

## Exploratory Breast cancer –

### SIMATIT MUNI

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)] 398 observations and 31 variables  
Maximum # NAs:0

#### Levels Storage

radius_mean	double
texture_mean	double
perimeter_mean	double
area_mean	double
smoothness_mean	double
compactness_mean	double
concavity_mean	double
concave.points_mean	double
symmetry_mean	double
fractal_dimension_mean	double
radius_se	double
texture_se	double
perimeter_se	double
area_se	double
smoothness_se	double
compactness_se	double
concavity_se	double
concave.points_se	double
symmetry_se	double
fractal_dimension_se	double
radius_worst	double
texture_worst	double
perimeter_worst	double
area_worst	double
smoothness_worst	double

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compactness_worst      double
concavity_worst        double
concave.points_worst   double
symmetry_worst         double
fractal_dimension_worst double
diagnosis              2 integer

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|Variable | Levels|

+----- +----- +

|diagnosis| B,M |

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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.

radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean
Min. : 6.981	Min. : 9.71	Min. : 43.79	Min. : 143.5	Min. : 0.05263
1st Qu.:11.693	1st Qu.:16.36	1st Qu.: 75.18	1st Qu.: 419.9	1st Qu.: 0.08496
Median :13.355	Median :18.90	Median : 86.21	Median : 546.4	Median : 0.09432
Mean :14.119	Mean :19.30	Mean : 91.89	Mean : 656.4	Mean : 0.09581
3rd Qu.:15.725	3rd Qu.:21.86	3rd Qu.:103.28	3rd Qu.: 765.4	3rd Qu.: 0.10505
Max. :28.110	Max. :33.81	Max. :188.50	Max. :2501.0	Max. : 0.16340
compactness_mean	concavity_mean	concave.points_mean	symmetry_mean	fractal_dimension_mean
Min. :0.01938	Min. :0.00000	Min. :0.00000	Min. :0.1060	Min. : 0.04996
1st Qu.:0.06173	1st Qu.:0.02694	1st Qu.:0.01977	1st Qu.:0.1613	1st Qu.: 0.05751
Median :0.08844	Median :0.05935	Median :0.03263	Median :0.1784	Median : 0.06128
Mean :0.10323	Mean :0.08875	Mean :0.04860	Mean :0.1801	Mean : 0.06264
3rd Qu.:0.12957	3rd Qu.:0.12582	3rd Qu.:0.07391	3rd Qu.:0.1946	3rd Qu.: 0.06587
Max. :0.34540	Max. :0.42680	Max. :0.20120	Max. :0.2906	Max. : 0.09744
radius_se	texture_se	perimeter_se	area_se	smoothness_se
Min. :0.1115	Min. :0.3602	Min. : 0.757	Min. : 7.228	Min. : 0.001713

1st Qu.:0.2316 1st Qu.:0.8425 1st Qu.: 1.581 1st Qu.: 18.025 1st Qu.:0.005114  
Median :0.3156 Median :1.1270 Median : 2.257 Median : 24.065 Median :0.006423  
Mean :0.4114 Mean :1.2212 Mean : 2.899 Mean : 41.628 Mean :0.007006 3rd Qu.:0.4749 3rd Qu.:1.4775 3rd Qu.: 3.318 3rd Qu.: 44.867 3rd Qu.:0.008247 Max. :2.8730 Max. :4.8850 Max. :21.980 Max. :542.200 Max. :0.023330 compactness\_se concavity\_se concave.points\_se symmetry\_se fractal\_dimension\_se Min. :0.002252 Min. :0.000000 Min. :0.000000 Min. :0.007882 Min. :0.0008948

1st Qu.:0.012363 1st Qu.:0.01430 1st Qu.:0.007439 1st Qu.:0.014993 1st Qu.:0.0021775 Median :0.019160 Median :0.02415 Median :0.010915 Median :0.018700 Median :0.0030410 Mean :0.025212 Mean :0.03187 Mean :0.011665 Mean :0.020583 Mean :0.0037148 3rd Qu.:0.032135 3rd Qu.:0.04216 3rd Qu.:0.014905 3rd Qu.:0.023670 3rd Qu.:0.0045450 Max. :0.135400 Max. :0.39600 Max. :0.052790 Max. :0.078950 Max. :0.0298400 radius\_worst texture\_worst perimeter\_worst area\_worst smoothness\_worst Min. : 7.93 Min. :12.02 Min. : 50.41 Min. : 185.2 Min. :0.07117

1st Qu.:13.02 1st Qu.:21.16 1st Qu.: 83.92 1st Qu.: 516.0 1st Qu.:0.11447  
Median :14.90 Median :25.58 Median : 96.72 Median : 679.0 Median :0.13020  
Mean :16.29 Mean :25.68 Mean :107.35 Mean : 887.6 Mean :0.13177 3rd Qu.:18.54 3rd Qu.:29.45 3rd Qu.:124.70 3rd Qu.:1045.5 3rd Qu.:0.14580 Max. :36.04 Max. :47.16 Max. :251.20 Max. :4254.0 Max. :0.22260  
compactness\_worst concavity\_worst concave.points\_worst symmetry\_worst fractal\_dimension\_worst Min. :0.02729 Min. :0.0000 Min. :0.00000 Min. :0.1565 Min. :0.05504

1st Qu.:0.13670 1st Qu.:0.1051 1st Qu.:0.06301 1st Qu.:0.2491 1st Qu.:0.07083  
Median :0.20925 Median :0.2225 Median :0.09777 Median :0.2808 Median :0.07909  
Mean :0.25403 Mean :0.2735 Mean :0.11446 Mean :0.2890 Mean :0.08369  
3rd Qu.:0.34358 3rd Qu.:0.3795 3rd Qu.:0.16085 3rd Qu.:0.3167 3rd Qu.:0.09218  
Max. :1.05800 Max. :1.2520 Max. :0.29100 Max. :0.6638 Max. :0.20750  
diagnosis  
B:252  
M:146

Rattle timestamp: 2018-11-01 14:15:28 tsraj

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Below is a description of the dataset.

The data is limited to the training dataset.

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crs$dataset[crs$train, c(crs$input, crs$risk, crs$target)]
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31 Variables 398 Observations

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radius\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	340	1	14.12	3.888	9.494	10.404	11.692	13.355	15.725	19.536	20.923

lowest : 6.981 7.691 7.760 8.196 8.571, highest: 24.630 25.220 27.220 27.420 28.110

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texture\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	352	1	19.3	4.717	13.09	14.07	16.36	18.90	21.86	24.93	27.21

lowest : 9.71 10.38 10.72 10.82 10.89, highest: 29.97 30.62 30.72 31.12 33.81

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perimeter\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	372	1	91.89	26.75	60.32	66.59	75.18	86.21	103.28	129.22	140.22

lowest : 43.79 47.92 48.34 51.71 54.34, highest: 166.20 171.50 182.10 186.90 188.50

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area\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	383	1	656.4	369.1	273.7	328.2	419.9	546.3	765.4	1191.9	1349.5

lowest : 143.5 170.4 181.0 201.9 221.3, highest: 1841.0 1878.0 2250.0 2499.0 2501.0

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#### smoothness\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	349	1	0.09581	0.01628	0.07494	0.07919	0.08496	0.09432	0.10505	0.11413	0.11971

lowest : 0.05263 0.06251 0.06429 0.06576 0.06613, highest: 0.13710 0.13980 0.14250 0.14470 0.16340

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#### compactness\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	385	1	0.1032	0.05925	0.04042	0.04725	0.06173	0.08844	0.12957	0.18366	0.21103

lowest : 0.01938 0.02344 0.02650 0.02675 0.03212, highest: 0.27760 0.28320 0.28390 0.28670 0.34540

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#### concavity\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	381	1	0.08875	0.08684	0.00500	0.01342	0.02694	0.05935	0.12582	0.21295	0.24901

lowest : 0.0000000 0.0009737 0.0011940 0.0014610 0.0014870, highest: 0.3635000 0.3754000 0.4108000  
0.4264000 0.4268000

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#### concave.points\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	381	1	0.0486	0.04243	0.005639	0.011101	0.019765	0.032635	0.073910	0.100660	0.128090

lowest : 0.000000 0.001852 0.002924 0.002941 0.003261, highest: 0.168900 0.182300 0.184500 0.187800 0.201200

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#### symmetry\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	330	1	0.1801	0.02962	0.1422	0.1493	0.1613	0.1784	0.1946	0.2131	0.2307

lowest : 0.1060 0.1167 0.1203 0.1220 0.1305, highest: 0.2595 0.2597 0.2655 0.2678 0.2906

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fractal\_dimension\_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	361	1	0.06264	0.007649	0.05389	0.05532	0.05751	0.06128	0.06586	0.07198	0.07604

lowest : 0.04996 0.05025 0.05044 0.05054 0.05096, highest: 0.08980 0.09296 0.09502 0.09575 0.09744

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radius\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	382	1	0.4114	0.273	0.1601	0.1843	0.2316	0.3156	0.4749	0.7967	1.0006

lowest : 0.1115 0.1153 0.1194 0.1199 0.1267, highest: 1.2960 1.3700 1.5090 2.5470 2.8730

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texture\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	375	1	1.221	0.5829	0.5369	0.6335	0.8425	1.1270	1.4775	1.9089	2.1898

lowest : 0.3602 0.3871 0.3981 0.4064 0.4125, highest: 2.9270 3.1200 3.6470 3.8960 4.8850

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perimeter\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	376	1	2.899	1.92	1.140	1.295	1.581	2.258	3.318	5.398	7.239

lowest : 0.7570 0.8439 0.8484 0.8730 0.9680, highest: 9.6350 9.8070 10.0500 18.6500 21.9800

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area\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	377	1	41.63	38.28	11.46	13.30	18.02	24.07	44.87	94.00	123.26

lowest : 7.228 7.254 8.205 8.322 9.006, highest: 199.700 224.100 233.000 525.600 542.200

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smoothness\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	391	1	0.007006	0.002967	0.003617	0.004124	0.005114	0.006423	0.008247	0.010380	0.012220

lowest : 0.001713 0.002667 0.002826 0.002838 0.002866, highest: 0.016040 0.017210 0.018350 0.021770 0.023330

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compactness\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	380	1	0.02521	0.01862	0.007104	0.008847	0.012363	0.019160	0.032135	0.049442	0.062496

lowest : 0.002252 0.003710 0.003746 0.004660 0.004693, highest: 0.086680 0.093680 0.095860 0.098060 0.135400

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concavity\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	376	1	0.03187	0.02732	0.003162	0.007074	0.014300	0.024150	0.042158	0.059243	0.079261

lowest : 0.0000000 0.0007929 0.0009737 0.0011280 0.0014870, highest: 0.1278000 0.1435000 0.1535000  
0.3038000 0.3960000

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concave.points\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	367	1	0.01166	0.006505	0.003616	0.005283	0.007439	0.010915	0.014905	0.018649	0.022367

lowest : 0.000000 0.001852 0.002386 0.002924 0.002941, highest: 0.028530 0.029190 0.033220 0.034870 0.052790

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symmetry\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	363	1	0.02058	0.008425	0.01168	0.01282	0.01499	0.01870	0.02367	0.03088	0.03510

lowest : 0.007882 0.010130 0.010540 0.010550 0.010620, highest: 0.051680 0.055430 0.056280 0.059630 0.078950

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fractal\_dimension\_se

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	386	1	0.003715	0.002308	0.001464	0.001687	0.002178	0.003041	0.004545	0.006149	0.007753

lowest : 0.0008948 0.0009502 0.0009683 0.0010020 0.0010580, highest: 0.0122000 0.0123300 0.0129800  
0.0219300 0.0298400

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radius\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	336	1	16.29	5.299	10.51	11.25	13.02	14.91	18.54	23.71	26.05

lowest : 7.930 8.678 8.964 9.262 9.414, highest: 30.790 31.010 32.490 33.120 36.040

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texture\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	367	1	25.68	6.821	16.40	17.90	21.16	25.58	29.45	33.47	36.04

lowest : 12.02 12.49 12.87 14.20 14.82, highest: 41.61 41.78 41.85 42.79 47.16

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perimeter\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	377	1	107.3	36.88	67.87	72.16	83.92	96.72	124.70	157.96	178.67

lowest : 50.41 54.49 57.26 58.36 59.16, highest: 211.50 211.70 214.00 220.80 251.20

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area\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	382	1	887.6	585.4	330.2	385.1	516.0	679.0	1045.5	1690.4	2074.2

lowest : 185.2 223.6 242.2 259.2 268.6, highest: 2944.0 3143.0 3216.0 3432.0 4254.0

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smoothness\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	321	1	0.1318	0.02633	0.09444	0.10294	0.11447	0.13020	0.14580	0.16157	0.17133

lowest : 0.07117 0.08125 0.08409 0.08567 0.08774, highest: 0.19090 0.20060 0.20980 0.21840 0.22260

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compactness\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	384	1	0.254	0.1743	0.06871	0.08805	0.13670	0.20925	0.34358	0.44674	0.58107

lowest : 0.02729 0.03432 0.04327 0.04619 0.04712, highest: 0.86630 0.86810 0.93270 0.93790 1.05800

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concavity\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	380	1	0.2735	0.2358	0.01630	0.04316	0.10512	0.22255	0.37955	0.58725	0.68795

lowest : 0.000000 0.003581 0.004955 0.005518 0.005579, highest: 0.938700 0.960800 1.105000 1.170000 1.252000

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concave.points\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	354	1	0.1145	0.07649	0.02359	0.03600	0.06301	0.09776	0.16085	0.21123	0.23973

lowest : 0.000000 0.008772 0.009259 0.011110 0.016350, highest: 0.268800 0.273300 0.286700 0.290300 0.291000

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symmetry\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	363	1	0.289	0.06576	0.2102	0.2237	0.2491	0.2809	0.3167	0.3622	0.4087

lowest : 0.1565 0.1566 0.1648 0.1652 0.1712, highest: 0.4882 0.5166 0.5440 0.5774 0.6638

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fractal\_dimension\_worst

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
398	0	381	1	0.08369	0.01945	0.06165	0.06554	0.07083	0.07909	0.09218	0.10682	0.12036

lowest : 0.05504 0.05521 0.05525 0.05695 0.05737, highest: 0.14090 0.14310 0.14460 0.17300 0.20750

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diagnosis

n	missing	distinct
398	0	2

Value      B      M

Frequency    252 146

Proportion 0.633 0.367

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Rattle timestamp: 2018-11-01 14:15:28 tsraj

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Basic statistics for each numeric variable of the dataset.

\$radius\_mean

X...X.i

nobs      398.000000

NAs      0.000000

Minimum    6.981000

Maximum    28.110000

1. Quartile 11.692500

3. Quartile 15.725000

Mean      14.118786

Median    13.355000

Sum 5619.277000

SE Mean   0.180193

LCL Mean 13.764534

UCL Mean 14.473039

Variance 12.922932

Stdev 3.594848

Skewness 1.041847

Kurtosis 1.106739

\$texture\_mean

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 9.710000

Maximum 33.810000

1. Quartile 16.360000

3. Quartile 21.857500

Mean 19.295879

Median 18.900000

Sum 7679.760000

SE Mean 0.210969

LCL Mean 18.881123

UCL Mean 19.710636

Variance 17.714221

Stdev 4.208827

Skewness 0.478610

Kurtosis 0.147978

\$perimeter\_mean

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 43.790000

Maximum 188.500000

1. Quartile 75.180000

3. Quartile 103.275000

Mean 91.888040  
Median 86.210000  
Sum 36571.440000  
SE Mean 1.244577  
LCL Mean 89.441255  
UCL Mean 94.334825  
Variance 616.490573  
Stdev 24.829228  
Skewness 1.098810  
Kurtosis 1.244244

#### \$area\_mean

X...X.i

nobs 398.000000  
NAs 0.000000  
Minimum 143.500000  
Maximum 2501.000000  
1. Quartile 419.925000  
3. Quartile 765.375000  
Mean 656.387940  
Median 546.350000 Sum  
261242.400000  
SE Mean 18.291232  
LCL Mean 620.428157  
UCL Mean 692.347723  
Variance 133158.524539  
Stdev 364.908926  
Skewness 1.777673  
Kurtosis 4.114227

#### \$smoothness\_mean

X...X.i

nobs 398.000000  
NAs 0.000000

Minimum 0.052630

Maximum 0.163400

1. Quartile 0.084960

3. Quartile 0.105050

Mean 0.095813

Median 0.094320

Sum38.133550

SE Mean 0.000735

LCL Mean 0.094369

UCL Mean 0.097257

Variance 0.000215

Stdev 0.014655

Skewness 0.596362

Kurtosis 1.055572

\$compactness\_mean

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.019380

Maximum 0.345400

1. Quartile 0.061735

3. Quartile 0.129575

Mean 0.103231

Median 0.088445

Sum41.085810

SE Mean 0.002764

LCL Mean 0.097796

UCL Mean 0.108665

Variance 0.003041

Stdev 0.055148

Skewness 1.206165

Kurtosis 1.428124

\$concavity\_mean

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.000000

Maximum 0.426800

1. Quartile 0.026935

3. Quartile 0.125825

Mean 0.088745

Median 0.059345

Sum35.320564

SE Mean 0.004188

LCL Mean 0.080511

UCL Mean 0.096979

Variance 0.006982

Stdev 0.083560

Skewness 1.465848

Kurtosis 2.047248

\$concave.points\_mean

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.000000

Maximum 0.201200

1. Quartile 0.019765

3. Quartile 0.073910

Mean 0.048604

Median 0.032635

Sum19.344262

SE Mean 0.001996

LCL Mean 0.044679

UCL Mean 0.052528

Variance 0.001586

Stddev 0.039822

Skewness 1.221588

Kurtosis 1.133587

#### \$symmetry\_mean

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.106000

Maximum 0.290600

1. Quartile 0.161325

3. Quartile 0.194575

Mean 0.180132

Median 0.178400

Sum71.692500

SE Mean 0.001348

LCL Mean 0.177482

UCL Mean 0.182782

Variance 0.000723

Stddev 0.026893

Skewness 0.688449

Kurtosis 1.026978

#### \$fractal\_dimension\_mean

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.049960

Maximum 0.097440

1. Quartile 0.057510

3. Quartile 0.065865

Mean 0.062639

Median 0.061285

Sum24.930370

SE Mean 0.000365  
LCL Mean 0.061921  
UCL Mean 0.063357  
Variance 0.000053  
Stdev 0.007289  
Skewness 1.493695  
Kurtosis 3.714497

\$radius\_se

X...X.i

nobs 398.000000  
NAs 0.000000  
Minimum 0.111500  
Maximum 2.873000  
1. Quartile 0.231575  
3. Quartile 0.474900  
Mean 0.411373  
Median 0.315600  
Sum 163.726500  
SE Mean 0.015048  
LCL Mean 0.381789  
UCL Mean 0.440957  
Variance 0.090125  
Stdev 0.300209  
Skewness 3.223227  
Kurtosis 17.518825

\$texture\_se

X...X.i

nobs 398.000000  
NAs 0.000000  
Minimum 0.360200  
Maximum 4.885000  
1. Quartile 0.842450

3. Quartile 1.477500

Mean 1.221151

Median 1.127000

Sum 486.018200

SE Mean 0.028185

LCL Mean 1.165741

UCL Mean 1.276561

Variance 0.316163

Stdev 0.562283

Skewness 1.776213

Kurtosis 6.219300

\$perimeter\_se

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.757000

Maximum 21.980000

1. Quartile 1.580750

3. Quartile 3.318250

Mean 2.898559

Median 2.257500 Sum

1153.626500

SE Mean 0.108483

LCL Mean 2.685287

UCL Mean 3.111831

Variance 4.683851

Stdev 2.164221

Skewness 3.597354

Kurtosis 21.849325

\$area\_se

X...X.i

nobs 398.000000

NAs 0.000000  
Minimum 7.228000  
Maximum 542.200000  
1. Quartile 18.025000  
3. Quartile 44.867500  
Mean 41.628078  
Median 24.065000  
Sum 16567.975000  
SE Mean 2.550935  
LCL Mean 36.613048  
UCL Mean 46.643108  
Variance 2589.893720  
Stdev 50.890998  
Skewness 5.353892  
Kurtosis 43.330859

#### \$smoothness\_se

X...X.i  
nobs 398.000000  
NAs 0.000000  
Minimum 0.001713  
Maximum 0.023330  
1. Quartile 0.005114  
3. Quartile 0.008247  
Mean 0.007006  
Median 0.006423  
Sum 2.788342  
SE Mean 0.000144  
LCL Mean 0.006723  
UCL Mean 0.007289  
Variance 0.000008  
Stdev 0.002871  
Skewness 1.713169  
Kurtosis 4.972610

\$compactness\_se

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.002252

Maximum 0.135400

1. Quartile 0.012362

3. Quartile 0.032135

Mean 0.025212

Median 0.019160

Sum10.034376

SE Mean 0.000920

LCL Mean 0.023404

UCL Mean 0.027020

Variance 0.000337

Stdev 0.018351

Skewness 1.824908

Kurtosis 4.657136

\$concavity\_se

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.000000

Maximum 0.396000

1. Quartile 0.014300

3. Quartile 0.042158

Mean 0.031870

Median 0.024150

Sum12.684342

SE Mean 0.001644

LCL Mean 0.028638

UCL Mean 0.035103

Variance 0.001076

Stdev 0.032803

Skewness 5.411525

Kurtosis 48.778602

\$concave.points\_se

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.000000

Maximum 0.052790

1. Quartile 0.007439

3. Quartile 0.014905

Mean 0.011665

Median 0.010915

Sum 4.642524

SE Mean 0.000306

LCL Mean 0.011063

UCL Mean 0.012266

Variance 0.000037

Stdev 0.006101

Skewness 1.345115

Kurtosis 5.291703

\$symmetry\_se

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.007882

Maximum 0.078950

1. Quartile 0.014992

3. Quartile 0.023670

Mean 0.020583

Median 0.018700

Sum 8.192132  
SE Mean 0.000426  
LCL Mean 0.019746  
UCL Mean 0.021421  
Variance 0.000072  
Stdev 0.008497  
Skewness 2.215117  
Kurtosis 8.092737

#### \$fractal\_dimension\_se

X...X.i

nobs 398.000000  
NAs 0.000000  
Minimum 0.000895  
Maximum 0.029840  
1. Quartile 0.002178  
3. Quartile 0.004545  
Mean 0.003715  
Median 0.003041  
Sum 1.478483  
SE Mean 0.000131  
LCL Mean 0.003458  
UCL Mean 0.003971  
Variance 0.000007  
Stdev 0.002604  
Skewness 4.165446  
Kurtosis 30.963162

#### \$radius\_worst

X...X.i

nobs 398.000000  
NAs 0.000000  
Minimum 7.930000  
Maximum 36.040000

1. Quartile 13.015000

3. Quartile 18.540000

Mean 16.290515

Median 14.905000

Sum 6483.625000

SE Mean 0.248516

LCL Mean 15.801944

UCL Mean 16.779086

Variance 24.580498

Stdev 4.957872

Skewness 1.172147

Kurtosis 1.061266

#### \$texture\_worst

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 12.020000

Maximum 47.160000

1. Quartile 21.157500

3. Quartile 29.452500

Mean 25.682513

Median 25.580000

Sum 10221.640000

SE Mean 0.302136

LCL Mean 25.088526

UCL Mean 26.276499

Variance 36.331887

Stdev 6.027594

Skewness 0.363188

Kurtosis -0.093897

#### \$perimeter\_worst

X...X.i

nobs 398.000000  
NAs 0.000000  
Minimum 50.410000  
Maximum 251.200000  
1. Quartile 83.922500  
3. Quartile 124.700000  
Mean 107.348291  
Median 96.715000  
Sum 42724.620000  
SE Mean 1.732094  
LCL Mean 103.943069  
UCL Mean 110.753514  
Variance 1194.059133  
Stdev 34.555161  
Skewness 1.203223  
Kurtosis 1.182513

#### \$area\_worst

X...X.i

nobs 398.000000  
NAs 0.000000  
Minimum 185.200000  
Maximum 4254.000000  
1. Quartile 516.050000  
3. Quartile 1045.500000  
Mean 887.579146  
Median 678.950000 Sum  
353256.500000  
SE Mean 29.798152  
LCL Mean 828.997247  
UCL Mean 946.161044  
Variance 353396.091075  
Stdev 594.471270  
Skewness 1.932651

Kurtosis 4.551019

\$smoothness\_worst

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.071170

Maximum 0.222600

1. Quartile 0.114475

3. Quartile 0.145800

Mean 0.131771

Median 0.130200

Sum 52.445050

SE Mean 0.001184

LCL Mean 0.129444

UCL Mean 0.134099

Variance 0.000558

Stdev 0.023624

Skewness 0.507653

Kurtosis 0.650222

\$compactness\_worst

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.027290

Maximum 1.058000

1. Quartile 0.136700

3. Quartile 0.343575

Mean 0.254028

Median 0.209250

Sum 101.103110

SE Mean 0.008358

LCL Mean 0.237597

UCL Mean 0.270459

Variance 0.027802

Stdev 0.166739

Skewness 1.530263

Kurtosis 3.078009

\$concavity\_worst

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.000000

Maximum 1.252000

1. Quartile 0.105125

3. Quartile 0.379550

Mean 0.273545

Median 0.222550

Sum 108.870790

SE Mean 0.010969

LCL Mean 0.251979

UCL Mean 0.295110

Variance 0.047891

Stdev 0.218841

Skewness 1.211683

Kurtosis 1.701479

\$concave.points\_worst

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.000000

Maximum 0.291000

1. Quartile 0.063010

3. Quartile 0.160850

Mean 0.114463

Median 0.097765

Sum 45.556271

SE Mean 0.003384

LCL Mean 0.107811

UCL Mean 0.121115

Variance 0.004556

Stdev 0.067501

Skewness 0.494460

Kurtosis -0.610604

#### \$symmetry\_worst

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.156500

Maximum 0.663800

1. Quartile 0.249100

3. Quartile 0.316675

Mean 0.288996

Median 0.280850

Sum 115.020400

SE Mean 0.003162

LCL Mean 0.282780

UCL Mean 0.295212

Variance 0.003979

Stdev 0.063078

Skewness 1.479430

Kurtosis 4.785210

#### \$fractal\_dimension\_worst

X...X.i

nobs 398.000000

NAs 0.000000

Minimum 0.055040

Maximum 0.207500

1. Quartile 0.070830

3. Quartile 0.092180

Mean 0.083692

Median 0.079090

Sum 33.309470

SE Mean 0.000944

LCL Mean 0.081836

UCL Mean 0.085548

Variance 0.000355

Stdev 0.018837

Skewness 1.783988

Kurtosis 5.839617

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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.

radius_mean	texture_mean	perimeter_mean	area_mean
1.1067391	0.1479779	1.2442441	4.1142267
smoothness_mean	compactness_mean	concavity_mean	concave.points_mean
1.0555719	1.4281244	2.0472480	1.1335867
symmetry_mean	fractal_dimension_mean	radius_se	texture_se
1.0269776	3.7144970	17.5188254	6.2192997
perimeter_se	area_se	smoothness_se	compactness_se
21.8493253	43.3308592	4.9726102	4.6571356
concavity_se	concave.points_se	symmetry_se	fractal_dimension_se
48.7786015	5.2917032	8.0927374	30.9631618
radius_worst	texture_worst	perimeter_worst	area_worst
1.0612662	-0.0938968	1.1825133	4.5510192

```
smoothness_worst    compactness_worst      concavity_worst  concave.points_worst  
0.6502218 3.0780089 1.7014786 -0.6106038 symmetry_worst  
fractal_dimension_worst  
4.7852100      5.8396169
```

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Skewness for each numeric variable of the dataset.

