Model Screening for Personal Loan

Table: UniversalBank **Response:** Personal Loan

Details

Bootstrap Forest for Personal Loan

Specifications

Target	Personal Loan	Training Rows:	5000
		Validation Rows:	0
Number of Trees in the Forest:	100	Test Rows:	0
Number of Terms Sampled per Split:	9	Number of Terms:	12
		Bootstrap Samples:	5000
		Minimum Splits per Tree:	10
		Minimum Size Split:	5

Overall Statistics

Individual Trees	RASE
In Bag	0.0584192
Out of Bag	0.1289424

RSquare	RASE	N
0.946	0.0685834	5000

Boosted Tree for Personal Loan

Specifications

Target	Personal Loan	Number of training rows:	5000
Number of Layers:	200	Number of validation rows:	0
Splits per Tree:	14		
Learning Rate:	0.124		

Overall Statistics

RSquare	RASE	N
0.958	0.0603749	5000

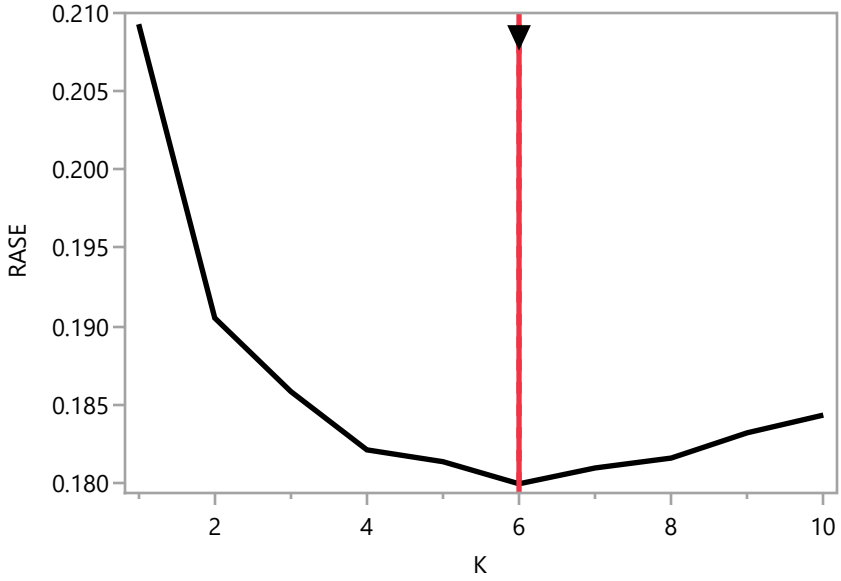
Model Screening for Personal Loan

Details

K Nearest Neighbors

Personal Loan

Model Selection



Training

K	Count	RSquare	RASE	SSE	
1	5000	0.4953	0.20928	219	
2	5000	0.58172	0.19053	181.5	
3	5000	0.60208	0.18583	172.667	
4	5000	0.61787	0.18211	165.813	
5	5000	0.62104	0.18135	164.44	
6	5000	0.62692	0.17994	161.889	*
7	5000	0.62271	0.18095	163.714	
8	5000	0.62007	0.18158	164.859	
9	5000	0.61329	0.18320	167.802	
10	5000	0.6085	0.18433	169.88	

Neural

Validation: Random Holdback

Model NTanH(3)NBoost(20)

Training

Personal Loan

Measures	Value
RSquare	0.8282364
RASE	0.1184332
Mean Abs Dev	0.052222
-LogLikelihood	-2381.32
SSE	46.750099
Sum Freq	3333

Validation

Personal Loan

Measures	Value
RSquare	0.7830779
RASE	0.1448989
Mean Abs Dev	0.0629628
-LogLikelihood	-854.8054
SSE	34.999804
Sum Freq	1667

Model Screening for Personal Loan

Details

Support Vector Machine

Model Comparison

Show	Method	Kernel Function	Cost	Gamma	# SV	Training RASE	Best
☑	Model 1	Radial Basis Function	1	0.08333	1690	0.1553	Smallest RASE

