

Kaggle Code

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7/28/2021

Loading in Data

```
library(readr)
Train.Data <- read_csv("~/Desktop/Stats 101C/BC Train.csv")
```

```
## Parsed with column specification:
## cols(
##   .default = col_double(),
##   diagnosis = col_character(),
##   age = col_character(),
##   menopause = col_character(),
##   inv.nodes = col_character(),
##   node.caps = col_character(),
##   breast = col_character(),
##   breast.quad = col_character(),
##   irradiat = col_character(),
##   Class = col_character()
## )

## See spec(...) for full column specifications.
```

```
Test.Data <- read_csv("~/Desktop/Stats 101C/BC Test NoY.csv")
```

```
## Parsed with column specification:
## cols(
##   .default = col_double(),
##   age = col_character(),
##   menopause = col_character(),
##   inv.nodes = col_character(),
##   node.caps = col_character(),
##   breast = col_character(),
##   breast.quad = col_character(),
##   irradiat = col_character(),
##   Class = col_character()
## )

## See spec(...) for full column specifications.
```

Getting Rid of NA's

```
Train.Data <- na.omit(Train.Data)
```

Testing a GLM Model

```
Train.t <- Train.Data[, -c(1)]
Model3 <- glm(as.factor(diagnosis) ~ ., family = "binomial", data=Train.t)

summary(Model3)
```

```
##
## Call:
## glm(formula = as.factor(diagnosis) ~ ., family = "binomial",
##      data = Train.t)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.5993  -0.9373  -0.7421   1.2436   1.8745
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -1.211e+00  2.076e+00  -0.583  0.55989
## radius_mean      5.342e-02  2.261e-02   2.363  0.01814 *
## texture_mean    -1.227e-02  1.996e-02  -0.615  0.53852
## perimeter_mean   5.814e-03  3.333e-03   1.745  0.08107 .
## area_mean      -2.262e-04  2.132e-04  -1.061  0.28871
## smoothness_mean  6.449e+00  5.995e+00   1.076  0.28198
## compactness_mean 1.341e+00  1.495e+00   0.897  0.36974
## concavity_mean   6.467e-01  1.010e+00   0.640  0.52204
## concave.points_mean 3.442e+00  2.134e+00   1.613  0.10677
## symmetry_mean    6.140e-01  2.983e+00   0.206  0.83693
## fractal_dimension_mean -3.270e+01  1.195e+01  -2.736  0.00621 **
## radius_se        6.920e-02  2.565e-01   0.270  0.78732
## texture_se       2.953e-01  1.568e-01   1.884  0.05960 .
## perimeter_se    -3.939e-02  3.862e-02  -1.020  0.30765
## area_se        -2.338e-03  1.935e-03  -1.208  0.22711
## smoothness_se   -2.694e+00  3.083e+01  -0.087  0.93036
## compactness_se   5.513e-01  4.668e+00   0.118  0.90599
## concavity_se    -6.340e-02  2.774e+00  -0.023  0.98176
## concave.points_se -1.820e+01  1.424e+01  -1.278  0.20113
## symmetry_se     -5.648e+00  1.006e+01  -0.561  0.57454
## fractal_dimension_se 2.952e+01  3.839e+01   0.769  0.44185
## radius_worst    -1.620e-02  1.738e-02  -0.932  0.35129
## texture_worst   -2.068e-03  1.293e-02  -0.160  0.87296
## perimeter_worst -2.037e-03  2.727e-03  -0.747  0.45517
## area_worst      2.704e-04  1.515e-04   1.785  0.07424 .
## smoothness_worst 4.393e+00  3.481e+00   1.262  0.20694
## compactness_worst -1.697e-01  5.355e-01  -0.317  0.75134
```

```
## concavity_worst      3.675e-01  4.132e-01   0.890  0.37369
## concave.points_worst -6.232e-01  1.259e+00  -0.495  0.62044
## symmetry_worst      -9.124e-01  1.298e+00  -0.703  0.48199
## fractal_dimension_worst -2.821e+00  4.620e+00  -0.611  0.54141
## age30-39             8.029e-01  1.257e+00   0.639  0.52311
## age40-49             6.602e-01  1.251e+00   0.528  0.59780
## age50-59             7.720e-01  1.248e+00   0.619  0.53614
## age60-69             6.558e-01  1.259e+00   0.521  0.60238
## age70-79             6.228e-01  1.378e+00   0.452  0.65123
## menopause<40        2.232e-01  4.529e-01   0.493  0.62214
## menopausepremeno    -4.148e-01  1.692e-01  -2.451  0.01424 *
## inv.nodes11-Sep      8.030e-02  5.823e-01   0.138  0.89032
## inv.nodes14-Dec     -4.700e-01  1.306e+00  -0.360  0.71896
## inv.nodes15-17     -5.359e-01  6.137e-01  -0.873  0.38250
## inv.nodes24-26     -4.545e-01  7.260e-01  -0.626  0.53129
## inv.nodes5-Mar       1.791e-01  2.416e-01   0.741  0.45850
## inv.nodes8-Jun      -1.311e-01  3.218e-01  -0.407  0.68366
## node.capsyes        -1.640e-01  1.924e-01  -0.852  0.39394
## deg.malig          -1.868e-02  1.122e-01  -0.166  0.86782
## breastright        -1.632e-01  1.676e-01  -0.974  0.33010
## breast.quadleft_low  4.418e-01  3.783e-01   1.168  0.24284
## breast.quadleft_up   5.200e-01  3.800e-01   1.368  0.17124
## breast.quadright_low 4.993e-01  4.511e-01   1.107  0.26838
## breast.quadright_up  7.875e-01  4.380e-01   1.798  0.07216 .
## irradiatyes         2.903e-02  2.133e-01   0.136  0.89176
## Classrecurrence-events 1.749e-01  1.733e-01   1.009  0.31285
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##    Null deviance: 946.9  on 726  degrees of freedom
## Residual deviance: 897.8  on 674  degrees of freedom
## AIC: 1003.8
##
## Number of Fisher Scoring iterations: 4
```

