

Credit Risk Modeling

Equity - Fit Nominal Logistic - JMP Pro

File Edit Tables Rows Cols DOE Analyze Graph Tools View Window Help

Nominal Logistic Fit for BAD

Fit Details

| Measure | Training | Validation | Test | Definition |
|------------------------|----------|------------|--------|---|
| Entropy RSquare | 0.2249 | 0.2434 | 0.2127 | $1 - \text{Loglike}(\text{model}) / \text{Loglike}(0)$ |
| Generalized RSquare | 0.2815 | 0.2930 | 0.2682 | $(1 - (L(0)/L(\text{model}))^{2/n}) / (1 - L(0)^{2/n})$ |
| Mean -Log p | 0.2397 | 0.1961 | 0.2473 | $\sum -\text{Log}(p[j]) / n$ |
| RASE | 0.2531 | 0.2276 | 0.2577 | $\sqrt{\sum (y[j] - p[j])^2 / n}$ |
| Mean Abs Dev | 0.1302 | 0.1117 | 0.1310 | $\sum y[j] - p[j] / n$ |
| Misclassification Rate | 0.0820 | 0.0663 | 0.0817 | $\sum (p[j] \neq p_{\text{Max}}) / n$ |
| N | 3576 | 1192 | 1192 | n |

Equity - Make Validation Column - JMP Pro

File Edit Tables Rows Cols DOE Analyze Graph Tools View Window Help

Make Validation Column

Random Validation Column

Randomly partitions the rows of the data table into a training set to estimate the model, a validation set to choose a model by comparing the predictive performance of several candidate models, and an optional test set to independently evaluate performance after the model is chosen.

Specify rates or relative rates

| | Adjusted Rates | Row Counts |
|----------------|----------------|------------|
| Training Set | 0.6 | 3576 |
| Validation Set | 0.2 | 1192 |
| Test Set | 0.2 | 1192 |
| Excluded Rows | | 0 |
| Total Rows | | 5960 |