Positive means the right tail is longer.

radius_mean	texture_mean	perimeter_mean	area_mean
1.0418472	0.4786104	1.0988098	1.7776732
smoothness_mean	compactness_mean	concavity_mean	concave.points_mean
0.5963615	1.2061645	1.4658483	1.2215884
symmetry_mean	fractal_dimension_mean	radius_se	texture_se
0.6884491	1.4936946	3.2232268	1.7762127
perimeter_se	area_se	smoothness_se	compactness_se
3.5973539	5.3538916	1.7131694	1.8249084
concavity_se	concave.points_se	symmetry_se	fractal_dimension_se
5.4115255	1.3451151	2.2151175	4.1654462
radius_worst	texture_worst	perimeter_worst	area_worst
1.1721472	0.3631878	1.2032233	1.9326515
smoothness_worst	compactness_worst	concavity_worst	concave.points_worst
0.5076533	1.5302633	1.2116833	0.4944602
symmetry_worst	fractal_dimension_worst		
1.4794301	1.7839884		

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Missing Value Summary

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

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radius\_mean texture\_mean perimeter\_mean area\_mean smoothness\_mean compactness\_mean  
569 1 1 1 1 1 1  
0 0 0 0 0 0  
concavity\_mean concave.points\_mean symmetry\_mean fractal\_dimension\_mean radius\_se texture\_se  
569 1 1 1 1 1 1 1  
0 0 0 0 0 0 0  
perimeter\_se area\_se smoothness\_se compactness\_se concavity\_se concave.points\_se symmetry\_se  
569 1 1 1 1 1 1 1  
0 0 0 0 0 0 0  
fractal\_dimension\_se radius\_worst texture\_worst perimeter\_worst area\_worst smoothness\_worst  
569 1 1 1 1 1 1 1  
0 0 0 0 0 0 0  
compactness\_worst concavity\_worst concave.points\_worst symmetry\_worst fractal\_dimension\_worst  
569 1 1 1 1 1  
0 0 0 0 0  
diagnosis  
569 1 0  
0 0

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orrelation summary using the 'Pearson' covariance.

Note that only correlations between numeric variables are reported.

	fractal_dimension_mean	smoothness_se	texture_se	symmetry_se
fractal_dimension_mean	1.000000000	0.43612446	0.120852587	0.33376323
smoothness_se	0.436124462	1.00000000	0.382812381	0.41330943
texture_se	0.120852587	0.38281238	1.000000000	0.39336019
symmetry_se	0.333763232	0.41330943	0.393360188	1.00000000

fractal_dimension_se	0.716382838	0.41887447	0.221335351	0.29566605
fractal_dimension_worst	0.769490624	0.10586898	-0.087263091	0.06047760
smoothness_worst	0.537624924	0.35312595	-0.084557686	0.01329026
symmetry_worst	0.352706880	-0.09878602	-0.138328477	0.41319724
symmetry_mean	0.485563007	0.22989474	0.118112073	0.46629324
concavity_se	0.481611527	0.25865299	0.152531127	0.30392948
smoothness_mean	0.605284766	0.38633869	0.073021817	0.23555009
compactness_se	0.602561377	0.35487603	0.177307772	0.35908562
texture_worst	-0.049624135	-0.10362569	0.390277233	-0.06599484
texture_mean	-0.074723745	-0.01615385	0.383031292	0.02255500
concave.points_se	0.388027367	0.32631159	0.150432438	0.29809097
compactness_worst	0.498035075	-0.02918206	-0.115409712	0.06440122
compactness_mean	0.599207106	0.17551523	0.005919014	0.24316711
concavity_worst	0.393495634	-0.03932172	-0.087717868	0.05692927
concavity_mean	0.384566345	0.12613541	0.058986271	0.21401785
radius_se	-0.007467023	0.17956456	0.190140880	0.22785103
perimeter_se	0.025929241	0.16771511	0.180818391	0.23656776
concave.points_worst	0.217642488	-0.08812530	-0.153068372	-0.01875548
area_se	-0.085393608	0.09548615	0.091778594	0.13175134
concave.points_mean	0.210065988	0.06215367	0.008823168	0.12645282
area_worst	-0.203471329	-0.17782375	-0.092216337	-0.10520944
perimeter_worst	-0.177720359	-0.21847053	-0.120663879	-0.10187748
radius_worst	-0.226073305	-0.23320419	-0.125956719	-0.12177103
area_mean	-0.255101426	-0.16070979	-0.076651286	-0.05868565
perimeter_mean	-0.234443400	-0.20227490	-0.103016429	-0.06861081
radius_mean	-0.285749859	-0.22564803	-0.111831026	-0.09193073
fractal_dimension_se fractal_dimension_worst smoothness_worst				
fractal_dimension_mean	0.7163828379	0.76949062	0.53762492	
smoothness_se	0.4188744696	0.10586898	0.35312595	
texture_se	0.2213353507	-0.08726309	-0.08455769	
symmetry_se	0.2956660489	0.06047760	0.01329026	
fractal_dimension_se	1.0000000000	0.63173005	0.22684260	
fractal_dimension_worst	0.6317300456	1.00000000	0.62267430	
smoothness_worst	0.2268425979	0.62267430	1.00000000	

	symmetry_worst	0.1422880802	0.53327988	0.48858539	
symmetry_mean	0.3705158052	0.43303316	0.43152843		
concavity_se	0.7461881883	0.45454244	0.19782785		
smoothness_mean	0.3347094321	0.52075814	0.82023482		
compactness_se	0.7943913795	0.63983628	0.29794675		
texture_worst	-0.0001537862	0.22067159	0.21773049		
texture_mean	0.0468335845	0.11747503	0.06792960		
concave.points_se	0.6306179255	0.35979108	0.26479215		
compactness_worst	0.4427199096	0.83420749	0.58016572		
compactness_mean	0.5460847943	0.71896603	0.59419222		
concavity_worst	0.4480664534	0.70770292	0.52444019		
concavity_mean	0.5109294614	0.53571811	0.45743688		
radius_se	0.2164825184	0.04803061	0.15285447		
perimeter_se	0.2256327242	0.08006531	0.14960015		
concave.points_worst	0.2730844354	0.54555741	0.56125161		
area_se	0.1259924543	0.01948520	0.13255270		
concave.points_mean	0.3099729508	0.39995808	0.46692163		
area_worst	0.0038989121	0.09891603	0.21233635		
perimeter_worst	0.0225876377	0.16098516	0.24350199		
radius_worst	-0.0143552510	0.11673458	0.22144951		
area_mean	-0.0014307009	0.02222391	0.12654494		
perimeter_mean	0.0109573505	0.07446124	0.15556171		
radius_mean	-0.0279876440	0.02976188	0.12262012		
	symmetry_worst	symmetry_mean	concavity_se	smoothness_mean	compactness_se
fractal_dimension_mean	0.35270688	0.48556301	0.48161153	0.605284766	0.6025614
smoothness_se	-0.09878602	0.22989474	0.25865299	0.386338693	0.3548760
texture_se	-0.13832848	0.11811207	0.15253113	0.073021817	0.1773078
symmetry_se	0.41319724	0.46629324	0.30392948	0.235550091	0.3590856
fractal_dimension_se	0.14228808	0.37051581	0.74618819	0.334709432	0.7943914
fractal_dimension_worst	0.53327988	0.43303316	0.45454244	0.520758140	0.6398363
smoothness_worst	0.48858539	0.43152843	0.19782785	0.820234825	0.2979467
symmetry_worst	1.00000000	0.70304318	0.22654126	0.401407657	0.3259791
symmetry_mean	0.70304318	1.00000000	0.39719821	0.560413278	0.4905492
concavity_se	0.22654126	0.39719821	1.00000000	0.273866901	0.7806716

smoothness_mean	0.40140766	0.56041328	0.27386690	1.0000000000	0.3771792
compactness_se	0.32597906	0.49054923	0.78067158	0.377179159	1.0000000
texture_worst	0.24860624	0.10386737	0.07738186	0.050532786	0.1464986
texture_mean	0.11404178	0.08627767	0.11564575	-0.005033315	0.1832011
concave.points_se	0.17559643	0.44198517	0.77855608	0.415003042	0.7350280
compactness_worst	0.61211045	0.49104533	0.47885734	0.494471723	0.7207137
compactness_mean	0.52684682	0.61778726	0.56508366	0.678409492	0.7714533
concavity_worst	0.52735622	0.45949862	0.67843201	0.458283619	0.6885796
concavity_mean	0.40731151	0.52734799	0.70567534	0.545032360	0.7113222
radius_se	0.06649558	0.27803622	0.32020613	0.318859395	0.3360836
perimeter_se	0.07495364	0.28189726	0.33579084	0.320018855	0.3861979
concave.points_worst	0.49721674	0.44455644	0.44583168	0.516718277	0.5211210
area_se	0.04830560	0.21292461	0.25509985	0.264001478	0.2725681
concave.points_mean	0.37025386	0.48036426	0.44305431	0.574290577	0.5294739
area_worst	0.19295179	0.19055623	0.17885921	0.222390254	0.2085872
perimeter_worst	0.25754399	0.22821052	0.20857273	0.253123556	0.2658989
radius_worst	0.23426148	0.19624560	0.17180577	0.225993788	0.2097769
area_mean	0.13483956	0.16935108	0.18960448	0.192046067	0.2159668
perimeter_mean	0.18689691	0.20012342	0.20463348	0.219779728	0.2521267
radius_mean	0.16147077	0.16418755	0.17028987	0.181111675	0.2047959
texture_worst texture_mean concave.points_se compactness_worst					
fractal_dimension_mean	-0.0496241353	-0.074723745	0.38802737	0.49803508	
smoothness_se	-0.1036256913	-0.016153850	0.32631159	-0.02918206	
texture_se	0.3902772333	0.383031292	0.15043244	-0.11540971	
symmetry_se	-0.0659948363	0.022555000	0.29809097	0.06440122	
fractal_dimension_se	-0.0001537862	0.046833584	0.63061793	0.44271991	
fractal_dimension_worst	0.2206715864	0.117475031	0.35979108	0.83420749	
smoothness_worst	0.2177304941	0.067929601	0.26479215	0.58016572	
symmetry_worst	0.2486062373	0.114041778	0.17559643	0.61211045	
symmetry_mean	0.1038673717	0.086277671	0.44198517	0.49104533	
concavity_se	0.0773818608	0.115645746	0.77855608	0.47885734	
smoothness_mean	0.0505327856	-0.005033315	0.41500304	0.49447172	
compactness_se	0.1464986134	0.183201144	0.73502795	0.72071366	
texture_worst	1.0000000000	0.909079320	0.06296549	0.35742027	

texture_mean	0.9090793202	1.0000000000	0.14183743	0.26665478	
concave.points_se	0.0629654927	0.141837432	1.00000000	0.47104732	
compactness_worst	0.3574202669	0.266654785	0.47104732	1.00000000	
compactness_mean	0.2501280401	0.234388579	0.64094515	0.87516821	
concavity_worst	0.3677108805	0.300683005	0.59521060	0.88876476	
concavity_mean	0.2848349436	0.293086525	0.71222854	0.74748161	
radius_se	0.1970527575	0.285185949	0.49279562	0.26483293	
perimeter_se	0.2060648369	0.296595381	0.51587595	0.31910629	
concave.points_worst	0.3611725527	0.297197451	0.61892706	0.79869138	
area_se	0.1898802053	0.260034428	0.39468455	0.25864738	
concave.points_mean	0.2922086927	0.299625165	0.62786430	0.66515310	
area_worst	0.3476136471	0.342291878	0.34234382	0.41534132	
perimeter_worst	0.3711606547	0.360306122	0.38350662	0.50947316	
radius_worst	0.3647675781	0.352121728	0.34875349	0.45555088	
area_mean	0.2848923357	0.320022426	0.35927998	0.37019008	
perimeter_mean	0.3048038753	0.330635257	0.38718343	0.43934037	
radius_mean	0.2980554611	0.323826834	0.35524560	0.39570641	
	compactness_mean	concavity_worst	concavity_mean	radius_se	perimeter_se
fractal_dimension_mean	0.599207106	0.39349563	0.38456635	-0.007467023	0.02592924
smoothness_se	0.175515230	-0.03932172	0.12613541	0.179564555	0.16771511
texture_se	0.005919014	-0.08771787	0.05898627	0.190140880	0.18081839
symmetry_se	0.243167111	0.05692927	0.21401785	0.227851028	0.23656776
fractal_dimension_se	0.546084794	0.44806645	0.51092946	0.216482518	0.22563272
fractal_dimension_worst	0.718966027	0.70770292	0.53571811	0.048030610	0.08006531
smoothness_worst	0.594192217	0.52444019	0.45743688	0.152854473	0.14960015
symmetry_worst	0.526846825	0.52735622	0.40731151	0.066495579	0.07495364
symmetry_mean	0.617787256	0.45949862	0.52734799	0.278036220	0.28189726
concavity_se	0.565083664	0.67843201	0.70567534	0.320206129	0.33579084
smoothness_mean	0.678409492	0.45828362	0.54503236	0.318859395	0.32001885
compactness_se	0.771453261	0.68857961	0.71132221	0.336083625	0.38619794
texture_worst	0.250128040	0.36771088	0.28483494	0.197052758	0.20606484
texture_mean	0.234388579	0.30068301	0.29308652	0.285185949	0.29659538
concave.points_se	0.640945149	0.59521060	0.71222854	0.492795621	0.51587595
compactness_worst	0.875168207	0.88876476	0.74748161	0.264832931	0.31910629

compactness_mean	1.000000000	0.82959776	0.88558312	0.473736092	0.52439353
concavity_worst	0.829597760	1.00000000	0.88493652	0.378588412	0.41668565
concavity_mean	0.885583116	0.88493652	1.00000000	0.634796917	0.66641378
radius_se	0.473736092	0.37858841	0.63479692	1.000000000	0.97899133
perimeter_se	0.524393527	0.41668565	0.66641378	0.978991334	1.00000000
concave.points_worst	0.820908407	0.86124255	0.85801649	0.520772548	0.54833268
area_se	0.435158968	0.37244795	0.61097455	0.954849504	0.94934934
concave.points_mean	0.836175812	0.75471579	0.91960482	0.702972658	0.72269782
area_worst	0.504682409	0.52808421	0.66363304	0.765154748	0.75426375
perimeter_worst	0.583254532	0.60450978	0.71558195	0.725868831	0.73403105
radius_worst	0.528554797	0.56035876	0.67393194	0.723504168	0.71413161
area_mean	0.492599453	0.49579140	0.67380665	0.753863243	0.75627153
perimeter_mean	0.549388318	0.55019236	0.70272312	0.705502269	0.71344428
radius_mean	0.497888043	0.51181490	0.66206268	0.694092923	0.69611321
	concave.points_worst	area_se	concave.points_mean	area_worst	
fractal_dimension_mean	0.21764249	-0.08539361	0.210065988	-0.203471329	
smoothness_se	-0.08812530	0.09548615	0.062153675	-0.177823753	
texture_se	-0.15306837	0.09177859	0.008823168	-0.092216337	
symmetry_se	-0.01875548	0.13175134	0.126452822	-0.105209437	
fractal_dimension_se	0.27308444	0.12599245	0.309972951	0.003898912	
fractal_dimension_worst	0.54555741	0.01948520	0.399958077	0.098916031	
smoothness_worst	0.56125161	0.13255270	0.466921632	0.212336355	
symmetry_worst	0.49721674	0.04830560	0.370253862	0.192951792	
symmetry_mean	0.44455644	0.21292461	0.480364260	0.190556232	
concavity_se	0.44583168	0.25509985	0.443054306	0.178859213	
smoothness_mean	0.51671828	0.26400148	0.574290577	0.222390254	
compactness_se	0.52112096	0.27256813	0.529473913	0.208587247	
texture_worst	0.36117255	0.18988021	0.292208693	0.347613647	
texture_mean	0.29719745	0.26003443	0.299625165	0.342291878	
concave.points_se	0.61892706	0.39468455	0.627864297	0.342343824	
compactness_worst	0.79869138	0.25864738	0.665153100	0.415341324	
compactness_mean	0.82090841	0.43515897	0.836175812	0.504682409	
concavity_worst	0.86124255	0.37244795	0.754715788	0.528084208	
concavity_mean	0.85801649	0.61097455	0.919604820	0.663633040	

radius_se	0.52077255	0.95484950	0.702972658	0.765154748	
perimeter_se	0.54833268	0.94934934	0.722697820	0.754263747	
concave.points_worst	1.00000000	0.52168842	0.905998889	0.741307514	
area_se	0.52168842	1.00000000	0.686508334	0.812994665	
concave.points_mean	0.90599889	0.68650833	1.00000000	0.804401025	
area_worst	0.74130751	0.81299466	0.804401025	1.000000000	
perimeter_worst	0.81232113	0.75719745	0.850952011	0.977288954	
radius_worst	0.78274208	0.75428022	0.824324045	0.983358653	
area_mean	0.71445554	0.80925972	0.818247636	0.956636477	
perimeter_mean	0.76666294	0.74790252	0.846512598	0.939755713	
radius_mean	0.73880162	0.73938743	0.816735079	0.939020893	
	perimeter_worst	radius_worst	area_mean	perimeter_mean	radius_mean
fractal_dimension_mean	-0.17772036	-0.22607331	-0.255101426	-0.23444340	-0.28574986
smoothness_se	-0.21847053	-0.23320419	-0.160709787	-0.20227490	-0.22564803
texture_se	-0.12066388	-0.12595672	-0.076651286	-0.10301643	-0.11183103
symmetry_se	-0.10187748	-0.12177103	-0.058685646	-0.06861081	-0.09193073
fractal_dimension_se	0.02258764	-0.01435525	-0.001430701	0.01095735	-0.02798764
fractal_dimension_worst	0.16098516	0.11673458	0.022223907	0.07446124	0.02976188
smoothness_worst	0.24350199	0.22144951	0.126544942	0.15556171	0.12262012
symmetry_worst	0.25754399	0.23426148	0.134839564	0.18689691	0.16147077
symmetry_mean	0.22821052	0.19624560	0.169351077	0.20012342	0.16418755
concavity_se	0.20857273	0.17180577	0.189604478	0.20463348	0.17028987
smoothness_mean	0.25312356	0.22599379	0.192046067	0.21977973	0.18111168
compactness_se	0.26589895	0.20977688	0.215966769	0.25212665	0.20479593
texture_worst	0.37116065	0.36476758	0.284892336	0.30480388	0.29805546
texture_mean	0.36030612	0.35212173	0.320022426	0.33063526	0.32382683
concave.points_se	0.38350662	0.34875349	0.359279978	0.38718343	0.35524560
compactness_worst	0.50947316	0.45555088	0.370190083	0.43934037	0.39570641
compactness_mean	0.58325453	0.52855480	0.492599453	0.54938832	0.49788804
concavity_worst	0.60450978	0.56035876	0.495791400	0.55019236	0.51181490
concavity_mean	0.71558195	0.67393194	0.673806655	0.70272312	0.66206268
radius_se	0.72586883	0.72350417	0.753863243	0.70550227	0.69409292
perimeter_se	0.73403105	0.71413161	0.756271534	0.71344428	0.69611321
concave.points_worst	0.81232113	0.78274208	0.714455539	0.76666294	0.73880162

area_se	0.75719745	0.75428022	0.809259725	0.74790252	0.73938743
concave.points_mean	0.85095201	0.82432404	0.818247636	0.84651260	0.81673508
area_worst	0.97728895	0.98335865	0.956636477	0.93975571	0.93902089
perimeter_worst	1.00000000	0.99363899	0.955826400	0.96867680	0.96330305
radius_worst	0.99363899	1.00000000	0.959434591	0.96792697	0.96797562
area_mean	0.95582640	0.95943459	1.000000000	0.98585967	0.98643614
perimeter_mean	0.96867680	0.96792697	0.985859668	1.00000000	0.99780552
radius_mean	0.96330305	0.96797562	0.986436139	0.99780552	1.00000000

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---

ote 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.

