Machine Learning Exercise

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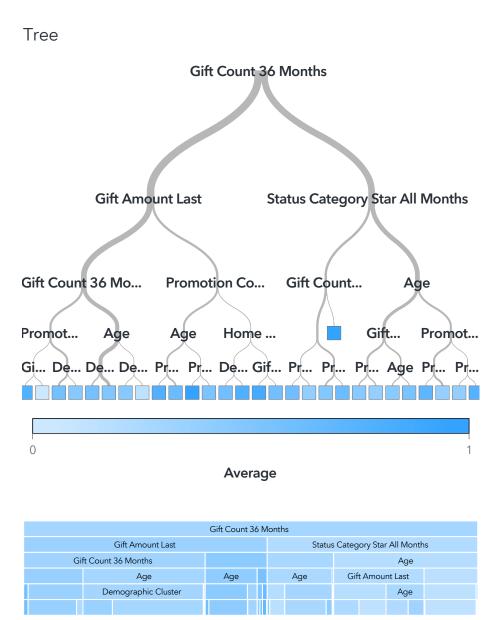
Machine Learning Exercise

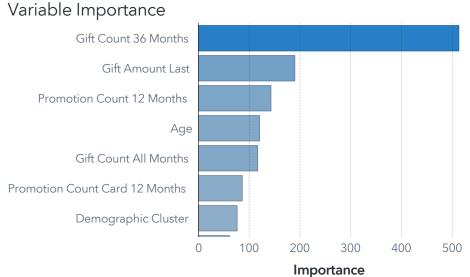
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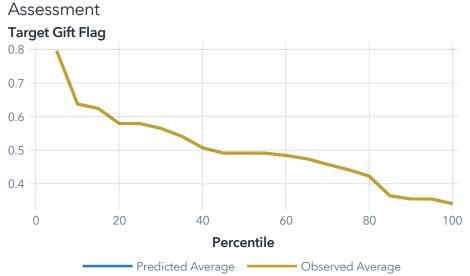
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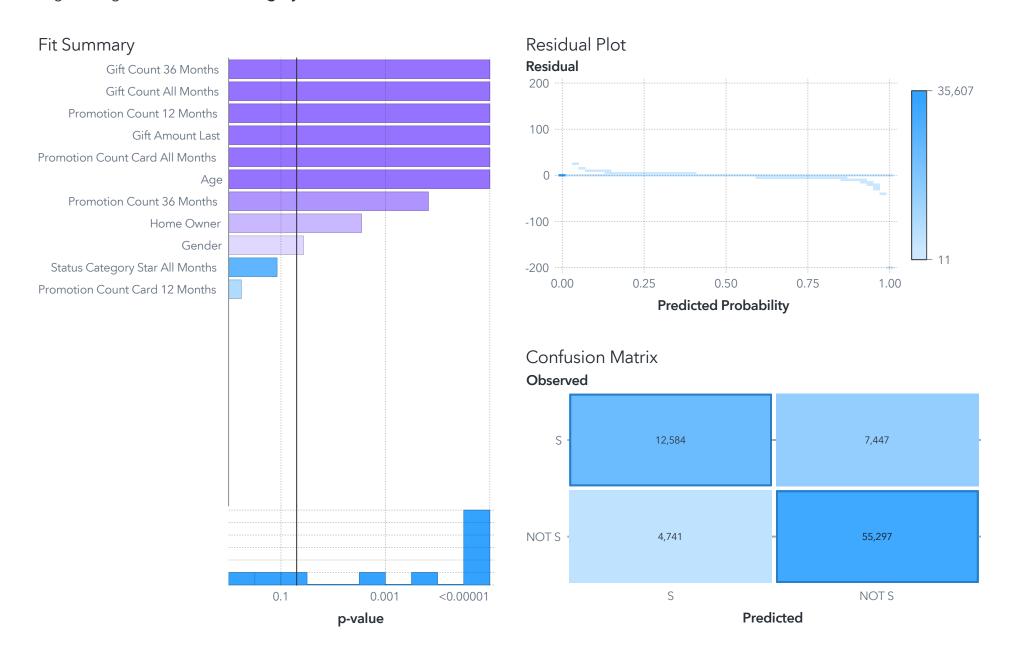
Decision Tree Target Gift Flag ASE 0.2373 Observations Used 106,546