Options

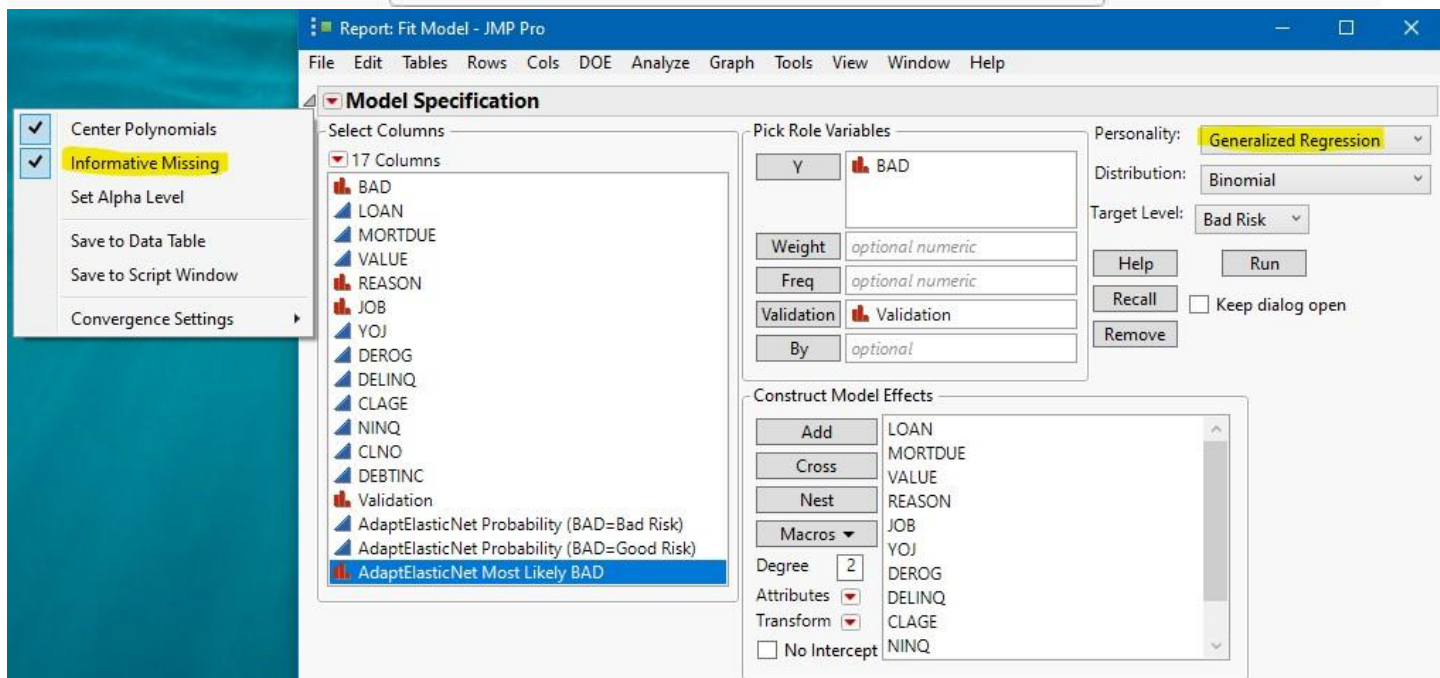
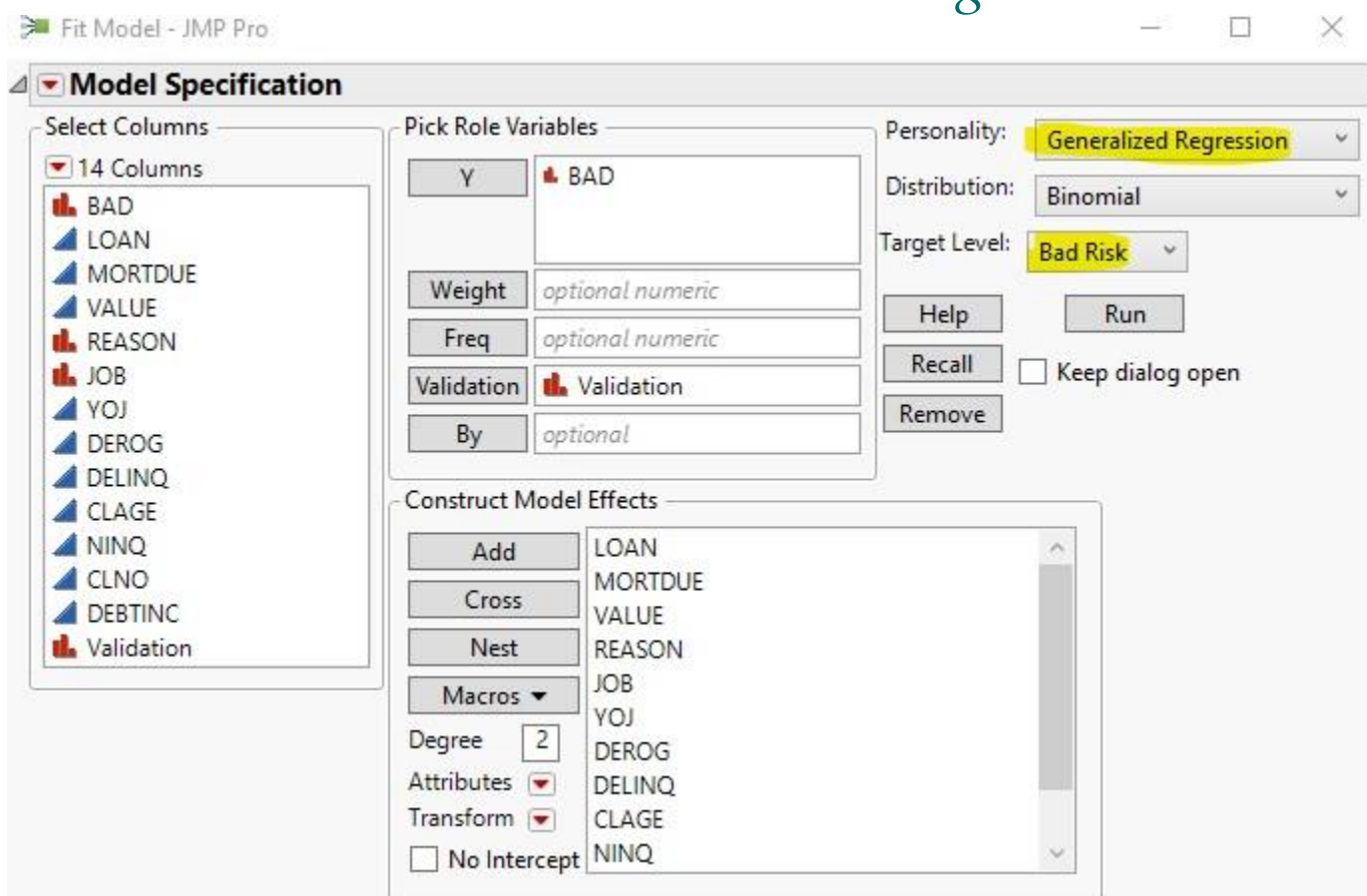
| | |
|------------------------|------------|
| New Column Name | Validation |
| Validation Column Type | Fixed |
| Random Seed | 123 |

Go

Cancel

Help

Credit Risk Modeling



Credit Risk Modeling

Equity - Generalized Regression 2 - JMP Pro

File Edit Tables Rows Cols DOE Analyze Graph Tools View Window Help

Generalized Regression for BAD = Bad Risk

Model Comparison

| Show | Response Distribution | Estimation Method | Validation Method | Nonzero Parameters | AICc | BIC | Generalized RSquare | Validation Generalized RSquare | Test Generalized RSquare |
|--------------------------|-----------------------|---------------------|-------------------|--------------------|-----------|-----------|---------------------|--------------------------------|--------------------------|
| <input type="checkbox"/> | Binomial | Logistic Regression | Validation Column | 17 | 999.01228 | 1094.0224 | 0.2815292 | 0.2930168 | 0.2681864 |

Model Launch

Response Distribution
Binomial

Estimation Method
Elastic Net
☒ Adaptive
Advanced Controls

Validation Method
Validation Column
☐ Early Stopping

Go

Credit Risk Modeling

Bootstrap Forest - JMP Pro

Builds a collection of decision trees using random sampling and averages the results to predict a response.

