Computer Aided Detection and Diagnosis of Breast Cancer

Sanja Stanisic, Universita' degli Studi di Milano Bicocca, CdLM Data Science, n. 800409

17. April 2021.

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Data for analyze

```
library(data.table)
library(dplyr)

filePath <- "results-p03-full.csv"

all_dt <- fread(filePath, stringsAsFactors = TRUE, dec=".")

tibble(all_dt)

## # A tibble: 1,311 x 15
##     PatientId LeftOrRightBrest ImageView FullFilePath ROIFilePath
TestOrTraining
##     <fct>     <fct>            <fct>     <fct>        <fct>          <fct>
##  1 P_00038   LEFT             CC        ./data/CALC~ ./data/CAL~ test
##  2 P_00038   LEFT             MLO       ./data/CALC~ ./data/CAL~ test
##  3 P_00100   RIGHT            CC        ./data/CALC~ ./data/CAL~ test
##  4 P_00100   RIGHT            MLO       ./data/CALC~ ./data/CAL~ test
##  5 P_00132   LEFT             MLO       ./data/CALC~ ./data/CAL~ test
##  6 P_00127   RIGHT            CC        ./data/CALC~ ./data/CAL~ test
##  7 P_00127   RIGHT            MLO       ./data/CALC~ ./data/CAL~ test
##  8 P_00141   LEFT             CC        ./data/CALC~ ./data/CAL~ test
##  9 P_00150   RIGHT            MLO       ./data/CALC~ ./data/CAL~ test
## 10 P_00163   LEFT             CC        ./data/CALC~ ./data/CAL~ test
## # ... with 1,301 more rows, and 9 more variables: BrestDensity <int>,
## #   CalcType <fct>, CalcDistribution <fct>, Patology <fct>, LesionVolume
<dbl>,
## #   LesionArea <dbl>, SphericalDisproportion <dbl>, Sphericity <dbl>,
## #   SurfaceToVolumeRatio <dbl>
```

This dataset consists of 1333 instances with 15 features:

```
all_dt$PatientId <- NULL
all_dt$FullFilePath <- NULL
all_dt$ROIFilePath <- NULL

all_dt$LeftOrRightBrest <-  as.numeric(all_dt$LeftOrRightBrest)
all_dt$LeftOrRightBrest <- NULL
```

```r
all_dt$ImageView <- as.numeric(all_dt$ImageView)
all_dt$ImageView <- NULL

all_dt$TestOrTraining <- as.numeric(all_dt$TestOrTraining)
all_dt$TestOrTraining <- NULL

all_dt$BrestDensity <- NULL

all_dt$CalcType <- as.numeric(all_dt$CalcType)
all_dt$CalcType <- NULL

all_dt$CalcDistribution <- as.numeric(all_dt$CalcDistribution)
all_dt$CalcDistribution <- NULL

all_dt$Patology <- as.numeric(all_dt$Patology)

head(all_dt)

##     Patology LesionVolume LesionArea SphericalDisproportion Sphericity
## 1:         1      95.4425    2.34285            0.002040456   490.0866
## 2:         1      92.8025    2.29005            0.002015944   496.0455
## 3:         1      97.5525    2.42505            0.002050132   487.7734
## 4:         1      86.7525    2.16905            0.001900044   526.3037
## 5:         1     608.0525   13.38705            0.003201888   312.3157
## 6:         2     121.7725    2.96545            0.001938515   515.8589
##     SurfaceToVolumeRatio
## 1:           0.02454724
## 2:           0.02467660
## 3:           0.02485892
## 4:           0.02500274
## 5:           0.02201627
## 6:           0.02435238
```

Preprocessing

Firstly, data should be set in adequate format.

```r
all_dt_ex <- fread(filePath, stringsAsFactors = TRUE, dec=".")
all_dt_ex$PatientId <- NULL
all_dt_ex$FullFilePath <- NULL
all_dt_ex$ROIFilePath <- NULL

all_dt_ex$LeftOrRightBrest <-  as.numeric(all_dt_ex$LeftOrRightBrest)
all_dt_ex$LeftOrRightBrest <- cut(all_dt_ex$LeftOrRightBrest, 2,
labels=c('LEFT', 'RIGHT'))
all_dt_ex$LeftOrRightBrest <- NULL

all_dt_ex$ImageView <- as.numeric(all_dt_ex$ImageView)
all_dt_ex$ImageView <- cut(all_dt_ex$ImageView, 2, labels=c('CC', 'MLO'))
```

```
all_dt_ex$ImageView <- NULL

all_dt_ex$TestOrTraining <- NULL

all_dt_ex$BrestDensity <- NULL

all_dt_ex$CalcType <- NULL

all_dt_ex$CalcDistribution <- NULL

tibble(all_dt_ex)

## # A tibble: 1,311 x 6
##     Patology LesionVolume LesionArea SphericalDispro~ Sphericity
SurfaceToVolume~
##     <fct>          <dbl>      <dbl>            <dbl>      <dbl>
<dbl>
##  1 BENIGN          95.4       2.34          0.00204       490.
0.0245
##  2 BENIGN          92.8       2.29          0.00202       496.
0.0247
##  3 BENIGN          97.6       2.43          0.00205       488.
0.0249
##  4 BENIGN          86.8       2.17          0.00190       526.
0.0250
##  5 BENIGN         608.       13.4           0.00320       312.
0.0220
##  6 MALIGNA~       122.        2.97          0.00194       516.
0.0244
##  7 MALIGNA~       106.        2.63          0.00188       532.
0.0249
##  8 BENIGN         191.        4.44          0.00235       426.
0.0233
##  9 MALIGNA~        56.6       1.47          0.00173       577.
0.0260
## 10 BENIGN          73.1       1.86          0.00178       561.
0.0254
## # ... with 1,301 more rows
```

After that, it should be checked is there missing values in dataset.

```
##              Patology         LesionVolume            LesionArea
##                     0                    0                     0
## SphericalDisproportion          Sphericity   SurfaceToVolumeRatio
##                     0                    0                     0
```

Obtained result indicate that thete is no misisng values. Therefore, there is no need to correct existng data.

Data exploration

Since the research question is to predict if the patient has malignant changes, so variable "pathology" to be the dependent variable in this analysis. That variable is treated as a discrete attribute and its prediction will be executed as classification process.

Firstly, distribution of "pathology" is examinated.

```
## [1] "pathology"

## .
##   1   2
## 645 666
```
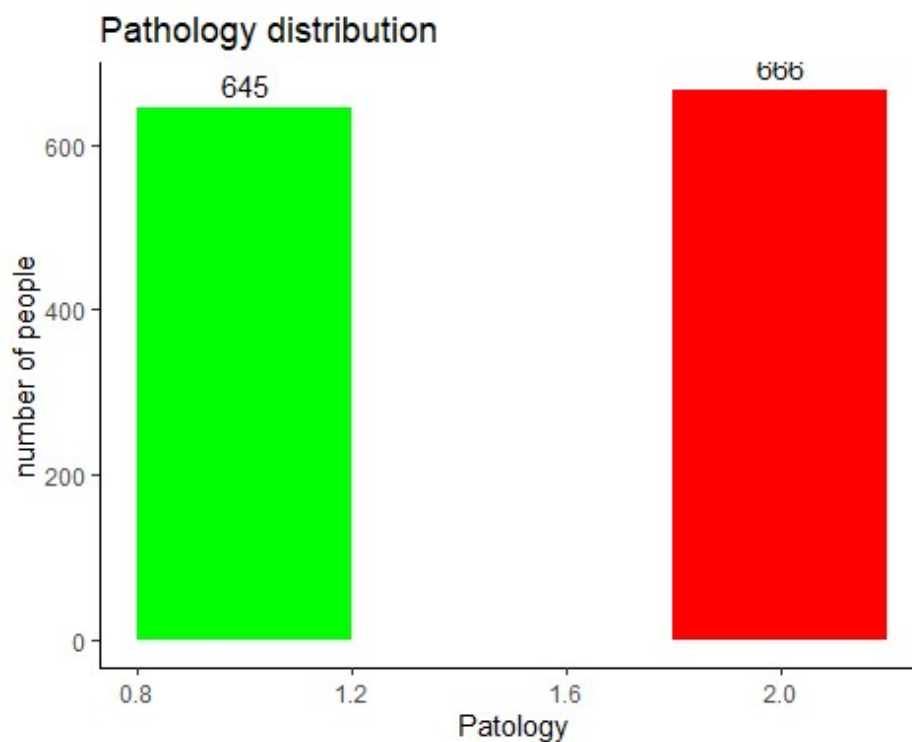

Corelation among variables in dataset is calculated and displayed on the following diagram.

```
##                        Patology LesionVolume LesionArea
SphericalDisproportion
## Patology                 1.000        0.172      0.145
0.208
## LesionVolume             0.172        1.000      0.983
0.861
## LesionArea               0.145        0.983      1.000
0.848
## SphericalDisproportion   0.208        0.861      0.848
1.000
## Sphericity              -0.184       -0.543     -0.503
-
```

```
0.850
## SurfaceToVolumeRatio      -0.083        -0.251       -0.189              -
0.485
##                      Sphericity SurfaceToVolumeRatio
## Patology                 -0.184                 -0.083
## LesionVolume             -0.543                 -0.251
## LesionArea               -0.503                 -0.189
## SphericalDisproportion   -0.850                 -0.485
## Sphericity                1.000                  0.777
## SurfaceToVolumeRatio      0.777                  1.000
```
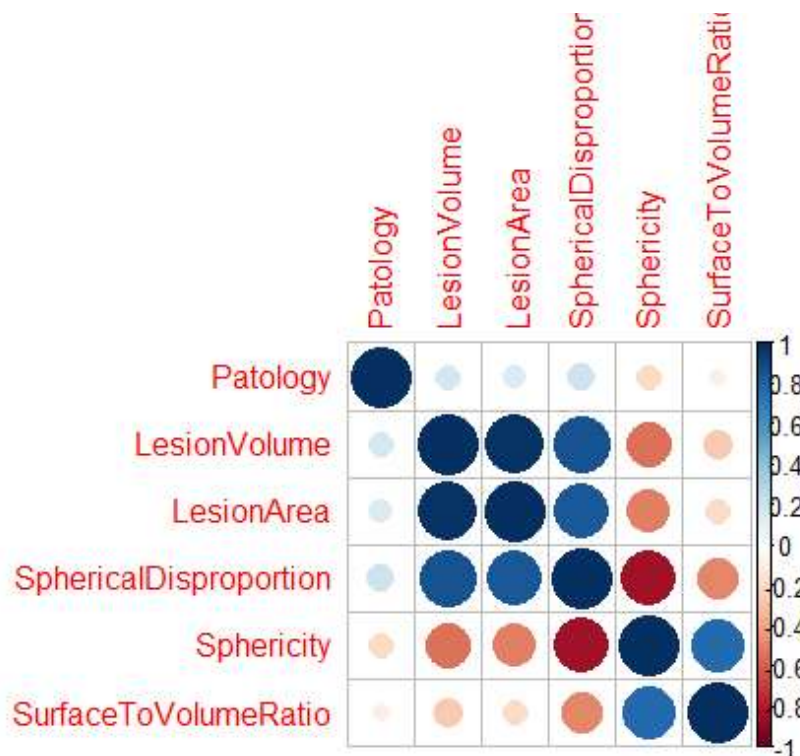

In this diagram, positive corelation is marked with different shades of blue, while negative correlation is marked with different shades of red. More intesive color indicate that correlation is higher.

Correlations of Patology [%]

SphericalDisproportion	20.8
Sphericity	-18.4
LesionVolume	17.2
LesionArea	14.5
SurfaceToVolumeRatio	-8.31
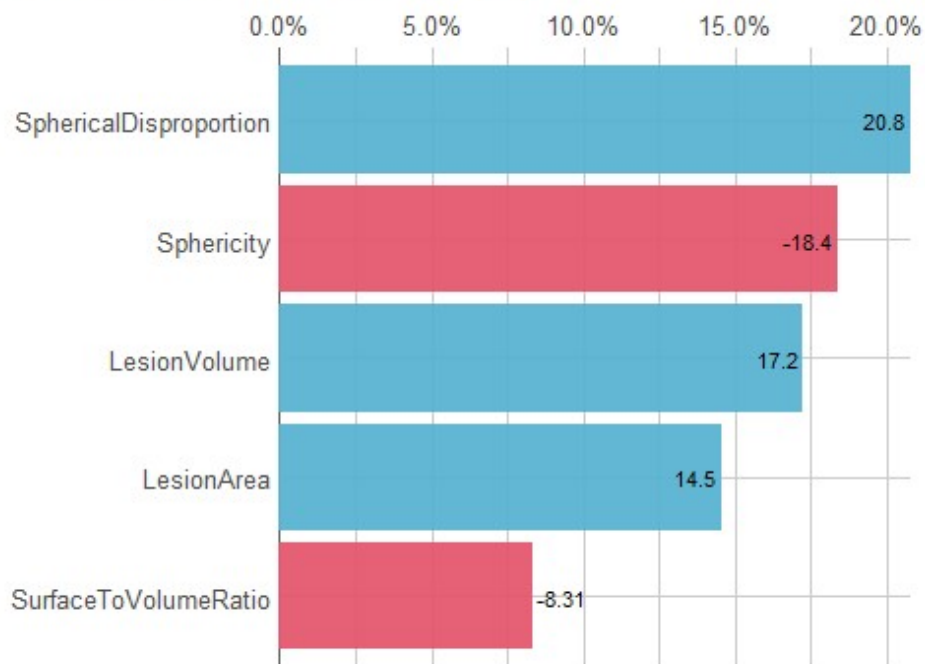
Models

Different Machine Learning models were chosen for predicting the "target" variable. Here is the list of models that are used in this report:

- k Nearest Neihbours (**k-nn**), described in (Murphy 2012, 16–18). An object is classified by a plurality vote of its neighbors, with the object being assigned to the class most common among its k nearest neighbors (k is a positive integer, typically small). I

- Naive Bayes (**nb**), explained in (Murphy 2012, 82–95). It is simple "probabilistic classifier" based on applying Bayes' theorem, with strong (e.g. naïve) assumptions of independence between the features. In other words, naive Bayes classifier assume that the value of a particular feature is independent of the value of any other feature, given the class variable.

- SVM with Linear Kernel (**svm-l**), described in (Murphy 2012, 482–86). Training algorithm of SVM builds a model that assigns new examples to one category or the other, making it a non-probabilistic binary linear classifier.

- SVM with Radial Kernel (**svm-r**), also described in (Murphy 2012, 498–505). It is using the kernel trick, which implicitly maps kernel inputs into high-dimensional feature spaces where features are linearly separable. In this case kernel is defined with Gaussian radial basis function, given by formula:

$$k(x_i, x_j) = e^{-\sigma|x_i - x_j|^2}$$

- Random Forest (**rf**), also described in (Murphy 2012, 550–53). Random forest operate by constructing a multitude of decision trees at training time and outputting the value that is mean/average prediction of the individual trees.

Implementation and evaluation

It is clear that various different alternatives and experiments should be created during ML process implementation.

Because of its popularity, efficiency, simplicity and flexibility and because of author's previous experience, R language and environment for statistical computing and graphics (R Core Team 2019) is used to implement the ML process. A decision tree is a flowchart-like structure in which each internal node represents a "test" on an attribute, each branch represents the outcome of the test, and each leaf node represents a class label (decision taken after computing all attributes). It is clear that paths from root to leaf represent classification rules.

The following ML predictor models are developed with R functions:

- Function 'knn'(R Documentation team, n.d.) in library 'class'(B. Ripley 2020) is used for k-nn model realization.

- Function 'NaiveBayes'(R Documentation team, n.d.) in library 'klaR'(C. Roever 2020) is used for nb model realization.

- Function 'ksvm' (R Documentation team, n.d.) in library 'kernlab'(A. Karatzoglou 2019) with parameter kernel = vanilladot() that represents linear kernel, is used for svm-l model realization.

- Function 'ksvm'in library 'kernlab' with parameter kernel = "rbfdot" - which represents radial kernel, is used for svm-r model realization.

- Function 'randomForest'(R Documentation team, n.d.) in library 'randomForest'(L. Breiman 2018) is used for rf model realization.

Last, but not the least, R function 'train' (R Documentation team, n.d.) in library 'caret' (M. Kuhn 2020) is used as umbrella that covers all the previously mentioned R functions and libraries for ML. They enables handling of a various learning models and functions in a uniform manner. In this moment, more than 230 classification and regression models are 'out-of-a-box' available for use with 'caret' and all of them are enlisted in (Kuhn, n.d.).

Developed models are compared using k-fold validation (Murphy 2012, 201–10), with value of parameter k is set to 10. Selected 10-fold validation is realized with caret R functions. In order to achieve exactly the same conditions for comparison among developed ML methods, in all 10-fold validation scenarios, random generator is set on predefined value 155294099.