Support Vector Machine Model 1

Model Summary

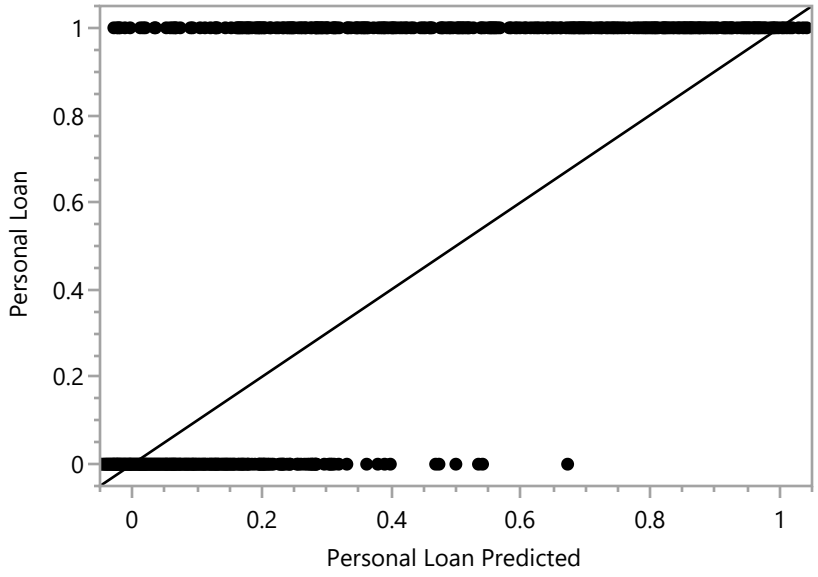
Response	Personal Loan
Validation Method	None
Kernel Function	Radial Basis Function

Measure	
Number of rows	5000
Sum of Frequencies	5000
RASE	0.1553037
R-Square	0.7220774
Number of Support Vectors	1690

Estimation Details

Cost	1
Gamma	0.08333

Actual by Predicted Plot



Response Personal Loan

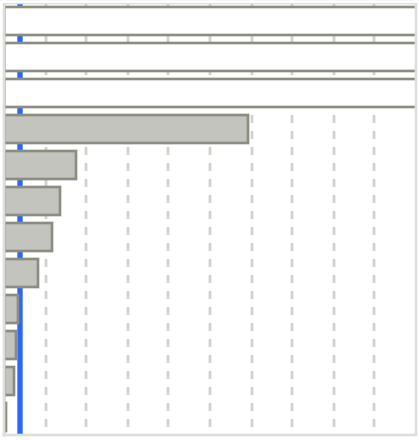
Model Screening for Personal Loan

Details

Response Personal Loan

Effect Summary

Source	Logworth	PValue
Income	192.527	0.00000
CD Account	91.592	0.00000
Education	79.955	0.00000
Family	29.530	0.00000
CreditCard	8.643	0.00000
Securities Account	6.910	0.00000
CCAvg	5.925	0.00000
Online	4.012	0.00010
Experience	1.606	0.02480
Age	1.408	0.03912
Mortgage	1.302	0.04992
ZIP Code	0.279	0.52661



Summary of Fit

RSquare	0.38628
RSquare Adj	0.384803
Root Mean Square Error	0.231084
Mean of Response	0.096
Observations (or Sum Wgts)	5000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	12	167.61455	13.9679	261.5711
Error	4987	266.30545	0.0534	Prob > F
C. Total	4999	433.92000		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-0.323736	0.160149	-2.02	0.0433*
Age	-0.005694	0.00276	-2.06	0.0391*
Experience	0.00619	0.002757	2.25	0.0248*
Income	0.003003	9.683e-5	31.01	<.0001*
ZIP Code	9.7664e-7	1.542e-6	0.63	0.5266
Family	0.0333215	0.002896	11.51	<.0001*
CCAvg	0.0119595	0.002459	4.86	<.0001*
Education	0.0796213	0.00411	19.37	<.0001*
Mortgage	6.4615e-5	0.000033	1.96	0.0499*
Securities Account	-0.060367	0.011397	-5.30	<.0001*
CD Account	0.3292972	0.015822	20.81	<.0001*
Online	-0.026495	0.006793	-3.90	<.0001*
CreditCard	-0.045209	0.00755	-5.99	<.0001*