Using AIC to Find a Better, Simpler Model

Using the step function, AIC, and in a backwards direction, we can get the number of variables down to only those that are significant.

```
step(Model3, direction = "backward")
```

```
## Start:  AIC=1003.8
## as.factor(diagnosis) ~ 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 +
##      age + menopause + inv.nodes + node.caps + deg.malig + breast +
##      breast.quad + irradiat + Class
##
##
##              Df Deviance      AIC
## - inv.nodes      6   900.04  994.04
## - age            5   898.75  994.75
## - breast.quad    4   901.34  999.34
## - concavity_se    1   897.80 1001.80
## - smoothness_se   1   897.80 1001.80
## - compactness_se  1   897.81 1001.81
## - irradiat        1   897.82 1001.82
## - texture_worst   1   897.82 1001.82
## - deg.malig       1   897.82 1001.82
## - symmetry_mean    1   897.84 1001.84
## - radius_se        1   897.87 1001.87
## - compactness_worst 1   897.90 1001.90
## - concave.points_worst 1  898.04 1002.04
## - symmetry_se      1   898.11 1002.11
## - fractal_dimension_worst 1  898.17 1002.17
## - texture_mean     1   898.18 1002.18
## - concavity_mean   1   898.20 1002.20
## - symmetry_worst   1   898.29 1002.29
## - perimeter_worst  1   898.36 1002.36
## - fractal_dimension_se 1  898.38 1002.38
## - node.caps        1   898.53 1002.53
## - concavity_worst  1   898.59 1002.59
## - compactness_mean 1   898.60 1002.60
## - radius_worst     1   898.67 1002.67
## - breast           1   898.75 1002.75
## - Class            1   898.81 1002.81
## - perimeter_se     1   898.88 1002.88
## - area_mean        1   898.94 1002.94
## - smoothness_mean  1   898.95 1002.95
## - area_se          1   899.33 1003.33
## - smoothness_worst 1   899.39 1003.39
## - concave.points_se 1   899.45 1003.45
## <none>              897.80 1003.80
## - concave.points_mean 1  900.39 1004.39
## - perimeter_mean    1  900.84 1004.84
## - area_worst        1  900.94 1004.94
## - texture_se        1  901.34 1005.34
## - menopause         2  904.67 1006.67
## - radius_mean       1  903.39 1007.39
## - fractal_dimension_mean 1  905.65 1009.65
##
## Step:  AIC=994.04
## as.factor(diagnosis) ~ 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 +
##      age + menopause + node.caps + deg.malig + breast + breast.quad +
##      irradiat + Class
##
##              Df Deviance      AIC
## - age              5    901.01  985.01
## - breast.quad       4    903.33  989.33
## - smoothness_se     1    900.04  992.04
## - concavity_se      1    900.04  992.04
## - compactness_se    1    900.05  992.05
## - irradiat          1    900.06  992.06
## - symmetry_mean     1    900.06  992.06
## - texture_worst     1    900.07  992.07
## - deg.malig         1    900.09  992.09
## - radius_se         1    900.13  992.13
## - compactness_worst 1    900.20  992.20
## - symmetry_se       1    900.28  992.28
## - concave.points_worst 1    900.33  992.33
## - texture_mean      1    900.36  992.36
## - fractal_dimension_worst 1    900.50  992.50
## - concavity_mean    1    900.52  992.52
## - symmetry_worst    1    900.59  992.59
## - perimeter_worst   1    900.59  992.59
## - fractal_dimension_se 1    900.61  992.61
## - node.caps         1    900.74  992.74
## - concavity_worst   1    900.76  992.76
## - radius_worst      1    900.76  992.76
## - compactness_mean  1    900.81  992.81
## - Class             1    900.90  992.90
## - breast            1    900.97  992.97
## - perimeter_se      1    901.04  993.04
## - area_mean         1    901.07  993.07
## - smoothness_mean   1    901.13  993.13
## - area_se           1    901.53  993.53
## - smoothness_worst  1    901.60  993.60
## - concave.points_se 1    901.66  993.66
## <none>              900.04  994.04
## - concave.points_mean 1    902.41  994.41
## - perimeter_mean    1    903.02  995.02
## - area_worst        1    903.03  995.03
## - texture_se        1    903.46  995.46
## - menopause         2    906.97  996.97
## - radius_mean       1    906.02  998.02
## - fractal_dimension_mean 1    908.08 1000.08
##
## Step:  AIC=985.01
## as.factor(diagnosis) ~ 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 +

```

```

##      menopause + node.caps + deg.malig + breast + breast.quad +
##      irradiat + Class
##
##              Df Deviance      AIC
## - breast.quad          4   904.43 980.43
## - concavity_se         1   901.01 983.01
## - smoothness_se        1   901.01 983.01
## - irradiat             1   901.02 983.02
## - compactness_se       1   901.02 983.02
## - symmetry_mean        1   901.02 983.02
## - texture_worst        1   901.04 983.04
## - deg.malig            1   901.04 983.04
## - radius_se            1   901.11 983.11
## - compactness_worst    1   901.13 983.13
## - symmetry_se          1   901.24 983.24
## - concave.points_worst 1   901.27 983.27
## - texture_mean         1   901.35 983.35
## - fractal_dimension_worst 1  901.36 983.36
## - symmetry_worst        1   901.48 983.48
## - concavity_mean       1   901.49 983.49
## - fractal_dimension_se  1   901.53 983.53
## - perimeter_worst      1   901.53 983.53
## - node.caps            1   901.60 983.60
## - radius_worst         1   901.69 983.69
## - compactness_mean     1   901.72 983.72
## - Class                1   901.74 983.74
## - concavity_worst      1   901.74 983.74
## - breast               1   901.94 983.94
## - perimeter_se         1   901.96 983.96
## - area_mean            1   902.02 984.02
## - smoothness_mean      1   902.08 984.08
## - area_se              1   902.51 984.51
## - concave.points_se    1   902.61 984.61
## - smoothness_worst     1   902.62 984.62
## <none>                  901.01 985.01
## - concave.points_mean  1   903.19 985.19
## - perimeter_mean       1   903.88 985.88
## - area_worst           1   904.02 986.02
## - texture_se           1   904.50 986.50
## - menopause            2   907.83 987.83
## - radius_mean          1   907.14 989.14
## - fractal_dimension_mean 1  909.02 991.02
##
## Step:  AIC=980.43
## as.factor(diagnosis) ~ 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 +
##      menopause + node.caps + deg.malig + breast + irradiat + Class
##

```

```

##                                Df Deviance    AIC
## - concavity_se                1   904.43 978.43
## - smoothness_se               1   904.44 978.44
## - irradiat                    1   904.46 978.46
## - texture_worst               1   904.47 978.47
## - compactness_se              1   904.47 978.47
## - symmetry_mean               1   904.48 978.48
## - deg.malig                   1   904.50 978.50
## - radius_se                   1   904.51 978.51
## - compactness_worst           1   904.57 978.57
## - symmetry_se                 1   904.67 978.67
## - texture_mean                1   904.73 978.73
## - concave.points_worst        1   904.74 978.74
## - radius_worst                1   904.76 978.76
## - fractal_dimension_worst      1   904.79 978.79
## - node.caps                   1   904.82 978.82
## - concavity_mean              1   904.92 978.92
## - symmetry_worst              1   904.94 978.94
## - perimeter_worst             1   905.00 979.00
## - fractal_dimension_se         1   905.13 979.13
## - Class                       1   905.21 979.21
## - compactness_mean            1   905.21 979.21
## - concavity_worst             1   905.38 979.38
## - breast                      1   905.38 979.38
## - area_mean                   1   905.51 979.51
## - perimeter_se                1   905.74 979.74
## - smoothness_mean             1   905.75 979.75
## - smoothness_worst            1   905.78 979.78
## - concave.points_se           1   905.99 979.99
## - area_se                     1   906.14 980.14
## <none>                        904.43 980.43
## - concave.points_mean         1   906.44 980.44
## - perimeter_mean              1   907.24 981.24
## - area_worst                  1   907.71 981.71
## - texture_se                  1   908.15 982.15
## - menopause                   2   910.56 982.56
## - radius_mean                 1   910.78 984.78
## - fractal_dimension_mean       1   912.25 986.25
##
## Step:  AIC=978.43
## as.factor(diagnosis) ~ 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 + 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 +
##   menopause + node.caps + deg.malig + breast + irradiat + Class
##
##                                Df Deviance    AIC
## - smoothness_se                1   904.44 976.44
## - irradiat                     1   904.46 976.46
## - texture_worst                 1   904.47 976.47