In order to evaluate quality of the selected ML regression methods, various measures (Murphy 2012, 176–94) are used.

The following overall measures are calculated for ML models:

For measuring the performance of algorithms, sensitivity (or recall), specificity and accuracy were used because these three criteria are used more in the medical field.

For calculation of sensitivity, specificity and accuracy confusion matrix is required. In the following table, a confusion matrix is shown:

	Actual class is C1	Actual class is C2
Predicted class is $C1$	True positive (TP)	False positive (FP)
Predicted class is $C2$	False negative (TN)	True negative (TN)

Cells in confusion matrix have the following meaning (R. Alizadehsani 2019): - Actual class is the class which determined by angiography and it is existed in dataset. - Predicted class is the one which is predicted by algorithms. - TP is number of samples of class C1 which has been correctly classified. - TN is number of samples of class C2 which has been correctly classified. - FN is number of samples of class C1 which has been falsely classified as C2. - FP is number of samples of class C2 which has been falsely classified as C1.

According to confusion matrix, sensitivity, specificity and accuracy are calculated as follows:

$$Specificity = \frac{TN}{TN + FP}$$

$$Sensitivity = \frac{TP}{TP + FN}$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

Quality of the classification algorithm is often displayed by ROC (receiver operating characteristic) curve. It is a diagram showing the performance of a classification model at all classification thresholds. This curve plots two parameters true positive rate (TPR) and false positive rate (FPR).

True Positive Rate (TPR) is a synonym for recall and is defined as follows:

$$TPR = \frac{TP}{TP + FN}$$

False Positive Rate (FPR) is defined as follows:

$$FPR = \frac{FP}{TN + FP}$$

An ROC curve plots TPR vs. FPR at different classification thresholds. Lowering the classification threshold classifies more items as positive, thus increasing both false positives and true positives.

Area Under the ROC Curve (AUC) measures the entire two-dimensional area underneath the entire ROC curve (think integral calculus) from (0,0) to (1,1).

Display info about k-nn model after 10-fold validation:

```
## 9-nearest neighbor model
## Training set outcome distribution:
##
##    BENIGN MALIGNANT
##       645       666

##    [1] 0.6142365 0.6216783 0.6003444 0.6723414 0.6383759 0.7206157
0.6819030
##    [8] 0.5736597 0.6094406 0.6028451 0.6832377 0.6230177 0.6596737
0.7074627
##   [15] 0.6783217 0.6605644 0.5741004 0.6735322 0.5957520 0.5370802
0.6350816
##   [22] 0.5625000 0.6046620 0.6610723 0.5987371 0.7826493 0.6520522
0.6427239
##   [29] 0.6048220 0.6568312 0.6833022 0.6019814 0.6355350 0.6531469
0.5345644
##   [36] 0.6019176 0.6879735 0.6898967 0.6343823 0.6041332 0.5966651
0.6280317
##   [43] 0.6455798 0.5715951 0.6667049 0.6309468 0.6258741 0.6424799
0.5645989
##   [50] 0.6245336 0.6512360 0.5798368 0.6286713 0.6360505 0.6549674
0.5754025
##   [57] 0.6629162 0.7103456 0.6435132 0.6131629 0.6281286 0.6026406
0.5775058
##   [64] 0.6193182 0.6180253 0.7277462 0.5932262 0.6161381 0.6476690
0.7696900
##   [71] 0.6290246 0.6360505 0.6332860 0.6499534 0.5677472 0.5903263
0.6660839
##   [78] 0.6584386 0.6636051 0.6086108 0.5993470 0.6853042 0.6876457
0.6722158
##   [85] 0.6067708 0.6165956 0.6399254 0.6931114 0.5820513 0.6118608
0.5940998
##   [92] 0.5569030 0.6275058 0.7547808 0.6669776 0.5942235 0.5981810
0.6431903
##   [99] 0.6742071 0.5525641

## Cross-Validated (10 fold, repeated 10 times) Confusion Matrix
##
## (entries are percentual average cell counts across resamples)
##
##           Reference
## Prediction  BENIGN MALIGNANT
##    BENIGN      31.1      22.0
##    MALIGNANT   18.1      28.8
##
##  Accuracy (average) : 0.5986
```

Confusion Matrix k-nn

Prediction: BENIGN

31.05	22
Reference: BENIGN	Reference: MALIGNANT
18.15	28.8

Prediction: MALIGNANT
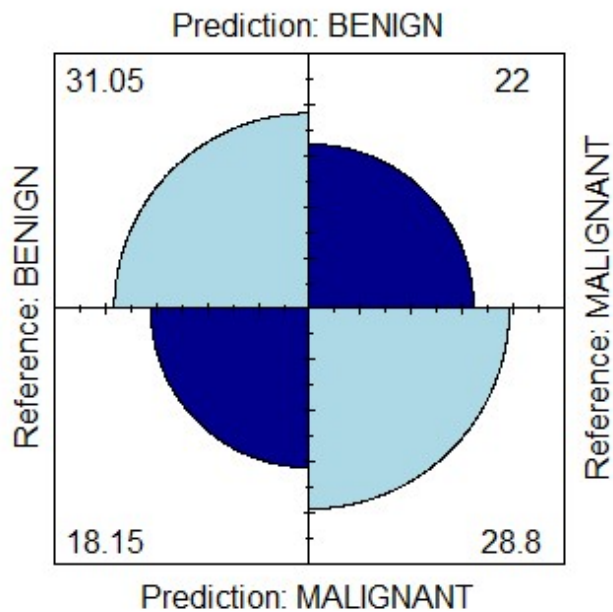
```
## [1] 0.566967
```

```
## [1] 0.6311628
```

```
## [1] 0.5985507
```

Display info about nb model after 10-fold validation:

```
## $apriori
## grouping
##     BENIGN MALIGNANT
## 0.4919908 0.5080092
##
## $tables
## $tables$LesionVolume
## $tables$LesionVolume$BENIGN
##
## Call:
##  density.default(x = xx, adjust = ..1)
##
## Data: xx (645 obs.); Bandwidth 'bw' = 62.1
##
##        x                y
##  Min.   : -178.1   Min.   :0.000e+00
##  1st Qu.: 5009.5   1st Qu.:0.000e+00
##  Median :10197.1   Median :0.000e+00
##  Mean   :10197.1   Mean   :4.812e-05
```

```
##   3rd Qu.:15384.7    3rd Qu.:2.574e-06
##   Max.   :20572.3    Max.   :2.396e-03
##
## $tables$LesionVolume$MALIGNANT
##
## Call:
##   density.default(x = xx, adjust = ..1)
##
## Data: xx (666 obs.); Bandwidth 'bw' = 186.6
##
##         x                 y
##   Min.   : -556.4   Min.   :0.000e+00
##   1st Qu.: 5214.8   1st Qu.:1.100e-09
##   Median :10986.0   Median :1.743e-06
##   Mean   :10986.0   Mean   :4.325e-05
##   3rd Qu.:16757.2   3rd Qu.:1.468e-05
##   Max.   :22528.5   Max.   :1.011e-03
##
##
## $tables$LesionArea
## $tables$LesionArea$BENIGN
##
## Call:
##   density.default(x = xx, adjust = ..1)
##
## Data: xx (645 obs.); Bandwidth 'bw' = 1.341
##
##         x                 y
##   Min.   : -3.721   Min.   :0.000000
##   1st Qu.:164.620   1st Qu.:0.000000
##   Median :332.962   Median :0.000000
##   Mean   :332.962   Mean   :0.001483
##   3rd Qu.:501.303   3rd Qu.:0.000000
##   Max.   :669.645   Max.   :0.105701
##
## $tables$LesionArea$MALIGNANT
##
## Call:
##   density.default(x = xx, adjust = ..1)
##
## Data: xx (666 obs.); Bandwidth 'bw' = 4.053
##
##         x                 y
##   Min.   :-11.99   Min.   :0.000e+00
##   1st Qu.:129.59   1st Qu.:0.000e+00
##   Median :271.18   Median :3.925e-05
##   Mean   :271.18   Mean   :1.765e-03
##   3rd Qu.:412.77   3rd Qu.:5.887e-04
##   Max.   :554.35   Max.   :4.648e-02
##
```

```
## 
## $tables$SphericalDisproportion
## $tables$SphericalDisproportion$BENIGN
## 
## Call:
##  density.default(x = xx, adjust = ..1)
## 
## Data: xx (645 obs.); Bandwidth 'bw' = 0.0001827
## 
##        x                  y
##  Min.   :0.0006667   Min.    :  0.000
##  1st Qu.:0.0047409   1st Qu.:  0.000
##  Median :0.0088152   Median :  1.021
##  Mean   :0.0088152   Mean    : 61.301
##  3rd Qu.:0.0128894   3rd Qu.: 19.865
##  Max.   :0.0169637   Max.    :583.307
## 
## $tables$SphericalDisproportion$MALIGNANT
## 
## Call:
##  density.default(x = xx, adjust = ..1)
## 
## Data: xx (666 obs.); Bandwidth 'bw' = 0.0003441
## 
##        x                  y
##  Min.   :0.0002021   Min.    :  0.016
##  1st Qu.:0.0033761   1st Qu.:  1.458
##  Median :0.0065501   Median : 17.187
##  Mean   :0.0065501   Mean    : 78.686
##  3rd Qu.:0.0097242   3rd Qu.:129.156
##  Max.   :0.0128982   Max.    :362.912
## 
## 
## $tables$Sphericity
## $tables$Sphericity$BENIGN
## 
## Call:
##  density.default(x = xx, adjust = ..1)
## 
## Data: xx (645 obs.); Bandwidth 'bw' = 31.4
## 
##        x                y
##  Min.   :-33.27   Min.   :2.250e-07
##  1st Qu.:204.39   1st Qu.:4.819e-05
##  Median :442.06   Median :6.654e-04
##  Mean   :442.06   Mean   :1.051e-03
##  3rd Qu.:679.72   3rd Qu.:1.821e-03
##  Max.   :917.38   Max.   :3.301e-03
## 
## $tables$Sphericity$MALIGNANT
```

```
##
## Call:
##  density.default(x = xx, adjust = ..1)
##
## Data: xx (666 obs.); Bandwidth 'bw' = 36.99
##
##        x                 y
##  Min.   :-26.69   Min.   :3.844e-07
##  1st Qu.:210.26   1st Qu.:1.389e-04
##  Median :447.21   Median :9.971e-04
##  Mean   :447.21   Mean   :1.054e-03
##  3rd Qu.:684.16   3rd Qu.:1.870e-03
##  Max.   :921.11   Max.   :2.668e-03
##
##
## $tables$SurfaceToVolumeRatio
## $tables$SurfaceToVolumeRatio$BENIGN
##
## Call:
##  density.default(x = xx, adjust = ..1)
##
## Data: xx (645 obs.); Bandwidth 'bw' = 0.0005583
##
##         x                 y
##  Min.   :0.01891   Min.   :  0.01566
##  1st Qu.:0.02429   1st Qu.:  1.34523
##  Median :0.02967   Median :  7.89618
##  Mean   :0.02967   Mean   : 46.44101
##  3rd Qu.:0.03505   3rd Qu.: 69.69501
##  Max.   :0.04043   Max.   :213.77942
##
## $tables$SurfaceToVolumeRatio$MALIGNANT
##
## Call:
##  density.default(x = xx, adjust = ..1)
##
## Data: xx (666 obs.); Bandwidth 'bw' = 0.0006193
##
##         x                 y
##  Min.   :0.01859   Min.   :  0.00004
##  1st Qu.:0.02657   1st Qu.:  0.36977
##  Median :0.03454   Median :  2.21571
##  Mean   :0.03454   Mean   : 31.31634
##  3rd Qu.:0.04252   3rd Qu.: 29.68035
##  Max.   :0.05049   Max.   :216.01950
##
##
##
## $levels
## [1] "BENIGN"     "MALIGNANT"
```

```
## 
## $call
## NaiveBayes.default(x = x, grouping = y, usekernel = TRUE, fL = param$fL,
##     adjust = param$adjust)
## 
## $x
##        LesionVolume LesionArea SphericalDisproportion Sphericity
## X1          95.4425    2.34285             0.002040456  490.08659
## X2          92.8025    2.29005             0.002015944  496.04546
## X3          97.5525    2.42505             0.002050132  487.77337
## X4          86.7525    2.16905             0.001900044  526.30369
## X5         608.0525   13.38705             0.003201888  312.31570
## X6         121.7725    2.96545             0.001938515  515.85886
## X7         105.6125    2.63425             0.001878189  532.42778
## X8         190.8025    4.44205             0.002346543  426.15886
## X9          56.6325    1.47065             0.001732668  577.14462
## X10         73.0525    1.85505             0.001781171  561.42840
## X11         43.2725    1.16345             0.001701697  587.64866
## X12        317.7125    7.18825             0.002650222  377.32682
## X13         74.0525    1.88305             0.001790120  558.62190
## X14       1378.8525   29.26705             0.004268041  234.29955
## X15        642.7750   16.69150             0.003847141  259.93331
## X16       1084.4325   23.23365             0.003813649  262.21605
## X17        569.2225   12.49045             0.003124650  320.03583
## X18       2328.0625   52.67125             0.005059026  197.66649
## X19       1433.0125   33.12525             0.004355159  229.61273
## X20        208.7125    4.83225             0.002357576  424.16441
## X21         40.2025    1.10605             0.001709975  584.80386
## X22         34.7025    1.03005             0.001575099  634.88059
## X23        127.2025    3.07405             0.002196800  455.20753
## X24       1049.4825   22.47965             0.003569182  280.17621
## X25        174.4725    4.09145             0.002359153  423.88094
## X26       1147.9825   25.28165             0.003820869  261.72057
## X27        266.0525    6.05905             0.002459677  406.55741
## X28       1197.4825   26.02365             0.003676331  272.01033
## X29        277.4825    6.32765             0.002711667  368.77685
## X30         48.9725    1.31745             0.001598764  625.48306
## X31         94.3925    2.33785             0.001799082  555.83904
## X32        221.0425    5.09485             0.002552705  391.74136
## X33        152.7125    3.63225             0.002332830  428.66392
## X34        233.6625    5.37125             0.002590344  386.04906
## X35        897.6025   19.31405             0.003820042  261.77726
## X36      17034.3125  560.50925             0.015581783   64.17751
## X37      20386.0525  665.62205             0.016415586   60.91772
## X38       1231.1575   47.29615             0.007577643  131.96715
## X39        720.6050   15.70210             0.003537068  282.72002
## X40        980.4925   20.99585             0.003840807  260.36197
## X41       1038.3625   22.28925             0.003935622  254.08947
## X42         71.3525    1.81405             0.001871860  534.22796
## X43        465.9925   10.36185             0.003119521  320.56198
```