Select Columns

20 Columns

- BAD
- LOAN
- MORTDUE
- VALUE
- REASON
- JOB
- YOJ
- DEROG
- DELINQ
- CLAGE
- NINQ
- CLNO
- DEBTINC
- Validation
- Adaptive Elastic Net 1 P...bability (BAD=Bad Risk)
- Adaptive Elastic Net 1 P...bility (BAD=Good Risk)
- Adaptive Elastic Net 1 Most Likely BAD
- Adaptive Elastic Net 2 P...bability (BAD=Bad Risk)
- Adaptive Elastic Net 2 P...bility (BAD=Good Risk)
- Adaptive Elastic Net 2 Most Likely BAD

Cast Selected Columns into Roles

Y, Response: BAD (optional)

X, Factor: LOAN, MORTDUE, VALUE, REASON

Weight: optional numeric

Freq: optional numeric

Validation: Validation

By: optional

Action

OK

Cancel

Remove

Recall

Help

Options

Method: Bootstrap Forest

Validation Portion: 0

☐ Informative Missing

☒ Ordinal Restricts Order

Credit Risk Modeling

Bootstrap Forest - JMP Pro

Builds a collection of decision trees using random sampling and averages the results to predict a response.

Select Columns

23 Columns

BAD

LOAN

MORTDUE

VALUE

REASON

JOB

YOJ

DEROG

DELINQ

CLAGE

NINQ

CLNO

DEBTINC

Validation

Adaptive Elastic Net 1 P...bability (BAD=Bad Risk)

Adaptive Elastic Net 1 P...bility (BAD=Good Risk)

Adaptive Elastic Net 1 Most Likely BAD

Adaptive Elastic Net 2 P...ability (BAD=Bad Risk)

Adaptive Elastic Net 2 P...bility (BAD=Good Risk)

Adaptive Elastic Net 2 Most Likely BAD

BootstrapForest-6 Prob(BAD==Good Risk)

BootstrapForest-6 Prob(BAD==Bad Risk)

BootstrapForest-6 Most Likely BAD

Cast Selected Columns into Roles

Y, Response

BAD
optional

X, Factor

LOAN
MORTDUE
VALUE
REASON

Weight

optional numeric

Freq

optional numeric

Validation

Validation

By

optional

Action

OK

Cancel

Remove

Recall

Help

Options

Method

Bootstrap Forest

Validation Portion

0

☒ Informative Missing

☒ Ordinal Restricts Order

JMP Alert



The starting number of terms to select, 9, is greater than the maximum terms to select, 6, so it will not do multiple fits.

OK

Credit Risk Modeling

Bootstrap Forest

Bootstrap Forest Specification

Number of Rows: 5960
Number of Terms: 12

Forest

Number of Trees in the Forest: 100
Number of Terms Sampled per Split: 6
Bootstrap Sample Rate: 1
Minimum Splits per Tree: 10
Maximum Splits per Tree: 2000
Minimum Size Split: 5
☒ Early Stopping

Multiple Fits

☒ Multiple Fits over Number of Terms
Max Number of Terms: 9
☐ Use Tuning Design Table

Reproducibility

☐ Suppress Multithreading
Random Seed: 123

OK Cancel

Credit Risk Modeling

Bootstrap Forest

Bootstrap Forest Specification

Number of Rows: 5960
Number of Terms: 12

Forest

Number of Trees in the Forest: 100
Number of Terms Sampled per Split: 9
Bootstrap Sample Rate: 1
Minimum Splits per Tree: 10
Maximum Splits per Tree: 2000
Minimum Size Split: 5
☒ Early Stopping

Multiple Fits

☒ Multiple Fits over Number of Terms
Max Number of Terms: 9
☐ Use Tuning Design Table

Reproducibility

☐ Suppress Multithreading
Random Seed: 123

OK Cancel

Credit Risk Modeling

Boosted Tree - JMP Pro

32 Columns

Enter column name

- BAD
- LOAN
- MORTDUE
- VALUE
- REASON
- JOB
- YOJ
- DEROG
- DELINQ
- CLAGE
- NINQ
- CLNO
- DEBTINC
- Validation
- Adaptive Elastic Net ...ability (BAD=Bad Risk)
- Adaptive Elastic Net ...ility (BAD=Good Risk)
- Adaptive Elastic Net 1 Most Likely BAD
- Adaptive Elastic Net ...bility (BAD=Bad Risk)
- Adaptive Elastic Net ...ility (BAD=Good Risk)
- Adaptive Elastic Net 2 Most Likely BAD
- BootstrapForest-6 Prob(BAD==Good Risk)
- BootstrapForest-6 Prob(BAD==Bad Risk)
- BootstrapForest-6 Most Likely BAD
- BootstrapForest-6 IM...ob(BAD==Good Risk)
- BootstrapForest-6 IM Prob(BAD==Bad Risk)
- BootstrapForest-6 IM Most Likely BAD
- BootstrapForest-9 Prob(BAD==Good Risk)
- BootstrapForest-9 Prob(BAD==Bad Risk)
- BootstrapForest-9 Most Likely BAD
- BootstrapForest-9 l...rob(BAD==Good Risk)