Model Screening for Personal Loan

Details

Response Personal Loan

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Age	1	1	0.227363	4.2577	0.0391*
Experience	1	1	0.269193	5.0411	0.0248*
Income	1	1	51.359553	961.7906	<.0001*
ZIP Code	1	1	0.021412	0.4010	0.5266
Family	1	1	7.069703	132.3916	<.0001*
CCAvg	1	1	1.263048	23.6526	<.0001*
Education	1	1	20.043563	375.3481	<.0001*
Mortgage	1	1	0.205377	3.8460	0.0499*
Securities Account	1	1	1.498136	28.0550	<.0001*
CD Account	1	1	23.129656	433.1402	<.0001*
Online	1	1	0.812297	15.2116	<.0001*
CreditCard	1	1	1.914635	35.8546	<.0001*

Effect Details

Age

Experience

Income

ZIP Code

Family

CCAvg

Education

Mortgage

Securities Account

CD Account

Online

CreditCard

Stepwise Fit for Personal Loan

Stepwise Regression Control

Stopping Rule: Minimum BIC

Direction: Forward

Training Rows 5000

SSE	DFE	RMSE	RSquare	RSquare Adj	Cp	p	AICc	BIC
266.94164	4991	0.2312674	0.3848	0.3838	16.913638	9	-441.386	-376.258

Model Screening for Personal Loan

Details

Stepwise Fit for Personal Loan

Current Estimates

Lock	Entered	Parameter	Estimate	nDF	SS	"F Ratio"	"Prob>F"
☑	☑	Intercept	-0.3590899	1	0	0.000	1
☐	☐	Age	0	1	0.138835	2.597	0.10715
☐	☐	Experience	0	1	0.180137	3.370	0.06647
☐	☑	Income	0.003039	1	54.34434	1016.075	4e-203
☐	☐	ZIP Code	0	1	0.019645	0.367	0.54453
☐	☑	Family	0.03285318	1	6.908406	129.166	1.4e-29
☐	☑	CCAvg	0.01142098	1	1.157205	21.636	3.38e-6
☐	☑	Education	0.07745161	1	20.28239	379.219	1.8e-81
☐	☐	Mortgage	0	1	0.205927	3.852	0.04973
☐	☑	Securities Account	-0.06155	1	1.559211	29.153	7e-8
☐	☑	CD Account	0.33307664	1	23.81418	445.253	9.6e-95
☐	☑	Online	-0.0267272	1	0.827336	15.469	8.5e-5
☐	☑	CreditCard	-0.0455791	1	1.947696	36.416	1.71e-9

Step History

Step	Parameter	Action	"Sig Prob"	Seq SS	RSquare	Cp	p	AICc	BIC	
1	Income	Entered	0.0000	109.5511	0.2525	1078.3	2	518.832	538.379	○
2	Education	Entered	0.0000	23.98697	0.3077	631.14	3	136.702	162.762	○
3	CD Account	Entered	0.0000	21.6956	0.3577	226.85	4	-236.13	-203.56	○
4	Family	Entered	0.0000	6.766747	0.3733	102.13	5	-357.03	-317.95	○
5	CreditCard	Entered	0.0000	1.523472	0.3769	75.605	6	-383.12	-337.52	○
6	Securities Account	Entered	0.0000	1.42113	0.3801	50.992	7	-407.46	-355.35	○
7	CCAvg	Entered	0.0000	1.206029	0.3829	30.407	8	-427.92	-369.3	○
8	Online	Entered	0.0001	0.827336	0.3848	16.914	9	-441.39	-376.26	○
9	Mortgage	Entered	0.0497	0.205927	0.3853	15.057	10	-443.24	-371.6	○
10	Experience	Entered	0.0658	0.180978	0.3857	13.668	11	-444.62	-366.48	○
11	Age	Entered	0.0389	0.22787	0.3862	11.401	12	-446.89	-362.24	○
12	ZIP Code	Entered	0.5266	0.021412	0.3863	13	13	-445.28	-354.12	○
13	Best	Specific	.	.	0.3848	16.914	9	-441.39	-376.26	◉