```

```

## - compactness_se      1  904.47 976.47
## - symmetry_mean      1  904.48 976.48
## - deg.malig          1  904.50 976.50
## - radius_se          1  904.51 976.51
## - compactness_worst  1  904.57 976.57
## - symmetry_se        1  904.67 976.67
## - texture_mean       1  904.73 976.73
## - concave.points_worst 1  904.74 976.74
## - radius_worst       1  904.76 976.76
## - fractal_dimension_worst 1 904.79 976.79
## - node.caps          1  904.82 976.82
## - concavity_mean     1  904.92 976.92
## - symmetry_worst     1  904.94 976.94
## - perimeter_worst    1  905.00 977.00
## - fractal_dimension_se 1 905.13 977.13
## - Class              1  905.21 977.21
## - compactness_mean   1  905.21 977.21
## - concavity_worst    1  905.38 977.38
## - breast             1  905.38 977.38
## - area_mean          1  905.51 977.51
## - perimeter_se       1  905.75 977.75
## - smoothness_mean    1  905.75 977.75
## - smoothness_worst   1  905.78 977.78
## - concave.points_se  1  905.99 977.99
## - area_se            1  906.14 978.14
## <none>                904.43 978.43
## - concave.points_mean 1  906.45 978.45
## - perimeter_mean     1  907.24 979.24
## - area_worst         1  907.75 979.75
## - texture_se         1  908.15 980.15
## - menopause          2  910.57 980.57
## - radius_mean        1  910.78 982.78
## - fractal_dimension_mean 1 912.30 984.30
##
## Step: AIC=976.44
## as.factor(diagnosis) ~ 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 + compactness_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 +
##   menopause + node.caps + deg.malig + breast + irradiat + Class
##
##               Df Deviance    AIC
## - irradiat      1  904.46 974.46
## - texture_worst  1  904.47 974.47
## - compactness_se 1  904.48 974.48
## - symmetry_mean  1  904.48 974.48
## - deg.malig      1  904.50 974.50
## - radius_se      1  904.52 974.52
## - compactness_worst 1 904.57 974.57
## - symmetry_se    1  904.68 974.68

```



```

## - texture_mean          1  904.73 974.73
## - concave.points_worst  1  904.75 974.75
## - radius_worst         1  904.77 974.77
## - fractal_dimension_worst 1  904.79 974.79
## - node.caps            1  904.82 974.82
## - concavity_mean       1  904.92 974.92
## - symmetry_worst       1  904.95 974.95
## - perimeter_worst      1  905.00 975.00
## - fractal_dimension_se  1  905.14 975.14
## - Class                1  905.22 975.22
## - compactness_mean     1  905.22 975.22
## - breast               1  905.38 975.38
## - concavity_worst      1  905.39 975.39
## - area_mean            1  905.52 975.52
## - perimeter_se         1  905.75 975.75
## - smoothness_mean      1  905.76 975.76
## - smoothness_worst     1  905.78 975.78
## - concave.points_se    1  906.01 976.01
## - area_se              1  906.14 976.14
## <none>                  904.44 976.44
## - concave.points_mean  1  906.46 976.46
## - perimeter_mean       1  907.24 977.24
## - area_worst           1  907.76 977.76
## - texture_se           1  908.15 978.15
## - menopause            2  910.59 978.59
## - radius_mean          1  910.78 980.78
## - fractal_dimension_mean 1  912.32 982.32
##
## Step:  AIC=974.46
## as.factor(diagnosis) ~ 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 + compactness_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 +
##   menopause + node.caps + deg.malig + breast + Class
##
##               Df Deviance    AIC
## - texture_worst      1  904.50 972.50
## - compactness_se     1  904.50 972.50
## - symmetry_mean      1  904.51 972.51
## - deg.malig          1  904.53 972.53
## - radius_se          1  904.54 972.54
## - compactness_worst  1  904.59 972.59
## - symmetry_se        1  904.69 972.69
## - texture_mean       1  904.75 972.75
## - concave.points_worst 1  904.79 972.79
## - radius_worst       1  904.80 972.80
## - fractal_dimension_worst 1  904.81 972.81
## - node.caps          1  904.84 972.84
## - concavity_mean     1  904.94 972.94
## - symmetry_worst     1  904.98 972.98

```

```

## - perimeter_worst      1  905.02 973.02
## - fractal_dimension_se 1  905.16 973.16
## - Class                1  905.25 973.25
## - compactness_mean     1  905.25 973.25
## - breast               1  905.40 973.40
## - concavity_worst      1  905.41 973.41
## - area_mean            1  905.55 973.55
## - perimeter_se         1  905.78 973.78
## - smoothness_mean      1  905.79 973.79
## - smoothness_worst     1  905.81 973.81
## - concave.points_se    1  906.09 974.09
## - area_se              1  906.19 974.19
## <none>                  904.46 974.46
## - concave.points_mean  1  906.49 974.49
## - perimeter_mean       1  907.26 975.26
## - area_worst           1  907.79 975.79
## - texture_se           1  908.20 976.20
## - menopause            2  910.63 976.63
## - radius_mean          1  910.79 978.79
## - fractal_dimension_mean 1  912.46 980.46
##
## Step: AIC=972.5
## as.factor(diagnosis) ~ 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 + compactness_se +
##   concave.points_se + symmetry_se + fractal_dimension_se +
##   radius_worst + perimeter_worst + area_worst + smoothness_worst +
##   compactness_worst + concavity_worst + concave.points_worst +
##   symmetry_worst + fractal_dimension_worst + menopause + node.caps +
##   deg.malig + breast + Class
##
##
##           Df Deviance    AIC
## - compactness_se      1  904.54 970.54
## - symmetry_mean        1  904.55 970.55
## - deg.malig            1  904.56 970.56
## - radius_se            1  904.57 970.57
## - compactness_worst    1  904.63 970.63
## - symmetry_se          1  904.73 970.73
## - texture_mean         1  904.80 970.80
## - fractal_dimension_worst 1  904.83 970.83
## - concave.points_worst 1  904.83 970.83
## - radius_worst         1  904.85 970.85
## - node.caps            1  904.88 970.88
## - concavity_mean       1  904.98 970.98
## - symmetry_worst       1  905.01 971.01
## - perimeter_worst      1  905.05 971.05
## - fractal_dimension_se 1  905.20 971.20
## - Class                1  905.28 971.28
## - compactness_mean     1  905.29 971.29
## - breast               1  905.42 971.42
## - concavity_worst      1  905.46 971.46
## - area_mean            1  905.59 971.59
## - perimeter_se         1  905.85 971.85