Y, Response: BAD
optional

X, Factor: LOAN, MORTDUE, VALUE, REASON

Weight: optional numeric

Freq: optional numeric

Validation: Validation

By: optional

OK
Cancel
Remove
Recall
Help

Options

Method: Boosted Tree

Validation Portion: 0

☐ Informative Missing

☒ Ordinal Restricts Order

Credit Risk Modeling

Fit Model - JMP Pro

Model Specification

Select Columns

36 Columns

Enter column name

- BAD
- LOAN
- MORTDUE
- VALUE
- REASON
- JOB
- YOJ
- DEROG
- DELINQ
- CLAGE
- NINQ
- CLNO
- DEBTINC
- Validation
- Adaptive Elastic Net ...ability (BAD=Bad Risk)
- Adaptive Elastic Net ...ility (BAD=Good Risk)
- Adaptive Elastic Net 1 Most Likely BAD
- Adaptive Elastic Net ...bility (BAD=Bad Risk)
- Adaptive Elastic Net ...ility (BAD=Good Risk)
- Adaptive Elastic Net 2 Most Likely BAD

Pick Role Variables

Y: BAD (optional)

Weight: optional numeric

Freq: optional numeric

Validation: Validation

By: optional

Personality: Nominal Logistic

Target Level: Bad Risk

Help Run

Recall ☐ Keep dialog open

Remove

Construct Model Effects

Add Cross Nest Macros

Degree: 2

Attributes: ☒

Transform: ☒

☐ No Intercept

LOAN
MORTDUE
VALUE
REASON
JOB
YOJ
DEROG
DELINQ
CLAGE
NINQ

Fit Model - JMP Pro

Model Specification

Select Columns

36 Columns

Enter column name

- BAD
- LOAN
- MORTDUE
- VALUE
- REASON
- JOB
- YOJ
- DEROG
- DELINQ
- CLAGE
- NINQ
- CLNO
- DEBTINC
- Validation
- Adaptive Elastic Net ...ability (BAD=Bad Risk)
- Adaptive Elastic Net ...ility (BAD=Good Risk)
- Adaptive Elastic Net 1 Most Likely BAD
- Adaptive Elastic Net ...bility (BAD=Bad Risk)
- Adaptive Elastic Net ...ility (BAD=Good Risk)
- Adaptive Elastic Net 2 Most Likely BAD

Pick Role Variables

Y: BAD (optional)

Weight: optional numeric

Freq: optional numeric

Validation: Validation

By: optional

Personality: Nominal Logistic

Target Level: Bad Risk

Help Run

Recall ☐ Keep dialog open

Remove

Construct Model Effects

Add Cross Nest Macros

Degree: 2

Attributes: ☒

Transform: ☒

☐ No Intercept

LOAN
MORTDUE
VALUE
REASON
JOB
YOJ
DEROG
DELINQ
CLAGE
NINQ

Center Polynomials

Informative Missing

Set Alpha Level

Save to Data Table

Save to Script Window

Create SAS Job

Submit to SAS

Convergence Settings

Credit Risk Modeling

Boosted Tree - JMP Pro

Builds a decision tree that is a sequence of smaller trees to predict a response.

Select Columns

▼ 40 Columns

Enter column name

- BAD
- LOAN
- MORTDUE
- VALUE
- REASON
- JOB
- YOJ
- DEROG
- DELINQ
- CLAGE
- NINQ
- CLNO
- DEBTINC
- Validation

Cast Selected Columns into Roles

| | |
|-------------|------------------------------------|
| Y, Response | BAD <i>optional</i> |
| X, Factor | LOAN MORTDUE VALUE REASON |
| Weight | <i>optional numeric</i> |
| Freq | <i>optional numeric</i> |
| Validation | Validation |
| By | <i>optional</i> |

Action

OK

Cancel

Remove

Recall

Help

Options

Method **Boosted Tree**

Validation Portion

☐ Informative Missing

☒ Ordinal Restricts Order

Credit Risk Modeling

Boosted Tree - JMP Pro

Builds a decision tree that is a sequence of smaller trees to predict a response.