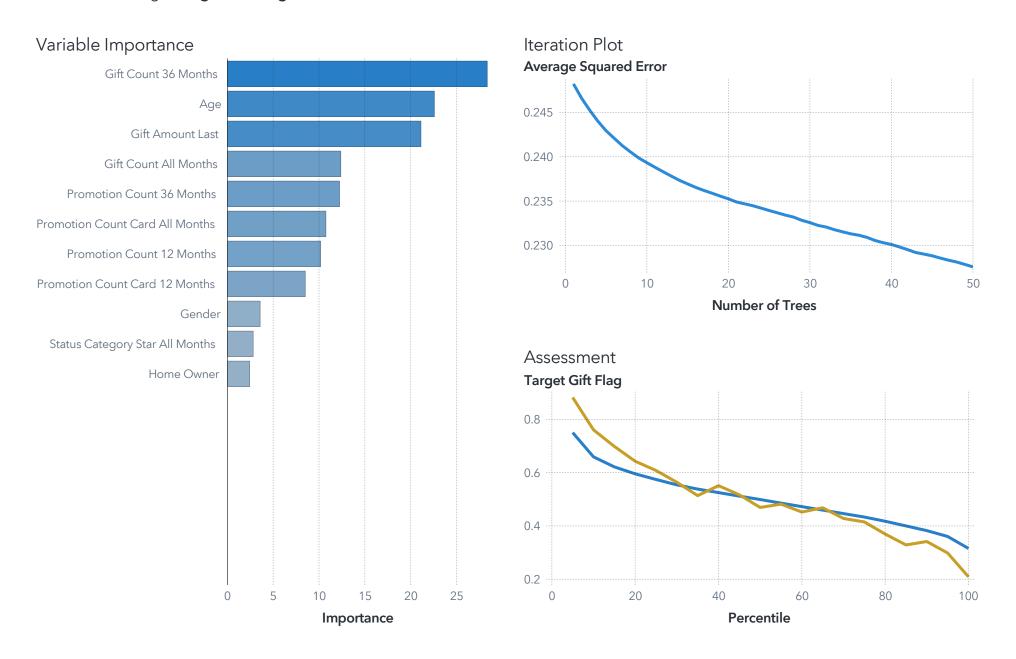




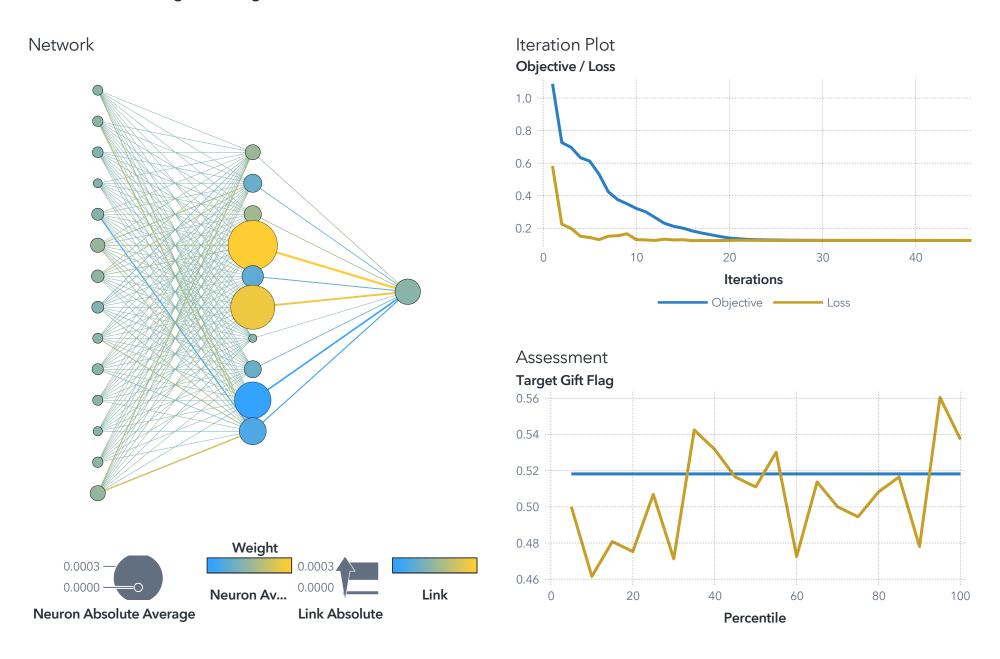
Logistic Regression Status Category 96NK (event=S) KS (Youden) 0.6809 Observations Used 80,069 Unused 26,477



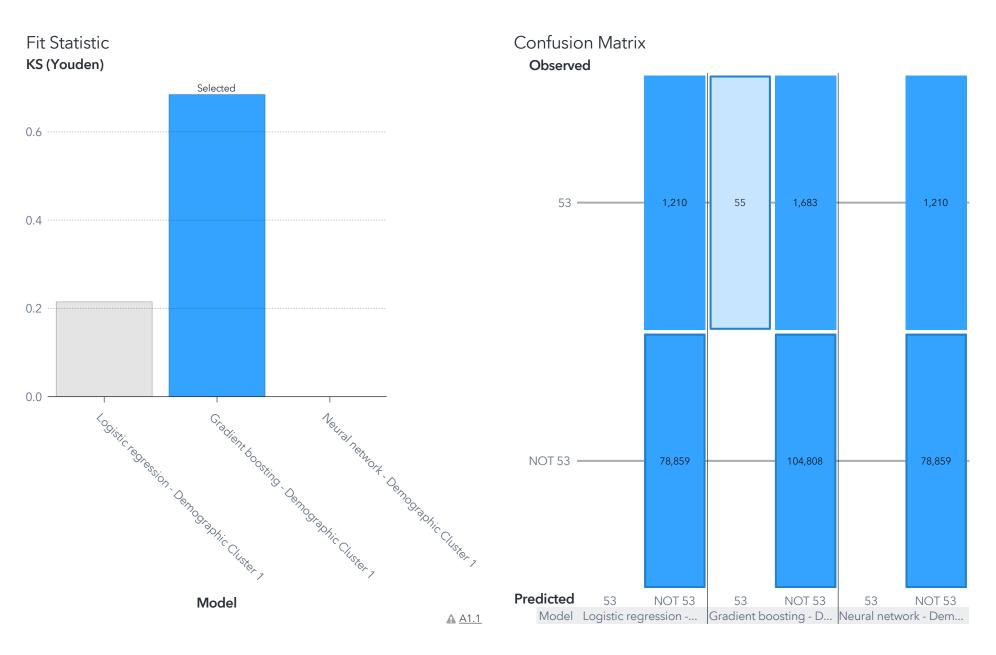
Gradient Boosting Target Gift Flag ASE 0.2276 Observations Used 106,546