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Standard deviations (1, .., p=30):

```
[1] 3.65780455 2.41578714 1.63820769 1.40902230 1.27711782 1.11086209 0.79905620 0.66896147
[9] 0.64107847 0.59919658 0.53468236 0.52136259 0.47345429 0.37065584 0.31014574 0.27060943
[17] 0.24031296 0.21937967 0.20767970 0.17870685 0.17007524 0.16315915 0.14490167 0.12457951
[25] 0.12311722 0.09014509 0.08389143 0.03755692 0.02769073 0.01146920
```

Rotation (n x k) = (30 x 30):

	PC1	PC2	PC3	PC4	PC5
radius_mean	0.214342118	0.238402121	0.0239610977	-0.04732229	0.0230903397
texture_mean	0.101436140	0.069869776	-0.0419034673	0.60336502	0.0218690631
perimeter_mean	0.223345595	0.220020120	0.0233894491	-0.04666199	0.0218575121
area_mean	0.216909810	0.235861082	-0.0245644686	-0.05825836	0.0021092174
smoothness_mean	0.151321524	-0.182732349	0.0409229639	-0.12048879	-0.3962580062

compactness_mean	0.240175258	-0.149050965	0.0727444768	-0.02536742	-0.0132632134
concavity_mean	0.258259421	-0.060618643	-0.0221904128	-0.02701827	0.0899674168
concave.points_mean	0.260680410	0.035287620	0.0085568073	-0.05688439	-0.0533739313
symmetry_mean	0.144579325	-0.185970027	0.0004814714	-0.01206818	-0.2837024634
fractal_dimension_mean	0.077760144	-0.357432492	0.0004789035	-0.04606434	-0.0430251172
radius_se	0.202719194	0.128679119	-0.2866247428	-0.06858069	-0.1105990273
texture_se	0.008139894	-0.066823552	-0.3833651921	0.40169165	-0.1085693491
perimeter_se	0.208612825	0.118232765	-0.2757498077	-0.06311662	-0.0847799490
area_se	0.197816879	0.167938234	-0.2329907659	-0.09080858	-0.0984528509
smoothness_se	0.021840742	-0.200742105	-0.3503781469	-0.03845165	-0.2257313187
compactness_se	0.177904058	-0.228678311	-0.1161069469	0.01735160	0.2643018246
concavity_se	0.153497717	-0.194572537	-0.1616662805	-0.03007771	0.3649003706
concave.points_se	0.185059825	-0.130582207	-0.1997120471	-0.09371025	0.2167502226
symmetry_se	0.045708678	-0.165871222	-0.3052702687	0.02381113	-0.2549854351
fractal_dimension_se	0.114825594	-0.270180521	-0.1799300111	-0.03119591	0.2948048003
radius_worst	0.223646863	0.223776186	0.0614696755	-0.01958612	-0.0118597931
texture_worst	0.102413810	0.053358365	0.0725391119	0.62953992	-0.0291257798
perimeter_worst	0.232285685	0.204989470	0.0635257128	-0.01706893	-0.0005215206
area_worst	0.220995902	0.223505597	0.0158407814	-0.02931134	-0.0267414154
smoothness_worst	0.134599796	-0.175550093	0.2104291263	-0.02026657	-0.3600551867
compactness_worst	0.209043143	-0.148258047	0.2458499687	0.07491908	0.0917210736
concavity_worst	0.229809929	-0.103207262	0.1725601332	0.05340529	0.1795542506
concave.points_worst	0.250280958	0.006267768	0.1786764147	-0.01652454	0.0277288946
symmetry_worst	0.123262886	-0.145331130	0.2584509515	0.07534619	-0.2723400005
fractal_dimension_worst	0.140937456	-0.265794140	0.2348652885	0.05262635	0.0855795100

PC6      PC7      PC8      PC9      PC10

radius_mean	-0.0377816625	0.114813334	-0.1382877651	0.166511532	-0.084820124
texture_mean	0.0621711301	-0.002501981	0.2301923988	0.041493914	-0.159175809
perimeter_mean	-0.0350138212	0.104762754	-0.1464895423	0.169212913	-0.075513348
area_mean	-0.0124954174	0.041464179	-0.0925408908	0.146723143	

Summary of the Decision Tree model for Classification (built using 'rpart'):

n= 398

```
node), split, n, loss, yval, (yprob)
```

```
* denotes terminal node
```

```
1) root 398 146 B (0.63316583 0.36683417)

2) perimeter_worst< 105.95 242 11 B (0.95454545 0.04545455)

4) concave.points_worst< 0.1589 234 5 B (0.97863248 0.02136752) *

5) concave.points_worst>=0.1589 8 2 M (0.25000000 0.75000000) *

3) perimeter_worst>=105.95 156 21 M (0.13461538 0.86538462)

6) concave.points_worst< 0.15075 47 21 M (0.44680851 0.55319149)

12) texture_worst< 20.645 11 0 B (1.00000000 0.00000000) *

13) texture_worst>=20.645 36 10 M (0.27777778 0.72222222)

26) radius_worst< 16.825 12 3 B (0.75000000 0.25000000) *

27) radius_worst>=16.825 24 1 M (0.04166667 0.95833333) *

7) concave.points_worst>=0.15075 109 0 M (0.00000000 1.00000000) *
```

Classification tree:

```
rpart(formula = diagnosis ~ ., data = crs$dataset[crs$train,
c(crs$input, crs$target)], method = "class", model = TRUE,
parms = list(split = "information"), control = rpart.control(usesurrogate =
0, maxsurrogate = 0))
```

Variables actually used in tree construction:

```
[1] concave.points_worst    perimeter_worst    radius_worst    texture_worst
```

Root node error: 146/398 = 0.36683

n= 398

	CP	nsplit	rel error	xerror	xstd
1	0.780822	0	1.000000	1.000000	0.065854
2	0.037671	1	0.219178	0.28767	0.041981
3	0.027397	4	0.102740	0.21918	0.037155
4	0.010000	5	0.075342	0.15753	0.031885

Time taken: 0.06 secs

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---

Summary of the Random Forest Model

---

Number of observations used to build the model: 398

Missing value imputation is active.

Call:

```
randomForest(formula = diagnosis ~ .,  
             data = crs$dataset[crs$train, c(crs$input, crs$target)],  
             ntree = 500, mtry = 5, 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: 5

OOB estimate of error rate: 3.77%

Confusion matrix:

B M class.error

B 245 7 0.02777778

M 8 138 0.05479452

Analysis of the Area Under the Curve (AUC)

---

Call:

```
roc.default(response = crs$rf$y, predictor = as.numeric(crs$rf$predicted))
```

Data: as.numeric(crs\$rf\$predicted) in 252 controls (crs\$rf\$y B) < 146 cases (crs\$rf\$y M).

Area under the curve: 0.9587

95% CI: 0.9376-0.9798 (DeLong)

Variable Importance

=====

	B	M	MeanDecreaseAccuracy	MeanDecreaseGini
area_worst	15.13	10.84	17.79	13.78
concave.points_worst	13.84	11.08	17.58	12.86
radius_worst	13.19	11.08	15.99	12.32
perimeter_worst	13.16	10.67	15.65	14.85
concave.points_mean	9.53	10.94	13.77	13.81
concavity_worst	7.32	9.27	11.99	3.33
texture_mean	8.28	9.79	11.95	2.10
texture_worst	8.63	10.24	11.74	2.30
area_se	8.40	7.98	11.33	5.83
smoothness_worst	6.42	8.05	10.23	1.57
perimeter_mean	8.58	5.62	9.60	7.04
radius_mean	8.55	5.14	9.37	4.99
area_mean	8.50	5.28	9.30	4.07
concavity_mean	5.31	6.54	9.03	3.90
perimeter_se	5.63	6.26	8.33	1.88
radius_se	5.66	4.59	7.60	1.23
smoothness_mean	4.07	6.30	7.34	0.92
compactness_mean	5.84	3.89	6.92	1.51
compactness_worst	4.29	4.11	6.37	1.44
compactness_se	4.34	2.83	5.35	0.59
concavity_se	3.20	3.77	5.33	0.76
smoothness_se	3.65	3.47	5.30	0.58
symmetry_worst	3.45	4.67	5.15	1.17
fractal_dimension_worst	4.31	2.39	5.05	1.06
texture_se	3.97	1.92	4.44	0.55
concave.points_se	3.70	2.72	4.39	0.51
symmetry_mean	0.22	3.69	3.03	0.45
fractal_dimension_mean	2.10	1.25	2.57	0.43

```
fractal_dimension_se 1.96 1.34          2.56    0.64  
symmetry_se        0.96 0.48          1.03    0.55
```

Time taken: 0.46 secs

---

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---

Summary of the Random Forest Model

```
=====
```

Number of observations used to build the model: 398

Missing value imputation is active.

Call:

```
randomForest(formula = diagnosis ~ .,  
             data = crs$dataset[crs$train, c(crs$input, crs$target)],  
             ntree = 500, mtry = 5, 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: 5

OOB estimate of error rate: 3.77%

Confusion matrix:

B M class.error

B 245 7 0.02777778

M 8 138 0.05479452

Analysis of the Area Under the Curve (AUC)

```
=====
```

Call:

```
roc.default(response = crs$rf$y, predictor = as.numeric(crs$rf$predicted))
```

Data: as.numeric(crs\$rf\$predicted) in 252 controls (crs\$rf\$y B) < 146 cases (crs\$rf\$y M).

Area under the curve: 0.9587

95% CI: 0.9376-0.9798 (DeLong)

Variable Importance

=====

	B	M	MeanDecreaseAccuracy	MeanDecreaseGini
area_worst	15.13	10.84	17.79	13.78
concave.points_worst	13.84	11.08	17.58	12.86
radius_worst	13.19	11.08	15.99	12.32
perimeter_worst	13.16	10.67	15.65	14.85
concave.points_mean	9.53	10.94	13.77	13.81
concavity_worst	7.32	9.27	11.99	3.33
texture_mean	8.28	9.79	11.95	2.10
texture_worst	8.63	10.24	11.74	2.30
area_se	8.40	7.98	11.33	5.83
smoothness_worst	6.42	8.05	10.23	1.57
perimeter_mean	8.58	5.62	9.60	7.04
radius_mean	8.55	5.14	9.37	4.99
area_mean	8.50	5.28	9.30	4.07
concavity_mean	5.31	6.54	9.03	3.90
perimeter_se	5.63	6.26	8.33	1.88
radius_se	5.66	4.59	7.60	1.23
smoothness_mean	4.07	6.30	7.34	0.92
compactness_mean	5.84	3.89	6.92	1.51
compactness_worst	4.29	4.11	6.37	1.44
compactness_se	4.34	2.83	5.35	0.59
concavity_se	3.20	3.77	5.33	0.76
smoothness_se	3.65	3.47	5.30	0.58
symmetry_worst	3.45	4.67	5.15	1.17
fractal_dimension_worst	4.31	2.39	5.05	1.06
texture_se	3.97	1.92	4.44	0.55
concave.points_se	3.70	2.72	4.39	0.51

symmetry_mean	0.22	3.69	3.03	0.45
fractal_dimension_mean	2.10	1.25	2.57	0.43
fractal_dimension_se	1.96	1.34	2.56	0.64
symmetry_se	0.96	0.48	1.03	0.55

Time taken: 0.46 secs

---

Rattle timestamp: 2018-11-01 14:58:16 tsraj

---

Summary of the Extreme Boost model:

Call:

```
ada(diagnosis ~ ., 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:

Final Prediction

True value B M

B 252 0

M 5 141

Train Error: 0.013

Out-Of-Bag Error: 0.015 iteration= 45

Additional Estimates of number of iterations:

train.err1 train.kap1

29 29

Variables actually used in tree construction:

```
[1] "area_mean"          "area_se"           "area_worst"
[4] "compactness_mean"   "compactness_se"    "compactness_worst"
[7] "concave.points_mean" "concave.points_se" "concave.points_worst"
[10] "concavity_se"       "concavity_worst"   "fractal_dimension_mean"
[13] "fractal_dimension_se" "fractal_dimension_worst" "perimeter_mean"
[16] "perimeter_se"       "perimeter_worst"   "radius_mean"
[19] "radius_se"          "radius_worst"      "smoothness_mean"
[22] "smoothness_se"      "smoothness_worst"  "symmetry_mean"
[25] "symmetry_se"        "symmetry_worst"   "texture_mean"
[28] "texture_se"          "texture_worst"
```

Frequency of variables actually used:

concave.points_worst	area_worst	texture_mean	texture_worst
19	14	14	14
concave.points_mean	perimeter_worst	area_se	smoothness_worst
13	13	10	10
concavity_worst	radius_worst	symmetry_se	smoothness_se
9	7	7	5
perimeter_mean	perimeter_se	smoothness_mean	concave.points_se
3	3	3	2
concavity_se	fractal_dimension_mean	fractal_dimension_se	symmetry_worst
2	2	2	2
area_mean	compactness_mean	compactness_se	compactness_worst
1	1	1	1
fractal_dimension_worst	radius_mean	radius_se	symmetry_mean
1	1	1	1
texture_se			
1			

Time taken: 0.98 secs

Rattle timestamp: 2018-11-01 15:03:23 tsraj

---

Summary of the Extreme Boost model:

```
##### xgb.Booster

raw: 23.7 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:

31 niter: 50

nfeatures : 31

formula :

diagnosis ~ .

<environment: 0x00000002f1abcc8>

dimnames : (Intercept) radius_mean texture_mean perimeter_mean area_mean smoothness_mean
compactness_mean concavity_mean concave.points_mean symmetry_mean fractal_dimension_mean radius_se
texture_se perimeter_se area_se smoothness_se compactness_se concavity_se concave.points_se symmetry_se
fractal_dimension_se radius_worst texture_worst perimeter_worst area_worst smoothness_worst
compactness_worst concavity_worst concave.points_worst symmetry_worst fractal_dimension_worst

evaluation_log:

iter train_error
1 0.030151
2 0.012563
---
49 0.000000
50 0.000000
```

Final iteration error rate:

```
iter train_error  
1: 50      0
```

Importance/Frequency of variables actually used:

	Feature	Gain	Cover	Frequency
1:	perimeter_worst	0.2860119772	0.0627899319	0.024875622
2:	concave.points_worst	0.2320516602	0.1667852537	0.069651741
3:	area_worst	0.2253040203	0.1535258518	0.119402985
4:	concave.points_mean	0.0837341558	0.0753190603	0.054726368
5:	texture_worst	0.0361342148	0.1025161365	0.109452736
6:	texture_mean	0.0350176633	0.0579703156	0.114427861
7:	concavity_worst	0.0266885075	0.0410815982	0.054726368
8:	radius_worst	0.0101222899	0.0449659147	0.029850746
9:	radius_mean	0.0097028514	0.0251147195	0.009950249
10:	area_se	0.0081110684	0.0544375224	0.079601990
11:	fractal_dimension_se	0.0079110708	0.0102615135	0.029850746
12:	smoothness_mean	0.0067744858	0.0102349626	0.039800995
13:	area_mean	0.0050643620	0.0172027459	0.034825871
14:	symmetry_se	0.0047192465	0.0112897273	0.029850746
15:	compactness_se	0.0041147552	0.0143072670	0.029850746
16:	symmetry_worst	0.0038544677	0.0245684697	0.024875622
17:	smoothness_worst	0.0036052689	0.0315560044	0.044776119
18:	radius_se	0.0030701463	0.0228321335	0.014925373
19:	concavity_se	0.0017202681	0.0035817455	0.014925373
20:	perimeter_mean	0.0016395510	0.0019944309	0.009950249
21:	concave.points_se	0.0014685044	0.0019886678	0.009950249
22:	compactness_mean	0.0013108865	0.0028414750	0.014925373
23:	smoothness_se	0.0007095682	0.0420139479	0.014925373
24:	fractal_dimension_mean	0.0005352605	0.0083152521	0.004975124
25:	texture_se	0.0003713217	0.0115063923	0.009950249
26:	compactness_worst	0.0002524276	0.0009989603	0.004975124

Feature Gain Cover Frequency

Time taken: 2.28 secs

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 : 31

Objective Function Value : -18.0672

Training error : 0.01005

Probability model included.

Time taken: 0.83 secs

Rattle timestamp: 2018-11-01 15:06:00 tsraj

=====

Rattle timestamp: 2018-11-01 15:04:22 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

Spline kernel function.

Number of Support Vectors : 65

Objective Function Value : -791315.5

Training error : 0.075377

Probability model included.

Time taken: 0.34 secs

Rattle timestamp: 2018-11-01 15:07:04 tsraj

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---

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 : 65

Objective Function Value : -791315.5

Training error : 0.075377

Probability model included.

Time taken: 0.34 secs

Rattle timestamp: 2018-11-01 15:07:04 tsraj

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---

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

Call:

```
glm(formula = diagnosis ~ ., family = binomial(link = "logit"),
  data = crs$dataset[crs$train, c(crs$input, crs$target)])
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.000095996	-0.000000021	-0.000000021	0.000000021	0.000101360

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	-1000.61483	761248.66277	-0.001	0.999
radius_mean	-97.90782	192161.08689	-0.001	1.000
texture_mean	-1.52749	7268.53089	0.000	1.000
perimeter_mean	11.62036	24789.12937	0.000	1.000
area_mean	0.06996	1137.59682	0.000	1.000
smoothness_mean	3596.94249	3367674.12125	0.001	0.999
compactness_mean	-2219.66177	1451428.51974	-0.002	0.999
concavity_mean	1711.09728	1494923.49969	0.001	0.999
concave.points_mean	847.30879	2188675.78519	0.000	1.000
symmetry_mean	103.60976	962422.22431	0.000	1.000
fractal_dimension_mean	-1178.76821	4084532.43591	0.000	1.000
radius_se	-234.05834	502063.31914	0.000	1.000
texture_se	-51.78826	48967.44486	-0.001	0.999
perimeter_se	22.28591	58783.97084	0.000	1.000
area_se	2.84002	5668.17774	0.001	1.000
smoothness_se	9005.17574	9414262.67903	0.001	0.999
compactness_se	6422.96812	3353945.21733	0.002	0.998
concavity_se	-1121.20300	2735903.33151	0.000	1.000
concave.points_se	1217.94946	6789082.78846	0.000	1.000
symmetry_se	-4547.31819	2578593.62926	-0.002	0.999
fractal_dimension_se	-69157.70783	23592060.24330	-0.003	0.998
radius_worst	82.16787	59057.50106	0.001	0.999
texture_worst	8.39038	6938.98401	0.001	0.999
perimeter_worst	-4.56604	9812.89418	0.000	1.000
area_worst	-0.31656	923.31265	0.000	1.000
smoothness_worst	-1011.75729	1964421.59749	-0.001	1.000
compactness_worst	-438.62888	625576.98058	-0.001	0.999
concavity_worst	-57.93867	508525.22171	0.000	1.000

```
concave.points_worst    137.35946 827468.28456  0.000   1.000
symmetry_worst         497.70771 379439.01635  0.001   0.999
fractal_dimension_worst 5759.84337 2409902.55103  0.002   0.998
```

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 5.2317e+02 on 397 degrees of freedom

Residual deviance: 9.8798e-08 on 367 degrees of freedom

AIC: 62

Number of Fisher Scoring iterations: 25

Log likelihood: -0.000 (31 df)

Null/Residual deviance difference: 523.170 (30 df)

Chi-square p-value: 0.00000000

Pseudo R-Square (optimistic): 1.00000000

==== ANOVA ====

Analysis of Deviance Table

Model: binomial, link: logit

Response: diagnosis

Terms added sequentially (first to last)

Df Deviance Resid. Df Resid. Dev Pr(>Chi)

NULL	397	523.17	
radius_mean	1	288.301	396 234.87 < 2.2e-16 ***
texture_mean	1	30.665	395 204.20 3.066e-08 ***
perimeter_mean	1	51.493	394 152.71 7.184e-13 ***
area_mean	1	3.341	393 149.37 0.0675854 .

smoothness_mean	1	32.183	392	117.19	1.403e-08 ***
compactness_mean	1	0.221	391	116.97	0.6383247
concavity_mean	1	10.594	390	106.37	0.0011344 **
concave.points_mean	1	5.976	389	100.40	0.0145041 *
symmetry_mean	1	0.050	388	100.35	0.8227536
fractal_dimension_mean	1	3.232	387	97.11	0.0721929 .
radius_se	1	0.612	386	96.50	0.4342138
texture_se	1	15.411	385	81.09	8.650e-05 ***
perimeter_se	1	0.051	384	81.04	0.8212168
area_se	1	13.504	383	67.54	0.0002380 ***
smoothness_se	1	4.136	382	63.40	0.0419689 *
compactness_se	1	4.120	381	59.28	0.0423710 *
concavity_se	1	12.684	380	46.60	0.0003687 ***
concave.points_se	1	0.423	379	46.17	0.5155001
symmetry_se	1	1.820	378	44.35	0.1773220
fractal_dimension_se	1	1.976	377	42.38	0.1598142
radius_worst	1	42.377	376	0.00	7.528e-11 ***
texture_worst	1	0.000	375	0.00	0.9993888
perimeter_worst	1	0.000	374	0.00	0.9997021
area_worst	1	0.000	373	0.00	1.0000000
smoothness_worst	1	0.000	372	0.00	0.9998906
compactness_worst	1	0.000	371	0.00	1.0000000
concavity_worst	1	0.000	370	0.00	0.9998360
concave.points_worst	1	0.000	369	0.00	0.9999952
symmetry_worst	1	0.000	368	0.00	0.9998467
fractal_dimension_worst	1	0.000	367	0.00	0.9996653

---

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

Time taken: 0.32 secs

Rattle timestamp: 2018-11-01 15:07:50 tsraj

---

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

Call:

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

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.000101599	-0.000000021	-0.000000021	0.000000021	0.000104597

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	-283.85110	124970.41277	-0.002	0.998
radius_mean	-28.53109	34548.05278	-0.001	0.999
texture_mean	-0.42295	1163.55866	0.000	1.000
perimeter_mean	3.33211	4248.88082	0.001	0.999
area_mean	0.02250	202.52746	0.000	1.000
smoothness_mean	1075.18012	632014.55799	0.002	0.999
compactness_mean	-653.78728	253896.16900	-0.003	0.998
concavity_mean	498.70895	274485.43359	0.002	0.999
concave.points_mean	263.34841	361254.35356	0.001	0.999
symmetry_mean	25.26393	180776.47282	0.000	1.000
fractal_dimension_mean	-379.18181	693712.24471	-0.001	1.000
radius_se	-77.94629	89882.69645	-0.001	0.999
texture_se	-14.51040	8175.76852	-0.002	0.999
perimeter_se	6.70496	10286.00298	0.001	0.999
area_se	0.90847	1004.37254	0.001	0.999
smoothness_se	2703.57495	1724445.17885	0.002	0.999
compactness_se	1844.90459	520710.84313	0.004	0.997
concavity_se	-301.43906	436469.75082	-0.001	0.999
concave.points_se	329.45611	1139075.51994	0.000	1.000
symmetry_se	-1343.13647	445655.90081	-0.003	0.998
fractal_dimension_se	-20322.56752	4111721.07940	-0.005	0.996
radius_worst	24.30690	10271.15053	0.002	0.998
texture_worst	2.38335	1141.28075	0.002	0.998
perimeter_worst	-1.41333	1664.15664	-0.001	0.999

area_worst	-0.09123	164.80735	-0.001	1.000
smoothness_worst	-311.74885	373902.02654	-0.001	0.999
compactness_worst	-120.39599	105239.51604	-0.001	0.999
concavity_worst	-20.05196	91807.31076	0.000	1.000
concave.points_worst	41.42246	139853.31978	0.000	1.000
symmetry_worst	147.47438	68501.67910	0.002	0.998
fractal_dimension_worst	1681.60016	394145.19857	0.004	0.997

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 523.17040256182 on 397 degrees of freedom

Residual deviance: 0.00000010545 on 367 degrees of freedom

AIC: 62

Number of Fisher Scoring iterations: 25

Log likelihood: -0.000 (31 df)

Null/Residual deviance difference: 523.170 (30 df)

Chi-square p-value: 0.00000000

Pseudo R-Square (optimistic): 1.00000000

==== ANOVA ====

Analysis of Deviance Table

Model: binomial, link: probit

Response: diagnosis

Terms added sequentially (first to last)

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL	397	523.17			

radius_mean	1	287.392	396	235.78	< 2.2e-16 ***
texture_mean	1	30.090	395	205.69	4.124e-08 ***
perimeter_mean	1	53.582	394	152.11	2.480e-13 ***
area_mean	1	3.753	393	148.35	0.0527222 .
smoothness_mean	1	32.534	392	115.82	1.171e-08 ***
compactness_mean	1	0.280	391	115.54	0.5967093
concavity_mean	1	9.832	390	105.71	0.0017151 **
concave.points_mean	1	6.230	389	99.48	0.0125605 *
symmetry_mean	1	0.034	388	99.44	0.8536301
fractal_dimension_mean	1	2.806	387	96.64	0.0938964 .
radius_se	1	0.566	386	96.07	0.4519414
texture_se	1	14.575	385	81.50	0.0001347 ***
perimeter_se	1	0.104	384	81.39	0.7471212
area_se	1	13.796	383	67.60	0.0002038 ***
smoothness_se	1	3.707	382	63.89	0.0541832 .
compactness_se	1	4.434	381	59.46	0.0352264 *
concavity_se	1	12.843	380	46.61	0.0003387 ***
concave.points_se	1	0.309	379	46.30	0.5783642
symmetry_se	1	1.792	378	44.51	0.1806390
fractal_dimension_se	1	2.206	377	42.30	0.1374391
radius_worst	1	42.304	376	0.00	7.812e-11 ***
texture_worst	1	0.000	375	0.00	0.9992524
perimeter_worst	1	0.000	374	0.00	0.9996586
area_worst	1	0.000	373	0.00	1.0000000
smoothness_worst	1	0.000	372	0.00	0.9998507
compactness_worst	1	0.000	371	0.00	1.0000000
concavity_worst	1	0.000	370	0.00	0.9997467
concave.points_worst	1	0.000	369	0.00	1.0000000
symmetry_worst	1	0.000	368	0.00	0.9998162
fractal_dimension_worst	1	0.000	367	0.00	0.9996156

---

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

Time taken: 0.35 secs

Rattle timestamp: 2018-11-01 15:09:49 tsraj

---

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

A 30-10-1 network with 351 weights.

Inputs: radius\_mean, texture\_mean, perimeter\_mean, area\_mean, smoothness\_mean, compactness\_mean, concavity\_mean, concave.points\_mean, symmetry\_mean, fractal\_dimension\_mean, radius\_se, texture\_se, perimeter\_se, area\_se, smoothness\_se, compactness\_se, concavity\_se, concave.points\_se, symmetry\_se, fractal\_dimension\_se, radius\_worst, texture\_worst, perimeter\_worst, area\_worst, smoothness\_worst, compactness\_worst, concavity\_worst, concave.points\_worst, symmetry\_worst, fractal\_dimension\_worst.

Output: as.factor(diagnosis).

Sum of Squares Residuals: 146.0000.