Select Columns

40 Columns

Enter column name

- BAD
- LOAN
- MORTDUE
- VALUE
- REASON
- JOB
- YOJ
- DEROG
- DELINQ
- CLAGE
- NINQ
- CLNO
- DEBTINC
- Validation

Cast Selected Columns into Roles

Y, Response: BAD (optional)

X, Factor: LOAN, MORTDUE, VALUE, REASON

Weight: optional numeric

Freq: optional numeric

Validation: Validation

By: optional

Action

OK

Cancel

Remove

Recall

Help

Options

Method: Boosted Tree

Validation Portion: 0

☒ Informative Missing

☒ Ordinal Restricts Order

Boosted Tree

Gradient-Boosted Trees Specification

Boosting

Number of Layers: 200

Splits per Tree: 15

Learning Rate: 0.128

Overfit Penalty: 0.0001

Minimum Size Split: 5

Multiple Fits

☒ Multiple Fits over Splits and Learning Rate

Max Splits Per Tree: 3

Max Learning Rate: 0.1

☐ Use Tuning Design Table

Stochastic Boosting

Row Sampling Rate: 1.0000

Column Sampling Rate: 1.0000

Reproducibility

☒ Suppress Multithreading

Random Seed: 123

☒ Early Stopping

OK

Cancel

Credit Risk Modeling

Equity - Model Comparison - JMP Pro

File Edit Tables Rows Cols DOE Analyze Graph Tools View Window Help

Model Comparison

Target BAD missing a predictor for category Good Risk
 Target BAD missing a predictor for category Good Risk
 Target BAD missing a predictor for category Good Risk
 Target BAD missing a predictor for category Good Risk

Predictors

Measures of Fit for BAD

| Validation | Creator | .2 .4 .6 .8 | Entropy RSquare | Generalized RSquare | Mean -Log p | RASE | Mean Abs Dev | Misclassification Rate | N |
|------------|--------------------------------------|-------------|--------------------|------------------------|-------------|--------|-----------------|---------------------------|------|
| Training | Fit Generalized Adaptive Elastic Net | | 0.2249 | 0.2815 | 0.2397 | 0.2531 | 0.1303 | 0.0820 | 2012 |
| Training | Fit Generalized Adaptive Elastic Net | | 0.4590 | 0.5845 | 0.2754 | 0.2836 | 0.1630 | 0.1057 | 3576 |
| Training | Fit Nominal Logistic | | 0.2249 | 0.2815 | 0.2397 | 0.2531 | 0.1302 | 0.0820 | 2012 |
| Training | Fit Nominal Logistic | | 0.4590 | 0.5845 | 0.2754 | 0.2837 | 0.1628 | 0.1057 | 3576 |
| Validation | Fit Generalized Adaptive Elastic Net | | 0.2432 | 0.2928 | 0.1962 | 0.2277 | 0.1117 | 0.0663 | 679 |
| Validation | Fit Generalized Adaptive Elastic Net | | 0.4812 | 0.6005 | 0.2513 | 0.2730 | 0.1537 | 0.1074 | 1192 |
| Validation | Fit Nominal Logistic | | 0.2434 | 0.2930 | 0.1961 | 0.2276 | 0.1117 | 0.0663 | 679 |
| Validation | Fit Nominal Logistic | | 0.4817 | 0.6010 | 0.2511 | 0.2728 | 0.1535 | 0.1074 | 1192 |
| Test | Fit Generalized Adaptive Elastic Net | | 0.2128 | 0.2683 | 0.2473 | 0.2577 | 0.1310 | 0.0817 | 673 |
| Test | Fit Generalized Adaptive Elastic Net | | 0.4134 | 0.5322 | 0.2849 | 0.2878 | 0.1640 | 0.1141 | 1192 |
| Test | Fit Nominal Logistic | | 0.2127 | 0.2682 | 0.2473 | 0.2577 | 0.1310 | 0.0817 | 673 |
| Test | Fit Nominal Logistic | | 0.4121 | 0.5308 | 0.2855 | 0.2882 | 0.1640 | 0.1166 | 1192 |

Credit Risk Modeling

Model Comparison - JMP Pro

Compares performance across models using prediction formula columns.

Select Columns

46 Columns

Enter column name

Validation

Adaptive Elastic Net 1 Probability (BAD=Bad Risk)

Adaptive Elastic Net 1 Probability (BAD=Good Risk)

Adaptive Elastic Net 1 Most Likely BAD

Adaptive Elastic Net 2 IM Probability (BAD=Bad Risk)

Adaptive Elastic Net 2 Probability (BAD=Good Risk)

Adaptive Elastic Net 2 Most Likely BAD

BootstrapForest-6 Prob(BAD==Good Risk)

BootstrapForest-6 Prob(BAD==Bad Risk)

BootstrapForest-6 Most Likely BAD

BootstrapForest-6 IM Prob(BAD==Good Risk)

BootstrapForest-6 IM Prob(BAD==Bad Risk)

BootstrapForest-6 IM Most Likely BAD

BootstrapForest-9 Prob(BAD==Good Risk)

BootstrapForest-9 Prob(BAD==Bad Risk)

BootstrapForest-9 Most Likely BAD

BootstrapForest-9 IM Prob(BAD==Good Risk)

BootstrapForest-9 IM Prob(BAD==Bad Risk)

