 | 0.057 | 0.241 | -0.052 | -0.048 | 0.018 | -0.008 |
| ps_ind_07_bin | -0.200 | -0.100 | 0.256 | 0.065 | -0.061 | -0.419 | 0.110 | 0.109 | -0.220 | -0.261 | -0.105 | 0.026 | 0.149 | 0.025 | 0.156 | -0.072 | 0.125 | -0.120 | -0.024 | -0.016 | 0.062 | 0.042 | 0.037 | -0.100 | -0.080 | 0.183 | 0.175 | 0.071 | -0.265 | -0.011 | 0.047 | -0.010 | 0.003 |
| ps_ind_08_bin | -0.051 | 0.044 | -0.164 | -0.034 | 0.047 | -0.131 | -0.477 | -0.236 | 0.438 | 0.148 | 0.295 | -0.060 | 0.202 | -0.013 | -0.048 | -0.093 | -0.020 | 0.086 | 0.070 | 0.031 | 0.012 | -0.074 | -0.094 | 0.000 | 0.141 | 0.182 | 0.035 | -0.098 | -0.056 | 0.068 | 0.011 | -0.009 | 0.026 |
| ps_ind_09_bin | 0.014 | 0.126 | -0.141 | 0.257 | 0.000 | 0.168 | 0.023 | -0.276 | -0.465 | 0.320 | -0.249 | 0.012 | -0.073 | -0.090 | -0.261 | -0.013 | 0.057 | 0.184 | 0.050 | -0.046 | -0.097 | -0.002 | 0.086 | 0.244 | 0.008 | -0.110 | -0.110 | -0.063 | 0.082 | 0.010 | -0.009 | -0.002 | -0.021 |
| ps_ind_10_bin | -0.021 | -0.132 | -0.047 | 0.053 | 0.117 | 0.022 | -0.049 | 0.074 | -0.010 | -0.056 | -0.025 | 0.044 | -0.001 | 0.868 | -0.379 | -0.105 | 0.074 | -0.029 | -0.018 | 0.002 | -0.050 | -0.095 | 0.084 | -0.038 | 0.014 | 0.009 | 0.013 | -0.002 | 0.006 | 0.001 | -0.002 | -0.001 | 0.000 |
| ps_ind_11_bin | -0.003 | -0.301 | -0.097 | 0.115 | 0.213 | 0.033 | -0.070 | 0.089 | 0.017 | 0.030 | -0.084 | -0.007 | -0.031 | -0.216 | 0.063 | 0.077 | -0.063 | -0.033 | 0.053 | 0.074 | -0.012 | -0.647 | 0.489 | -0.157 | -0.041 | 0.046 | 0.025 | 0.002 | 0.018 | 0.006 | 0.004 | 0.004 | -0.001 |
| ps_ind_12_bin | -0.014 | -0.419 | -0.110 | 0.132 | 0.204 | 0.029 | -0.075 | 0.064 | 0.001 | 0.008 | -0.052 | 0.003 | 0.033 | -0.106 | 0.077 | -0.032 | 0.083 | 0.163 | -0.419 | 0.038 | 0.024 | 0.286 | -0.288 | 0.115 | 0.020 | -0.047 | -0.023 | 0.021 | -0.046 | -0.008 | 0.002 | 0.000 | -0.003 |
| ps_ind_13_bin | -0.012 | -0.225 | -0.075 | 0.087 | 0.181 | 0.034 | -0.073 | 0.076 | 0.009 | 0.001 | -0.081 | 0.012 | -0.076 | -0.047 | -0.042 | 0.104 | -0.116 | -0.272 | 0.789 | -0.114 | 0.040 | 0.300 | -0.121 | 0.019 | -0.009 | 0.016 | 0.002 | -0.011 | 0.008 | -0.004 | -0.006 | -0.003 | 0.002 |
| ps_ind_14 | -0.017 | -0.492 | -0.141 | 0.167 | 0.286 | 0.044 | -0.105 | 0.107 | 0.007 | 0.008 | -0.091 | 0.010 | -0.004 | -0.031 | 0.012 | 0.010 | 0.025 | 0.043 | -0.112 | 0.026 | 0.016 | 0.062 | -0.074 | 0.035 | 0.002 | -0.015 | -0.007 | 0.014 | -0.026 | -0.005 | 0.001 | 0.000 | -0.002 |
