Various Exploratory & other studies through Rattle

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Summary of the Multinomial Regression model (built using multinom):

Call:

multinom(formula = CustServ.Calls ~ ., data = crs$dataset[crs$train,

c(crs$input, crs$target)], trace = FALSE, maxit = 1000)

n=2333

Coefficients:

	(Intercept)	Account.Length	VMail.Message	Day.Mins	Eve.Mins	Night.Mins	Intl.Mins
1	1.7174951	-0.0002073348	0.001691133	4.9469024	-0.10225138	0.2264159	-2.7339118
2	0.9025520	-0.0018330642	0.010517486	0.9935579	-0.64541161	0.4752644	-2.3290208
3	0.4651127	0.0003766296	0.021861280	5.9213133	-1.08489141	0.5236462	0.9840321
4	-0.2324683	-0.0004345877	0.020225855	2.3003790	1.24349716	1.4973822	-13.4879556
5	3.5054215	-0.0026132744	-0.031569226	-9.1409862	0.55459025	-4.6601567	-12.4612558
6	-67.5501346	-0.0062816294	0.079003761	9.4690457	-5.07410382	-2.1406764	-15.0483685
7	-145.3707694	0.3249832821	6.172524578	1.6917353	0.72906234	0.7859022	-1.1878160
8	-116.5048038	-0.1010146107	3.046893387	0.1079611	0.03871748	-0.3427917	-2.0818858
9	-71.1203556	0.0002323310	-3.307115496	-0.2122298	-0.61647088	0.7899313	1.0617690

	Churn	Int.l.Plan	VMail.Plan	Day.Calls	Day.Charge	Eve.Calls	Eve.Charge
1	-0.07953821	-0.2949223	-0.03053733	0.0020190922	-29.1050588	0.0001021566	1.2025946
2	0.24850880	-0.6847256	-0.32687304	-0.0019498547	-5.8539147	0.0017489426	7.5891566
3	-0.12159971	-0.5176210	-1.06120488	-0.0004137456	-34.8291450	-0.0033660031	12.7410907
4	2.18647815	-0.5993560	-0.37943221	0.0036114079	-13.5539910	0.0035980393	-14.6439823
5	3.97169003	-2.0744313	0.95884496	-0.0101226789	53.6990519	0.0023979730	-6.5799203

6	3.67779762	-111.2109882	-0.82940454	-0.0018549431	-55.7737525	-0.0211286325	59.6860194
7	49.26536931	-9.2047324	-210.73375680	-0.2911854206	-11.6154789	0.4107829220	-6.0170052
8	-22.45887292	-40.8842280	-81.67689486	0.2290708919	0.3270394	-0.2789783078	0.3444265
9	34.73584308	9.8285288	97.58437439	0.7313746396	1.4710336	0.2300812346	4.2210108

	Night.Calls	Night.Charge	Intl.Calls	Intl.Charge	StateAL	StateAR	StateAZ
1	0.0007471414	-5.053951	0.025261441	10.000585	-0.42964514	-0.6716540180	-0.7632014
2	0.0064274904	-10.608330	0.007361663	8.550461	-0.10260100	0.3520341375	-0.3810947
3	-0.0008540287	-11.660293	0.030542173	-3.742693	-0.58530452	-0.4105154747	-0.9471705
4	-0.0037573754	-33.357294	0.032705303	49.689614	0.09345191	0.3740269668	0.6073499
5	-0.0067051610	103.345572	0.052600281	46.189597	1.66321297	1.5313284448	-95.0476569
6	-0.0102381964	47.501133	-0.225107296	55.757161	-30.24527889	69.7866979150	-28.9636831
7	0.7739854476	-13.384460	3.102733987	-14.283941	39.93078534	-9.5075207329	10.0191316
8	-0.2021614173	3.920641	2.745190793	-4.472463	-3.95826800	-27.6196310545	2.1646287
9	0.2146727925	-14.101126	-4.532196641	-2.051728	7.07568383	0.0009549334	0.9925651

	StateCA	StateCO	StateCT	StateDC	StateDE	StateFL	StateGA
1	-0.7978965	0.1434548	-0.2969325	-0.2974990	-0.4029092	-0.58881009	0.004822069
2	-0.3966794	-0.1639379	0.1013974	-0.6662818	0.2806752	-0.89634213	0.481622639
3	-2.2974547	-0.1016537	-0.8222186	-2.0130531	-1.3696304	-0.56156945	-0.181999839
4	-0.1874523	0.3914958	0.5495261	-0.1129899	0.4477417	0.13439399	1.212806628
5	0.1323399	0.4905419	-125.1877042	-0.2136141	0.5769369	0.01697681	-73.091579570
6	-41.4205672	69.9197815	-28.6825516	-30.3599823	-19.2832842	-52.70823406	-6.256873864
7	-11.2742395	-18.8078420	12.8675051	13.3761175	10.9984391	-18.65642743	19.153759009
8	-13.3151875	1.7039386	-2.1168581	0.5108310	-0.4593843	-14.99922760	1.356028099
9	-19.6240113	-25.8854424	-3.2769244	-11.3590416	14.4477954	7.75029578	-45.669650731

	StateHI	StateIA	StateID	StateIL	StateIN	StateKS	StateKY
1	-0.4575285	-0.1616992	-0.67640122	-0.2401671	-0.03842128	0.158900434	-0.24427923
2	-0.1579745	-0.3539358	-0.07188173	-1.0484508	-0.19365567	0.004297796	-0.05017304
3	-2.4860193	-2.2629393	-0.71658843	-1.5378266	-0.43091582	-0.277405994	-1.13469478
4	-108.7594690	0.6396499	0.38306413	-125.8583719	1.00651721	0.450767136	-0.58540446
5	-91.6263793	1.6622917	-122.88229702	-97.4429467	0.68662232	-115.177642349	0.93636724
6	-24.6985529	-17.2427897	70.38188805	-17.4026951	-30.08052328	-31.001508853	68.78766058

7	44.9866268	9.8229762	-12.65847918	-4.1707942	-2.73169203	17.547816615	-0.17248978
8	-1.4188170	-5.0597266	-4.25597802	-9.8162316	-6.88600086	1.637458430	11.98028619
9	-5.0154178	2.0119941	-0.86770265	-16.8546691	0.47028536	-6.245777599	-5.29830370

	StateLA	StateMA	StateMD	StateME	StateMI	StateMN	StateMO
1	-0.1843728	-0.72595785	-0.67093755	-0.9033239	-0.3888301	-0.22112591	-0.1714332
2	-0.5737889	-0.34298051	-0.84787191	0.3882893	-0.4513386	0.03444821	0.1786384
3	-0.6326427	-0.85737618	-0.28687798	-1.1574460	-0.4395690	-0.98288128	-0.6263743
4	0.3246957	-0.84677919	0.39873494	0.8074682	-138.3115008	-134.12954350	0.1113955
5	-96.5904177	-113.85202786	0.07902186	-118.0138871	-0.2734926	0.62261800	1.2984745
6	69.8790421	-23.62986152	-27.21564513	-36.1233111	69.0637806	68.60123072	-35.6958991
7	2.1010817	-3.79726941	-8.81864880	4.4894266	19.0755184	12.79687266	-22.6889675
8	-4.1185492	-5.58141026	0.10945895	-3.5594052	2.9189742	8.99542296	-28.8542860
9	3.3202842	0.01150029	-6.28210807	-15.1605827	0.2281907	19.42259890	1.6824855

	StateMS	StateMT	StateNC	StateND	StateNE	StateNH	StateNJ
1	0.37718777	0.39793489	-0.3262828	1.25018565	-0.7988006	-0.1403191	-0.52053310
2	0.65466578	0.04922969	0.4519165	1.23278588	-0.6753224	0.3762929	0.04072129
3	-0.77637813	-0.61842319	-1.6214289	0.06180439	-0.6303322	-2.3339461	-0.95227869
4	0.49981425	0.98008591	-0.5801298	-97.59586423	0.1550529	0.5080007	-0.35886721
5	-0.08764253	-146.13566884	1.7182628	-72.77241234	-98.5255882	0.3562739	0.26618808
6	68.72183506	-58.47498893	-29.7223518	-22.03374160	69.8850020	-33.5338007	-30.70406428
7	-11.48962818	-0.04406371	-13.0417185	-26.91702136	1.3627099	-26.2868366	3.35307407
8	2.85870730	5.59610417	0.4041235	10.60093615	5.8788002	-0.9254067	-9.03579414
9	-3.64568600	2.56386931	-5.3679918	14.29070955	2.6550529	-1.4242915	22.03892128

	StateNM	StateNV	StateNY	StateOH	StateOK	StateOR	StatePA
1	0.45376013	0.27275049	-0.4908061	-1.1006945	-0.2006944	-0.4688542	-0.2756905
2	0.66279100	0.69088353	-0.1066901	-0.2227711	-0.1809547	0.3536458	-1.5916541
3	-0.07212559	-0.09329353	-0.9052029	-2.4437819	0.0318598	-0.6485398	-1.0283934
4	0.18181714	-97.61651831	-0.1215401	-0.1147413	0.4297209	0.4351254	-0.1328598
5	1.49619354	0.93113187	-0.2214521	-116.2735215	0.2082205	1.0258497	-115.4143749
6	-16.51866568	-26.66753581	69.7934314	-20.6858778	-23.1757133	69.5066237	-58.6958329
7	3.07215873	-0.81835339	-3.5604755	2.4559434	-3.5593111	-7.4329852	-34.3376113

8 7.72500460 -1.30856427 -0.1037767 -1.8963688 -1.1966504 -5.2490212 -10.7881482

9 -11.48023792 -4.62539183 -1.7428269 6.0010681 4.2872520 -9.4547505 -11.4191816

StateRI StateSC StateSD StateTN StateTX StateUT StateVA

1 -0.8631727 -0.7427528 -0.45006557 0.2288792 -0.7186157 -0.2614154 -0.64246662

2 -0.5406943 0.1341436 -0.01605315 -0.6345547 -0.7378131 -0.5551481 0.07193204

3 -0.9997579 -1.8861735 -0.87981942 -0.5323949 -1.3425087 -1.2141661 -0.75528417

4 0.6988940 0.2287809 -113.76419092 0.6066932 0.1625652 -129.1507592 -0.55981361

5 -131.5552012 -117.6934909 -88.04817253 -94.3657723 -114.1034793 -0.1805105 2.38733020

6 -24.9103719 -43.2669873 -56.00479499 68.5594783 -35.9856979 68.3225517 -26.14829150

7 -21.6449657 -9.6841713 -45.23120170 19.8990520 -17.0142517 -28.3080448 -2.13883356

8 9.5535837 35.9216647 -8.35992715 14.0993352 -2.3753205 -14.3921229 -1.10794764

9 -10.1655965 -2.0638767 10.57026329 9.5783471 -3.7654539 9.1336954 7.19272489

StateVT StateWA StateWI StateWV StateWY Area.Code

1 -0.14052237 -0.6894722 0.06924695 0.5989910 -0.4438284 -0.00117993487

2 -0.24064172 -0.1216489 0.08699473 0.4520604 -0.5525711 -0.00052787353

3 -0.96341142 -1.1189534 -1.29404173 -0.4017963 -0.9894524 0.00243597394

4 0.67021970 -0.4673353 -0.63725063 0.5213509 0.2027271 -0.00003775782

5 1.69859106 -0.5463301 0.93229264 1.4247202 0.9819430 -0.00307247527

6 70.23953141 68.6648556 69.93882635 -47.2211535 -30.5474044 0.00425588348

7 17.49347297 -12.5588001 39.19349094 -16.0485157 -22.9322687 -0.16584088115

8 -0.04406534 0.4074805 -5.27945976 -15.0771973 -4.5709547 0.17058075798

9 17.69927795 -3.2515088 4.21235729 -6.5209359 6.0876037 -0.26972965836

Std. Errors:

(Intercept) Account.Length VMail.Message Day.Mins Eve.Mins

1 0.033768881962965 0.00143102695806 0.01081991331542 0.0010610557302 0.0010887125872

2 0.036959786610747 0.00157925971075 0.01233255660725 0.0011714408642 0.0012140684996

3 0.030296427472113 0.00186872862998 0.00907268027536 0.0014018466537 0.0014316101866

4 0.022119832821538 0.00272776368864 0.00814160004930 0.0017736248742 0.0020735827819

5 0.008447570874858 0.00441850843685 0.01354805108979 0.0026447707747 0.0032952195268

6 0.002344223665467 0.00643366636778 0.01695427549562 0.0044143942476 0.0052166966284

7 0.000550480181673 0.24343078190697 0.39707144991789 0.1400623314982 0.1634627575267

8 0.000000000885313 0.00000007346384 0.00000003440756 0.0000002158062 0.0000001902035

9 0.000000422039481 0.00003476629737 0.00000733754850 0.0001003971381 0.0000681128584

	Night.Mins	Intl.Mins	Churn	Int.l.Plan	VMail.Plan	Day.Calls
1	0.0010967974580	0.018859020764396	1.830620e-01	1.832829e-01	3.191639e-01	0.0027521640473
2	0.0012147967372	0.020938784927278	1.978366e-01	2.210957e-01	3.677660e-01	0.0030506860919
3	0.0014325969474	0.024651063579934	2.502394e-01	2.641167e-01	2.354922e-01	0.0036417076808
4	0.0021192920307	0.035918734791697	2.495827e-01	3.238705e-01	7.824650e-02	0.0052057999468
5	0.0033144482439	0.058857569636289	3.250194e-01	2.537574e-01	2.820121e-02	0.0076873480452
6	0.0052170007009	0.087213351362719	2.859447e-01	7.136789e-24	1.458859e-02	0.0122854544775
7	0.1635955196941	0.026633933273983	6.300122e-03	2.948683e-03	9.430576e-03	0.3474466287931
8	0.0000001579381	0.000000009343033	7.327192e-20	1.138985e-20	8.852619e-10	0.0000001080032
9	0.0001081933165	0.000004756136016	8.351503e-08	7.278955e-08	3.475827e-07	0.0000560049036

	Day.Charge	Eve.Calls	Eve.Charge	Night.Calls	Night.Charge
1	0.00093045596609	0.00278070443613	0.00097571000042	0.00278853068646	0.000835067948548
2	0.00107110855169	0.00306659290990	0.00107186242316	0.00310107699721	0.000888693721279
3	0.00084883639092	0.00362662077464	0.00088650762090	0.00365474348162	0.000816905305774
4	0.00067468468527	0.00526726742230	0.00071426176131	0.00530362059703	0.000696748440808
5	0.00057143566632	0.00842136537485	0.00038607965277	0.00819298052818	0.000269992312300
6	0.00076131428409	0.01233732861292	0.00045359668424	0.01204233750102	0.000263591790821
7	0.02380542647647	0.31227709308778	0.01389969679392	0.39187824780549	0.007353436177916

8 0.00000003668544 0.00000008230439 0.00000001616815 0.00000008188292 0.000000007108482

9 0.00001706764393 0.00004433572627 0.00000578877554 0.00004035583233 0.000004867975858

	Intl.Calls	Intl.Charge	StateAL	StateAR	StateAZ	StateCA
1	0.023853599892098	0.005188577516784	3.147082e-01	2.818712e-01	3.205608e-01	4.154343e-01
2	0.026617736804001	0.005755004423380	3.511110e-01	2.707359e-01	3.491259e-01	4.497553e-01
3	0.030771619458891	0.006730053908738	3.852152e-01	2.689977e-01	3.912041e-01	6.828024e-02
4	0.044523673835662	0.009774780809218	1.546742e-01	3.583108e-02	3.309095e-01	1.726927e-01
5	0.065240705668384	0.015902573070613	1.219719e-01	2.576301e-02	3.750360e-22	7.152552e-02
6	0.142110032893661	0.023554498535763	NaN	9.408155e-03	NaN	NaN
7	0.033681716059230	0.007167176672366	2.548113e-03	1.006357e-07	1.341013e-09	1.401453e-06
8	0.000000004766828	0.000000002523332	2.238902e-21	5.639639e-13	4.010660e-21	4.735855e-24
9	0.000001503501078	0.000001285184616	2.405896e-07	2.332587e-08	1.051712e-12	1.448854e-21

	StateCO	StateCT	StateDC	StateDE	StateFL	StateGA	StateHI
1	2.435338e-01	2.889284e-01	3.095726e-01	3.225432e-01	3.055577e-01	2.966055e-01	3.987580e-01
2	2.731049e-01	3.085492e-01	4.175440e-01	3.233566e-01	4.052054e-01	3.102414e-01	4.427408e-01
3	2.766890e-01	3.907582e-01	1.082978e-01	1.597408e-01	3.636440e-01	3.063299e-01	1.007135e-01
4	2.760510e-02	3.141951e-01	9.786709e-02	1.223963e-01	2.803283e-01	2.082024e-01	NaN
5	7.262362e-03	1.155060e-22	2.901950e-02	2.466669e-02	2.004700e-02	NaN	3.019177e-23
6	1.669837e-02	8.752537e-25	NaN	NaN	NaN	3.619940e-25	5.246475e-25
7	4.275087e-06	1.316015e-08	6.276020e-07	3.669736e-07	1.472460e-07	4.271229e-05	6.194218e-03
8	4.599244e-18	3.388781e-14	4.253646e-29	4.862064e-22	3.038937e-12	1.644087e-19	1.008518e-13

9 3.799422e-11 1.629198e-13 2.224758e-10 2.183557e-17 3.404622e-13 3.762390e-17 1.592627e-13

StateIA StateID StateIL StateIN StateKS StateKY StateLA

1 3.581315e-01 3.061559e-01 2.970208e-01 2.655213e-01 2.854464e-01 2.856025e-01 2.563513e-01

2 4.474798e-01 3.192895e-01 4.288191e-01 3.333409e-01 3.545854e-01 3.194246e-01 2.870626e-01

3 6.740495e-02 3.719969e-01 3.135615e-01 3.364840e-01 3.711157e-01 2.132149e-01 2.981790e-01

4 1.927884e-01 2.410179e-01 NaN 3.453093e-01 3.577210e-01 2.207658e-02 3.936859e-02

5 6.419490e-02 3.319618e-21 6.304692e-22 1.393010e-02 2.783281e-22 4.190299e-02 5.678785e-22

6 9.922863e-25 8.055471e-02 NaN NaN NaN 2.578228e-02 1.297180e-02

7 5.611527e-15 2.751615e-04 5.942844e-04 6.986486e-05 1.196444e-05 3.839901e-08 1.743764e-06

8 2.278211e-22 7.795723e-17 3.108008e-32 9.998435e-17 1.585502e-20 2.023947e-19 6.586623e-23

9 1.769581e-09 5.056598e-09 2.779366e-15 3.396973e-18 1.696391e-15 3.214111e-13 1.378627e-15

StateMA StateMD StateME StateMI StateMN StateMO StateMS

1 2.584600e-01 2.817322e-01 3.219294e-01 2.332824e-01 3.091745e-01 2.593973e-01 2.658976e-01

2 2.736535e-01 3.447666e-01 2.721050e-01 2.517470e-01 3.399802e-01 2.806370e-01 2.908942e-01

3 2.554262e-01 2.936854e-01 3.589680e-01 2.519594e-01 4.413351e-01 2.580097e-01 2.134372e-01

4 1.319237e-02 3.300124e-01 3.681952e-01 6.845535e-17 1.174004e-16 6.476571e-02 1.342259e-01

5 9.402864e-22 1.304624e-02 NaN 1.586011e-02 1.420056e-01 5.041145e-02 1.992252e-02

6 NaN NaN NaN 1.201525e-02 4.365584e-02 8.106407e-26 2.364875e-02

7 3.332151e-06 4.056201e-09 1.041076e-04 4.139578e-03 2.769589e-07 2.451277e-04 6.786971e-05

8 1.172178e-25 1.054543e-21 2.196766e-24 1.887357e-21 6.453565e-11 1.012218e-14 6.345018e-10

9 1.015040e-10 1.944984e-09 3.642104e-11 2.946165e-08 2.606208e-08 4.497641e-15 4.473617e-15

	StateMT	StateNC	StateND	StateNE	StateNH	StateNJ	StateNM
1	2.513538e-01	3.554221e-01	2.490370e-01	3.242311e-01	3.235880e-01	2.852634e-01	2.649258e-01
2	3.165287e-01	3.496531e-01	2.828164e-01	3.693971e-01	3.387437e-01	2.925277e-01	2.937223e-01
3	3.677344e-01	1.411047e-01	3.214956e-01	3.604264e-01	4.489417e-02	2.396620e-01	2.923878e-01
4	3.699327e-01	4.484340e-02	1.858864e-17	1.615191e-01	2.000011e-01	4.794702e-02	1.736300e-02
5	NaN	9.403677e-02	NaN	NaN	3.022987e-02	1.715309e-02	1.687300e-02
6	NaN	1.145104e-25	5.118683e-26	6.793497e-02	9.898763e-26	4.329690e-26	9.959899e-27
7	1.070280e-10	5.556035e-04	4.523867e-10	3.898237e-04	8.844325e-12	2.661512e-04	1.454689e-11
8	1.739613e-20	1.166405e-16	1.291475e-16	6.300668e-24	1.394129e-12	3.266339e-13	2.192572e-13
9	2.734597e-17	3.233843e-14	6.682002e-13	2.763425e-13	6.749335e-14	1.116386e-08	2.317056e-13

	StateNV	StateNY	StateOH	StateOK	StateOR	StatePA	StateRI
1	2.341368e-01	3.028125e-01	3.199956e-01	3.032999e-01	3.140902e-01	3.187462e-01	2.757180e-01
2	2.472600e-01	3.269725e-01	3.039434e-01	3.570566e-01	2.995874e-01	4.772400e-02	3.108335e-01
3	2.584019e-01	3.560849e-01	5.832295e-02	3.302945e-01	3.866559e-01	1.291382e-01	3.401664e-01
4	6.110945e-17	1.304877e-01	9.304444e-02	3.407061e-01	2.679326e-01	4.384108e-02	3.077751e-01
5	1.604258e-02	2.783001e-02	8.443036e-22	1.680270e-02	7.132700e-02	8.903373e-23	1.518645e-22
6	1.407420e-26	7.269799e-02	3.512150e-26	NaN	2.611000e-02	2.227769e-26	2.420648e-26
7	8.834225e-10	5.371705e-09	5.655214e-03	9.331369e-06	9.991009e-05	1.152899e-17	3.134569e-04
8	1.804221e-18	2.556690e-20	2.484270e-15	4.217747e-16	1.499333e-11	1.241769e-18	5.240995e-19
9	1.288840e-15	1.751174e-11	1.436281e-09	3.892638e-18	1.362435e-08	4.534329e-14	3.500670e-08

	StateSC	StateSD	StateTN	StateTX	StateUT	StateVA	StateVT

1 3.329607e-01 2.783570e-01 2.795659e-01 3.050356e-01 2.560573e-01 3.170503e-01 2.911162e-01

2 3.124110e-01 2.947683e-01 3.214303e-01 3.649864e-01 3.165413e-01 3.236430e-01 3.654285e-01

3 7.798325e-02 2.760697e-01 3.589428e-01 3.968848e-01 2.544836e-01 3.870414e-01 4.118350e-01

4 2.017027e-01 3.556510e-18 3.922504e-02 3.838187e-01 NaN 4.026483e-02 3.138813e-01

5 3.626948e-22 6.939177e-22 NaN NaN 1.709369e-02 2.405959e-01 5.194352e-02

6 1.145382e-26 NaN 2.122184e-02 NaN 2.400971e-02 NaN 4.447819e-02

7 4.089355e-04 1.285790e-04 2.622342e-05 1.535924e-04 5.268638e-05 1.454270e-04 5.622239e-03

8 3.131129e-12 1.605212e-20 7.330141e-19 6.931642e-22 2.685259e-12 3.151299e-10 1.003044e-18

9 6.662070e-17 1.962796e-15 4.991309e-21 8.764724e-21 5.380646e-10 1.836243e-14 3.553440e-13

	StateWA	StateWI	StateWV	StateWY	Area.Code
1	3.354110e-01	2.610516e-01	2.532299e-01	2.816310e-01	0.0010360406913
2	3.409879e-01	3.080274e-01	3.011117e-01	3.594796e-01	0.0011487380003
3	4.455249e-01	1.904866e-01	3.675582e-01	3.906772e-01	0.0013225935365
4	1.745327e-01	2.314042e-02	2.539297e-01	2.434819e-01	0.0018993212563
5	3.884583e-02	2.355077e-02	1.115826e-01	5.896955e-02	0.0028295117483
6	3.790905e-02	2.538530e-02	NaN	NaN	0.0043502379395
7	1.615486e-05	2.878142e-05	2.961145e-03	5.257284e-06	0.1271103473297
8	6.712211e-20	4.494248e-20	4.513685e-10	1.598172e-19	0.0000004393837
9	1.161270e-19	1.795717e-09	6.468682e-08	1.839370e-10	0.0001783001349

Value/SE (Wald statistics):

	(Intercept)	Account.Length	VMail.Message	Day.Mins	Eve.Mins	Night.Mins
1	5.086029e+01	-0.1448853	0.1562982	4662.24558	-93.919531	206.433632
2	2.441984e+01	-1.1607111	0.8528228	848.15031	-531.610538	391.229583
3	1.535206e+01	0.2015432	2.4095724	4223.93795	-757.812022	365.522350
4	-1.050950e+01	-0.1593201	2.4842604	1296.99297	599.685322	706.548314
5	4.149621e+02	-0.5914381	-2.3301673	-3456.24893	168.301457	-1406.012823

6 -2.881557e+04 -0.9763685 4.6598134 2145.03853 -972.666072 -410.327030

7 -2.640799e+05 1.3350131 15.5451231 12.07845 4.460113 4.803935

8 -1.315973e+11 -1375024.9342949 88553018.8217174 500268.84424 203558.211371 -2170418.346721

9 -1.685159e+08 6.6826514 -450711.2283378 -2113.90263 -9050.726965 7301.109732

	Intl.Mins	Churn	Int.l.Plan	VMail.Plan	Day.Calls	Day.Charge
1	-144.96573	-4.344878e-01	-1.609110e+00	-9.567913e-02	0.7336380	-31280.4258
2	-111.22999	1.256131e+00	-3.096965e+00	-8.888072e-01	-0.6391529	-5465.2861
3	39.91845	-4.859334e-01	-1.959819e+00	-4.506327e+00	-0.1136131	-41031.6350
4	-375.51310	8.760534e+00	-1.850604e+00	-4.849191e+00	0.6937278	-20089.3711
5	-211.71883	1.221985e+01	-8.174860e+00	3.400014e+01	-1.3167973	93972.1740
6	-172.54661	1.286192e+01	-1.558278e+25	-5.685296e+01	-0.1509869	-73259.8267
7	-44.59785	7.819749e+03	-3.121642e+03	-2.234580e+04	-0.8380724	-487.9341
8	-222827619.90229	-3.065141e+20	-3.589533e+21	-9.226297e+10	2120963.1906104	8914690.9594
9	223241.92837	4.159233e+08	1.350266e+08	2.807516e+08	13059.1179116	86188.4378

	Eve.Calls	Eve.Charge	Night.Calls	Night.Charge	Intl.Calls
1	0.03673767	1232.5329	0.2679337	-6052.143	1.0590201
2	0.57032108	7080.3458	2.0726639	-11936.992	0.2765698
3	-0.92813759	14372.2292	-0.2336768	-14273.739	0.9925436
4	0.68309411	-20502.2627	-0.7084548	-47875.664	0.7345598
5	0.28474872	-17042.9088	-0.8184031	382772.275	0.8062494
6	-1.71257759	131583.8971	-0.8501835	180207.179	-1.5840352
7	1.31544366	-432.8875	1.9750661	-1820.164	92.1192371
8	-3389591.98188584	21302778.7606	-2468908.3776622	551544097.335	575894601.6893122
9	5189.52217545	729171.6170	5319.4985737	-2896712.469	-3014428.5932726

	Intl.Charge	StateAL	StateAR	StateAZ	StateCA	StateCO
1	1927.4232	-1.365217e+00	-2.382840e+00	-2.380832e+00	-1.920632e+00	5.890552e-01
2	1485.7436	-2.922181e-01	1.300286e+00	-1.091568e+00	-8.819894e-01	-6.002745e-01
3	-556.1163	-1.519422e+00	-1.526093e+00	-2.421167e+00	-3.364743e+01	-3.673931e-01
4	5083.4505	6.041856e-01	1.043862e+01	1.835396e+00	-1.085468e+00	1.418201e+01
5	2904.5360	1.363603e+01	5.943904e+01	-2.534361e+23	1.850247e+00	6.754577e+01

6 2367.1555 NaN 7.417681e+03 NaN NaN 4.187222e+03

7 -1992.9662 1.567073e+04 -9.447466e+07 7.471318e+09 -8.044676e+06 -4.399406e+06

8 -1772443605.3338 -1.767951e+21 -4.897411e+13 5.397189e+20 -2.811570e+24 3.704823e+17

9 -1596445.9134 2.940977e+07 4.093882e+04 9.437611e+11 -1.354450e+22 -6.812996e+11

StateCT StateDC StateDE StateFL StateGA StateHI

1 -1.027703e+00 -9.609990e-01 -1.249164e+00 -1.927002e+00 1.625752e-02 -1.147384e+00

2 3.286262e-01 -1.595716e+00 8.680052e-01 -2.212069e+00 1.552413e+00 -3.568104e-01

3 -2.104162e+00 -1.858813e+01 -8.574080e+00 -1.544284e+00 -5.941302e-01 -2.468406e+01

4 1.748996e+00 -1.154524e+00 3.658132e+00 4.794163e-01 5.825132e+00 NaN

5 -1.083819e+24 -7.361053e+00 2.338932e+01 8.468504e-01 NaN -3.034813e+24

6 -3.277056e+25 NaN NaN NaN -1.728447e+25 -4.707647e+25

7 9.777630e+08 2.131306e+07 2.997065e+07 -1.267024e+08 4.484368e+05 7.262680e+03

8 -6.246666e+13 1.200925e+28 -9.448340e+20 -4.935682e+12 8.247907e+18 -1.406834e+13

9 -2.011372e+13 -5.105742e+10 6.616633e+17 2.276404e+13 -1.213847e+18 -3.149147e+13

StateIA StateID StateIL StateIN StateKS StateKY

1 -4.515077e-01 -2.209336e+00 -8.085870e-01 -1.447013e-01 5.566735e-01 -8.553119e-01

2 -7.909538e-01 -2.251302e-01 -2.444972e+00 -5.809538e-01 1.212062e-02 -1.570732e-01

3 -3.357230e+01 -1.926329e+00 -4.904387e+00 -1.280643e+00 -7.474920e-01 -5.321836e+00

4 3.317886e+00 1.589360e+00 NaN 2.914828e+00 1.260108e+00 -2.651699e+01

5 2.589445e+01 -3.701700e+22 -1.545562e+23 4.929054e+01 -4.138197e+23 2.234607e+01

6 -1.737683e+25 8.737154e+02 NaN NaN NaN 2.668020e+03

7 1.750500e+15 -4.600382e+04 -7.018179e+03 -3.909966e+04 1.466665e+06 -4.492038e+06

8 -2.220921e+22 -5.459376e+16 -3.158368e+32 -6.887079e+16 1.032770e+20 5.919268e+19

9 1.136989e+09 -1.715981e+08 -6.064215e+15 1.384425e+17 -3.681803e+15 -1.648451e+13

StateLA StateMA StateMD StateME StateMI StateMN

1 -7.192194e-01 -2.808782e+00 -2.381473e+00 -2.805969e+00 -1.666779e+00 -7.152139e-01

2 -1.998828e+00 -1.253339e+00 -2.459263e+00 1.426983e+00 -1.792826e+00 1.013242e-01

3 -2.121688e+00 -3.356650e+00 -9.768208e-01 -3.224371e+00 -1.744603e+00 -2.227063e+00

4 8.247582e+00 -6.418702e+01 1.208242e+00 2.193044e+00 -2.020463e+18 -1.142496e+18

5 -1.700899e+23 -1.210823e+23 6.057060e+00 NaN -1.724405e+01 4.384462e+00

6 5.386997e+03 NaN NaN NaN 5.748011e+03 1.571410e+03

7 1.204912e+06 -1.139585e+06 -2.174116e+09 4.312295e+04 4.608083e+03 4.620496e+07