```

```

## - smoothness_mean      1  905.85 971.85
## - smoothness_worst     1  905.86 971.86
## - concave.points_se    1  906.11 972.11
## - area_se              1  906.20 972.20
## <none>                  904.50 972.50
## - concave.points_mean  1  906.51 972.51
## - perimeter_mean       1  907.29 973.29
## - area_worst           1  907.84 973.84
## - texture_se           1  908.29 974.29
## - menopause            2  910.66 974.66
## - radius_mean          1  910.89 976.89
## - fractal_dimension_mean 1  912.51 978.51
##
## Step: AIC=970.54
## as.factor(diagnosis) ~ 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 + concave.points_se +
##   symmetry_se + fractal_dimension_se + radius_worst + perimeter_worst +
##   area_worst + smoothness_worst + compactness_worst + concavity_worst +
##   concave.points_worst + symmetry_worst + fractal_dimension_worst +
##   menopause + node.caps + deg.malig + breast + Class
##
##
##           Df Deviance    AIC
## - symmetry_mean      1  904.58 968.58
## - deg.malig          1  904.60 968.60
## - radius_se          1  904.61 968.61
## - compactness_worst  1  904.67 968.67
## - symmetry_se        1  904.76 968.76
## - texture_mean       1  904.83 968.83
## - fractal_dimension_worst 1  904.85 968.85
## - concave.points_worst 1  904.87 968.87
## - radius_worst       1  904.88 968.88
## - node.caps          1  904.93 968.93
## - concavity_mean     1  905.03 969.03
## - symmetry_worst     1  905.04 969.04
## - perimeter_worst    1  905.11 969.11
## - fractal_dimension_se 1  905.22 969.22
## - Class              1  905.33 969.33
## - compactness_mean   1  905.33 969.33
## - breast             1  905.44 969.44
## - concavity_worst    1  905.48 969.48
## - area_mean          1  905.62 969.62
## - perimeter_se       1  905.85 969.85
## - smoothness_mean    1  905.87 969.87
## - smoothness_worst   1  905.90 969.90
## - concave.points_se  1  906.13 970.13
## - area_se            1  906.24 970.24
## <none>                904.54 970.54
## - concave.points_mean 1  906.54 970.54
## - perimeter_mean     1  907.33 971.33
## - area_worst         1  907.89 971.89
## - texture_se         1  908.31 972.31
## - menopause          2  910.75 972.75

```

```

## - radius_mean          1    910.90 974.90
## - fractal_dimension_mean 1    912.54 976.54
##
## Step: AIC=968.58
## as.factor(diagnosis) ~ radius_mean + texture_mean + perimeter_mean +
##   area_mean + smoothness_mean + compactness_mean + concavity_mean +
##   concave.points_mean + fractal_dimension_mean + radius_se +
##   texture_se + perimeter_se + area_se + concave.points_se +
##   symmetry_se + fractal_dimension_se + radius_worst + perimeter_worst +
##   area_worst + smoothness_worst + compactness_worst + concavity_worst +
##   concave.points_worst + symmetry_worst + fractal_dimension_worst +
##   menopause + node.caps + deg.malig + breast + Class
##
##
##              Df Deviance    AIC
## - deg.malig      1    904.65 966.65
## - radius_se      1    904.65 966.65
## - compactness_worst 1    904.71 966.71
## - symmetry_se    1    904.80 966.80
## - texture_mean   1    904.87 966.87
## - fractal_dimension_worst 1  904.91 966.91
## - concave.points_worst 1  904.92 966.92
## - radius_worst   1    904.94 966.94
## - node.caps      1    904.99 966.99
## - symmetry_worst 1    905.09 967.09
## - concavity_mean 1    905.09 967.09
## - perimeter_worst 1    905.16 967.16
## - fractal_dimension_se 1  905.25 967.25
## - Class          1    905.35 967.35
## - compactness_mean 1  905.37 967.37
## - breast         1    905.48 967.48
## - concavity_worst 1    905.54 967.54
## - area_mean      1    905.68 967.68
## - perimeter_se   1    905.86 967.86
## - smoothness_mean 1    905.92 967.92
## - smoothness_worst 1    905.95 967.95
## - concave.points_se 1  906.16 968.16
## - area_se        1    906.29 968.29
## <none>           904.58 968.58
## - concave.points_mean 1  906.59 968.59
## - perimeter_mean 1    907.38 969.38
## - area_worst     1    907.97 969.97
## - texture_se     1    908.37 970.37
## - menopause      2    910.77 970.77
## - radius_mean    1    910.92 972.92
## - fractal_dimension_mean 1  912.61 974.61
##
## Step: AIC=966.65
## as.factor(diagnosis) ~ radius_mean + texture_mean + perimeter_mean +
##   area_mean + smoothness_mean + compactness_mean + concavity_mean +
##   concave.points_mean + fractal_dimension_mean + radius_se +
##   texture_se + perimeter_se + area_se + concave.points_se +
##   symmetry_se + fractal_dimension_se + radius_worst + perimeter_worst +
##   area_worst + smoothness_worst + compactness_worst + concavity_worst +
##   concave.points_worst + symmetry_worst + fractal_dimension_worst +

```

```

##      menopause + node.caps + breast + Class
##
##              Df Deviance    AIC
## - radius_se      1   904.72 964.72
## - compactness_worst 1   904.79 964.79
## - symmetry_se     1   904.87 964.87
## - texture_mean    1   904.94 964.94
## - concave.points_worst 1  904.98 964.98
## - fractal_dimension_worst 1 904.99 964.99
## - radius_worst    1  905.02 965.02
## - node.caps       1  905.05 965.05
## - symmetry_worst  1  905.15 965.15
## - concavity_mean  1  905.18 965.18
## - perimeter_worst 1  905.21 965.21
## - fractal_dimension_se 1 905.33 965.33
## - Class          1  905.42 965.42
## - compactness_mean 1  905.44 965.44
## - breast         1  905.56 965.56
## - concavity_worst 1  905.60 965.60
## - area_mean      1  905.72 965.72
## - perimeter_se   1  905.89 965.89
## - smoothness_mean 1  906.00 966.00
## - smoothness_worst 1  906.00 966.00
## - concave.points_se 1  906.22 966.22
## - area_se        1  906.34 966.34
## <none>           904.65 966.65
## - concave.points_mean 1  906.66 966.66
## - perimeter_mean  1  907.52 967.52
## - area_worst      1  908.00 968.00
## - texture_se      1  908.41 968.41
## - menopause       2  910.92 968.92
## - radius_mean     1  911.02 971.02
## - fractal_dimension_mean 1 912.73 972.73
##
## Step:  AIC=964.72
## as.factor(diagnosis) ~ radius_mean + texture_mean + perimeter_mean +
##      area_mean + smoothness_mean + compactness_mean + concavity_mean +
##      concave.points_mean + fractal_dimension_mean + texture_se +
##      perimeter_se + area_se + concave.points_se + symmetry_se +
##      fractal_dimension_se + radius_worst + perimeter_worst + area_worst +
##      smoothness_worst + compactness_worst + concavity_worst +
##      concave.points_worst + symmetry_worst + fractal_dimension_worst +
##      menopause + node.caps + breast + Class
##
##              Df Deviance    AIC
## - compactness_worst 1   904.85 962.85
## - symmetry_se       1   904.94 962.94
## - texture_mean      1   905.02 963.02
## - fractal_dimension_worst 1  905.03 963.03
## - concave.points_worst 1  905.05 963.05
## - radius_worst      1  905.10 963.10
## - node.caps         1  905.11 963.11
## - symmetry_worst    1  905.23 963.23
## - concavity_mean    1  905.28 963.28