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## X44       1116.3125     24.14425              0.004126808   242.31801
## X45       1441.7725     30.89345              0.004400430   227.25050
## X46       1211.2400     29.46580              0.004758337   210.15747
## X47       1119.1225     23.88045              0.004062785   246.13661
## X48        108.9025      2.66805              0.002149357   465.25542
## X49        169.2375      3.96275              0.002154820   464.07589
## X50        530.9725     11.78145              0.003167272   315.72912
## X51        908.4225     19.58645              0.003584642   278.96786
## X52       1005.7550     21.78710              0.003774549   264.93231
## X53       3519.5950     80.49590              0.005842694   171.15392
## X54         47.0125      1.24625              0.001731276   577.60875
## X55        357.1525      8.00905              0.002928168   341.51047
## X56        501.9150     11.08030              0.003031157   329.90701
## X57        539.7200     11.89240              0.003288011   304.13521
## X58        201.7475      4.78595              0.002286808   437.29082
## X59        219.5525      5.25105              0.002714603   368.37798
## X60        340.0925      7.66785              0.002508906   398.58003
## X61        251.4200      5.87540              0.002363455   423.10937
## X62        143.1525      3.53005              0.002230809   448.26791
## X63        408.4775      9.22655              0.002911904   343.41789
## X64        141.6500      5.43700              0.003192084   313.27501
## X65        418.8525      9.58405              0.003205727   311.94176
## X66        298.6625     11.57325              0.004220525   236.93735
## X67        389.9200      8.70440              0.002954519   338.46462
## X68        664.5975     14.46995              0.003444088   290.35264
## X69       4448.8525     92.21105              0.005598494   178.61947
## X70         46.5625      1.24525              0.001762322   567.43304
## X71         36.6025      1.02205              0.001786845   559.64561
## X72        538.5150     11.95730              0.003175096   314.95107
## X73        735.5150     15.98730              0.003371259   296.62509
## X74         85.9250      2.23650              0.001917370   521.54764
## X75        145.2625      3.48325              0.002110284   473.86987
## X76        440.6125      9.78225              0.003043275   328.59334
## X77        692.6525     15.02305              0.003456911   289.27560
## X78        417.0225      9.33445              0.002870766   348.33911
## X79        111.6925      2.80385              0.002094581   477.42255
## X80        155.3125      3.72325              0.002271534   440.23116
## X81        110.0325      2.69065              0.002121585   471.34571
## X82        137.1125      3.28025              0.002223514   449.73859
## X83         51.0025      1.35005              0.001700776   587.96682
## X84        107.5325      2.64065              0.002116723   472.42840
## X85       3730.1525     77.40505              0.005555110   180.01443
## X86         50.4325      1.33865              0.001683483   594.00660
## X87        104.7825      2.56965              0.002082677   480.15137
## X88       1227.8500     26.27100              0.004141171   241.47761
## X89       1029.9125     22.04825              0.003894463   256.77480
## X90         54.5525      1.42905              0.001799848   555.60242
## X91         54.6425      1.43085              0.001805303   553.92370
## X92        130.8525      3.24305              0.002169894   460.85194
## X93        148.5625      3.62125              0.002216160   451.23101
```

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## X94       49.3525    1.31705        0.001641003  609.38323
## X95       42.3925    1.17785        0.001676935  596.32597
## X96       46.0000    1.23400        0.001617223  618.34388
## X97       34.7425    0.97685        0.001592554  627.92209
## X98       60.4325    1.57865        0.001687595  592.55917
## X99      122.9325    3.00465        0.001963547  509.28239
## X100     227.9025    5.24005        0.002359762  423.77157
## X101     304.2025    6.91805        0.002881039  347.09698
## X102     316.7925    7.19385        0.002657420  376.30489
## X103     722.3625   15.73725        0.003288910  304.05206
## X104      30.9325    0.90065        0.001711315  584.34592
## X105      38.1225    1.05245        0.001712059  584.09201
## X106     300.8425    6.82685        0.002742139  364.67878
## X107     284.6150    6.70230        0.002659096  376.06765
## X108     266.7525    6.06505        0.002650000  377.35844
## X109     105.5425    2.60085        0.002129365  469.62357
## X110      94.6075    2.39715        0.002137724  467.78731
## X111     139.2825    3.47565        0.002322329  430.60220
## X112      58.2825    1.52465        0.001741112  574.34556
## X113     145.2450    3.64890        0.002368272  422.24887
## X114      53.5600    1.40720        0.001700112  588.19663
## X115      55.2625    1.49925        0.001762762  567.29161
## X116      90.9650    2.27030        0.001806701  553.49488
## X117      78.8725    1.97145        0.001805204  553.95387
## X118    1619.8925   34.24785        0.004338840  230.47635
## X119     199.8825    4.76765        0.002436982  410.34364
## X120     205.9825    4.88165        0.002402675  416.20270
## X121     118.7525    2.91205        0.002067239  483.73694
## X122    1144.4525   24.70705        0.003876482  257.96588
## X123     373.5225    8.41645        0.002913218  343.26298
## X124     222.6225    5.16645        0.002467301  405.30121
## X125      85.2250    2.28450        0.002126167  470.32988
## X126     591.7500   12.93200        0.003193834  313.10327
## X127      95.8575    2.53315        0.002187258  457.19347
## X128     506.4675   11.13935        0.003157262  316.73009
## X129      59.6875    1.56275        0.001772797  564.08053
## X130     135.9925    3.30585        0.002174037  459.97375
## X131     190.4425    4.47485        0.002169487  460.93841
## X132      52.7950    1.42490        0.001783047  560.83757
## X133     381.5625    8.57725        0.002798893  357.28411
## X134      42.1025    1.15605        0.001639784  609.83632
## X135     844.1225   18.23545        0.003504786  285.32412
## X136     540.4125   11.88225        0.003102940  322.27499
## X137     174.0225    4.05845        0.002358784  423.94727
## X138     313.7425    7.06885        0.002775106  360.34665
## X139     770.9225   16.72445        0.003414759  292.84644
## X140     176.6325    4.13465        0.002382063  419.80424
## X141      83.4025    2.11005        0.002011724  497.08610
## X142     163.1225    3.88845        0.002374570  421.12895
## X143      85.2700    2.13940        0.002013317  496.69283
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## X144        474.7950      13.49990          0.003906311   255.99599
## X145        326.1125       7.38025          0.002674082   373.96005
## X146        121.4000       2.95600          0.002077294   481.39561
## X147        168.3700       4.00240          0.002253336   443.78638
## X148         41.5000       1.15100          0.001529687   653.72871
## X149        333.7950       7.86590          0.002850982   350.75632
## X150        378.9275       8.73455          0.002909170   343.74068
## X151         82.4325       2.06665          0.001874761   533.40125
## X152         26.3775       0.79955          0.001703777   586.93143
## X153        375.6825       8.41965          0.002891150   345.88308
## X154         59.9400       1.60080          0.001847925   541.14761
## X155        576.2225      12.63045          0.003131175   319.36891
## X156       2478.7900      51.84180          0.004709039   212.35754
## X157       1426.6050      30.20710          0.003976264   251.49238
## X158         23.6425       0.69885          0.001610039   621.10310
## X159         25.2225       0.75445          0.001644513   608.08272
## X160        243.7425       5.87685          0.002585468   386.77722
## X161        963.6525      20.71505          0.003580651   279.27882
## X162       1067.7325      22.89265          0.003662120   273.06584
## X163        369.7925       8.26185          0.002598895   384.77893
## X164         32.6875       0.91075          0.001540608   649.09437
## X165         32.9700       0.93240          0.001556700   642.38444
## X166        285.0025       6.53705          0.002715472   368.26005
## X167        543.4400      12.07980          0.003200778   312.42409
## X168         78.6125       1.99025          0.001861781   537.12012
## X169        170.1825       4.00565          0.002379397   420.27456
## X170        145.0725       3.47945          0.002309741   432.94892
## X171         64.4250       1.64250          0.001745530   572.89187
## X172        137.6925       3.27585          0.002102206   475.69081
## X173        145.6525       3.49105          0.002304495   433.93446
## X174        918.7025      19.90405          0.003558360   281.02835
## X175        521.0125      11.67825          0.003050048   327.86368
## X176         80.7025       2.03205          0.001953568   511.88395
## X177         78.5025       1.98005          0.001949870   512.85469
## X178        270.7075       6.14315          0.002668604   374.72774
## X179         78.7125       1.98325          0.001969785   507.66963
## X180        160.6825       3.81565          0.002352275   425.12044
## X181        142.7725       3.41745          0.002274219   439.71132
## X182        125.3825       3.05365          0.002263936   441.70870
## X183        847.9225      18.30445          0.003587713   278.72907
## X184        935.1825      20.09765          0.003607694   277.18536
## X185        482.3725      10.65745          0.003097816   322.80811
## X186         33.6025       0.95405          0.001672299   597.97926
## X187        353.5825       8.07365          0.002981693   335.37996
## X188       2473.6350      52.29870          0.005216001   191.71776
## X189        317.6225       7.21045          0.002857044   350.01214
## X190       2970.6850      64.88270          0.005496998   181.91747
## X191        234.9525       5.45305          0.002401943   416.32964
## X192        389.1125       8.80025          0.002834394   352.80908
## X193        388.2825       8.66365          0.002720282   367.60899
```

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## X194     485.3925    10.73385        0.003141258  318.34384
## X195     631.1625    13.80925        0.003411687  293.11012
## X196     707.4825    15.49565        0.003350282  298.48235
## X197      45.5125     1.21625        0.001664058  600.94075
## X198     111.2725     2.74745        0.001926140  519.17308
## X199      45.3025     1.22005        0.001749415  571.61956
## X200      19.7525     0.60505        0.001437309  695.74439
## X201      22.0525     0.66705        0.001480816  675.30334
## X202      20.5325     0.61265        0.001402598  712.96263
## X203     363.6425     8.14685        0.002918751  342.61226
## X204     427.7600     9.48520        0.003063934  326.37778
## X205      45.4300     1.21460        0.001646693  607.27785
## X206      32.5850     0.92470        0.001555981  642.68122
## X207     159.0725     3.79145        0.002322485  430.57322
## X208     102.0525     2.53905        0.002089734  478.52989
## X209    1499.1175    32.50335        0.004158034  240.49826
## X210    1392.1125    30.02825        0.004043129  247.33318
## X211    4060.4275    88.89455        0.006034450  165.71519
## X212     230.8625     5.31925        0.002460483  406.42428
## X213     742.7600    16.12920        0.003436462  290.99692
## X214     390.9625     8.70125        0.002835590  352.66032
## X215    3623.0725    75.26345        0.005569900  179.53645
## X216     339.9975     7.64995        0.002733676  365.80784
## X217     341.0125     7.66225        0.002551898  391.86513
## X218     222.3825     5.12965        0.002266578  441.19380
## X219     837.4675    18.05535        0.003561354  280.79208
## X220    7028.7950   148.71290        0.006760025  147.92844
## X221    6922.9100   144.61420        0.006646127  150.46357
## X222    1361.5325    28.89665        0.004083218  244.90488
## X223    4850.8575   114.64115        0.006518682  153.40524
## X224    3096.8675    64.84235        0.004890502  204.47798
## X225    2432.0825    50.94765        0.004894652  204.30463
## X226     836.0325    18.00665        0.003237006  308.92748
## X227    2038.8375    42.90275        0.004640419  215.49780
## X228    1191.1875    25.40575        0.003650126  273.96314
## X229     948.7175    20.36435        0.003654300  273.65019
## X230     774.6275    16.74555        0.003459309  289.07511
## X231    1860.8625    39.25925        0.004139918  241.55066
## X232     362.1050     8.91010        0.003125956  319.90212
## X233    3421.6975    71.08395        0.005046419  198.16032
## X234     720.2725    15.61545        0.003386168  295.31911
## X235     434.6225     9.64645        0.003034082  329.58899
## X236     159.6575     4.62915        0.002738087  365.21848
## X237     706.5525    15.32105        0.003407917  293.43435
## X238     594.2825    13.03565        0.003186259  313.84765
## X239     649.0925    14.15985        0.003269439  305.86287
## X240     865.8025    18.68605        0.003531184  283.19116
## X241     152.4725     3.73145        0.002263092  441.87328
## X242    1442.7125    30.59225        0.004014905  249.07190
## X243    1470.5525    31.17305        0.004030249  248.12365
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## X244      622.1925     13.57385          0.003068540  325.88783
## X245       89.1925      2.27385          0.001955352  511.41688
## X246      157.2725      3.73945          0.002315861  431.80479
## X247      342.6925      7.77585          0.003027892  330.26281
## X248      287.2925      6.57985          0.002594270  385.46491
## X249      565.3625     12.39725          0.003031936  329.82228
## X250       92.0725      2.29945          0.002041838  489.75488
## X251      210.8125      4.88225          0.002488519  401.84545
## X252      212.7225      4.90445          0.002490489  401.52754
## X253      279.4025      6.34205          0.002648083  377.63169
## X254       43.4425      1.18285          0.001653726  604.69515
## X255     1055.0525     22.59905          0.003473761  287.87239
## X256      239.2825      5.49165          0.002546812  392.64777
## X257       39.2425      1.09885          0.001633488  612.18687
## X258       22.5425      0.66885          0.001444109  692.46861
## X259       92.4825      2.29965          0.001791353  558.23721
## X260       68.1125      1.74825          0.001682184  594.46525
## X261       43.0825      1.15965          0.001644163  608.21226
## X262      173.3025      4.15605          0.002175209  459.72590
## X263     1270.7225     27.15245          0.004021225  248.68043
## X264       17.0825      0.53565          0.001456382  686.63285
## X265      427.6225      9.50645          0.002668111  374.79704
## X266       21.3625      0.63725          0.001491015  670.68385
## X267      172.8525      4.06705          0.002319637  431.10186
## X268      108.3725      2.66545          0.002077381  481.37533
## X269      141.1225      3.37745          0.002234576  447.51223
## X270      174.9225      4.09245          0.002389629  418.47500
## X271      154.3625      3.64925          0.002310686  432.77189
## X272      146.7225      3.51945          0.002293278  436.05710
## X273      153.7625      3.67725          0.002302811  434.25186
## X274      114.5925      2.81385          0.002158242  463.34010
## X275      202.4500      4.70700          0.002315127  431.94172
## X276      148.0125      3.53025          0.002065451  484.15573
## X277      229.9325      5.29665          0.002389837  418.43867
## X278      142.4125      3.47425          0.002104071  475.26921
## X279       83.1925      2.08185          0.001875320  533.24239
## X280      495.7650     11.33130          0.003111031  321.43690
## X281      895.4550     19.50010          0.003842419  260.25274
## X282      375.6325      8.58165          0.002829724  353.39138
## X283       31.8775      0.90955          0.001668780  599.24014
## X284      707.3975     15.65295          0.003600792  277.71666
## X285       47.8150      1.26330          0.001663014  601.31795
## X286      370.2725      8.28745          0.002684667  372.48573
## X287      500.6825     11.04765          0.002922785  342.13938
## X288     1161.8425     24.91885          0.004061659  246.20478
## X289     1110.0300     30.28460          0.005082988  196.73466
## X290      316.1225      7.16445          0.002650297  377.31615
## X291      479.5725     10.58545          0.002965891  337.16683
## X292       71.2225      1.81845          0.001904336  525.11734
## X293       74.5325      1.87665          0.001903472  525.35590
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## X294       105.4425      2.60685        0.002148309  465.48246
## X295        90.6625      2.23125        0.002027509  493.21604
## X296       398.3425      8.86485        0.002745029  364.29485
## X297       149.6600      3.64020        0.002347549  425.97622
## X298       264.1625      6.05325        0.002679002  373.27333
## X299       350.5600      7.86120        0.002644733  378.11003
## X300        65.9725      1.70545        0.001879537  532.04604
## X301        37.9625      1.04125        0.001658717  602.87569
## X302      1249.4525     26.66305        0.003945591  253.44749
## X303      1537.9025     32.72005        0.004283125  233.47441
## X304        71.0750      1.89150        0.001756120  569.43704
## X305        87.2725      2.19145        0.001775642  563.17644
## X306       188.9425      4.46085        0.002296748  435.39824
## X307       182.6225      4.37445        0.002607867  383.45515
## X308       413.7225      9.41245        0.002827593  353.65773
## X309       180.6825      4.34365        0.002341621  427.05454
## X310       182.9925      4.27785        0.002432463  411.10602
## X311       479.9325     10.56065        0.002748505  363.83417
## X312       282.6225      6.43045        0.002436762  410.38067
## X313        95.5525      2.38505        0.001958926  510.48368
## X314       115.0125      2.84625        0.002065975  484.03299
## X315       216.0650      5.01830        0.002392484  417.97564
## X316       255.2225      5.83445        0.002521822  396.53873
## X317       242.2125      5.59825        0.002473261  404.32450
## X318        23.2025      0.67405        0.001442363  693.30691
## X319        20.7425      0.62485        0.001431361  698.63581
## X320      1294.6825     27.63965        0.003934758  254.14523
## X321       703.0925     15.34485        0.003281825  304.70855
## X322      2288.4625     49.27125        0.004712834  212.18656
## X323       827.4825     17.89565        0.003441499  290.57109
## X324       176.1725      4.13345        0.002370672  421.82125
## X325       726.0925     15.72385        0.003176439  314.81797
## X326        54.5225      1.44445        0.001896887  527.17957
## X327       687.9525     14.98505        0.003237322  308.89732
## X328      1374.3000     29.32700        0.004091535  244.40708
## X329        66.9025      1.72405        0.001819346  549.64793
## X330       203.6325      4.73865        0.002464829  405.70770
## X331      1092.2725     23.46545        0.003798017  263.29529
## X332        14.3025      0.46405        0.001365806  732.16857
## X333       207.7825      4.80565        0.002351589  425.24429
## X334       318.6125      7.17425        0.002640077  378.77678
## X335       110.6825      2.73465        0.002036406  491.06111
## X336       476.5125     10.53225        0.002979976  335.57320
## X337       910.0925     19.77185        0.003614146  276.69057
## X338       237.3100      5.49220        0.002430981  411.35651
## X339       303.0150      7.04230        0.002512606  397.99310
## X340        97.3925      2.40585        0.001934624  516.89641
## X341      3741.0125     78.23725        0.005858154  170.70223
## X342     16317.2550    345.66210        0.008935260  111.91616
## X343     21004.7050    521.76910        0.011458828   87.26896
```

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## X344    109.3025     2.73205    0.002072529  482.50221
## X345   5215.4425   107.79085    0.006504265  153.74527
## X346    104.8425     2.57085    0.001984878  503.80927
## X347    612.4325    13.74665    0.003334061  299.93452
## X348    838.5025    18.21105    0.003515719  284.43688
## X349   4967.6850   102.72870    0.006363329  157.15045
## X350   4680.4800    96.62660    0.006234787  160.39041
## X351     76.3950     1.97790    0.002008695  497.83554
## X352     31.1025     0.88005    0.001417543  705.44583
## X353    213.3825     4.92565    0.002519234  396.94600
## X354    100.9825     2.49365    0.001974029  506.57828
## X355     87.3925     2.18985    0.001908887  523.86541
## X356    342.9550     8.61810    0.003177490  314.71383
## X357    781.9325    17.02465    0.003376427  296.17105
## X358    276.5950     7.16890    0.003045451  328.35862
## X359    938.1625    20.57325    0.003592366  278.36804
## X360    125.4425     3.08585    0.002251635  444.12164
## X361    158.0825     3.74765    0.002315620  431.84984
## X362     45.3025     1.25305    0.001631139  613.06849
## X363    123.1025     2.96805    0.002154535  464.13730
## X364     84.5025     2.14205    0.001759339  568.39545
## X365    115.2475     2.81795    0.002144684  466.26926
## X366     92.4525     2.27505    0.002011200  497.21562
## X367    150.6100     3.55820    0.002275857  439.39486
## X368    271.3525     6.19705    0.002538114  393.99333
## X369    132.3525     3.20105    0.002115857  472.62166
## X370     75.7025     1.95605    0.001779646  561.90950
## X371    238.0825     5.46765    0.002414877  414.09975
## X372    188.6925     4.37585    0.002259873  442.50269
## X373   1263.2325    26.89065    0.003920751  255.05319
## X374     66.3425     1.76885    0.001785530  560.05778
## X375   1158.0600    24.82120    0.003824079  261.50090
## X376    351.6575     7.97015    0.002673405  374.05480
## X377    130.6525     3.13505    0.002210849  452.31484
## X378    389.9500     8.71300    0.002735345  365.58457
## X379    926.5725    20.06145    0.003817384  261.95950
## X380    120.4025     2.91405    0.002183928  457.89045
## X381     44.4825     1.20365    0.001678579  595.74192
## X382    968.5025    22.78705    0.004123943  242.48639
## X383    886.2400    19.84680    0.003702794  270.06634
## X384    101.8400     2.53380    0.002092403  477.91946
## X385    473.4725    10.55145    0.003174052  315.05469
## X386    127.9650     3.12630    0.002205583  453.39493
## X387   1233.8925    26.40785    0.004207179  237.68897
## X388    185.7025     4.57205    0.002435929  410.52104
## X389    265.0725     6.03945    0.002455668  407.22111
## X390     17.1725     0.52945    0.001516811  659.27794
## X391     74.2125     1.88625    0.001833566  545.38531
## X392     70.8025     1.80205    0.001807520  553.24420
## X393     31.0025     0.87805    0.001556217  642.58375
```