8 -6.252900e+22 -4.761574e+25 1.037975e+20 -1.620293e+24 1.546593e+21 1.393869e+11

9 2.408400e+15 1.132989e+08 -3.229903e+09 -4.162589e+11 7.745348e+06 7.452435e+08

	StateMO	StateMS	StateMT	StateNC	StateND	StateNE
1	-6.608906e-01	1.418545e+00	1.583167e+00	-9.180152e-01	5.020080e+00	-2.463677e+00
2	6.365460e-01	2.250529e+00	1.555299e-01	1.292471e+00	4.358962e+00	-1.828174e+00
3	-2.427716e+00	-3.637502e+00	-1.681712e+00	-1.149097e+01	1.922402e-01	-1.748851e+00
4	1.719977e+00	3.723680e+00	2.649363e+00	-1.293679e+01	-5.250296e+18	9.599663e-01
5	2.575753e+01	-4.399170e+00	NaN	1.827224e+01	NaN	NaN
6	-4.403418e+26	2.905939e+03	NaN	-2.595603e+26	-4.304572e+26	1.028704e+03
7	-9.255979e+04	-1.692895e+05	-4.117024e+08	-2.347307e+04	-5.950003e+10	3.495709e+03
8	-2.850599e+15	4.505436e+09	3.216868e+20	3.464694e+15	8.208392e+16	9.330439e+23
9	3.740818e+14	-8.149302e+14	9.375674e+16	-1.659942e+14	2.138687e+13	9.607834e+12

	StateNH	StateNJ	StateNM	StateNV	StateNY	StateOH
1	-4.336351e-01	-1.824745e+00	1.712782e+00	1.164919e+00	-1.620825e+00	-3.439717e+00
2	1.110848e+00	1.392049e-01	2.256522e+00	2.794158e+00	-3.262969e-01	-7.329363e-01
3	-5.198774e+01	-3.973424e+00	-2.466778e-01	-3.610404e-01	-2.542098e+00	-4.190087e+01
4	2.539989e+00	-7.484662e+00	1.047153e+01	-1.597405e+18	-9.314302e-01	-1.233188e+00
5	1.178549e+01	1.551837e+01	8.867382e+01	5.804130e+01	-7.957310e+00	-1.377153e+23
6	-3.387676e+26	-7.091516e+26	-1.658517e+27	-1.894782e+27	9.600462e+02	-5.889805e+26
7	-2.972170e+12	1.259838e+04	2.111900e+11	-9.263443e+08	-6.628203e+08	4.342795e+02
8	-6.637886e+11	-2.766337e+13	3.523262e+13	-7.252793e+17	-4.059025e+18	-7.633504e+14
9	-2.110269e+13	1.974132e+09	-4.954666e+13	-3.588803e+15	-9.952334e+10	4.178200e+09

	StateOK	StateOR	StatePA	StateRI	StateSC	StateSD
1	-6.617027e-01	-1.492738e+00	-8.649216e-01	-3.130636e+00	-2.230752e+00	-1.616865e+00
2	-5.067954e-01	1.180443e+00	-3.335123e+01	-1.739498e+00	4.293817e-01	-5.446022e-02
3	9.645877e-02	-1.677305e+00	-7.963508e+00	-2.939026e+00	-2.418691e+01	-3.186946e+00
4	1.261265e+00	1.624011e+00	-3.030487e+00	2.270794e+00	1.134248e+00	-3.198760e+19
5	1.239209e+01	1.438235e+01	-1.296299e+24	-8.662672e+23	-3.244973e+23	-1.268856e+23
6	NaN	2.662069e+03	-2.634736e+27	-1.029079e+27	-3.777516e+27	NaN
7	-3.814350e+05	-7.439675e+04	-2.978370e+18	-6.905245e+04	-2.368142e+04	-3.517775e+05

8 -2.837179e+15 -3.500903e+11 -8.687729e+18 1.822857e+19 1.147243e+13 -5.207988e+20

9 1.101374e+18 -6.939599e+08 -2.518384e+14 -2.903900e+08 -3.097951e+16 5.385310e+15

	StateTN	StateTX	StateUT	StateVA	StateVT	StateWA
1	8.186950e-01	-2.355842e+00	-1.020926e+00	-2.026387e+00	-4.827021e-01	-2.055604e+00
2	-1.974160e+00	-2.021481e+00	-1.753793e+00	2.222574e-01	-6.585192e-01	-3.567542e-01
3	-1.483230e+00	-3.382616e+00	-4.771098e+00	-1.951430e+00	-2.339314e+00	-2.511540e+00
4	1.546699e+01	4.235469e-01	NaN	-1.390329e+01	2.135265e+00	-2.677637e+00
5	NaN	NaN	-1.056007e+01	9.922574e+00	3.270073e+01	-1.406406e+01
6	3.230610e+03	NaN	2.845622e+03	NaN	1.579191e+03	1.811305e+03
7	7.588274e+05	-1.107753e+05	-5.372934e+05	-1.470727e+04	3.111478e+03	-7.774006e+05
8	1.923474e+19	-3.426779e+21	-5.359678e+12	-3.515844e+09	-4.393162e+16	6.070735e+18
9	1.919005e+21	-4.296147e+20	1.697509e+10	3.917088e+14	4.980886e+13	-2.799959e+19

	StateWI	StateWV	StateWY	Area.Code
1	2.652615e-01	2.365405e+00	-1.575922e+00	-1.13888854
2	2.824253e-01	1.501305e+00	-1.537142e+00	-0.45952474
3	-6.793347e+00	-1.093150e+00	-2.532660e+00	1.84181600
4	-2.753843e+01	2.053130e+00	8.326165e-01	-0.01987964
5	3.958651e+01	1.276830e+01	1.665170e+01	-1.08586765
6	2.755092e+03	NaN	NaN	0.97831051
7	1.361764e+06	-5.419700e+03	-4.361999e+06	-1.30470009
8	-1.174715e+20	-3.340330e+10	-2.860115e+19	388227.27980866
9	2.345780e+09	-1.008078e+08	3.309614e+10	-1512.78437623

Residual Deviance: 6596.518

AIC: 7838.518

Log likelihood: -3298.259 (621 df)

Pseudo R-Square: 0.38432291

==== ANOVA ====

Analysis of Deviance Table (Type II tests)

Response: CustServ.Calls

	LR Chisq	Df	Pr(>Chisq)	
Account.Length	494.87	9	< 2.2e-16	***
VMail.Message	563.08	9	< 2.2e-16	***
Day.Mins	1266.11	9	< 2.2e-16	***
Eve.Mins	409.33	9	< 2.2e-16	***
Night.Mins	286.88	9	< 2.2e-16	***
Intl.Mins	858.83	9	< 2.2e-16	***
Churn	1102.18	9	< 2.2e-16	***
Int.l.Plan	1315.97	9	< 2.2e-16	***
VMail.Plan	1318.78	9	< 2.2e-16	***
Day.Calls	498.07	9	< 2.2e-16	***
Day.Charge	1201.05	9	< 2.2e-16	***
Eve.Calls	546.85	9	< 2.2e-16	***
Eve.Charge	1162.61	9	< 2.2e-16	***
Night.Calls	506.12	9	< 2.2e-16	***
Night.Charge	1346.58	9	< 2.2e-16	***
Intl.Calls	654.76	9	< 2.2e-16	***
Intl.Charge	1223.97	9	< 2.2e-16	***
State	1156.92	450	< 2.2e-16	***
Area.Code	309.41	9	< 2.2e-16	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

[1] "\n"

Time taken: 2.52 mins

Rattle timestamp: 2018-10-13 16:03:21 tsraj

---

[1] "68 308 147 362 323 56 57 310 261 441"

Data means:

Account.Length	VMail.Message	Day.Mins	Eve.Mins	Night.Mins	Intl.Mins
0.43348864	0.16273753	0.51023159	0.51276068	0.47656505	0.51502786

Churn	Int.l.Plan	VMail.Plan	Day.Calls	Day.Charge	Eve.Calls
0.15045006	0.09858551	0.28118303	0.62814777	0.51020568	0.56556156

Eve.Charge	Night.Calls	Night.Charge	Intl.Calls	Intl.Charge	Area.Code
0.51288507	0.46024047	0.47683782	0.22366052	0.51512994	0.28935226

Cluster centers:

	Account.Length	VMail.Message	Day.Mins	Eve.Mins	Night.Mins	Intl.Mins	Churn	Int.l.Plan
1	0.4621849	0.5919839	0.5363623	0.5284830	0.4816829	0.5529412	0.41176471	1.0000000
2	0.3994350	0.0000000	0.4777734	0.3740475	0.5666624	0.5107792	0.00000000	0.0000000
3	0.4294254	0.5766307	0.5132603	0.5160432	0.4875271	0.5034014	0.08163265	0.0000000
4	0.4395614	0.0000000	0.4161238	0.6276933	0.4945866	0.5379972	0.00000000	0.0000000
5	0.4361438	0.0000000	0.4871439	0.5057278	0.4696423	0.5178483	0.00000000	0.0000000
6	0.4342919	0.0000000	0.5217717	0.5547154	0.4518558	0.5122321	0.46428571	1.0000000
7	0.4458115	0.0000000	0.5196943	0.4899354	0.4602267	0.4923684	0.00000000	1.0000000
8	0.4430108	0.0000000	0.5833790	0.4759825	0.3599724	0.4835484	0.00000000	0.0000000
9	0.4364665	0.0000000	0.6171739	0.5566479	0.4973227	0.5296169	1.00000000	0.1877395
10	0.4371215	0.5774310	0.5046218	0.5144303	0.4743968	0.5118821	0.05442177	0.0000000

	VMail.Plan	Day.Calls	Day.Charge	Eve.Calls	Eve.Charge	Night.Calls	Night.Charge	Intl.Calls
1	1	0.6415441	0.5363431	0.5690045	0.5286208	0.4620186	0.4819363	0.2536765
2	0	0.6300122	0.4777474	0.5562146	0.3741533	0.4871531	0.5669650	0.2336039
3	1	0.6385629	0.5132313	0.5673731	0.5161835	0.4499584	0.4878157	0.2187075
4	0	0.6222030	0.4161081	0.5621193	0.6278294	0.4472157	0.4948533	0.2272099
5	0	0.6217686	0.4871193	0.5561046	0.5058490	0.4731719	0.4699054	0.2201238
6	0	0.6166295	0.5217406	0.5567766	0.5548478	0.4759764	0.4521390	0.2276786
7	0	0.6439693	0.5196677	0.5813090	0.4900610	0.4770920	0.4605027	0.2631579
8	0	0.6333065	0.5833479	0.5825062	0.4761101	0.4331167	0.3602318	0.2267742
9	0	0.6391044	0.6171403	0.5697760	0.5567676	0.4533752	0.4976079	0.2005747

10 1 0.6201672 0.5045956 0.5653817 0.5145523 0.4647710 0.4746589 0.2192744

Intl.Charge Area.Code

1 0.5530501 0.32742215

2 0.5109067 0.04523173

3 0.5035399 1.00000000

4 0.5380909 0.04436139

5 0.5179051 1.00000000

6 0.5122354 1.00000000

7 0.4923977 0.05056760

8 0.4836619 0.04538267

9 0.5297361 0.22785666

10 0.5119971 0.04621849

Within cluster sum of squares:

[1] 48.58109 63.94573 55.01248 78.16978 82.18625 29.55092 14.07416 63.47851 154.54029

[10] 148.98046

Time taken: 0.00 secs

Rattle timestamp: 2018-10-13 16:18:19 tsraj

Below we summarise the dataset.

The data is limited to the training dataset.

Data frame:crs$dataset[crs$train, c(crs$input, crs$risk, crs$target)] 2333 observations and 20 variables Maximum # NAs:0

Levels Storage

Account.Length integer

VMail.Message integer

Day.Mins double

Eve.Mins double

Night.Mins double

Intl.Mins double

Churn integer

Int.l.Plan integer

VMail.Plan integer

Day.Calls integer

Day.Charge double

Eve.Calls integer

Eve.Charge double

Night.Calls integer

Night.Charge double

Intl.Calls integer

Intl.Charge double

State 51 integer

Area.Code integer

CustServ.Calls integer

Variable	Levels
State	AK,AL,AR,AZ,CA,CO,CT,DC,DE,FL,GA,HI,IA,ID,IL,IN,KS,KY,LA,MA,MD,ME,MI,MN,MO,MS,MT,NC,ND,NE
	NH,NJ,NM,NV,NY,OH,OK,OR,PA,RI,SC,SD,TN,TX,UT,VA,VT,WA,WI,WV,WY

For the simple distribution tables below the 1st and 3rd Qu.

refer to the first and third quartiles, indicating that 25%
of the observations have values of that variable which are
less than or greater than (respectively) the value listed.

```
 Account.Length  VMail.Message     Day.Mins       Eve.Mins       Night.Mins      Intl.Mins
 Min.   :  1.0   Min.   : 0.0   Min.   :  0.0   Min.   : 31.2   Min.   : 23.2   Min.   : 0.0
 1st Qu.: 74.0   1st Qu.: 0.0   1st Qu.:143.3   1st Qu.:165.9   1st Qu.:165.9   1st Qu.: 8.5
 Median :100.0   Median : 0.0   Median :178.7   Median :202.3   Median :200.6   Median :10.4
 Mean   :101.1   Mean   : 8.3   Mean   :179.0   Mean   :201.7   Mean   :200.4   Mean   :10.3
 3rd Qu.:128.0   3rd Qu.:20.0   3rd Qu.:215.4   3rd Qu.:236.0   3rd Qu.:234.9   3rd Qu.:12.1
 Max.   :232.0   Max.   :51.0   Max.   :350.8   Max.   :363.7   Max.   :395.0   Max.   :20.0

    Churn          Int.l.Plan       VMail.Plan       Day.Calls       Day.Charge
 Min.   :0.0000   Min.   :0.00000   Min.   :0.0000   Min.   :  0.0   Min.   : 0.00
 1st Qu.:0.0000   1st Qu.:0.00000   1st Qu.:0.0000   1st Qu.: 88.0   1st Qu.:24.36
 Median :0.0000   Median :0.00000   Median :0.0000   Median :101.0   Median :30.38
 Mean   :0.1505   Mean   :0.09859   Mean   :0.2812   Mean   :100.5   Mean   :30.43
 3rd Qu.:0.0000   3rd Qu.:0.00000   3rd Qu.:1.0000   3rd Qu.:114.0   3rd Qu.:36.62
 Max.   :1.0000   Max.   :1.00000   Max.   :1.0000   Max.   :160.0   Max.   :59.64

  Eve.Calls       Eve.Charge      Night.Calls      Night.Charge       Intl.Calls
 Min.   : 12.0   Min.   : 2.65   Min.   : 36.00   Min.   : 1.040   Min.   : 0.000
 1st Qu.: 87.0   1st Qu.:14.10   1st Qu.: 86.00   1st Qu.: 7.470   1st Qu.: 3.000
 Median :101.0   Median :17.20   Median :100.00   Median : 9.030   Median : 4.000
 Mean   :100.2   Mean   :17.14   Mean   : 99.97   Mean   : 9.017   Mean   : 4.473
 3rd Qu.:114.0   3rd Qu.:20.06   3rd Qu.:114.00   3rd Qu.:10.570   3rd Qu.: 6.000
 Max.   :168.0   Max.   :30.91   Max.   :175.00   Max.   :17.770   Max.   :20.000

 Intl.Charge       State        Area.Code      CustServ.Calls
 Min.   :0.000   WV     :  76   Min.   :408.0   Min.   :0.000
 1st Qu.:2.300   MN     :  61   1st Qu.:408.0   1st Qu.:1.000
```

```
 Median :2.810   WI    :  57   Median :415.0   Median :1.000
 Mean   :2.782   AL    :  56   Mean   :437.5   Mean   :1.538
 3rd Qu.:3.270   OH    :  56   3rd Qu.:510.0   3rd Qu.:2.000
 Max.   :5.400   WY    :  56   Max.   :510.0   Max.   :9.000
                 (Other):1971
```

Rattle timestamp: 2018-10-13 16:22:35 tsraj

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Below is a description of the dataset.

The data is limited to the training dataset.

crs$dataset[crs$train, c(crs$input, crs$risk, crs$target)]

20 Variables 2333 Observations

Account.Length

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	205	1	101.1	45.28	35	50	74	100	128	153	168

lowest : 1 3 4 5 6, highest: 215 217 221 224 232

VMail.Message

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	44	0.629	8.3	12.61	0	0	0	0	20	32	37

lowest : 0 9 10 11 12, highest: 47 48 49 50 51

Day.Mins

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95

2333	0	1408	1	179	61.4	89.1	109.5	143.3	178.7	215.4	248.7	269.4

lowest : 0.0 2.6 17.6 18.9 19.5, highest: 334.3 335.5 337.4 345.3 350.8

Eve.Mins

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	1358	1	201.7	57.48	119.7	137.2	165.9	202.3	236.0	267.3	285.9

lowest : 31.2 42.2 42.5 48.1 56.0, highest: 350.9 351.6 354.2 361.8 363.7

Night.Mins

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	1342	1	200.4	57.49	117.9	136.0	165.9	200.6	234.9	264.3	284.4

lowest : 23.2 45.0 47.4 50.1 53.3, highest: 364.3 364.9 367.7 381.9 395.0

Intl.Mins

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	154	1	10.3	3.12	5.76	6.70	8.50	10.40	12.10	13.78	14.70

lowest : 0.0 1.1 1.3 2.1 2.4, highest: 17.9 18.0 18.2 18.4 20.0

Churn

n	missing	distinct	Info	Sum	Mean	Gmd
2333	0	2	0.383	351	0.1505	0.2557

Int.l.Plan

n	missing	distinct	Info	Sum	Mean	Gmd
2333	0	2	0.267	230	0.09859	0.1778

VMail.Plan

n	missing	distinct	Info	Sum	Mean	Gmd
2333	0	2	0.606	656	0.2812	0.4044

Day.Calls

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	116	1	100.5	22.49	67	75	88	101	114	126	133

lowest : 0 30 35 36 40, highest: 152 156 157 158 160

Day.Charge

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	1408	1	30.43	10.44	15.15	18.62	24.36	30.38	36.62	42.28	45.80

lowest : 0.00 0.44 2.99 3.21 3.32, highest: 56.83 57.04 57.36 58.70 59.64

Eve.Calls

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	117	1	100.2	22.35	67	75	87	101	114	125	133

lowest : 12 36 42 43 44, highest: 154 155 157 164 168

Eve.Charge

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	1228	1	17.14	4.886	10.17	11.66	14.10	17.20	20.06	22.72	24.30

lowest : 2.65 3.59 3.61 4.09 4.76, highest: 29.83 29.89 30.11 30.75 30.91

Night.Calls

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	119	1	99.97	22.37	67.6	74.0	86.0	100.0	114.0	125.0	132.0

lowest : 36 38 42 44 46, highest: 157 158 164 166 175

Night.Charge

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	851	1	9.017	2.587	5.306	6.120	7.470	9.030	10.570	11.890	12.800

lowest : 1.04 2.03 2.13 2.25 2.40, highest: 16.39 16.42 16.55 17.19 17.77

Intl.Calls

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	21	0.978	4.473	2.581	1	2	3	4	6	8	9

lowest : 0 1 2 3 4, highest: 16 17 18 19 20

Intl.Charge

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	154	1	2.782	0.8424	1.558	1.810	2.300	2.810	3.270	3.724	3.970

lowest : 0.00 0.30 0.35 0.57 0.65, highest: 4.83 4.86 4.91 4.97 5.40

State

n	missing	distinct
2333	0	51

lowest : AK AL AR AZ CA, highest: VT WA WI WV WY

Area.Code

n	missing	distinct	Info	Mean	Gmd
2333	0	3	0.847	437.5	38.79

Value	408	415	510
Frequency	585	1152	596
Proportion	0.251	0.494	0.255

CustServ.Calls

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
2333	0	10	0.931	1.538	1.391	0	0	1	1	2	3	4

Value	0	1	2	3	4	5	6	7	8	9
Frequency	505	837	520	286	113	45	18	6	1	2
Proportion	0.216	0.359	0.223	0.123	0.048	0.019	0.008	0.003	0.000	0.001

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Basic statistics for each numeric variable of the dataset.

$Account.Length

	X...X.i
nobs	2333.000000
NAs	0.000000
Minimum	1.000000
Maximum	232.000000
1. Quartile	74.000000
3. Quartile	128.000000
Mean	101.135877
Median	100.000000
Sum	235950.000000
SE Mean	0.827716
LCL Mean	99.512741
UCL Mean	102.759013
Variance	1598.370466
Stdev	39.979626
Skewness	0.121828
Kurtosis	-0.204211

$VMail.Message

	X...X.i
nobs	2333.000000
NAs	0.000000
Minimum	0.000000
Maximum	51.000000
1. Quartile	0.000000
3. Quartile	20.000000
Mean	8.299614
Median	0.000000
Sum	19363.000000
SE Mean	0.287061

LCL Mean 7.736693

UCL Mean 8.862536

Variance 192.248529

Stdev 13.865372

Skewness 1.235569

Kurtosis -0.131103

$Day.Mins

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 350.800000

1. Quartile 143.300000

3. Quartile 215.400000

Mean 178.989241

Median 178.700000

Sum 417581.900000

SE Mean 1.127169

LCL Mean 176.778883

UCL Mean 181.199600

Variance 2964.100832

Stdev 54.443556

Skewness 0.002140

Kurtosis -0.013918

$Eve.Mins

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 31.200000

Maximum	363.700000
1. Quartile	165.900000
3. Quartile	236.000000
Mean	201.692928
Median	202.300000
Sum	470549.600000
SE Mean	1.053888
LCL Mean	199.626272
UCL Mean	203.759583
Variance	2591.217501
Stdev	50.904003
Skewness	0.025809
Kurtosis	-0.028868

$Night.Mins

	X...X.i
nobs	2333.000000
NAs	0.000000
Minimum	23.200000
Maximum	395.000000
1. Quartile	165.900000
3. Quartile	234.900000
Mean	200.386884
Median	200.600000
Sum	467502.600000
SE Mean	1.055977
LCL Mean	198.316131
UCL Mean	202.457636
Variance	2601.501217
Stdev	51.004914
Skewness	0.031490

Kurtosis 0.085437

$Intl.Mins

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 20.000000

1. Quartile 8.500000

3. Quartile 12.100000

Mean 10.300557

Median 10.400000

Sum 24031.200000

SE Mean 0.057779

LCL Mean 10.187254

UCL Mean 10.413861

Variance 7.788529

Stdev 2.790794

Skewness -0.190983

Kurtosis 0.481506

$Churn

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 1.000000

1. Quartile 0.000000

3. Quartile 0.000000

Mean 0.150450

Median 0.000000

Sum 351.000000

SE Mean 0.007403

LCL Mean 0.135932

UCL Mean 0.164968

Variance 0.127870

Stdev 0.357589

Skewness 1.954201

Kurtosis 1.819683

$Int.l.Plan

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 1.000000

1. Quartile 0.000000

3. Quartile 0.000000

Mean 0.098586

Median 0.000000

Sum 230.000000

SE Mean 0.006173

LCL Mean 0.086480

UCL Mean 0.110691

Variance 0.088905

Stdev 0.298169

Skewness 2.691379

Kurtosis 5.245772

$VMail.Plan

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 1.000000

1. Quartile 0.000000

3. Quartile 1.000000

Mean 0.281183

Median 0.000000

Sum 656.000000

SE Mean 0.009310

LCL Mean 0.262927

UCL Mean 0.299439

Variance 0.202206

Stdev 0.449673

Skewness 0.972810

Kurtosis -1.054092

$Day.Calls

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 160.000000

1. Quartile 88.000000

3. Quartile 114.000000

Mean 100.503643

Median 101.000000

Sum 234475.000000

SE Mean 0.413616

LCL Mean 99.692550

UCL Mean 101.314737

Variance 399.125737

Stdev 19.978131

Skewness -0.093965

Kurtosis 0.173801

$Day.Charge

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 59.640000

1. Quartile 24.360000

3. Quartile 36.620000

Mean 30.428667

Median 30.380000

Sum 70990.080000

SE Mean 0.191619

LCL Mean 30.052906

UCL Mean 30.804427

Variance 85.662342

Stdev 9.255395

Skewness 0.002146

Kurtosis -0.013747

$Eve.Calls

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 12.000000

Maximum 168.000000

1. Quartile 87.000000

3. Quartile 114.000000

Mean 100.227604

Median 101.000000

Sum 233831.000000

SE Mean 0.410887

LCL Mean 99.421862

UCL Mean 101.033346

Variance 393.875704

Stdev 19.846302

Skewness -0.046122

Kurtosis 0.099564

$Eve.Charge

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 2.650000

Maximum 30.910000

1. Quartile 14.100000

3. Quartile 20.060000

Mean 17.144132

Median 17.200000

Sum 39997.260000

SE Mean 0.089581

LCL Mean 16.968465

UCL Mean 17.319799

Variance 18.721892

Stdev 4.326880

Skewness 0.025848

Kurtosis -0.029115

$Night.Calls

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 36.000000

Maximum 175.000000

1. Quartile 86.000000

3. Quartile 114.000000

Mean 99.973425

Median 100.000000

Sum 233238.000000

SE Mean 0.409197

LCL Mean 99.170997

UCL Mean 100.775853

Variance 390.642518

Stdev 19.764679

Skewness 0.027847

Kurtosis -0.122783

$Night.Charge

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 1.040000

Maximum 17.770000

1. Quartile 7.470000

3. Quartile 10.570000

Mean 9.017497

Median 9.030000

Sum 21037.820000

SE Mean 0.047521

LCL Mean 8.924310

UCL Mean 9.110684

Variance 5.268422

Stdev 2.295304

Skewness 0.031459

Kurtosis 0.085175

$Intl.Calls

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 20.000000

1. Quartile 3.000000

3. Quartile 6.000000

Mean 4.473210

Median 4.000000

Sum 10436.000000

SE Mean 0.050745

LCL Mean 4.373701

UCL Mean 4.572720

Variance 6.007537

Stdev 2.451028

Skewness 1.410734

Kurtosis 3.773854

$Intl.Charge

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 5.400000

1. Quartile	2.300000
3. Quartile	3.270000
Mean	2.781702
Median	2.810000
Sum	6489.710000
SE Mean	0.015600
LCL Mean	2.751110
UCL Mean	2.812293
Variance	0.567778
Stdev	0.753510
Skewness	-0.191010
Kurtosis	0.481474

$Area.Code

	X...X.i
nobs	2333.000000
NAs	0.000000
Minimum	408.000000
Maximum	510.000000
1. Quartile	408.000000
3. Quartile	510.000000
Mean	437.513931
Median	415.000000
Sum	1020720.000000
SE Mean	0.881237
LCL Mean	435.785841
UCL Mean	439.242020
Variance	1811.758489
Stdev	42.564756
Skewness	1.105003
Kurtosis	-0.754820

$CustServ.Calls

X...X.i

nobs 2333.000000

NAs 0.000000

Minimum 0.000000

Maximum 9.000000

1. Quartile 1.000000

3. Quartile 2.000000

Mean 1.537934

Median 1.000000

Sum 3588.000000

SE Mean 0.027364

LCL Mean 1.484273

UCL Mean 1.591595

Variance 1.746952

Stdev 1.321723

Skewness 1.152688

Kurtosis 1.952767

Rattle timestamp: 2018-10-13 16:22:56 tsraj

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Kurtosis for each numeric variable of the dataset.

Larger values mean sharper peaks and flatter tails.

Positive values indicate an acute peak around the mean.

Negative values indicate a smaller peak around the mean.

Account.Length VMail.Message Day.Mins Eve.Mins Night.Mins Intl.Mins

-0.20421146 -0.13110262 -0.01391788 -0.02886757 0.08543688 0.48150574

Churn Int.l.Plan VMail.Plan Day.Calls Day.Charge Eve.Calls

1.81968309 5.24577247 -1.05409208 0.17380089 -0.01374730 0.09956360

Eve.Charge Night.Calls Night.Charge Intl.Calls Intl.Charge Area.Code

-0.02911453 -0.12278298 0.08517450 3.77385403 0.48147351 -0.75481986

CustServ.Calls

1.95276727

Rattle timestamp: 2018-10-13 16:22:56 tsraj

==========

Skewness for each numeric variable of the dataset.

Positive means the right tail is longer.

Account.Length VMail.Message Day.Mins Eve.Mins Night.Mins Intl.Mins

0.121828068 1.235568976 0.002140295 0.025808734 0.031489744 -0.190983314

Churn Int.l.Plan VMail.Plan Day.Calls Day.Charge Eve.Calls

1.954201259 2.691379462 0.972809946 -0.093964893 0.002146377 -0.046121802

Eve.Charge Night.Calls Night.Charge Intl.Calls Intl.Charge Area.Code

0.025847825 0.027846820 0.031458870 1.410733828 -0.191009563 1.105003190

CustServ.Calls

1.152688498

Rattle timestamp: 2018-10-13 16:22:56 tsraj

==========

Missing Value Summary

/\ /\

{ `---' }

{ O O }

==> V <== No need for mice. This data set is completely observed.