```

```

## - perimeter_worst      1  905.28 963.28
## - fractal_dimension_se 1  905.40 963.40
## - compactness_mean     1  905.50 963.50
## - Class                1  905.50 963.50
## - breast               1  905.64 963.64
## - concavity_worst      1  905.66 963.66
## - area_mean            1  905.79 963.79
## - perimeter_se         1  905.95 963.95
## - smoothness_mean      1  906.05 964.05
## - smoothness_worst     1  906.06 964.06
## - concave.points_se    1  906.25 964.25
## - area_se              1  906.38 964.38
## - concave.points_mean  1  906.70 964.70
## <none>                  904.72 964.72
## - perimeter_mean       1  907.60 965.60
## - area_worst           1  908.04 966.04
## - texture_se           1  908.47 966.47
## - menopause            2  910.93 966.93
## - radius_mean          1  911.12 969.12
## - fractal_dimension_mean 1  912.81 970.81
##
## Step: AIC=962.85
## as.factor(diagnosis) ~ radius_mean + texture_mean + perimeter_mean +
##   area_mean + smoothness_mean + compactness_mean + concavity_mean +
##   concave.points_mean + fractal_dimension_mean + texture_se +
##   perimeter_se + area_se + concave.points_se + symmetry_se +
##   fractal_dimension_se + radius_worst + perimeter_worst + area_worst +
##   smoothness_worst + concavity_worst + concave.points_worst +
##   symmetry_worst + fractal_dimension_worst + menopause + node.caps +
##   breast + Class
##
##
##           Df Deviance    AIC
## - symmetry_se      1  905.07 961.07
## - texture_mean      1  905.12 961.12
## - fractal_dimension_worst 1  905.19 961.19
## - concave.points_worst 1  905.21 961.21
## - node.caps         1  905.24 961.24
## - radius_worst      1  905.25 961.25
## - symmetry_worst     1  905.36 961.36
## - concavity_mean     1  905.45 961.45
## - perimeter_worst    1  905.48 961.48
## - fractal_dimension_se 1  905.51 961.51
## - compactness_mean   1  905.64 961.64
## - Class             1  905.64 961.64
## - concavity_worst    1  905.85 961.85
## - breast            1  905.89 961.89
## - area_mean          1  905.96 961.96
## - perimeter_se       1  906.06 962.06
## - smoothness_mean    1  906.20 962.20
## - smoothness_worst   1  906.23 962.23
## - concave.points_se  1  906.34 962.34
## - area_se            1  906.51 962.51
## - concave.points_mean 1  906.85 962.85
## <none>               904.85 962.85

```

```

## - perimeter_mean          1  907.71 963.71
## - area_worst              1  908.12 964.12
## - texture_se              1  908.53 964.53
## - menopause               2  911.11 965.11
## - radius_mean             1  911.35 967.35
## - fractal_dimension_mean  1  912.89 968.89
##
## Step: AIC=961.07
## as.factor(diagnosis) ~ radius_mean + texture_mean + perimeter_mean +
##   area_mean + smoothness_mean + compactness_mean + concavity_mean +
##   concave.points_mean + fractal_dimension_mean + texture_se +
##   perimeter_se + area_se + concave.points_se + fractal_dimension_se +
##   radius_worst + perimeter_worst + area_worst + smoothness_worst +
##   concavity_worst + concave.points_worst + symmetry_worst +
##   fractal_dimension_worst + menopause + node.caps + breast +
##   Class
##
##               Df Deviance    AIC
## - texture_mean          1  905.34 959.34
## - fractal_dimension_worst 1  905.40 959.40
## - concave.points_worst   1  905.41 959.41
## - node.caps              1  905.45 959.45
## - radius_worst           1  905.48 959.48
## - symmetry_worst         1  905.56 959.56
## - concavity_mean         1  905.64 959.64
## - fractal_dimension_se   1  905.69 959.69
## - perimeter_worst        1  905.71 959.71
## - Class                  1  905.87 959.87
## - compactness_mean       1  905.91 959.91
## - breast                 1  906.04 960.04
## - concavity_worst        1  906.05 960.05
## - area_mean              1  906.16 960.16
## - perimeter_se           1  906.31 960.31
## - smoothness_worst       1  906.44 960.44
## - smoothness_mean        1  906.47 960.47
## - concave.points_se      1  906.51 960.51
## - area_se                1  906.72 960.72
## - concave.points_mean    1  907.06 961.06
## <none>                   905.07 961.07
## - perimeter_mean         1  907.85 961.85
## - area_worst             1  908.40 962.40
## - texture_se             1  908.67 962.67
## - menopause              2  911.22 963.22
## - radius_mean            1  911.48 965.48
## - fractal_dimension_mean  1  912.92 966.92
##
## Step: AIC=959.34
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concavity_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + radius_worst +
##   perimeter_worst + area_worst + smoothness_worst + concavity_worst +
##   concave.points_worst + symmetry_worst + fractal_dimension_worst +
##   menopause + node.caps + breast + Class

```

```

##
##              Df Deviance    AIC
## - fractal_dimension_worst 1  905.67 957.67
## - concave.points_worst    1  905.71 957.71
## - node.caps                1  905.72 957.72
## - radius_worst             1  905.77 957.77
## - symmetry_worst           1  905.82 957.82
## - fractal_dimension_se     1  905.94 957.94
## - concavity_mean           1  905.94 957.94
## - perimeter_worst          1  905.99 957.99
## - Class                    1  906.17 958.17
## - compactness_mean         1  906.21 958.21
## - concavity_worst          1  906.29 958.29
## - area_mean                1  906.40 958.40
## - breast                   1  906.42 958.42
## - perimeter_se             1  906.61 958.61
## - smoothness_worst         1  906.70 958.70
## - concave.points_se        1  906.72 958.72
## - smoothness_mean          1  906.76 958.76
## - area_se                  1  906.96 958.96
## - concave.points_mean      1  907.29 959.29
## <none>                     905.34 959.34
## - perimeter_mean           1  908.06 960.06
## - area_worst               1  908.58 960.58
## - texture_se               1  908.86 960.86
## - menopause                2  911.49 961.49
## - radius_mean              1  911.55 963.55
## - fractal_dimension_mean    1  913.00 965.00
##
## Step:  AIC=957.67
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concavity_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + radius_worst +
##   perimeter_worst + area_worst + smoothness_worst + concavity_worst +
##   concave.points_worst + symmetry_worst + menopause + node.caps +
##   breast + Class
##
##              Df Deviance    AIC
## - node.caps                1  906.05 956.05
## - concave.points_worst      1  906.07 956.07
## - radius_worst              1  906.10 956.10
## - symmetry_worst            1  906.14 956.14
## - fractal_dimension_se      1  906.27 956.27
## - concavity_mean            1  906.31 956.31
## - perimeter_worst           1  906.32 956.32
## - Class                    1  906.48 956.48
## - compactness_mean          1  906.60 956.60
## - concavity_worst           1  906.61 956.61
## - area_mean                 1  906.72 956.72
## - breast                    1  906.74 956.74
## - perimeter_se              1  906.93 956.93
## - smoothness_worst          1  907.00 957.00
## - concave.points_se         1  907.03 957.03