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## X394     291.4925    6.59985     0.002514414  397.70694
## X395      55.0925    1.43985     0.001810932  552.20184
## X396      48.8025    1.30605     0.001773754  563.77619
## X397     253.6225    5.81845     0.002442176  409.47086
## X398     131.7325    3.14065     0.002033625  491.73268
## X399    1303.3875   27.70575     0.003919322  255.14615
## X400     107.8825    2.61565     0.001934902  516.82204
## X401     685.8125   14.95825     0.003301864  302.85921
## X402    1037.0625   22.31925     0.003739599  267.40838
## X403    1222.7475   26.01695     0.003713141  269.31378
## X404     925.2600   20.04820     0.003406174  293.58451
## X405     185.4725    4.32745     0.002443021  409.32921
## X406      90.0325    2.21865     0.001838344  543.96785
## X407     187.2700    4.38740     0.002450839  408.02351
## X408     544.6825   11.98365     0.003318783  301.31531
## X409     151.1325    3.57665     0.002098177  476.60430
## X410    1678.1375   51.07775     0.006664766  150.04278
## X411      68.2225    1.75845     0.001912918  522.76163
## X412      53.4325    1.39865     0.001741402  574.25001
## X413     318.1025    7.18005     0.002766314  361.49184
## X414     233.4125    5.42225     0.002572219  388.76946
## X415     182.7600    4.31420     0.002361461  423.46663
## X416      90.4450    2.36090     0.002011422  497.16067
## X417     436.7950    9.71390     0.002826157  353.83744
## X418     968.8225   20.80245     0.003820874  261.72021
## X419     201.2775    4.96555     0.002420448  413.14661
## X420      17.8925    0.58385     0.001550590  644.91590
## X421     507.7125   11.16425     0.003101530  322.42151
## X422     421.9125    9.39225     0.002866180  348.89649
## X423      49.9075    1.34315     0.001806474  553.56471
## X424     130.9150    3.24030     0.001996302  500.92632
## X425      60.4275    1.58555     0.001689654  591.83699
## X426      89.4525    2.21505     0.002026112  493.55623
## X427     119.0775    2.88855     0.001961524  509.80763
## X428      97.1825    2.37765     0.002057930  485.92507
## X429      52.0325    1.38665     0.001813850  551.31352
## X430      50.8325    1.40165     0.001862214  536.99524
## X431     283.8025    6.44605     0.002526471  395.80898
## X432     233.4325    5.36665     0.002384987  419.28949
## X433     689.2925   15.04385     0.003484710  286.96790
## X434     278.9725    6.55745     0.002776115  360.21562
## X435    1749.7025   37.19605     0.004248057  235.40175
## X436     645.5125   14.25425     0.003136714  318.80502
## X437     317.8225    7.19045     0.002650422  377.29843
## X438     446.3925    9.89785     0.002844680  351.53338
## X439     236.1425    5.43685     0.002442943  409.34240
## X440     440.2825    9.74365     0.002818552  354.79216
## X441     226.7525    5.22105     0.002458240  406.79517
## X442     333.3775    7.48155     0.002716535  368.11598
## X443      63.4725    1.62945     0.001631335  612.99488
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## X444         58.5425      1.52485        0.001838539  543.91015
## X445         42.4225      1.15445        0.001516375  659.46766
## X446         66.1025      1.69205        0.001891326  528.72963
## X447         44.3825      1.20165        0.001570563  636.71448
## X448       1813.7125     38.47625        0.004625277  216.20327
## X449       1156.9125     24.76325        0.003857352  259.24517
## X450       2308.4225     48.69045        0.004785371  208.97022
## X451      21968.6250    542.19450        0.011865933   84.27488
## X452        274.0025      6.24205        0.002679013  373.27184
## X453        247.5525      5.67305        0.002609756  383.17758
## X454       2012.6125     42.32525        0.004558005  219.39424
## X455       3457.7700     72.36540        0.005295781  188.82957
## X456       1692.5525     36.06905        0.004359687  229.37428
## X457       2672.2725     56.15945        0.004880138  204.91223
## X458        189.0275      4.40155        0.002294058  435.90883
## X459        121.6625      2.96325        0.002190152  456.58931
## X460        102.2925      2.55185        0.002118454  472.04226
## X461         32.7900      0.93680        0.001484236  673.74709
## X462       1131.2025     24.43405        0.003863527  258.83088
## X463       1556.2325     32.92665        0.004209010  237.58559
## X464         49.5400      1.38280        0.001717121  582.37016
## X465        116.3425      2.82485        0.002177591  459.22308
## X466        297.0825      6.77565        0.002755392  362.92471
## X467        347.5125      7.77625        0.002856602  350.06624
## X468         48.2925      1.30385        0.001805189  553.95856
## X469        476.3500     10.52900        0.003127288  319.76586
## X470        512.2325     11.29465        0.003199800  312.51951
## X471         96.4125      2.41825        0.002077669  481.30861
## X472         20.6675      0.62835        0.001375746  726.87821
## X473         34.1875      0.95075        0.001477621  676.76335
## X474         26.0325      0.75465        0.001457802  685.96422
## X475         34.5925      0.95785        0.001447874  690.66788
## X476       1523.6625     32.25125        0.004422629  226.10984
## X477       1478.5825     31.38165        0.004380365  228.29148
## X478          9.9025      0.35205        0.001291627  774.21711
## X479         77.4925      1.95985        0.001984421  503.92531
## X480        597.3525     13.61205        0.003517325  284.30693
## X481          3.4225      0.16645        0.001240565  806.08408
## X482        847.8525     18.49505        0.003594023  278.23973
## X483        130.2800      3.11160        0.002227014  449.03166
## X484        662.0825     14.57965        0.003294739  303.51416
## X485        134.4825      3.23565        0.002116085  472.57088
## X486        207.5825      4.84165        0.002422565  412.78559
## X487         51.9125      1.37625        0.001809357  552.68263
## X488        149.8425      3.55885        0.002165551  461.77630
## X489         59.3225      1.54045        0.001863883  536.51424
## X490        125.8725      3.02345        0.002183285  458.02544
## X491         35.6325      0.98665        0.001533059  652.29054
## X492        269.6225      6.12245        0.002668282  374.77298
## X493         47.9775      1.30655        0.001753043  570.43656
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## X494      322.5125     7.26025      0.002817805   354.88610
## X495      274.7900     6.38680      0.002746898   364.04696
## X496     2928.1025    61.58805      0.005454462   183.33614
## X497       40.7850     1.13070      0.001598336   625.65064
## X498     3804.0225    79.11445      0.005898434   169.53652
## X499      313.7125     7.42825      0.002601481   384.39644
## X500       30.4825     0.88365      0.001499242   667.00394
## X501      321.0725     7.59145      0.002742360   364.64946
## X502     1813.5425    38.24085      0.004629555   216.00349
## X503       26.8725     0.78745      0.001467676   681.34919
## X504      227.0625     5.21525      0.002232222   447.98413
## X505      322.4325     7.27465      0.002466390   405.45084
## X506     1234.0625    26.31525      0.004136559   241.74684
## X507       43.1525     1.16105      0.001596650   626.31133
## X508     7798.7325   168.53765      0.007184462   139.18926
## X509     5677.1300   119.62960      0.006265199   159.61186
## X510      113.8525     2.78305      0.002002560   499.36086
## X511       42.5125     1.14825      0.001728722   578.46214
## X512      116.9600     3.78920      0.002860495   349.58990
## X513      160.3650     4.83030      0.002959540   337.89037
## X514       88.4925     2.19585      0.002021862   494.59370
## X515      131.8525     3.21905      0.002366591   422.54865
## X516       64.5025     1.69205      0.001892994   528.26368
## X517      138.1650     3.42530      0.002310517   432.80363
## X518       68.1125     1.75625      0.001894766   527.76971
## X519      303.5925     6.85785      0.002737931   365.23925
## X520      363.5100     8.15220      0.002894590   345.47207
## X521      393.7925     8.90985      0.003112722   321.26220
## X522     1666.5025    35.30805      0.004216708   237.15180
## X523      393.1025     8.96005      0.002871541   348.24509
## X524     1634.9725    34.70145      0.004210804   237.48434
## X525      453.4450    10.09390      0.003014698   331.70813
## X526      527.2025    11.90705      0.003132092   319.27539
## X527      169.4425     3.98285      0.002166880   461.49297
## X528     3298.2250    68.65750      0.005353587   186.79066
## X529      120.2825     2.91165      0.001993301   501.68043
## X530     2006.8825    42.67565      0.004669149   214.17179
## X531      190.7075     4.44015      0.002341802   427.02152
## X532      158.7275     3.74855      0.002236543   447.11851
## X533      280.2125     6.42225      0.002574607   388.40884
## X534      302.0725     6.85945      0.002795797   357.67982
## X535      824.2325    17.94265      0.003503769   285.40696
## X536      277.2875     6.31475      0.002728197   366.54239
## X537      247.2225     5.69845      0.002648267   377.60543
## X538     3256.3325    68.28065      0.005420564   184.48266
## X539     4268.7525    88.87205      0.005802866   172.32863
## X540      194.2025     4.55005      0.002277631   439.05260
## X541      113.3975     2.77195      0.001979913   505.07262
## X542      271.9325     6.17665      0.002513259   397.88983
## X543      186.1525     4.37305      0.002271463   440.24488
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## X544        310.9825      7.02165              0.002580903   387.46135
## X545        176.2875      4.15475              0.002215358   451.39434
## X546        544.5025     12.03605              0.003188191   313.65749
## X547        466.7225     10.37645              0.002968586   336.86075
## X548        186.2025      4.35805              0.002426769   412.07059
## X549        288.6125      6.52625              0.002529405   395.34983
## X550        206.5925      4.78985              0.002481587   402.96801
## X551         79.2600      2.14620              0.002091760   478.06630
## X552         94.0975      2.47495              0.002159896   462.98522
## X553        576.0675     12.69835              0.003107431   321.80925
## X554        204.1025      4.82805              0.002353050   424.98029
## X555       1305.4425     27.71085              0.004174442   239.55297
## X556       1798.0250     46.17450              0.005064715   197.44449
## X557       1404.7925     31.62785              0.004542224   220.15646
## X558       1205.5925     26.79685              0.003768564   265.35306
## X559        244.2125      5.60625              0.002428802   411.72569
## X560        342.5150      7.68430              0.002653246   376.89688
## X561        140.3025      3.34405              0.002092446   477.90969
## X562        211.9825      4.92165              0.002507893   398.74115
## X563        361.6000      8.17000              0.002922781   342.13990
## X564        229.5425      5.28785              0.002375353   420.99013
## X565        115.3625      2.78125              0.002118924   471.93760
## X566        331.3125      7.46825              0.002828927   353.49086
## X567       2679.9125     56.24025              0.005410483   184.82637
## X568       2372.1625     49.70125              0.005145749   194.33517
## X569       3021.0025     63.34205              0.005585082   179.04839
## X570       3584.4700     76.12540              0.006093197   164.11744
## X571         69.4625      1.78325              0.001912897   522.76727
## X572       2593.0725     54.37545              0.005113952   195.54347
## X573         62.4825      1.61165              0.001847922   541.14838
## X574        186.3125      4.34425              0.002418132   413.54237
## X575       1261.9225     27.21645              0.004008219   249.48735
## X576        168.1825      3.97365              0.002364007   423.01062
## X577        266.0325      7.05265              0.003126767   319.81912
## X578       9912.6175    203.53935              0.007338403   136.26944
## X579        297.7175      7.24535              0.002969533   336.75325
## X580        286.6025      6.50205              0.002739786   364.99198
## X581       6856.8125    152.40025              0.007031275   142.22173
## X582        356.8100      7.99420              0.002914182   343.14944
## X583         32.8525      0.91505              0.001639826   609.82078
## X584         43.3325      1.17265              0.001743113   573.68617
## X585        163.8725      3.85545              0.002333397   428.55976
## X586        135.3225      3.31645              0.002270388   440.45331
## X587        335.4725      7.67145              0.002875253   347.79542
## X588       2648.7950     57.30690              0.005416823   184.61005
## X589        117.6725      2.88345              0.002072702   482.46201
## X590       3123.7575     68.60515              0.005812849   172.03267
## X591        104.0625      2.77125              0.002049016   488.03914
## X592         21.2625      0.64325              0.001453458   688.01458
## X593         37.5425      1.04085              0.001728146   578.65470
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## X594      233.0150      5.45730           0.002528121   395.55073
## X595      166.8650      4.01430           0.002148076   465.53293
## X596      501.6325     11.64765           0.003316016   301.56668
## X597      817.2525     18.33905           0.003766674   265.48618
## X598       42.1325      1.14065           0.001629127   613.82556
## X599       34.8225      0.96245           0.001549364   645.42597
## X600       84.3525      2.15305           0.001841351   543.07951
## X601       56.0925      1.50785           0.001650137   606.01018
## X602      128.1700      3.08540           0.002216655   451.13019
## X603      144.5525      3.45305           0.002295001   435.72971
## X604       42.5325      1.16465           0.001732337   577.25485
## X605      349.3525      7.84505           0.002742744   364.59839
## X606      121.9725      2.95345           0.001922842   520.06364
## X607      600.6625     13.12725           0.003329190   300.37337
## X608       58.2225      1.51845           0.001746427   572.59782
## X609       91.9425      2.28085           0.002036556   491.02497
## X610       99.2725      2.44345           0.002076583   481.56026
## X611      125.4825      3.03965           0.002210985   452.28713
## X612      555.6100     12.17820           0.003068695   325.87137
## X613       98.0150      2.41230           0.002008294   497.93503
## X614      274.0925      6.22785           0.002519556   396.89527
## X615      131.7150      3.17130           0.002126445   470.26836
## X616       98.4625      2.45925           0.002088203   478.88071
## X617       71.4725      1.82345           0.001914804   522.24664
## X618      116.0525      2.83805           0.002197806   454.99929
## X619     4090.2125     84.73325           0.005551457   180.13288
## X620      153.7125      3.65225           0.002321800   430.70026
## X621       68.2275      1.75155           0.001799161   555.81467
## X622     7574.1450    155.36490           0.006753214   148.07764
## X623      216.0625      5.01925           0.002551817   391.87757
## X624      585.1900     12.94180           0.003374431   296.34624
## X625      759.8175     16.53335           0.003624197   275.92319
## X626       70.6575      1.81015           0.001819786   549.51505
## X627     1104.1000     23.61200           0.004004289   249.73224
## X628      116.7725      2.89745           0.002081953   480.31824
## X629       29.4325      0.83065           0.001504092   664.85294
## X630     5876.8825    120.99565           0.006879314   145.36333
## X631     5737.8050    118.32810           0.006798842   147.08387
## X632     1413.3100     41.09520           0.005918264   168.96847
## X633       93.2325      2.30665           0.002024309   493.99571
## X634     5482.7450    112.92790           0.006664378   150.05151
## X635     6148.8525    126.87505           0.007068889   141.46494
## X636       98.3125      2.41625           0.002057300   486.07407
## X637      140.3525      3.33705           0.002222083   450.02813
## X638      154.6525      3.68705           0.002291176   436.45709
## X639      457.5075     10.87415           0.003143971   318.06910
## X640      903.3200     20.07640           0.003794766   263.52085
## X641       76.2950      1.93890           0.001850291   540.45552
## X642      242.6625      5.58325           0.002601347   384.41623
## X643      199.9300      4.69660           0.002487036   402.08498
```

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## X644      75.4225      1.90245       0.001956715  511.06069
## X645      43.4225      1.17445       0.001738245  575.29283
## X646      39.4225      1.09445       0.001621991  616.52614
## X647      37.8225      1.06245       0.001618665  617.79298
## X648     192.0725      4.50745       0.002268843  440.75322
## X649      32.2425      0.97485       0.001689729  591.81075
## X650      38.5325      1.07665       0.001630548  613.29091
## X651     205.5825      4.80165       0.002305690  433.70962
## X652      52.2125      1.38225       0.001807096  553.37412
## X653      68.9275      1.85055       0.001877784  532.54249
## X654      83.9325      2.10465       0.002025446  493.71853
## X655      17.4425      0.55085       0.001464260  682.93889
## X656      89.2000      2.51900       0.002288476  436.97195
## X657     703.7400     15.37280       0.003578127  279.47584
## X658      90.8650      2.30430       0.001795547  556.93322
## X659      27.9725      0.80945       0.001507942  663.15565
## X660     156.2700      3.68740       0.002314460  432.06617
## X661      99.7725      2.46145       0.002071736  482.68707
## X662      24.1775      0.71055       0.001616476  618.62980
## X663      80.5225      2.06845       0.002003846  499.04043
## X664      28.4650      0.82130       0.001508209  663.03812
## X665    1225.4525     26.35105       0.003950169  253.15376
## X666     149.2925      3.56385       0.002179887  458.73931
## X667    1313.5525     28.24905       0.004043160  247.33131
## X668      28.1225      0.82045       0.001438907  694.97188
## X669     206.9925      4.86985       0.002389064  418.57389
## X670      56.2625      1.47125       0.001720422  581.25282
## X671      23.6825      0.69165       0.001336064  748.46725
## X672     113.6725      2.77145       0.002021951  494.57188
## X673      47.0825      1.23965       0.001653433  604.80237
## X674    2826.1750     70.00550       0.006273689  159.39585
## X675     555.9325     12.18465       0.003324751  300.77439
## X676     468.1225     10.37245       0.003162571  316.19847
## X677    4320.9575    105.86815       0.007152789  139.80561
## X678      41.7825      1.14965       0.001684740  593.56346
## X679     160.3125      3.79225       0.002205976  453.31415
## X680     218.2725      5.14345       0.002513508  397.85040
## X681     254.2525      5.82305       0.002618434  381.90766
## X682     203.0125      4.88625       0.002428338  411.80424
## X683      43.5425      1.17685       0.001632278  612.64060
## X684      57.9625      1.50925       0.001729863  578.08034
## X685     214.2625      4.95925       0.002562876  390.18670
## X686      51.7325      1.39365       0.001723165  580.32762
## X687      10.3525      0.36105       0.001251315  799.15928
## X688     170.0225      4.00245       0.002393015  417.88292
## X689    1376.4925     29.21985       0.004260907  234.69180
## X690    1039.5325     22.25665       0.003904792  256.09557
## X691     181.7225      4.24545       0.002247183  445.00168
## X692     240.2625      5.51925       0.002427460  411.95321
## X693     162.8325      3.90665       0.002136390  468.07923
```