\ \|/ /

`-----'

Account.Length VMail.Message Day.Mins Eve.Mins Night.Mins Intl.Mins Churn Int.l.Plan

3333 1 1 1 1 1 1 1 1

0 0 0 0 0 0 0 0

VMail.Plan Day.Calls Day.Charge Eve.Calls Eve.Charge Night.Calls Night.Charge Intl.Calls

3333 1 1 1 1 1 1 1 1

0 0 0 0 0 0 0 0

Intl.Charge State Area.Code CustServ.Calls

3333 1 1 1 1 0

0 0 0 0 0

Rattle timestamp: 2018-10-13 16:23:16 tsraj

==========

Cross tabulations:

CrossTab of State by target variable CustServ.Calls

Cell Contents

|-------------------------|

| N |

| Expected N |

| Chi-square contribution |

| N / Row Total |

| N / Col Total |

| N / Table Total |

|-------------------------|

==========

crs$dataset[[crs$target]]

crs$dataset[[i]] 0 1 2 3 4 5 6 7 8 9 Total

AK 11 18 10 10 2 1 0 0 0 0 52

10.9 18.4 11.8 6.7 2.6 1.0 0.3 0.1 0.0 0.0

0.001 0.010 0.286 1.634 0.134 0.001 0.343 0.140 0.031 0.031

0.212 0.346 0.192 0.192 0.038 0.019 0.000 0.000 0.000 0.000 0.016

0.016 0.015 0.013 0.023 0.012 0.015 0.000 0.000 0.000 0.000

0.003 0.005 0.003 0.003 0.001 0.000 0.000 0.000 0.000 0.000

AL 18 28 17 11 2 3 0 1 0 0 80

16.7 28.3 18.2 10.3 4.0 1.6 0.5 0.2 0.0 0.0

0.096 0.004 0.081 0.048 0.988 1.265 0.528 2.845 0.048 0.048

0.225 0.350 0.212 0.138 0.025 0.038 0.000 0.012 0.000 0.000 0.024

0.026 0.024 0.022 0.026 0.012 0.045 0.000 0.111 0.000 0.000

0.005 0.008 0.005 0.003 0.001 0.001 0.000 0.000 0.000 0.000

AR 10 14 14 9 3 3 1 1 0 0 55

11.5 19.5 12.5 7.1 2.7 1.1 0.4 0.1 0.0 0.0

0.196 1.546 0.174 0.521 0.025 3.353 1.118 4.882 0.033 0.033

0.182 0.255 0.255 0.164 0.055 0.055 0.018 0.018 0.000 0.000 0.017

0.014 0.012 0.018 0.021 0.018 0.045 0.045 0.111 0.000 0.000

0.003 0.004 0.004 0.003 0.001 0.001 0.000 0.000 0.000 0.000

AZ 14 20 15 8 7 0 0 0 0 0 64

13.4 22.7 14.6 8.2 3.2 1.3 0.4 0.2 0.0 0.0

0.028 0.316 0.012 0.007 4.560 1.267 0.422 0.173 0.038 0.038

0.219 0.312 0.234 0.125 0.109 0.000 0.000 0.000 0.000 0.000 0.019

0.020 0.017 0.020 0.019 0.042 0.000 0.000 0.000 0.000 0.000

0.004 0.006 0.005 0.002 0.002 0.000 0.000 0.000 0.000 0.000

CA 10 11 7 1 3 2 0 0 0 0 34

7.1 12.0 7.7 4.4 1.7 0.7 0.2 0.1 0.0 0.0

1.175 0.091 0.071 2.605 1.008 2.614 0.224 0.092 0.020 0.020

0.294 0.324 0.206 0.029 0.088 0.059 0.000 0.000 0.000 0.000 0.010

0.014 0.009 0.009 0.002 0.018 0.030 0.000 0.000 0.000 0.000

0.003 0.003 0.002 0.000 0.001 0.001 0.000 0.000 0.000 0.000

CO 10 27 10 10 5 3 1 0 0 0 66

13.8 23.4 15.0 8.5 3.3 1.3 0.4 0.2 0.0 0.0

1.047 0.558 1.683 0.267 0.893 2.193 0.731 0.178 0.040 0.040

0.152 0.409 0.152 0.152 0.076 0.045 0.015 0.000 0.000 0.000 0.020

0.014 0.023 0.013 0.023 0.030 0.045 0.045 0.000 0.000 0.000

0.003 0.008 0.003 0.003 0.002 0.001 0.000 0.000 0.000 0.000

CT 17 24 18 10 3 2 0 0 0 0 74

15.5 26.2 16.9 9.5 3.7 1.5 0.5 0.2 0.0 0.0

0.150 0.188 0.078 0.024 0.128 0.195 0.488 0.200 0.044 0.044

0.230 0.324 0.243 0.135 0.041 0.027 0.000 0.000 0.000 0.000 0.022

0.024 0.020 0.024 0.023 0.018 0.030 0.000 0.000 0.000 0.000

0.005 0.007 0.005 0.003 0.001 0.001 0.000 0.000 0.000 0.000

DC 13 21 12 5 2 1 0 0 0 0 54

11.3 19.1 12.3 7.0 2.7 1.1 0.4 0.1 0.0 0.0

0.258 0.182 0.007 0.547 0.177 0.004 0.356 0.146 0.032 0.032

0.241 0.389 0.222 0.093 0.037 0.019 0.000 0.000 0.000 0.000 0.016

0.019 0.018 0.016 0.012 0.012 0.015 0.000 0.000 0.000 0.000

0.004 0.006 0.004 0.002 0.001 0.000 0.000 0.000 0.000 0.000

DE 12 18 19 7 3 2 0 0 0 0 61

12.8 21.6 13.9 7.9 3.0 1.2 0.4 0.2 0.0 0.0

0.045 0.604 1.879 0.092 0.000 0.519 0.403 0.165 0.037 0.037

0.197 0.295 0.311 0.115 0.049 0.033 0.000 0.000 0.000 0.000 0.018

0.017 0.015 0.025 0.016 0.018 0.030 0.000 0.000 0.000 0.000

0.004 0.005 0.006 0.002 0.001 0.001 0.000 0.000 0.000 0.000

FL 16 19 10 13 4 1 0 0 0 0 63

13.2 22.3 14.3 8.1 3.1 1.2 0.4 0.2 0.0 0.0

0.606 0.495 1.317 2.950 0.237 0.049 0.416 0.170 0.038 0.038

0.254 0.302 0.159 0.206 0.063 0.016 0.000 0.000 0.000 0.000 0.019

0.023 0.016 0.013 0.030 0.024 0.015 0.000 0.000 0.000 0.000

0.005 0.006 0.003 0.004 0.001 0.000 0.000 0.000 0.000 0.000

GA 10 14 12 11 4 2 0 1 0 0 54

11.3 19.1 12.3 7.0 2.7 1.1 0.4 0.1 0.0 0.0

0.148 1.378 0.007 2.359 0.639 0.810 0.356 5.004 0.032 0.032

0.185 0.259 0.222 0.204 0.074 0.037 0.000 0.019 0.000 0.000 0.016

0.014 0.012 0.016 0.026 0.024 0.030 0.000 0.111 0.000 0.000

0.003 0.004 0.004 0.003 0.001 0.001 0.000 0.000 0.000 0.000

HI 10 23 12 3 3 0 0 2 0 0 53

11.1 18.8 12.1 6.8 2.6 1.0 0.3 0.1 0.0 0.0

0.106 0.948 0.000 2.141 0.049 1.050 0.350 24.093 0.032 0.032

0.189 0.434 0.226 0.057 0.057 0.000 0.000 0.038 0.000 0.000 0.016

0.014 0.019 0.016 0.007 0.018 0.000 0.000 0.222 0.000 0.000

0.003 0.007 0.004 0.001 0.001 0.000 0.000 0.001 0.000 0.000

IA 9 17 8 4 5 1 0 0 0 0 44

9.2 15.6 10.0 5.7 2.2 0.9 0.3 0.1 0.0 0.0

0.004 0.127 0.407 0.489 3.600 0.019 0.290 0.119 0.026 0.026

0.205 0.386 0.182 0.091 0.114 0.023 0.000 0.000 0.000 0.000 0.013

0.013 0.014 0.011 0.009 0.030 0.015 0.000 0.000 0.000 0.000

0.003 0.005 0.002 0.001 0.002 0.000 0.000 0.000 0.000 0.000

ID 16 23 15 12 4 1 2 0 0 0 73

15.3 25.9 16.6 9.4 3.6 1.4 0.5 0.2 0.0 0.0

0.035 0.318 0.159 0.722 0.036 0.137 4.783 0.197 0.044 0.044

0.219 0.315 0.205 0.164 0.055 0.014 0.027 0.000 0.000 0.000 0.022

0.023 0.019 0.020 0.028 0.024 0.015 0.091 0.000 0.000 0.000

0.005 0.007 0.005 0.004 0.001 0.000 0.001 0.000 0.000 0.000

IL 18 24 9 4 3 0 0 0 0 0 58

12.1 20.6 13.2 7.5 2.9 1.1 0.4 0.2 0.0 0.0

2.842 0.579 1.341 1.609 0.004 1.149 0.383 0.157 0.035 0.035

0.310 0.414 0.155 0.069 0.052 0.000 0.000 0.000 0.000 0.000 0.017

0.026 0.020 0.012 0.009 0.018 0.000 0.000 0.000 0.000 0.000

0.005 0.007 0.003 0.001 0.001 0.000 0.000 0.000 0.000 0.000

IN 12 27 13 11 6 2 0 0 0 0 71

14.8 25.2 16.2 9.1 3.5 1.4 0.5 0.2 0.0 0.0

0.546 0.135 0.621 0.379 1.717 0.251 0.469 0.192 0.043 0.043

0.169 0.380 0.183 0.155 0.085 0.028 0.000 0.000 0.000 0.000 0.021

0.017 0.023 0.017 0.026 0.036 0.030 0.000 0.000 0.000 0.000

0.004 0.008 0.004 0.003 0.002 0.001 0.000 0.000 0.000 0.000

KS 13 34 10 9 4 0 0 0 0 0 70

14.6 24.8 15.9 9.0 3.5 1.4 0.5 0.2 0.0 0.0

0.183 3.410 2.214 0.000 0.076 1.386 0.462 0.189 0.042 0.042

0.186 0.486 0.143 0.129 0.057 0.000 0.000 0.000 0.000 0.000 0.021

0.019 0.029 0.013 0.021 0.024 0.000 0.000 0.000 0.000 0.000

0.004 0.010 0.003 0.003 0.001 0.000 0.000 0.000 0.000 0.000

KY 10 19 20 5 1 2 1 1 0 0 59

12.3 20.9 13.4 7.6 2.9 1.2 0.4 0.2 0.0 0.0

0.443 0.174 3.207 0.886 1.279 0.592 0.957 4.436 0.035 0.035

0.169 0.322 0.339 0.085 0.017 0.034 0.017 0.017 0.000 0.000 0.018

0.014 0.016 0.026 0.012 0.006 0.030 0.045 0.111 0.000 0.000

0.003 0.006 0.006 0.002 0.000 0.001 0.000 0.000 0.000 0.000

LA 10 20 9 8 3 0 1 0 0 0 51

10.7 18.1 11.6 6.6 2.5 1.0 0.3 0.1 0.0 0.0

0.041 0.206 0.588 0.314 0.083 1.010 1.307 0.138 0.031 0.031

0.196 0.392 0.176 0.157 0.059 0.000 0.020 0.000 0.000 0.000 0.015

0.014 0.017 0.012 0.019 0.018 0.000 0.045 0.000 0.000 0.000

0.003 0.006 0.003 0.002 0.001 0.000 0.000 0.000 0.000 0.000

MA 22 19 14 8 2 0 0 0 0 0 65

13.6 23.0 14.8 8.4 3.2 1.3 0.4 0.2 0.0 0.0

5.200 0.706 0.043 0.016 0.473 1.287 0.429 0.176 0.039 0.039

0.338 0.292 0.215 0.123 0.031 0.000 0.000 0.000 0.000 0.000 0.020

0.032 0.016 0.018 0.019 0.012 0.000 0.000 0.000 0.000 0.000

0.007 0.006 0.004 0.002 0.001 0.000 0.000 0.000 0.000 0.000

MD 16 24 8 13 6 2 1 0 0 0 70

14.6 24.8 15.9 9.0 3.5 1.4 0.5 0.2 0.0 0.0

0.127 0.026 3.956 1.767 1.812 0.272 0.626 0.189 0.042 0.042

0.229 0.343 0.114 0.186 0.086 0.029 0.014 0.000 0.000 0.000 0.021

0.023 0.020 0.011 0.030 0.036 0.030 0.045 0.000 0.000 0.000

0.005 0.007 0.002 0.004 0.002 0.001 0.000 0.000 0.000 0.000

ME 11 16 20 8 7 0 0 0 0 0 62

13.0 22.0 14.1 8.0 3.1 1.2 0.4 0.2 0.0 0.0

0.298 1.622 2.450 0.000 4.956 1.228 0.409 0.167 0.037 0.037

0.177 0.258 0.323 0.129 0.113 0.000 0.000 0.000 0.000 0.000 0.019

0.016 0.014 0.026 0.019 0.042 0.000 0.000 0.000 0.000 0.000

0.003 0.005 0.006 0.002 0.002 0.000 0.000 0.000 0.000 0.000

MI 16 24 16 12 1 2 1 1 0 0 73

15.3 25.9 16.6 9.4 3.6 1.4 0.5 0.2 0.0 0.0

0.035 0.135 0.023 0.722 1.911 0.213 0.557 3.270 0.044 0.044

0.219 0.329 0.219 0.164 0.014 0.027 0.014 0.014 0.000 0.000 0.022

0.023 0.020 0.021 0.028 0.006 0.030 0.045 0.111 0.000 0.000

0.005 0.007 0.005 0.004 0.000 0.001 0.000 0.000 0.000 0.000

MN 18 31 21 9 0 3 1 0 0 1 84

17.6 29.8 19.1 10.8 4.2 1.7 0.6 0.2 0.1 0.1

0.011 0.051 0.183 0.304 4.184 1.074 0.358 0.227 0.050 17.890

0.214 0.369 0.250 0.107 0.000 0.036 0.012 0.000 0.000 0.012 0.025

0.026 0.026 0.028 0.021 0.000 0.045 0.045 0.000 0.000 0.500

0.005 0.009 0.006 0.003 0.000 0.001 0.000 0.000 0.000 0.000

MO 11 24 16 8 2 2 0 0 0 0 63

13.2 22.3 14.3 8.1 3.1 1.2 0.4 0.2 0.0 0.0

0.359 0.126 0.191 0.001 0.413 0.454 0.416 0.170 0.038 0.038

0.175 0.381 0.254 0.127 0.032 0.032 0.000 0.000 0.000 0.000 0.019

0.016 0.020 0.021 0.019 0.012 0.030 0.000 0.000 0.000 0.000

0.003 0.007 0.005 0.002 0.001 0.001 0.000 0.000 0.000 0.000

MS 9 25 16 10 3 1 1 0 0 0 65

13.6 23.0 14.8 8.4 3.2 1.3 0.4 0.2 0.0 0.0

1.552 0.168 0.097 0.319 0.017 0.064 0.760 0.176 0.039 0.039

0.138 0.385 0.246 0.154 0.046 0.015 0.015 0.000 0.000 0.000 0.020

0.013 0.021 0.021 0.023 0.018 0.015 0.045 0.000 0.000 0.000

0.003 0.008 0.005 0.003 0.001 0.000 0.000 0.000 0.000 0.000

MT 9 29 16 8 5 0 1 0 0 0 68

14.2 24.1 15.5 8.8 3.4 1.3 0.4 0.2 0.0 0.0

1.916 0.999 0.017 0.065 0.768 1.347 0.677 0.184 0.041 0.041

0.132 0.426 0.235 0.118 0.074 0.000 0.015 0.000 0.000 0.000 0.020

0.013 0.025 0.021 0.019 0.030 0.000 0.045 0.000 0.000 0.000

0.003 0.009 0.005 0.002 0.002 0.000 0.000 0.000 0.000 0.000

NC 16 19 21 7 2 2 1 0 0 0 68

14.2 24.1 15.5 8.8 3.4 1.3 0.4 0.2 0.0 0.0

0.223 1.077 1.964 0.351 0.568 0.317 0.677 0.184 0.041 0.041

0.235 0.279 0.309 0.103 0.029 0.029 0.015 0.000 0.000 0.000 0.020

0.023 0.016 0.028 0.016 0.012 0.030 0.045 0.000 0.000 0.000

0.005 0.006 0.006 0.002 0.001 0.001 0.000 0.000 0.000 0.000

ND 7 29 18 7 1 0 0 0 0 0 62

13.0 22.0 14.1 8.0 3.1 1.2 0.4 0.2 0.0 0.0

2.745 2.250 1.067 0.120 1.412 1.228 0.409 0.167 0.037 0.037

0.113 0.468 0.290 0.113 0.016 0.000 0.000 0.000 0.000 0.000 0.019

0.010 0.025 0.024 0.016 0.006 0.000 0.000 0.000 0.000 0.000

0.002 0.009 0.005 0.002 0.000 0.000 0.000 0.000 0.000 0.000

NE 16 21 9 12 2 0 1 0 0 0 61

12.8 21.6 13.9 7.9 3.0 1.2 0.4 0.2 0.0 0.0

0.825 0.017 1.722 2.192 0.355 1.208 0.886 0.165 0.037 0.037

0.262 0.344 0.148 0.197 0.033 0.000 0.016 0.000 0.000 0.000 0.018

0.023 0.018 0.012 0.028 0.012 0.000 0.045 0.000 0.000 0.000

0.005 0.006 0.003 0.004 0.001 0.000 0.000 0.000 0.000 0.000

NH 12 21 15 3 3 1 0 0 1 0 56

11.7 19.8 12.8 7.2 2.8 1.1 0.4 0.2 0.0 0.0

0.007 0.067 0.396 2.457 0.016 0.011 0.370 0.151 27.793 0.034

0.214 0.375 0.268 0.054 0.054 0.018 0.000 0.000 0.018 0.000 0.017

0.017 0.018 0.020 0.007 0.018 0.015 0.000 0.000 0.500 0.000

0.004 0.006 0.005 0.001 0.001 0.000 0.000 0.000 0.000 0.000

NJ 15 19 18 11 3 1 0 0 0 1 68

14.2 24.1 15.5 8.8 3.4 1.3 0.4 0.2 0.0 0.0

0.043 1.077 0.408 0.577 0.044 0.089 0.449 0.184 0.041 22.548

0.221 0.279 0.265 0.162 0.044 0.015 0.000 0.000 0.000 0.015 0.020

0.022 0.016 0.024 0.026 0.018 0.015 0.000 0.000 0.000 0.500

0.005 0.006 0.005 0.003 0.001 0.000 0.000 0.000 0.000 0.000

NM 7 26 18 8 2 1 0 0 0 0 62

13.0 22.0 14.1 8.0 3.1 1.2 0.4 0.2 0.0 0.0

2.745 0.740 1.067 0.000 0.383 0.042 0.409 0.167 0.037 0.037

0.113 0.419 0.290 0.129 0.032 0.016 0.000 0.000 0.000 0.000 0.019

0.010 0.022 0.024 0.019 0.012 0.015 0.000 0.000 0.000 0.000

0.002 0.008 0.005 0.002 0.001 0.000 0.000 0.000 0.000 0.000

NV 9 27 18 8 2 2 0 0 0 0 66

13.8 23.4 15.0 8.5 3.3 1.3 0.4 0.2 0.0 0.0

1.671 0.558 0.587 0.029 0.504 0.368 0.436 0.178 0.040 0.040

0.136 0.409 0.273 0.121 0.030 0.030 0.000 0.000 0.000 0.000 0.020

0.013 0.023 0.024 0.019 0.012 0.030 0.000 0.000 0.000 0.000

0.003 0.008 0.005 0.002 0.001 0.001 0.000 0.000 0.000 0.000

NY 13 31 22 7 6 2 2 0 0 0 83

17.4 29.4 18.9 10.7 4.1 1.6 0.5 0.2 0.0 0.0

1.094 0.086 0.508 1.270 0.842 0.077 3.849 0.224 0.050 0.050

0.157 0.373 0.265 0.084 0.072 0.024 0.024 0.000 0.000 0.000 0.025

0.019 0.026 0.029 0.016 0.036 0.030 0.091 0.000 0.000 0.000

0.004 0.009 0.007 0.002 0.002 0.001 0.001 0.000 0.000 0.000

OH 23 20 26 5 3 0 0 1 0 0 78

16.3 27.6 17.8 10.0 3.9 1.5 0.5 0.2 0.0 0.0

2.743 2.111 3.820 2.530 0.202 1.545 0.515 2.958 0.047 0.047

0.295 0.256 0.333 0.064 0.038 0.000 0.000 0.013 0.000 0.000 0.023

0.033 0.017 0.034 0.012 0.018 0.000 0.000 0.111 0.000 0.000

0.007 0.006 0.008 0.002 0.001 0.000 0.000 0.000 0.000 0.000

OK 10 20 13 12 3 3 0 0 0 0 61

12.8 21.6 13.9 7.9 3.0 1.2 0.4 0.2 0.0 0.0

0.596 0.121 0.057 2.192 0.000 2.659 0.403 0.165 0.037 0.037

0.164 0.328 0.213 0.197 0.049 0.049 0.000 0.000 0.000 0.000 0.018

0.014 0.017 0.017 0.028 0.018 0.045 0.000 0.000 0.000 0.000

0.003 0.006 0.004 0.004 0.001 0.001 0.000 0.000 0.000 0.000

OR 13 23 24 12 3 2 1 0 0 0 78

16.3 27.6 17.8 10.0 3.9 1.5 0.5 0.2 0.0 0.0

0.672 0.778 2.190 0.383 0.202 0.134 0.457 0.211 0.047 0.047

0.167 0.295 0.308 0.154 0.038 0.026 0.013 0.000 0.000 0.000 0.023

0.019 0.019 0.032 0.028 0.018 0.030 0.045 0.000 0.000 0.000

0.004 0.007 0.007 0.004 0.001 0.001 0.000 0.000 0.000 0.000

PA 13 18 5 7 2 0 0 0 0 0 45

9.4 15.9 10.2 5.8 2.2 0.9 0.3 0.1 0.0 0.0

1.369 0.265 2.687 0.252 0.026 0.891 0.297 0.122 0.027 0.027

0.289 0.400 0.111 0.156 0.044 0.000 0.000 0.000 0.000 0.000 0.014

0.019 0.015 0.007 0.016 0.012 0.000 0.000 0.000 0.000 0.000

0.004 0.005 0.002 0.002 0.001 0.000 0.000 0.000 0.000 0.000

RI 21 16 13 10 5 0 0 0 0 0 65

13.6 23.0 14.8 8.4 3.2 1.3 0.4 0.2 0.0 0.0

4.036 2.147 0.219 0.319 0.960 1.287 0.429 0.176 0.039 0.039

0.323 0.246 0.200 0.154 0.077 0.000 0.000 0.000 0.000 0.000 0.020

0.030 0.014 0.017 0.023 0.030 0.000 0.000 0.000 0.000 0.000

0.006 0.005 0.004 0.003 0.002 0.000 0.000 0.000 0.000 0.000

SC	16	16	17	3	7	0	0	0	1	0	60
	12.5	21.3	13.7	7.7	3.0	1.2	0.4	0.2	0.0	0.0	
	0.950	1.301	0.815	2.888	5.386	1.188	0.396	0.162	25.811	0.036	
	0.267	0.267	0.283	0.050	0.117	0.000	0.000	0.000	0.017	0.000	0.018
	0.023	0.014	0.022	0.007	0.042	0.000	0.000	0.000	0.500	0.000	
	0.005	0.005	0.005	0.001	0.002	0.000	0.000	0.000	0.000	0.000	

SD	13	22	14	10	1	0	0	0	0	0	60
	12.5	21.3	13.7	7.7	3.0	1.2	0.4	0.2	0.0	0.0	
	0.016	0.026	0.008	0.671	1.323	1.188	0.396	0.162	0.036	0.036	
	0.217	0.367	0.233	0.167	0.017	0.000	0.000	0.000	0.000	0.000	0.018
	0.019	0.019	0.018	0.023	0.006	0.000	0.000	0.000	0.000	0.000	
	0.004	0.007	0.004	0.003	0.000	0.000	0.000	0.000	0.000	0.000	

TN	12	26	6	6	2	0	1	0	0	0	53
	11.1	18.8	12.1	6.8	2.6	1.0	0.3	0.1	0.0	0.0	
	0.076	2.776	3.052	0.099	0.155	1.050	1.208	0.143	0.032	0.032	
	0.226	0.491	0.113	0.113	0.038	0.000	0.019	0.000	0.000	0.000	0.016
	0.017	0.022	0.008	0.014	0.012	0.000	0.045	0.000	0.000	0.000	
	0.004	0.008	0.002	0.002	0.001	0.000	0.000	0.000	0.000	0.000	

TX	16	23	15	11	5	2	0	0	0	0	72
	15.1	25.5	16.4	9.3	3.6	1.4	0.5	0.2	0.0	0.0	
	0.059	0.247	0.119	0.324	0.558	0.231	0.475	0.194	0.043	0.043	
	0.222	0.319	0.208	0.153	0.069	0.028	0.000	0.000	0.000	0.000	0.022
	0.023	0.019	0.020	0.026	0.030	0.030	0.000	0.000	0.000	0.000	
	0.005	0.007	0.005	0.003	0.002	0.001	0.000	0.000	0.000	0.000	

UT	16	31	15	7	0	1	2	0	0	0	72
	15.1	25.5	16.4	9.3	3.6	1.4	0.5	0.2	0.0	0.0	

0.059 1.180 0.119 0.555 3.586 0.127 4.892 0.194 0.043 0.043

0.222 0.431 0.208 0.097 0.000 0.014 0.028 0.000 0.000 0.000 0.022

0.023 0.026 0.020 0.016 0.000 0.015 0.091 0.000 0.000 0.000

0.005 0.009 0.005 0.002 0.000 0.000 0.001 0.000 0.000 0.000

VA 16 22 24 10 2 3 0 0 0 0 77

16.1 27.3 17.5 9.9 3.8 1.5 0.5 0.2 0.0 0.0

0.001 1.023 2.384 0.001 0.878 1.427 0.508 0.208 0.046 0.046

0.208 0.286 0.312 0.130 0.026 0.039 0.000 0.000 0.000 0.000 0.023

0.023 0.019 0.032 0.023 0.012 0.045 0.000 0.000 0.000 0.000

0.005 0.007 0.007 0.003 0.001 0.001 0.000 0.000 0.000 0.000

VT 15 26 12 10 6 2 1 1 0 0 73

15.3 25.9 16.6 9.4 3.6 1.4 0.5 0.2 0.0 0.0

0.005 0.001 1.286 0.039 1.537 0.213 0.557 3.270 0.044 0.044

0.205 0.356 0.164 0.137 0.082 0.027 0.014 0.014 0.000 0.000 0.022

0.022 0.022 0.016 0.023 0.036 0.030 0.045 0.111 0.000 0.000

0.005 0.008 0.004 0.003 0.002 0.001 0.000 0.000 0.000 0.000

WA 15 22 16 8 3 1 1 0 0 0 66

13.8 23.4 15.0 8.5 3.3 1.3 0.4 0.2 0.0 0.0

0.104 0.082 0.063 0.029 0.025 0.072 0.731 0.178 0.040 0.040

0.227 0.333 0.242 0.121 0.045 0.015 0.015 0.000 0.000 0.000 0.020

0.022 0.019 0.021 0.019 0.018 0.015 0.045 0.000 0.000 0.000

0.005 0.007 0.005 0.002 0.001 0.000 0.000 0.000 0.000 0.000

WI 17 31 17 9 2 1 1 0 0 0 78

16.3 27.6 17.8 10.0 3.9 1.5 0.5 0.2 0.0 0.0

0.029 0.409 0.033 0.108 0.914 0.192 0.457 0.211 0.047 0.047

0.218 0.397 0.218 0.115 0.026 0.013 0.013 0.000 0.000 0.000 0.023

0.024 0.026 0.022 0.021 0.012 0.015 0.045 0.000 0.000 0.000

0.005 0.009 0.005 0.003 0.001 0.000 0.000 0.000 0.000 0.000

WV 18 47 22 11 5 3 0 0 0 0 106

22.2 37.6 24.1 13.6 5.3 2.1 0.7 0.3 0.1 0.1

0.783 2.373 0.189 0.512 0.015 0.387 0.700 0.286 0.064 0.064

0.170 0.443 0.208 0.104 0.047 0.028 0.000 0.000 0.000 0.000 0.032

0.026 0.040 0.029 0.026 0.030 0.045 0.000 0.000 0.000 0.000

0.005 0.014 0.007 0.003 0.002 0.001 0.000 0.000 0.000 0.000

WY 17 32 14 8 3 3 0 0 0 0 77

16.1 27.3 17.5 9.9 3.8 1.5 0.5 0.2 0.0 0.0

0.050 0.815 0.713 0.368 0.182 1.427 0.508 0.208 0.046 0.046

0.221 0.416 0.182 0.104 0.039 0.039 0.000 0.000 0.000 0.000 0.023

0.024 0.027 0.018 0.019 0.018 0.045 0.000 0.000 0.000 0.000

0.005 0.010 0.004 0.002 0.001 0.001 0.000 0.000 0.000 0.000

Total 697 1181 759 429 166 66 22 9 2 2 3333

0.209 0.354 0.228 0.129 0.050 0.020 0.007 0.003 0.001 0.001

==========

==========

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NULL

Rattle timestamp: 2018-10-13 16:23:24 tsraj

Note that principal components on only the numeric

variables is calculated, and so we can not use this

approach to remove categoric variables from consideration.

Any numeric variables with relatively large rotation

values (negative or positive) in any of the first few

components are generally variables that you may wish

to include in the modelling.

Rattle timestamp: 2018-10-13 16:47:44 tsraj

==========

Call:

princomp(x = na.omit(crs$dataset[crs$train, crs$numeric]), scale = TRUE,

center = TRUE, tol = 0)

Standard deviations:

Comp.1 Comp.2 Comp.3 Comp.4 Comp.5 Comp.6 Comp.7

55.363183749 51.176157476 50.830996123 42.534087301 39.966920531 20.060631402
19.909459329

Comp.8 Comp.9 Comp.10 Comp.11 Comp.12 Comp.13 Comp.14

19.537257865 13.864712221 2.888155671 2.446667752 0.366767768 0.267523436 0.129534168

Comp.15 Comp.16 Comp.17 Comp.18

0.002874405 0.002853748 0.002809956 0.002749023

18 variables and 2333 observations.

Rattle timestamp: 2018-10-13 16:47:44 tsraj

==========

Importance of components:

Comp.1 Comp.2 Comp.3 Comp.4 Comp.5 Comp.6

Standard deviation 55.3631837 51.1761575 50.8309961 42.5340873 39.9669205 20.0606314

Proportion of Variance 0.2346622 0.2005102 0.1978146 0.1385082 0.1222933 0.0308099

Cumulative Proportion 0.2346622 0.4351724 0.6329870 0.7714952 0.8937885 0.9245984

Comp.7 Comp.8 Comp.9 Comp.10 Comp.11 Comp.12

Standard deviation 19.9094593 19.53725787 13.86471222 2.8881556710 2.4466677525
0.36676776756

Proportion of Variance 0.0303473 0.02922324 0.01471712 0.0006386197 0.0004583013 0.00001029872

Cumulative Proportion 0.9549457 0.98416889 0.99888601 0.9995246336 0.9999829349 0.9999323366

	Comp.13	Comp.14	Comp.15	Comp.16	Comp.17
Standard deviation	0.267523435595	0.129534167556	2.874405e-03	2.853748e-03	2.809956e-03
Proportion of Variance	0.000005479296	0.000001284606	6.325531e-10	6.234941e-10	6.045052e-10
Cumulative Proportion	0.999998712955	0.999999997561	1.000000e+00	1.000000e+00	1.000000e+00

	Comp.18
Standard deviation	2.749023e-03
Proportion of Variance	5.785725e-10
Cumulative Proportion	1.000000e+00

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Correlation summary using the 'Pearson' covariance.

Note that only correlations between numeric variables are reported.