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 i19->h1 i20->h1 i21->h1 i22->h1 i23->h1  
0.29 -0.50 0.39 0.25 -0.16 -0.55 -0.52 0.25 -0.65 -0.15 -0.03 -0.20  
i24->h1 i25->h1 i26->h1 i27->h1 i28->h1 i29->h1 i30->h1  
0.30 -0.16 -0.04 0.49 0.56 0.44 0.41

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  
0.51 0.38 0.22 0.47 -0.41 0.15 -0.22 0.46 -0.08 -0.41 0.33 -0.54  
i12->h2 i13->h2 i14->h2 i15->h2 i16->h2 i17->h2 i18->h2 i19->h2 i20->h2 i21->h2 i22->h2 i23->h2  
0.56 0.59 0.64 0.13 -0.68 -0.51 0.55 0.05 0.15 0.31 -0.15 0.24  
i24->h2 i25->h2 i26->h2 i27->h2 i28->h2 i29->h2 i30->h2

0.02 0.33 -0.44 -0.47 -0.68 0.07 0.30

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  
0.35 -0.01 0.09 0.65 -0.36 -0.41 -0.56 0.50 -0.53 -0.19 -0.24 -0.62  
i12->h3 i13->h3 i14->h3 i15->h3 i16->h3 i17->h3 i18->h3 i19->h3 i20->h3 i21->h3 i22->h3 i23->h3  
0.23 -0.47 -0.14 -0.28 0.33 0.44 -0.07 -0.08 0.51 -0.17 -0.26 0.07  
i24->h3 i25->h3 i26->h3 i27->h3 i28->h3 i29->h3 i30->h3 -0.01 -0.52 0.14 -0.18 -0.62 0.70 -0.04

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 -0.37 -0.06 -0.07 -0.12 0.41 0.37 0.03 -0.19 -0.46 0.05 0.29 -0.18  
i12->h4 i13->h4 i14->h4 i15->h4 i16->h4 i17->h4 i18->h4 i19->h4 i20->h4 i21->h4 i22->h4 i23->h4 -0.51 -0.16 0.55 0.51 -0.57 -0.56 -0.02 0.09 0.21 0.62 0.06 0.66  
i24->h4 i25->h4 i26->h4 i27->h4 i28->h4 i29->h4 i30->h4 0.07 -0.39 0.08 0.50 -0.64 0.12 0.45

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 -0.21 -0.54 -0.44 0.08 -0.61 0.57 0.30 0.64 0.16 -0.42 0.51 -0.59  
i12->h5 i13->h5 i14->h5 i15->h5 i16->h5 i17->h5 i18->h5 i19->h5 i20->h5 i21->h5 i22->h5 i23->h5 -0.23 0.31 -0.19 0.69 -0.37 0.26 -0.18 -0.16 0.53 -0.42 -0.65 -0.30  
i24->h5 i25->h5 i26->h5 i27->h5 i28->h5 i29->h5 i30->h5 -0.49 -0.69 0.68 0.26 0.17 -0.22 0.23

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 -0.25 0.06 -0.52 -0.13 0.58 0.14 0.28 0.23 0.53 0.25 0.34 -0.02  
i12->h6 i13->h6 i14->h6 i15->h6 i16->h6 i17->h6 i18->h6 i19->h6 i20->h6 i21->h6 i22->h6 i23->h6 -0.17 0.33 0.57 0.46 0.47 0.68 -0.44 -0.61 0.16 -0.65 0.20 0.55  
i24->h6 i25->h6 i26->h6 i27->h6 i28->h6 i29->h6 i30->h6 -0.44 0.05 0.43 -0.24 0.63 -0.07 -0.59

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  
0.50 0.35 0.31 -0.15 0.14 0.30 0.50 -0.63 -0.54 -0.44 0.65 0.27  
  
i12->h7 i13->h7 i14->h7 i15->h7 i16->h7 i17->h7 i18->h7 i19->h7 i20->h7 i21->h7 i22->h7 i23->h7  
-0.49 -0.66 0.60 -0.56 0.19 0.04 -0.28 -0.38 -0.41 -0.14 -0.01 0.09  
  
i24->h7 i25->h7 i26->h7 i27->h7 i28->h7 i29->h7 i30->h7  
0.17 -0.45 0.61 -0.17 -0.07 -0.44 -0.22

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 -  
0.67 -0.07 0.57 -0.64 0.31 -0.04 -0.70 0.40 -0.31 -0.02 0.64 0.12  
  
i12->h8 i13->h8 i14->h8 i15->h8 i16->h8 i17->h8 i18->h8 i19->h8 i20->h8 i21->h8 i22->h8 i23->h8  
-0.25 -0.17 -0.17 -0.33 0.68 -0.26 0.48 -0.51 0.24 -0.58 -0.58 -0.58  
  
i24->h8 i25->h8 i26->h8 i27->h8 i28->h8 i29->h8 i30->h8  
-0.41 0.31 0.18 0.09 0.35 -0.62 -0.17

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  
0.44 0.36 -0.62 -0.55 0.31 -0.52 0.06 0.40 0.10 -0.07 -0.43 0.60  
  
i12->h9 i13->h9 i14->h9 i15->h9 i16->h9 i17->h9 i18->h9 i19->h9 i20->h9 i21->h9 i22->h9 i23->h9  
-0.63 0.12 0.36 -0.67 -0.58 -0.41 0.56 0.57 0.29 -0.28 0.25 -0.39  
  
i24->h9 i25->h9 i26->h9 i27->h9 i28->h9 i29->h9 i30->h9  
0.43 -0.29 -0.36 0.08 -0.61 0.36 -0.12

Weights for node h10:

b->h10 i1->h10 i2->h10 i3->h10 i4->h10 i5->h10 i6->h10 i7->h10 i8->h10 i9->h10 i10->h10 0.14  
-0.25 -0.20 0.50 -0.15 0.10 -0.20 -0.69 0.50 -0.33 0.24  
  
i11->h10 i12->h10 i13->h10 i14->h10 i15->h10 i16->h10 i17->h10 i18->h10 i19->h10 i20->h10 i21->h10  
-0.17 -0.38 -0.09 -0.66 -0.37 -0.70 0.04 0.26 -0.57 0.59 -0.15  
  
i22->h10 i23->h10 i24->h10 i25->h10 i26->h10 i27->h10 i28->h10 i29->h10 i30->h10  
-0.42 0.43 0.46 0.46 0.62 -0.35 0.68 0.30 -0.65

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

```

-0.05 0.32 0.40 -0.53 -0.33 -0.30 -0.40 -0.56 0.27 -0.45 -0.10 -5.38 i2->o i3->o i4-
>o i5->o i6->o i7->o i8->o i9->o i10->o i11->o i12->o i13->o -7.27 -31.40 -182.28
0.38 0.32 -0.12 -0.55 -0.24 -0.61 -0.64 -0.36 -1.45
i14->o i15->o i16->o i17->o i18->o i19->o i20->o i21->o i22->o i23->o i24->o i25->o
-7.74 0.00 -0.64 -0.18 -0.46 -0.64 -0.33 -5.97 -9.47 -34.21 -219.97 0.48
i26->o i27->o i28->o i29->o i30->o
-0.38 -0.46 -0.15 -0.35 -0.38

```

Time taken: 0.09 secs

---

Rattle timestamp: 2018-11-01 15:11:00 tsraj

---

A 30-10-1 network with 351 weights.

Inputs: radius\_mean, texture\_mean, perimeter\_mean, area\_mean, smoothness\_mean, compactness\_mean, concavity\_mean, concave.points\_mean, symmetry\_mean, fractal\_dimension\_mean, radius\_se, texture\_se, perimeter\_se, area\_se, smoothness\_se, compactness\_se, concavity\_se, concave.points\_se, symmetry\_se, fractal\_dimension\_se, radius\_worst, texture\_worst, perimeter\_worst, area\_worst, smoothness\_worst, compactness\_worst, concavity\_worst, concave.points\_worst, symmetry\_worst, fractal\_dimension\_worst.

Output: as.factor(diagnosis).

Sum of Squares Residuals: 146.0000.

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 i19->h1 i20->h1 i21->h1 i22->h1 i23->h1
0.29 -0.50 0.39 0.25 -0.16 -0.55 -0.52 0.25 -0.65 -0.15 -0.03 -0.20
i24->h1 i25->h1 i26->h1 i27->h1 i28->h1 i29->h1 i30->h1
0.30 -0.16 -0.04 0.49 0.56 0.44 0.41

```

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  
0.51 0.38 0.22 0.47 -0.41 0.15 -0.22 0.46 -0.08 -0.41 0.33 -0.54  
i12->h2 i13->h2 i14->h2 i15->h2 i16->h2 i17->h2 i18->h2 i19->h2 i20->h2 i21->h2 i22->h2 i23->h2  
0.56 0.59 0.64 0.13 -0.68 -0.51 0.55 0.05 0.15 0.31 -0.15 0.24  
i24->h2 i25->h2 i26->h2 i27->h2 i28->h2 i29->h2 i30->h2  
0.02 0.33 -0.44 -0.47 -0.68 0.07 0.30

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  
0.35 -0.01 0.09 0.65 -0.36 -0.41 -0.56 0.50 -0.53 -0.19 -0.24 -0.62  
i12->h3 i13->h3 i14->h3 i15->h3 i16->h3 i17->h3 i18->h3 i19->h3 i20->h3 i21->h3 i22->h3 i23->h3  
0.23 -0.47 -0.14 -0.28 0.33 0.44 -0.07 -0.08 0.51 -0.17 -0.26 0.07  
i24->h3 i25->h3 i26->h3 i27->h3 i28->h3 i29->h3 i30->h3  
-0.01 -0.52 0.14 -0.18 -0.62 0.70 -0.04

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 -  
0.37 -0.06 -0.07 -0.12 0.41 0.37 0.03 -0.19 -0.46 0.05 0.29 -0.18  
i12->h4 i13->h4 i14->h4 i15->h4 i16->h4 i17->h4 i18->h4 i19->h4 i20->h4 i21->h4 i22->h4 i23->h4  
-0.51 -0.16 0.55 0.51 -0.57 -0.56 -0.02 0.09 0.21 0.62 0.06 0.66  
i24->h4 i25->h4 i26->h4 i27->h4 i28->h4 i29->h4 i30->h4  
0.07 -0.39 0.08 0.50 -0.64 0.12 0.45

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 -  
0.21 -0.54 -0.44 0.08 -0.61 0.57 0.30 0.64 0.16 -0.42 0.51 -0.59  
i12->h5 i13->h5 i14->h5 i15->h5 i16->h5 i17->h5 i18->h5 i19->h5 i20->h5 i21->h5 i22->h5 i23->h5  
-0.23 0.31 -0.19 0.69 -0.37 0.26 -0.18 -0.16 0.53 -0.42 -0.65 -0.30  
i24->h5 i25->h5 i26->h5 i27->h5 i28->h5 i29->h5 i30->h5  
-0.49 -0.69 0.68 0.26 0.17 -0.22 0.23

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 -  
 0.25 0.06 -0.52 -0.13 0.58 0.14 0.28 0.23 0.53 0.25 0.34 -0.02  
  
 i12->h6 i13->h6 i14->h6 i15->h6 i16->h6 i17->h6 i18->h6 i19->h6 i20->h6 i21->h6 i22->h6 i23->h6  
 -0.17 0.33 0.57 0.46 0.47 0.68 -0.44 -0.61 0.16 -0.65 0.20 0.55  
  
 i24->h6 i25->h6 i26->h6 i27->h6 i28->h6 i29->h6 i30->h6 -  
 0.44 0.05 0.43 -0.24 0.63 -0.07 -0.59

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  
 0.50 0.35 0.31 -0.15 0.14 0.30 0.50 -0.63 -0.54 -0.44 0.65 0.27  
  
 i12->h7 i13->h7 i14->h7 i15->h7 i16->h7 i17->h7 i18->h7 i19->h7 i20->h7 i21->h7 i22->h7 i23->h7  
 -0.49 -0.66 0.60 -0.56 0.19 0.04 -0.28 -0.38 -0.41 -0.14 -0.01 0.09  
  
 i24->h7 i25->h7 i26->h7 i27->h7 i28->h7 i29->h7 i30->h7  
 0.17 -0.45 0.61 -0.17 -0.07 -0.44 -0.22

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 -  
 0.67 -0.07 0.57 -0.64 0.31 -0.04 -0.70 0.40 -0.31 -0.02 0.64 0.12  
  
 i12->h8 i13->h8 i14->h8 i15->h8 i16->h8 i17->h8 i18->h8 i19->h8 i20->h8 i21->h8 i22->h8 i23->h8  
 -0.25 -0.17 -0.17 -0.33 0.68 -0.26 0.48 -0.51 0.24 -0.58 -0.58 -0.58  
  
 i24->h8 i25->h8 i26->h8 i27->h8 i28->h8 i29->h8 i30->h8 -  
 0.41 0.31 0.18 0.09 0.35 -0.62 -0.17

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  
 0.44 0.36 -0.62 -0.55 0.31 -0.52 0.06 0.40 0.10 -0.07 -0.43 0.60  
  
 i12->h9 i13->h9 i14->h9 i15->h9 i16->h9 i17->h9 i18->h9 i19->h9 i20->h9 i21->h9 i22->h9 i23->h9  
 -0.63 0.12 0.36 -0.67 -0.58 -0.41 0.56 0.57 0.29 -0.28 0.25 -0.39  
  
 i24->h9 i25->h9 i26->h9 i27->h9 i28->h9 i29->h9 i30->h9  
 0.43 -0.29 -0.36 0.08 -0.61 0.36 -0.12

Weights for node h10:

b->h10 i1->h10 i2->h10 i3->h10 i4->h10 i5->h10 i6->h10 i7->h10 i8->h10 i9->h10 i10->h10 0.14  
 -0.25 -0.20 0.50 -0.15 0.10 -0.20 -0.69 0.50 -0.33 0.24

```
i11->h10 i12->h10 i13->h10 i14->h10 i15->h10 i16->h10 i17->h10 i18->h10 i19->h10 i20->h10 i21->h10 -0.17 -0.38 -0.09 -0.66 -0.37 -0.70 0.04 0.26 -0.57 0.59 -0.15  
i22->h10 i23->h10 i24->h10 i25->h10 i26->h10 i27->h10 i28->h10 i29->h10 i30->h10 -0.42 0.43 0.46 0.46 0.62 -0.35 0.68 0.30 -0.65
```

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 -0.05 0.32  
0.40 -0.53 -0.33 -0.30 -0.40 -0.56 0.27 -0.45 -0.10 -5.38  
i2->o i3->o i4->o i5->o i6->o i7->o i8->o i9->o i10->o i11->o i12->o i13->o -7.27 -31.40 -182.28 0.38 0.32 -0.12 -0.55 -0.24 -0.61 -0.64 -0.36 -1.45  
i14->o i15->o i16->o i17->o i18->o i19->o i20->o i21->o i22->o i23->o i24->o i25->o  
-7.74 0.00 -0.64 -0.18 -0.46 -0.64 -0.33 -5.97 -9.47 -34.21 -219.97 0.48  
i26->o i27->o i28->o i29->o i30->o  
-0.38 -0.46 -0.15 -0.35 -0.38
```

Time taken: 0.07 secs

---

Rattle timestamp: 2018-11-01 15:11:57 tsraj

Area under the ROC curve for the rpart model on CancerData.csv [validate] is 0.9487

Rattle timestamp: 2018-11-01 15:13:00 tsraj

---

Area under the ROC curve for the xgb model on CancerData.csv [validate] is 0.9917

Rattle timestamp: 2018-11-01 15:13:00 tsraj

---

Area under the ROC curve for the rf model on CancerData.csv [validate] is 0.9841

Rattle timestamp: 2018-11-01 15:13:01 tsraj

---

Area under the ROC curve for the glm model on CancerData.csv [validate] is 0.9581

Rattle timestamp: 2018-11-01 15:13:02 tsraj

---

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

---

Rattle timestamp: 2018-11-01 15:13:02 tsraj

---

Area under the ROC curve for the rpart model on CancerData.csv [validate] is 0.9487

Rattle timestamp: 2018-11-01 15:13:33 tsraj

---

Area under the ROC curve for the xgb model on CancerData.csv [validate] is 0.9917

Rattle timestamp: 2018-11-01 15:13:33 tsraj

---

Area under the ROC curve for the rf model on CancerData.csv [validate] is 0.9841

Rattle timestamp: 2018-11-01 15:13:33 tsraj

---

Area under the ROC curve for the glm model on CancerData.csv [validate] is 0.9581

Rattle timestamp: 2018-11-01 15:13:34 tsraj

---

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

---

Rattle timestamp: 2018-11-01 15:13:34 tsraj

---

Error matrix for the Decision Tree model on CancerData.csv (counts):

Predicted

Actual B M Error

B 352 5 1.4

M 15 197 7.1

Error matrix for the Decision Tree model on CancerData.csv (proportions):

Predicted

Actual B M Error

B 61.9 0.9 1.4

M 2.6 34.6 7.1

Overall error: 3.5%, Averaged class error: 4.25%

Rattle timestamp: 2018-11-01 15:14:36 tsraj

=====

Error matrix for the Random Forest model on CancerData.csv (counts):

		Predicted	
Actual	B	M	Error
B	355	2	0.6
M	4	208	1.9

Error matrix for the Random Forest model on CancerData.csv (proportions):

		Predicted	
Actual	B	M	Error
B	62.4	0.4	0.6
M	0.7	36.6	1.9

Overall error: 1%, Averaged class error: 1.25%

Rattle timestamp: 2018-11-01 15:14:36 tsraj

=====

Error matrix for the SVM model on CancerData.csv (counts):

		Predicted	
Actual	B	M	Error
B	331	26	7.3
M	28	184	13.2

Error matrix for the SVM model on CancerData.csv (proportions):

Predicted

Actual B M Error

B 58.2 4.6 7.3

M 4.9 32.3 13.2

Overall error: 9.5%, Averaged class error: 10.25%

Rattle timestamp: 2018-11-01 15:14:36 tsraj

=====

Error matrix for the Linear model on CancerData.csv (counts):

Predicted

Actual B M Error

B 352 5 1.4

M 5 207 2.4

Error matrix for the Linear model on CancerData.csv (proportions):

Predicted

Actual B M Error

B 61.9 0.9 1.4

M 0.9 36.4 2.4

Overall error: 1.7%, Averaged class error: 1.9%

Rattle timestamp: 2018-11-01 15:14:36 tsraj

=====

Error matrix for the Neural Net model on CancerData.csv (counts):

Predicted

Actual B M Error

B 357 0 0

M 212 0 100

Error matrix for the Neural Net model on CancerData.csv (proportions):

Predicted

Actual B M Error

B 62.7 0 0

M 37.3 0 100

Overall error: 37.3%, Averaged class error: 50%

Rattle timestamp: 2018-11-01 15:14:36 tsraj

---

Summary Decision Tree model (built using rpart) on CancerData.csv by probability cutoffs.

Recall Caseload Precision

	Recall	Caseload	Precision
0	1.0000000	1.0000000	0.3725835
0.0213675213675	0.9905660	0.9701230	0.3804348
0.25	0.9528302	0.3831283	0.9266055
0.75	0.9292453	0.3550088	0.9752475
0.9583333333333	0.8867925	0.3356766	0.9842932
1	0.7358491	0.2759227	0.9936306
1.00.0000000	0.0000000	1.0000000	

Rattle timestamp: 2018-11-01 17:16:41 tsraj

---

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

Area under the Recall (green) curve: 98% (0.976)

Rattle timestamp: 2018-11-01 17:16:42 tsraj

---

Summary Extreme Boost model (built using xgb) on CancerData.csv by probability cutoffs.

The sequence has been truncated to just 100 from 490.

Recall Caseload Precision

0.00020011382 1.00000000 1.00000000 0.3725835  
0.0002478994429 1.00000000 0.98066784 0.3799283  
0.0002715170558 1.00000000 0.96836555 0.3847550  
0.0003008110216 1.00000000 0.95606327 0.3897059  
0.0003222170926 1.00000000 0.94024605 0.3962617  
0.000361145474 1.00000000 0.93145870 0.4000000  
0.0003779999388 1.00000000 0.92267135 0.4038095  
0.0004021935747 1.00000000 0.91036907 0.4092664  
0.0004462691722 1.00000000 0.90158172 0.4132554  
0.0004618838138 1.00000000 0.88927944 0.4189723  
0.0004876778694 1.00000000 0.87521968 0.4257028  
0.0005152804079 1.00000000 0.86643234 0.4300203  
0.0005266146036 1.00000000 0.85413005 0.4362140  
0.0005664617056 1.00000000 0.83128295 0.4482030  
0.0005896180519 1.00000000 0.81898067 0.4549356  
0.0006142104976 1.00000000 0.81019332 0.4598698  
0.0006508078077 1.00000000 0.79613357 0.4679912  
0.0006864480674 1.00000000 0.78734622 0.4732143  
0.0007097688504 1.00000000 0.77855888 0.4785553  
0.0007395144203 1.00000000 0.76625659 0.4862385  
0.000794324209 1.00000000 0.75746924 0.4918794  
0.0008577474509 1.00000000 0.74868190 0.4976526  
0.0008956011152 1.00000000 0.73989455 0.5035629  
0.0009268695139 1.00000000 0.72934974 0.5108434  
0.0009553827113 1.00000000 0.72056239 0.5170732  
0.000993526075 1.00000000 0.71353251 0.5221675  
0.0010224645957 1.00000000 0.70474517 0.5286783  
0.0010753752431 1.00000000 0.69595782 0.5353535  
0.0011456098873 1.00000000 0.68541301 0.5435897  
0.0011843921384 1.00000000 0.67662566 0.5506494  
0.0012489745859 1.00000000 0.66783831 0.5578947  
0.0013400976313 1.00000000 0.65729350 0.5668449  
0.0014259951422 1.00000000 0.64850615 0.5745257

0.0015227971599 1.00000000 0.63971880 0.5824176  
0.001588984509 1.00000000 0.63093146 0.5905292  
0.0017315800069 1.00000000 0.62214411 0.5988701  
0.0018909320934 1.00000000 0.61335677 0.6074499  
0.0020361798815 1.00000000 0.60281195 0.6180758  
0.0022338468116 1.00000000 0.59402460 0.6272189  
0.0025132596493 1.00000000 0.58523726 0.6366366  
0.0027079826687 1.00000000 0.57644991 0.6463415  
0.0027971777599 1.00000000 0.56766257 0.6563467  
0.0029055066407 1.00000000 0.56063269 0.6645768  
0.0031024166383 1.00000000 0.55184534 0.6751592  
0.0035062162206 1.00000000 0.54305800 0.6860841  
0.0039484756999 1.00000000 0.53251318 0.6996700  
0.0043755820952 1.00000000 0.52372583 0.7114094  
0.0050587309524 1.00000000 0.51493849 0.7235495  
0.0059412182309 1.00000000 0.50615114 0.7361111  
0.0067070452496 1.00000000 0.49736380 0.7491166  
0.0070689176209 0.99528302 0.48857645 0.7589928  
0.0076389159076 0.99528302 0.47978910 0.7728938  
0.0092537375167 0.99528302 0.47100176 0.7873134  
0.0105618489906 0.99528302 0.46221441 0.8022814  
0.0108782229945 0.99528302 0.45342707 0.8178295  
0.0163095220923 0.99528302 0.44463972 0.8339921  
0.0179338473827 0.99528302 0.43585237 0.8508065  
0.0211464185268 0.99528302 0.42706503 0.8683128  
0.0246634613723 0.99528302 0.42003515 0.8828452  
0.032096054405 0.99528302 0.41124780 0.9017094  
0.0387517176569 0.99528302 0.40246046 0.9213974  
0.0696671009064 0.99528302 0.39367311 0.9419643  
0.0949085280299 0.99528302 0.38488576 0.9634703  
0.1421777755022 0.99056604 0.37609842 0.9813084  
0.7053359746933 0.98584906 0.36731107 1.0000000  
0.8709681630135 0.96226415 0.35852373 1.0000000  
0.9191648364067 0.93867925 0.34973638 1.0000000

0.9542414546013	0.91509434	0.34094903	1.0000000
0.9642020463943	0.89150943	0.33216169	1.0000000
0.9758301973343	0.86792453	0.32337434	1.0000000
0.9826594591141	0.83490566	0.31107206	1.0000000
0.9864323735237	0.81132075	0.30228471	1.0000000
0.9912557601929	0.78773585	0.29349736	1.0000000
0.9935803413391	0.76415094	0.28471002	1.0000000
0.994782269001	0.74056604	0.27592267	1.0000000
0.995125234127	0.72169811	0.26889279	1.0000000
0.995714366436	0.69811321	0.26010545	1.0000000
0.996067404747	0.67452830	0.25131810	1.0000000
0.9967898726463	0.65094340	0.24253076	1.0000000
0.9981338381767	0.62735849	0.23374341	1.0000000
0.9983183145523	0.60377358	0.22495606	1.0000000
0.9985632300377	0.58018868	0.21616872	1.0000000
0.9987875819206	0.55660377	0.20738137	1.0000000
0.9988604784012	0.53301887	0.19859402	1.0000000
0.9988974332809	0.50471698	0.18804921	1.0000000
0.99895632267	0.48113208	0.17926186	1.0000000
0.9990074038506	0.45754717	0.17047452	1.0000000
0.999091386795	0.42924528	0.15992970	1.0000000
0.9991641044617	0.40566038	0.15114236	1.0000000
0.9992083907127	0.36320755	0.13532513	1.0000000
0.9992380142212	0.33962264	0.12653779	1.0000000
0.99928855896	0.31603774	0.11775044	1.0000000
0.9993268251419	0.29245283	0.10896309	1.0000000
0.9993545413017	0.26886792	0.10017575	1.0000000
0.9993959665298	0.22641509	0.08435852	1.0000000
0.9994580149651	0.19339623	0.07205624	1.0000000
0.99948823452	0.14622642	0.05448155	1.0000000
0.9995451569557	0.06603774	0.02460457	1.0000000
0.9995892643929	0.03773585	0.01405975	1.0000000
1.0	0.00000000	0.00000000	1.0000000

Rattle timestamp: 2018-11-01 17:17:14 tsraj

---

The area under the Risk and Recall curves for Extreme Boost model

Area under the Recall (green) curve: 100% (0.999)

Rattle timestamp: 2018-11-01 17:17:14 tsraj

---

Summary Random Forest model (built using rf) on CancerData.csv by probability cutoffs.