Generalized Regression for Personal Loan

Model Comparison

Show	Response Distribution	Estimation Method	Validation Method	Nonzero Parameters	AICc	BIC	Generalized RSquare
☑	Normal	Lasso	AICc	14	-445.2766	-354.1201	0.3862798

Model Screening for Personal Loan

Details

Generalized Regression for Personal Loan

Normal Lasso with AICc Validation

Model Summary

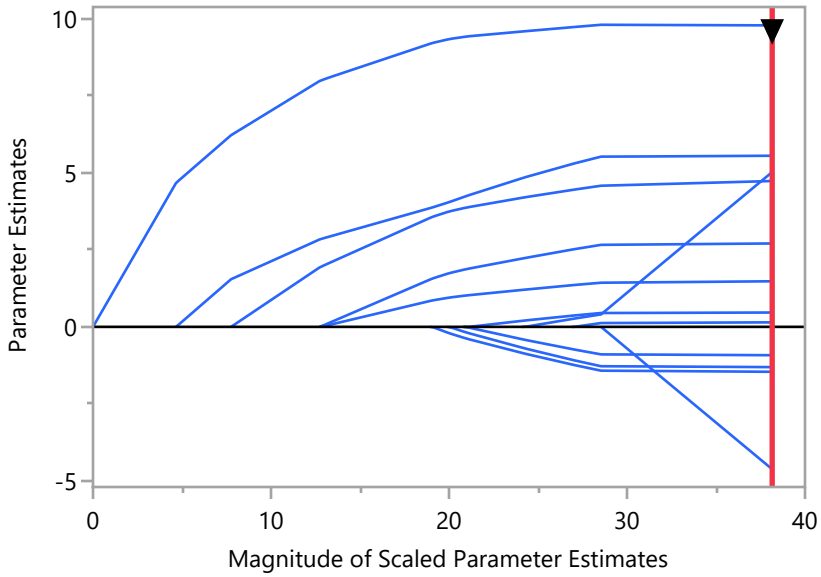
Response	Personal Loan
Distribution	Normal
Estimation Method	Lasso
Validation Method	AICc with Early Stopping
Mean Model Link	Identity
Scale Model Link	Identity

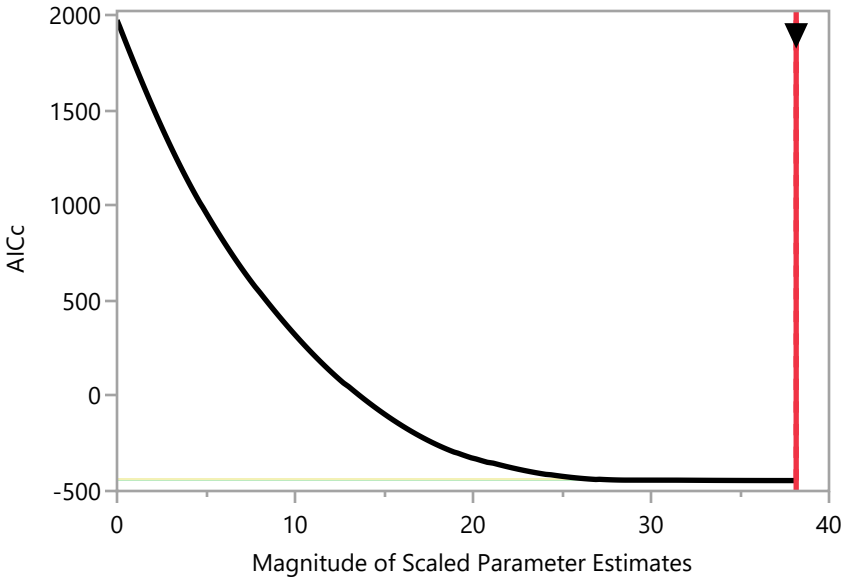
Measure	
Number of rows	5000
Sum of Frequencies	5000
-LogLikelihood	-236.6804
Number of Parameters	14
BIC	-354.1201
AICc	-445.2766
ERIC	-388.9335
RSquare	0.3862798
RASE	0.2307836
Lambda Penalty	0