Neural Network Target Gift Flag ASE 0.2501 Observations Used 80,069 Unused 26,477



Model Comparison Demographic Cluster (event=53)



Appendix

A1.1 Fit Statistic

Warnings:

Number of observations for all models do not match.

Node ID	Depth	Parent ID	N Children	Туре	Observations	% Observations	Percent of Parent	N Missing	Gain	Predicted Value	Average	XK
0	0	-1	2	Class	106,546	100.00%		0	450.2782	0.5000	0.5000	
1	1	0	2	Class	57,156	53.64%	53.64%	0	162.1013	0.5604	0.5604	
2	1	0	2	Class	49,390	46.36%	46.36%	0	61.4338	0.4301	0.4301	
3	2	1	2	Class	42,603	39.99%	74.54%	0	52.7057	0.5293	0.5293	
4	2	1	2	Class	14,553	13.66%	25.46%	0	37.0136	0.6515	0.6515	
5	2	2	2	Class	15,587	14.63%	31.56%	0	96.6307	0.4820	0.4820	
6	2	2	2	Class	33,803	31.73%	68.44%	0	28.3190	0.4061	0.4061	
7	3	3	2	Class	13,926	13.07%	32.69%	0	41.7087	0.5798	0.5798	
8	3	3	2	Class	28,677	26.92%	67.31%	0	26.8691	0.5048	0.5048	
9	3	4	2	Class	12,199	11.45%	83.82%	0	25.8147	0.6294	0.6294	
10	3	4	2	Class	2,354	2.21%	16.18%	0	12.6389	0.7664	0.7664	
11	3	5	2	Class	15,235	14.30%	97.74%	0	21.9553	0.4700	0.4700	
12	3	5	0	Leaf	352	0.33%	2.26%	0	0.0000	1.0000	1.0000	
13	3	6	2	Class	21,208	19.91%	62.74%	0	27.9441	0.4284	0.4284	
14	3	6	2	Class	12,595	11.82%	37.26%	0	26.8067	0.3686	0.3686	
15	4	7	2	Class	1,056	0.99%	7.58%	0	20.2406	0.7708	0.7708	
16	4	7	2	Class	12,870	12.08%	92.42%	0	22.6105	0.5641	0.5641	
17	4	8	2	Class	28,248	26.51%	98.50%	0	26.2072	0.5086	0.5086	
18	4	8	2	Class	429	0.40%	1.50%	0	13.0012	0.2564	0.2564	
19	4	9	2	Class	9,911	9.30%	81.24%	0	20.2955	0.6515	0.6515	
20	4	9	2	Class	2,288	2.15%	18.76%	0	17.3291	0.5337	0.5337	
21	4	10	2	Class	1,232	1.16%	52.34%	0	14.6088	0.6964	0.6964	
22	4	10	2	Class	1,122	1.05%	47.66%	0	10.0977	0.8431	0.8431	
23	4	11	2	Class	4,103	3.85%	26.93%	0	26.2947	0.4075	0.4075	
24	4	11	2	Class	11,132	10.45%	73.07%	0	26.5688	0.4931	0.4931	
25	4	13	2	Class	12,287	11.53%	57.94%	0	24.5573	0.3975	0.3975	
26	4	13	2	Class	8,921	8.37%	42.06%	0	17.6680	0.4710	0.4710	
27	4	14	2	Class	12,232	11.48%	97.12%	0	26.3169	0.3606	0.3606	
28	4	14	2	Class	363	0.34%	2.88%	0	13.5000	0.6364	0.6364	