The sequence has been truncated to just 100 from 143.

Recall Caseload Precision

	Recall	Caseload	Precision
0	1.0000000	1.0000000	0.3725835
0.002	1.0000000	0.8137083	0.4578834
0.006	1.0000000	0.6924429	0.5380711
0.008	1.0000000	0.6485062	0.5745257
0.012	1.0000000	0.6045694	0.6162791
0.014	1.0000000	0.5905097	0.6309524
0.018	1.0000000	0.5694200	0.6543210
0.02	1.0000000	0.5571178	0.6687697
0.022	1.0000000	0.5553603	0.6708861
0.026	1.0000000	0.5465729	0.6816720
0.028	1.0000000	0.5377856	0.6928105
0.032	1.0000000	0.5307557	0.7019868
0.034	1.0000000	0.5272408	0.7066667
0.038	0.9952830	0.5149385	0.7201365
0.04	0.9952830	0.5131810	0.7226027
0.044	0.9952830	0.5043937	0.7351916
0.046	0.9952830	0.5008787	0.7403509
0.048	0.9952830	0.4991213	0.7429577
0.054	0.9952830	0.4956063	0.7482270
0.056	0.9952830	0.4920914	0.7535714

0.06 0.9952830 0.4780316 0.7757353  
0.062 0.9952830 0.4762742 0.7785978  
0.066 0.9952830 0.4674868 0.7932331  
0.068 0.9952830 0.4657293 0.7962264  
0.074 0.9952830 0.4639719 0.7992424  
0.086 0.9952830 0.4569420 0.8115385  
0.088 0.9952830 0.4534271 0.8178295  
0.1 0.9952830 0.4446397 0.8339921  
0.102 0.9952830 0.4411248 0.8406375  
0.108 0.9952830 0.4376098 0.8473896  
0.11 0.9952830 0.4358524 0.8508065  
0.112 0.9952830 0.4323374 0.8577236  
0.118 0.9952830 0.4288225 0.8647541  
0.128 0.9952830 0.4270650 0.8683128  
0.134 0.9952830 0.4235501 0.8755187  
0.136 0.9952830 0.4217926 0.8791667  
0.144 0.9952830 0.4165202 0.8902954  
0.15 0.9952830 0.4147627 0.8940678  
0.164 0.9952830 0.4112478 0.9017094  
0.168 0.9952830 0.4094903 0.9055794  
0.18 0.9952830 0.4059754 0.9134199  
0.198 0.9952830 0.4024605 0.9213974  
0.204 0.9952830 0.4007030 0.9254386  
0.224 0.9952830 0.3971880 0.9336283  
0.226 0.9952830 0.3954306 0.9377778  
0.258 0.9952830 0.3919156 0.9461883  
0.26 0.9952830 0.3901582 0.9504505  
0.264 0.9952830 0.3884007 0.9547511  
0.268 0.9952830 0.3848858 0.9634703  
0.316 0.9952830 0.3831283 0.9678899  
0.354 0.9952830 0.3796134 0.9768519  
0.474 0.9952830 0.3778559 0.9813953  
0.492 0.9858491 0.3725835 0.9858491  
0.496 0.9811321 0.3708260 0.9857820

0.528 0.9811321 0.3690685 0.9904762  
0.664 0.9764151 0.3655536 0.9951923  
0.674 0.9716981 0.3637961 0.9951691  
0.68 0.9622642 0.3602812 0.9951220  
0.696 0.9575472 0.3585237 0.9950980  
0.726 0.9433962 0.3532513 0.9950249  
0.744 0.9433962 0.3514938 1.0000000  
0.76 0.9386792 0.3497364 1.0000000  
0.79 0.9292453 0.3462214 1.0000000  
0.792 0.9245283 0.3444640 1.0000000  
0.816 0.9103774 0.3391916 1.0000000  
0.824 0.9056604 0.3374341 1.0000000  
0.828 0.8962264 0.3339192 1.0000000  
0.832 0.8915094 0.3321617 1.0000000  
0.848 0.8820755 0.3286467 1.0000000  
0.85 0.8679245 0.3233743 1.0000000  
0.852 0.8632075 0.3216169 1.0000000  
0.856 0.8537736 0.3181019 1.0000000  
0.874 0.8490566 0.3163445 1.0000000  
0.878 0.8349057 0.3110721 1.0000000  
0.882 0.8301887 0.3093146 1.0000000  
0.89 0.8207547 0.3057996 1.0000000  
0.894 0.8160377 0.3040422 1.0000000  
0.9 0.8113208 0.3022847 1.0000000  
0.91 0.7924528 0.2952548 1.0000000  
0.914 0.7877358 0.2934974 1.0000000  
0.926 0.7783019 0.2899824 1.0000000  
0.928 0.7735849 0.2882250 1.0000000  
0.932 0.7641509 0.2847100 1.0000000  
0.936 0.7405660 0.2759227 1.0000000  
0.94 0.7358491 0.2741652 1.0000000  
0.944 0.7122642 0.2653779 1.0000000  
0.95 0.7075472 0.2636204 1.0000000  
0.964 0.6886792 0.2565905 1.0000000

```
0.966 0.6792453 0.2530756 1.0000000
0.972 0.6698113 0.2495606 1.0000000
0.974 0.6509434 0.2425308 1.0000000
0.98 0.6226415 0.2319859 1.0000000
0.982 0.6084906 0.2267135 1.0000000
0.984 0.5943396 0.2214411 1.0000000
0.988 0.5660377 0.2108963 1.0000000
0.99 0.5424528 0.2021090 1.0000000
0.994 0.5094340 0.1898067 1.0000000
0.996 0.4716981 0.1757469 1.0000000
1 0.3537736 0.1318102 1.0000000
1.0 0.0000000 0.0000000 1.0000000
```

Rattle timestamp: 2018-11-01 17:17:23 tsraj

=====

The area under the Risk and Recall curves for Random Forest model

Area under the Recall (green) curve: 100% (0.999)

Rattle timestamp: 2018-11-01 17:17:23 tsraj

=====

Summary Linear model (built using glm) on CancerData.csv by probability cutoffs.

Recall Caseload Precision

```
0 1.0000000 1.0000000 0.3725835
1e-130.9858491 0.4165202 0.8818565
3e-120.9858491 0.4130053 0.8893617
4.63e-11 0.9858491 0.4112478 0.8931624
1.016e-10 0.9858491 0.4094903 0.8969957
3.122e-10 0.9858491 0.4077329 0.9008621
4.445e-10 0.9858491 0.4059754 0.9047619
5.857e-10 0.9858491 0.4042179 0.9086957
6.758e-10 0.9858491 0.4024605 0.9126638
```

7.003e-10	0.9858491	0.4007030	0.9166667
9.125e-10	0.9858491	0.3989455	0.9207048
0.0000000010371	0.9858491	0.3971880	0.9247788
0.0000000011892	0.9858491	0.3954306	0.9288889
0.0000000017847	0.9858491	0.3936731	0.9330357
0.0000000028089	0.9858491	0.3919156	0.9372197
0.0000000043087	0.9858491	0.3901582	0.9414414
0.0000000047833	0.9858491	0.3884007	0.9457014
0.0000000050312	0.9858491	0.3866432	0.9500000
0.0000000051612	0.9858491	0.3848858	0.9543379
0.0000000843796	0.9858491	0.3831283	0.9587156
0.0000001769536	0.9858491	0.3813708	0.9631336
0.0000013399978	0.9858491	0.3796134	0.9675926
0.0000047574925	0.9858491	0.3778559	0.9720930
0.0000564450847	0.9811321	0.3760984	0.9719626
0.0079358754521	0.9764151	0.3743409	0.9718310
0.6299784833914	0.9764151	0.3725835	0.9764151
0.6627636394277	0.9764151	0.3708260	0.9810427
0.9999999850255	0.9764151	0.3690685	0.9857143
0.9999999945297	0.9764151	0.3673111	0.9904306
0.9999999965944	0.9716981	0.3655536	0.9903846
0.9999999976513	0.9669811	0.3637961	0.9903382
0.9999999977641	0.9622642	0.3620387	0.9902913
0.9999999983468	0.9575472	0.3602812	0.9902439
0.9999999987343	0.9575472	0.3585237	0.9950980
0.9999999987933	0.9528302	0.3567663	0.9950739
0.9999999989862	0.9481132	0.3550088	0.9950495
0.9999999991045	0.9433962	0.3532513	0.9950249
0.9999999991897	0.9386792	0.3514938	0.9950000
0.9999999992543	0.9339623	0.3497364	0.9949749
0.9999999993005	0.9292453	0.3479789	0.9949495
0.9999999993182	0.9245283	0.3462214	0.9949239
0.9999999994228	0.9198113	0.3444640	0.9948980
0.9999999996621	0.9150943	0.3427065	0.9948718

```
0.999999999715 0.9103774 0.3409490 0.9948454  
0.9999999997249 0.9056604 0.3391916 0.9948187  
0.9999999997561 0.9009434 0.3374341 0.9947917  
0.9999999997581 0.8962264 0.3356766 0.9947644  
0.9999999998389 0.8915094 0.3339192 0.9947368  
0.9999999999611 0.8867925 0.3321617 0.9947090  
0.9999999999977 0.8820755 0.3304042 0.9946809  
1      0.8820755 0.3286467 1.0000000  
1.00.0000000 0.0000000 1.0000000
```

Rattle timestamp: 2018-11-01 17:17:33 tsraj

---

The area under the Risk and Recall curves for Linear model

Area under the Recall (green) curve: 99% (0.994)

---

Rattle timestamp: 2018-11-01 17:17:33 tsraj

---

Summary of the Random Forest Model

---

Number of observations used to build the model: 398

Missing value imputation is active.

Call:

```
randomForest(formula = diagnosis ~ .,  
             data = crs$dataset[crs$train, c(crs$input, crs$target)],  
             ntree = 500, mtry = 5, 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: 5

OOB estimate of error rate: 3.77%

Confusion matrix:

	B	M	class.error
B	245	7	0.02777778
M	8	138	0.05479452

Analysis of the Area Under the Curve (AUC)

=====

Call:

```
roc.default(response = crs$rf$y, predictor = as.numeric(crs$rf$predicted))
```

Data: as.numeric(crs\$rf\$predicted) in 252 controls (crs\$rf\$y B) < 146 cases (crs\$rf\$y M).

Area under the curve: 0.9587

95% CI: 0.9376-0.9798 (DeLong)

Variable Importance

=====

	B	M	MeanDecreaseAccuracy	MeanDecreaseGini
area_worst	15.13	10.84	17.79	13.78
concave.points_worst	13.84	11.08	17.58	12.86
radius_worst	13.19	11.08	15.99	12.32
perimeter_worst	13.16	10.67	15.65	14.85
concave.points_mean	9.53	10.94	13.77	13.81
concavity_worst	7.32	9.27	11.99	3.33
texture_mean	8.28	9.79	11.95	2.10
texture_worst	8.63	10.24	11.74	2.30
area_se	8.40	7.98	11.33	5.83
smoothness_worst	6.42	8.05	10.23	1.57
perimeter_mean	8.58	5.62	9.60	7.04
radius_mean	8.55	5.14	9.37	4.99
area_mean	8.50	5.28	9.30	4.07

concavity_mean	5.31 6.54	9.03	3.90
perimeter_se	5.63 6.26	8.33	1.88
radius_se	5.66 4.59	7.60	1.23
smoothness_mean	4.07 6.30	7.34	0.92
compactness_mean	5.84 3.89	6.92	1.51
compactness_worst	4.29 4.11	6.37	1.44
compactness_se	4.34 2.83	5.35	0.59
concavity_se	3.20 3.77	5.33	0.76
smoothness_se	3.65 3.47	5.30	0.58
symmetry_worst	3.45 4.67	5.15	1.17
fractal_dimension_worst	4.31 2.39	5.05	1.06
texture_se	3.97 1.92	4.44	0.55
concave.points_se	3.70 2.72	4.39	0.51
symmetry_mean	0.22 3.69	3.03	0.45
fractal_dimension_mean	2.10 1.25	2.57	0.43
fractal_dimension_se	1.96 1.34	2.56	0.64
symmetry_se	0.96 0.48	1.03	0.55

Time taken: 0.30 secs

---

Rattle timestamp: 2018-11-02 16:27:50 tsraj

---

Summary of the Random Forest Model

=====

Number of observations used to build the model: 398

Missing value imputation is active.

Random Forest using Conditional Inference Trees

Number of trees: 500

Response: diagnosis

Inputs: radius\_mean, texture\_mean, perimeter\_mean, area\_mean, smoothness\_mean, compactness\_mean, concavity\_mean, concave.points\_mean, symmetry\_mean, fractal\_dimension\_mean, radius\_se, texture\_se, perimeter\_se, area\_se, smoothness\_se, compactness\_se, concavity\_se, concave.points\_se, symmetry\_se,

fractal\_dimension\_se, radius\_worst, texture\_worst, perimeter\_worst, area\_worst, smoothness\_worst, compactness\_worst, concavity\_worst, concave.points\_worst, symmetry\_worst, fractal\_dimension\_worst

Number of observations: 398

#### Variable Importance

=====

##### Importance

perimeter_worst	0.03954794521
concave.points_worst	0.03890410959
radius_worst	0.03447945205
area_worst	0.02839726027
concave.points_mean	0.02002739726
perimeter_mean	0.01805479452
radius_mean	0.01502739726
area_mean	0.01323287671
concavity_mean	0.00765753425
concavity_worst	0.00739726027
texture_worst	0.00442465753
texture_mean	0.00431506849
compactness_worst	0.00398630137
compactness_mean	0.00305479452
smoothness_worst	0.00260273973
area_se	0.00231506849
radius_se	0.00139726027
perimeter_se	0.00121917808
symmetry_worst	0.00098630137
smoothness_mean	0.00089041096
fractal_dimension_worst	0.00082191781
smoothness_se	0.00030136986
concavity_se	0.00019178082
symmetry_se	0.00013698630
fractal_dimension_mean	0.00012328767

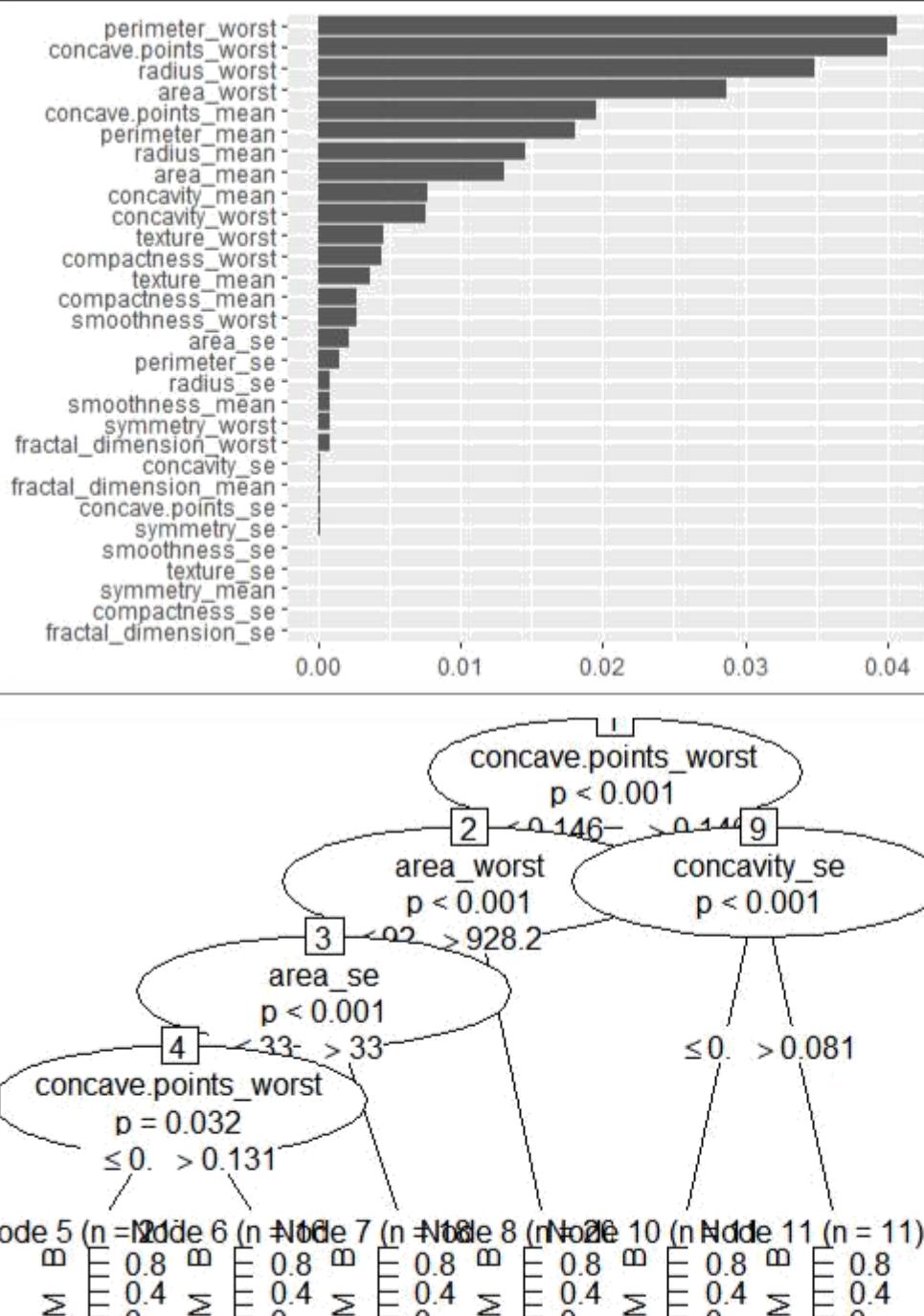
```

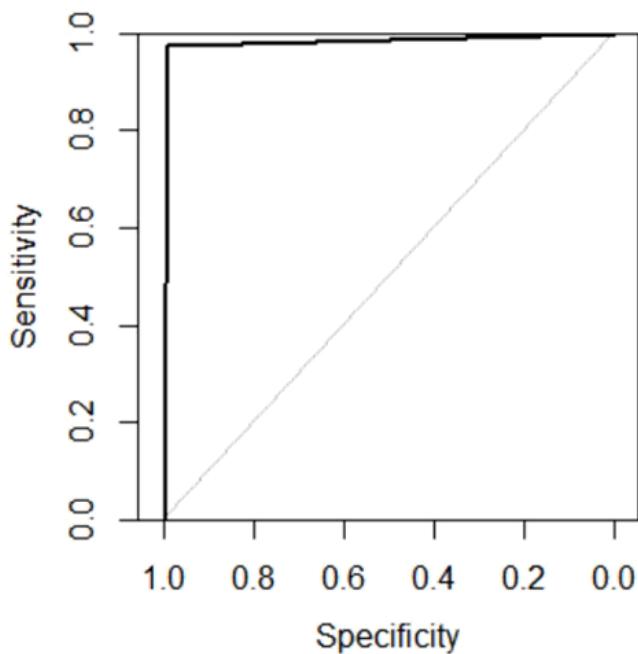
texture_se      0.00004109589
concave.points_se 0.00004109589
compactness_se    0.00002739726
fractal_dimension_se 0.00000000000
symmetry_mean     -0.00006849315

```

Time taken: 2.61 secs

Rattle timestamp: 2018-11-02 16:30:54 tsraj





Summary of the Random Forest Model

=====

Number of observations used to build the model: 398

Missing value imputation is active.

Call:

```
randomForest(formula = diagnosis ~ .,  
             data = crs$dataset[crs$train, c(crs$input, crs$target)],  
             ntree = 500, mtry = 5, 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: 5

OOB estimate of error rate: 3.77%

Confusion matrix:

B M class.error

B 245 7 0.02777778

M 8 138 0.05479452

Analysis of the Area Under the Curve (AUC)

=====

Call:

```
roc.default(response = crs$rf$y, predictor = as.numeric(crs$rf$predicted))
```

Data: as.numeric(crs\$rf\$predicted) in 252 controls (crs\$rf\$y B) < 146 cases (crs\$rf\$y M).

Area under the curve: 0.9587

95% CI: 0.9376-0.9798 (DeLong)

Variable Importance

=====

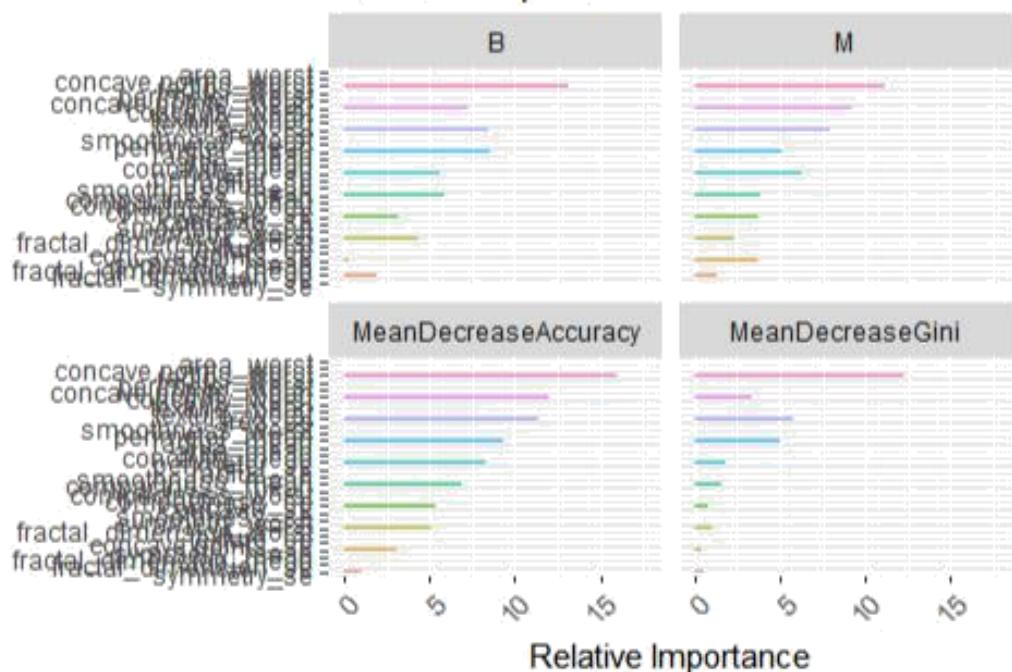
	B	M	MeanDecreaseAccuracy	MeanDecreaseGini
area_worst	15.13	10.84	17.79	13.78
concave.points_worst	13.84	11.08	17.58	12.86
radius_worst	13.19	11.08	15.99	12.32
perimeter_worst	13.16	10.67	15.65	14.85
concave.points_mean	9.53	10.94	13.77	13.81
concavity_worst	7.32	9.27	11.99	3.33
texture_mean	8.28	9.79	11.95	2.10
texture_worst	8.63	10.24	11.74	2.30
area_se	8.40	7.98	11.33	5.83
smoothness_worst	6.42	8.05	10.23	1.57
perimeter_mean	8.58	5.62	9.60	7.04
radius_mean	8.55	5.14	9.37	4.99
area_mean	8.50	5.28	9.30	4.07
concavity_mean	5.31	6.54	9.03	3.90
perimeter_se	5.63	6.26	8.33	1.88
radius_se	5.66	4.59	7.60	1.23
smoothness_mean	4.07	6.30	7.34	0.92
compactness_mean	5.84	3.89	6.92	1.51
compactness_worst	4.29	4.11	6.37	1.44
compactness_se	4.34	2.83	5.35	0.59

concavity_se	3.20	3.77	5.33	0.76
smoothness_se	3.65	3.47	5.30	0.58
symmetry_worst	3.45	4.67	5.15	1.17
fractal_dimension_worst	4.31	2.39	5.05	1.06
texture_se	3.97	1.92	4.44	0.55
concave.points_se	3.70	2.72	4.39	0.51
symmetry_mean	0.22	3.69	3.03	0.45
fractal_dimension_mean	2.10	1.25	2.57	0.43
fractal_dimension_se	1.96	1.34	2.56	0.64
symmetry_se	0.96	0.48	1.03	0.55

Time taken: 0.33 secs

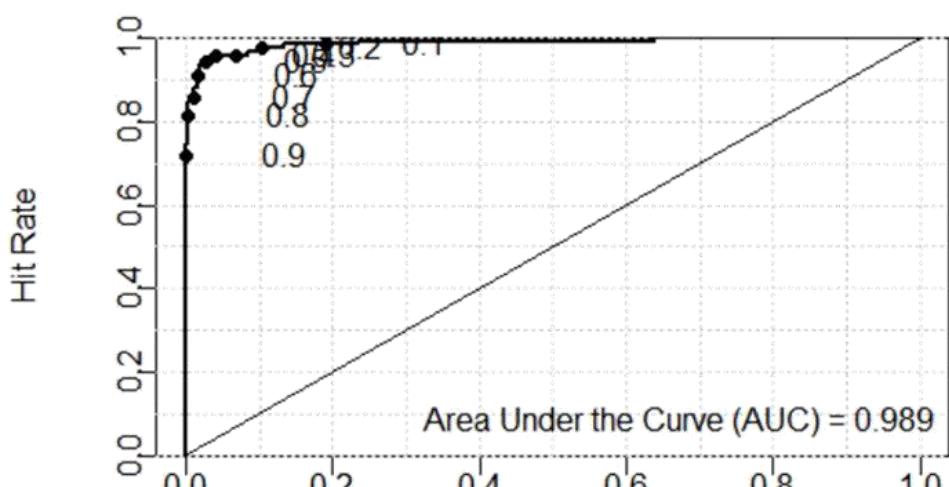
Rattle timestamp: 2018-11-02 16:37:44 tsraj