BootstrapForest-9 IM Most Likely BAD

Nominal Lin[Bad Risk]

Prob for BAD (2/0)

Nominal Most Likely BAD

Nominal IM Lin[Bad Risk]

Prob for BAD 2 (2/0)

Nominal IM Most Likely BAD

Boosted Tree Prob(BAD==Bad Risk)

Boosted Tree Prob(BAD==Good Risk)

Boosted Tree Most Likely BAD

Boosted Tree IM Prob(BAD==Bad Risk)

Boosted Tree IM Prob(BAD==Good Risk)

Boosted Tree IM Most Likely BAD

Cast Selected Columns into Roles

Y, Predictors

BootstrapForest-6 Prob(BAD==Bad Risk)

BootstrapForest-6 IM Prob(BAD==Bad Risk)

BootstrapForest-9 Prob(BAD==Bad Risk)

BootstrapForest-9 IM Prob(BAD==Bad Risk)

Group

Validation

optional

Weight

optional numeric

Freq

optional numeric

By

optional

If you choose no Predictor columns, it will find and analyze all predictors.

Action

OK

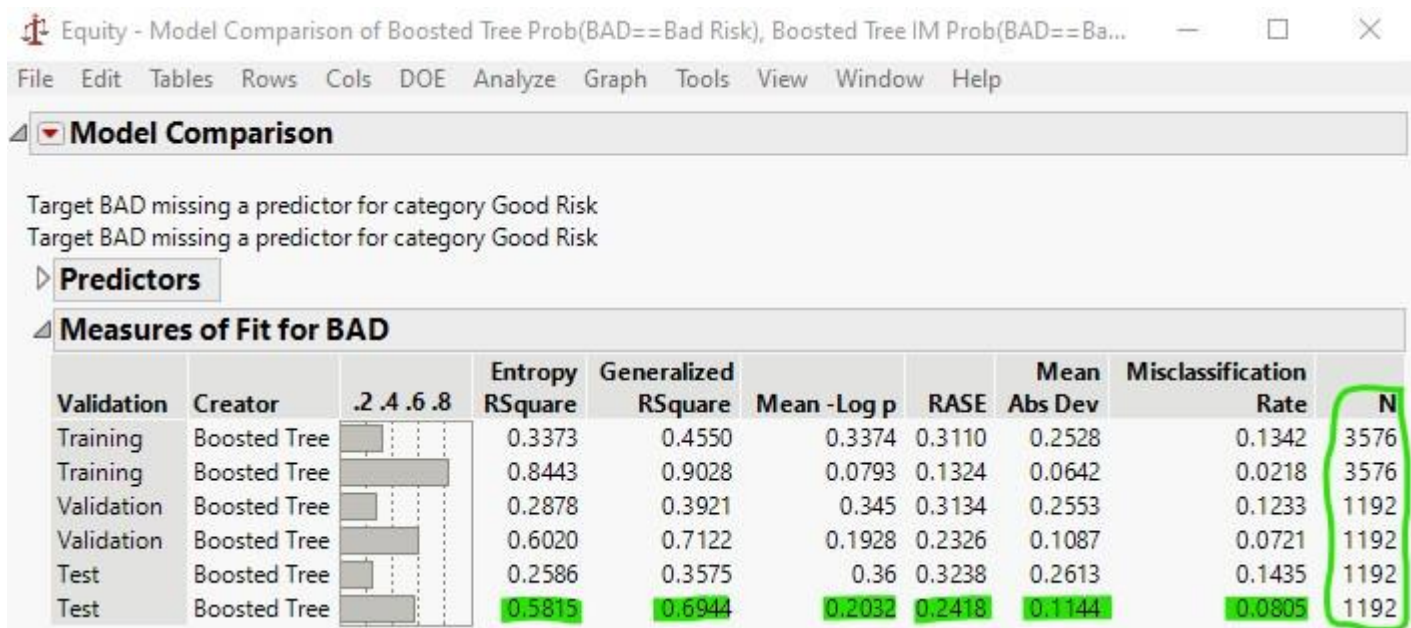
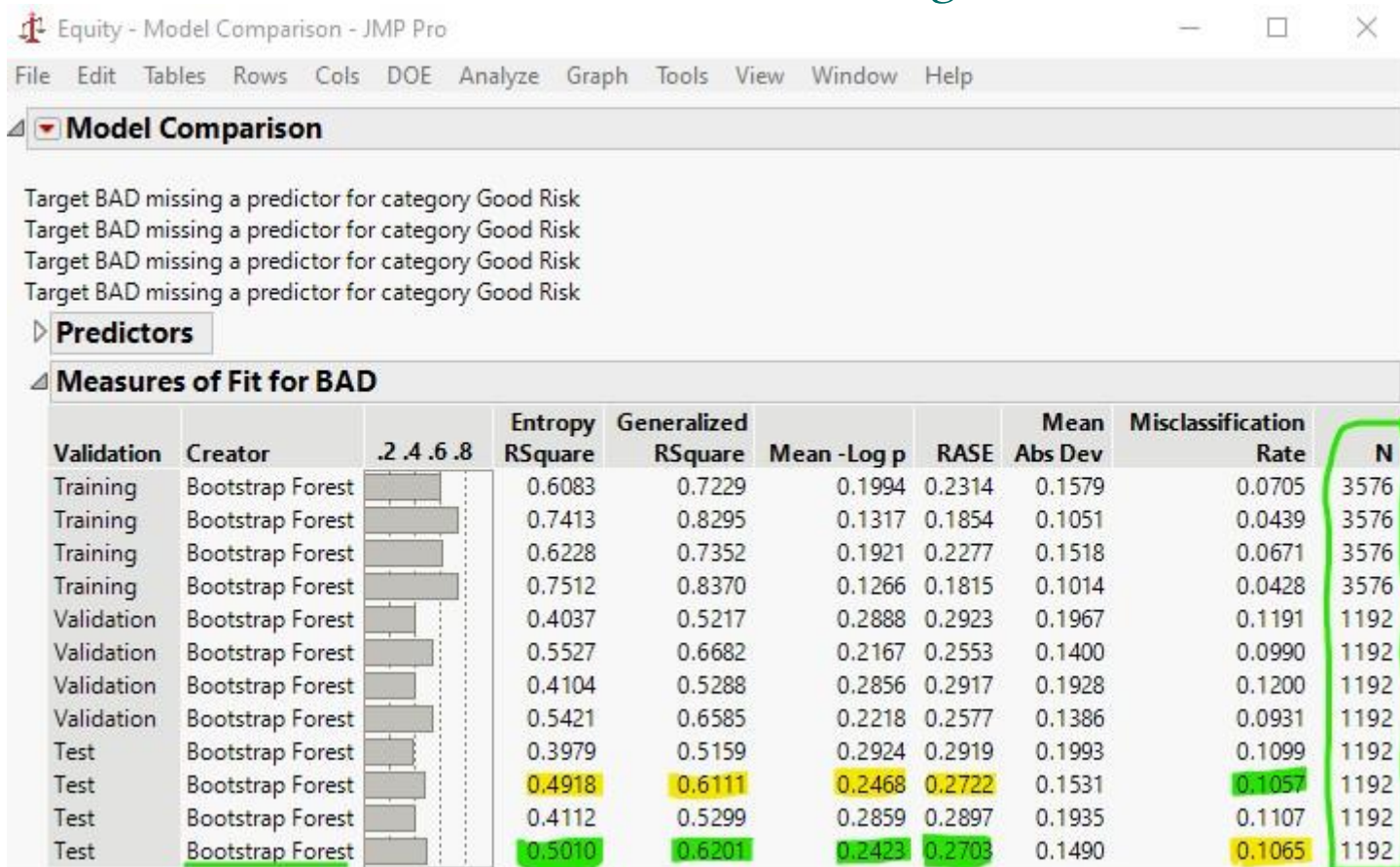
Cancel