0.4817

Node ID	Depth	Parent ID	N Children	Туре	Observations	% Observations	Percent of Parent	N Missing	Gain	Predicted Value	Average	K
29	5	15	0	Leaf	1,023	0.96%	96.88%	0	0.0000	0.7957	0.7957	
30	5	15	0	Leaf	33	0.03%	3.13%	0	0.0000	0.0000	0.0000	
31	5	16	0	Leaf	11,374	10.68%	88.38%	0	0.0000	0.5793	0.5793	
32	5	16	0	Leaf	1,496	1.40%	11.62%	0	0.0000	0.4485	0.4485	
33	5	17	0	Leaf	6,908	6.48%	24.45%	0	0.0000	0.5621	0.5621	
34	5	17	0	Leaf	21,340	20.03%	75.55%	0	0.0000	0.4912	0.4912	
35	5	18	0	Leaf	198	0.19%	46.15%	0	0.0000	0.4444	0.4444	
36	5	18	0	Leaf	231	0.22%	53.85%	0	0.0000	0.0952	0.0952	
37	5	19	0	Leaf	869	0.82%	8.77%	0	0.0000	0.7975	0.7975	
38	5	19	0	Leaf	9,042	8.49%	91.23%	0	0.0000	0.6375	0.6375	
39	5	20	0	Leaf	77	0.07%	3.37%	0	0.0000	1.0000	1.0000	
40	5	20	0	Leaf	2,211	2.08%	96.63%	0	0.0000	0.5174	0.5174	
41	5	21	0	Leaf	649	0.61%	52.68%	0	0.0000	0.5932	0.5932	
42	5	21	0	Leaf	583	0.55%	47.32%	0	0.0000	0.8113	0.8113	
43	5	22	0	Leaf	990	0.93%	88.24%	0	0.0000	0.8778	0.8778	
44	5	22	0	Leaf	132	0.12%	11.76%	0	0.0000	0.5833	0.5833	
45	5	23	0	Leaf	605	0.57%	14.75%	0	0.0000	0.6000	0.6000	
46	5	23	0	Leaf	3,498	3.28%	85.25%	0	0.0000	0.3742	0.3742	
47	5	24	0	Leaf	9,735	9.14%	87.45%	0	0.0000	0.4746	0.4746	
48	5	24	0	Leaf	1,397	1.31%	12.55%	0	0.0000	0.6220	0.6220	
49	5	25	0	Leaf	5,951	5.59%	48.43%	0	0.0000	0.4436	0.4436	
50	5	25	0	Leaf	6,336	5.95%	51.57%	0	0.0000	0.3542	0.3542	
51	5	26	0	Leaf	5,203	4.88%	58.32%	0	0.0000	0.4334	0.4334	
52	5	26	0	Leaf	3,718	3.49%	41.68%	0	0.0000	0.5237	0.5237	
53	5	27	0	Leaf	198	0.19%	1.62%	0	0.0000	0.7222	0.7222	
54	5	27	0	Leaf	12,034	11.29%	98.38%	0	0.0000	0.3547	0.3547	
55	5	28	0	Leaf	121	0.11%	33.33%	0	0.0000	0.3636	0.3636	
56	5	28	0	Leaf	242	0.23%	66.67%	0	0.0000	0.7727	0.7727	

rd. Dev	K
4034	
4937	
4975	
4962	
4999	
4982	
2942	
4021	
4808	
4998	
4916	
3916	
3277	
4949	
4903	
4840	
4994	
4850	
4969	
4783	
4956	
4995	
4490	
4784	
4830	
4199	

Node ID	Parent ID	Туре	Age
0	-1	Class	
1		Class	
2	0	Class	
3	1	Class	
4	1	Class	
5	2	Class	
6	2	Class	
7	3	Class	
8	3	Class	
9	4	Class	
10		Class	
11	5	Class	
12	5	Leaf	
13	6	Class	≥ 39
14	6	Class	0 to 39 or Missing
15	7	Class	
16	7	Class	
17	8	Class	≥ 26 or Missing
18	8	Class	0 to 26
19	9	Class	≥ 50 or Missing
20			0 to 50
21		Class	
22		Class	
23			≥ 83 or Missing
24			0 to 83
25		Class	
26		Class	
27			0 to 39 or Missing
28	14	Class	0 to 39 or Missing

Demographic Cluster	Gender	Home Owner	ĀR
		11	
		H	
		U	

Gift Count 36 Months	Gift Count All Months	Promotion Count 36 Months	Promotion Count 12 Months	Promotion Count Card All Months	Status Category Star All Months	A)
≥ 3						
0 to 3						
≥ 3						
≥ 3						
0 to 3					= 1	
0 to 3					0 to 1	
≥ 5						
3 to 5						
≥ 3			≥ 11			
≥ 3			2 to 11			
0 to 3	≥ 4				= 1	
0 to 3	1 to 4				= 1	
0 to 3					0 to 1	
0 to 3					0 to 1	
≥ 5						
≥ 5						
3 to 5						
3 to 5						
≥ 3			≥ 11			
≥ 3			≥ 11			
≥ 3			2 to 11			
≥ 3			2 to 11			
0 to 3	≥ 4				= 1	
0 to 3	≥ 4				= 1	
0 to 3					0 to 1	
0 to 3					0 to 1	
0 to 3			≥ 7		0 to 1	
0 to 3			2 to 7		0 to 1	