Estimation Details

Number of Grid Points	150
Minimum Penalty Fraction	0
Grid Scale	Square Root

Solution Path




2000
1500
1000
500
0
-500
AICc
0
10
20
30
40
Magnitude of Scaled Parameter Estimates

Model Screening for Personal Loan

Details

Generalized Regression for Personal Loan

Normal Lasso with AICc Validation

Parameter Estimates for Original Predictors

Term	Estimate	Std Error	Wald ChiSquare	Prob > ChiSquare	Lower 95%	Upper 95%
Intercept	-0.323736	0.1399846	5.3483688	0.0207*	-0.598101	-0.049371
Age	-0.005694	0.0026492	4.6197184	0.0316*	-0.010887	-0.000502
Experience	0.00619	0.0026481	5.4640976	0.0194*	0.0009999	0.0113801
Income	0.003003	0.0001355	491.16273	<.0001*	0.0027375	0.0032686
ZIP Code	9.7664e-7	1.3198e-6	0.5476264	0.4593	-1.61e-6	3.5633e-6
Family	0.0333215	0.0029338	128.99838	<.0001*	0.0275714	0.0390717
CCAvg	0.0119595	0.0034368	12.108954	0.0005*	0.0052234	0.0186956
Education	0.0796213	0.0043896	329.01452	<.0001*	0.0710179	0.0882247
Mortgage	6.4615e-5	4.438e-5	2.1198076	0.1454	-2.237e-5	0.0001516
Securities Account	-0.060367	0.010438	33.447666	<.0001*	-0.080825	-0.039909
CD Account	0.3292972	0.0222688	218.66741	<.0001*	0.2856513	0.3729432
Online	-0.026495	0.0066439	15.903444	<.0001*	-0.039517	-0.013473
CreditCard	-0.045209	0.0067654	44.655105	<.0001*	-0.058469	-0.03195

Normal Distribution Parameters	Estimate	Std Error	Wald ChiSquare	Prob > ChiSquare	Lower 95%	Upper 95%
Scale	0.2307836	0.0036126	4080.9718	<.0001*	0.223703	0.2378643

Training

Method	N	Sum Freq	RSquare	RASE
Boosted Tree	5000	5000.00	0.9580	0.06037
Bootstrap Forest	5000	5000.00	0.9458	0.06858
Neural Boosted	3333	3333.00	0.8282	0.11843
Support Vector Machines	5000	5000.00	0.7221	0.15530
K Nearest Neighbors	5000	5000.00	0.6269	0.17994
Generalized Regression Lasso	5000	5000.00	0.3863	0.23078
Fit Least Squares	.	5000.00	0.3863	0.23108
Fit Stepwise	5000	5000.00	0.3848	0.23106

Validation

Method	N	RSquare	RASE
Neural Boosted	1667	0.7831	0.14490
Bootstrap Forest	.	.	.
Boosted Tree	.	.	.
K Nearest Neighbors	.	.	.
Support Vector Machines	.	.	.
Fit Least Squares	.	.	.
Fit Stepwise	.	.	.
Generalized Regression Lasso	.	.	.

Sum Freq and Sum Weight are suppressed when they are the same as N.