```



```

## - smoothness_mean      1   907.09 957.09
## - area_se              1   907.22 957.22
## - concave.points_mean  1   907.57 957.57
## <none>                  905.67 957.67
## - perimeter_mean       1   908.37 958.37
## - area_worst           1   908.95 958.95
## - texture_se           1   909.16 959.16
## - menopause            2   911.69 959.69
## - radius_mean          1   911.82 961.82
## - fractal_dimension_mean 1   913.20 963.20
##
## Step: AIC=956.05
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concavity_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + radius_worst +
##   perimeter_worst + area_worst + smoothness_worst + concavity_worst +
##   concave.points_worst + symmetry_worst + menopause + breast +
##   Class
##
##           Df Deviance   AIC
## - concave.points_worst  1   906.43 954.43
## - radius_worst         1   906.47 954.47
## - symmetry_worst       1   906.52 954.52
## - perimeter_worst      1   906.64 954.64
## - concavity_mean       1   906.67 954.67
## - fractal_dimension_se  1   906.67 954.67
## - Class                1   906.86 954.86
## - compactness_mean     1   906.97 954.97
## - concavity_worst      1   907.06 955.06
## - area_mean            1   907.10 955.10
## - breast               1   907.10 955.10
## - smoothness_worst     1   907.33 955.33
## - perimeter_se         1   907.35 955.35
## - concave.points_se    1   907.37 955.37
## - smoothness_mean      1   907.41 955.41
## - area_se              1   907.54 955.54
## - concave.points_mean  1   907.94 955.94
## <none>                  906.05 956.05
## - perimeter_mean       1   908.70 956.70
## - area_worst           1   909.38 957.38
## - texture_se           1   909.50 957.50
## - menopause            2   912.16 958.16
## - radius_mean          1   912.36 960.36
## - fractal_dimension_mean 1   913.57 961.57
##
## Step: AIC=954.43
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concavity_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + radius_worst +
##   perimeter_worst + area_worst + smoothness_worst + concavity_worst +
##   symmetry_worst + menopause + breast + Class
##

```

```

##          Df Deviance    AIC
## - symmetry_worst      1   906.84 952.84
## - radius_worst        1   906.86 952.86
## - perimeter_worst     1   907.03 953.03
## - concavity_mean      1   907.05 953.05
## - fractal_dimension_se 1   907.08 953.08
## - Class               1   907.24 953.24
## - compactness_mean    1   907.39 953.39
## - concavity_worst     1   907.39 953.39
## - breast             1   907.40 953.40
## - area_mean          1   907.47 953.47
## - smoothness_mean     1   907.72 953.72
## - smoothness_worst    1   907.72 953.72
## - concave.points_se   1   907.73 953.73
## - perimeter_se        1   907.73 953.73
## - area_se            1   907.90 953.90
## - concave.points_mean 1   908.28 954.28
## <none>                906.43 954.43
## - perimeter_mean      1   909.01 955.01
## - area_worst          1   909.79 955.79
## - texture_se          1   909.93 955.93
## - menopause           2   912.52 956.52
## - radius_mean         1   912.60 958.60
## - fractal_dimension_mean 1  913.93 959.93
##
## Step:  AIC=952.84
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concavity_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + radius_worst +
##   perimeter_worst + area_worst + smoothness_worst + concavity_worst +
##   menopause + breast + Class
##
##          Df Deviance    AIC
## - radius_worst      1   907.40 951.40
## - perimeter_worst    1   907.45 951.45
## - concavity_mean     1   907.48 951.48
## - fractal_dimension_se 1   907.51 951.51
## - Class             1   907.58 951.58
## - concavity_worst    1   907.78 951.78
## - compactness_mean   1   907.82 951.82
## - breast            1   907.84 951.84
## - area_mean          1   907.89 951.89
## - smoothness_mean    1   908.12 952.12
## - concave.points_se  1   908.12 952.12
## - perimeter_se       1   908.13 952.13
## - smoothness_worst   1   908.15 952.15
## - area_se           1   908.29 952.29
## - concave.points_mean 1   908.69 952.69
## <none>              906.84 952.84
## - perimeter_mean     1   909.30 953.30
## - area_worst         1   910.15 954.15
## - texture_se         1   910.36 954.36
## - menopause          2   912.69 954.69

```

```

## - radius_mean          1   912.91 956.91
## - fractal_dimension_mean 1   914.33 958.33
##
## Step: AIC=951.4
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concavity_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + perimeter_worst +
##   area_worst + smoothness_worst + concavity_worst + menopause +
##   breast + Class
##
##
##           Df Deviance    AIC
## - perimeter_worst      1   907.94 949.94
## - fractal_dimension_se  1   908.10 950.10
## - concavity_mean        1   908.12 950.12
## - Class                  1   908.15 950.15
## - concavity_worst       1   908.27 950.27
## - compactness_mean      1   908.32 950.32
## - area_mean             1   908.39 950.39
## - breast                1   908.41 950.41
## - concave.points_se     1   908.63 950.63
## - smoothness_mean       1   908.64 950.64
## - perimeter_se          1   908.66 950.66
## - smoothness_worst      1   908.72 950.72
## - area_se               1   908.76 950.76
## - concave.points_mean   1   909.16 951.16
## <none>                   907.40 951.40
## - perimeter_mean        1   909.70 951.70
## - texture_se            1   910.97 952.97
## - area_worst            1   911.01 953.01
## - menopause              2   913.40 953.40
## - radius_mean           1   913.62 955.62
## - fractal_dimension_mean 1   914.72 956.72
##
## Step: AIC=949.94
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concavity_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + area_worst + smoothness_worst +
##   concavity_worst + menopause + breast + Class
##
##
##           Df Deviance    AIC
## - concavity_mean        1   908.60 948.60
## - fractal_dimension_se  1   908.70 948.70
## - Class                  1   908.70 948.70
## - concavity_worst       1   908.86 948.86
## - compactness_mean      1   908.87 948.87
## - area_mean             1   908.89 948.89
## - breast                1   909.04 949.04
## - smoothness_mean       1   909.18 949.18
## - perimeter_se          1   909.23 949.23
## - smoothness_worst      1   909.23 949.23
## - area_se               1   909.24 949.24
## - concave.points_se     1   909.26 949.26