Node ID	Parent ID	Туре	Age
29	15	Leaf	
30	15	Leaf	
31	16	Leaf	
32	16	Leaf	
33	17	Leaf	≥ 26 or Missing
34	17	Leaf	≥ 26 or Missing
35			0 to 26
36	18	Leaf	0 to 26
37	19	Leaf	≥ 50 or Missing
38	19	Leaf	≥ 50 or Missing
39	20	Leaf	0 to 50
40	20	Leaf	0 to 50
41	21	Leaf	
42	21	Leaf	
43	22	Leaf	
44	22	Leaf	
45	23	Leaf	≥ 83 or Missing
46	23	Leaf	≥ 83 or Missing
47	24	Leaf	0 to 83
48	24	Leaf	0 to 83
49	25	Leaf	≥ 39
50	25	Leaf	≥ 39
51	26	Leaf	≥ 57
52	26	Leaf	39 to 57
53	27	Leaf	0 to 39 or Missing
54	27	Leaf	0 to 39 or Missing
55	28	Leaf	0 to 39 or Missing
56	28	Leaf	0 to 39 or Missing

Demographic Cluster	Gender	Home Owner)
00, 02, 03, 08, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 23, 24, 25, 27, 28, 29, 30, 34, 35, 36, 38, 39, 40, 41, 42, 43,			
01, 04, 05, 06, 07, 09, 19, 22, 26, 31, 32, 33, 37, 47, 48, 50, or 52			
12, 24, 27, 35, 36, or 40			
00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 29, 30, 31, 32, 33,			
20, 23, 30, 40, 49, or 53			
08, 10, 11, 12, 13, 14, 24, 25, 27, 29, 33, 34, 35, 36, 37, 38, 41, 42, 44, or 46			
05, 10, 16, 17, 23, 24, 30, 33, 36, 40, 45, or 49		Н	
02, 03, 04, 07, 08, 11, 13, 18, 20, 21, 22, 25, 26, 27, 28, 29, 32, 34, 35, 37, 39, 41, 43, 44, 46, 48, 50, 51, or 53		Н	
		U	
		U	

Gift Count 36 Months	Gift Count All Months	Promotion Count 36 Months	Promotion Count 12 Months	Promotion Count Card All Months	Status Category Star All Months	IK IK
≥ 5	≥ 9					
≥ 5	1 to 9					
≥ 5						
≥ 5						
3 to 5						
3 to 5						
3 to 5						
3 to 5						
≥ 3			≥ 11			
≥ 3			≥ 11			
≥ 3		≥ 44	≥ 11			
≥ 3		4 to 44	≥ 11			
≥ 3			2 to 11			
≥ 3			2 to 11			
≥ 4			2 to 11			
3 to 4			2 to 11			
0 to 3	≥ 4		≥ 15		= 1	
0 to 3	≥ 4		2 to 15		= 1	
0 to 3	≥ 4		≥ 10		= 1	
0 to 3	≥ 4		2 to 10		= 1	
0 to 3					0 to 1	
0 to 3					0 to 1	
0 to 3					0 to 1	
0 to 3					0 to 1	
0 to 3			≥ 26		0 to 1	
0 to 3			7 to 26		0 to 1	
0 to 3			2 to 7	≥ 10	0 to 1	
0 to 3			2 to 7	2 to 10	0 to 1	

Variable	Importance	Standard Deviation
Gift Count 36 Months	513.0817	198.2250
Gift Amount Last	190.0454	67.0786
Promotion Count 12 Months	143.0008	4.2109
Age	120.6261	3.8568
Gift Count All Months	116.8713	38.1951
Promotion Count Card 12 Months	86.5615	9.2548
Demographic Cluster	76.4278	5.4818
Status Category Star All Months	61.4338	0.0000
Promotion Count 36 Months	17.3291	0.0000
Promotion Count Card All Months	13.5000	0.0000
Home Owner	12.6389	0.0000
Gender	0.0000	0.0000

Observed Average	Predicted Average	Observations	Percentile
0.7961044987	0.7961044987	5328	5
0.6374695864	0.6374695864	5328	10
0.6241382884	0.6241382884	5328	15
0.5795158243	0.5795158243	5328	20
0.579303675	0.579303675	5328	25
0.5649850143	0.5649850143	5328	30
0.5415075056	0.5415075056	5328	35
0.5073525693	0.5073525693	5328	40
0.4912371134	0.4912371134	5328	45
0.4912371134	0.4912371134	5328	50
0.4912371134	0.4912371134	5328	55
0.4842763336	0.4842763336	5328	60
0.4745762712	0.4745762712	5328	65
0.4577017551	0.4577017551	5328	70
0.4420309788	0.4420309788	5328	75
0.4227944924	0.4227944924	5328	80
0.3641975974	0.3641975974	5328	85
0.3546617916	0.3546617916	5328	90
0.3545422851	0.3545422851	5328	95
0.3407116422	0.3407116422	5314	100

Unused	Observations Used	SSE	Observed Average	ASE
	106,546	25,284.9839	0.7961	0.2373

Description	Value	NK NK
Data Source	SVSO35.PVA	
Response Variable	Status Category 96NK	
Distribution	Binary	
Link Function	Logit	
Optimization Technique	Newton-Raphson with Ridging	
Predicted Response Level	I_va_d_E_Status_Category_96NK	

Description	Value	XK XK
Number of Model Effects	12	
Number of Classification Effects	2	
Number of Columns in X	15	
Rank of Cross-product Matrix	13	
Number of Observations Read	106,546	
Number of Observations Used	80,069	