Remove

Recall

Help

Credit Risk Modeling



Credit Risk Modeling

Model Comparison - JMP Pro

Compares performance across models using prediction formula columns.

Select Columns

46 Columns

Enter column name

- Validation
- Adaptive Elastic Net ...ility (BAD=Bad Risk)
- Adaptive Elastic Net ...y (BAD=Good Risk)
- Adaptive Elastic Net 1 Most Likely BAD
- Adaptive Elastic Net ...ity (BAD=Bad Risk)**
- Adaptive Elastic Net ... (BAD=Good Risk)
- Adaptive Elastic Net 2 Most Likely BAD
- BootstrapForest-6 ...BAD==Good Risk)
- BootstrapForest-6 ...b(BAD==Bad Risk)
- BootstrapForest-6 Most Likely BAD
- BootstrapForest-6 ...BAD==Good Risk)
- BootstrapForest-6 ...b(BAD==Bad Risk)
- BootstrapForest-6 IM Most Likely BAD
- BootstrapForest-9 ...BAD==Good Risk)
- BootstrapForest-9 ...b(BAD==Bad Risk)
- BootstrapForest-9 Most Likely BAD
- BootstrapForest-9 ...BAD==Good Risk)
- BootstrapForest-9 ...b(BAD==Bad Risk)**
- BootstrapForest-9 IM Most Likely BAD
- Nominal Lin[Bad Risk]
- Prob for BAD (2/0)
- Nominal Most Likely BAD
- Nominal IM Lin[Bad Risk]
- Prob for BAD 2 (2/1)
- Nominal IM Prob[Bad Risk]**
- Nominal IM Prob[Good Risk]
- Nominal IM Most Likely BAD
- Boosted Tree Prob(BAD==Bad Risk)
- Boosted Tree Prob(BAD==Good Risk)
- Boosted Tree Most Likely BAD
- Boosted Tree IM Prob(BAD==Bad Risk)**
- Boosted Tree IM P...(BAD==Good Risk)
- Boosted Tree IM Most Likely BAD

Cast Selected Columns into Roles

Y, Predictors

- Adaptive Elastic Net ...ability (BAD=Bad Risk)
- BootstrapForest-9 IM Prob(BAD==Bad Risk)
- Nominal IM Prob[Bad Risk]
- Boosted Tree IM Prob(BAD==Bad Risk)

Group

- Validation
optional

Weight

optional numeric

Freq

optional numeric

By

optional

If you choose no Predictor columns, it will find and analyze all predictors.