```

```

## - concave.points_mean      1   909.69 949.69
## <none>                      907.94 949.94
## - perimeter_mean          1   910.25 950.25
## - area_worst              1   911.55 951.55
## - texture_se              1   911.61 951.61
## - menopause               2   913.97 951.97
## - radius_mean             1   914.42 954.42
## - fractal_dimension_mean  1   915.18 955.18
##
## Step:  AIC=948.6
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + area_worst + smoothness_worst +
##   concavity_worst + menopause + breast + Class
##
##               Df Deviance    AIC
## - Class        1   909.35 947.35
## - fractal_dimension_se  1   909.36 947.36
## - concavity_worst      1   909.49 947.49
## - compactness_mean     1   909.53 947.53
## - area_mean           1   909.53 947.53
## - breast              1   909.56 947.56
## - smoothness_mean     1   909.75 947.75
## - smoothness_worst    1   909.84 947.84
## - concave.points_se   1   909.93 947.93
## - perimeter_se        1   909.96 947.96
## - area_se             1   909.97 947.97
## - concave.points_mean  1   910.43 948.43
## <none>                908.60 948.60
## - perimeter_mean      1   910.79 948.79
## - area_worst          1   912.22 950.22
## - texture_se          1   912.41 950.41
## - menopause           2   914.54 950.54
## - radius_mean         1   915.04 953.04
## - fractal_dimension_mean 1   915.72 953.72
##
## Step:  AIC=947.35
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + fractal_dimension_se + area_worst + smoothness_worst +
##   concavity_worst + menopause + breast
##
##               Df Deviance    AIC
## - fractal_dimension_se  1   910.11 946.11
## - compactness_mean     1   910.17 946.17
## - concavity_worst      1   910.28 946.28
## - area_mean           1   910.29 946.29
## - breast              1   910.38 946.38
## - smoothness_mean     1   910.42 946.42
## - area_se             1   910.56 946.56
## - smoothness_worst    1   910.60 946.60
## - perimeter_se        1   910.64 946.64

```

```

## - concave.points_se      1   910.80 946.80
## - concave.points_mean    1   911.29 947.29
## - perimeter_mean         1   911.33 947.33
## <none>                    909.35 947.35
## - area_worst             1   912.66 948.66
## - menopause              2   915.30 949.30
## - texture_se             1   913.32 949.32
## - radius_mean            1   915.71 951.71
## - fractal_dimension_mean  1   916.48 952.48
##
## Step:  AIC=946.11
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + compactness_mean + concave.points_mean +
##   fractal_dimension_mean + texture_se + perimeter_se + area_se +
##   concave.points_se + area_worst + smoothness_worst + concavity_worst +
##   menopause + breast
##
##               Df Deviance    AIC
## - compactness_mean      1   910.93 944.93
## - concavity_worst       1   910.93 944.93
## - area_mean             1   911.02 945.02
## - smoothness_mean       1   911.14 945.14
## - breast                1   911.15 945.15
## - smoothness_worst      1   911.30 945.30
## - area_se               1   911.30 945.30
## - perimeter_se          1   911.36 945.36
## - concave.points_se     1   911.49 945.49
## - concave.points_mean   1   912.01 946.01
## <none>                  910.11 946.11
## - perimeter_mean        1   912.11 946.11
## - area_worst            1   913.45 947.45
## - menopause             2   915.80 947.80
## - texture_se            1   914.33 948.33
## - radius_mean           1   916.32 950.32
## - fractal_dimension_mean 1   917.03 951.03
##
## Step:  AIC=944.93
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + concave.points_mean + fractal_dimension_mean +
##   texture_se + perimeter_se + area_se + concave.points_se +
##   area_worst + smoothness_worst + concavity_worst + menopause +
##   breast
##
##               Df Deviance    AIC
## - concavity_worst       1   911.76 943.76
## - area_mean             1   911.81 943.81
## - smoothness_mean       1   911.97 943.97
## - breast                1   912.00 944.00
## - smoothness_worst      1   912.12 944.12
## - area_se               1   912.16 944.16
## - perimeter_se          1   912.24 944.24
## - concave.points_se     1   912.32 944.32
## - concave.points_mean   1   912.75 944.75
## <none>                  910.93 944.93

```

```

## - perimeter_mean          1    912.98 944.98
## - area_worst              1    914.22 946.22
## - menopause               2    916.71 946.71
## - texture_se              1    915.31 947.31
## - radius_mean             1    916.92 948.92
## - fractal_dimension_mean  1    917.80 949.80
##
## Step: AIC=943.76
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + area_mean +
##   smoothness_mean + concave.points_mean + fractal_dimension_mean +
##   texture_se + perimeter_se + area_se + concave.points_se +
##   area_worst + smoothness_worst + menopause + breast
##
##               Df Deviance    AIC
## - area_mean          1    912.70 942.70
## - smoothness_mean     1    912.79 942.79
## - smoothness_worst    1    912.82 942.82
## - breast              1    912.88 942.88
## - area_se             1    913.08 943.08
## - concave.points_se   1    913.18 943.18
## - perimeter_se        1    913.23 943.23
## - concave.points_mean 1    913.42 943.42
## <none>                911.76 943.76
## - perimeter_mean      1    913.92 943.92
## - area_worst          1    914.92 944.92
## - menopause           2    917.83 945.83
## - texture_se          1    916.14 946.14
## - radius_mean         1    917.47 947.47
## - fractal_dimension_mean 1    918.57 948.57
##
## Step: AIC=942.7
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + smoothness_mean +
##   concave.points_mean + fractal_dimension_mean + texture_se +
##   perimeter_se + area_se + concave.points_se + area_worst +
##   smoothness_worst + menopause + breast
##
##               Df Deviance    AIC
## - smoothness_mean     1    913.65 941.65
## - breast              1    913.75 941.75
## - smoothness_worst    1    914.00 942.00
## - perimeter_se        1    914.08 942.08
## - area_se             1    914.09 942.09
## - concave.points_se   1    914.12 942.12
## - concave.points_mean 1    914.45 942.45
## <none>                912.70 942.70
## - perimeter_mean      1    914.88 942.88
## - area_worst          1    915.76 943.76
## - menopause           2    918.68 944.68
## - texture_se          1    917.19 945.19
## - radius_mean         1    918.53 946.53
## - fractal_dimension_mean 1    919.42 947.42
##
## Step: AIC=941.65
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + concave.points_mean +