Ordered Value	Count	Status Category 96NK
1	20031	S
2	60038	NOT S

Iteration	Evaluations	Objective	Change	Max Gradient
0	4	0.335529		0.878485
1	2	0.311277	0.024251	0.589056
2	2	0.303289	0.007988	0.233181
3	2	0.300672	0.002617	0.085371
4	2	0.299752	0.00092	0.031314
5	2	0.299418	0.000334	0.011526
6	2	0.299296	0.000122	0.004241
7	2	0.299251	0.000045	0.00156
8	2	0.299234	0.000017	0.000574
9	2	0.299228	6.075E-6	0.000211
10	2	0.299226	2.235E-6	0.000078
11	2	0.299225	8.221E-7	0.000029
12	2	0.299225	3.024E-7	0.000011

Reason	Status
Convergence criterion (GCONV=1E-6) satisfied.	0

Statistic	Value
-2 Log Likelihood	47917.26
AIC	47943.26
AICC	47943.26
BIC	48064.04
Max-rescaled R-Square	0.606176
R-Square	0.409389

Parameter	Estimate	Standard Error	Chi-Square	Pr > ChiSq
Intercept	-16.3539	8.424493	3.768375	0.05223
Gender F	-0.02889	0.058376	0.244859	0.62072
Gender M	0.030134	0.059089	0.260067	0.61007
Gender U	0			
Home Owner H	-0.07046	0.023619	8.899972	0.00285
Home Owner U	0			
Age	0.003234	0.000681	22.54679	< 0.00001
Gift Amount Last	-0.01888	0.001421	176.6714	< 0.00001
Gift Count 36 Months	0.435021	0.00773	3167.106	< 0.00001
Gift Count All Months	0.064131	0.002464	677.6695	< 0.00001
Promotion Count 36 Months	0.016589	0.004376	14.3744	0.00015
Promotion Count 12 Months	-0.07244	0.005219	192.6773	< 0.00001
Promotion Count Card All Months	0.03384	0.002896	136.5603	< 0.00001
Status Category Star All Months	13.14769	8.423917	2.435964	0.11858
Promotion Count Card 12 Months	0.007901	0.013957	0.320488	0.57131

Effect	DF	Chi-Square	Pr > ChiSq
Gender	2	6.597009	0.03694
Home Owner	1	8.899972	0.00285
Age	1	22.54679	<0.0001
Gift Amount Last	1	176.6714	<0.0001
Gift Count 36 Months	1	3167.106	<0.00001
Gift Count All Months	1	677.6695	<0.0001
Promotion Count 36 Months	1	14.3744	0.00015
Promotion Count 12 Months	1	192.6773	<0.0001
Promotion Count Card All Months	1	136.5603	<0.0001
Status Category Star All Months	1	2.435964	0.11858
Promotion Count Card 12 Months	1	0.320488	0.57131

redicted	Observed	Frequency	Percentage
	S	12,584	62.82%
OT S	S	7,447	37.18%
	NOT S	4,741	7.90%
OT S	NOT S	55,297	92.10%

Percentile	Observations	Events	Model	Best	Cumulative Model	Cumulative Best
5.00	4004	3608	3.6024	3.9978	3.6024	3.9978
10.00	4004	3223	3.2180	3.9978	3.4102	3.9978
15.00	4004	2772	2.7677	3.9978	3.1960	3.9978
20.00	4004	2409	2.4053	3.9978	2.9984	3.9978
25.00	4004	2024	2.0209	3.9978	2.8029	3.9978
30.00	4004	1628	1.6255	0.0110	2.6066	3.3333
35.00	4004	1364	1.3619	0.0000	2.4288	2.8571
40.00	4004	1221	1.2191	0.0000	2.2776	2.5000
45.00	4004	902	0.9006	0.0000	2.1246	2.2222
50.00	4004	495	0.4942	0.0000	1.9616	2.0000
55.00	4004	363	0.3624	0.0000	1.8162	1.8182
60.00	4004	22	0.0220	0.0000	1.6667	1.6667
65.00	4004	0	0.0000	0.0000	1.5385	1.5385
70.00	4004	0	0.0000	0.0000	1.4286	1.4286
75.00	4004	0	0.0000	0.0000	1.3333	1.3333
80.00	4004	0	0.0000	0.0000	1.2500	1.2500
85.00	4004	0	0.0000	0.0000	1.1765	1.1765
90.00	4004	0	0.0000	0.0000	1.1111	1.1111
95.00	4004	0	0.0000	0.0000	1.0526	1.0526
100.00	3993	0	0.0000	0.0000	1.0000	1.0000

1 - Specificity	Sensitivity	Cutoff
1.000	1.0000	0.00
0.407	1.0000	0.01
0.407	1.0000	0.02
0.405	1.0000	0.03
0.404	0.9995	0.04
0.401	0.9989	0.05
0.399	0.9984	0.06
0.397	0.9956	0.07
0.392	0.9956	0.08
0.386	0.9945	0.09
0.382	0.9929	0.10
0.374	0.9907	0.11
0.366	0.9890	0.12
0.355	0.9863	0.13
0.344	0.9824	0.14
0.333	0.9780	0.15
0.323	0.9736	0.16
0.313	0.9692	0.17
0.301	0.9665	0.18
0.292	0.9594	0.19
0.281	0.9550	0.20
0.270	0.9451	0.21
0.261	0.9357	0.22
0.251	0.9275	0.23
0.241	0.9187	0.24
0.231	0.9116	0.25
0.221	0.9001	0.26
0.212	0.8907	0.27
0.203	0.8786	0.28
0.196	0.8655	0.29