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## X694      99.0025    2.46205        0.001895446 527.58031
## X695     125.0525    3.02305        0.002053035 487.08375
## X696     126.5275    3.16655        0.002063399 484.63715
## X697    1542.3925   32.72185        0.004541293 220.20160
## X698     134.7925    3.23385        0.002240041 446.42043
## X699    1369.3825   29.22965        0.004331505 230.86662
## X700     168.7700    5.19040        0.003087784 323.85680
## X701     242.1725    5.55645        0.002622692 381.28767
## X702     174.3600    4.08920        0.002407023 415.45092
## X703      68.7525    1.76905        0.001843727 542.37967
## X704      65.8725    1.70345        0.001792842 557.77369
## X705     204.5125    4.75625        0.002499512 400.07806
## X706     736.4925   16.07585        0.003773050 265.03754
## X707     877.0125   18.95825        0.003684194 271.42982
## X708     208.1425    4.90085        0.002552931 391.70665
## X709     100.6150    2.47830        0.001942769 514.72916
## X710      37.7025    1.04405        0.001479223 676.03049
## X711      48.1025    1.31605        0.001717520 582.23495
## X712      62.0125    1.59425        0.001724011 580.04270
## X713      50.7325    1.37665        0.001724440 579.89846
## X714    1011.6325   21.69865        0.003582308 279.14964
## X715     113.6975    2.77395        0.001882885 531.09979
## X716    1371.4625   29.20725        0.003931322 254.36738
## X717     222.8700    5.19740        0.002252393 443.97217
## X718      97.4775    2.55055        0.002052709 487.16108
## X719     337.5325    7.72865        0.002605857 383.75088
## X720     416.5725    9.86145        0.002999575 333.38059
## X721     322.0725    7.24345        0.002688700 371.92697
## X722     239.4825    5.50365        0.002449911 408.17810
## X723     725.9925   15.84185        0.003382134 295.67135
## X724    2482.6775   52.33555        0.005313627 188.19536
## X725      97.2025    2.41805        0.001915732 521.99377
## X726      66.5425    1.70085        0.001743514 573.55449
## X727    1989.0400   42.03280        0.004583166 218.18978
## X728     228.8825    5.33965        0.002515585 397.52182
## X729      18.5125    0.56425        0.001476889 677.09893
## X730      76.2200    1.94240        0.001976822 505.86249
## X731    1604.8425   33.93885        0.004498335 222.30446
## X732      44.1900    1.26580        0.001746447 572.59115
## X733    1781.0225   37.55845        0.004628198 216.06681
## X734    6072.5900  125.33680        0.006798521 147.09081
## X735      37.4275    1.08055        0.001620316 617.16351
## X736     298.3925    6.84185        0.002446200 408.79727
## X737    6292.7275  134.76555        0.007138464 140.08616
## X738     196.1025    4.64405        0.002361875 423.39252
## X739     254.3650    6.07830        0.002671616 374.30529
## X740     465.5400   12.28380        0.003510563 284.85461
## X741     185.1650    4.46030        0.002253024 443.84789
## X742     458.7675   10.12135        0.002939818 340.15715
## X743     576.8175   12.63835        0.003162983 316.15724
```

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## X744      133.0825     3.20765      0.002250053  444.43399
## X745      166.3325     3.91265      0.002357137  424.24351
## X746       51.3075     1.35615      0.001787770  559.35602
## X747       58.1425     1.51685      0.001688982  592.07261
## X748      196.8925     4.61985      0.002320266  430.98505
## X749       51.3025     1.34005      0.001626344  614.87613
## X750       53.5825     1.43665      0.001735206  576.30049
## X751      331.4975     8.45695      0.003239793  308.66165
## X752      428.4475    10.84295      0.003498770  285.81471
## X753      198.6625     4.63125      0.002252057  444.03854
## X754      305.7625     6.92525      0.002753294  363.20126
## X755      217.7975     5.14495      0.002439839  409.86303
## X756      307.8825     6.97565      0.002759031  362.44606
## X757      122.2150     3.04430      0.002129824  469.52241
## X758       33.5125     0.96825      0.001505017  664.44411
## X759       30.7225     0.90445      0.001496571  668.19411
## X760       45.7325     1.22065      0.001677633  596.07808
## X761      190.5000     4.43600      0.002247181  445.00192
## X762       75.6725     1.96345      0.001845678  541.80623
## X763      706.5875    15.52475      0.003484406  286.99300
## X764       66.9925     1.70985      0.001779464  561.96693
## X765      779.6475    17.00895      0.003495298  286.09865
## X766       22.5925     0.66185      0.001421670  703.39823
## X767       58.4275     1.55055      0.001824313  548.15166
## X768      118.8625     2.90525      0.001981598  504.64313
## X769      197.5500     4.69500      0.002257119  443.04269
## X770     1692.8025    35.92205      0.004538036  220.35965
## X771     2803.5675    59.04135      0.005322459  187.88308
## X772       65.6525     1.75505      0.001807876  553.13526
## X773       41.7825     1.14965      0.001528825  654.09697
## X774      285.3425     6.46885      0.002389853  418.43569
## X775      157.3525     3.72505      0.002306161  433.62101
## X776      113.3425     2.75685      0.002120435  471.60134
## X777        4.4025     0.19405      0.001295541  771.87846
## X778       12.0425     0.40285      0.001376631  726.41084
## X779      564.8525    12.39505      0.003280560  304.82596
## X780     3044.0125    63.77825      0.004943890  202.26987
## X781      378.7025     8.45605      0.002646797  377.81522
## X782       61.3125     1.59625      0.001860864  537.38489
## X783      445.6825     9.88365      0.002775356  360.31408
## X784      402.7175     8.99235      0.002666213  375.06378
## X785       54.2925     1.43185      0.001823819  548.29988
## X786      316.1700     7.14640      0.002643355  378.30705
## X787      379.4425     8.57585      0.002808850  356.01759
## X788      923.4325    19.80665      0.003585554  278.89692
## X789     1059.9125    22.65625      0.003741307  267.28626
## X790       30.9825     0.87765      0.001436392  696.18879
## X791     2120.9850    44.87270      0.004918814  203.30102
## X792     1771.2300    40.00760      0.004942526  202.32568
## X793     1371.7425    29.34885      0.003979861  251.26503
```

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## X794      66.1825     1.70165      0.001741139  574.33675
## X795      58.3125     1.52025      0.001694808  590.03724
## X796     718.2225    15.78245      0.003600338  277.75172
## X797      95.5950     2.35290      0.002003832  499.04373
## X798    1321.5325    28.29565      0.003933626  254.21839
## X799      21.4625     0.63925      0.001440863  694.02842
## X800     766.0575    17.25415      0.003457812  289.20019
## X801      23.2200     0.71240      0.001547536  646.18850
## X802      52.6150     1.40930      0.001771035  564.64149
## X803      51.5025     1.38705      0.001747589  572.21706
## X804    1835.5750    39.63350      0.004387740  227.90775
## X805     562.1325    12.35265      0.003356673  297.91400
## X806     192.4525     4.50705      0.002265655  441.37352
## X807     306.5525     6.92505      0.002546591  392.68179
## X808     756.5475    16.38895      0.003496917  285.96616
## X809      25.8925     0.75185      0.001529549  653.78769
## X810      29.9125     0.84025      0.001496886  668.05354
## X811    1577.6525    33.90605      0.004232846  236.24770
## X812     332.4825     7.63565      0.002890523  345.95812
## X813    1701.5225    36.77445      0.004373479  228.65092
## X814     280.6425     6.45485      0.002737435  365.30553
## X815    1654.3625    35.32025      0.004535901  220.46338
## X816     166.3225     4.13645      0.002462393  406.10909
## X817     903.0125    20.27825      0.003573256  279.85683
## X818    2059.9225    43.69645      0.004873011  205.21193
## X819     417.5175     9.31335      0.002996573  333.71451
## X820     683.8525    14.89505      0.003449073  289.93293
## X821     102.9625     2.64525      0.002163088  462.30199
## X822     638.3425    14.01685      0.003479622  287.38757
## X823     694.0825    15.09965      0.003532313  283.10061
## X824     481.2525    10.63505      0.003166484  315.80772
## X825     681.1425    14.78585      0.003500503  285.67324
## X826      38.2650     1.06730      0.001612028  620.33679
## X827      29.5150     0.84230      0.001516748  659.30538
## X828      46.1225     1.24445      0.001731704  577.46599
## X829      46.8325     1.25065      0.001685280  593.37334
## X830     267.2425     6.10685      0.002710552  368.92849
## X831     177.4125     4.19025      0.002458794  406.70351
## X832     175.2525     4.27505      0.002343403  426.72976
## X833     393.8525     8.87905      0.002871181  348.28871
## X834    1224.5425    26.22885      0.004168123  239.91612
## X835    1296.1125    27.63625      0.004214024  237.30289
## X836     325.8225     7.34245      0.002874687  347.86391
## X837     137.4625     3.33525      0.002259499  442.57589
## X838     145.5900     3.50580      0.002281952  438.22136
## X839    2880.4225    60.12245      0.005293251  188.91980
## X840     347.1125     7.76825      0.002908627  343.80479
## X841    2536.3550    53.44410      0.005016579  199.33902
## X842    1108.8025    23.77005      0.003833578  260.85289
## X843     509.5425    11.16885      0.003152875  317.17085
```

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## X844      511.3100     12.21320          0.003324902  300.76076
## X845      430.8225      9.60245          0.003063690  326.40379
## X846      864.4625     18.65125          0.003727680  268.26334
## X847       48.0225      1.29045          0.001763450  567.07020
## X848      145.4375      3.62475          0.002129016  469.70053
## X849      545.5725     12.26545          0.003339451  299.45043
## X850      577.8575     12.90315          0.003382926  295.60211
## X851      230.5525      5.29305          0.002543061  393.22684
## X852       54.9025      1.43505          0.001834534  545.09755
## X853      332.0600      7.51520          0.002839190  352.21319
## X854       33.5000      0.93300          0.001834522  545.10127
## X855       40.2025      1.09505          0.001683965  593.83642
## X856       59.6650      1.57530          0.001808026  553.08933
## X857       58.4400      1.54280          0.001674532  597.18168
## X858       53.1975      1.40295          0.001580061  632.88690
## X859       31.6075      0.89515          0.001442386  693.29579
## X860       58.7375      1.51975          0.001691827  591.07703
## X861      302.7725      6.84945          0.002662151  375.63614
## X862      299.0950      7.56090          0.003161840  316.27153
## X863      417.3125      9.30025          0.003021603  330.95015
## X864      192.5325      4.47665          0.002332743  428.67983
## X865     1188.0800     26.13060          0.004347848  229.99885
## X866     5640.0725    116.27545          0.006174355  161.96025
## X867     5338.1725    110.44445          0.006050788  165.26773
## X868     1357.6975     29.33895          0.004419718  226.25880
## X869      201.1025      4.68805          0.002366313  422.59832
## X870      131.4825      3.15965          0.002223935  449.65350
## X871      197.9725      4.61745          0.002401002  416.49275
## X872      116.7925      2.81785          0.002156392  463.73767
## X873       13.4325      0.43865          0.001310299  763.18471
## X874       33.6825      0.99465          0.001749297  571.65819
## X875       81.3725      2.11745          0.001935724  516.60260
## X876       86.0325      2.18665          0.001926133  519.17496
## X877       10.3975      0.36095          0.001272513  785.84651
## X878       78.6225      1.98245          0.001820794  549.21091
## X879      445.2125      9.89825          0.003098637  322.72258
## X880      426.4625      9.49925          0.003060266  326.76895
## X881      130.4125      3.13025          0.002220428  450.36361
## X882     1397.4325     30.02265          0.004376501  228.49305
## X883     1406.1625     30.47725          0.004352267  229.76533
## X884       57.8825      1.50365          0.001783797  560.60182
## X885      433.4025      9.78205          0.002862108  349.39285
## X886       64.0125      1.65025          0.001740724  574.47352
## X887      650.2900     14.32180          0.003197250  312.76878
## X888      311.1325      7.19965          0.002560929  390.48331
## X889       50.0425      1.35485          0.001589368  629.18100
## X890       77.7725      1.98145          0.001734969  576.37918
## X891       48.4125      1.27925          0.001601008  624.60645
## X892      396.9625      8.84525          0.002746547  364.09354
## X893      253.7925      5.82085          0.002648933  377.51043
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## X894     472.5225    10.46845            0.002898023  345.06277
## X895     218.6225     5.05445            0.002563272  390.12630
## X896     202.3725     4.72945            0.002481415  402.99583
## X897     381.1725     8.52945            0.002908060  343.87184
## X898     326.0725     7.51545            0.002867404  348.74747
## X899      77.8525     2.01505            0.001788368  559.16893
## X900      73.9525     1.88105            0.001736955  575.72013
## X901     414.5800     9.25360            0.003008259  332.41819
## X902    3356.6025    70.17405            0.005651474  176.94497
## X903    1125.7725    24.25345            0.004050884  246.85968
## X904      77.1325     1.96065            0.001894420  527.86612
## X905     204.1525     4.74105            0.002294447  435.83477
## X906     119.3225     2.95645            0.002095883  477.12591
## X907     160.6125     3.79025            0.002141762  466.90531
## X908     534.1925    11.79785            0.003267046  306.08686
## X909     409.1925     9.09785            0.003012850  331.91168
## X910      19.1925     0.59385            0.001494001  669.34343
## X911      56.7625     1.48925            0.001691102  591.33035
## X912      10.9525     0.36505            0.001331132  751.24010
## X913      59.6625     1.57125            0.001718943  581.75295
## X914     221.4525     5.11905            0.002400772  416.53260
## X915       8.1725     0.30145            0.001281302  780.45593
## X916     310.8425     7.06685            0.002643713  378.25589
## X917     106.4800     2.60560            0.002024776  493.88179
## X918     173.1925     4.08985            0.002143130  466.60729
## X919      10.2625     0.35125            0.001214779  823.19499
## X920      58.9475     1.52795            0.001769599  565.09988
## X921     247.2425     5.71485            0.002311082  432.69784
## X922    3719.3325    77.30065            0.005364497  186.41077
## X923     224.1200     5.21340            0.002276039  439.35979
## X924    3421.2025    71.44905            0.005713959  175.01001
## X925    3803.1925    79.16185            0.005875888  170.18703
## X926    4983.5300   103.18460            0.005955906  167.90056
## X927    5220.4900   108.47680            0.006292800  158.91176
## X928   18575.2425   381.64585            0.009113641  109.72563
## X929   17353.4150   363.35930            0.009120941  109.63781
## X930    4229.8525    88.41905            0.005676938  176.15129
## X931      65.7425     1.80485            0.001959004  510.46350
## X932     504.3425    11.45585            0.002981300  335.42418
## X933      75.6325     1.91465            0.001791688  558.13290
## X934     226.2825     5.23865            0.002426203  412.16662
## X935     983.6825    21.53165            0.003803982  262.88242
## X936     676.4325    14.85865            0.003099073  322.67709
## X937      42.8825     1.15565            0.001619279  617.55891
## X938     957.2325    20.74665            0.003666782  272.71873
## X939      62.4525     1.61105            0.001663782  601.04031
## X940     157.3225     3.71645            0.002310287  432.84663
## X941      52.0825     1.37965            0.001615688  618.93146
## X942      74.6425     1.90285            0.001903447  525.36271
## X943     113.5825     2.78565            0.002038924  490.45487
```