	Night.Calls	Eve.Mins	Eve.Charge	Area.Code	Intl.Mins	Intl.Charge
Night.Calls	1.0000000000	0.00728610375	0.00730390213	0.0204932171	0.020744861	0.020745785
Eve.Mins	0.0072861038	1.00000000000	0.99999978024	0.0191211028	-0.010588282	-0.010676641
Eve.Charge	0.0073039021	0.99999978024	1.00000000000	0.0191392025	-0.010595150	-0.010683532
Area.Code	0.0204932171	0.01912110278	0.01913920253	1.0000000000	-0.007280666	-0.007392959
Intl.Mins	0.0207448614	-0.01058828174	-0.01059514976	-0.0072806656	1.000000000	0.999992677
Intl.Charge	0.0207457852	-0.01067664103	-0.01068353187	-0.0073929587	0.999992677	1.000000000

Night.Charge 0.0100791240 -0.00561750295 -0.00562149959 0.0012700083 -0.014917770 -0.014826747

Night.Mins 0.0100649946 -0.00559031608 -0.00559431590 0.0012835639 -0.014892704 -0.014801566

VMail.Message 0.0008396175 0.01099002832 0.01100558044 0.0003384187 -0.002098786 -0.002032482

Eve.Calls 0.0126966191 -0.02173690069 -0.02173662436 -0.0145870162 0.032973269 0.032976668

Day.Charge 0.0091175696 0.00007908231 0.00006842788 -0.0090016246 -0.011799410 -0.011668614

Day.Mins 0.0091172798 0.00006773940 0.00005708320 -0.0089990374 -0.011793062 -0.011662247

Churn 0.0043883761 0.10226424269 0.10225946229 0.0219078423 0.069999164 0.070013105

VMail.Plan 0.0040737924 0.01425143805 0.01426376688 -0.0003839688 -0.003541920 -0.003462970

Int.l.Plan 0.0111411462 0.03392358656 0.03392256550 0.0578715377 0.050796605 0.050690415

Intl.Calls -0.0138501260 -0.00408992509 -0.00408755943 -0.0109390565 0.019332522 0.019438841

Day.Calls -0.0202860949 -0.01187573163 -0.01185789994 -0.0004356262 0.015322572 0.015398550

Account.Length -0.0368140243 -0.01027130542 -0.01026470090 -0.0063062700 0.001643488 0.001732922

	Night.Charge	Night.Mins	VMail.Message	Eve.Calls	Day.Charge	Day.Mins
Night.Calls	0.010079124	0.010064995	0.0008396175	0.012696619	0.00911756964	0.0091172798
Eve.Mins	-0.005617503	-0.005590316	0.0109900283	-0.021736901	0.00007908231	0.0000677394
Eve.Charge	-0.005621500	-0.005594316	0.0110055804	-0.021736624	0.00006842788	0.0000570832
Area.Code	0.001270008	0.001283564	0.0003384187	-0.014587016	-0.00900162461	-0.0089990374
Intl.Mins	-0.014917770	-0.014892704	-0.0020987858	0.032973269	-0.01179941013	-0.0117930624
Intl.Charge	-0.014826747	-0.014801566	-0.0020324824	0.032976668	-0.01166861419	-0.0116622466

Night.Charge 1.000000000 0.999999221 0.0140906682 0.007491734 0.02936540805 0.0293676546

Night.Mins 0.999999221 1.000000000 0.0141229901 0.007441521 0.02935449645 0.0293567393

VMail.Message 0.014090668 0.014122990 1.0000000000 0.003381435 0.00338888240 0.0033901877

Eve.Calls 0.007491734 0.007441521 0.0033814349 1.000000000 0.02767185546 0.0276685649

Day.Charge 0.029365408 0.029354496 0.0033888824 0.027671855 1.00000000000 0.9999999527

Day.Mins 0.029367655 0.029356739 0.0033901877 0.027668565 0.99999995266 1.0000000000

Churn 0.039188502 0.039179234 -0.0776805214 0.006713751 0.21370153671 0.2136984813

VMail.Plan 0.006947450 0.006973910 0.9572692355 0.003156504 -0.00154813634 -0.0015473797

Int.l.Plan -0.027239647 -0.027240313 0.0149454169 0.009250272 0.05229650697 0.0522972414

Intl.Calls -0.000989097 -0.000996865 -0.0004766350 0.030437267 0.00967755667 0.0096786340

Day.Calls 0.020549231 0.020563384 -0.0069430780 0.009730020 0.01613228711 0.0161311687

Account.Length 0.006437866 0.006444948 0.0112013521 0.011818414 0.01359306373 0.0135931558

Churn VMail.Plan Int.l.Plan Intl.Calls Day.Calls Account.Length

Night.Calls 0.004388376 0.0040737924 0.011141146 -0.013850126 -0.0202860949 -0.036814024

Eve.Mins 0.102264243 0.0142514381 0.033923587 -0.004089925 -0.0118757316 -0.010271305

Eve.Charge 0.102259462 0.0142637669 0.033922565 -0.004087559 -0.0118578999 -0.010264701

Area.Code 0.021907842 -0.0003839688 0.057871538 -0.010939056 -0.0004356262 -0.006306270

Intl.Mins 0.069999164 -0.0035419202 0.050796605 0.019332522 0.0153225721 0.001643488

Intl.Charge 0.070013105 -0.0034629697 0.050690415 0.019438841 0.0153985502 0.001732922

Night.Charge 0.039188502 0.0069474498 -0.027239647 -0.000989097 0.0205492306 0.006437866

Night.Mins 0.039179234 0.0069739102 -0.027240313 -0.000996865 0.0205633836 0.006444948

VMail.Message -0.077680521 0.9572692355 0.014945417 -0.000476635 -0.0069430780 0.011201352

Eve.Calls 0.006713751 0.0031565037 0.009250272 0.030437267 0.0097300199 0.011818414

Day.Charge 0.213701537 -0.0015481363 0.052296507 0.009677557 0.0161322871 0.013593064

Day.Mins 0.213698481 -0.0015473797 0.052297241 0.009678634 0.0161311687 0.013593156

Churn 1.000000000 -0.0925253694 0.275080361 -0.063161904 0.0293655468 0.015786593

VMail.Plan -0.092525369 1.0000000000 0.010643477 -0.004834593 -0.0082287144 0.016288113

Int.l.Plan 0.275080361 0.0106434769 1.000000000 0.021804979 0.0067064638 0.025351573

Intl.Calls -0.063161904 -0.0048345928 0.021804979 1.000000000 -0.0013312991 0.026672128

Day.Calls 0.029365547 -0.0082287144 0.006706464 -0.001331299 1.0000000000 0.032119615

Account.Length 0.015786593 0.0162881126 0.025351573 0.026672128 0.0321196153 1.000000000

Rattle timestamp: 2018-10-13 16:50:11 tsraj

Correlation Test

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Day.Mins'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.2052

STATISTIC:

t: 12.0976

P VALUE:

Alternative Two-Sided: < 2.2e-16

Alternative Less: 1

Alternative Greater: < 2.2e-16

CONFIDENCE INTERVAL:

Two-Sided: 0.1724, 0.2374

Less: -1, 0.2323

Greater: 0.1777, 1

Description:

Sat Oct 13 17:09:54 2018

Rattle timestamp: 2018-10-13 17:09:54 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Eve.Mins'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0928

STATISTIC:

t: 5.3789

P VALUE:

Alternative Two-Sided: 0.00000008011

Alternative Less: 1

Alternative Greater: 0.00000004006

CONFIDENCE INTERVAL:

Two-Sided: 0.059, 0.1263

Less: -1, 0.121

Greater: 0.0645, 1

Description:

Sat Oct 13 17:11:03 2018

Rattle timestamp: 2018-10-13 17:11:03 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Account.Length'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0165

STATISTIC:

t: 0.9548

P VALUE:

Alternative Two-Sided: 0.3398

Alternative Less: 0.8301

Alternative Greater: 0.1699

CONFIDENCE INTERVAL:

Two-Sided: -0.0174, 0.0505

Less: -1, 0.045

Greater: -0.012, 1

Description:

Sat Oct 13 17:12:03 2018

Rattle timestamp: 2018-10-13 17:12:03 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Night.Mins'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0355

STATISTIC:

t: 2.0498

P VALUE:

Alternative Two-Sided: 0.04047

Alternative Less: 0.9798

Alternative Greater: 0.02023

CONFIDENCE INTERVAL:

Two-Sided: 0.0015, 0.0694

Less: -1, 0.0639

Greater: 0.007, 1

Description:

Sat Oct 13 17:13:01 2018

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Intl.Mins'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0682

STATISTIC:

t: 3.9476

P VALUE:

Alternative Two-Sided: 0.00008057

Alternative Less: 1

Alternative Greater: 0.00004029

CONFIDENCE INTERVAL:

Two-Sided: 0.0344, 0.102

Less: -1, 0.0965

Greater: 0.0398, 1

Description:

Sat Oct 13 17:13:33 2018

Rattle timestamp: 2018-10-13 17:13:33 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Int.l.Plan'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.2599

STATISTIC:

t: 15.5308

P VALUE:

Alternative Two-Sided: < 2.2e-16

Alternative Less: 1

Alternative Greater: < 2.2e-16

CONFIDENCE INTERVAL:

Two-Sided: 0.2279, 0.2912

Less: -1, 0.2862

Greater: 0.2331, 1

Description:

Sat Oct 13 17:14:59 2018

Rattle timestamp: 2018-10-13 17:14:59 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'VMail.Plan'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: -0.1021

STATISTIC:

t: -5.9265

P VALUE:

Alternative Two-Sided: 0.000000003411

Alternative Less: 0.000000001706

Alternative Greater: 1

CONFIDENCE INTERVAL:

Two-Sided: -0.1356, -0.0684

Less: -1, -0.0739

Greater: -0.1303, 1

Description:

Sat Oct 13 17:15:38 2018

Rattle timestamp: 2018-10-13 17:15:38 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Day.Calls'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0185

STATISTIC:

t: 1.0656

P VALUE:

Alternative Two-Sided: 0.2867

Alternative Less: 0.8566

Alternative Greater: 0.1434

CONFIDENCE INTERVAL:

Two-Sided: -0.0155, 0.0524

Less: -1, 0.0469

Greater: -0.01, 1

Description:

Sat Oct 13 17:16:27 2018

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Day.Charge'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.2052

STATISTIC:

t: 12.0975

P VALUE:

Alternative Two-Sided: < 2.2e-16

Alternative Less: 1

Alternative Greater: < 2.2e-16

CONFIDENCE INTERVAL:

Two-Sided: 0.1724, 0.2374

Less: -1, 0.2323

Greater: 0.1777, 1

Description:

Sat Oct 13 17:17:14 2018

Rattle timestamp: 2018-10-13 17:17:14 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Eve.Calls'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0092

STATISTIC:

t: 0.5329

P VALUE:

Alternative Two-Sided: 0.5941

Alternative Less: 0.7029

Alternative Greater: 0.2971

CONFIDENCE INTERVAL:

Two-Sided: -0.0247, 0.0432

Less: -1, 0.0377

Greater: -0.0193, 1

Description:

Sat Oct 13 17:17:58 2018

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Eve.Charge'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0928

STATISTIC:

t: 5.3783

P VALUE:

Alternative Two-Sided: 0.00000008037

Alternative Less: 1

Alternative Greater: 0.00000004018

CONFIDENCE INTERVAL:

Two-Sided: 0.059, 0.1263

Less: -1, 0.121

Greater: 0.0645, 1

Description:

Sat Oct 13 17:18:38 2018

Rattle timestamp: 2018-10-13 17:18:38 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Night.Calls'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0061

STATISTIC:

t: 0.3544

P VALUE:

Alternative Two-Sided: 0.723

Alternative Less: 0.6385

Alternative Greater: 0.3615

CONFIDENCE INTERVAL:

Two-Sided: -0.0278, 0.0401

Less: -1, 0.0346

Greater: -0.0224, 1

Description:

Sat Oct 13 17:19:28 2018

Rattle timestamp: 2018-10-13 17:19:28 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Night.Charge'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0355

STATISTIC:

t: 2.0499

P VALUE:

Alternative Two-Sided: 0.04045

Alternative Less: 0.9798

Alternative Greater: 0.02023

CONFIDENCE INTERVAL:

Two-Sided: 0.0015, 0.0694

Less: -1, 0.0639

Greater: 0.007, 1

Description:

Sat Oct 13 17:20:00 2018

Rattle timestamp: 2018-10-13 17:20:00 tsraj

Correlation Test

The paired sample correlation test is performed on the two specified samples.
The two samples are expected to be paired (two observations for the same entity).
The null hypothesis is that the two samples have no (i.e., 0) correlation.
Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and
accept the alternative hypothesis that the samples are correlated,
at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Intl.Calls'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: -0.0528

STATISTIC:

t: -3.0542

P VALUE:

Alternative Two-Sided: 0.002275

Alternative Less: 0.001137

Alternative Greater: 0.9989

CONFIDENCE INTERVAL:

Two-Sided: -0.0866, -0.0189

Less: -1, -0.0244

Greater: -0.0812, 1

Description:

Sat Oct 13 17:20:30 2018

Rattle timestamp: 2018-10-13 17:20:30 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and

accept the alternative hypothesis that the samples are correlated,

at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Intl.Charge'

Title:

Pearson's Correlation Test

Test Results:

PARAMETER:

Degrees of Freedom: 3331

SAMPLE ESTIMATES:

Correlation: 0.0683

STATISTIC:

t: 3.9487

P VALUE:

Alternative Two-Sided: 0.00008019

Alternative Less: 1

Alternative Greater: 0.00004009

CONFIDENCE INTERVAL:

Two-Sided: 0.0344, 0.102

Less: -1, 0.0966

Greater: 0.0398, 1

Description:

Sat Oct 13 17:21:08 2018

Rattle timestamp: 2018-10-13 17:21:08 tsraj

The paired sample correlation test is performed on the two specified samples.

The two samples are expected to be paired (two observations for the same entity).

The null hypothesis is that the two samples have no (i.e., 0) correlation.

Pearson's product moment correlation coefficient is used.

If the p-value is less than 0.05 then we reject the null hypothesis and
accept the alternative hypothesis that the samples are correlated,
at the 95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Area.Code'
Title:
Pearson's Correlation Test

Test Results:
PARAMETER:
Degrees of Freedom: 3331
SAMPLE ESTIMATES:
Correlation: 0.0062
STATISTIC:
t: 0.3564
P VALUE:
Alternative Two-Sided: 0.7216
Alternative Less: 0.6392
Alternative Greater: 0.3608
CONFIDENCE INTERVAL:
Two-Sided: -0.0278, 0.0401
Less: -1, 0.0347
Greater: -0.0223, 1

Description:
Sat Oct 13 17:21:50 2018

Wilcoxon Rank Sum Test

The two-sample non-parametric Wilcoxon rank sum test (equivalent to
the Mann-Whitney test) is performed on the two specified samples. The null
hypothesis is that the distributions are the same (i.e., there is no
shift in the location of the two distributions) with an alternative
hypothesis that they differ on location (based on median).

This test does not assume that the two samples are normally distributed
but does assume they have distributions of the same shape.

If the p-value is less than 0.05 then we reject the null hypothesis and
accept the alternative hypothesis, that the two samples have different medians,
at the 95% level of confidence.

The two samples being compared come from the 'Churn' variable, grouped by
'CustServ.Calls', with values '0' and '1'

Wilcoxon rank sum test with continuity correction

data: na.omit(crs$dataset[crs$dataset[["CustServ.Calls"]] == "0", "Churn"]) and
na.omit(crs$dataset[crs$dataset[["CustServ.Calls"]] == "1", "Churn"])

W = 423390, p-value = 0.05878

alternative hypothesis: true location shift is not equal to 0

Rattle timestamp: 2018-10-13 17:22:39 tsraj

Wilcoxon Signed Rank Test

The paired sample non-parametric Wilcoxon signed rank test is
performed on the two specified samples. The two samples are expected to be
paired (two observations for the same entity). The null hypothesis is that

the distributions are the same.

This test does not assume that the two samples are are normally distributed.

If the p-value is less than 0.05 then we reject the null hypothesis and
accept the alternative hypothesis, that the distributions differ, at the
95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Day.Mins'

Wilcoxon signed rank test with continuity correction

data: na.omit(crs$dataset[, "Churn"]) and na.omit(crs$dataset[, "Day.Mins"])
V = 1, p-value < 2.2e-16
alternative hypothesis: true location shift is not equal to 0

Rattle timestamp: 2018-10-13 17:24:00 tsraj

Wilcoxon Signed Rank Test

The paired sample non-parametric Wilcoxon signed rank test is
performed on the two specified samples. The two samples are expected to be
paired (two observations for the same entity). The null hypothesis is that
the distributions are the same.

This test does not assume that the two samples are are normally distributed.

If the p-value is less than 0.05 then we reject the null hypothesis and
accept the alternative hypothesis, that the distributions differ, at the
95% level of confidence.

The two samples being compared are the two variables, 'Churn' and 'Day.Calls'

Wilcoxon signed rank test with continuity correction

data: na.omit(crs$dataset[, "Churn"]) and na.omit(crs$dataset[, "Day.Calls"])

V = 1, p-value < 2.2e-16

alternative hypothesis: true location shift is not equal to 0

Rattle timestamp: 2018-10-13 17:25:40 tsrajan

Neural network

Summary of the Neural Net model (built using nnet):

A 18-10-1 network with 219 weights.

Inputs: Account.Length, VMail.Message, Day.Mins, Eve.Mins, Night.Mins, Intl.Mins, CustServ.Calls, Int.l.Plan, VMail.Plan, Day.Calls, Day.Charge, Eve.Calls, Eve.Charge, Night.Calls, Night.Charge, Intl.Calls, Intl.Charge, Area.Code.

Output: as.factor(Churn).

Sum of Squares Residuals: 351.0000.

Neural Network build options: skip-layer connections; entropy fitting.

In the following table:

b represents the bias associated with a node

h1 represents hidden layer node 1

i1 represents input node 1 (i.e., input variable 1)

o represents the output node

Weights for node h1:

b->h1 i1->h1 i2->h1 i3->h1 i4->h1 i5->h1 i6->h1 i7->h1 i8->h1 i9->h1 i10->h1 i11->h1

-0.66 0.23 0.29 -0.31 -0.68 -0.36 0.27 0.23 -0.31 -0.18 0.31 -0.02

i12->h1 i13->h1 i14->h1 i15->h1 i16->h1 i17->h1 i18->h1

0.29 -0.50 0.39 0.25 -0.16 -0.55 -0.52

Weights for node h2:

b->h2 i1->h2 i2->h2 i3->h2 i4->h2 i5->h2 i6->h2 i7->h2 i8->h2 i9->h2 i10->h2 i11->h2

0.25 -0.65 -0.15 -0.03 -0.20 0.30 -0.16 -0.04 0.49 0.56 0.44 0.41

i12->h2 i13->h2 i14->h2 i15->h2 i16->h2 i17->h2 i18->h2

0.51 0.38 0.22 0.47 -0.41 0.15 -0.22

Weights for node h3:

b->h3 i1->h3 i2->h3 i3->h3 i4->h3 i5->h3 i6->h3 i7->h3 i8->h3 i9->h3 i10->h3 i11->h3

0.46 -0.08 -0.41 0.33 -0.54 0.56 0.59 0.64 0.13 -0.68 -0.51 0.55

i12->h3 i13->h3 i14->h3 i15->h3 i16->h3 i17->h3 i18->h3

0.05 0.15 0.31 -0.15 0.24 0.02 0.33

Weights for node h4:

b->h4 i1->h4 i2->h4 i3->h4 i4->h4 i5->h4 i6->h4 i7->h4 i8->h4 i9->h4 i10->h4 i11->h4

-0.44 -0.47 -0.68 0.07 0.30 0.35 -0.01 0.09 0.65 -0.36 -0.41 -0.56

i12->h4 i13->h4 i14->h4 i15->h4 i16->h4 i17->h4 i18->h4

0.50 -0.53 -0.19 -0.24 -0.62 0.23 -0.47

Weights for node h5:

b->h5 i1->h5 i2->h5 i3->h5 i4->h5 i5->h5 i6->h5 i7->h5 i8->h5 i9->h5 i10->h5 i11->h5

-0.14 -0.28 0.33 0.44 -0.07 -0.08 0.51 -0.17 -0.26 0.07 -0.01 -0.52

i12->h5 i13->h5 i14->h5 i15->h5 i16->h5 i17->h5 i18->h5

0.14 -0.18 -0.62 0.70 -0.04 -0.37 -0.06

Weights for node h6:

b->h6 i1->h6 i2->h6 i3->h6 i4->h6 i5->h6 i6->h6 i7->h6 i8->h6 i9->h6 i10->h6 i11->h6

-0.07 -0.12 0.41 0.37 0.03 -0.19 -0.46 0.05 0.29 -0.18 -0.51 -0.16

i12->h6 i13->h6 i14->h6 i15->h6 i16->h6 i17->h6 i18->h6

0.55 0.51 -0.57 -0.56 -0.02 0.09 0.21

Weights for node h7:

b->h7 i1->h7 i2->h7 i3->h7 i4->h7 i5->h7 i6->h7 i7->h7 i8->h7 i9->h7 i10->h7 i11->h7

0.62 0.06 0.66 0.07 -0.39 0.08 0.50 -0.64 0.12 0.45 -0.21 -0.54

i12->h7 i13->h7 i14->h7 i15->h7 i16->h7 i17->h7 i18->h7

-0.44 0.08 -0.61 0.57 0.30 0.64 0.16

Weights for node h8:

b->h8 i1->h8 i2->h8 i3->h8 i4->h8 i5->h8 i6->h8 i7->h8 i8->h8 i9->h8 i10->h8 i11->h8

-0.42 0.51 -0.59 -0.23 0.31 -0.19 0.69 -0.37 0.26 -0.18 -0.16 0.53

i12->h8 i13->h8 i14->h8 i15->h8 i16->h8 i17->h8 i18->h8

-0.42 -0.65 -0.30 -0.49 -0.69 0.68 0.26

Weights for node h9:

b->h9 i1->h9 i2->h9 i3->h9 i4->h9 i5->h9 i6->h9 i7->h9 i8->h9 i9->h9 i10->h9 i11->h9

0.17 -0.22 0.23 -0.25 0.06 -0.52 -0.13 0.58 0.14 0.28 0.23 0.53

i12->h9 i13->h9 i14->h9 i15->h9 i16->h9 i17->h9 i18->h9

0.25 0.34 -0.02 -0.17 0.33 0.57 0.46

Weights for node h10:

b->h10 i1->h10 i2->h10 i3->h10 i4->h10 i5->h10 i6->h10 i7->h10 i8->h10 i9->h10

0.47 0.68 -0.44 -0.61 0.16 -0.65 0.20 0.55 -0.44 0.05

i10->h10 i11->h10 i12->h10 i13->h10 i14->h10 i15->h10 i16->h10 i17->h10 i18->h10

0.43 -0.24 0.63 -0.07 -0.59 0.50 0.35 0.31 -0.15

Weights for node o:

b->o h1->o h2->o h3->o h4->o h5->o h6->o h7->o h8->o h9->o h10->o i1->o i2->o

0.14 0.30 0.50 -0.63 -0.54 -0.44 0.65 0.27 -0.49 -0.66 0.60 -0.56 0.19

i3->o i4->o i5->o i6->o i7->o i8->o i9->o i10->o i11->o i12->o i13->o i14->o i15->o

0.04 -0.28 -0.38 -0.41 -0.14 -0.01 0.09 0.17 -0.45 0.61 -0.17 -0.07 -0.44

i16->o i17->o i18->o

-0.22 -0.67 -0.07

Time taken: 0.12 secs

Rattle timestamp: 2018-10-20 05:30:24 tsraj

Boost

Summary of the Extreme Boost model:

Call:

```
ada(Churn ~ ., data = crs$dataset[crs$train, c(crs$input, crs$target)],
   control = rpart::rpart.control(maxdepth = 6, cp = 0.01, minsplit = 20,
      xval = 10), iter = 50)
```

Loss: exponential Method: discrete Iteration: 50

Final Confusion Matrix for Data:

True value	Final Prediction 0	1
0	1977	5
1	61	290

Train Error: 0.028

Out-Of-Bag Error: 0.033 iteration= 50

Additional Estimates of number of iterations:

train.err1	train.kap1
44	50

Random Forest

Summary of the Random Forest Model

==========

Number of observations used to build the model: 2333

Missing value imputation is active.

Call:

randomForest(formula = as.factor(Churn) ~ .,

data = crs$dataset[crs$train, c(crs$input, crs$target)],

ntree = 500, mtry = 4, importance = TRUE, replace = FALSE,

na.action = randomForest::na.roughfix)

Type of random forest: classification

Number of trees: 500

No. of variables tried at each split: 4

OOB estimate of error rate: 4.63%

Confusion matrix:

	0	1	class.error
0	1962	20	0.01009082
1	88	263	0.25071225

Analysis of the Area Under the Curve (AUC)

==========

Call:

roc.default(response = crsrfy, predictor = as.numeric(crsrfpredicted))

Data: as.numeric(crsrfpredicted) in 1982 controls (crsrfy 0) < 351 cases (crsrfy 1).

Area under the curve: 0.8696

95% CI: 0.8468-0.8924 (DeLong)

Variable Importance

==========

A higher **Mean Decrease** in **Gini** indicates higher variable importance.

	0	1	MeanDecreaseAccuracy	MeanDecreaseGini
CustServ.Calls	57.20	72.51	75.35	46.32
Int.l.Plan	49.69	63.11	62.99	30.26
Day.Charge	30.09	32.57	40.02	57.47
Day.Mins	29.86	32.18	39.73	54.84
Intl.Calls	25.3	31.31	34.28	18.93
Intl.Mins	17.80	15.39	22.04	15.84
VMail.Message	16.64	20.59	21.99	12.06
VMail.Plan	17.32	20.50	21.49	7.92
Intl.Charge	16.89	16.12	21.44	15.82
Eve.Mins	17.20	20.69	21.03	23.82
Eve.Charge	17.21	20.04	20.94	23.14
Night.Mins	12.11	3.90	12.98	12.83
Night.Charge	11.92	2.57	12.47	12.60
Night.Calls	1.16	-0.87	0.69	10.90
Day.Calls	-0.56	1.33	0.10	11.34
Eve.Calls	0.58	-2.18	-0.48	9.54
Account.Length	-0.24	-1.57	-0.88	10.40

Area.Code	-1.85	0.70	-1.42	2.90

Time taken: 3.97 secs

Rattle timestamp: 2018-10-20 05:37:13 tsraj

Random Forest – conditional

Summary of the Random Forest Model

==========

Number of observations used to build the model: 2333

Missing value imputation is active.

Random Forest using Conditional Inference Trees

Number of trees: 500

Response: as.factor(Churn)

Inputs: Account.Length, VMail.Message, Day.Mins, Eve.Mins, Night.Mins, Intl.Mins, CustServ.Calls, Int.l.Plan, VMail.Plan, Day.Calls, Day.Charge, Eve.Calls, Eve.Charge, Night.Calls, Night.Charge, Intl.Calls, Intl.Charge, Area.Code

Number of observations: 2333

Variable Importance

	Importance
Day.Charge	0.03610955711
CustServ.Calls	0.03498601399
Day.Mins	0.03400233100
Int.l.Plan	0.02481118881
Eve.Mins	0.00944988345
Eve.Charge	0.00888111888
VMail.Plan	0.00800233100
Intl.Calls	0.00725407925

VMail.Message	0.00557342657
Intl.Charge	0.00525874126
Intl.Mins	0.00478088578
Night.Mins	0.00123543124
Night.Charge	0.00105128205
Night.Calls	0.00002331002
Area.Code	-0.00003030303
Day.Calls	-0.00023076923
Account.Length	-0.00023776224
Eve.Calls	-0.00024009324

Time taken: 58.34 secs

Rattle timestamp: 2018-10-20 05:51:20 tsraj

Summary of the SVM model (built using ksvm):

Support Vector Machine object of class "ksvm"

SV type: C-svc (classification)

parameter : cost C = 1

Linear (vanilla) kernel function.

Number of Support Vectors : 846

Objective Function Value : -701.9998

Training error : 0.15045

Probability model included.

Time taken: 2.69 secs

Rattle timestamp: 2018-10-20 06:13:45 tsraj

Summary of the SVM model (built using ksvm):

Support Vector Machine object of class "ksvm"

SV type: C-svc (classification)

 parameter : cost C = 1

Anova RBF kernel function.

 Hyperparameter : sigma = 1 degree = 1

Summary of the SVM model (built using ksvm):

Support Vector Machine object of class "ksvm"

SV type: C-svc (classification)

 parameter : cost C = 1

Spline kernel function.

Number of Support Vectors : 540

Objective Function Value : -181908496

Training error : 0.315902

Probability model included.

Time taken: 6.43 secs

Rattle timestamp: 2018-10-20 06:22:35 tsraj

Summary of the SVM model (built using ksvm):

Support Vector Machine object of class "ksvm"

SV type: C-svc (classification)

 parameter : cost C = 1

Polynomial kernel function.

 Hyperparameters : degree = 1 scale = 1 offset = 1

Number of Support Vectors : 844

Objective Function Value : -701.9997

Training error : 0.15045

Probability model included.

Time taken: 0.99 secs

Rattle timestamp: 2018-10-20 06:23:38 tsraj

Summary of the SVM model (built using ksvm):

Support Vector Machine object of class "ksvm"

SV type: C-svc (classification)

 parameter : cost C = 1

Gaussian Radial Basis kernel function.

 Hyperparameter : sigma = 0.0371006263641309

Number of Support Vectors : 672

Objective Function Value : -472.9835

Training error : 0.058723

Probability model included.

Time taken: 0.78 secs

Rattle timestamp: 2018-10-20 06:24:28 tsraj

Summary of the SVM model (built using ksvm):

Support Vector Machine object of class "ksvm"

SV type: C-svc (classification)

 parameter : cost C = 1

Hyperbolic Tangent kernel function.

 Hyperparameters : scale = 1 offset = 1

Number of Support Vectors : 656

Objective Function Value : -15022.58

Training error : 0.27904

Probability model included.

Time taken: 0.64 secs

Rattle timestamp: 2018-10-20 06:25:30 tsraj

Summary of the SVM model (built using ksvm):

Support Vector Machine object of class "ksvm"

SV type: C-svc (classification)

 parameter : cost C = 1

Laplace kernel function.

Hyperparameter : sigma = 0.0371006263641309

Number of Support Vectors : 802

Objective Function Value : -621.556

Training error : 0.130304

Probability model included.

Time taken: 1.42 secs

Rattle timestamp: 2018-10-20 06:26:25 tsraj

Summary of the SVM model (built using ksvm):

Support Vector Machine object of class "ksvm"

SV type: C-svc (classification)

parameter : cost C = 1

Bessel kernel function.

Hyperparameter : sigma = 1 order = 1 degree = 1

Number of Support Vectors : 667

Objective Function Value : -3872.931

Training error : 0.243463

Probability model included.

Time taken: 2.51 secs

Rattle timestamp: 2018-10-20 06:27:12 tsraj

Summary of the Logistic Regression model (built using glm):

Call:

glm(formula = Churn ~ ., family = binomial(link = "logit"), data = crs$dataset[crs$train,

c(crs$input, crs$target)])

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.2595	-0.5118	-0.3293	-0.1839	3.3154

Coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-9.1410055	1.0972846	-8.331	< 2e-16	***
Account.Length	0.0006974	0.0016655	0.419	0.67540	
VMail.Message	0.0405693	0.0210937	1.923	0.05444	.
Day.Mins	-2.7193428	3.9250795	-0.693	0.48843	
Eve.Mins	-0.2438798	1.9738485	-0.124	0.90167	
Night.Mins	-0.3872339	1.0383899	-0.373	0.70921	
Intl.Mins	-3.4091433	6.2758889	-0.543	0.58698	
CustServ.Calls	0.5548319	0.0475284	11.674	< 2e-16	***
Int.l.Plan	2.1542618	0.1752836	12.290	< 2e-16	***
VMail.Plan	-2.0957774	0.6836272	-3.066	0.00217	**
Day.Calls	0.0047000	0.0033097	1.420	0.15559	
Day.Charge	16.0765756	23.0887829	0.696	0.48624	
Eve.Calls	0.0010232	0.0033329	0.307	0.75884	
Eve.Charge	2.9611441	23.2214290	0.128	0.89853	
Night.Calls	-0.0010430	0.0033537	-0.311	0.75581	
Night.Charge	8.6908025	23.0743681	0.377	0.70644	
Intl.Calls	-0.1099353	0.0302615	-3.633	0.00028	***
Intl.Charge	12.9736701	23.2429337	0.558	0.57672	

```
Area.Code       0.0004223  0.0015401   0.274  0.78392
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1976.0  on 2332  degrees of freedom
Residual deviance: 1510.4  on 2314  degrees of freedom
AIC: 1548.4

Number of Fisher Scoring iterations: 6

Log likelihood: -755.217 (19 df)
Null/Residual deviance difference: 465.567 (18 df)
Chi-square p-value: 0.00000000
Pseudo R-Square (optimistic): 0.47679870

==== ANOVA ====

Analysis of Deviance Table

Model: binomial, link: logit

Response: Churn

Terms added sequentially (first to last)


              Df Deviance Resid. Df Resid. Dev     Pr(>Chi)
NULL                       2332     1976.0
Account.Length  1    0.581     2331     1975.4    0.4460100
```

VMail.Message 1 15.236 2330 1960.2 0.0000948989 ***

Day.Mins 1 109.177 2329 1851.0 < 2.2e-16 ***

Eve.Mins 1 26.384 2328 1824.6 0.0000002799 ***

Night.Mins 1 3.269 2327 1821.3 0.0705824 .