1 - Specificity	Sensitivity	Cutoff
0.188	0.8550	0.30
0.179	0.8462	0.31
0.174	0.8375	0.32
0.168	0.8287	0.33
0.162	0.8232	0.34
0.154	0.8111	0.35
0.148	0.7979	0.36
0.141	0.7858	0.37
0.136	0.7732	0.38
0.129	0.7622	0.39
0.123	0.7529	0.40
0.117	0.7403	0.41
0.113	0.7282	0.42
0.108	0.7177	0.43
0.102	0.7062	0.44
0.098	0.6941	0.45
0.095	0.6826	0.46
0.091	0.6722	0.47
0.085	0.6595	0.48
0.082	0.6425	0.49
0.079	0.6282	0.50
0.074	0.6189	0.51
0.071	0.6052	0.52
0.065	0.5953	0.53
0.061	0.5815	0.54
0.059	0.5662	0.55
0.055	0.5546	0.56
0.052	0.5437	0.57
0.050	0.5294	0.58
0.047	0.5173	0.59

1 - Specificity	Sensitivity	Cutoff
0.044	0.5096	0.60
0.042	0.4953	0.61
0.040	0.4794	0.62
0.037	0.4673	0.63
0.036	0.4530	0.64
0.034	0.4454	0.65
0.032	0.4371	0.66
0.031	0.4250	0.67
0.029	0.4135	0.68
0.027	0.4036	0.69
0.025	0.3850	0.70
0.023	0.3690	0.71
0.022	0.3597	0.72
0.020	0.3449	0.73
0.019	0.3328	0.74
0.016	0.3180	0.75
0.016	0.3070	0.76
0.014	0.2921	0.77
0.013	0.2779	0.78
0.012	0.2669	0.79
0.011	0.2565	0.80
0.011	0.2438	0.81
0.010	0.2323	0.82
0.009	0.2191	0.83
0.008	0.2092	0.84
0.008	0.1971	0.85
0.007	0.1851	0.86
0.006	0.1735	0.87
0.006	0.1598	0.88
0.005	0.1455	0.89

Cutoff	Sensitivity	1 - Specificity
0.90	0.1378	0.004
0.91	0.1296	0.004
0.92	0.1175	0.003
0.93	0.1021	0.003
0.94	0.0923	0.003
0.95	0.0791	0.002
0.96	0.0604	0.001
0.97	0.0467	0.001
0.98	0.0302	0.000
0.99	0.0192	0.000

Response	Event	Value	Frequency
Correct	S	True Positive	12,584
Incorrect	S	False Negative	7,447
Correct	NOT S	True Negative	55,297
Incorrect	NOT S	False Positive	4,741

	Misclassification Rate	Misclassification Rate (Event)	C Statistic	FPR	FDR	F1 Score	Lift	Cumulative Lift	Cumulative % Events	XK
0.6809	0.1522			0.079	0.274	0.674	3.602	3.602	90.110	

Cumulative %	C-:			Tau	Observations Used	Unused	
		0.839	0.842	0.315	80,069	26,477	

Importance	Standard Deviation
28.3591	40.7913
22.5858	3.6593
21.1228	19.6069
12.3785	7.6742
12.2413	4.0922
10.7510	3.2165
10.1734	5.9256
8.5025	4.1983
3.5760	2.5120
2.8187	7.8489
2.4360	3.2141
	28.3591 22.5858 21.1228 12.3785 12.2413 10.7510 10.1734 8.5025 3.5760 2.8187

Number of Trees	Average Squared Erron
1	0.2482
2	0.2466
3	0.2452
4	0.2440
5	0.2429
6	0.2421
7	0.2412
8	0.2405
9	0.2399
10	0.2393
11	0.2388
12	0.2383
13	0.2378
14	0.2373
15	0.2369
16	0.2365
17	0.2362
18	0.2359
19	0.2356
20	0.2353
21	0.2349
22	0.2347
23	0.2345
24	0.2342
25	0.2339
26	0.2337
27	0.2334
28	0.2332
29	0.2328
30	0.2326

Average Squared Error	Number of Trees
0.2323	31
0.2321	32
0.2318	33
0.2315	34
0.2313	35
0.2312	36
0.2309	37
0.2306	38
0.2303	39
0.2301	40
0.2298	41
0.2295	42
0.2292	43
0.2290	44
0.2288	45
0.2286	46
0.2283	47
0.2281	48
0.2279	49
0.2276	50