```

```

## fractal_dimension_mean + texture_se + perimeter_se + area_se +
## concave.points_se + area_worst + smoothness_worst + menopause +
## breast
##
## Df Deviance AIC
## - breast 1 914.66 940.66
## - area_se 1 914.92 940.92
## - perimeter_se 1 914.95 940.95
## - smoothness_worst 1 914.95 940.95
## - concave.points_se 1 914.99 940.99
## - concave.points_mean 1 915.34 941.34
## <none> 913.65 941.65
## - perimeter_mean 1 915.84 941.84
## - area_worst 1 916.82 942.82
## - menopause 2 919.77 943.77
## - texture_se 1 918.38 944.38
## - radius_mean 1 919.27 945.27
## - fractal_dimension_mean 1 920.40 946.40
##
## Step: AIC=940.66
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + concave.points_mean +
## fractal_dimension_mean + texture_se + perimeter_se + area_se +
## concave.points_se + area_worst + smoothness_worst + menopause
##
## Df Deviance AIC
## - area_se 1 915.87 939.87
## - smoothness_worst 1 915.89 939.89
## - perimeter_se 1 916.03 940.03
## - concave.points_se 1 916.07 940.07
## - concave.points_mean 1 916.38 940.38
## <none> 914.66 940.66
## - perimeter_mean 1 916.75 940.75
## - area_worst 1 917.94 941.94
## - menopause 2 920.65 942.65
## - texture_se 1 919.41 943.41
## - radius_mean 1 919.96 943.96
## - fractal_dimension_mean 1 921.30 945.30
##
## Step: AIC=939.87
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + concave.points_mean +
## fractal_dimension_mean + texture_se + perimeter_se + concave.points_se +
## area_worst + smoothness_worst + menopause
##
## Df Deviance AIC
## - smoothness_worst 1 917.04 939.04
## - perimeter_se 1 917.21 939.21
## - concave.points_se 1 917.35 939.35
## - concave.points_mean 1 917.50 939.50
## <none> 915.87 939.87
## - perimeter_mean 1 917.88 939.88
## - area_worst 1 918.85 940.85
## - menopause 2 921.74 941.74
## - texture_se 1 920.51 942.51
## - radius_mean 1 920.87 942.87

```

```

## - fractal_dimension_mean 1 922.53 944.53
##
## Step: AIC=939.04
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + concave.points_mean +
## fractal_dimension_mean + texture_se + perimeter_se + concave.points_se +
## area_worst + menopause
##
## Df Deviance AIC
## - concave.points_se 1 918.36 938.36
## - concave.points_mean 1 918.46 938.46
## - perimeter_se 1 918.47 938.47
## - perimeter_mean 1 918.99 938.99
## <none> 917.04 939.04
## - area_worst 1 919.81 939.81
## - menopause 2 923.04 941.04
## - radius_mean 1 921.77 941.77
## - texture_se 1 921.78 941.78
## - fractal_dimension_mean 1 923.54 943.54
##
## Step: AIC=938.36
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + concave.points_mean +
## fractal_dimension_mean + texture_se + perimeter_se + area_worst +
## menopause
##
## Df Deviance AIC
## - perimeter_se 1 919.79 937.79
## - concave.points_mean 1 919.95 937.95
## <none> 918.36 938.36
## - perimeter_mean 1 920.52 938.52
## - area_worst 1 921.15 939.15
## - menopause 2 924.41 940.41
## - radius_mean 1 922.89 940.89
## - texture_se 1 923.07 941.07
## - fractal_dimension_mean 1 924.95 942.95
##
## Step: AIC=937.79
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + concave.points_mean +
## fractal_dimension_mean + texture_se + area_worst + menopause
##
## Df Deviance AIC
## - concave.points_mean 1 921.47 937.47
## <none> 919.79 937.79
## - perimeter_mean 1 921.88 937.88
## - area_worst 1 922.38 938.38
## - menopause 2 925.59 939.59
## - radius_mean 1 924.02 940.02
## - texture_se 1 924.63 940.63
## - fractal_dimension_mean 1 926.40 942.40
##
## Step: AIC=937.47
## as.factor(diagnosis) ~ radius_mean + perimeter_mean + fractal_dimension_mean +
## texture_se + area_worst + menopause
##
## Df Deviance AIC

```



```
## - perimeter_mean          1    923.26 937.26
## <none>                    921.47 937.47
## - area_worst              1    924.22 938.22
## - menopause               2    927.18 939.18
## - radius_mean             1    925.92 939.92
## - texture_se              1    926.30 940.30
## - fractal_dimension_mean  1    927.92 941.92
##
## Step: AIC=937.26
## as.factor(diagnosis) ~ radius_mean + fractal_dimension_mean +
## texture_se + area_worst + menopause
##
##              Df Deviance    AIC
## <none>                923.26 937.26
## - area_worst          1    926.03 938.03
## - menopause           2    929.08 939.08
## - radius_mean         1    927.86 939.86
## - texture_se           1    928.03 940.03
## - fractal_dimension_mean 1    929.92 941.92
##
##
## Call: glm(formula = as.factor(diagnosis) ~ radius_mean + fractal_dimension_mean +
## texture_se + area_worst + menopause, family = "binomial",
## data = Train.t)
##
## Coefficients:
## (Intercept)                radius_mean fractal_dimension_mean
##      9.968e-02              4.545e-02          -2.846e+01
## texture_se                area_worst      menopauselt40
##      3.250e-01              2.392e-04          2.129e-01
## menopausepremeno
##      -3.623e-01
##
## Degrees of Freedom: 726 Total (i.e. Null); 720 Residual
## Null Deviance:          946.9
## Residual Deviance: 923.3    AIC: 937.3
```

The step function helped to show us that the best variables to use in the final model are: radius_mean, fractal_dimension_mean, texture_se, area_worst, and menopause, so that is what we included in the final model.

Our Final Model

```
Model6 <- glm(as.factor(diagnosis) ~ radius_mean + fractal_dimension_mean + texture_se +
              area_worst + menopause, family = "binomial", data=Train.t)

summary(Model6)
```

```
##
## Call:
```

```
## glm(formula = as.factor(diagnosis) ~ radius_mean + fractal_dimension_mean +
##      texture_se + area_worst + menopause, family = "binomial",
##      data = Train.t)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.3309  -0.9489  -0.8006   1.3040   1.8660
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    9.968e-02  7.883e-01   0.126   0.8994
## radius_mean    4.545e-02  2.116e-02   2.148   0.0317 *
## fractal_dimension_mean -2.846e+01  1.129e+01  -2.522   0.0117 *
## texture_se     3.250e-01  1.486e-01   2.186   0.0288 *
## area_worst     2.392e-04  1.430e-04   1.672   0.0945 .
## menopauselt40   2.129e-01  4.321e-01   0.493   0.6222
## menopausepremeno -3.623e-01  1.617e-01  -2.240   0.0251 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 946.90  on 726  degrees of freedom
## Residual deviance: 923.26  on 720  degrees of freedom
## AIC: 937.26
##
## Number of Fisher Scoring iterations: 4
```

Creating the Kaggle Submission CSV File

```
Ob <- 1:321

diagnosis <- predict(Model6, Test.Data, type = "response")
diagnosis <- ifelse(diagnosis>=0.5, "M", "B")

KaggleProject <- data.frame(Ob, diagnosis)
write.csv(KaggleProject, file="Attempt2.csv", row.names= FALSE)
```