Intl.Mins 1 14.707 2326 1806.7 0.0001256 ***

CustServ.Calls 1 122.190 2325 1684.5 < 2.2e-16 ***

Int.l.Plan 1 146.896 2324 1537.6 < 2.2e-16 ***

VMail.Plan 1 9.821 2323 1527.7 0.0017256 **

Day.Calls 1 2.244 2322 1525.5 0.1341519

Day.Charge 1 0.344 2321 1525.2 0.5575432

Eve.Calls 1 0.048 2320 1525.1 0.8270146

Eve.Charge 1 0.015 2319 1525.1 0.9028665

Night.Calls 1 0.067 2318 1525.0 0.7957121

Night.Charge 1 0.127 2317 1524.9 0.7210522

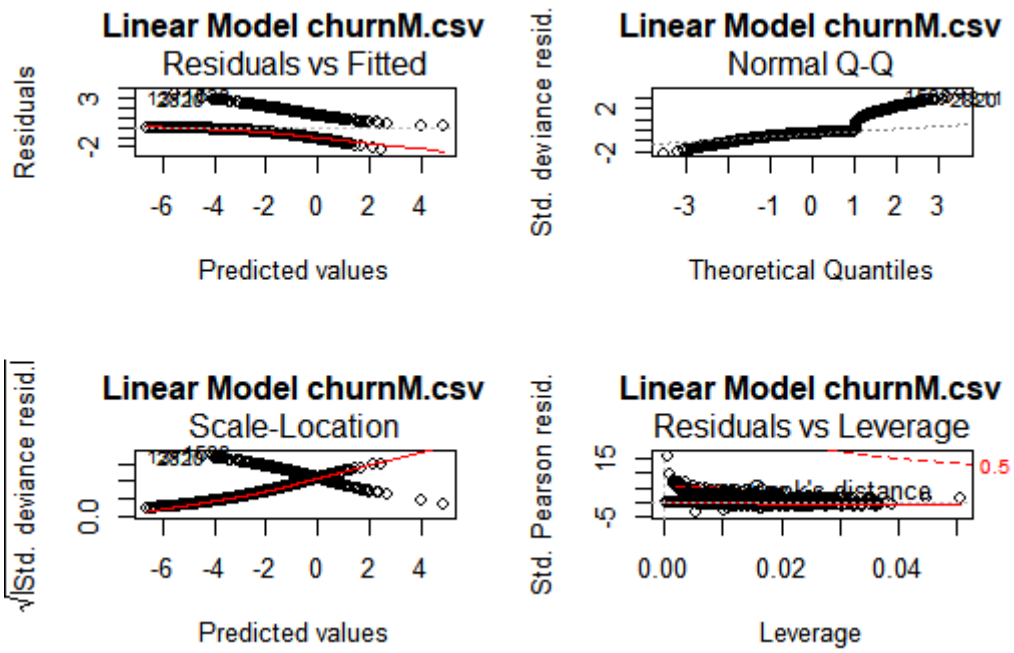
Intl.Calls 1 14.084 2316 1510.8 0.0001748 ***

Intl.Charge 1 0.303 2315 1510.5 0.5820379

Area.Code 1 0.075 2314 1510.4 0.7842430

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Time taken: 0.44 secs



Error matrix for the Decision Tree model on churnM.csv [validate] (counts):

Actual	Predicted 0	1	Error
0	418	11	2.6
1	18	52	25.7

Error matrix for the Decision Tree model on churnM.csv [validate] (proportions):

Actual	Predicted 0	1	Error
0	83.8	2.2	2.6
1	3.6	10.4	25.7

Overall error: 5.8%, Averaged class error: 14.15%

Rattle timestamp: 2018-10-20 06:41:37 tsraj

==========

Error matrix for the Extreme Boost model on churnM.csv [validate] (counts):

```
     Predicted
Actual   0  1 Error
    0 423  6   1.4
    1  21 49  30.0
```

Error matrix for the Extreme Boost model on churnM.csv [validate] (proportions):

```
     Predicted
Actual    0   1 Error
    0 84.8 1.2   1.4
    1  4.2 9.8  30.0
```

Overall error: 5.4%, Averaged class error: 15.7%

Rattle timestamp: 2018-10-20 06:41:37 tsraj

==========

Error matrix for the Random Forest model on churnM.csv [validate] (counts):

```
     Predicted
Actual   0  1 Error
    0 423  6   1.4
    1  24 46  34.3
```

Error matrix for the Random Forest model on churnM.csv [validate] (proportions):

```
     Predicted
Actual    0   1 Error
    0 84.8 1.2   1.4
    1  4.8 9.2  34.3
```

Overall error: 6%, Averaged class error: 17.85%

Rattle timestamp: 2018-10-20 06:41:49 tsraj

==========

Error matrix for the SVM model on churnM.csv [validate] (counts):

Actual	Predicted 0	1	Error
0	366	63	14.7
1	64	6	91.4

Error matrix for the SVM model on churnM.csv [validate] (proportions):

Actual	Predicted 0	1	Error
0	73.3	12.6	14.7
1	12.8	1.2	91.4

Overall error: 25.5%, Averaged class error: 53.05%

Area under the ROC curve for the rpart model on churnM.csv [validate] is 0.8894

Rattle timestamp: 2018-10-20 06:43:50 tsraj

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Area under the ROC curve for the ada model on churnM.csv [validate] is 0.9052

Rattle timestamp: 2018-10-20 06:43:51 tsraj

==========

Area under the ROC curve for the rf model on churnM.csv [validate] is 0.8979

Rattle timestamp: 2018-10-20 06:44:02 tsraj

==========

Area under the ROC curve for the ksvm model on churnM.csv [validate] is 0.7013

Rattle timestamp: 2018-10-20 06:44:03 tsraj

==========

Area under the ROC curve for the glm model on churnM.csv [validate] is 0.8155

Rattle timestamp: 2018-10-20 06:44:04 tsraj

==========

Area under the ROC curve for the nnet model on churnM.csv [validate] is 0.5000

Rattle timestamp: 2018-10-20 06:44:04 tsraj

Summary Decision Tree model (built using rpart) on churnM.csv [validate] by probability cutoffs.

	Recall	Caseload	Precision
0.0183486238532	1.0000000	1.00000000	0.1402806
0.0239327296248	0.9857143	0.93787575	0.1474359
0.0650887573964	0.8428571	0.28857715	0.4097222
0.1147540983607	0.8142857	0.21042084	0.5428571
0.1578947368421	0.8000000	0.18436874	0.6086957
0.1666666666667	0.7714286	0.16232465	0.6666667
0.625	0.7428571	0.12625251	0.8253968
0.7142857142857	0.6428571	0.10821643	0.8333333
0.72	0.5857143	0.09819639	0.8367347
0.8796296296296	0.5428571	0.09018036	0.8444444
0.9066666666667	0.3428571	0.05410822	0.8888889
1	0.2000000	0.02805611	1.0000000
1.0	0.0000000	0.00000000	1.0000000

Rattle timestamp: 2018-10-20 06:45:51 tsraj

==========

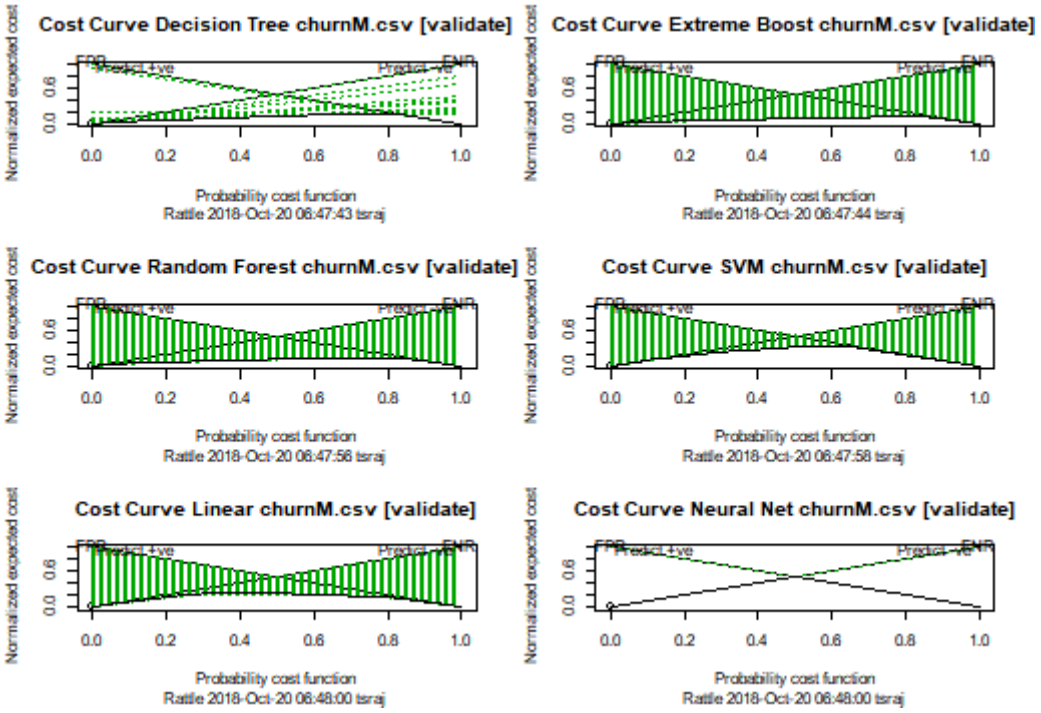
The area under the Risk and Recall curves for Decision Tree model

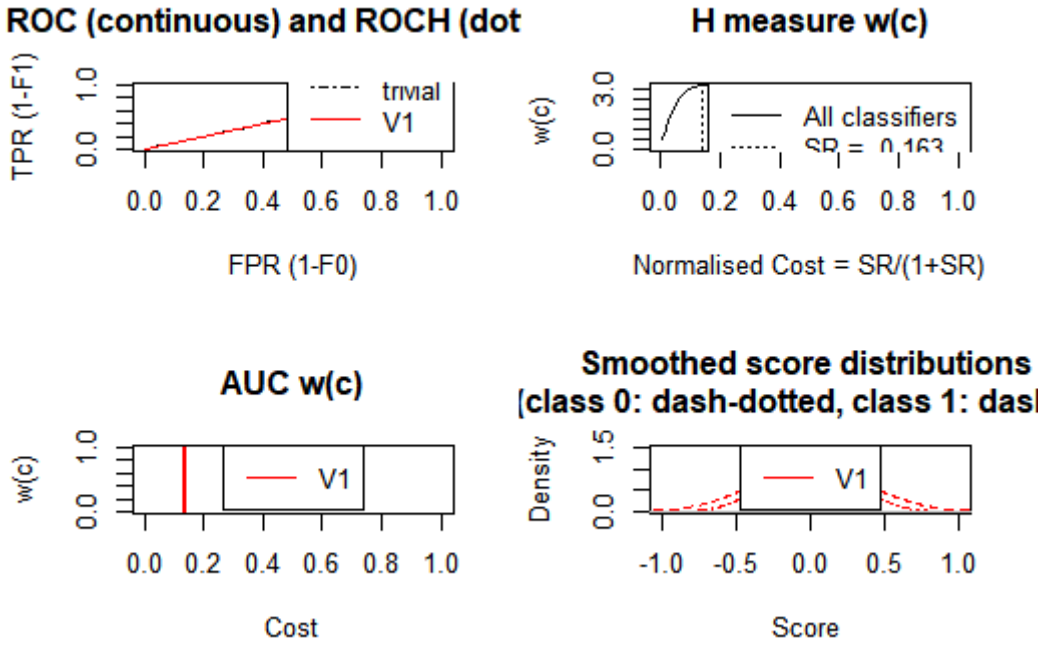
Area under the Recall (green) curve: 90% (0.898)

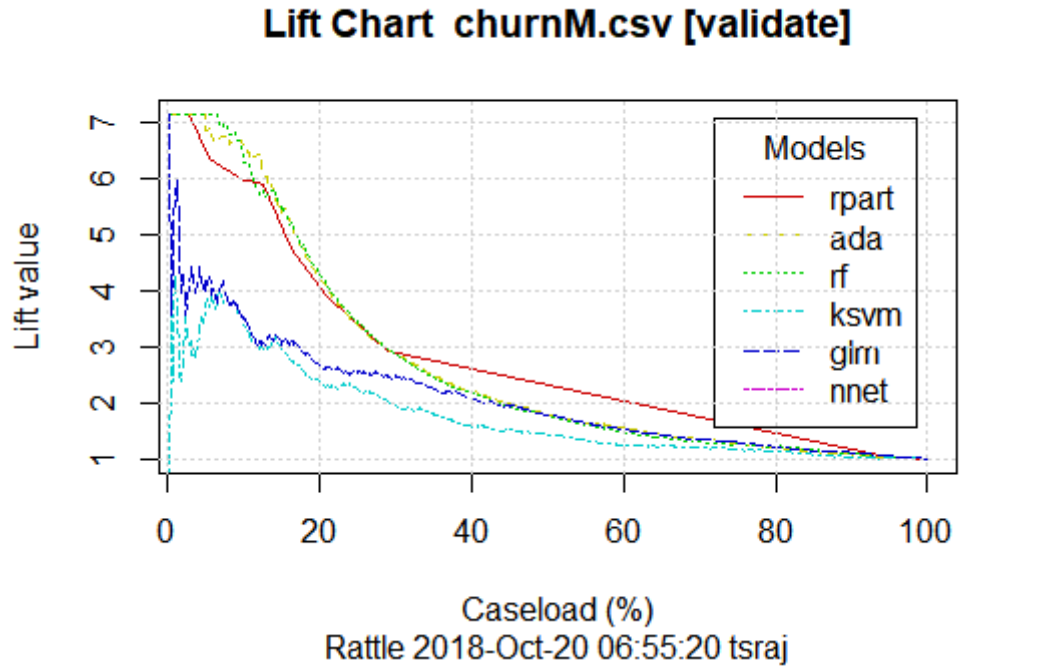
Rattle timestamp: 2018-10-20 06:45:51 tsraj

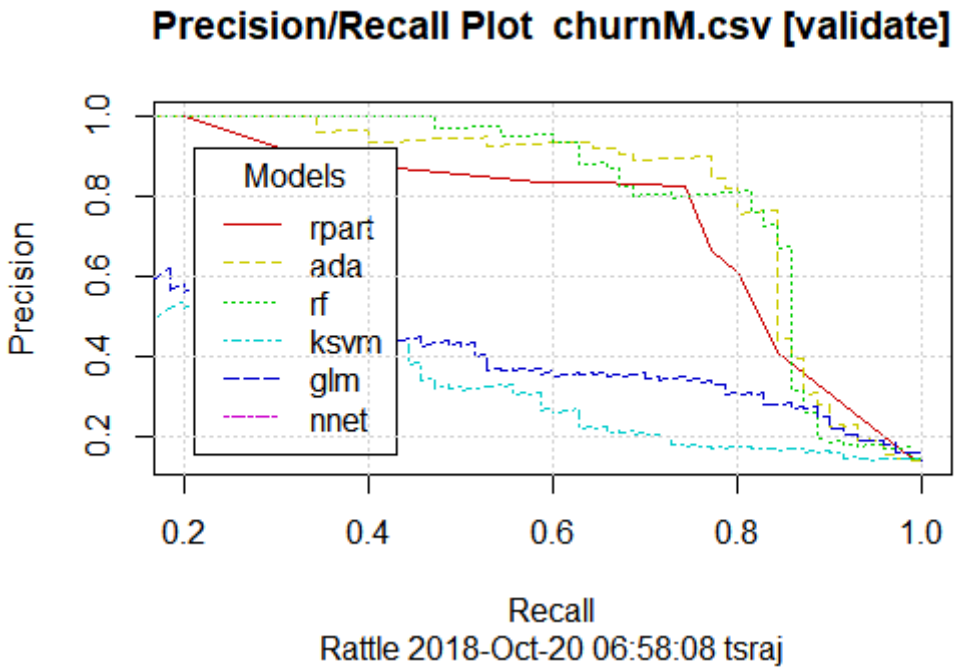
==========

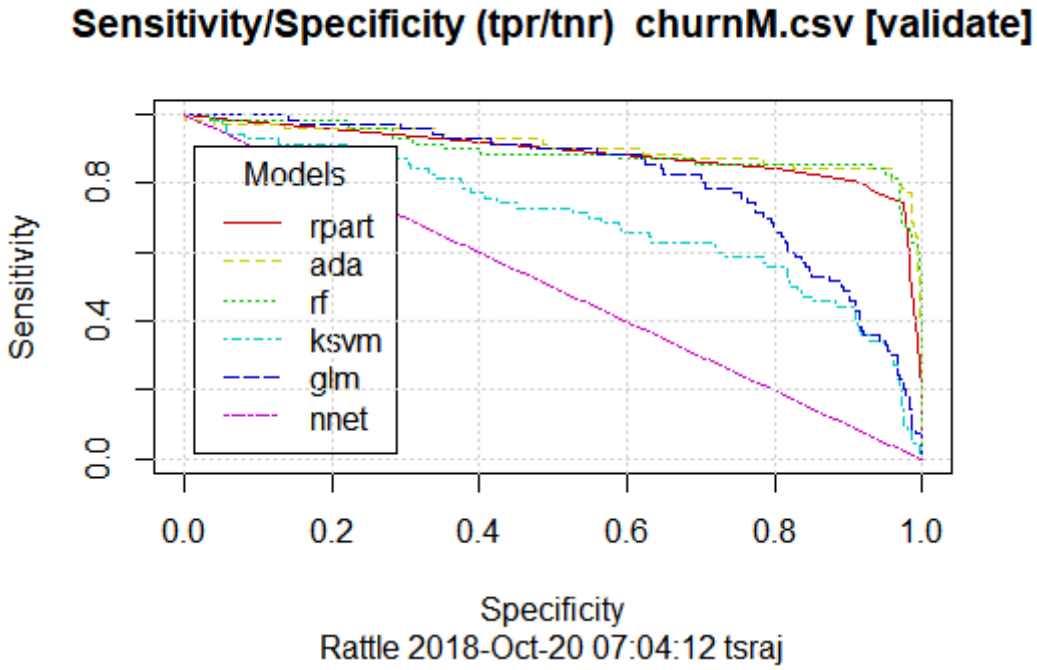
Summary Extreme Boost model (built using ada) on churnM.csv [validate] by probability cutoffs.

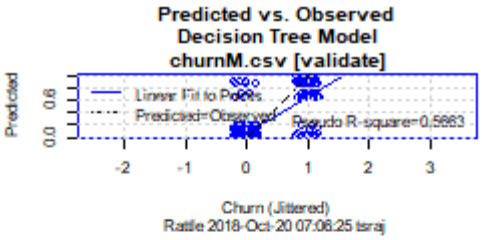


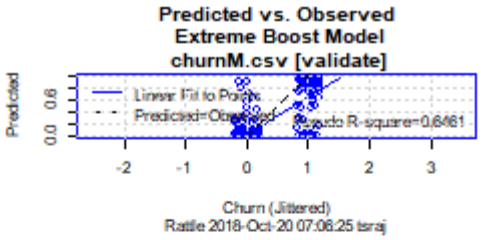

ROC (continuous) and ROCH (dot
TPR (1-F1)
0.0
1.0
trivial
V1
0.0 0.2 0.4 0.6 0.8 1.0
FPR (1-F0)
H measure w(c)
w(c)
0.0
3.0
All classifiers
0.0 0.2 0.4 0.6 0.8 1.0
Normalised Cost = SR/(1+SR)
AUC w(c)
w(c)
0.0
1.0
V1
0.0 0.2 0.4 0.6 0.8 1.0
Cost
Smoothed score distributions
[class 0: dash-dotted, class 1: das
Density
0.0
1.5
V1
-1.0 -0.5 0.0 0.5 1.0
Score

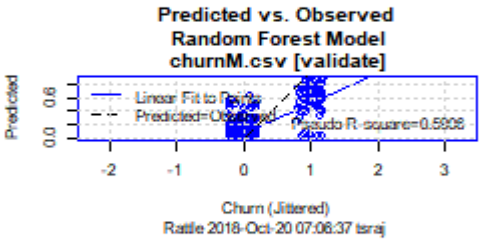

Lift Chart churnM.csv [validate]
Lift value
1 2 3 4 5 6 7
Models
rpart
ada
rf
ksvm
glm
nnet
0 20 40 60 80 100
Caseload (%)
Rattle 2018-Oct-20 06:55:20 tsraj

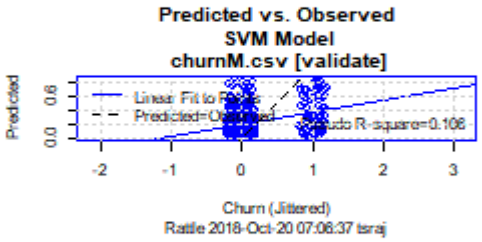

Precision/Recall Plot churnM.csv [validate]
Precision
Recall
Models
rpart
ada
rf
ksvm
glm
nnet
0.2
0.4
0.6
0.8
1.0
Rattle 2018-Oct-20 06:58:08 tsraj

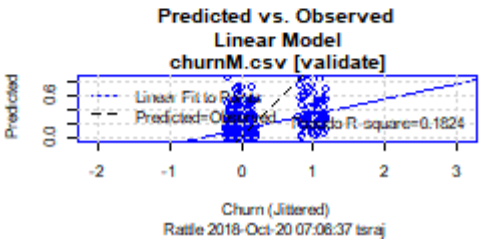

Sensitivity/Specificity (tpr/tnr) churnM.csv [validate]
Sensitivity
Specificity
Models
rpart
ada
rf
ksvm
glm
nnet
0.0
0.2
0.4
0.6
0.8
1.0
Rattle 2018-Oct-20 07:04:12 tsraj

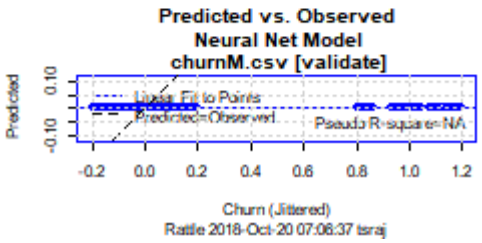












Rattle timestamp: 2018-10-20 06:41:49 tsraj

==========

Error matrix for the Linear model on churnM.csv [validate] (counts):

Actual	Predicted 0	1	Error
0	414	15	3.5
1	51	19	72.9

Error matrix for the Linear model on churnM.csv [validate] (proportions):

Predicted

Actual 0 1 Error

0 83.0 3.0 3.5

1 10.2 3.8 72.9

Overall error: 13.2%, Averaged class error: 38.2%

Rattle timestamp: 2018-10-20 06:41:49 tsraj

==========

Error matrix for the Neural Net model on churnM.csv [validate] (counts):

Predicted

Actual 0 Error

0 429 0

1 70 100

Error matrix for the Neural Net model on churnM.csv [validate] (proportions):