Percentile	Observations	Predicted Average	Observed Average
5	5328	0.7503858148	0.8823198198
10	5328	0.659213642	0.7605105105
15	5328	0.621627683	0.6985735736
20	5328	0.5955580733	0.6428303303
25	5328	0.5743650889	0.6081081081
30	5328	0.5542409343	0.5640015015
35	5328	0.5383316592	0.5137012012
40	5328	0.5251304885	0.5510510511
45	5328	0.5118967949	0.5168918919
50	5328	0.4991116969	0.4694069069
55	5328	0.4856121872	0.4817942943
60	5328	0.4724411	0.4521396396
65	5328	0.4594418311	0.4680930931
70	5328	0.4462713466	0.4279279279
75	5328	0.4333642067	0.4149774775
80	5328	0.4175180482	0.3695570571
85	5328	0.4000291925	0.3286411411
90	5328	0.3823474414	0.3414039039
95	5328	0.360365927	0.2982357357
100	5314	0.3153804667	0.2090703801

Unu	Observations Used	SSE	Observed Average	ASE
	106,546	24,247.7301	0.8823	0.2276

Description	Value
Model	Neural Net
Number of Observations Used	80,069
Number of Observations Read	106546
Target/Response Variable	Target Gift Flag
Number of Neurons	25
Number of Input Neurons	14
Number of Output Neurons	1
Number of Hidden Neurons	10
Number of Hidden Layers	1
Number of Weight Parameters	150
Number of Bias Parameters	11
Architecture	MLP
Number of Neural Nets	1
Objective Value	0.12513

Iterations	Objective	Loss
1	1.0877	0.5825
2	0.7269	0.2255
3	0.6976	0.1990
4	0.6339	0.1509
5	0.6129	0.1434
6	0.5322	0.1304
7	0.4236	0.1515
8	0.3765	0.1546
9	0.3505	0.1661
10	0.3217	0.1307
11	0.3017	0.1286
12	0.2671	0.1253
13	0.2310	0.1330
14	0.2124	0.1283
15	0.2012	0.1298
16	0.1840	0.1241
17	0.1712	0.1247
18	0.1603	0.1245
19	0.1496	0.1247
20	0.1400	0.1256
21	0.1357	0.1265
22	0.1318	0.1263
23	0.1299	0.1256
24	0.1285	0.1254
25	0.1279	0.1254
26	0.1272	0.1253
27	0.1264	0.1252
28	0.1262	0.1252
29	0.1260	0.1252
30	0.1258	0.1252

Iterations	Objective	Loss
31	0.1256	0.1252
32	0.1255	0.1252
33	0.1255	0.1252
34	0.1254	0.1252
35	0.1253	0.1252
36	0.1253	0.1252
37	0.1253	0.1252
38	0.1253	0.1252
39	0.1252	0.1252
40	0.1252	0.1251
41	0.1252	0.1251
42	0.1252	0.1251
43	0.1252	0.1251
44	0.1251	0.1251
45	0.1251	0.1251
46	0.1251	0.1251

Neural network - Target Gift Flag 1 Supplement 3

Reason

The optimization achieved the desired objective value.

Observed Average	Predicted Average	Observations	Percentile
0.5	0.518186411	4004	5
0.4615384615	0.518186405	4004	10
0.4807692308	0.5181864021	4004	15
0.4752747253	0.5181863992	4004	20
0.5068870523	0.5181863966	3993	25
0.4712328767	0.5181863944	4015	30
0.5424657534	0.5181863923	4015	35
0.5316804408	0.5181863907	3993	40
0.5164835165	0.5181863891	4004	45
0.510989011	0.5181863877	4004	50
0.5302197802	0.5181863862	4004	55
0.4725274725	0.5181863848	4004	60
0.5137362637	0.5181863832	4004	65
0.5	0.5181863814	4004	70
0.4945054945	0.5181863794	4004	75
0.5082417582	0.5181863772	4004	80
0.5164835165	0.5181863749	4004	85
0.478021978	0.5181863727	4004	90
0.5604395604	0.5181863704	4004	95
0.5371900826	0.5181863661	3993	100

Unus	Observations Used	SSE	Observed Average	ASE
26,4	80,069	20,027.9284	0.5000	0.2501

Selected	Model	Visualization Type	Number Of Observations	Percentile	Prediction cutoff	C Statistic	X
No	Logistic regression - Demographic Cluster 1	Logistic Regression	80,069	5	0.5	0.648	
Yes	Gradient boosting - Demographic Cluster 1	Gradient Boosting	106,546	5	0.5	0.924	
No	Neural network - Demographic Cluster 1	Neural Network	80,069	5	0.5	0.500	
. 10	read in the work Demographic claster i	reardirection	00,007	0	0.0	0.000	

Lift	KS (Youden)	Gini	Gamma	Gain	FPR	FDR	F1 Score	Cumulative Lift	Cumulative % Events	Cumulative % Captured
3.2727	0.215	0.296	0.396	2.273	0.000		0.000	3.2727	4.945	16.364
13.4177	0.684	0.848	0.904	12.418	0.000	0.000	0.061	13.4177	21.884	67.089
1.0909	0.000	0.000		0.091	0.000		0.000	1.0909	1.648	5.455

	Model	comparison	1	Supplement 1
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Misclassification Rate (Event)	Tau
0.015	0.009
0.016	0.027
0.015	0.000

Model comparison 1 Supplement 2			
Neural network - Demographic Cluster 1 Importance			וע ות