| ps_ind_15 | 0.040 | 0.334 | -0.082 | 0.024 | 0.233 | 0.038 | -0.170 | 0.214 | -0.055 | -0.044 | -0.104 | 0.018 | -0.037 | 0.029 | 0.025 | 0.151 | -0.042 | 0.004 | 0.033 | 0.055 | 0.096 | -0.273 | -0.300 | 0.109 | 0.113 | -0.164 | -0.231 | 0.392 | -0.513 | 0.001 | 0.031 | 0.000 | 0.011 |
| ps_ind_16_bin | 0.065 | 0.282 | 0.049 | -0.035 | 0.581 | -0.087 | 0.133 | -0.034 | 0.078 | 0.024 | -0.094 | -0.057 | -0.052 | -0.042 | -0.020 | -0.117 | 0.032 | -0.020 | -0.070 | -0.042 | -0.001 | 0.109 | 0.059 | -0.101 | -0.031 | 0.113 | 0.074 | -0.145 | 0.128 | -0.036 | -0.004 | -0.005 | 0.006 |
| ps_ind_17_bin | -0.068 | -0.054 | -0.080 | 0.025 | -0.522 | 0.079 | -0.310 | 0.339 | 0.050 | 0.008 | -0.281 | 0.084 | 0.022 | -0.017 | -0.069 | 0.141 | 0.051 | 0.041 | 0.012 | 0.166 | 0.042 | 0.017 | 0.012 | 0.074 | 0.001 | 0.026 | 0.122 | -0.077 | 0.054 | 0.073 | 0.000 | -0.004 | -0.005 |
| ps_ind_18_bin | -0.009 | -0.333 | 0.028 | 0.022 | -0.195 | 0.026 | 0.177 | -0.351 | -0.157 | -0.034 | 0.454 | -0.026 | 0.040 | 0.073 | 0.107 | -0.031 | -0.098 | -0.025 | 0.073 | -0.142 | -0.054 | -0.128 | -0.051 | 0.031 | 0.027 | -0.155 | -0.200 | 0.202 | -0.126 | -0.022 | -0.001 | -0.001 | 0.001 |
| ps_reg_01 | -0.125 | 0.025 | -0.090 | 0.294 | -0.143 | 0.239 | 0.270 | 0.011 | 0.139 | 0.033 | -0.160 | -0.083 | 0.019 | -0.028 | -0.053 | 0.004 | -0.021 | -0.021 | -0.070 | -0.291 | 0.024 | 0.011 | -0.074 | -0.373 | 0.436 | 0.339 | -0.106 | 0.025 | -0.100 | 0.067 | -0.022 | 0.018 | 0.337 |
| ps_reg_02 | -0.240 | 0.100 | -0.159 | 0.331 | -0.030 | 0.108 | 0.254 | -0.048 | 0.243 | -0.151 | 0.029 | -0.027 | 0.034 | -0.010 | -0.014 | -0.018 | 0.047 | -0.076 | -0.005 | 0.030 | 0.207 | -0.013 | 0.046 | 0.157 | 0.099 | 0.012 | 0.083 | 0.030 | -0.012 | 0.013 | 0.014 | -0.008 | -0.732 |
| ps_reg_03 | -0.249 | 0.104 | -0.140 | 0.259 | 0.028 | 0.025 | 0.179 | -0.058 | 0.203 | -0.187 | 0.097 | 0.016 | 0.028 | 0.001 | 0.013 | -0.033 | 0.086 | -0.075 | 0.033 | 0.199 | 0.210 | -0.018 | 0.103 | 0.394 | -0.149 | -0.217 | 0.165 | 0.019 | 0.052 | -0.065 | -0.014 | -0.022 | 0.589 |

Loading: -0.868 0.868

Value broken down by PC vs. Var. Color shows value. The marks are labeled by value.