### Variable Importance

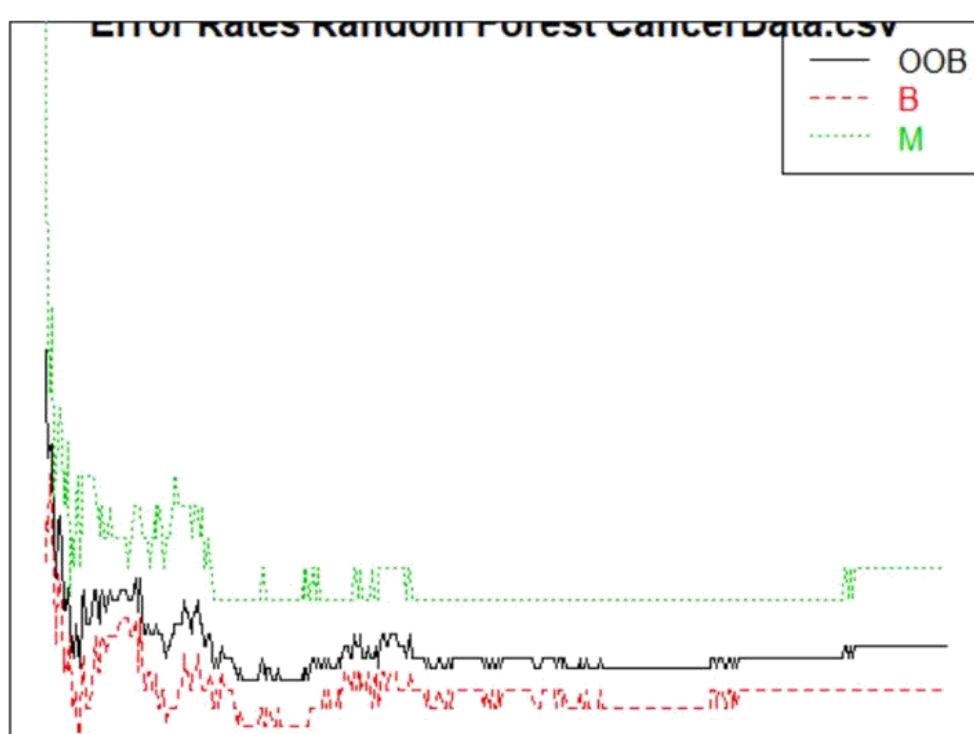


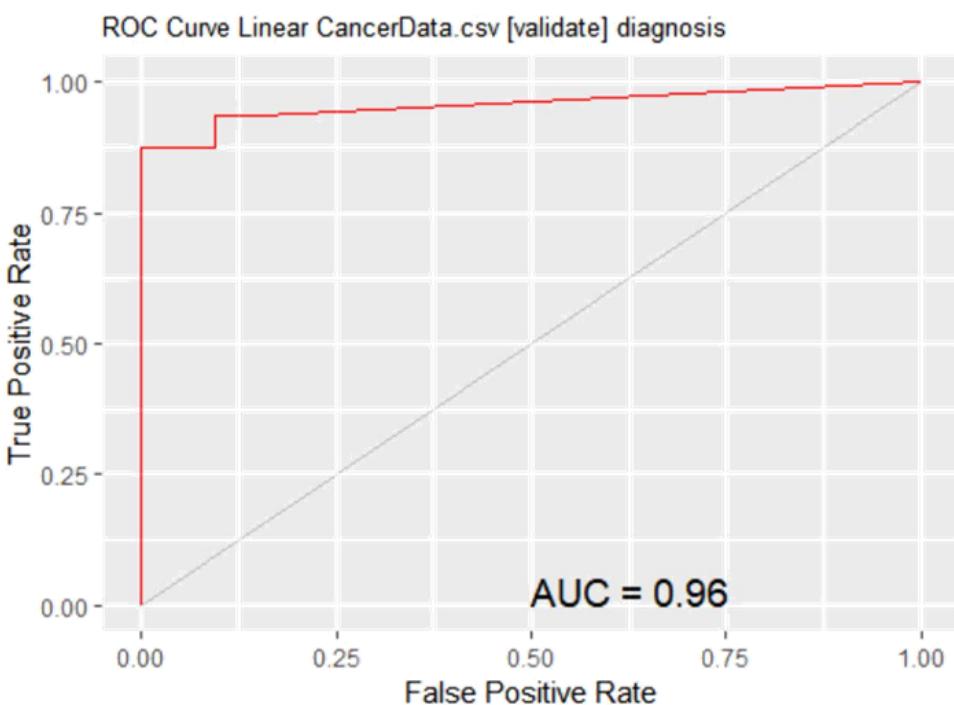
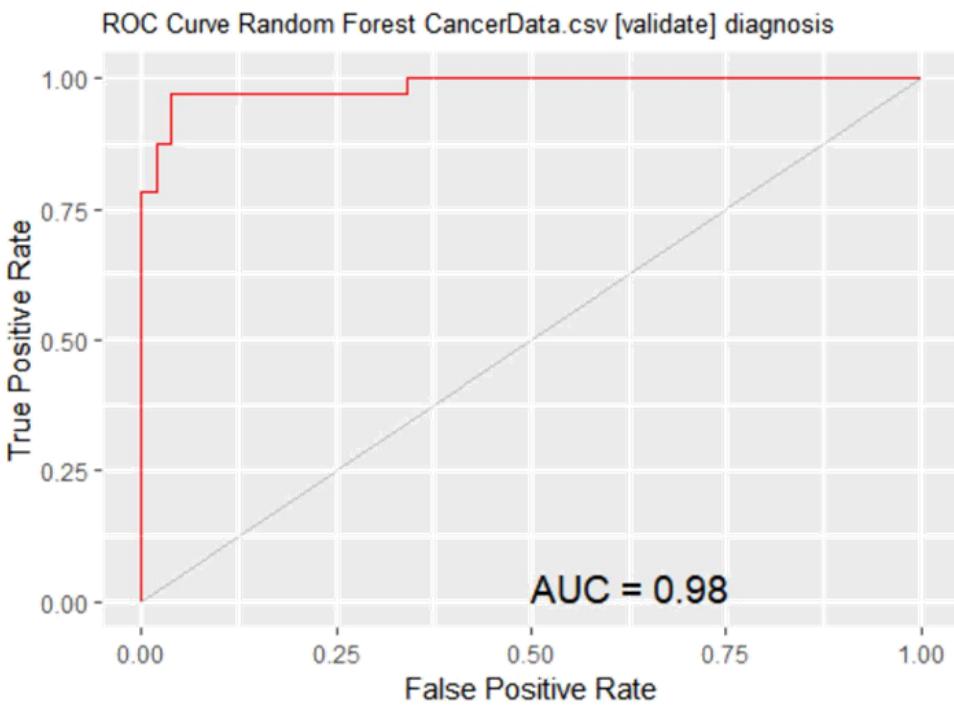
Rattle 2018-Nov-02 16:37:49 tsraj

## OOB ROC Curve Random Forest CancerData.csv



False Alarm Rate





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

Call:

```
glm(formula = diagnosis ~ ., family = binomial(link = "logit"),
  data = crs$dataset[crs$train, c(crs$input, crs$target)])
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.000095996	-0.000000021	-0.000000021	0.000000021	0.000101360

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	-1000.61483	761248.66277	-0.001	0.999
radius_mean	-97.90782	192161.08689	-0.001	1.000
texture_mean	-1.52749	7268.53089	0.000	1.000
perimeter_mean	11.62036	24789.12937	0.000	1.000
area_mean	0.06996	1137.59682	0.000	1.000
smoothness_mean	3596.94249	3367674.12125	0.001	0.999
compactness_mean	-2219.66177	1451428.51974	-0.002	0.999
concavity_mean	1711.09728	1494923.49969	0.001	0.999
concave.points_mean	847.30879	2188675.78519	0.000	1.000
symmetry_mean	103.60976	962422.22431	0.000	1.000
fractal_dimension_mean	-1178.76821	4084532.43591	0.000	1.000
radius_se	-234.05834	502063.31914	0.000	1.000
texture_se	-51.78826	48967.44486	-0.001	0.999
perimeter_se	22.28591	58783.97084	0.000	1.000
area_se	2.84002	5668.17774	0.001	1.000
smoothness_se	9005.17574	9414262.67903	0.001	0.999
compactness_se	6422.96812	3353945.21733	0.002	0.998
concavity_se	-1121.20300	2735903.33151	0.000	1.000
concave.points_se	1217.94946	6789082.78846	0.000	1.000
symmetry_se	-4547.31819	2578593.62926	-0.002	0.999
fractal_dimension_se	-69157.70783	23592060.24330	-0.003	0.998
radius_worst	82.16787	59057.50106	0.001	0.999
texture_worst	8.39038	6938.98401	0.001	0.999
perimeter_worst	-4.56604	9812.89418	0.000	1.000
area_worst	-0.31656	923.31265	0.000	1.000
smoothness_worst	-1011.75729	1964421.59749	-0.001	1.000
compactness_worst	-438.62888	625576.98058	-0.001	0.999
concavity_worst	-57.93867	508525.22171	0.000	1.000
concave.points_worst	137.35946	827468.28456	0.000	1.000
symmetry_worst	497.70771	379439.01635	0.001	0.999
fractal_dimension_worst	5759.84337	2409902.55103	0.002	0.998

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 5.2317e+02 on 397 degrees of freedom

Residual deviance: 9.8798e-08 on 367 degrees of freedom

AIC: 62

Number of Fisher Scoring iterations: 25

Log likelihood: -0.000 (31 df)

Null/Residual deviance difference: 523.170 (30 df)

Chi-square p-value: 0.00000000

Pseudo R-Square (optimistic): 1.00000000

===== ANOVA =====

Analysis of Deviance Table

Model: binomial, link: logit

Response: diagnosis

Terms added sequentially (first to last)

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL			397	523.17	
radius_mean	1	288.301	396	234.87	< 2.2e-16 ***
texture_mean	1	30.665	395	204.20	3.066e-08 ***
perimeter_mean	1	51.493	394	152.71	7.184e-13 ***
area_mean	1	3.341	393	149.37	0.0675854 .
smoothness_mean	1	32.183	392	117.19	1.403e-08 ***
compactness_mean	1	0.221	391	116.97	0.6383247
concavity_mean	1	10.594	390	106.37	0.0011344 **

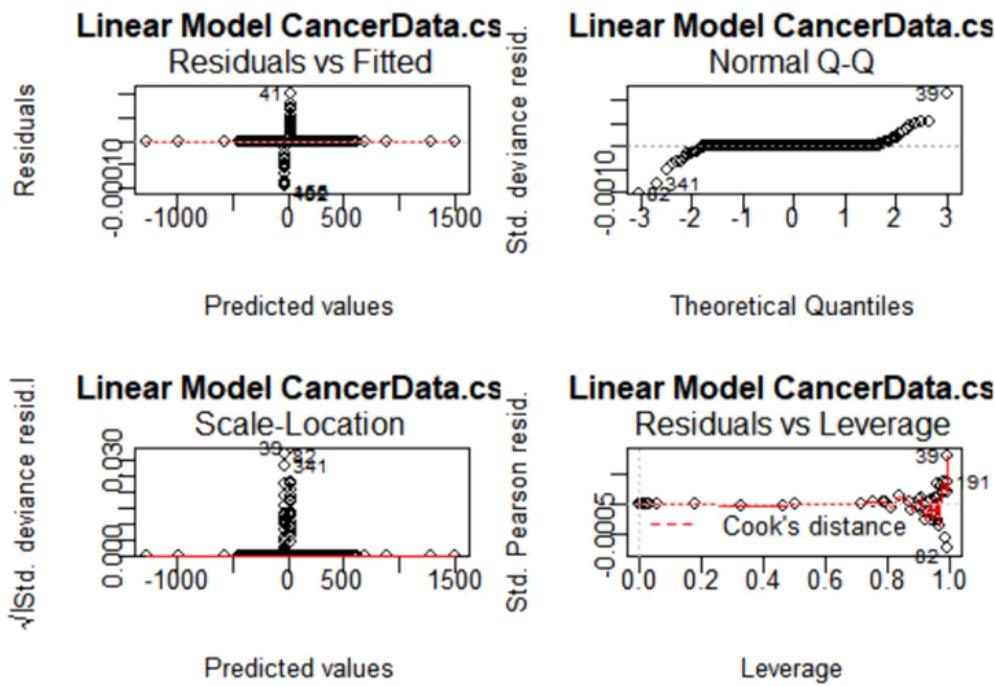
concave.points_mean	1	5.976	389	100.40	0.0145041 *
symmetry_mean	1	0.050	388	100.35	0.8227536
fractal_dimension_mean	1	3.232	387	97.11	0.0721929 .
radius_se	1	0.612	386	96.50	0.4342138
texture_se	1	15.411	385	81.09	8.650e-05 ***
perimeter_se	1	0.051	384	81.04	0.8212168
area_se	1	13.504	383	67.54	0.0002380 ***
smoothness_se	1	4.136	382	63.40	0.0419689 *
compactness_se	1	4.120	381	59.28	0.0423710 *
concavity_se	1	12.684	380	46.60	0.0003687 ***
concave.points_se	1	0.423	379	46.17	0.5155001
symmetry_se	1	1.820	378	44.35	0.1773220
fractal_dimension_se	1	1.976	377	42.38	0.1598142
radius_worst	1	42.377	376	0.00	7.528e-11 ***
texture_worst	1	0.000	375	0.00	0.9993888
perimeter_worst	1	0.000	374	0.00	0.9997021
area_worst	1	0.000	373	0.00	1.0000000
smoothness_worst	1	0.000	372	0.00	0.9998906
compactness_worst	1	0.000	371	0.00	1.0000000
concavity_worst	1	0.000	370	0.00	0.9998360
concave.points_worst	1	0.000	369	0.00	0.9999952
symmetry_worst	1	0.000	368	0.00	0.9998467
fractal_dimension_worst	1	0.000	367	0.00	0.9996653

---

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

Time taken: 0.36 secs

Rattle timestamp: 2018-11-02 16:44:07 tsraj



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

Call:

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

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.000101599	-0.000000021	-0.000000021	0.000000021	0.000104597

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	-283.85110	124970.41277	-0.002	0.998
radius_mean	-28.53109	34548.05278	-0.001	0.999
texture_mean	-0.42295	1163.55866	0.000	1.000
perimeter_mean	3.33211	4248.88082	0.001	0.999
area_mean	0.02250	202.52746	0.000	1.000
smoothness_mean	1075.18012	632014.55799	0.002	0.999
compactness_mean	-653.78728	253896.16900	-0.003	0.998
concavity_mean	498.70895	274485.43359	0.002	0.999
concave.points_mean	263.34841	361254.35356	0.001	0.999
symmetry_mean	25.26393	180776.47282	0.000	1.000

fractal_dimension_mean	-379.18181	693712.24471	-0.001	1.000
radius_se	-77.94629	89882.69645	-0.001	0.999
texture_se	-14.51040	8175.76852	-0.002	0.999
perimeter_se	6.70496	10286.00298	0.001	0.999
area_se	0.90847	1004.37254	0.001	0.999
smoothness_se	2703.57495	1724445.17885	0.002	0.999
compactness_se	1844.90459	520710.84313	0.004	0.997
concavity_se	-301.43906	436469.75082	-0.001	0.999
concave.points_se	329.45611	1139075.51994	0.000	1.000
symmetry_se	-1343.13647	445655.90081	-0.003	0.998
fractal_dimension_se	-20322.56752	4111721.07940	-0.005	0.996
radius_worst	24.30690	10271.15053	0.002	0.998
texture_worst	2.38335	1141.28075	0.002	0.998
perimeter_worst	-1.41333	1664.15664	-0.001	0.999
area_worst	-0.09123	164.80735	-0.001	1.000
smoothness_worst	-311.74885	373902.02654	-0.001	0.999
compactness_worst	-120.39599	105239.51604	-0.001	0.999
concavity_worst	-20.05196	91807.31076	0.000	1.000
concave.points_worst	41.42246	139853.31978	0.000	1.000
symmetry_worst	147.47438	68501.67910	0.002	0.998
fractal_dimension_worst	1681.60016	394145.19857	0.004	0.997

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 523.17040256182 on 397 degrees of freedom

Residual deviance: 0.00000010545 on 367 degrees of freedom

AIC: 62

Number of Fisher Scoring iterations: 25

Log likelihood: -0.000 (31 df)

Null/Residual deviance difference: 523.170 (30 df)

Chi-square p-value: 0.00000000

Pseudo R-Square (optimistic): 1.00000000

==== ANOVA ====

Analysis of Deviance Table

Model: binomial, link: probit

Response: diagnosis

Terms added sequentially (first to last)

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL		397	523.17		
radius_mean	1	287.392	396	235.78	< 2.2e-16 ***
texture_mean	1	30.090	395	205.69	4.124e-08 ***
perimeter_mean	1	53.582	394	152.11	2.480e-13 ***
area_mean	1	3.753	393	148.35	0.0527222 .
smoothness_mean	1	32.534	392	115.82	1.171e-08 ***
compactness_mean	1	0.280	391	115.54	0.5967093
concavity_mean	1	9.832	390	105.71	0.0017151 **
concave.points_mean	1	6.230	389	99.48	0.0125605 *
symmetry_mean	1	0.034	388	99.44	0.8536301
fractal_dimension_mean	1	2.806	387	96.64	0.0938964 .
radius_se	1	0.566	386	96.07	0.4519414
texture_se	1	14.575	385	81.50	0.0001347 ***
perimeter_se	1	0.104	384	81.39	0.7471212
area_se	1	13.796	383	67.60	0.0002038 ***
smoothness_se	1	3.707	382	63.89	0.0541832 .
compactness_se	1	4.434	381	59.46	0.0352264 *
concavity_se	1	12.843	380	46.61	0.0003387 ***
concave.points_se	1	0.309	379	46.30	0.5783642
symmetry_se	1	1.792	378	44.51	0.1806390
fractal_dimension_se	1	2.206	377	42.30	0.1374391

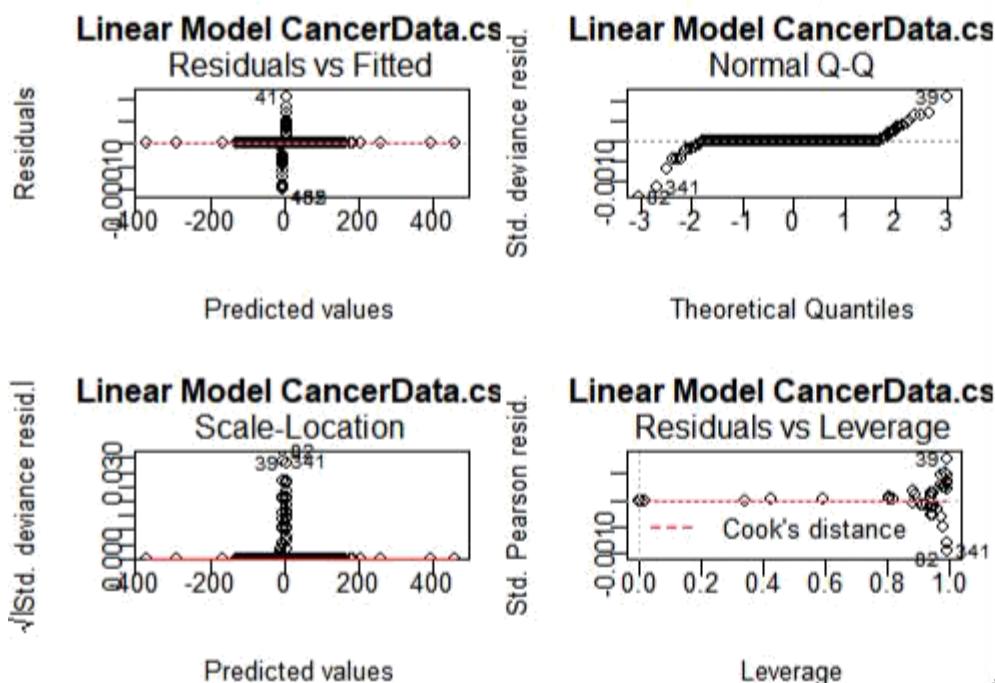
radius_worst	1	42.304	376	0.00	7.812e-11 ***
texture_worst	1	0.000	375	0.00	0.9992524
perimeter_worst	1	0.000	374	0.00	0.9996586
area_worst	1	0.000	373	0.00	1.0000000
smoothness_worst	1	0.000	372	0.00	0.9998507
compactness_worst	1	0.000	371	0.00	1.0000000
concavity_worst	1	0.000	370	0.00	0.9997467
concave.points_worst	1	0.000	369	0.00	1.0000000
symmetry_worst	1	0.000	368	0.00	0.9998162
fractal_dimension_worst	1	0.000	367	0.00	0.9996156

---

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

Time taken: 0.34 secs

Rattle timestamp: 2018-11-02 16:48:28 tsraj



Summary of the Extreme Boost model:

##### xgb.Booster

raw: 23.7 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:

31 niter: 50

nfeatures : 31

formula :

diagnosis ~ .

<environment: 0x00000002b4471f0>

dimnames : (Intercept) radius_mean texture_mean perimeter_mean area_mean smoothness_mean
compactness_mean concavity_mean concave.points_mean symmetry_mean fractal_dimension_mean radius_se
texture_se perimeter_se area_se smoothness_se compactness_se concavity_se concave.points_se symmetry_se
fractal_dimension_se radius_worst texture_worst perimeter_worst area_worst smoothness_worst
compactness_worst concavity_worst concave.points_worst symmetry_worst fractal_dimension_worst

evaluation_log:

iter train_error
  1  0.030151
  2  0.012563
---
  49  0.000000
  50  0.000000

Final iteration error rate:

iter train_error
1: 50      0
```

Importance/Frequency of variables actually used:

	Feature	Gain	Cover	Frequency
1:	perimeter_worst	0.2860119772	0.0627899319	0.024875622
2:	concave.points_worst	0.2320516602	0.1667852537	0.069651741
3:	area_worst	0.2253040203	0.1535258518	0.119402985
4:	concave.points_mean	0.0837341558	0.0753190603	0.054726368
5:	texture_worst	0.0361342148	0.1025161365	0.109452736
6:	texture_mean	0.0350176633	0.0579703156	0.114427861
7:	concavity_worst	0.0266885075	0.0410815982	0.054726368
8:	radius_worst	0.0101222899	0.0449659147	0.029850746
9:	radius_mean	0.0097028514	0.0251147195	0.009950249
10:	area_se	0.0081110684	0.0544375224	0.079601990
11:	fractal_dimension_se	0.0079110708	0.0102615135	0.029850746
12:	smoothness_mean	0.0067744858	0.0102349626	0.039800995
13:	area_mean	0.0050643620	0.0172027459	0.034825871
14:	symmetry_se	0.0047192465	0.0112897273	0.029850746
15:	compactness_se	0.0041147552	0.0143072670	0.029850746
16:	symmetry_worst	0.0038544677	0.0245684697	0.024875622
17:	smoothness_worst	0.0036052689	0.0315560044	0.044776119
18:	radius_se	0.0030701463	0.0228321335	0.014925373
19:	concavity_se	0.0017202681	0.0035817455	0.014925373
20:	perimeter_mean	0.0016395510	0.0019944309	0.009950249
21:	concave.points_se	0.0014685044	0.0019886678	0.009950249
22:	compactness_mean	0.0013108865	0.0028414750	0.014925373
23:	smoothness_se	0.0007095682	0.0420139479	0.014925373
24:	fractal_dimension_mean	0.0005352605	0.0083152521	0.004975124
25:	texture_se	0.0003713217	0.0115063923	0.009950249
26:	compactness_worst	0.0002524276	0.0009989603	0.004975124

Feature Gain Cover Frequency

Time taken: 0.18 secs

Rattle timestamp: 2018-11-02 16:50:23 tsraj

---

Summary of the Extreme Boost model:

Call:

```
ada(diagnosis ~ ., 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:

Final Prediction

True value B M

B 252 0

M 5 141

Train Error: 0.013

Out-Of-Bag Error: 0.015 iteration= 45

Additional Estimates of number of iterations:

train.err1 train.kap1

29 29

Variables actually used in tree construction:

```
[1] "area_mean"      "area_se"        "area_worst"
[4] "compactness_mean" "compactness_se"   "compactness_worst"
[7] "concave.points_mean" "concave.points_se" "concave.points_worst"
[10] "concavity_se"    "concavity_worst"   "fractal_dimension_mean"
[13] "fractal_dimension_se" "fractal_dimension_worst" "perimeter_mean"
[16] "perimeter_se"    "perimeter_worst"   "radius_mean"
[19] "radius_se"        "radius_worst"     "smoothness_mean"
[22] "smoothness_se"    "smoothness_worst"  "symmetry_mean"
[25] "symmetry_se"      "symmetry_worst"   "texture_mean"
[28] "texture_se"        "texture_worst"
```

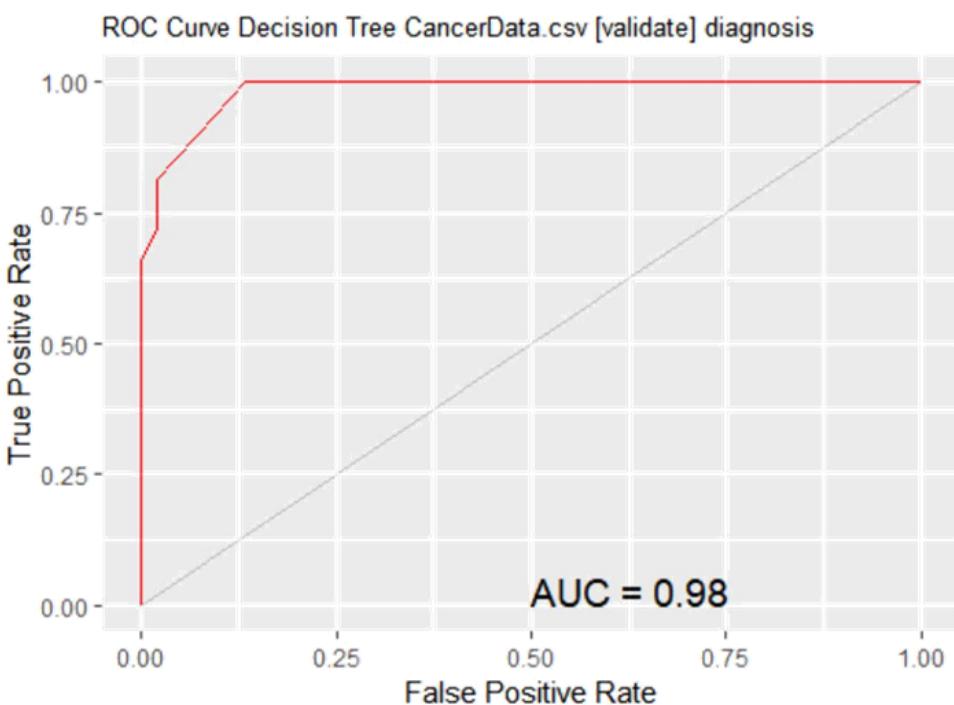
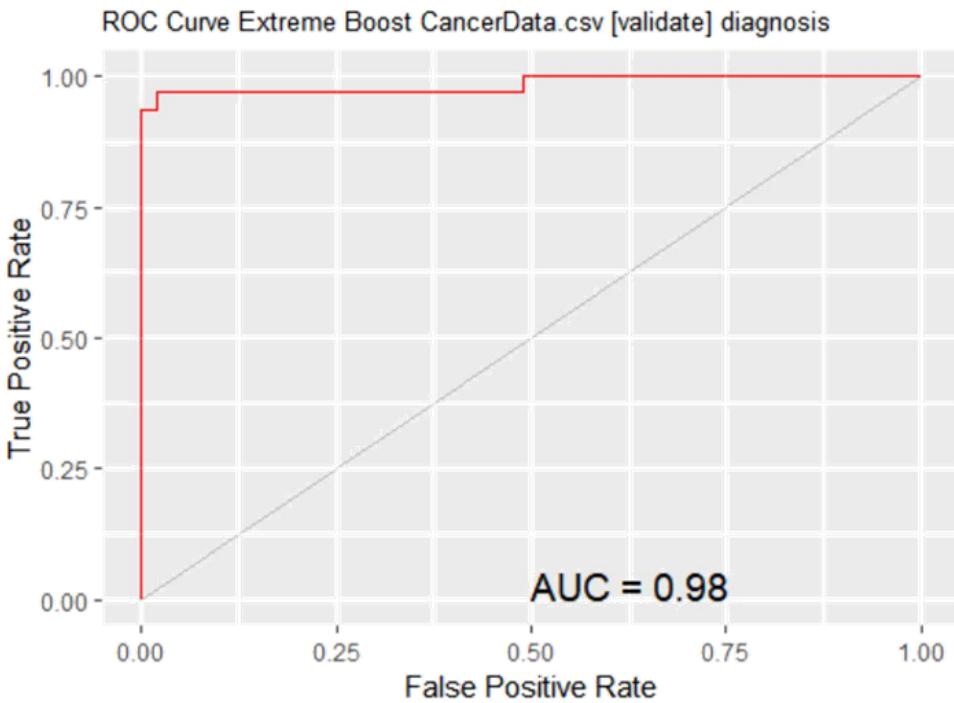
Frequency of variables actually used:

concave.points_worst	area_worst	texture_mean	texture_worst
19	14	14	14
concave.points_mean	perimeter_worst	area_se	smoothness_worst
13	13	10	10
concavity_worst	radius_worst	symmetry_se	smoothness_se
9	7	7	5
perimeter_mean	perimeter_se	smoothness_mean	concave.points_se
3	3	3	2
concavity_se	fractal_dimension_mean	fractal_dimension_se	symmetry_worst
2	2	2	2
area_mean	compactness_mean	compactness_se	compactness_worst
1	1	1	1
fractal_dimension_worst	radius_mean	radius_se	symmetry_mean
1	1	1	1
texture_se			
	1		

Time taken: 1.34 secs

Rattle timestamp: 2018-11-02 16:51:00 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 : 31

Objective Function Value : -18.0672

Training error : 0.01005

Probability model included.

Time taken: 0.07 secs

Rattle timestamp: 2018-11-02 16:54:10 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 = 0.0363422610332654

Number of Support Vectors : 107

Objective Function Value : -48.7126

Training error : 0.015075

Probability model included.

Time taken: 0.06 secs

Rattle timestamp: 2018-11-02 16:55:19 tsraj

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

A 30-10-1 network with 351 weights.

Inputs: radius\_mean, texture\_mean, perimeter\_mean, area\_mean, smoothness\_mean, compactness\_mean, concavity\_mean, concave.points\_mean, symmetry\_mean, fractal\_dimension\_mean, radius\_se, texture\_se, perimeter\_se, area\_se, smoothness\_se, compactness\_se, concavity\_se, concave.points\_se, symmetry\_se, fractal\_dimension\_se, radius\_worst, texture\_worst, perimeter\_worst, area\_worst, smoothness\_worst, compactness\_worst, concavity\_worst, concave.points\_worst, symmetry\_worst, fractal\_dimension\_worst.

Output: as.factor(diagnosis).

Sum of Squares Residuals: 146.0000.

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 i19->h1 i20->h1 i21->h1 i22->h1 i23->h1

0.29 -0.50 0.39 0.25 -0.16 -0.55 -0.52 0.25 -0.65 -0.15 -0.03 -0.20

i24->h1 i25->h1 i26->h1 i27->h1 i28->h1 i29->h1 i30->h1

0.30 -0.16 -0.04 0.49 0.56 0.44 0.41

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

0.51 0.38 0.22 0.47 -0.41 0.15 -0.22 0.46 -0.08 -0.41 0.33 -0.54

i12->h2 i13->h2 i14->h2 i15->h2 i16->h2 i17->h2 i18->h2 i19->h2 i20->h2 i21->h2 i22->h2 i23->h2

0.56 0.59 0.64 0.13 -0.68 -0.51 0.55 0.05 0.15 0.31 -0.15 0.24

i24->h2 i25->h2 i26->h2 i27->h2 i28->h2 i29->h2 i30->h2

0.02 0.33 -0.44 -0.47 -0.68 0.07 0.30

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

0.35 -0.01 0.09 0.65 -0.36 -0.41 -0.56 0.50 -0.53 -0.19 -0.24 -0.62

i12->h3 i13->h3 i14->h3 i15->h3 i16->h3 i17->h3 i18->h3 i19->h3 i20->h3 i21->h3 i22->h3 i23->h3

0.23 -0.47 -0.14 -0.28 0.33 0.44 -0.07 -0.08 0.51 -0.17 -0.26 0.07

i24->h3 i25->h3 i26->h3 i27->h3 i28->h3 i29->h3 i30-

>h3 -0.01 -0.52 0.14 -0.18 -0.62 0.70 -0.04

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 -  
0.37 -0.06 -0.07 -0.12 0.41 0.37 0.03 -0.19 -0.46 0.05 0.29 -0.18  
i12->h4 i13->h4 i14->h4 i15->h4 i16->h4 i17->h4 i18->h4 i19->h4 i20->h4 i21->h4 i22->h4 i23->h4  
-0.51 -0.16 0.55 0.51 -0.57 -0.56 -0.02 0.09 0.21 0.62 0.06 0.66  
i24->h4 i25->h4 i26->h4 i27->h4 i28->h4 i29->h4 i30->h4  
0.07 -0.39 0.08 0.50 -0.64 0.12 0.45

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 -  
0.21 -0.54 -0.44 0.08 -0.61 0.57 0.30 0.64 0.16 -0.42 0.51 -0.59  
i12->h5 i13->h5 i14->h5 i15->h5 i16->h5 i17->h5 i18->h5 i19->h5 i20->h5 i21->h5 i22->h5 i23->h5  
-0.23 0.31 -0.19 0.69 -0.37 0.26 -0.18 -0.16 0.53 -0.42 -0.65 -0.30  
i24->h5 i25->h5 i26->h5 i27->h5 i28->h5 i29->h5 i30->h5  
-0.49 -0.69 0.68 0.26 0.17 -0.22 0.23

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 -  
0.25 0.06 -0.52 -0.13 0.58 0.14 0.28 0.23 0.53 0.25 0.34 -0.02  
i12->h6 i13->h6 i14->h6 i15->h6 i16->h6 i17->h6 i18->h6 i19->h6 i20->h6 i21->h6 i22->h6 i23->h6  
-0.17 0.33 0.57 0.46 0.47 0.68 -0.44 -0.61 0.16 -0.65 0.20 0.55  
i24->h6 i25->h6 i26->h6 i27->h6 i28->h6 i29->h6 i30->h6  
-0.44 0.05 0.43 -0.24 0.63 -0.07 -0.59

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  
0.50 0.35 0.31 -0.15 0.14 0.30 0.50 -0.63 -0.54 -0.44 0.65 0.27  
i12->h7 i13->h7 i14->h7 i15->h7 i16->h7 i17->h7 i18->h7 i19->h7 i20->h7 i21->h7 i22->h7 i23->h7  
-0.49 -0.66 0.60 -0.56 0.19 0.04 -0.28 -0.38 -0.41 -0.14 -0.01 0.09  
i24->h7 i25->h7 i26->h7 i27->h7 i28->h7 i29->h7 i30->h7  
0.17 -0.45 0.61 -0.17 -0.07 -0.44 -0.22

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 -  
 0.67 -0.07 0.57 -0.64 0.31 -0.04 -0.70 0.40 -0.31 -0.02 0.64 0.12  
 i12->h8 i13->h8 i14->h8 i15->h8 i16->h8 i17->h8 i18->h8 i19->h8 i20->h8 i21->h8 i22->h8 i23->h8  
 -0.25 -0.17 -0.17 -0.33 0.68 -0.26 0.48 -0.51 0.24 -0.58 -0.58 -0.58  
 i24->h8 i25->h8 i26->h8 i27->h8 i28->h8 i29->h8 i30->h8 -  
 0.41 0.31 0.18 0.09 0.35 -0.62 -0.17

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  
 0.44 0.36 -0.62 -0.55 0.31 -0.52 0.06 0.40 0.10 -0.07 -0.43 0.60  
 i12->h9 i13->h9 i14->h9 i15->h9 i16->h9 i17->h9 i18->h9 i19->h9 i20->h9 i21->h9 i22->h9 i23->h9  
 -0.63 0.12 0.36 -0.67 -0.58 -0.41 0.56 0.57 0.29 -0.28 0.25 -0.39  
 i24->h9 i25->h9 i26->h9 i27->h9 i28->h9 i29->h9 i30->h9  
 0.43 -0.29 -0.36 0.08 -0.61 0.36 -0.12

Weights for node h10:

b->h10 i1->h10 i2->h10 i3->h10 i4->h10 i5->h10 i6->h10 i7->h10 i8->h10 i9->h10 i10->h10 0.14  
 -0.25 -0.20 0.50 -0.15 0.10 -0.20 -0.69 0.50 -0.33 0.24  
 i11->h10 i12->h10 i13->h10 i14->h10 i15->h10 i16->h10 i17->h10 i18->h10 i19->h10 i20->h10 i21->h10  
 -0.17 -0.38 -0.09 -0.66 -0.37 -0.70 0.04 0.26 -0.57 0.59 -0.15  
 i22->h10 i23->h10 i24->h10 i25->h10 i26->h10 i27->h10 i28->h10 i29->h10 i30->h10  
 -0.42 0.43 0.46 0.46 0.62 -0.35 0.68 0.30 -0.65

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 -0.05 0.32  
 0.40 -0.53 -0.33 -0.30 -0.40 -0.56 0.27 -0.45 -0.10 -5.38  
 i2->o i3->o i4->o i5->o i6->o i7->o i8->o i9->o i10->o i11->o i12->o i13->o -7.27 -  
 31.40 -182.28 0.38 0.32 -0.12 -0.55 -0.24 -0.61 -0.64 -0.36 -1.45  
 i14->o i15->o i16->o i17->o i18->o i19->o i20->o i21->o i22->o i23->o i24->o i25->o  
 -7.74 0.00 -0.64 -0.18 -0.46 -0.64 -0.33 -5.97 -9.47 -34.21 -219.97 0.48  
 i26->o i27->o i28->o i29->o i30->o  
 -0.38 -0.46 -0.15 -0.35 -0.38

Time taken: 0.05 secs

Rattle timestamp: 2018-11-02 16:56:25 tsraj

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Area under the ROC curve for the rpart model on CancerData.csv [validate] is 0.9835

Rattle timestamp: 2018-11-02 16:57:29 tsraj

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Area under the ROC curve for the ada model on CancerData.csv [validate] is 0.9841

Rattle timestamp: 2018-11-02 16:57:30 tsraj

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Area under the ROC curve for the rf model on CancerData.csv [validate] is 0.9841

Rattle timestamp: 2018-11-02 16:57:31 tsraj

---

Area under the ROC curve for the ksvm model on CancerData.csv [validate] is 0.9882

Rattle timestamp: 2018-11-02 16:57:31 tsraj

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Area under the ROC curve for the glm model on CancerData.csv [validate] is 0.9581

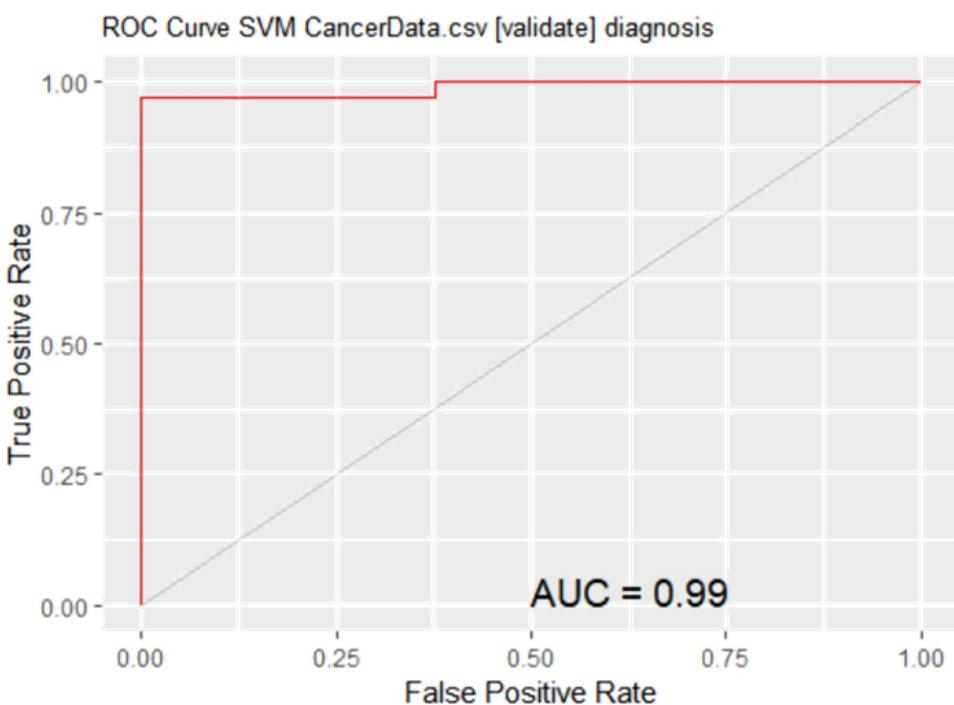
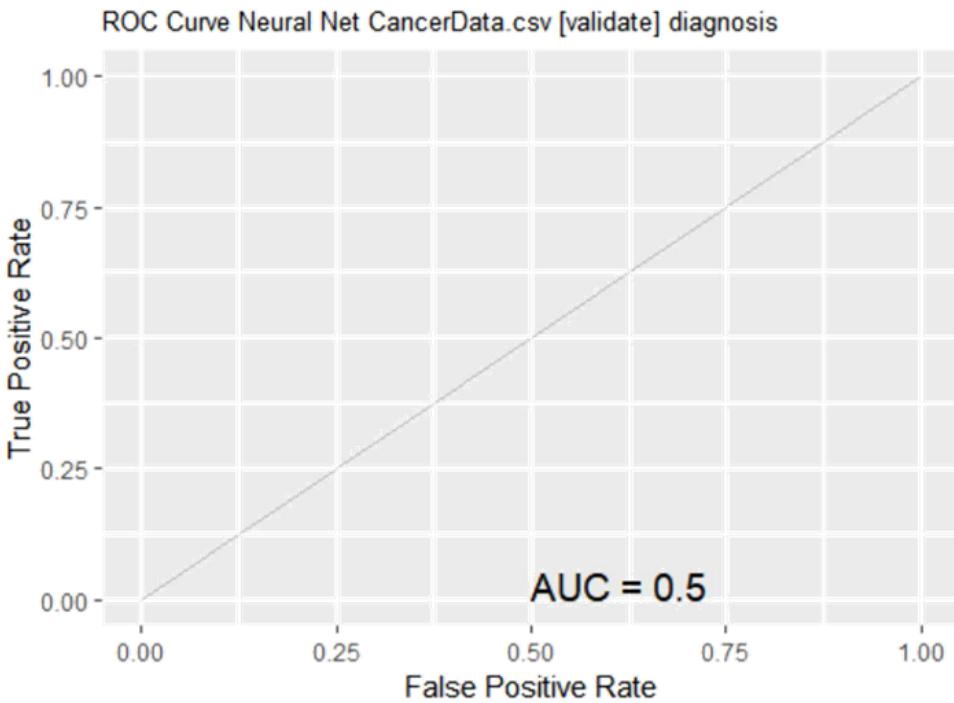
Rattle timestamp: 2018-11-02 16:57:32 tsraj

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

Rattle timestamp: 2018-11-02 16:57:32 tsraj

---



Cluster sizes:

```
[1] "52 64 39 52 21 27 46 8 52 37"
```

Data means:

radius_mean	texture_mean	perimeter_mean	area_mean
0.33781942	0.39775433	0.33237537	0.21755586
smoothness_mean	compactness_mean	concavity_mean	concave.points_mean

0.38984328	0.25719489	0.20793143	0.24156895
symmetry_mean	fractal_dimension_mean	radius_se	texture_se
0.40158131	0.26704129	0.10859066	0.19027388
perimeter_se	area_se	smoothness_se	compactness_se
0.10090746	0.06430258	0.24484824	0.17243969
concavity_se	concave.points_se	symmetry_se	fractal_dimension_se
0.08048032	0.22096293	0.17871962	0.09742486
radius_worst	texture_worst	perimeter_worst	area_worst
0.29742138	0.38880229	0.28357135	0.17262563
smoothness_worst	compactness_worst	concavity_worst	concave.points_worst
0.40019469	0.21998226	0.21848618	0.39334362
symmetry_worst	fractal_dimension_worst		
0.26117875	0.18793215		

Cluster centers:

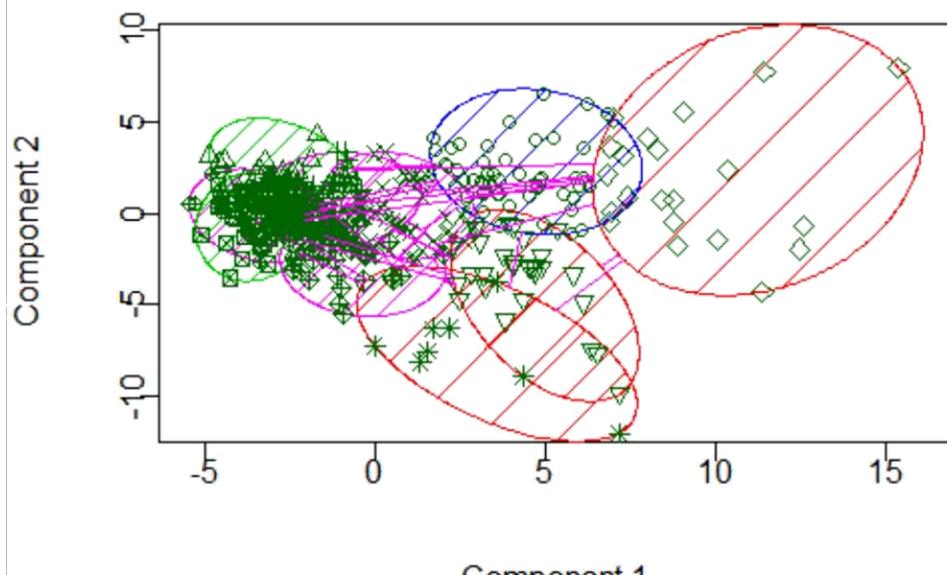
	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean
1	0.5721520	0.4913661	0.5648924	0.42620116	0.4233790	0.3492412
2	0.3164904	0.2857754	0.3025070	0.18556469	0.2864226	0.1362733
3	0.3033393	0.6146505	0.2916319	0.17783506	0.2902272	0.1546932
4	0.3811641	0.3941590	0.3756771	0.23811975	0.4071968	0.2951093
5	0.7424663	0.5428571	0.7558335	0.61997677	0.5374371	0.6158868
6	0.3478158	0.4808821	0.3607675	0.21116060	0.5700701	0.5353614
7	0.1895098	0.2124121	0.1804268	0.09837706	0.3545164	0.1188404
8	0.1456292	0.2822095	0.1595432	0.07320255	0.5058567	0.5099610
9	0.2134698	0.3287823	0.2114667	0.11285341	0.4554413	0.2566950
10	0.1845497	0.4456432	0.1744925	0.09542289	0.3135716	0.1032419
	concavity_mean	concave.points_mean	symmetry_mean	fractal_dimension_mean	radius_se	texture_se
1	0.36770510	0.46701426	0.4305775	0.1924333	0.23529088	0.1978923
2	0.07648555	0.11266681	0.3028846	0.1607618	0.04570546	0.1127180
3	0.11036137	0.13532574	0.3196933	0.1761065	0.08174116	0.2585109
4	0.23000685	0.28708900	0.3918347	0.2433616	0.08213903	0.1209747
5	0.69692507	0.75404715	0.5764330	0.3389196	0.36443789	0.2070810
6	0.45550870	0.43429608	0.5980900	0.4896643	0.10764815	0.1840965

7	0.05415660	0.08411023	0.3320811	0.2673208	0.04999331	0.1257010
8	0.51305061	0.28604001	0.5916847	0.8001527	0.10898515	0.2470717
9	0.14567939	0.16859220	0.4517147	0.3528287	0.07632279	0.2170151
10	0.03706547	0.05290608	0.3637668	0.2454291	0.07836810	0.3645710
perimeter_se area_se smoothness_se compactness_se concavity_se concave.points_se symmetry_se						
1	0.20955948	0.16350870	0.2276182	0.20809637	0.09668706	0.3012262
2	0.04203378	0.02393148	0.1464443	0.08670333	0.04056017	0.1397353
3	0.07372625	0.04045441	0.1975357	0.13194802	0.06301722	0.1923096
4	0.07842363	0.04651300	0.1872147	0.16862222	0.07926331	0.2285839
5	0.35513358	0.30232575	0.2761649	0.34139525	0.16928571	0.3498408
6	0.10763480	0.05733107	0.2539736	0.34325379	0.13802376	0.2950313
7	0.04382038	0.01837227	0.2650038	0.07400754	0.03542944	0.1474019
8	0.10249493	0.03119883	0.4580885	0.53387396	0.39233902	0.5148466
9	0.07468947	0.02975752	0.3628635	0.21536561	0.08942648	0.2535493
10	0.06856941	0.02765065	0.3086872	0.08203085	0.03048485	0.1230720
fractal_dimension_se radius_worst texture_worst perimeter_worst area_worst smoothness_worst						
1	0.10233356	0.5592316	0.4824548	0.5301444	0.38415692	0.4426595
2	0.04315801	0.2543634	0.2911123	0.2347618	0.12751379	0.2840236
3	0.07207324	0.2537011	0.5879267	0.2356078	0.12924305	0.3010073
4	0.08178811	0.3383343	0.3920581	0.3251177	0.18604805	0.4447676
5	0.14875597	0.7012587	0.4835623	0.6958917	0.52963785	0.5035896
6	0.17191541	0.3378526	0.5359936	0.3411783	0.18733160	0.6485358
7	0.06375045	0.1466026	0.2003353	0.1330841	0.06500314	0.3651149
8	0.47139768	0.1098942	0.2348463	0.1160852	0.04590727	0.4502328
9	0.12368292	0.1701400	0.3200221	0.1655030	0.07745291	0.4640657
10	0.07370255	0.1407588	0.4147656	0.1268126	0.06182911	0.2864886
compactness_worst concavity_worst concave.points_worst symmetry_worst fractal_dimension_worst						
1	0.28483577	0.32263763	0.6403185	0.2821081	0.1863149	
2	0.13169639	0.11680871	0.2562333	0.2132059	0.1124926	
3	0.14824708	0.15227370	0.2963080	0.2106223	0.1266461	
4	0.28471076	0.28554620	0.5192770	0.2978135	0.2160504	
5	0.44660431	0.51743496	0.8396334	0.3350042	0.2603743	
6	0.55803569	0.52281978	0.7046201	0.4762979	0.4482779	
7	0.08882817	0.07291087	0.1822389	0.2078823	0.1365091	

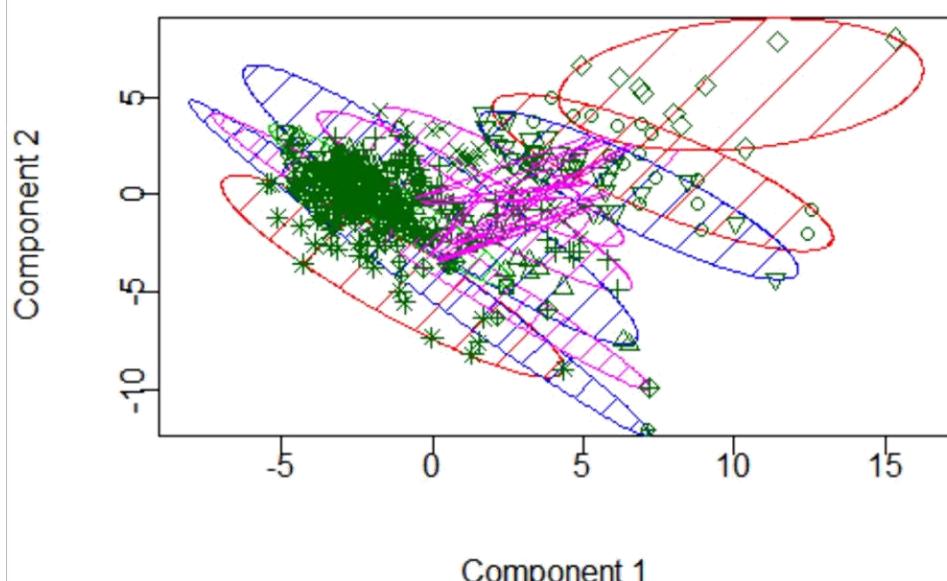
8	0.31596909	0.44532748	0.4301804	0.2731618	0.4155024
9	0.19634524	0.16531288	0.3071418	0.2471417	0.2020328
10	0.06640162	0.03844463	0.1038917	0.2010645	0.1095883

Within cluster sum of squares:

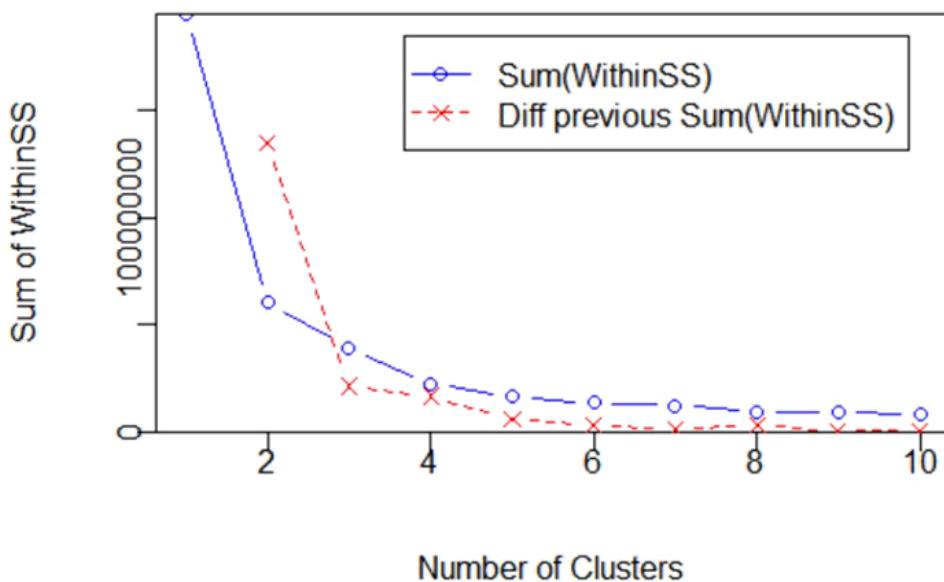
**Discriminant Coordinates CancerData.csv**



**Discriminant Coordinates CancerData.csv**



## Sum of WithinSS Over Number of Clusters



EWKM: 10 clusters, 0 iterations, 0 restarts, 1 total iterations.

Cluster sizes:

```
[1] "19 31 79 18 66 61 20 50 22 32"
```

Data means:

radius_mean	texture_mean	perimeter_mean	area_mean
0.33781942	0.39775433	0.33237537	0.21755586
smoothness_mean	compactness_mean	concavity_mean	concave.points_mean
0.38984328	0.25719489	0.20793143	0.24156895
symmetry_mean	fractal_dimension_mean	radius_se	texture_se
0.40158131	0.26704129	0.10859066	0.19027388
perimeter_se	area_se	smoothness_se	compactness_se
0.10090746	0.06430258	0.24484824	0.17243969
concavity_se	concave.points_se	symmetry_se	fractal_dimension_se
0.08048032	0.22096293	0.17871962	0.09742486
radius_worst	texture_worst	perimeter_worst	area_worst
0.29742138	0.38880229	0.28357135	0.17262563
smoothness_worst	compactness_worst	concavity_worst	concave.points_worst
0.40019469	0.21998226	0.21848618	0.39334362

symmetry\_worst fractal\_dimension\_worst

0.26117875 0.18793215

Cluster centers:

radius\_mean texture\_mean perimeter\_mean area\_mean smoothness\_mean compactness\_mean

1	0.3753908	0.6139113	0.3604196	0.23511749	0.2949402	0.1639373
2	0.2993882	0.3129300	0.2854340	0.17270345	0.2462033	0.1176031
3	0.2312240	0.4822680	0.2227274	0.12536988	0.3402717	0.1592335
4	0.7749276	0.5672660	0.7882739	0.65954990	0.5357347	0.6126686
5	0.5553792	0.4723626	0.5482030	0.40750088	0.4206997	0.3452707
6	0.3295897	0.4548126	0.3354317	0.19672479	0.5035763	0.4233392
7	0.3538265	0.2081950	0.3389503	0.21520255	0.3291370	0.1478590
8	0.1910284	0.2727386	0.1812522	0.09921273	0.3285763	0.1111183
9	0.3030690	0.1692380	0.2956854	0.17451075	0.3962757	0.2246474
10	0.1802440	0.2558610	0.1817234	0.09346501	0.4744629	0.3102714

concavity\_mean concave.points\_mean symmetry\_mean fractal\_dimension\_mean radius\_se texture\_se

1	0.12346434	0.17797792	0.3640303	0.1370217	0.08544936	0.20785798
2	0.07578914	0.09083916	0.2667669	0.1618610	0.03549146	0.13477766
3	0.08648823	0.10588375	0.3642292	0.2386001	0.07983828	0.27898485
4	0.69935177	0.76838966	0.5545022	0.3080829	0.37867302	0.21184116
5	0.36051731	0.45312669	0.4334187	0.1941136	0.21692098	0.18284183
6	0.34853004	0.34816429	0.4927979	0.4036592	0.09103214	0.17467415
7	0.09403936	0.15860015	0.3413326	0.1469356	0.05808800	0.10360458
8	0.05120078	0.07982594	0.3551354	0.2446420	0.06583089	0.21088446
9	0.12872433	0.18392147	0.3361814	0.2641782	0.04338880	0.04818395
10	0.19729015	0.16865821	0.4763170	0.4952809	0.06544903	0.16717521

perimeter\_se area\_se smoothness\_se compactness\_se concavity\_se concave.points\_se symmetry\_se

1	0.07575446	0.04715820	0.1583476	0.10080828	0.05536935	0.1900549	0.1551827
2	0.03307808	0.01907468	0.1193714	0.08328326	0.04271204	0.1220142	0.0871714
3	0.07281806	0.03235345	0.2706262	0.13573950	0.05806105	0.1812906	0.2048144
4	0.37512500	0.32020637	0.2778960	0.33750413	0.16191639	0.3534024	0.2460585
5	0.19260336	0.14966436	0.2227021	0.20023389	0.09685989	0.2906697	0.1615116
6	0.09057448	0.04704987	0.2463597	0.27352750	0.12360904	0.2762443	0.1891742

7	0.05315460	0.03164371	0.1810543	0.08362724	0.04190884	0.1857700	0.1107320
8	0.05716251	0.02413237	0.3101143	0.09104620	0.03754947	0.1636992	0.2314628
9	0.04135308	0.02136170	0.1730309	0.10936190	0.05134183	0.1657416	0.1177656
10	0.06636521	0.02275399	0.3655977	0.27512289	0.13674006	0.2588996	0.1966321
fractal_dimension_se radius_worst texture_worst perimeter_worst area_worst smoothness_worst							
1	0.04652858	0.3237657	0.5947338	0.2997948	0.17646739	0.2945429	
2	0.04077282	0.2398412	0.3390677	0.2201032	0.11881921	0.2442265	
3	0.08008271	0.1872936	0.4647198	0.1737069	0.08741824	0.3439322	
4	0.13746397	0.7285268	0.5018339	0.7272717	0.55891991	0.4937522	
5	0.09829243	0.5380647	0.4658509	0.5090604	0.36320068	0.4489503	
6	0.14012641	0.3063958	0.4828788	0.3046017	0.16405570	0.5685492	
7	0.04451999	0.2817147	0.2058907	0.2596593	0.14588576	0.3146734	
8	0.06935050	0.1414963	0.2292146	0.1278012	0.06242332	0.2944106	
9	0.06979081	0.2456906	0.1621178	0.2333736	0.12033367	0.4149712	
10	0.21555862	0.1425216	0.2449843	0.1447563	0.06366435	0.4873869	
compactness_worst concavity_worst concave.points_worst symmetry_worst fractal_dimension_worst							
1	0.15417068	0.17030478	0.3679888	0.2734912	0.11257828		
2	0.12613166	0.12052425	0.2270135	0.1843918	0.11389132		
3	0.12970658	0.10873559	0.2249793	0.2246417	0.13395421		
4	0.44164163	0.49834487	0.8473654	0.3233020	0.23676155		
5	0.28370353	0.32898756	0.6344892	0.2922931	0.18773131		
6	0.42559887	0.41078668	0.6050758	0.3794243	0.34469778		
7	0.11796868	0.11525240	0.3035808	0.1995466	0.09714351		
8	0.06867713	0.04889382	0.1428902	0.1866785	0.10282697		
9	0.18945546	0.17116831	0.3435208	0.2437683	0.19137061		
10	0.24593848	0.22307907	0.3105037	0.2608294	0.29912764		

Cluster weights:

	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean
1	0.03	0.02	0.03	0.03	0.04	0.04
2	0.03	0.03	0.03	0.04	0.03	0.03
3	0.04	0.01	0.04	0.05	0.02	0.04
4	0.04	0.04	0.04	0.03	0.04	0.03

5	0.04	0.02	0.04	0.04	0.04	0.03
6	0.05	0.02	0.05	0.06	0.03	0.02
7	0.03	0.03	0.03	0.03	0.03	0.03
8	0.04	0.03	0.04	0.04	0.02	0.04
9	0.03	0.03	0.03	0.03	0.03	0.03
10	0.04	0.03	0.04	0.05	0.03	0.03
concavity_mean concave.points_mean symmetry_mean fractal_dimension_mean radius_se texture_se						
1	0.03	0.03	0.03	0.03	0.04	0.03
2	0.03	0.03	0.03	0.03	0.04	0.03
3	0.04	0.04	0.01	0.03	0.04	0.01
4	0.03	0.04	0.02	0.03	0.02	0.04
5	0.02	0.03	0.03	0.02	0.03	0.03
6	0.02	0.03	0.02	0.02	0.06	0.05
7	0.03	0.03	0.03	0.03	0.04	0.03
8	0.04	0.04	0.02	0.03	0.04	0.01
9	0.03	0.03	0.03	0.03	0.04	0.04
10	0.02	0.04	0.03	0.01	0.05	0.04
perimeter_se area_se smoothness_se compactness_se concavity_se concave.points_se symmetry_se						
1	0.04	0.04	0.03	0.04	0.04	0.03
2	0.04	0.04	0.03	0.03	0.03	0.04
3	0.04	0.05	0.02	0.03	0.05	0.03
4	0.02	0.02	0.02	0.03	0.04	0.02
5	0.04	0.04	0.04	0.03	0.06	0.04
6	0.06	0.06	0.04	0.01	0.04	0.04
7	0.04	0.04	0.03	0.03	0.04	0.03
8	0.04	0.04	0.01	0.03	0.04	0.03
9	0.04	0.04	0.03	0.03	0.04	0.03
10	0.05	0.05	0.02	0.02	0.02	0.04
fractal_dimension_se radius_worst texture_worst perimeter_worst area_worst smoothness_worst						
1	0.04	0.03	0.03	0.03	0.04	0.03
2	0.04	0.03	0.03	0.03	0.04	0.03
3	0.04	0.04	0.02	0.04	0.05	0.02
4	0.05	0.04	0.04	0.04	0.03	0.04
5	0.05	0.03	0.02	0.04	0.03	0.03

6	0.05	0.04	0.02	0.05	0.05	0.02
7	0.04	0.03	0.03	0.03	0.04	0.03
8	0.04	0.04	0.03	0.04	0.04	0.02
9	0.04	0.03	0.03	0.03	0.04	0.03
10	0.02	0.04	0.03	0.04	0.05	0.03
	compactness_worst	concavity_worst	concave.points_worst	symmetry_worst	fractal_dimension_worst	
1	0.03	0.03	0.03	0.03	0.04	
2	0.03	0.03	0.03	0.03	0.03	
3	0.04	0.04	0.02	0.03	0.04	
4	0.03	0.04	0.04	0.03	0.04	
5	0.03	0.03	0.03	0.03	0.04	
6	0.01	0.01	0.03	0.02	0.02	
7	0.03	0.03	0.03	0.03	0.04	
8	0.04	0.04	0.03	0.03	0.04	
9	0.03	0.03	0.03	0.03	0.03	
10	0.04	0.02	0.03	0.04	0.04	

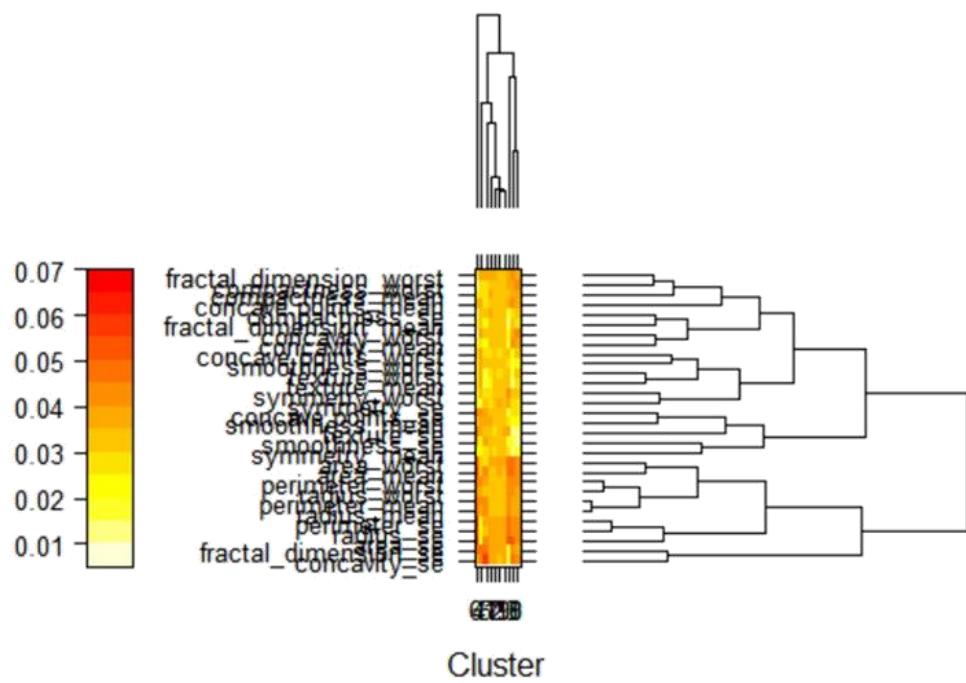
Within cluster sum of squares:

[1] 0 0 0 0 0 0 0 0 0

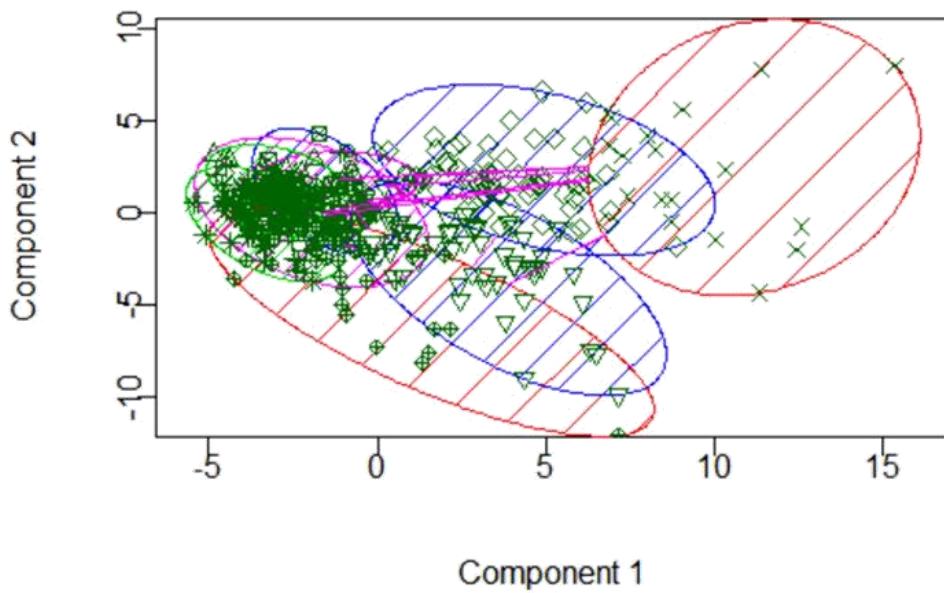
Time taken: 0.00 secs

Rattle timestamp: 2018-11-02 17:04:20 tsraj

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**Discriminant Coordinates CancerData.csv**



Hierachical Cluster

Call:

```
amap::hclusterpar(x = ., method = "euclidean", link = "ward", nbproc = 1)
```

Cluster method : ward

Distance : euclidean

Number of objects: 398

Time taken: 0.10 secs

---

Rattle timestamp: 2018-11-02 17:07:30 tsraj

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Hierachical Cluster

Call:

```
amap::hclusterpar(x = ., method = "euclidean", link = "ward", nbproc = 1)
```

Cluster method : ward

Distance : euclidean

Number of objects: 398

Time taken: 0.10 secs

Rattle timestamp: 2018-11-02 17:07:30 tsraj

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=====  
Cluster means:

	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean
[1,]	9.673764	17.44218	61.84345	287.1255	0.09771836	0.08393745
[2,]	14.241316	19.26289	92.66605	627.7553	0.09543895	0.10527053
[3,]	20.763333	21.21000	138.45714	1349.6000	0.10656429	0.17728286
[4,]	12.776000	18.41120	82.16380	503.6320	0.09033180	0.07632780
[5,]	15.380000	19.88963	100.92889	729.9148	0.10011630	0.12910815
[6,]	16.707879	20.59121	109.39212	872.2364	0.09913636	0.11994303
[7,]	24.485000	23.25600	163.18000	1903.3000	0.10252400	0.16428200
[8,]	11.665357	18.59643	74.84286	418.1774	0.09220036	0.07731643
[9,]	13.567500	18.55295	87.80523	567.4727	0.09187773	0.09227886
[10,]	18.969167	22.08222	125.44167	1123.6778	0.09973861	0.14688694

	concavity_mean	concave.points_mean	symmetry_mean	fractal_dimension_mean	radius_se	texture_se
[1,]	0.05108395	0.01951782	0.1841345	0.06953564	0.3073036	1.527907
[2,]	0.08384895	0.04678842	0.1780842	0.06173868	0.3359579	1.053266
[3,]	0.22825714	0.12210952	0.1990048	0.06248667	0.8646810	1.140667
[4,]	0.04515686	0.02646972	0.1728300	0.06037000	0.2736560	1.118784

[5,]	0.12513259	0.06452407	0.1871926	0.06351704	0.3939370	1.009711
[6,]	0.11880848	0.07297879	0.1833848	0.05970727	0.5020545	1.212330
[7,]	0.23825000	0.13839100	0.1802600	0.05846600	1.3881900	1.193860
[8,]	0.04260840	0.02458631	0.1745905	0.06280393	0.2860250	1.365424
[9,]	0.06430564	0.03527832	0.1692159	0.06131795	0.2542295	0.991250
[10,]	0.17175361	0.09592167	0.1932694	0.06071222	0.7199750	1.237436
perimeter_se area_se smoothness_se compactness_se concavity_se concave.points_se						
[1,]	2.105836	18.26076	0.010162691	0.02653996	0.03841905	0.010788345
[2,]	2.462316	29.81711	0.005925211	0.02460945	0.02903821	0.011402553
[3,]	6.074857	117.19429	0.006971524	0.03883048	0.05246476	0.016564286
[4,]	1.876900	21.33740	0.006154480	0.01921192	0.02296532	0.008731880
[5,]	2.774926	36.66630	0.006347037	0.02987389	0.04093222	0.014015222
[6,]	3.511364	53.50818	0.006076242	0.02613955	0.03069576	0.012893879
[7,]	9.970800	238.03000	0.006747800	0.03036800	0.04314800	0.016171000
[8,]	2.022495	20.58694	0.007572143	0.02113699	0.02360232	0.010154798
[9,]	1.861657	21.41295	0.005309864	0.02136716	0.02515389	0.009973636
[10,]	5.014222	85.97500	0.006695889	0.03263725	0.04385667	0.015943389
symmetry_se fractal_dimension_se radius_worst texture_worst perimeter_worst area_worst						
[1,]	0.02565527	0.005197345	10.64991	22.38200	68.59036	346.3818
[2,]	0.01753084	0.003270284	16.31105	26.03079	108.04053	817.0342
[3,]	0.01966952	0.004481095	26.36000	28.25238	177.48571	2133.6190
[4,]	0.01974820	0.003024686	14.09020	24.30380	91.35420	608.3280
[5,]	0.02132259	0.003772444	17.57000	26.28593	116.97037	943.2407
[6,]	0.01859606	0.003402970	19.99364	28.70152	132.24242	1235.3333
[7,]	0.01889900	0.003560400	31.29000	30.59500	211.13000	3038.0000
[8,]	0.02177214	0.003373002	12.87095	24.82369	83.61012	506.2679
[9,]	0.01658682	0.003255932	15.09295	24.73545	99.29205	699.3818
[10,]	0.02159444	0.004074167	22.99056	29.35000	153.50278	1611.7500
smoothness_worst compactness_worst concavity_worst concave.points_worst symmetry_worst						
[1,]	0.1327040	0.1653631	0.1525696	0.05311673	0.2701782	
[2,]	0.1318532	0.2806205	0.2994221	0.12411289	0.2899368	
[3,]	0.1471571	0.4341190	0.5712667	0.22855714	0.3230952	
[4,]	0.1224558	0.1953282	0.1832081	0.07678162	0.2786300	
[5,]	0.1364407	0.3411059	0.4125333	0.15266778	0.3091852	

```
[6,] 0.1414200 0.3152382 0.3578970 0.16160424 0.3182273
[7,] 0.1384500 0.3477100 0.4724400 0.22675000 0.2663900
[8,] 0.1270945 0.1838368 0.1591179 0.07442024 0.2761167
[9,] 0.1258345 0.2524100 0.2448639 0.10462295 0.2799136
[10,] 0.1381917 0.3562083 0.4480861 0.18618333 0.3167528
```

fractal\_dimension\_worst

```
[1,] 0.08602382
[2,] 0.08531921
[3,] 0.09316524
[4,] 0.07747180
[5,] 0.08985556
[6,] 0.08462576
[7,] 0.07961900
[8,] 0.07917964
[9,] 0.08435545
[10,] 0.08689722
```

Rattle timestamp: 2018-11-02 17:08:11 tsraj

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General cluster statistics:

\$n

```
[1] 398
```

## Cluster Dendrogram CancerData.csv

Rattle 2018-Nov-02 17:08:05 tsraj