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## X944     560.1725    12.28545        0.003280855  304.79862
## X945     220.3125     5.06425        0.002387614  418.82814
## X946     265.7825     6.06965        0.002570675  389.00292
## X947    1502.3650    35.26330        0.004482441  223.09275
## X948     479.7525    10.59005        0.003168980  315.55891
## X949      79.1125     2.00825        0.002005573  498.61062
## X950    2125.1000    48.42900        0.004900651  204.05452
## X951     124.6625     3.01525        0.002215810  451.30228
## X952      66.9025     1.70005        0.001865620  536.01474
## X953      68.9025     1.76405        0.001902540  525.61301
## X954     154.4825     3.66765        0.002157258  463.55132
## X955     201.3425     4.69285        0.002308012  433.27333
## X956      28.6675     0.83035        0.001611491  620.54336
## X957      44.2525     1.19905        0.001753424  570.31277
## X958     240.2625     5.51925        0.002612748  382.73876
## X959     181.7225     4.24545        0.002423842  412.56817
## X960     136.8775     3.44455        0.002376251  420.83097
## X961     250.1775     6.03555        0.002619131  381.80600
## X962      30.3925     0.86585        0.001512558  661.13146
## X963      28.6125     0.82225        0.001457593  686.06251
## X964     402.8325     8.97065        0.002823295  354.19607
## X965     439.8825     9.77565        0.002901371  344.66469
## X966      80.3925     2.02585        0.001958065  510.70827
## X967      46.8125     1.25825        0.001741116  574.34411
## X968      77.5225     1.95245        0.001971710  507.17407
## X969      74.5425     1.88485        0.001951524  512.42008
## X970     278.6025     6.38205        0.002568338  389.35682
## X971     187.8625     4.56725        0.002354629  424.69543
## X972      84.7425     2.19285        0.001920288  520.75516
## X973     636.6925    13.88785        0.003368997  296.82425
## X974     820.4450    17.71490        0.003639172  274.78779
## X975      75.9925     1.92985        0.001736623  575.83008
## X976      95.2125     2.34625        0.002026992  493.34190
## X977      57.8625     1.51125        0.001823854  548.28957
## X978    1282.9025    27.51605        0.004323410  231.29888
## X979    3021.7325    63.30865        0.005465531  182.96483
## X980    1362.3725    29.31345        0.004094665  244.22022
## X981    3480.4150    73.26230        0.005749686  173.92254
## X982      25.3125     0.75625        0.001598357  625.64229
## X983      65.8025     1.72305        0.001833306  545.46255
## X984     395.4625     8.84725        0.002971493  336.53115
## X985      40.2825     1.10265        0.001704785  586.58409
## X986    1094.4025    23.41005        0.003984382  250.97992
## X987    1474.7425    31.57685        0.004183824  239.01582
## X988    1511.4025    32.02205        0.004173923  239.58278
## X989    4892.6800   102.16160        0.006440202  155.27464
## X990    1680.7275    36.76655        0.004493641  222.53668
## X991    3755.1325    78.32865        0.005856901  170.73876
## X992     228.4700     5.25940        0.002588458  386.33034
## X993      21.1725     0.64945        0.001544622  647.40769
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## X994      147.1125      3.50425          0.002352913   425.00505
## X995      108.7225      2.66445          0.001956422   511.13722
## X996      128.8300      3.12260          0.002054053   486.84225
## X997      695.3150     15.62330          0.003495293   286.09908
## X998      623.9775     13.76655          0.003284967   304.41708
## X999     3360.7075     69.85615          0.005349693   186.92662
## X1000    1736.8375     36.64575          0.004419122   226.28930
## X1001     939.5900     20.19780          0.003466101   288.50858
## X1002    4492.5525     93.46105          0.005733929   174.40049
## X1003     196.7900      4.64280          0.002681990   372.85740
## X1004     187.5650      4.40330          0.002332657   428.69576
## X1005    6617.7875    139.74175          0.006628123   150.87229
## X1006     266.2025      6.08605          0.002370829   421.79337
## X1007     261.3825      5.97365          0.002570807   388.98290
## X1008     577.9025     12.61605          0.003085079   324.14078
## X1009     285.8525      6.47905          0.002523730   396.23891
## X1010      94.2925      2.32785          0.002055788   486.43142
## X1011      65.9925      1.68985          0.001902174   525.71415
## X1012      64.4625      1.65125          0.001884655   530.60117
## X1013      84.5525      2.12505          0.002026553   493.44868
## X1014     542.2525     11.92705          0.003264327   306.34185
## X1015    2154.4425     45.28285          0.004926301   202.99206
## X1016      84.1325      2.11665          0.002000554   499.86150
## X1017     372.6925      8.35185          0.002940130   340.12100
## X1018     601.5125     13.19225          0.003040484   328.89505
## X1019       4.2225      0.19045          0.001310298   763.18534
## X1020     427.2925      9.49185          0.003057495   327.06512
## X1021     755.2425     16.37085          0.003249699   307.72085
## X1022       4.5925      0.18985          0.001234349   810.14349
## X1023      56.0175      1.49435          0.001752206   570.70911
## X1024     451.5925      9.99485          0.003117645   320.75491
## X1025     382.2225      8.53445          0.002712835   368.61813
## X1026     380.8525      8.58705          0.002737330   365.31950
## X1027     123.2625      2.97125          0.002015660   496.11533
## X1028     152.0225      3.61845          0.002129597   469.57251
## X1029    2238.0800     47.16360          0.004996542   200.13842
## X1030    1009.2325     21.80265          0.003930158   254.44272
## X1031    2119.2425     44.83485          0.004922966   203.12958
## X1032     815.2425     17.81085          0.003695251   270.61758
## X1033     428.7125      9.68125          0.002776670   360.14369
## X1034     245.2825      5.69965          0.002343057   426.79285
## X1035     662.8125     14.57025          0.003290197   303.93317
## X1036     597.5025     13.16005          0.003184538   314.01731
## X1037     159.7625      3.91725          0.002354629   424.69542
## X1038      49.5925      1.32885          0.001721925   580.74554
## X1039     179.0025      4.23005          0.002286238   437.39976
## X1040      15.9425      0.50485          0.001413357   707.53556
## X1041     305.5225      6.90445          0.002555078   391.37753
## X1042    2557.2700     54.11440          0.004967568   201.30575
## X1043    2490.4825     53.09165          0.005001760   199.92962
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## X1044      421.8525      9.35905           0.003009178  332.31671
## X1045      440.9225      9.78845           0.003054095  327.42928
## X1046     2521.7325     52.84465           0.004777375  209.31995
## X1047     2902.1100     60.82020           0.005013586  199.45802
## X1048       49.0825      1.33565           0.001827152  547.29995
## X1049       84.5025      2.13205           0.002082236  480.25289
## X1050       50.6025      1.33405           0.001764523  566.72527
## X1051      241.2525      5.60205           0.002663410  375.45854
## X1052      172.2625      4.18325           0.002374884  421.07329
## X1053       85.0525      2.11905           0.001978191  505.51225
## X1054       24.6425      0.71885           0.001457238  686.22976
## X1055      665.3925     14.75785           0.003416656  292.68381
## X1056       20.0525      0.61905           0.001439778  694.55174
## X1057      173.0025      4.12605           0.002281296  438.34738
## X1058      291.5225      6.75245           0.002636505  379.28994
## X1059      221.6925      5.27585           0.002512028  398.08481
## X1060      353.4425      7.97485           0.002743585  364.48659
## X1061      171.6650      4.08530           0.002374423  421.15499
## X1062      302.5425      6.85285           0.002552608  391.75621
## X1063      147.7150      3.56630           0.002190871  456.43945
## X1064      262.7325      5.99265           0.002462443  406.10074
## X1065     1308.1975     31.00695           0.004610885  216.87811
## X1066      587.8925     12.91985           0.003133794  319.10200
## X1067       86.2725      2.16745           0.001936125  516.49551
## X1068      173.7825      4.10965           0.002265424  441.41847
## X1069      216.4225      5.34645           0.002443670  409.22055
## X1070      212.4425      4.96285           0.002440458  409.75920
## X1071       49.6150      1.32430           0.001722171  580.66251
## X1072      184.6625      4.43125           0.002235319  447.36336
## X1073       60.9350      1.57370           0.001781006  561.48055
## X1074       34.3225      0.94445           0.001535118  651.41580
## X1075       62.3200      1.60640           0.001754355  570.01014
## X1076      691.5325     14.98465           0.003503681  285.41408
## X1077       51.5925      1.36185           0.001784287  560.44793
## X1078      824.8125     17.90625           0.003767415  265.43399
## X1079       46.8625      1.24325           0.001735742  576.12233
## X1080      319.7150      7.44130           0.002686356  372.25147
## X1081      309.5900      7.24880           0.002666704  374.99476
## X1082       49.1625      1.30525           0.001711138  584.40629
## X1083       41.3525      1.13305           0.001563607  639.54708
## X1084       36.3225      1.00045           0.001565886  638.61593
## X1085       46.0525      1.24305           0.001541271  648.81522
## X1086      307.9525      6.96905           0.002657734  376.26036
## X1087      854.9775     21.13455           0.004127660  242.26800
## X1088      525.2725     11.56345           0.003060344  326.76067
## X1089      904.4725     19.46745           0.003619978  276.24477
## X1090       89.9825      2.23365           0.002008298  497.93396
## X1091      119.9025      2.89605           0.002146701  465.83112
## X1092      492.4000     11.13500           0.003003123  332.98673
## X1093      490.3025     10.82405           0.002927579  341.57918
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## X1094     655.4925    14.48785           0.003295901  303.40718
## X1095     899.4825    19.43965           0.003581311  279.22739
## X1096      47.2825     1.27565           0.001798721  555.95056
## X1097     106.6025     2.67805           0.001897578  526.98760
## X1098      35.9325     0.98465           0.001658275  603.03617
## X1099      97.8325     2.45465           0.001886733  530.01679
## X1100     273.2525     6.21105           0.002722775  367.27237
## X1101     199.5625     4.63325           0.002502998  399.52083
## X1102      25.6425     0.77085           0.001546069  646.80159
## X1103      35.5725     0.98545           0.001564013  639.38088
## X1104      63.3625     1.62925           0.001720044  581.38044
## X1105     235.5425     5.44085           0.002396915  417.20287
## X1106    1574.2050    33.54010           0.004266418  234.38864
## X1107     110.7025     2.71605           0.001900495  526.17861
## X1108    1259.1175    26.80335           0.004140810  241.49867
## X1109    1242.2000    26.61600           0.004156124  240.60882
## X1110     363.0450     8.11090           0.002929728  341.32861
## X1111     196.1625     4.56525           0.002476891  403.73191
## X1112     115.5625     2.80125           0.002147589  465.63847
## X1113     343.8025     7.80605           0.002730490  366.23457
## X1114     147.5925     3.49785           0.002276765  439.21968
## X1115     191.5025     4.48805           0.002459922  406.51701
## X1116     298.0425     6.81885           0.002657783  376.25350
## X1117     142.2625     3.41525           0.002286122  437.42201
## X1118    2352.1775    49.80555           0.004581291  218.27911
## X1119     161.9400     3.81580           0.002419302  413.34228
## X1120     178.4900     4.20180           0.002294273  435.86792
## X1121     437.3725     9.67745           0.002892186  345.75928
## X1122     585.2725    12.82745           0.003126593  319.83692
## X1123     171.6125     4.05825           0.002196095  455.35379
## X1124      93.5125     2.30425           0.001868244  535.26203
## X1125    1187.7625    28.31925           0.004668119  214.21903
## X1126     213.7625     5.04525           0.002422574  412.78411
## X1127     545.3700    12.29140           0.003419873  292.40855
## X1128     873.4575    19.90215           0.003866361  258.64113
## X1129     684.5025    15.19505           0.003564653  280.53218
## X1130     286.2100     6.70020           0.002703662  369.86868
## X1131     236.9775     5.57655           0.002525377  395.98041
## X1132      98.4150     2.46530           0.002067694  483.63063
## X1133     275.2400     6.53680           0.002787996  358.68062
## X1134     304.4325     6.93865           0.002818466  354.80287
## X1135     178.4225     4.17845           0.002412072  414.58131
## X1136      41.0025     1.12605           0.001545469  647.05270
## X1137      44.3525     1.21705           0.001590150  628.87151
## X1138    4059.3025    84.25205           0.005813594  172.01064
## X1139    5617.2775   116.55355           0.006372629  156.92111
## X1140     275.9825     6.25765           0.002550551  392.07220
## X1141    1070.0825    22.79565           0.003944816  253.49724
## X1142     380.0425     8.48685           0.002794702  357.81994
## X1143    1053.1825    22.46565           0.003788766  263.93815
```

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## X1144      241.7375      5.50875         0.002454923   407.34480
## X1145      159.5625      3.76525         0.002225873   449.26194
## X1146     1341.1725     28.47745         0.004080028   245.09635
## X1147      124.8725      3.00745         0.002278591   438.86769
## X1148      892.7625     19.20525         0.003598978   277.85667
## X1149      621.0200     13.53740         0.003331847   300.13385
## X1150      543.9925     12.10585         0.003156336   316.82308
## X1151     1773.2725     37.33045         0.004461155   224.15720
## X1152      452.5375     10.01675         0.002936077   340.59047
## X1153      356.6175      7.97035         0.002785680   358.97873
## X1154     1198.2175     25.47835         0.003920318   255.08137
## X1155      844.6375     18.22675         0.003585238   278.92151
## X1156     1054.7425     22.63285         0.003739459   267.41838
## X1157      467.9675     10.36535         0.003087181   323.92010
## X1158      516.3475     11.37695         0.003122181   320.28894
## X1159      835.3175     18.05235         0.003364211   297.24648
## X1160      438.0250      9.72650         0.002938388   340.32264
## X1161      384.5425      8.55285         0.002820854   354.50260
## X1162      731.2850     17.59270         0.003730909   268.03118
## X1163      573.7975     12.52595         0.003013163   331.87715
## X1164      752.7625     18.36125         0.003888524   257.16697
## X1165      728.5475     15.77695         0.003172573   315.20157
## X1166     2737.4275     57.06655         0.004715291   212.07597
## X1167     1084.6275     23.16655         0.003770674   265.20458
## X1168      519.4875     11.43575         0.002897052   345.17846
## X1169      423.4775      9.36355         0.002771855   360.76928
## X1170      526.2725     11.57445         0.002916174   342.91503
## X1171      361.6675      8.05935         0.002635038   379.50112
## X1172      607.6350     14.56970         0.003433993   291.20620
## X1173      688.7200     16.45140         0.003489622   286.56395
## X1174      303.2025      6.84105         0.002685299   372.39805
## X1175     2219.5225     46.46445         0.004379047   228.36021
## X1176     2497.3325     52.17665         0.004920384   203.23616
## X1177      275.1475      6.26095         0.002573892   388.51671
## X1178      747.3475     16.12895         0.003383775   295.52796
## X1179      834.8175     17.99435         0.003533030   283.04315
## X1180     1290.5025     27.41205         0.003995575   250.27684
## X1181      749.3475     16.24495         0.003502437   285.51549
## X1182     1168.2575     24.85115         0.003937704   253.95508
## X1183     1255.0075     26.72215         0.003998030   250.12318
## X1184      929.1075     20.00015         0.003755317   266.28913
## X1185      866.1200     18.64440         0.003565164   280.49199
## X1186      857.6750     20.88150         0.004022910   248.57629
## X1187      809.0825     17.49965         0.003621950   276.09438
## X1188      948.8675     20.43535         0.003698079   270.41069
## X1189     1124.0025     24.09005         0.003850081   259.73478
## X1190      603.7625     13.20525         0.003294776   303.51080
## X1191      792.7925     17.11385         0.003508110   285.05378
## X1192     2765.0925     57.72785         0.005105804   195.85556
## X1193     1723.0225     36.32645         0.004370956   228.78290
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## X1194     274.7425     6.24085     0.002587901  386.41348
## X1195     197.9825     4.58565     0.002332348  428.75242
## X1196    7157.2900   149.23380     0.006482394  154.26398
## X1197    6568.2425   134.81385     0.006723322  148.73601
## X1198     822.9325    17.84465     0.003265884  306.19584
## X1199    5889.4725   121.58445     0.006611308  151.25599
## X1200    9056.4425   185.20285     0.006989379  143.07423
## X1201     704.2575    15.29915     0.003265223  306.25779
## X1202     675.3925    14.88185     0.003378188  296.01664
## X1203     786.3575    16.94515     0.003173156  315.14370
## X1204    1622.0775    37.94955     0.004909495  203.68693
## X1205    3198.8150    70.54630     0.005694681  175.60247
## X1206    1505.8725    32.01145     0.004329603  230.96806
## X1207     329.6625     7.41925     0.002799833  357.16411
## X1208     784.0425    16.92685     0.003439485  290.74117
## X1209     650.7350    15.29570     0.003519197  284.15570
## X1210     525.4850    12.17370     0.003263600  306.41006
## X1211    2518.4225    52.77445     0.005011030  199.55978
## X1212    2780.4775    58.05555     0.005125608  195.09879
## X1213    2321.8275    48.64655     0.004834118  206.86297
## X1214    1198.1725    26.11545     0.004037544  247.67534
## X1215    1481.6225    31.41445     0.004227853  236.52666
## X1216    6678.0425   137.36685     0.006698794  149.28061
## X1217    5092.4200   105.47840     0.006185685  161.66359
## X1218     696.7925    15.28985     0.003386412  295.29780
## X1219     284.3275     6.43655     0.002591271  385.91105
## X1220     542.8275    11.91455     0.003128726  319.61891
## X1221    3263.1175    67.95235     0.005068628  197.29207
## X1222    7007.7875   144.05775     0.006360697  157.21548
## X1223     565.1075    12.34015     0.002946293  339.40954
## X1224     584.2525    13.59105     0.003168723  315.58457
## X1225     544.5525    11.90505     0.002902187  344.56779
## X1226     510.9375    11.20075     0.002864569  349.09266
## X1227     649.0925    14.15985     0.003269439  305.86287
## X1228     594.2825    13.03565     0.003186259  313.84765
## X1229     706.5525    15.32105     0.003407917  293.43435
## X1230     865.8025    18.68605     0.003531184  283.19116
## X1231     152.4725     3.73145     0.002263092  441.87328
## X1232      89.1925     2.27385     0.001955352  511.41688
## X1233    1442.7125    30.59225     0.004014905  249.07190
## X1234    1470.5525    31.17305     0.004030249  248.12365
## X1235     157.2725     3.73945     0.002315861  431.80479
## X1236      92.0725     2.29945     0.002041838  489.75488
## X1237     622.1925    13.57385     0.003068540  325.88783
## X1238     342.6925     7.77585     0.003027892  330.26281
## X1239     287.2925     6.57985     0.002594270  385.46491
## X1240     210.8125     4.88225     0.002488519  401.84545
## X1241     212.7225     4.90445     0.002490489  401.52754
## X1242    1055.0525    22.59905     0.003473761  287.87239
## X1243     279.4025     6.34205     0.002648083  377.63169
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## X1244    565.3625    12.39725    0.003031936    329.82228
## X1245     39.2425     1.09885    0.001633488    612.18687
## X1246     43.4425     1.18285    0.001653726    604.69515
## X1247    239.2825     5.49165    0.002546812    392.64777
## X1248     22.5425     0.66885    0.001444109    692.46861
## X1249     92.4825     2.29965    0.001791353    558.23721
## X1250     68.1125     1.74825    0.001682184    594.46525
## X1251     43.0825     1.15965    0.001644163    608.21226
## X1252    173.3025     4.15605    0.002175209    459.72590
## X1253    427.6225     9.50645    0.002668111    374.79704
## X1254     21.3625     0.63725    0.001491015    670.68385
## X1255     17.0825     0.53565    0.001456382    686.63285
## X1256   1270.7225    27.15245    0.004021225    248.68043
## X1257    172.8525     4.06705    0.002319637    431.10186
## X1258    108.3725     2.66545    0.002077381    481.37533
## X1259    174.9225     4.09245    0.002389629    418.47500
## X1260    154.3625     3.64925    0.002310686    432.77189
## X1261    153.7625     3.67725    0.002302811    434.25186
## X1262    141.1225     3.37745    0.002234576    447.51223
## X1263    146.7225     3.51945    0.002293278    436.05710
## X1264    114.5925     2.81385    0.002158242    463.34010
## X1265    202.4500     4.70700    0.002315127    431.94172
## X1266    229.9325     5.29665    0.002389837    418.43867
## X1267    148.0125     3.53025    0.002065451    484.15573
## X1268    142.4125     3.47425    0.002104071    475.26921
## X1269    495.7650    11.33130    0.003111031    321.43690
## X1270     83.1925     2.08185    0.001875320    533.24239
## X1271    375.6325     8.58165    0.002829724    353.39138
## X1272     31.8775     0.90955    0.001668780    599.24014
## X1273    895.4550    19.50010    0.003842419    260.25274
## X1274    707.3975    15.65295    0.003600792    277.71666
## X1275     47.8150     1.26330    0.001663014    601.31795
## X1276    370.2725     8.28745    0.002684667    372.48573
## X1277    500.6825    11.04765    0.002922785    342.13938
## X1278   1161.8425    24.91885    0.004061659    246.20478
## X1279    479.5725    10.58545    0.002965891    337.16683
## X1280   1110.0300    30.28460    0.005082988    196.73466
## X1281    316.1225     7.16445    0.002650297    377.31615
## X1282     71.2225     1.81845    0.001904336    525.11734
## X1283     90.6625     2.23125    0.002027509    493.21604
## X1284     74.5325     1.87665    0.001903472    525.35590
## X1285    105.4425     2.60685    0.002148309    465.48246
## X1286    264.1625     6.05325    0.002679002    373.27333
## X1287    398.3425     8.86485    0.002745029    364.29485
## X1288    350.5600     7.86120    0.002644733    378.11003
## X1289   1249.4525    26.66305    0.003945591    253.44749
## X1290    149.6600     3.64020    0.002347549    425.97622
## X1291     65.9725     1.70545    0.001879537    532.04604
## X1292     37.9625     1.04125    0.001658717    602.87569
## X1293   1537.9025    32.72005    0.004283125    233.47441
```