Action

OK

Cancel

Remove

Recall

Help

Credit Risk Modeling

Equity - Model Comparison - JMP Pro

File Edit Tables Rows Cols DOE Analyze Graph Tools View Window Help

Model Comparison

Target BAD missing a predictor for category Good Risk
Target BAD missing a predictor for category Good Risk
Target BAD missing a predictor for category Good Risk
Target BAD missing a predictor for category Good Risk

Predictors

Measures of Fit for BAD

| Validation | Creator | .2 .4 .6 .8 | Entropy RSquare | Generalized RSquare | Mean -Log p | RASE | Mean Abs Dev | Misclassification Rate | N |
|------------|--------------------------------------|-------------|--------------------|------------------------|-------------|--------|-----------------|---------------------------|------|
| Training | Fit Generalized Adaptive Elastic Net | | 0.4590 | 0.5845 | 0.2754 | 0.2836 | 0.1630 | 0.1057 | 3576 |
| Training | Bootstrap Forest | | 0.7512 | 0.8370 | 0.1266 | 0.1815 | 0.1014 | 0.0428 | 3576 |
| Training | Fit Nominal Logistic | | 0.4590 | 0.5845 | 0.2754 | 0.2837 | 0.1628 | 0.1057 | 3576 |
| Training | Boosted Tree | | 0.8443 | 0.9028 | 0.0793 | 0.1324 | 0.0642 | 0.0218 | 3576 |
| Validation | Fit Generalized Adaptive Elastic Net | | 0.4812 | 0.6005 | 0.2513 | 0.2730 | 0.1537 | 0.1074 | 1192 |
| Validation | Bootstrap Forest | | 0.5421 | 0.6585 | 0.2218 | 0.2577 | 0.1386 | 0.0931 | 1192 |
| Validation | Fit Nominal Logistic | | 0.4817 | 0.6010 | 0.2511 | 0.2728 | 0.1535 | 0.1074 | 1192 |
| Validation | Boosted Tree | | 0.6020 | 0.7122 | 0.1928 | 0.2326 | 0.1087 | 0.0721 | 1192 |
| Test | Fit Generalized Adaptive Elastic Net | | 0.4134 | 0.5322 | 0.2849 | 0.2878 | 0.1640 | 0.1141 | 1192 |
| Test | Bootstrap Forest | | 0.5010 | 0.6201 | 0.2423 | 0.2703 | 0.1490 | 0.1065 | 1192 |
| Test | Fit Nominal Logistic | | 0.4121 | 0.5308 | 0.2855 | 0.2882 | 0.1640 | 0.1166 | 1192 |
| Test | Boosted Tree | | 0.5815 | 0.6944 | 0.2032 | 0.2418 | 0.1144 | 0.0805 | 1192 |

Equity - Boosted Tree of BAD - JMP Pro

File Edit Tables Rows Cols DOE Analyze Graph Tools View Window Help

Boosted Tree for BAD

Specifications

Target BAD Number of training rows: 3576
Validation Column: Validation Number of validation rows: 1192
Number of Layers: 189 Number of test rows: 1192
Splits per Tree: 15
Learning Rate: 0.128
Overfit Penalty: 0.0001

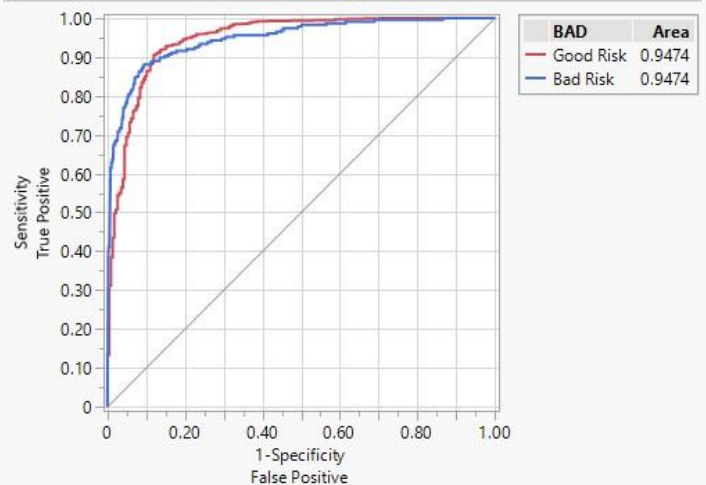
Overall Statistics

Cumulative Validation

Receiver Operating Characteristic on Training Data

Receiver Operating Characteristic on Validation Data

Receiver Operating Characteristic on Test Data



Credit Risk Modeling