Predicted

Actual 0 Error

0 86 0

1 14 100

Overall error: -86%, Averaged class error: 50%

Rattle timestamp: 2018-10-20 06:41:49 tsraj

==========

Rattle timestamp: 2018-10-20 06:27:57 tsraj

Summary of the Probit Regression model (built using glm):

```
Call:
glm(formula = Churn ~ ., family = binomial(link = "probit"),
    data = crs$dataset[crs$train, c(crs$input, crs$target)])

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.1845  -0.5221  -0.3288  -0.1584   3.6149

Coefficients:
                 Estimate Std. Error z value Pr(>|z|)
(Intercept)    -4.9189678  0.5913606  -8.318  < 2e-16 ***
Account.Length  0.0004871  0.0009117   0.534 0.593174
VMail.Message   0.0197615  0.0109672   1.802 0.071565 .
Day.Mins       -1.1705668  2.1474204  -0.545 0.585682
Eve.Mins       -0.2194590  1.0772598  -0.204 0.838573
Night.Mins     -0.1153398  0.5676477  -0.203 0.838987
Intl.Mins      -1.6190837  3.4226575  -0.473 0.636178
CustServ.Calls  0.3130725  0.0261958  11.951  < 2e-16 ***
Int.l.Plan      1.2380890  0.0999490  12.387  < 2e-16 ***
VMail.Plan     -1.0392980  0.3515287  -2.957 0.003111 **
Day.Calls       0.0021796  0.0018112   1.203 0.228819
Day.Charge      6.9276043 12.6319266   0.548 0.583403
Eve.Calls       0.0007442  0.0018226   0.408 0.683047
Eve.Charge      2.6293967 12.6734790   0.207 0.835641
Night.Calls    -0.0004833  0.0018437  -0.262 0.793228
Night.Charge    2.6076023 12.6138088   0.207 0.836224
Intl.Calls     -0.0547029  0.0160597  -3.406 0.000659 ***
Intl.Charge     6.1724013 12.6763145   0.487 0.626312
Area.Code       0.0002238  0.0008429   0.265 0.790662
---
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 1976.0 on 2332 degrees of freedom

Residual deviance: 1510.7 on 2314 degrees of freedom

AIC: 1548.7

Number of Fisher Scoring iterations: 6

Log likelihood: -755.345 (19 df)

Null/Residual deviance difference: 465.309 (18 df)

Chi-square p-value: 0.00000000

Pseudo R-Square (optimistic): 0.47391175

==== ANOVA ====

Analysis of Deviance Table
Model: binomial, link: probit
Response: ChurnTerms added sequentially (first to last)

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL			2332	1976.0	
Account.Length	1	0.589	2331	1975.4	0.4428532
VMail.Message	1	15.036	2330	1960.4	0.0001055 ***
Day.Mins	1	94.529	2329	1865.8	< 2.2e-16 ***
Eve.Mins	1	21.278	2328	1844.6	0.000003973 ***
Night.Mins	1	2.431	2327	1842.1	0.1189529
Intl.Mins	1	14.557	2326	1827.6	0.0001360 ***
CustServ.Calls	1	135.923	2325	1691.7	< 2.2e-16 ***
Int.l.Plan	1	156.328	2324	1535.3	< 2.2e-16 ***
VMail.Plan	1	9.877	2323	1525.5	0.0016736 **
Day.Calls	1	1.489	2322	1524.0	0.2223286
Day.Charge	1	0.164	2321	1523.8	0.6853416
Eve.Calls	1	0.093	2320	1523.7	0.7599448
Eve.Charge	1	0.020	2319	1523.7	0.8882200
Night.Calls	1	0.043	2318	1523.6	0.8363527
Night.Charge	1	0.061	2317	1523.6	0.8045178
Intl.Calls	1	12.590	2316	1511.0	0.0003877 ***

Intl.Charge 1 0.229 2315 1510.8 0.6319434
Area.Code 1 0.070 2314 1510.7 0.7907806
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Time taken: 0.29 secs

Rattle timestamp: 2018-10-20 06:29:32 tsraj

==========

Number of Support Vectors : 610

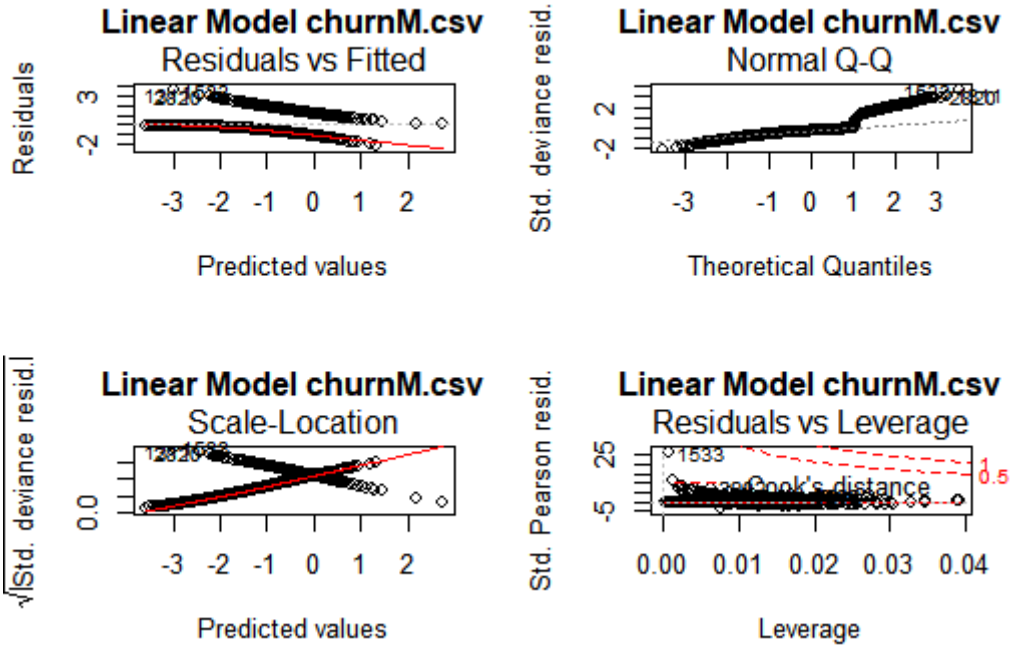
Objective Function Value : -549.4773

Training error : 0.095156

Probability model included.

Time taken: 11.11 secs

Rattle timestamp: 2018-10-20 06:19:23 tsraj



Cluster sizes:

[1] "68 243 147 304 373 56 106 292 303 441"

Data means:

Account.Length	VMail.Message	Day.Mins	Eve.Mins	Night.Mins	Intl.Mins
0.43348864	0.16273753	0.51023159	0.51276068	0.47656505	0.51502786

CustServ.Calls	Int.l.Plan	VMail.Plan	Day.Calls	Day.Charge	Eve.Calls
0.17088155	0.09858551	0.28118303	0.62814777	0.51020568	0.56556156

Eve.Charge	Night.Calls	Night.Charge	Intl.Calls	Intl.Charge	Area.Code
0.51288507	0.46024047	0.47683782	0.22366052	0.51512994	0.28935226

Cluster centers:

	Account.Length	VMail.Message	Day.Mins	Eve.Mins	Night.Mins	Intl.Mins	CustServ.Calls
1	0.4621849	0.5919839	0.5363623	0.5284830	0.4816829	0.5529412	0.1683007
2	0.4581797	0.0000000	0.5525782	0.6388527	0.4289232	0.3890329	0.1842707
3	0.4294254	0.5766307	0.5132603	0.5160432	0.4875271	0.5034014	0.1836735
4	0.4446058	0.0000000	0.3849284	0.5764306	0.5285250	0.5934539	0.1535088
5	0.4316122	0.0000000	0.5028369	0.5125917	0.4748827	0.5144236	0.1796247
6	0.4342919	0.0000000	0.5217717	0.5547154	0.4518558	0.5122321	0.1587302
7	0.4434371	0.0000000	0.5406134	0.5145780	0.4618226	0.5386792	0.1498952
8	0.3803890	0.0000000	0.6702156	0.4920363	0.5005287	0.5766781	0.1700913
9	0.4426300	0.0000000	0.4449838	0.3519968	0.4480318	0.4726733	0.1870187
10	0.4371215	0.5774310	0.5046218	0.5144303	0.4743968	0.5118821	0.1602419

	Int.l.Plan	VMail.Plan	Day.Calls	Day.Charge	Eve.Calls	Eve.Charge	Night.Calls	Night.Charge
1	1	1	0.6415441	0.5363431	0.5690045	0.5286208	0.4620186	0.4819363
2	0	0	0.6274434	0.5525506	0.5409940	0.6389959	0.4338751	0.4291839
3	0	1	0.6385629	0.5132313	0.5673731	0.5161835	0.4499584	0.4878157
4	0	0	0.6299137	0.3849131	0.5795800	0.5765588	0.4555566	0.5288129
5	0	0	0.6254859	0.5028109	0.5601327	0.5127142	0.4685324	0.4751446
6	1	0	0.6166295	0.5217406	0.5567766	0.5548478	0.4759764	0.4521390

7 1 0 0.6311321 0.5405815 0.5757136 0.5146917 0.4611782 0.4621006

8 0 0 0.6324486 0.6701803 0.5751668 0.4921509 0.4772100 0.5008168

9 0 0 0.6307137 0.4449613 0.5653085 0.3521088 0.4542821 0.4483063

10 0 1 0.6201672 0.5045956 0.5653817 0.5145523 0.4647710 0.4746589

Intl.Calls Intl.Charge Area.Code

1 0.2536765 0.5530501 0.32742215

2 0.2442387 0.3891328 0.04518680

3 0.2187075 0.5035399 1.00000000

4 0.2100329 0.5935490 0.04402090

5 0.2176944 0.5144822 1.00000000

6 0.2276786 0.5122354 1.00000000

7 0.2198113 0.5387317 0.04790973

8 0.2239726 0.5767948 0.04677008

9 0.2305281 0.4728212 0.04393969

10 0.2192744 0.5119971 0.04621849

Within cluster sum of squares:

[1] 34.46834 59.38000 47.93412 65.28677 106.58891 16.60647 31.68245 63.96352 69.15545

[10] 134.71590

Time taken: 0.04 secs

Rattle timestamp: 2018-10-20 07:35:33 tsraj

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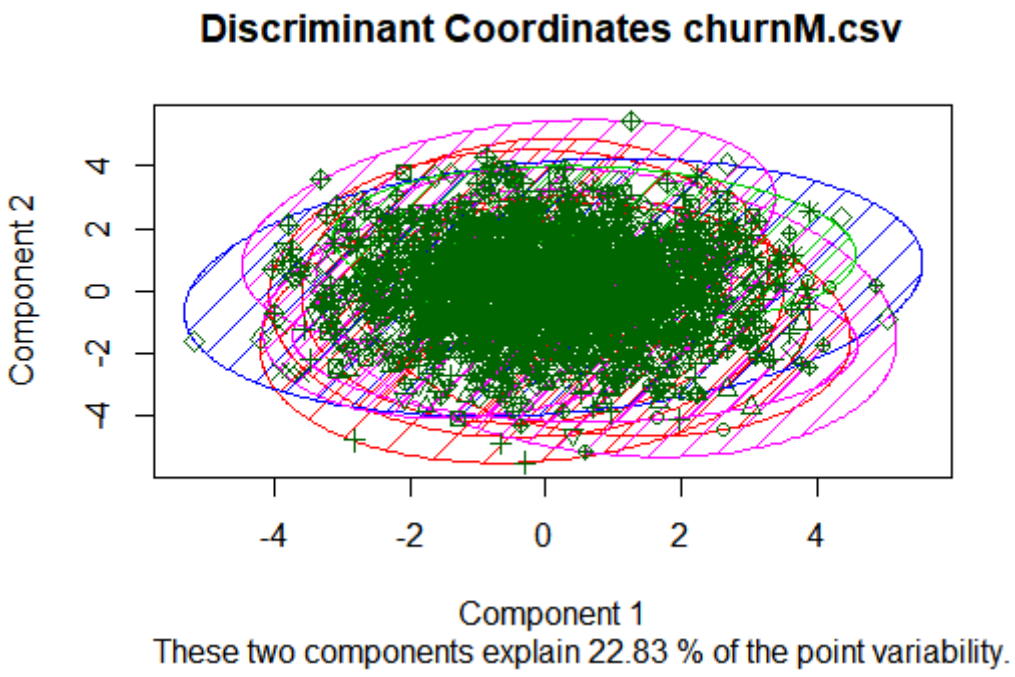

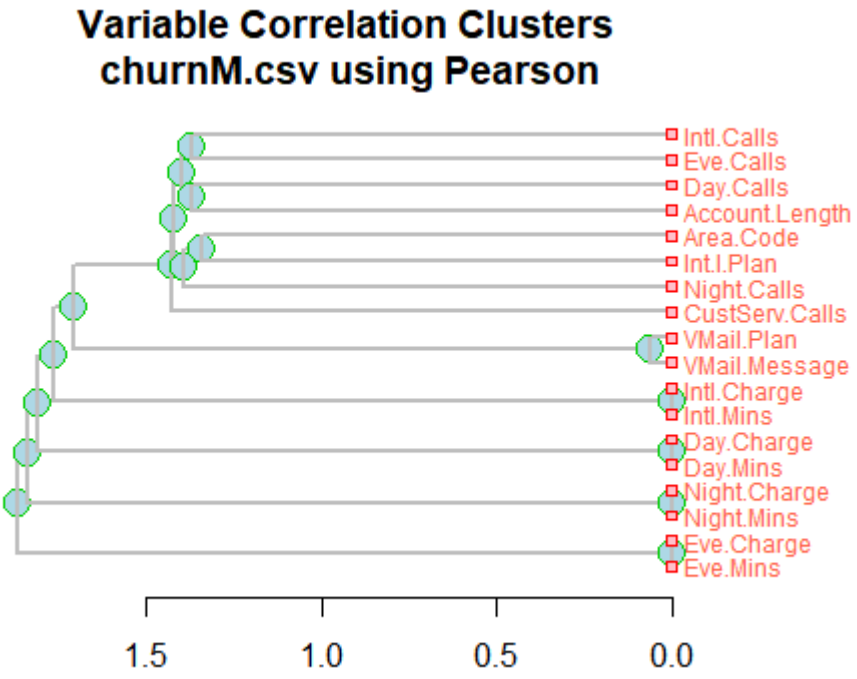

Cluster sizes:

[1] "68 243 147 304 373 56 106 292 303 441"

Data means:

Account.Length	VMail.Message	Day.Mins	Eve.Mins	Night.Mins	Intl.Mins
0.43348864	0.16273753	0.51023159	0.51276068	0.47656505	0.51502786

CustServ.Calls	Int.l.Plan	VMail.Plan	Day.Calls	Day.Charge	Eve.Calls
0.17088155	0.09858551	0.28118303	0.62814777	0.51020568	0.56556156

Eve.Charge	Night.Calls	Night.Charge	Intl.Calls	Intl.Charge	Area.Code
0.51288507	0.46024047	0.47683782	0.22366052	0.51512994	0.28935226

Cluster centers:

	Account.Length	VMail.Message	Day.Mins	Eve.Mins	Night.Mins	Intl.Mins	CustServ.Calls
1	0.4621849	0.5919839	0.5363623	0.5284830	0.4816829	0.5529412	0.1683007
2	0.4581797	0.0000000	0.5525782	0.6388527	0.4289232	0.3890329	0.1842707
3	0.4294254	0.5766307	0.5132603	0.5160432	0.4875271	0.5034014	0.1836735
4	0.4446058	0.0000000	0.3849284	0.5764306	0.5285250	0.5934539	0.1535088
5	0.4316122	0.0000000	0.5028369	0.5125917	0.4748827	0.5144236	0.1796247
6	0.4342919	0.0000000	0.5217717	0.5547154	0.4518558	0.5122321	0.1587302
7	0.4434371	0.0000000	0.5406134	0.5145780	0.4618226	0.5386792	0.1498952
8	0.3803890	0.0000000	0.6702156	0.4920363	0.5005287	0.5766781	0.1700913
9	0.4426300	0.0000000	0.4449838	0.3519968	0.4480318	0.4726733	0.1870187
10	0.4371215	0.5774310	0.5046218	0.5144303	0.4743968	0.5118821	0.1602419

	Int.l.Plan	VMail.Plan	Day.Calls	Day.Charge	Eve.Calls	Eve.Charge	Night.Calls	Night.Charge
1	1	1	0.6415441	0.5363431	0.5690045	0.5286208	0.4620186	0.4819363
2	0	0	0.6274434	0.5525506	0.5409940	0.6389959	0.4338751	0.4291839
3	0	1	0.6385629	0.5132313	0.5673731	0.5161835	0.4499584	0.4878157
4	0	0	0.6299137	0.3849131	0.5795800	0.5765588	0.4555566	0.5288129
5	0	0	0.6254859	0.5028109	0.5601327	0.5127142	0.4685324	0.4751446
6	1	0	0.6166295	0.5217406	0.5567766	0.5548478	0.4759764	0.4521390
7	1	0	0.6311321	0.5405815	0.5757136	0.5146917	0.4611782	0.4621006
8	0	0	0.6324486	0.6701803	0.5751668	0.4921509	0.4772100	0.5008168
9	0	0	0.6307137	0.4449613	0.5653085	0.3521088	0.4542821	0.4483063

10 0 1 0.6201672 0.5045956 0.5653817 0.5145523 0.4647710 0.4746589

Intl.Calls Intl.Charge Area.Code

1 0.2536765 0.5530501 0.32742215

2 0.2442387 0.3891328 0.04518680

3 0.2187075 0.5035399 1.00000000

4 0.2100329 0.5935490 0.04402090

5 0.2176944 0.5144822 1.00000000

6 0.2276786 0.5122354 1.00000000

7 0.2198113 0.5387317 0.04790973

8 0.2239726 0.5767948 0.04677008

9 0.2305281 0.4728212 0.04393969

10 0.2192744 0.5119971 0.04621849

Within cluster sum of squares:

[1] 34.46834 59.38000 47.93412 65.28677 106.58891 16.60647 31.68245 63.96352 69.15545

[10] 134.71590

Time taken: 0.04 secs

Rattle timestamp: 2018-10-20 07:35:33 tsraj

==========

General cluster statistics:

$n

[1] 2333

$cluster.number

[1] 10

$cluster.size

[1] 68 243 147 304 373 56 106 292 303 441

$min.cluster.size

[1] 56

$noisen

[1] 0

$diameter

[1] 279.8213 321.1045 335.1228 311.6485 386.9092 320.0751 331.4308 311.9211 319.3952 378.8818

$average.distance

[1] 150.6913 125.8667 145.7017 118.7096 139.7922 147.6301 147.5793 119.6916 118.6351 140.9351

$median.distance

[1] 150.1293 122.4997 141.6348 115.1054 134.8453 142.1468 143.2492 116.7128 115.1237 137.0978

$separation

[1] 26.44234 15.44481 35.14619 16.08097 23.41238 23.41238 15.44481 19.72394 15.46257 21.87825

$average.toother

[1] 154.7483 153.8085 170.8982 153.7870 170.5390 169.9141 154.0822 156.2074 156.4244 154.3364

$separation.matrix

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]
[1,]	0.00000	37.10494	36.87602	37.68645	42.82166	45.32797	40.72404	28.16922	32.48308
[2,]	37.10494	0.00000	101.29671	16.08097	96.72072	97.70852	15.44481	22.54606	30.01217
[3,]	36.87602	101.29671	0.00000	99.69132	35.14619	40.30975	103.75655	100.31605	100.41120

[4,] 37.68645 16.08097 99.69132 0.00000 96.29025 98.04075 23.57545 23.88938 21.65695

[5,] 42.82166 96.72072 35.14619 96.29025 0.00000 23.41238 97.10185 96.95081 96.67486

[6,] 45.32797 97.70852 40.30975 98.04075 23.41238 0.00000 99.10811 97.24553 99.43702

[7,] 40.72404 15.44481 103.75655 23.57545 97.10185 99.10811 0.00000 22.58056 15.46257

[8,] 28.16922 22.54606 100.31605 23.88938 96.95081 97.24553 22.58056 0.00000 19.72394

[9,] 32.48308 30.01217 100.41120 21.65695 96.67486 99.43702 15.46257 19.72394 0.00000

[10,] 26.44234 28.84096 97.82765 21.87825 100.55096 100.11497 34.08834 28.47962 28.97713

[,10]

[1,] 26.44234

[2,] 28.84096

[3,] 97.82765

[4,] 21.87825

[5,] 100.55096

[6,] 100.11497

[7,] 34.08834

[8,] 28.47962

[9,] 28.97713

[10,] 0.00000

$ave.between.matrix

[,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]

[1,] 0.0000 150.0113 163.5174 152.6663 164.3545 167.3997 154.4373 150.3015 155.6149 148.5626

[2,] 150.0113 0.0000 178.0440 141.0051 173.1867 172.4114 143.2869 140.8371 158.4174 144.3402

[3,] 163.5174 178.0440 0.0000 176.6130 146.1033 150.2073 180.4027 177.7486 179.4279 175.0777

[4,] 152.6663 141.0051 176.6130 0.0000 171.0256 176.0227 147.1627 157.5282 143.2980 142.3121

[5,] 164.3545 173.1867 146.1033 171.0256 0.0000 144.0214 175.7162 174.5860 173.5560 175.2140

[6,] 167.3997 172.4114 150.2073 176.0227 144.0214 0.0000 178.4973 176.4738 181.5758 178.7650

[7,] 154.4373 143.2869 180.4027 147.1627 175.7162 178.4973 0.0000 142.1477 146.3382 147.7969

[8,] 150.3015 140.8371 177.7486 157.5282 174.5860 176.4738 142.1477 0.0000 150.7970 146.4749

[9,] 155.6149 158.4174 179.4279 143.2980 173.5560 181.5758 146.3382 150.7970 0.0000 145.2985

[10,] 148.5626 144.3402 175.0777 142.3121 175.2140 178.7650 147.7969 146.4749 145.2985 0.0000

$average.between

[1] 158.756

$average.within

[1] 131.3747

$n.between

[1] 2370068

$n.within

[1] 350210

$max.diameter

[1] 386.9092

$min.separation

[1] 15.44481

$within.cluster.ss

[1] 22396981

$clus.avg.silwidths

1 2 3 4 5 6 7

-0.158827251 0.014496403 -0.005160415 0.090926819 0.012339369 -0.032334494 -0.187049411

8 9 10

0.098189473 0.112811347 -0.131426417

$avg.silwidth

[1] 0.003199432

$g2

NULL

$g3

NULL

$pearsongamma

[1] 0.202978

$dunn

[1] 0.03991843

$dunn2

[1] 0.9346066

$entropy

[1] 2.14156

$wb.ratio

[1] 0.8275258

$ch

[1] 93.11326

$cwidegap

[1] 122.14944 101.97878 122.24204 108.99001 121.02131 109.21531 110.91793 87.51856 91.60257

[10] 102.40012

$widestgap

[1] 122.242

$sindex

[1] 28.28592

$corrected.rand

NULL

$vi

NULL

Rattle timestamp: 2018-10-20 07:41:01 tsraj

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General cluster statistics:

$n

[1] 2333

$cluster.number

[1] 10

$cluster.size

[1] 68 243 147 304 373 56 106 292 303 441

$min.cluster.size

[1] 56

$noisen

[1] 0

$diameter

[1] 279.8213 321.1045 335.1228 311.6485 386.9092 320.0751 331.4308 311.9211 319.3952 378.8818

$average.distance

[1] 150.6913 125.8667 145.7017 118.7096 139.7922 147.6301 147.5793 119.6916 118.6351 140.9351

$median.distance

[1] 150.1293 122.4997 141.6348 115.1054 134.8453 142.1468 143.2492 116.7128 115.1237 137.0978

$separation

[1] 26.44234 15.44481 35.14619 16.08097 23.41238 23.41238 15.44481 19.72394 15.46257 21.87825

$average.toother

[1] 154.7483 153.8085 170.8982 153.7870 170.5390 169.9141 154.0822 156.2074 156.4244 154.3364

$separation.matrix

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]
[1,]	0.00000	37.10494	36.87602	37.68645	42.82166	45.32797	40.72404	28.16922	32.48308
[2,]	37.10494	0.00000	101.29671	16.08097	96.72072	97.70852	15.44481	22.54606	30.01217
[3,]	36.87602	101.29671	0.00000	99.69132	35.14619	40.30975	103.75655	100.31605	100.41120
[4,]	37.68645	16.08097	99.69132	0.00000	96.29025	98.04075	23.57545	23.88938	21.65695
[5,]	42.82166	96.72072	35.14619	96.29025	0.00000	23.41238	97.10185	96.95081	96.67486

[6,] 45.32797 97.70852 40.30975 98.04075 23.41238 0.00000 99.10811 97.24553 99.43702

[7,] 40.72404 15.44481 103.75655 23.57545 97.10185 99.10811 0.00000 22.58056 15.46257

[8,] 28.16922 22.54606 100.31605 23.88938 96.95081 97.24553 22.58056 0.00000 19.72394

[9,] 32.48308 30.01217 100.41120 21.65695 96.67486 99.43702 15.46257 19.72394 0.00000

[10,] 26.44234 28.84096 97.82765 21.87825 100.55096 100.11497 34.08834 28.47962 28.97713

[,10]

[1,] 26.44234

[2,] 28.84096

[3,] 97.82765

[4,] 21.87825

[5,] 100.55096

[6,] 100.11497

[7,] 34.08834

[8,] 28.47962

[9,] 28.97713

[10,] 0.00000

$ave.between.matrix

[,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]

[1,] 0.0000 150.0113 163.5174 152.6663 164.3545 167.3997 154.4373 150.3015 155.6149 148.5626

[2,] 150.0113 0.0000 178.0440 141.0051 173.1867 172.4114 143.2869 140.8371 158.4174 144.3402

[3,] 163.5174 178.0440 0.0000 176.6130 146.1033 150.2073 180.4027 177.7486 179.4279 175.0777

[4,] 152.6663 141.0051 176.6130 0.0000 171.0256 176.0227 147.1627 157.5282 143.2980 142.3121

[5,] 164.3545 173.1867 146.1033 171.0256 0.0000 144.0214 175.7162 174.5860 173.5560 175.2140

[6,] 167.3997 172.4114 150.2073 176.0227 144.0214 0.0000 178.4973 176.4738 181.5758 178.7650

[7,] 154.4373 143.2869 180.4027 147.1627 175.7162 178.4973 0.0000 142.1477 146.3382 147.7969

[8,] 150.3015 140.8371 177.7486 157.5282 174.5860 176.4738 142.1477 0.0000 150.7970 146.4749

[9,] 155.6149 158.4174 179.4279 143.2980 173.5560 181.5758 146.3382 150.7970 0.0000 145.2985

[10,] 148.5626 144.3402 175.0777 142.3121 175.2140 178.7650 147.7969 146.4749 145.2985 0.0000

$average.between

[1] 158.756

$average.within

[1] 131.3747

$n.between

[1] 2370068

$n.within

[1] 350210

$max.diameter

[1] 386.9092

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[1] 15.44481

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[1] 22396981

$clus.avg.silwidths

1 2 3 4 5 6 7

-0.158827251 0.014496403 -0.005160415 0.090926819 0.012339369 -0.032334494 -0.187049411

8 9 10

0.098189473 0.112811347 -0.131426417

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$g2

NULL

$g3

NULL

$pearsongamma

[1] 0.202978

$dunn

[1] 0.03991843

$dunn2

[1] 0.9346066

$entropy

[1] 2.14156

$wb.ratio

[1] 0.8275258

$ch

[1] 93.11326

$cwidegap

[1] 122.14944 101.97878 122.24204 108.99001 121.02131 109.21531 110.91793 87.51856 91.60257

[10] 102.40012

$widestgap

[1] 122.242

$sindex

[1] 28.28592

$corrected.rand

NULL

$vi

NULL

Rattle timestamp: 2018-10-20 07:42:22 tsraj

Correlation summary using the 'Pearson' covariance.

Note that only correlations between numeric variables are reported.

	Night.Calls	CustServ.Calls	Eve.Mins	Eve.Charge	Area.Code
Night.Calls	1.0000000000	0.0005803019	0.00728610375	0.00730390213	0.0204932171
CustServ.Calls	0.0005803019	1.0000000000	-0.01573954810	-0.01573386446	0.0256869703
Eve.Mins	0.0072861038	-0.0157395481	1.00000000000	0.99999978024	0.0191211028
Eve.Charge	0.0073039021	-0.0157338645	0.99999978024	1.00000000000	0.0191392025

Area.Code 0.0204932171 0.0256869703 0.01912110278 0.01913920253 1.0000000000

Intl.Mins 0.0207448614 -0.0129853517 -0.01058828174 -0.01059514976 -0.0072806656

Intl.Charge 0.0207457852 -0.0129797314 -0.01067664103 -0.01068353187 -0.0073929587

Night.Charge 0.0100791240 -0.0305310202 -0.00561750295 -0.00562149959 0.0012700083

Night.Mins 0.0100649946 -0.0305173273 -0.00559031608 -0.00559431590 0.0012835639

VMail.Message 0.0008396175 -0.0080730654 0.01099002832 0.01100558044 0.0003384187

Eve.Calls 0.0126966191 -0.0065985529 -0.02173690069 -0.02173662436 -0.0145870162

Day.Charge 0.0091175696 -0.0263092262 0.00007908231 0.00006842788 -0.0090016246

Day.Mins 0.0091172798 -0.0263066623 0.00006773940 0.00005708320 -0.0089990374

VMail.Plan 0.0040737924 -0.0193972104 0.01425143805 0.01426376688 -0.0003839688

Int.l.Plan 0.0111411462 -0.0301673885 0.03392358656 0.03392256550 0.0578715377

Intl.Calls -0.0138501260 -0.0056758202 -0.00408992509 -0.00408755943 -0.0109390565

Day.Calls -0.0202860949 -0.0087218563 -0.01187573163 -0.01185789994 -0.0004356262

Account.Length -0.0368140243 -0.0119658723 -0.01027130542 -0.01026470090 -0.0063062700

Intl.Mins Intl.Charge Night.Charge Night.Mins VMail.Message Eve.Calls

Night.Calls 0.020744861 0.020745785 0.010079124 0.010064995 0.0008396175 0.012696619

CustServ.Calls -0.012985352 -0.012979731 -0.030531020 -0.030517327 -0.0080730654 -0.006598553

Eve.Mins -0.010588282 -0.010676641 -0.005617503 -0.005590316 0.0109900283 -0.021736901

Eve.Charge -0.010595150 -0.010683532 -0.005621500 -0.005594316 0.0110055804 -0.021736624

Area.Code -0.007280666 -0.007392959 0.001270008 0.001283564 0.0003384187 -0.014587016

Intl.Mins 1.000000000 0.999992677 -0.014917770 -0.014892704 -0.0020987858 0.032973269

Intl.Charge 0.999992677 1.000000000 -0.014826747 -0.014801566 -0.0020324824 0.032976668

Night.Charge -0.014917770 -0.014826747 1.000000000 0.999999221 0.0140906682 0.007491734

Night.Mins -0.014892704 -0.014801566 0.999999221 1.000000000 0.0141229901 0.007441521

VMail.Message -0.002098786 -0.002032482 0.014090668 0.014122990 1.0000000000 0.003381435

Eve.Calls 0.032973269 0.032976668 0.007491734 0.007441521 0.0033814349 1.000000000

Day.Charge -0.011799410 -0.011668614 0.029365408 0.029354496 0.0033888824 0.027671855

Day.Mins -0.011793062 -0.011662247 0.029367655 0.029356739 0.0033901877 0.027668565

VMail.Plan -0.003541920 -0.003462970 0.006947450 0.006973910 0.9572692355 0.003156504

Int.l.Plan 0.050796605 0.050690415 -0.027239647 -0.027240313 0.0149454169 0.009250272

Intl.Calls 0.019332522 0.019438841 -0.000989097 -0.000996865 -0.0004766350 0.030437267

Day.Calls 0.015322572 0.015398550 0.020549231 0.020563384 -0.0069430780 0.009730020

Account.Length 0.001643488 0.001732922 0.006437866 0.006444948 0.0112013521 0.011818414

	Day.Charge	Day.Mins	VMail.Plan	Int.l.Plan	Intl.Calls
Night.Calls	0.00911756964	0.0091172798	0.0040737924	0.011141146	-0.013850126
CustServ.Calls	-0.02630922621	-0.0263066623	-0.0193972104	-0.030167388	-0.005675820
Eve.Mins	0.00007908231	0.0000677394	0.0142514381	0.033923587	-0.004089925
Eve.Charge	0.00006842788	0.0000570832	0.0142637669	0.033922565	-0.004087559
Area.Code	-0.00900162461	-0.0089990374	-0.0003839688	0.057871538	-0.010939056
Intl.Mins	-0.01179941013	-0.0117930624	-0.0035419202	0.050796605	0.019332522
Intl.Charge	-0.01166861419	-0.0116622466	-0.0034629697	0.050690415	0.019438841
Night.Charge	0.02936540805	0.0293676546	0.0069474498	-0.027239647	-0.000989097
Night.Mins	0.02935449645	0.0293567393	0.0069739102	-0.027240313	-0.000996865
VMail.Message	0.00338888240	0.0033901877	0.9572692355	0.014945417	-0.000476635
Eve.Calls	0.02767185546	0.0276685649	0.0031565037	0.009250272	0.030437267
Day.Charge	1.00000000000	0.9999999527	-0.0015481363	0.052296507	0.009677557
Day.Mins	0.99999995266	1.0000000000	-0.0015473797	0.052297241	0.009678634
VMail.Plan	-0.00154813634	-0.0015473797	1.0000000000	0.010643477	-0.004834593
Int.l.Plan	0.05229650697	0.0522972414	0.0106434769	1.000000000	0.021804979
Intl.Calls	0.00967755667	0.0096786340	-0.0048345928	0.021804979	1.000000000
Day.Calls	0.01613228711	0.0161311687	-0.0082287144	0.006706464	-0.001331299
Account.Length	0.01359306373	0.0135931558	0.0162881126	0.025351573	0.026672128

	Day.Calls	Account.Length
Night.Calls	-0.0202860949	-0.036814024
CustServ.Calls	-0.0087218563	-0.011965872
Eve.Mins	-0.0118757316	-0.010271305
Eve.Charge	-0.0118578999	-0.010264701
Area.Code	-0.0004356262	-0.006306270
Intl.Mins	0.0153225721	0.001643488

Intl.Charge 0.0153985502 0.001732922

Night.Charge 0.0205492306 0.006437866

Night.Mins 0.0205633836 0.006444948

VMail.Message -0.0069430780 0.011201352

Eve.Calls 0.0097300199 0.011818414

Day.Charge 0.0161322871 0.013593064

Day.Mins 0.0161311687 0.013593156

VMail.Plan -0.0082287144 0.016288113

Int.l.Plan 0.0067064638 0.025351573

Intl.Calls -0.0013312991 0.026672128

Day.Calls 1.0000000000 0.032119615

Account.Length 0.0321196153 1.000000000

Rattle timestamp: 2018-10-20 07:55:06 tsraj

Correlation summary using the 'Pearson' covariance.

Note that only correlations between numeric variables are reported.

	Night.Calls	CustServ.Calls	Eve.Mins	Eve.Charge	Area.Code
Night.Calls	1.0000000000	0.0005803019	0.00728610375	0.00730390213	0.0204932171
CustServ.Calls	0.0005803019	1.0000000000	-0.01573954810	-0.01573386446	0.0256869703
Eve.Mins	0.0072861038	-0.0157395481	1.00000000000	0.99999978024	0.0191211028
Eve.Charge	0.0073039021	-0.0157338645	0.99999978024	1.00000000000	0.0191392025
Area.Code	0.0204932171	0.0256869703	0.01912110278	0.01913920253	1.0000000000
Intl.Mins	0.0207448614	-0.0129853517	-0.01058828174	-0.01059514976	-0.0072806656
Intl.Charge	0.0207457852	-0.0129797314	-0.01067664103	-0.01068353187	-0.0073929587
Night.Charge	0.0100791240	-0.0305310202	-0.00561750295	-0.00562149959	0.0012700083
Night.Mins	0.0100649946	-0.0305173273	-0.00559031608	-0.00559431590	0.0012835639

VMail.Message 0.0008396175 -0.0080730654 0.01099002832 0.01100558044 0.0003384187

Eve.Calls 0.0126966191 -0.0065985529 -0.02173690069 -0.02173662436 -0.0145870162

Day.Charge 0.0091175696 -0.0263092262 0.00007908231 0.00006842788 -0.0090016246

Day.Mins 0.0091172798 -0.0263066623 0.00006773940 0.00005708320 -0.0089990374

VMail.Plan 0.0040737924 -0.0193972104 0.01425143805 0.01426376688 -0.0003839688

Int.l.Plan 0.0111411462 -0.0301673885 0.03392358656 0.03392256550 0.0578715377

Intl.Calls -0.0138501260 -0.0056758202 -0.00408992509 -0.00408755943 -0.0109390565

Day.Calls -0.0202860949 -0.0087218563 -0.01187573163 -0.01185789994 -0.0004356262

Account.Length -0.0368140243 -0.0119658723 -0.01027130542 -0.01026470090 -0.0063062700

Intl.Mins Intl.Charge Night.Charge Night.Mins VMail.Message Eve.Calls

Night.Calls 0.020744861 0.020745785 0.010079124 0.010064995 0.0008396175 0.012696619

CustServ.Calls -0.012985352 -0.012979731 -0.030531020 -0.030517327 -0.0080730654 -0.006598553

Eve.Mins -0.010588282 -0.010676641 -0.005617503 -0.005590316 0.0109900283 -0.021736901

Eve.Charge -0.010595150 -0.010683532 -0.005621500 -0.005594316 0.0110055804 -0.021736624

Area.Code -0.007280666 -0.007392959 0.001270008 0.001283564 0.0003384187 -0.014587016

Intl.Mins 1.000000000 0.999992677 -0.014917770 -0.014892704 -0.0020987858 0.032973269

Intl.Charge 0.999992677 1.000000000 -0.014826747 -0.014801566 -0.0020324824 0.032976668

Night.Charge -0.014917770 -0.014826747 1.000000000 0.999999221 0.0140906682 0.007491734

Night.Mins -0.014892704 -0.014801566 0.999999221 1.000000000 0.0141229901 0.007441521

VMail.Message -0.002098786 -0.002032482 0.014090668 0.014122990 1.0000000000 0.003381435

Eve.Calls 0.032973269 0.032976668 0.007491734 0.007441521 0.0033814349 1.000000000

Day.Charge -0.011799410 -0.011668614 0.029365408 0.029354496 0.0033888824 0.027671855

Day.Mins -0.011793062 -0.011662247 0.029367655 0.029356739 0.0033901877 0.027668565

VMail.Plan -0.003541920 -0.003462970 0.006947450 0.006973910 0.9572692355 0.003156504

Int.l.Plan 0.050796605 0.050690415 -0.027239647 -0.027240313 0.0149454169 0.009250272

Intl.Calls 0.019332522 0.019438841 -0.000989097 -0.000996865 -0.0004766350 0.030437267

Day.Calls 0.015322572 0.015398550 0.020549231 0.020563384 -0.0069430780 0.009730020

Account.Length 0.001643488 0.001732922 0.006437866 0.006444948 0.0112013521 0.011818414

	Day.Charge	Day.Mins	VMail.Plan	Int.l.Plan	Intl.Calls
Night.Calls	0.00911756964	0.0091172798	0.0040737924	0.011141146	-0.013850126
CustServ.Calls	-0.02630922621	-0.0263066623	-0.0193972104	-0.030167388	-0.005675820
Eve.Mins	0.00007908231	0.0000677394	0.0142514381	0.033923587	-0.004089925
Eve.Charge	0.00006842788	0.0000570832	0.0142637669	0.033922565	-0.004087559
Area.Code	-0.00900162461	-0.0089990374	-0.0003839688	0.057871538	-0.010939056
Intl.Mins	-0.01179941013	-0.0117930624	-0.0035419202	0.050796605	0.019332522
Intl.Charge	-0.01166861419	-0.0116622466	-0.0034629697	0.050690415	0.019438841
Night.Charge	0.02936540805	0.0293676546	0.0069474498	-0.027239647	-0.000989097
Night.Mins	0.02935449645	0.0293567393	0.0069739102	-0.027240313	-0.000996865
VMail.Message	0.00338888240	0.0033901877	0.9572692355	0.014945417	-0.000476635
Eve.Calls	0.02767185546	0.0276685649	0.0031565037	0.009250272	0.030437267
Day.Charge	1.00000000000	0.9999999527	-0.0015481363	0.052296507	0.009677557
Day.Mins	0.99999995266	1.0000000000	-0.0015473797	0.052297241	0.009678634
VMail.Plan	-0.00154813634	-0.0015473797	1.0000000000	0.010643477	-0.004834593
Int.l.Plan	0.05229650697	0.0522972414	0.0106434769	1.000000000	0.021804979
Intl.Calls	0.00967755667	0.0096786340	-0.0048345928	0.021804979	1.000000000
Day.Calls	0.01613228711	0.0161311687	-0.0082287144	0.006706464	-0.001331299
Account.Length	0.01359306373	0.0135931558	0.0162881126	0.025351573	0.026672128

	Day.Calls	Account.Length
Night.Calls	-0.0202860949	-0.036814024
CustServ.Calls	-0.0087218563	-0.011965872
Eve.Mins	-0.0118757316	-0.010271305
Eve.Charge	-0.0118578999	-0.010264701
Area.Code	-0.0004356262	-0.006306270
Intl.Mins	0.0153225721	0.001643488
Intl.Charge	0.0153985502	0.001732922
Night.Charge	0.0205492306	0.006437866
Night.Mins	0.0205633836	0.006444948
VMail.Message	-0.0069430780	0.011201352
Eve.Calls	0.0097300199	0.011818414

Day.Charge 0.0161322871 0.013593064

Day.Mins 0.0161311687 0.013593156

VMail.Plan -0.0082287144 0.016288113

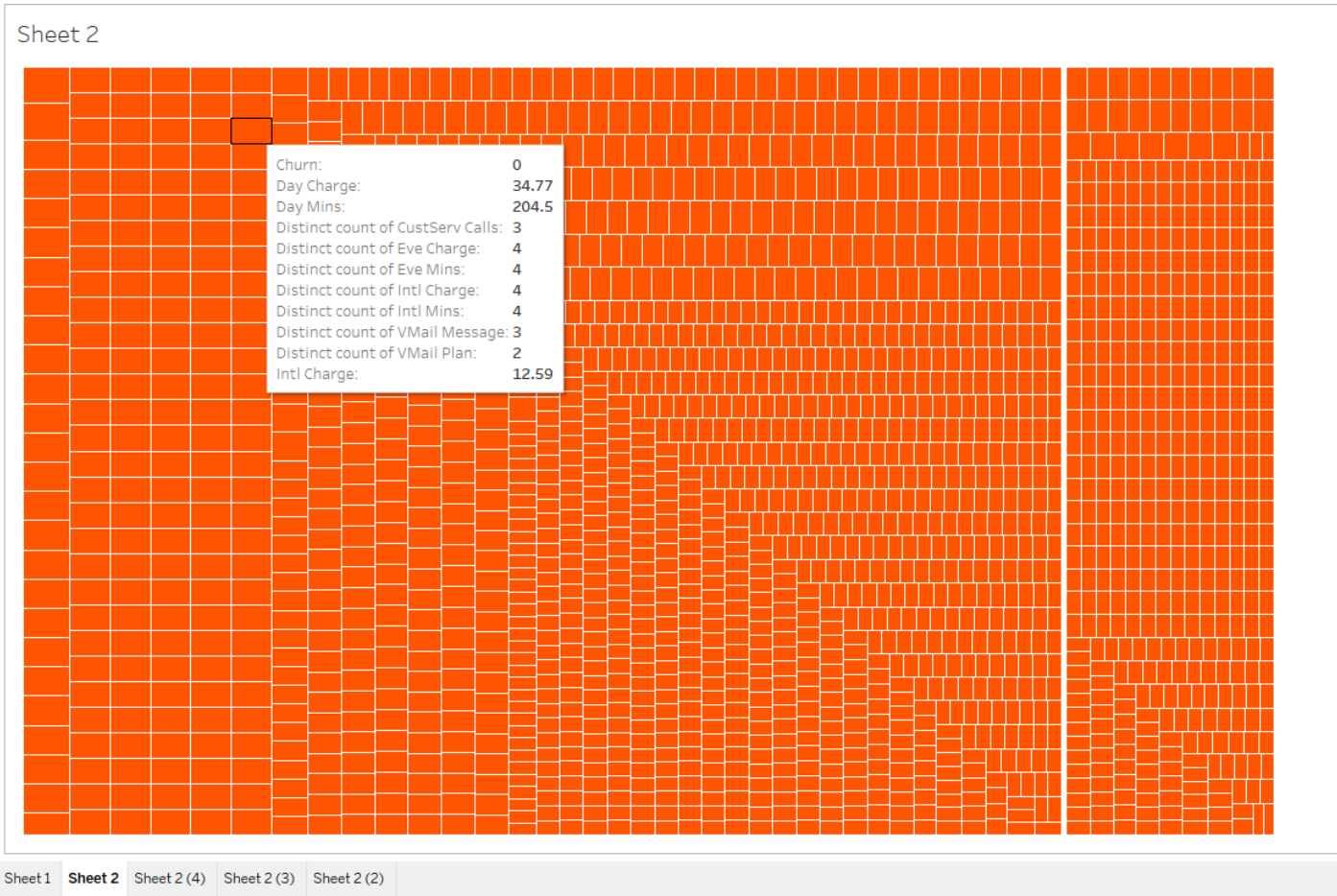
Int.l.Plan 0.0067064638 0.025351573

Intl.Calls -0.0013312991 0.026672128

Day.Calls 1.0000000000 0.032119615

Account.Length 0.0321196153 1.000000000

Rattle timestamp: 2018-10-20 07:55:06 tsraj



Correlation summary using the 'Pearson' covariance.

Note that only correlations between numeric variables are reported.

	Night.Calls	CustServ.Calls	Eve.Mins	Eve.Charge	Area.Code
Night.Calls	1.0000000000	0.0005803019	0.00728610375	0.00730390213	0.0204932171
CustServ.Calls	0.0005803019	1.0000000000	-0.01573954810	-0.01573386446	0.0256869703
Eve.Mins	0.0072861038	-0.0157395481	1.00000000000	0.99999978024	0.0191211028
Eve.Charge	0.0073039021	-0.0157338645	0.99999978024	1.00000000000	0.0191392025
Area.Code	0.0204932171	0.0256869703	0.01912110278	0.01913920253	1.0000000000
Intl.Mins	0.0207448614	-0.0129853517	-0.01058828174	-0.01059514976	-0.0072806656
Intl.Charge	0.0207457852	-0.0129797314	-0.01067664103	-0.01068353187	-0.0073929587
Night.Charge	0.0100791240	-0.0305310202	-0.00561750295	-0.00562149959	0.0012700083
Night.Mins	0.0100649946	-0.0305173273	-0.00559031608	-0.00559431590	0.0012835639
VMail.Message	0.0008396175	-0.0080730654	0.01099002832	0.01100558044	0.0003384187
Eve.Calls	0.0126966191	-0.0065985529	-0.02173690069	-0.02173662436	-0.0145870162
Day.Charge	0.0091175696	-0.0263092262	0.00007908231	0.00006842788	-0.0090016246
Day.Mins	0.0091172798	-0.0263066623	0.00006773940	0.00005708320	-0.0089990374
VMail.Plan	0.0040737924	-0.0193972104	0.01425143805	0.01426376688	-0.0003839688
Int.l.Plan	0.0111411462	-0.0301673885	0.03392358656	0.03392256550	0.0578715377
Intl.Calls	-0.0138501260	-0.0056758202	-0.00408992509	-0.00408755943	-0.0109390565
Day.Calls	-0.0202860949	-0.0087218563	-0.01187573163	-0.01185789994	-0.0004356262
Account.Length	-0.0368140243	-0.0119658723	-0.01027130542	-0.01026470090	-0.0063062700

	Intl.Mins	Intl.Charge	Night.Charge	Night.Mins	VMail.Message	Eve.Calls
Night.Calls	0.020744861	0.020745785	0.010079124	0.010064995	0.0008396175	0.012696619
CustServ.Calls	-0.012985352	-0.012979731	-0.030531020	-0.030517327	-0.0080730654	-0.006598553
Eve.Mins	-0.010588282	-0.010676641	-0.005617503	-0.005590316	0.0109900283	-0.021736901
Eve.Charge	-0.010595150	-0.010683532	-0.005621500	-0.005594316	0.0110055804	-0.021736624
Area.Code	-0.007280666	-0.007392959	0.001270008	0.001283564	0.0003384187	-0.014587016

Intl.Mins 1.000000000 0.999992677 -0.014917770 -0.014892704 -0.0020987858 0.032973269

Intl.Charge 0.999992677 1.000000000 -0.014826747 -0.014801566 -0.0020324824 0.032976668

Night.Charge -0.014917770 -0.014826747 1.000000000 0.999999221 0.0140906682 0.007491734

Night.Mins -0.014892704 -0.014801566 0.999999221 1.000000000 0.0141229901 0.007441521

VMail.Message -0.002098786 -0.002032482 0.014090668 0.014122990 1.0000000000 0.003381435

Eve.Calls 0.032973269 0.032976668 0.007491734 0.007441521 0.0033814349 1.000000000

Day.Charge -0.011799410 -0.011668614 0.029365408 0.029354496 0.0033888824 0.027671855

Day.Mins -0.011793062 -0.011662247 0.029367655 0.029356739 0.0033901877 0.027668565

VMail.Plan -0.003541920 -0.003462970 0.006947450 0.006973910 0.9572692355 0.003156504

Int.l.Plan 0.050796605 0.050690415 -0.027239647 -0.027240313 0.0149454169 0.009250272

Intl.Calls 0.019332522 0.019438841 -0.000989097 -0.000996865 -0.0004766350 0.030437267

Day.Calls 0.015322572 0.015398550 0.020549231 0.020563384 -0.0069430780 0.009730020

Account.Length 0.001643488 0.001732922 0.006437866 0.006444948 0.0112013521 0.011818414

	Day.Charge	Day.Mins	VMail.Plan	Int.l.Plan	Intl.Calls
Night.Calls	0.00911756964	0.0091172798	0.0040737924	0.011141146	-0.013850126
CustServ.Calls	-0.02630922621	-0.0263066623	-0.0193972104	-0.030167388	-0.005675820
Eve.Mins	0.00007908231	0.0000677394	0.0142514381	0.033923587	-0.004089925
Eve.Charge	0.00006842788	0.0000570832	0.0142637669	0.033922565	-0.004087559
Area.Code	-0.00900162461	-0.0089990374	-0.0003839688	0.057871538	-0.010939056
Intl.Mins	-0.01179941013	-0.0117930624	-0.0035419202	0.050796605	0.019332522
Intl.Charge	-0.01166861419	-0.0116622466	-0.0034629697	0.050690415	0.019438841
Night.Charge	0.02936540805	0.0293676546	0.0069474498	-0.027239647	-0.000989097
Night.Mins	0.02935449645	0.0293567393	0.0069739102	-0.027240313	-0.000996865
VMail.Message	0.00338888240	0.0033901877	0.9572692355	0.014945417	-0.000476635
Eve.Calls	0.02767185546	0.0276685649	0.0031565037	0.009250272	0.030437267
Day.Charge	1.00000000000	0.9999999527	-0.0015481363	0.052296507	0.009677557
Day.Mins	0.99999995266	1.0000000000	-0.0015473797	0.052297241	0.009678634
VMail.Plan	-0.00154813634	-0.0015473797	1.0000000000	0.010643477	-0.004834593
Int.l.Plan	0.05229650697	0.0522972414	0.0106434769	1.000000000	0.021804979