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## X1294        87.2725      2.19145          0.001775642  563.17644
## X1295        71.0750      1.89150          0.001756120  569.43704
## X1296       188.9425      4.46085          0.002296748  435.39824
## X1297       182.6225      4.37445          0.002607867  383.45515
## X1298       413.7225      9.41245          0.002827593  353.65773
## X1299       180.6825      4.34365          0.002341621  427.05454
## X1300       182.9925      4.27785          0.002432463  411.10602
## X1301       115.0125      2.84625          0.002065975  484.03299
## X1302       479.9325     10.56065          0.002748505  363.83417
## X1303       282.6225      6.43045          0.002436762  410.38067
## X1304       216.0650      5.01830          0.002392484  417.97564
## X1305       255.2225      5.83445          0.002521822  396.53873
## X1306       242.2125      5.59825          0.002473261  404.32450
## X1307        95.5525      2.38505          0.001958926  510.48368
## X1308        20.7425      0.62485          0.001431361  698.63581
## X1309        23.2025      0.67405          0.001442363  693.30691
## X1310       703.0925     15.34485          0.003281825  304.70855
## X1311      1294.6825     27.63965          0.003934758  254.14523
##        SurfaceToVolumeRatio
## X1              0.02454724
## X2              0.02467660
## X3              0.02485892
## X4              0.02500274
## X5              0.02201627
## X6              0.02435238
## X7              0.02494260
## X8              0.02328088
## X9              0.02596830
## X10             0.02539338
## X11             0.02688659
## X12             0.02262501
## X13             0.02542858
## X14             0.02122566
## X15             0.02596787
## X16             0.02142471
## X17             0.02194300
## X18             0.02262450
## X19             0.02311581
## X20             0.02315266
## X21             0.02751197
## X22             0.02968230
## X23             0.02416659
## X24             0.02141975
## X25             0.02345040
## X26             0.02202268
## X27             0.02277389
## X28             0.02173197
## X29             0.02280378
## X30             0.02690183
## X31             0.02476733
```

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## X32           0.02304919
## X33           0.02378489
## X34           0.02298721
## X35           0.02151737
## X36           0.03290472
## X37           0.03265085
## X38           0.03841600
## X39           0.02179016
## X40           0.02141358
## X41           0.02146577
## X42           0.02542378
## X43           0.02223609
## X44           0.02162858
## X45           0.02142741
## X46           0.02432697
## X47           0.02133855
## X48           0.02449944
## X49           0.02341532
## X50           0.02218844
## X51           0.02156095
## X52           0.02166243
## X53           0.02287079
## X54           0.02650891
## X55           0.02242474
## X56           0.02207605
## X57           0.02203439
## X58           0.02372247
## X59           0.02391706
## X60           0.02254637
## X61           0.02336886
## X62           0.02465937
## X63           0.02258766
## X64           0.03838334
## X65           0.02288168
## X66           0.03875026
## X67           0.02232355
## X68           0.02177250
## X69           0.02072693
## X70           0.02674362
## X71           0.02792296
## X72           0.02220421
## X73           0.02173620
## X74           0.02602851
## X75           0.02397900
## X76           0.02220148
## X77           0.02168916
## X78           0.02238356
## X79           0.02510330
## X80           0.02397264
## X81           0.02445323
```

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## X82              0.02392378
## X83              0.02647027
## X84              0.02455676
## X85              0.02075118
## X86              0.02654340
## X87              0.02452366
## X88              0.02139594
## X89              0.02140789
## X90              0.02619587
## X91              0.02618566
## X92              0.02478401
## X93              0.02437526
## X94              0.02668659
## X95              0.02778440
## X96              0.02682609
## X97              0.02811686
## X98              0.02612253
## X99              0.02444146
## X100             0.02299251
## X101             0.02274159
## X102             0.02270840
## X103             0.02178581
## X104             0.02911663
## X105             0.02760706
## X106             0.02269244
## X107             0.02354865
## X108             0.02273662
## X109             0.02464268
## X110             0.02533784
## X111             0.02495396
## X112             0.02615965
## X113             0.02512238
## X114             0.02627334
## X115             0.02712961
## X116             0.02495795
## X117             0.02499540
## X118             0.02114205
## X119             0.02385226
## X120             0.02369934
## X121             0.02452201
## X122             0.02158853
## X123             0.02253265
## X124             0.02320722
## X125             0.02680551
## X126             0.02185382
## X127             0.02642621
## X128             0.02199420
## X129             0.02618220
## X130             0.02430906
## X131             0.02349712
```

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## X132           0.02698930
## X133           0.02247928
## X134           0.02745799
## X135           0.02160285
## X136           0.02198737
## X137           0.02332141
## X138           0.02253074
## X139           0.02169407
## X140           0.02340821
## X141           0.02529960
## X142           0.02383761
## X143           0.02508971
## X144           0.02843311
## X145           0.02263099
## X146           0.02434926
## X147           0.02377146
## X148           0.02773494
## X149           0.02356506
## X150           0.02305072
## X151           0.02507082
## X152           0.03031182
## X153           0.02241161
## X154           0.02670671
## X155           0.02191940
## X156           0.02091416
## X157           0.02117412
## X158           0.02955906
## X159           0.02991178
## X160           0.02411090
## X161           0.02149639
## X162           0.02144044
## X163           0.02234185
## X164           0.02786233
## X165           0.02828026
## X166           0.02293682
## X167           0.02222840
## X168           0.02531722
## X169           0.02353738
## X170           0.02398421
## X171           0.02549476
## X172           0.02379106
## X173           0.02396835
## X174           0.02166539
## X175           0.02241453
## X176           0.02517952
## X177           0.02522276
## X178           0.02269294
## X179           0.02519612
## X180           0.02374652
## X181           0.02393633
```

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## X182          0.02435467
## X183          0.02158741
## X184          0.02149062
## X185          0.02209382
## X186          0.02839223
## X187          0.02283385
## X188          0.02114245
## X189          0.02270132
## X190          0.02184099
## X191          0.02320916
## X192          0.02261621
## X193          0.02231275
## X194          0.02211375
## X195          0.02187907
## X196          0.02190252
## X197          0.02672343
## X198          0.02469119
## X199          0.02693118
## X200          0.03063157
## X201          0.03024827
## X202          0.02983806
## X203          0.02240346
## X204          0.02217412
## X205          0.02673564
## X206          0.02837809
## X207          0.02383473
## X208          0.02487984
## X209          0.02168166
## X210          0.02157027
## X211          0.02189290
## X212          0.02304077
## X213          0.02171522
## X214          0.02225597
## X215          0.02077338
## X216          0.02250002
## X217          0.02246912
## X218          0.02306679
## X219          0.02155946
## X220          0.02115767
## X221          0.02088922
## X222          0.02122362
## X223          0.02363317
## X224          0.02093804
## X225          0.02094816
## X226          0.02153822
## X227          0.02104275
## X228          0.02132809
## X229          0.02146514
## X230          0.02161755
## X231          0.02109734
```

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## X233             0.02077447
## X234             0.02167992
## X235             0.02219501
## X236             0.02899425
## X237             0.02168423
## X238             0.02193511
## X239             0.02181484
## X240             0.02158235
## X241             0.02447294
## X242             0.02120467
## X243             0.02119819
## X244             0.02181616
## X245             0.02549374
## X246             0.02377688
## X247             0.02269046
## X248             0.02290297
## X249             0.02192797
## X250             0.02497434
## X251             0.02315920
## X252             0.02305562
## X253             0.02269862
## X254             0.02722794
## X255             0.02141984
## X256             0.02295049
## X257             0.02800153
## X258             0.02967062
## X259             0.02486579
## X260             0.02566710
## X261             0.02691696
## X262             0.02398148
## X263             0.02136773
## X264             0.03135665
## X265             0.02223094
## X266             0.02983031
## X267             0.02352902
## X268             0.02459526
## X269             0.02393275
## X270             0.02339579
## X271             0.02364078
## X272             0.02398712
## X273             0.02391513
## X274             0.02455527
## X275             0.02325018
## X276             0.02385103
## X277             0.02303567
## X278             0.02439568
## X279             0.02502449
## X280             0.02285619
## X281             0.02177675
```