```
Intl.Calls      0.00967755667  0.0096786340 -0.0048345928  0.021804979  1.000000000
Day.Calls       0.01613228711  0.0161311687 -0.0082287144  0.006706464 -0.001331299
Account.Length  0.01359306373  0.0135931558  0.0162881126  0.025351573  0.026672128
                Day.Calls Account.Length
Night.Calls    -0.0202860949   -0.036814024
CustServ.Calls -0.0087218563   -0.011965872
Eve.Mins       -0.0118757316   -0.010271305
Eve.Charge     -0.0118578999   -0.010264701
Area.Code      -0.0004356262   -0.006306270
Intl.Mins       0.0153225721    0.001643488
Intl.Charge     0.0153985502    0.001732922
Night.Charge    0.0205492306    0.006437866
Night.Mins      0.0205633836    0.006444948
VMail.Message  -0.0069430780    0.011201352
Eve.Calls       0.0097300199    0.011818414
Day.Charge      0.0161322871    0.013593064
Day.Mins        0.0161311687    0.013593156
VMail.Plan     -0.0082287144    0.016288113
Int.l.Plan      0.0067064638    0.025351573
Intl.Calls     -0.0013312991    0.026672128
Day.Calls       1.0000000000    0.032119615
Account.Length  0.0321196153    1.000000000
Summary of the Extreme Boost model:


##### xgb.Booster
raw: 86.6 Kb
call:
  xgb.train(params = params, data = dtrain, nrounds = nrounds,
    watchlist = watchlist, verbose = verbose, print_every_n = print_every_n,
    early_stopping_rounds = early_stopping_rounds, maximize = maximize,
    save_period = save_period, save_name = save_name, xgb_model = xgb_model,
```

```
    callbacks = callbacks, max_depth = 6, eta = 0.3, num_parallel_tree = 1,
    nthread = 2, metrics = "error", objective = "binary:logistic")
params (as set within xgb.train):
  max_depth = "6", eta = "0.3", num_parallel_tree = "1", nthread = "2", metrics = "error", objective =
"binary:logistic", silent = "1"
xgb.attributes:
  niter
callbacks:
  cb.print.evaluation(period = print_every_n)
  cb.evaluation.log()
# of features: 19
niter: 50
nfeatures : 19
formula :
            Churn ~ .
<environment: 0x00000000228148c0>
dimnames : (Intercept) Account.Length VMail.Message Day.Mins Eve.Mins Night.Mins Intl.Mins
CustServ.Calls Int.l.Plan VMail.Plan Day.Calls Day.Charge Eve.Calls Eve.Charge Night.Calls
Night.Charge Intl.Calls Intl.Charge Area.Code
evaluation_log:
    iter train_error
       1    0.043721
       2    0.032576
---
      49    0.000857
      50    0.000857


Final iteration error rate:
   iter train_error
1:   50          0


Importance/Frequency of variables actually used:
```

	Feature	Gain	Cover	Frequency
1:	Day.Mins	0.280393021	0.270826483	0.189954338
2:	Eve.Mins	0.140813455	0.136555895	0.151598174
3:	CustServ.Calls	0.127246216	0.118632975	0.061187215
4:	Intl.Mins	0.088087332	0.066494323	0.095890411
5:	Int.l.Plan	0.076126718	0.107131059	0.038356164
6:	Intl.Calls	0.075868127	0.029553977	0.057534247
7:	VMail.Message	0.068819281	0.080641249	0.059360731
8:	Night.Mins	0.052989869	0.061224109	0.100456621
9:	Eve.Calls	0.028333532	0.045822940	0.068493151
10:	Night.Calls	0.021927970	0.032395979	0.054794521
11:	Day.Calls	0.021821245	0.023399012	0.062100457
12:	Account.Length	0.015939539	0.024818703	0.052968037
13:	Area.Code	0.001633695	0.002503296	0.007305936

Time taken: 3.95 secs

Rattle timestamp: 2018-10-22 17:58:49 tsraj

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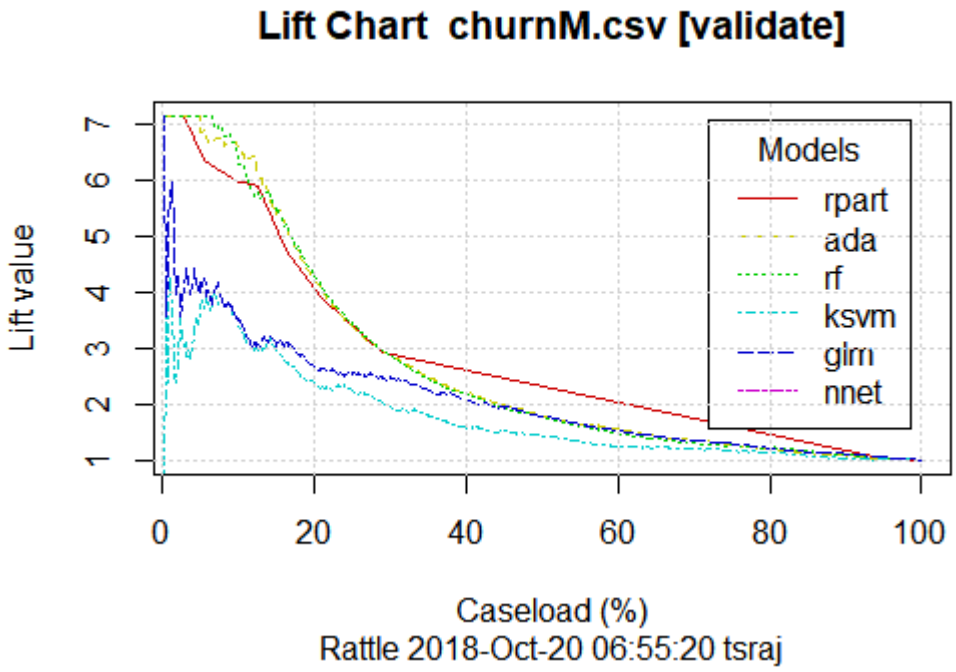
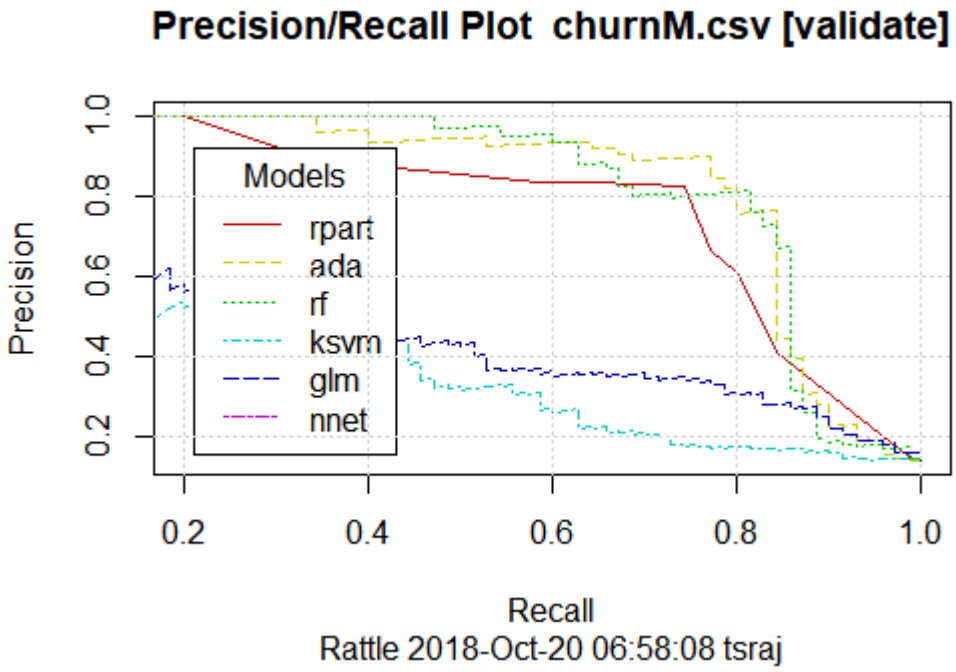
Rattle timestamp: 2018-10-20 07:55:06 tsraj



To summarize, Gain and Lift Charts help answer the following questions:

* How good is the predictive model?

* How does the response rate of a targeted selection compare to a random selection? Gain > 1 means the results from the predictive model are better than random.Understanding And Interpreting Gain And Lift Charts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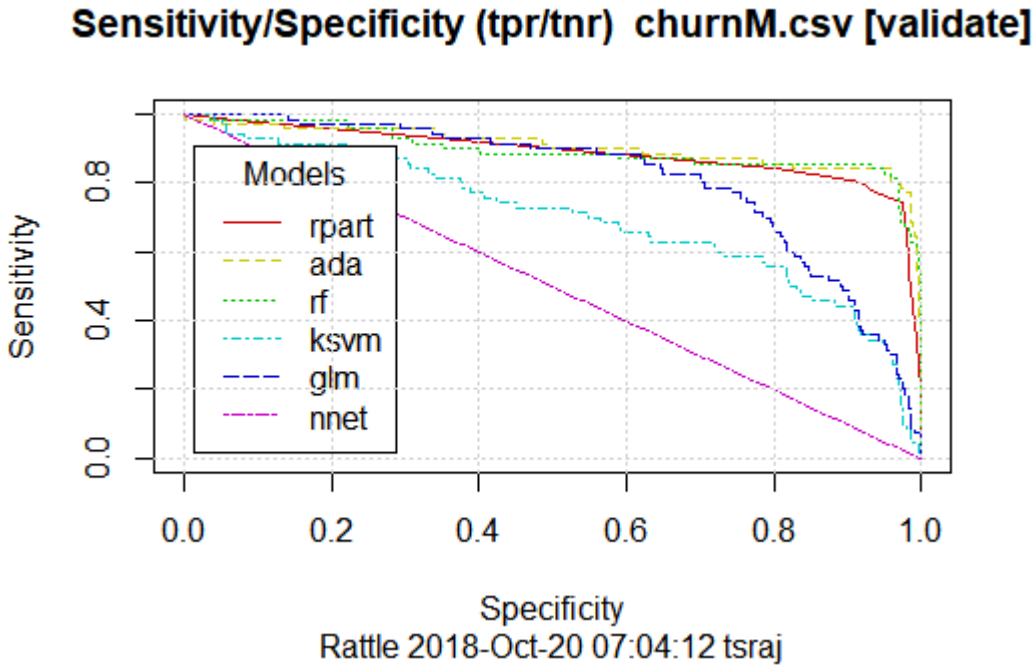
Rattle 2018-Oct-20 06:58:08 tsraj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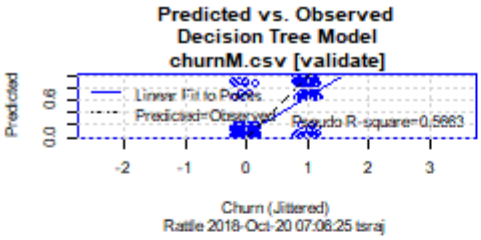
Rattle 2018-Oct-20 07:04:12 tsraj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Decision Tree Model
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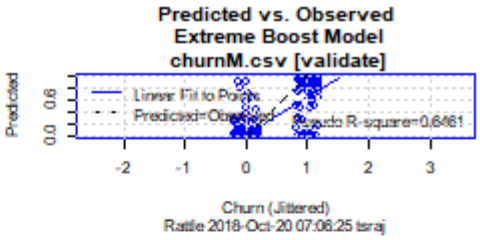
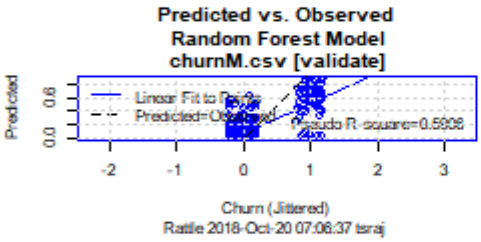
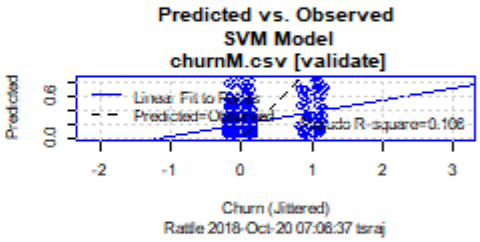
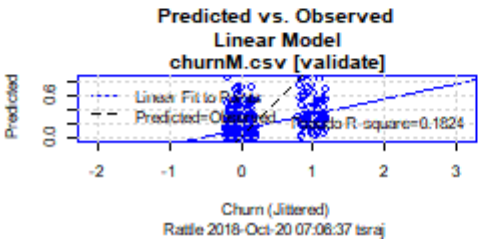
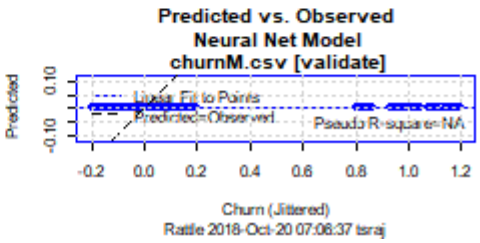
Predicted
Linear Fit to Points
Predicted=Observed
Pseudo R-square=0.5983
Churn (Jittered)
Rattle 2018-Oct-20 07:06:25 tsraj

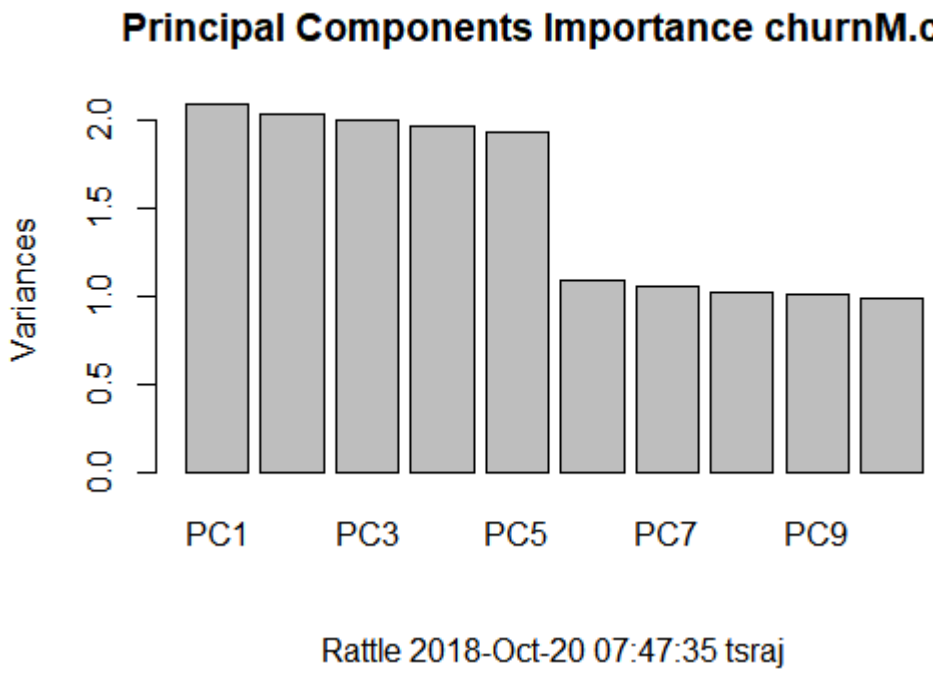

Predicted vs. Observed
Extreme Boost Model
churnM.csv [validate]
Predicted
Linear Fit to Points
Predicted=Observed
Pseudo R-square=0.6461
Churn (Jittered)
Rattle 2018-Oct-20 07:06:25 tsraj

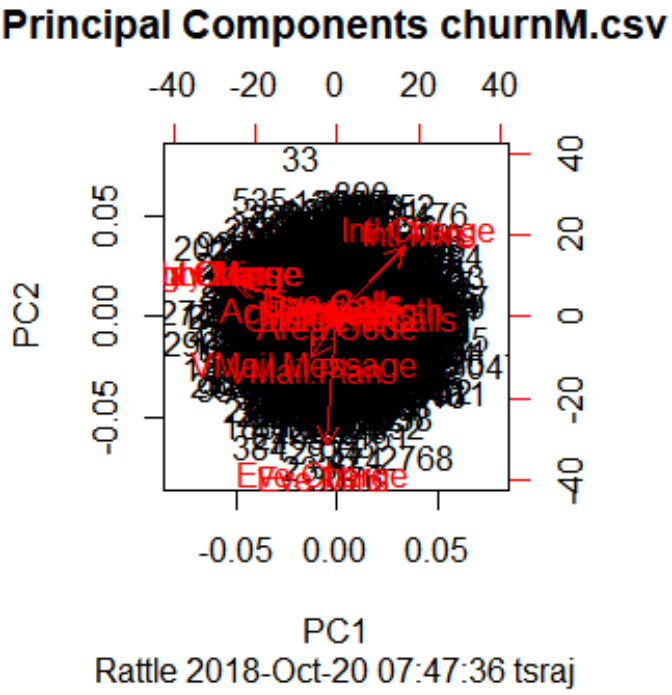

Predicted vs. Observed
Random Forest Model
churnM.csv [validate]
Predicted
Linear Fit to Points
Predicted=Observed
Pseudo R-square=0.5936
Churn (Jittered)
Rattle 2018-Oct-20 07:06:37 tsraj

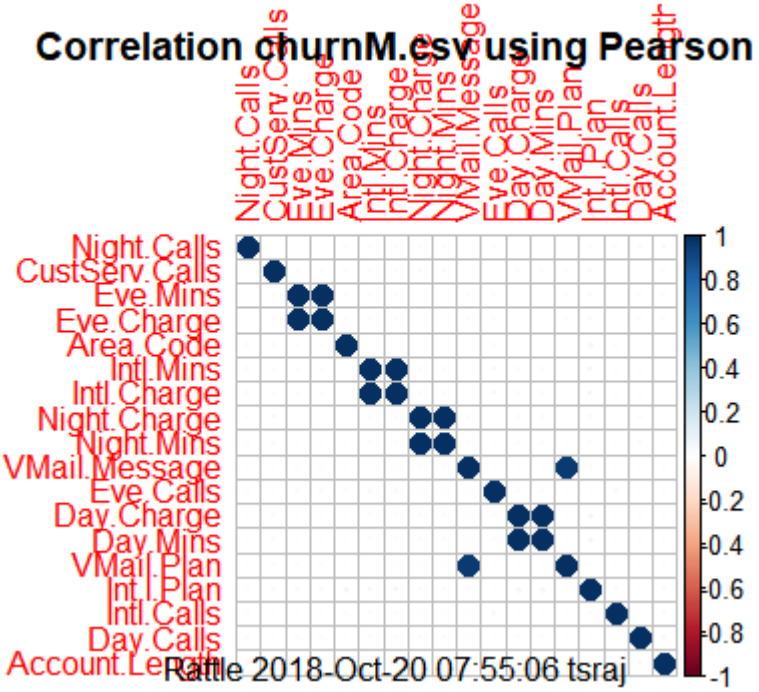

Predicted vs. Observed
SVM Model
churnM.csv [validate]
Predicted
Linear Fit to Points
Predicted=Observed
Pseudo R-square=0.106
Churn (Jittered)
Rattle 2018-Oct-20 07:06:37 tsraj

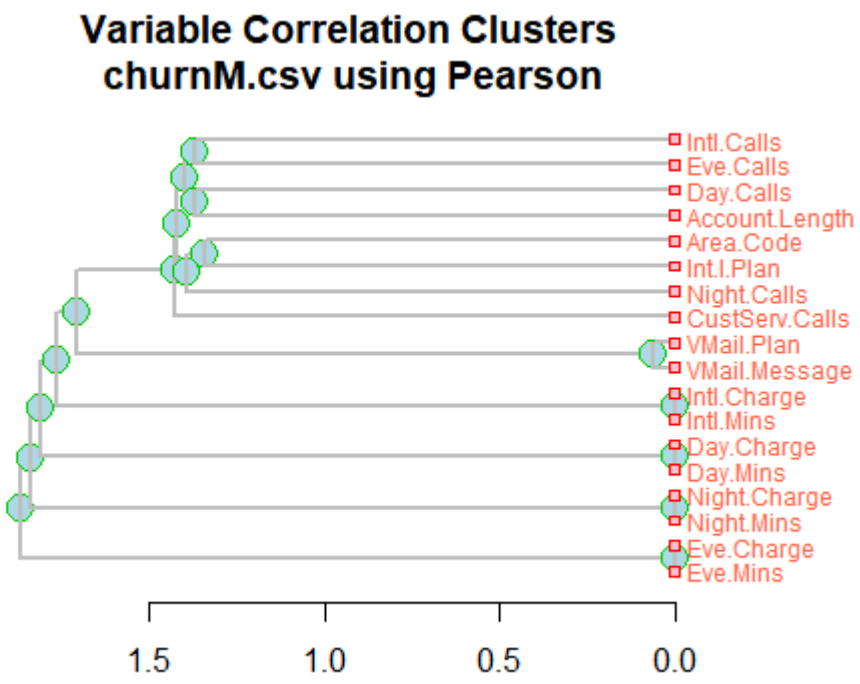

Predicted vs. Observed
Linear Model
churnM.csv [validate]
Predicted
Linear Fit to Points
Predicted=Observed
Pseudo R-square=0.1824
Churn (Jittered)
Rattle 2018-Oct-20 07:06:37 tsraj

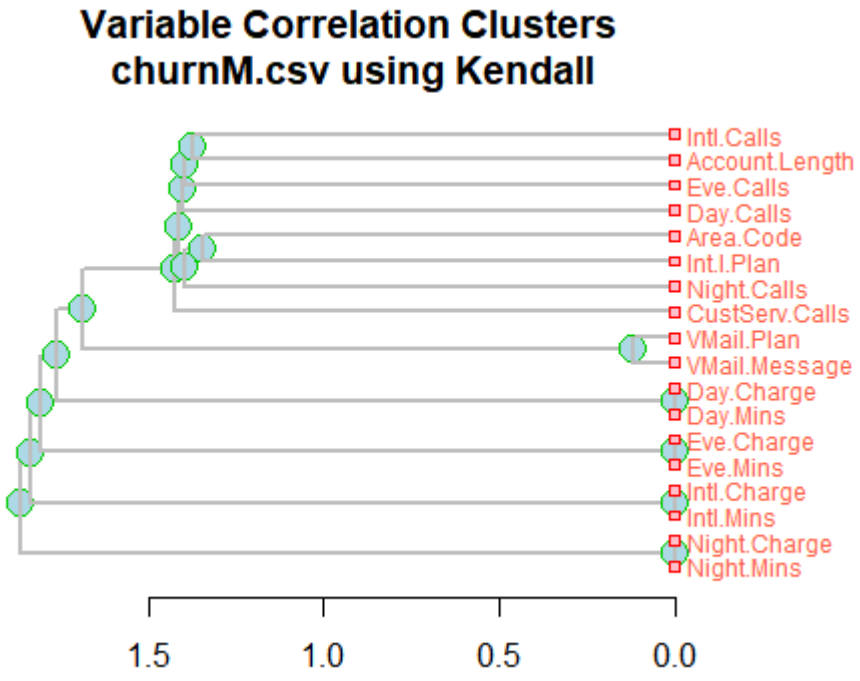

Predicted vs. Observed
Neural Net Model
churnM.csv [validate]
Predicted
Linear Fit to Points
Predicted=Observed
Pseudo R-square=NA
Churn (Jittered)
Rattle 2018-Oct-20 07:06:37 tsraj

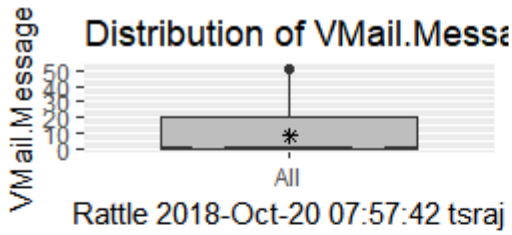

Principal Components Importance churnM.csv
Variances
PC1
PC3
PC5
PC7
PC9
Rattle 2018-Oct-20 07:47:35 tsraj

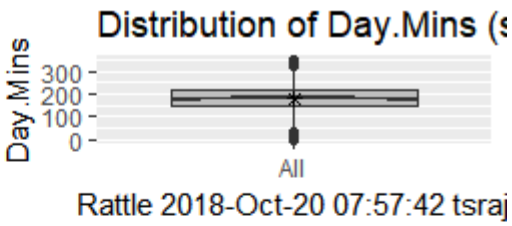

Principal Components churnM.csv
PC2
PC1
Rattle 2018-Oct-20 07:47:36 tsraj

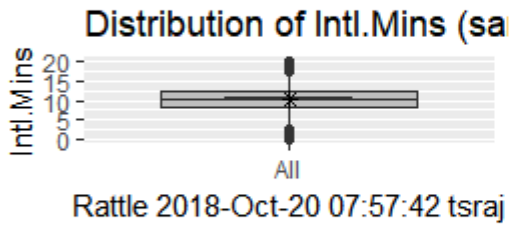

Correlation churnM.csv using Pearson
Night.Calls
CustServ.Calls
Eve.Mins
Eve.Charge
Area.Code
Intl.Mins
Intl.Charge
Night.Charge
Night.Mins
VMail.Message
Eve.Calls
Day.Charge
Day.Mins
VMail.Plan
Intl.Plan
Intl.Calls
Day.Calls
Account.Length
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Rattle 2018-Oct-20 07:55:06 tsraj

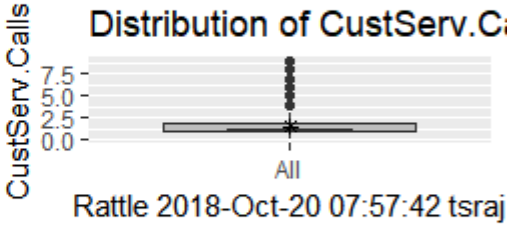

Variable Correlation Clusters
churnM.csv using Pearson
Intl.Calls
Eve.Calls
Day.Calls
Account.Length
Area.Code
Int.l.Plan
Night.Calls
CustServ.Calls
VMail.Plan
VMail.Message
Intl.Charge
Intl.Mins
Day.Charge
Day.Mins
Night.Charge
Night.Mins
Eve.Charge
Eve.Mins
1.5
1.0
0.5
0.0

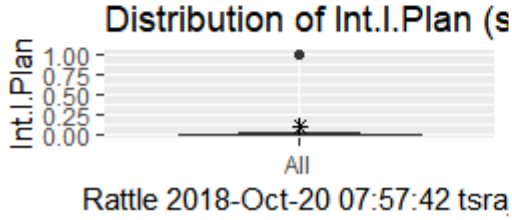

Variable Correlation Clusters
churnM.csv using Kendall
Intl.Calls
Account.Length
Eve.Calls
Day.Calls
Area.Code
Int.l.Plan
Night.Calls
CustServ.Calls
VMail.Plan
VMail.Message
Day.Charge
Day.Mins
Eve.Charge
Eve.Mins
Intl.Charge
Intl.Mins
Night.Charge
Night.Mins
1.5
1.0
0.5
0.0

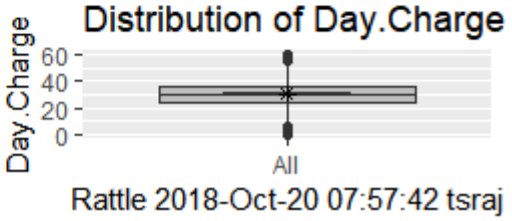

Distribution of VMail.Messa
VMail.Message
50
40
30
20
10
0
All
Rattle 2018-Oct-20 07:57:42 tsraj

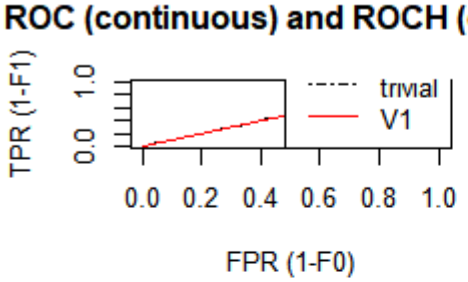

Distribution of Day.Mins (s
Day.Mins
300
200
100
0
All
Rattle 2018-Oct-20 07:57:42 tsraj

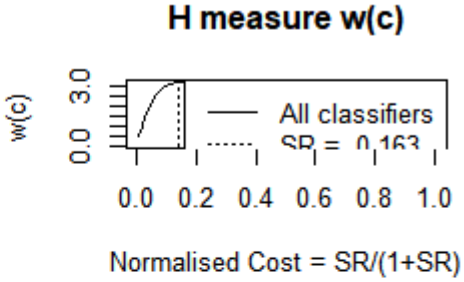

Distribution of Intl.Mins (sa
Intl.Mins
20
15
10
5
0
All
Rattle 2018-Oct-20 07:57:42 tsraj

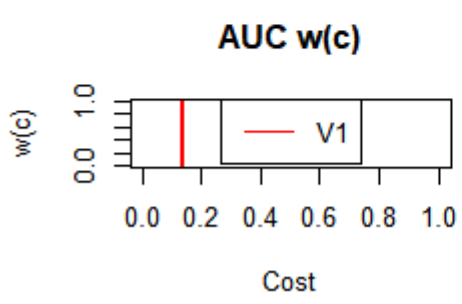

Distribution of CustServ.Ca
CustServ.Calls
7.5
5.0
2.5
0.0
All
Rattle 2018-Oct-20 07:57:42 tsraj

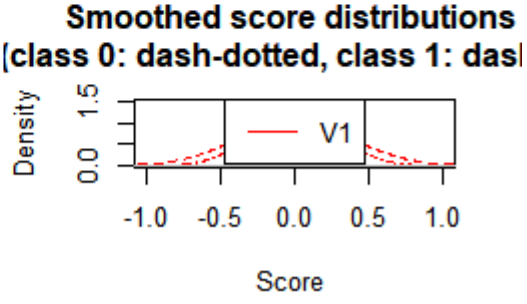

Distribution of Int.l.Plan (s
Int.l.Plan
1.00
0.75
0.50
0.25
0.00
All
Rattle 2018-Oct-20 07:57:42 tsra

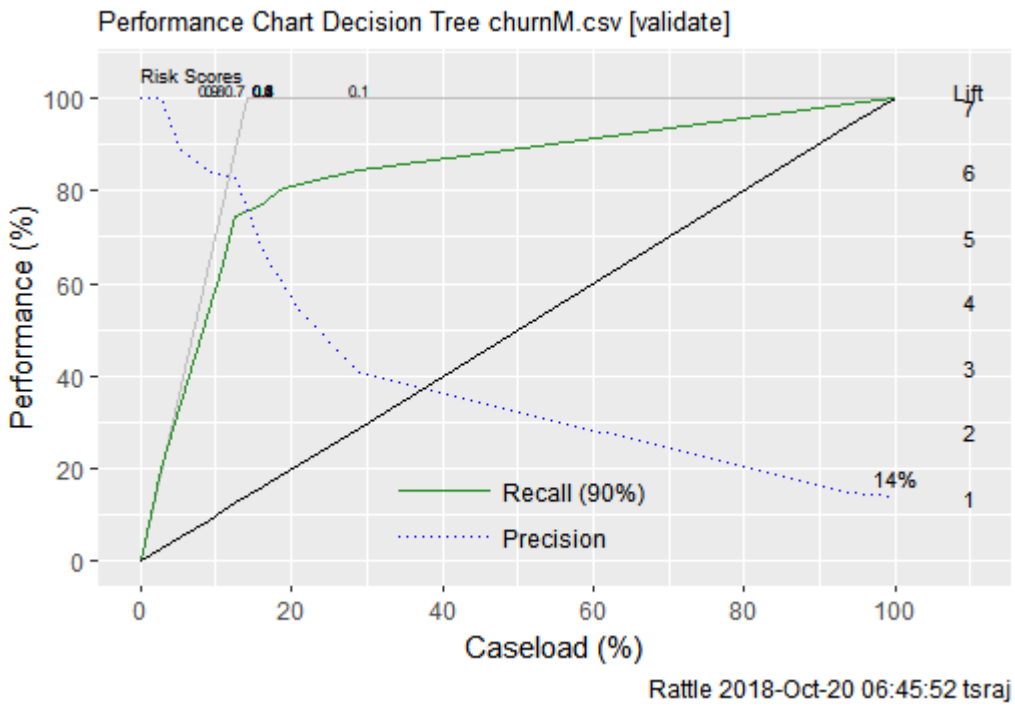

Distribution of Day.Charge
Day.Charge
60
40
20
0
All
Rattle 2018-Oct-20 07:57:42 tsraj

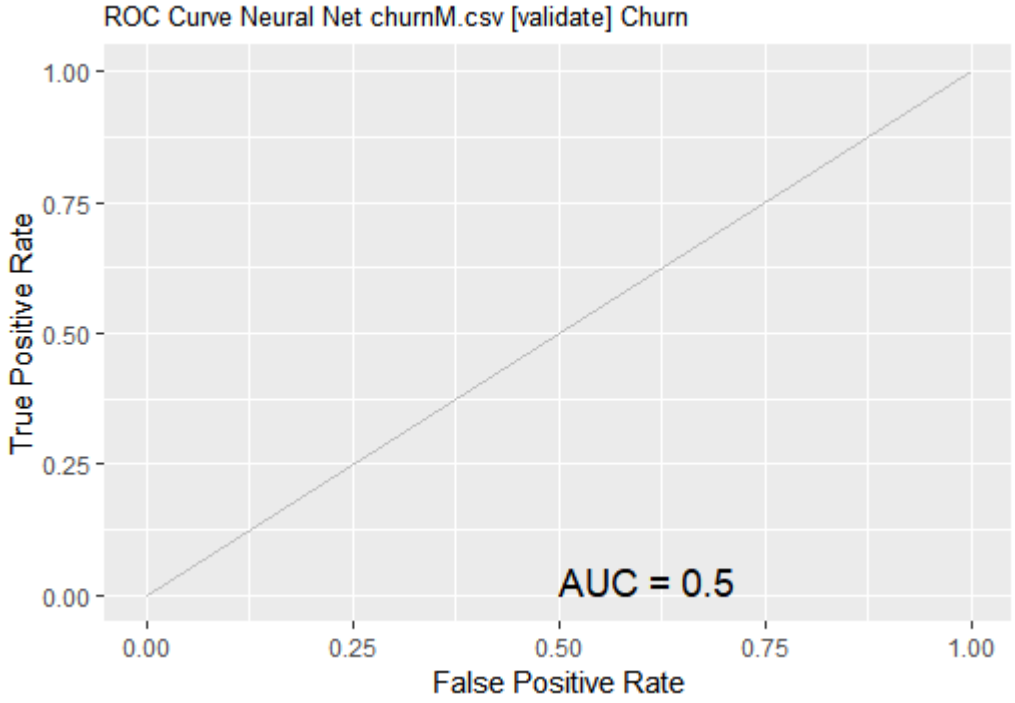

ROC (continuous) and ROCH (dot
TPR (1-F1)
0.0
1.0
trivial
V1
0.0 0.2 0.4 0.6 0.8 1.0
FPR (1-F0)

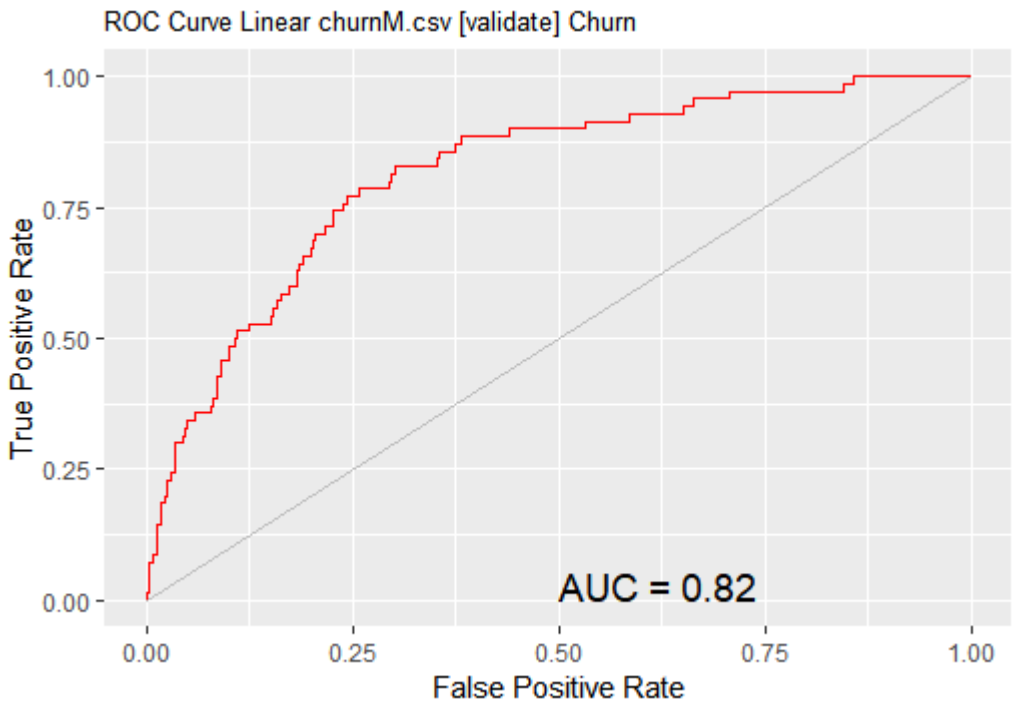

H measure w(c)
w(c)
0.0
3.0
All classifiers
0.0 0.2 0.4 0.6 0.8 1.0
Normalised Cost = SR/(1+SR)

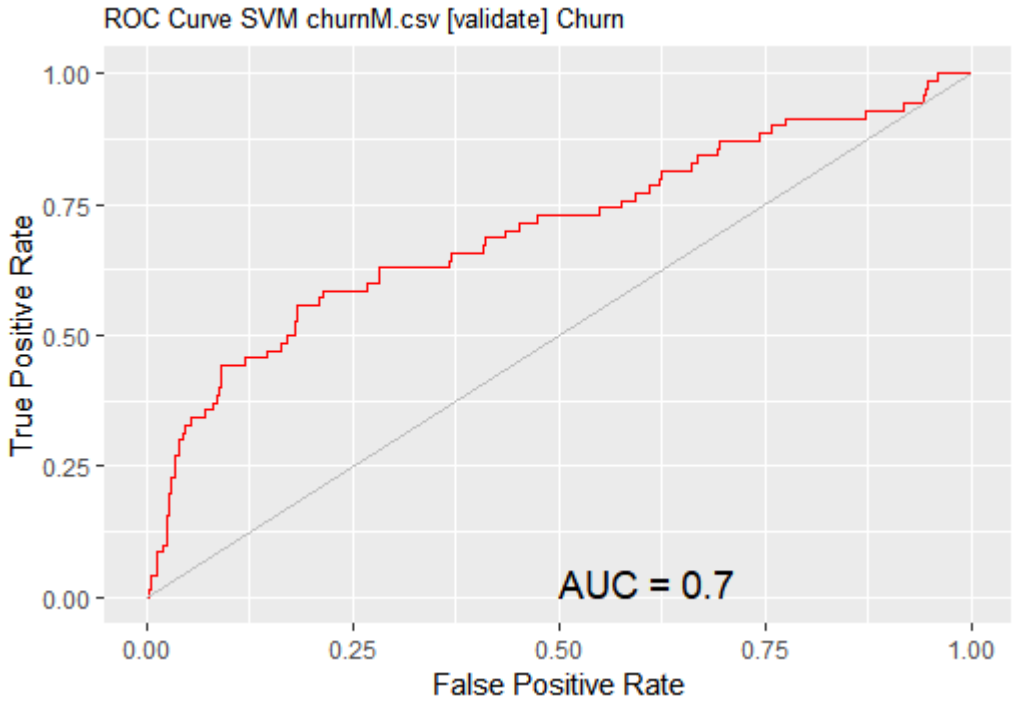

AUC w(c)
w(c)
0.0
1.0
V1
0.0 0.2 0.4 0.6 0.8 1.0
Cost

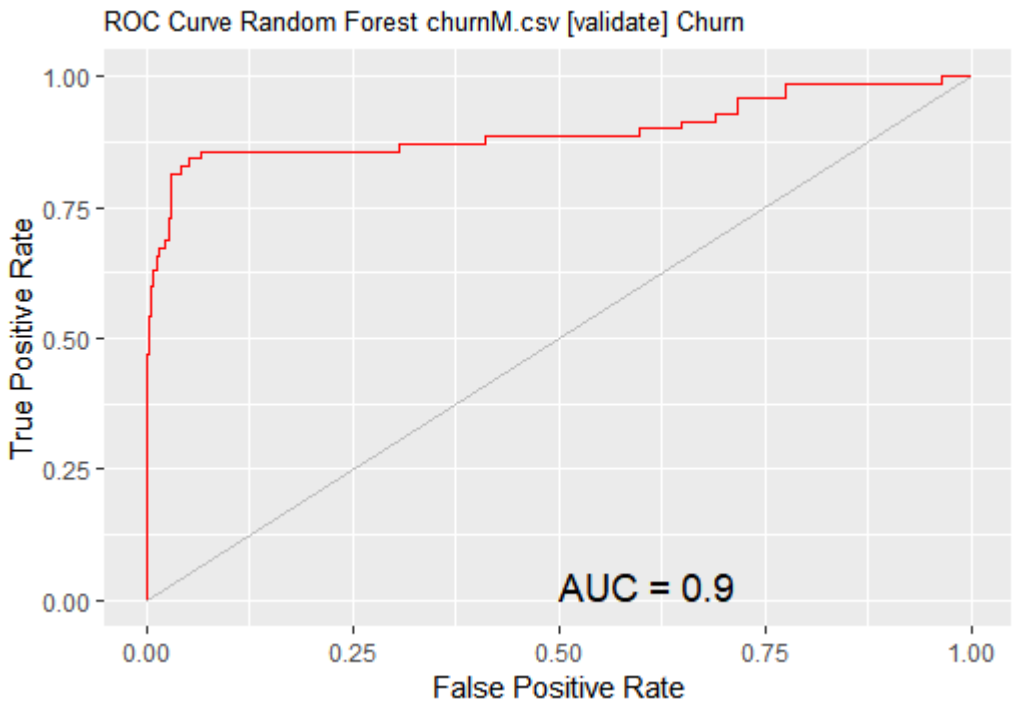

Smoothed score distributions
(class 0: dash-dotted, class 1: dash
Density
0.0
1.5
V1
-1.0 -0.5 0.0 0.5 1.0
Score

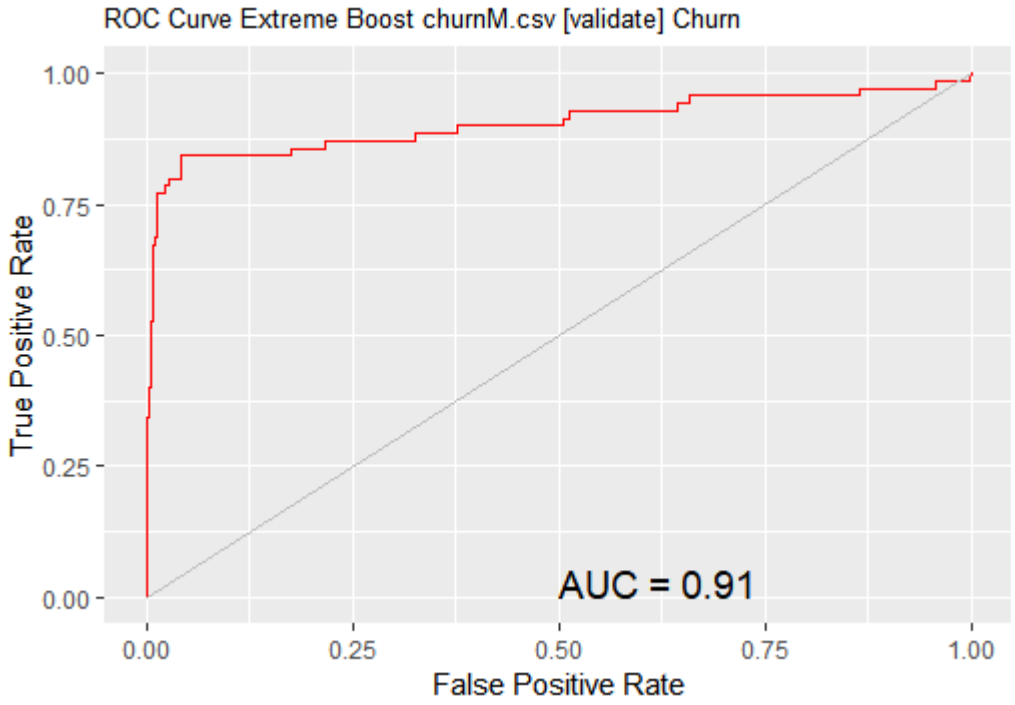

Performance Chart Decision Tree churnM.csv [validate]
Risk Scores
0.1
Lift
Performance (%)
Recall (90%)
Precision
14%
Caseload (%)
Rattle 2018-Oct-20 06:45:52 tsraj

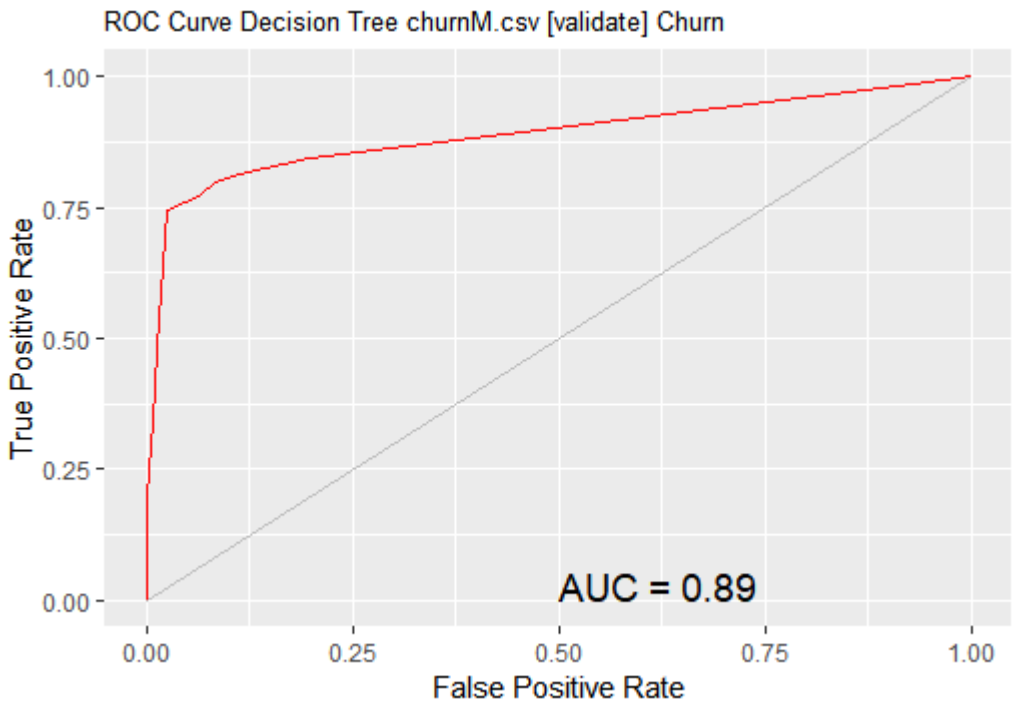

ROC Curve Neural Net churnM.csv [validate] Churn
True Positive Rate
AUC = 0.5
False Positive Rate

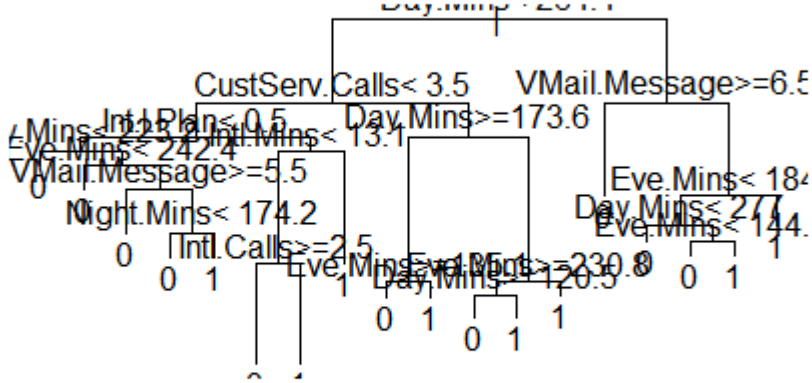

ROC Curve Linear churnM.csv [validate] Churn
True Positive Rate
False Positive Rate
AUC = 0.82
0.00
0.25
0.50
0.75
1.00

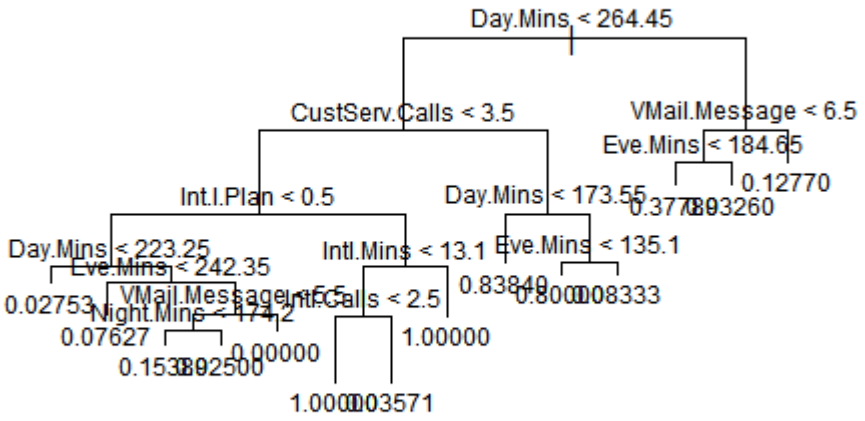

ROC Curve SVM churnM.csv [validate] Churn
True Positive Rate
False Positive Rate
AUC = 0.7
0.00
0.25
0.50
0.75
1.00

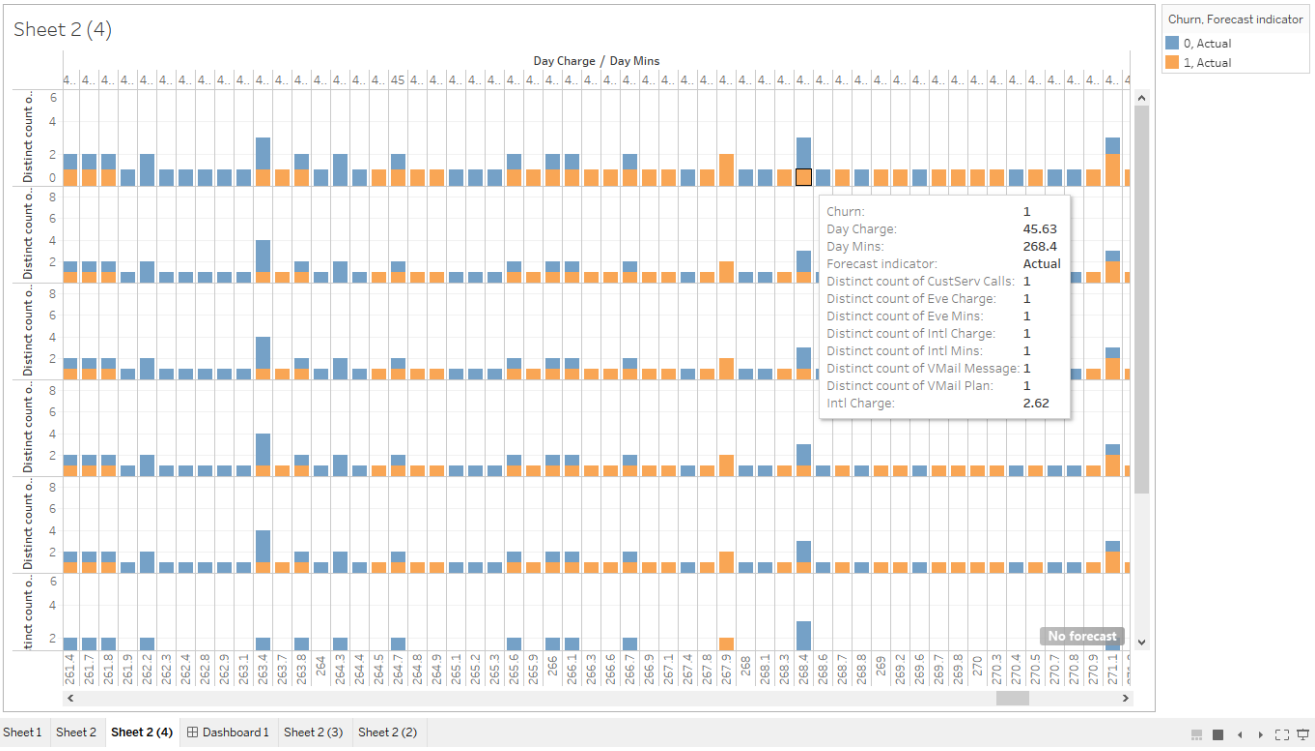

ROC Curve Random Forest churnM.csv [validate] Churn
True Positive Rate
False Positive Rate
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
AUC = 0.9


ROC Curve Extreme Boost churnM.csv [validate] Churn
True Positive Rate
False Positive Rate
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
AUC = 0.91


ROC Curve Decision Tree churnM.csv [validate] Churn
True Positive Rate
False Positive Rate
AUC = 0.89
0.00
0.25
0.50
0.75
1.00


CustServ.Calls< 3.5
VMail.Message>=6.5
Int.Plan< 0.5
Day.Mins>=173.6
Eve.Mins< 242.4
Intl.Mins< 13.1
VMail.Message>=5.5
Night.Mins< 174.2
Intl.Calls>=2.5
Eve.Mins< 184
Day.Mins< 277
Eve.Mins< 144.
0 1


Day.Mins < 264.45
CustServ.Calls < 3.5
VMail.Message < 6.5
Eve.Mins < 184.65
0.12770
Int.l.Plan < 0.5
Day.Mins < 173.55
Day.Mins < 223.25
Intl.Mins < 13.1
Eve.Mins < 135.1
Eve.Mins < 242.35
0.83849
0.02753
Night.Mins < 174.2
Intl.Calls < 2.5
0.07627
1.00000
0.00000


Sheet 2 (4)
Day Charge / Day Mins
Churn, Forecast indicator
0, Actual
1, Actual
Churn: 1
Day Charge: 45.63
Day Mins: 268.4
Forecast indicator: Actual
Distinct count of CustServ Calls: 1
Distinct count of Eve Charge: 1
Distinct count of Eve Mins: 1
Distinct count of Intl Charge: 1
Distinct count of Intl Mins: 1
Distinct count of VMail Message: 1
Distinct count of VMail Plan: 1
Intl Charge: 2.62
No forecast
Sheet 1
Sheet 2
Sheet 2 (4)
Dashboard 1
Sheet 2 (3)
Sheet 2 (2)