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## X283            0.02853266
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## X285            0.02642058
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## X288            0.02144770
## X289            0.02728269
## X290            0.02266352
## X291            0.02207268
## X292            0.02553196
## X293            0.02517895
## X294            0.02472295
## X295            0.02461051
## X296            0.02225434
## X297            0.02432313
## X298            0.02291487
## X299            0.02242469
## X300            0.02585092
## X301            0.02742838
## X302            0.02133979
## X303            0.02127576
## X304            0.02661273
## X305            0.02511043
## X306            0.02360956
## X307            0.02395351
## X308            0.02275064
## X309            0.02404024
## X310            0.02337719
## X311            0.02200445
## X312            0.02275279
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## X314            0.02474731
## X315            0.02322588
## X316            0.02286025
## X317            0.02311297
## X318            0.02905075
## X319            0.03012414
## X320            0.02134859
## X321            0.02182480
## X322            0.02153028
## X323            0.02162662
## X324            0.02346251
## X325            0.02165544
## X326            0.02649273
## X327            0.02178210
## X328            0.02133959
## X329            0.02576959
## X330            0.02327060
## X331            0.02148315
```

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## X335           0.02470716
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## X338           0.02314357
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## X345           0.02066763
## X346           0.02452107
## X347           0.02244598
## X348           0.02171854
## X349           0.02067939
## X350           0.02064459
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## X352           0.02829515
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## X367           0.02362526
## X368           0.02283764
## X369           0.02418579
## X370           0.02583865
## X371           0.02296536
## X372           0.02319038
## X373           0.02128717
## X374           0.02666240
## X375           0.02143343
## X376           0.02266452
## X377           0.02399533
## X378           0.02234389
## X379           0.02165125
## X380           0.02420257
## X381           0.02705896
```

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## X385          0.02228524
## X386          0.02443090
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## X388          0.02462029
## X389          0.02278414
## X390          0.03083127
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## X392          0.02545179
## X393          0.02832191
## X394          0.02264158
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## X396          0.02676195
## X397          0.02294138
## X398          0.02384112
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## X402          0.02152160
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## X404          0.02166764
## X405          0.02333203
## X406          0.02464277
## X407          0.02342821
## X408          0.02200117
## X409          0.02366566
## X410          0.03043717
## X411          0.02577522
## X412          0.02617602
## X413          0.02257150
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## X421          0.02198931
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## X425          0.02623888
## X426          0.02476230
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## X428          0.02446583
## X429          0.02664969
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## X431          0.02271315
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## X437          0.02262411
## X438          0.02217298
## X439          0.02302360
## X440          0.02213045
## X441          0.02302532
## X442          0.02244168
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## X444          0.02604689
## X445          0.02721315
## X446          0.02559737
## X447          0.02707486
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## X449          0.02140460
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## X454          0.02103001
## X455          0.02092834
## X456          0.02131045
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## X469          0.02210350
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## X472          0.03040281
## X473          0.02780987
## X474          0.02898876
## X475          0.02768953
## X476          0.02116692
## X477          0.02122414
## X478          0.03555163
## X479          0.02529084
## X480          0.02278730
## X481          0.04863404
```

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## X488            0.02375061
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## X491            0.02768961
## X492            0.02270749
## X493            0.02723256
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## X495            0.02324248
## X496            0.02103343
## X497            0.02772343
## X498            0.02079758
## X499            0.02367853
## X500            0.02898876
## X501            0.02364404
## X502            0.02108627
## X503            0.02930319
## X504            0.02296835
## X505            0.02256178
## X506            0.02132408
## X507            0.02690574
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## X509            0.02107220
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## X530            0.02126465
## X531            0.02328251
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## X1199        0.02064437
## X1200        0.02044985
## X1201        0.02172380
## X1202        0.02203437
## X1203        0.02154891
## X1204        0.02339564
## X1205        0.02205389
## X1206        0.02125774
## X1207        0.02250559
## X1208        0.02158920
## X1209        0.02350527
## X1210        0.02316660
## X1211        0.02095536
## X1212        0.02087970
## X1213        0.02095184
## X1214        0.02179607
## X1215        0.02120274
## X1216        0.02056993
## X1217        0.02071282
## X1218        0.02194319
## X1219        0.02263780
## X1220        0.02194905
## X1221        0.02082437
## X1222        0.02055681
## X1223        0.02183682
## X1224        0.02326229
## X1225        0.02186208
## X1226        0.02192196
## X1227        0.02181484
## X1228        0.02193511
## X1229        0.02168423
## X1230        0.02158235
## X1231        0.02447294
```

```
## X1232          0.02549374
## X1233          0.02120467
## X1234          0.02119819
## X1235          0.02377688
## X1236          0.02497434
## X1237          0.02181616
## X1238          0.02269046
## X1239          0.02290297
## X1240          0.02315920
## X1241          0.02305562
## X1242          0.02141984
## X1243          0.02269862
## X1244          0.02192797
## X1245          0.02800153
## X1246          0.02722794
## X1247          0.02295049
## X1248          0.02967062
## X1249          0.02486579
## X1250          0.02566710
## X1251          0.02691696
## X1252          0.02398148
## X1253          0.02223094
## X1254          0.02983031
## X1255          0.03135665
## X1256          0.02136773
## X1257          0.02352902
## X1258          0.02459526
## X1259          0.02339579
## X1260          0.02364078
## X1261          0.02391513
## X1262          0.02393275
## X1263          0.02398712
## X1264          0.02455527
## X1265          0.02325018
## X1266          0.02303567
## X1267          0.02385103
## X1268          0.02439568
## X1269          0.02285619
## X1270          0.02502449
## X1271          0.02284587
## X1272          0.02853266
## X1273          0.02177675
## X1274          0.02212752
## X1275          0.02642058
## X1276          0.02238203
## X1277          0.02206518
## X1278          0.02144770
## X1279          0.02207268
## X1280          0.02728269
## X1281          0.02266352
```

```
## X1282              0.02553196
## X1283              0.02461051
## X1284              0.02517895
## X1285              0.02472295
## X1286              0.02291487
## X1287              0.02225434
## X1288              0.02242469
## X1289              0.02133979
## X1290              0.02432313
## X1291              0.02585092
## X1292              0.02742838
## X1293              0.02127576
## X1294              0.02511043
## X1295              0.02661273
## X1296              0.02360956
## X1297              0.02395351
## X1298              0.02275064
## X1299              0.02404024
## X1300              0.02337719
## X1301              0.02474731
## X1302              0.02200445
## X1303              0.02275279
## X1304              0.02322588
## X1305              0.02286025
## X1306              0.02311297
## X1307              0.02496062
## X1308              0.03012414
## X1309              0.02905075
## X1310              0.02182480
## X1311              0.02134859
##
## $usekernel
## [1] TRUE
##
## $varnames
## [1] "LesionVolume"          "LesionArea"
"SphericalDisproportion"
## [4] "Sphericity"            "SurfaceToVolumeRatio"
##
## $xNames
## [1] "LesionVolume"          "LesionArea"
"SphericalDisproportion"
## [4] "Sphericity"            "SurfaceToVolumeRatio"
##
## $problemType
## [1] "Classification"
##
## $tuneValue
##   fL usekernel adjust
## 2  0      TRUE      1
```

```
##
## $obsLevels
## [1] "BENIGN"    "MALIGNANT"
## attr(,"ordered")
## [1] FALSE
##
## $param
## list()
##
## attr(,"class")
## [1] "NaiveBayes"

##   [1] 0.6977612 0.6941725 0.5849905 0.6483209 0.6709422 0.6286147
0.5352468
##   [8] 0.6314685 0.6118881 0.6190586 0.6808266 0.7326259 0.7487945
0.6991604
##  [15] 0.5958807 0.6546498 0.5363806 0.5601399 0.6659674 0.6588542
0.7329757
##  [22] 0.4995338 0.5935706 0.6483209 0.6214452 0.6874126 0.5830966
0.5688920
##  [29] 0.6479908 0.6702641 0.6359608 0.5594683 0.6121735 0.6397245
0.5703963
##  [36] 0.6133396 0.6163713 0.6613806 0.5913753 0.6613054 0.6884328
0.7208807
##  [43] 0.7388731 0.6312285 0.5554779 0.6833525 0.6484848 0.6275653
0.6168377
##  [50] 0.6564868 0.5940299 0.6319963 0.6304451 0.6078071 0.6460701
0.6808266
##  [57] 0.6030303 0.6602746 0.6462220 0.5652681 0.6254879 0.6732955
0.6161381
##  [64] 0.6456876 0.5859375 0.5260620 0.6540793 0.6184701 0.6813447
0.6199770
##  [71] 0.6175373 0.7255131 0.6075775 0.7524684 0.6456946 0.6065341
0.6194030
##  [78] 0.5310023 0.6683239 0.5345149 0.6150886 0.6054104 0.6673660
0.6723414
##  [85] 0.6208955 0.6654420 0.7139860 0.6647727 0.5847538 0.6539610
0.7233065
##  [92] 0.7267509 0.6243004 0.5491241 0.7628265 0.5631702 0.6483209
0.6748565
##  [99] 0.5862471 0.6298507

## Cross-Validated (10 fold, repeated 10 times) Confusion Matrix
##
## (entries are percentual average cell counts across resamples)
##
##            Reference
## Prediction  BENIGN MALIGNANT
##   BENIGN      40.5      30.2
##   MALIGNANT    8.7      20.6
```

```
## 
##  Accuracy (average) : 0.6105
```

Confusion Matrix nb

Prediction: BENIGN

| 40.49 | | 30.24 |

Reference: BENIGN — Reference: MALIGNANT

| 8.71 | | 20.56 |

Prediction: MALIGNANT
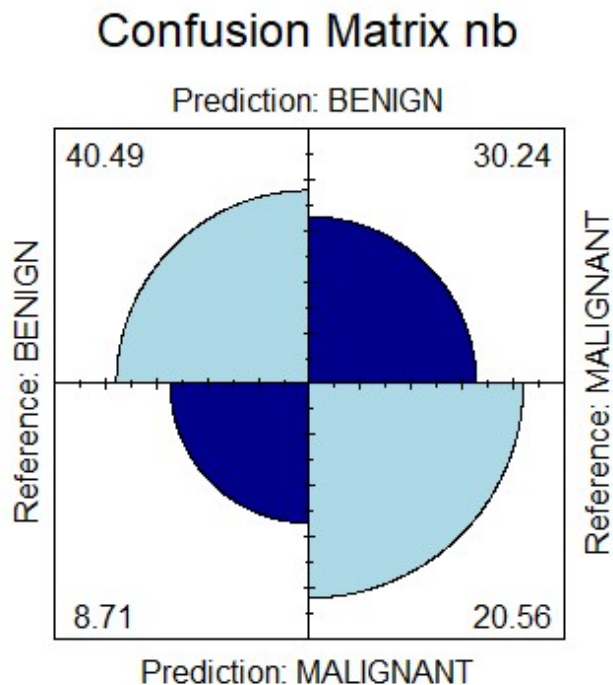
```
## [1] 0.4048048
```

```
## [1] 0.8229457
```

```
## [1] 0.6105263
```

Display info about svm-l model after 10-fold validation:

```
## Support Vector Machine object of class "ksvm"
## 
## SV type: C-svc  (classification)
##  parameter : cost C = 1
## 
## Linear (vanilla) kernel function.
## 
## Number of Support Vectors : 1122
## 
## Objective Function Value : -1111.639
## Training error : 0.386728
## Probability model included.

##   [1] 0.6683769 0.5588978 0.6421911 0.6753731 0.6808858 0.5939867
0.6515858
##   [8] 0.6007463 0.6470862 0.5995408 0.7066231 0.6681437 0.6867968
0.5191142
```

```
##  [15] 0.6524621 0.5533800 0.6376579 0.6789897 0.6500947 0.5643657
0.7051282
##  [22] 0.7583955 0.5653272 0.5988345 0.5660511 0.6110218 0.6177705
0.6359608
##  [29] 0.6240093 0.6177705 0.6559441 0.5485322 0.6615385 0.5820896
0.5834673
##  [36] 0.5886194 0.6681437 0.6664336 0.7308239 0.6332951 0.6594719
0.6023787
##  [43] 0.6464552 0.6116550 0.6788713 0.7019413 0.5738928 0.6463869
0.6103078
##  [50] 0.5850746 0.5968277 0.6711648 0.5871795 0.6261660 0.6360505
0.6865672
##  [57] 0.5697295 0.6289323 0.6727899 0.6453598 0.5745921 0.6576705
0.6554779
##  [64] 0.5547646 0.6154384 0.6204363 0.6958955 0.7143513 0.6149720
0.5991951
##  [71] 0.6951049 0.6534091 0.6110075 0.6149254 0.6195178 0.6082090
0.6690341
##  [78] 0.6112407 0.6200466 0.6130884 0.6680653 0.5916193 0.5223776
0.5872201
##  [85] 0.5909515 0.6765392 0.6211251 0.6747159 0.6326062 0.7336395
0.6115057
##  [92] 0.5762238 0.7067738 0.6213548 0.5416667 0.6964409 0.6014459
0.7280784
##  [99] 0.6543843 0.5883450

## Cross-Validated (10 fold, repeated 10 times) Confusion Matrix
##
## (entries are percentual average cell counts across resamples)
##
##           Reference
## Prediction  BENIGN MALIGNANT
##   BENIGN      37.4      26.4
##   MALIGNANT   11.8      24.4
##
##  Accuracy (average) : 0.6174
```

Confusion Matrix svm-l
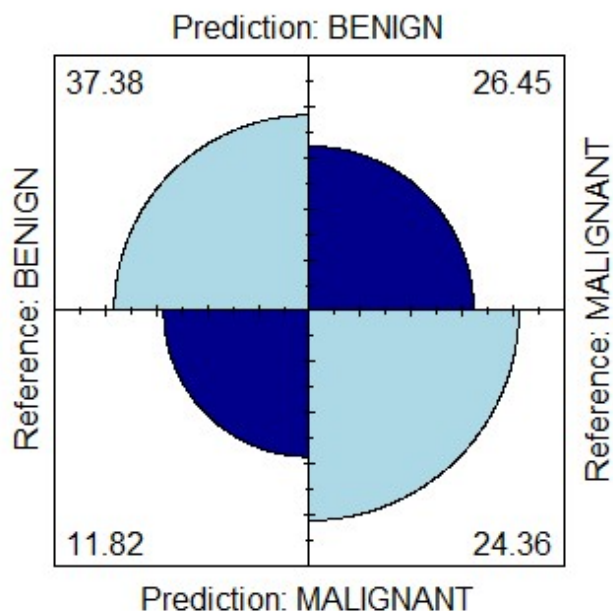

```
## [1] 0.4794294

## [1] 0.759845

## [1] 0.6173913
```

Display info about svm-r model after 10-fold validation:

```
## Support Vector Machine object of class "ksvm"
##
## SV type: C-svc  (classification)
##  parameter : cost C = 1
##
## Gaussian Radial Basis kernel function.
##  Hyperparameter : sigma =  3.28132203402867
##
## Number of Support Vectors : 1045
##
## Objective Function Value : -961.6327
## Training error : 0.342487
## Probability model included.

##   [1] 0.6681975 0.5990676 0.6617681 0.7126866 0.7005208 0.7546642
0.6639459
##   [8] 0.4920746 0.6881119 0.6436567 0.6955224 0.7252799 0.6571096
0.6948335
##  [15] 0.7020979 0.6581157 0.6815814 0.6747159 0.6190586 0.5736940
0.6400932
```

```
## [22] 0.5645989 0.6769231 0.6624709 0.6043628 0.7961754 0.6415578
0.6765392
## [29] 0.6247991 0.6831228 0.6646455 0.6552448 0.6254735 0.7312354
0.6304451
## [36] 0.6422822 0.6960227 0.6399541 0.7114219 0.6957520 0.6448228
0.6303638
## [43] 0.6753157 0.6690765 0.6521240 0.6644123 0.6317016 0.6466131
0.6576493
## [50] 0.6632463 0.6452892 0.6668998 0.6834499 0.6721010 0.6588153
0.6633523
## [57] 0.7242250 0.7438447 0.6975890 0.7308239 0.6769231 0.6165327
0.6279720
## [64] 0.6690341 0.6675086 0.7286932 0.6766935 0.6877332 0.6986014
0.7901263
## [71] 0.6761364 0.6500574 0.6789773 0.7285448 0.6770056 0.6512821
0.6937063
## [78] 0.6766935 0.7053961 0.6826636 0.6392257 0.6675086 0.6916084
0.7501722
## [85] 0.5788352 0.6399148 0.6522854 0.6537313 0.6326340 0.6335227
0.6389925
## [92] 0.5606343 0.6820513 0.7651586 0.5888526 0.6313920 0.6679104
0.7070896
## [99] 0.6574160 0.6363636

## Cross-Validated (10 fold, repeated 10 times) Confusion Matrix
##
## (entries are percentual average cell counts across resamples)
##
##           Reference
## Prediction  BENIGN MALIGNANT
##   BENIGN      33.9      23.0
##   MALIGNANT   15.3      27.8
##
##  Accuracy (average) : 0.6169
```

Confusion Matrix svm-r

Prediction: BENIGN

33.89	23
15.31	27.8

Reference: BENIGN (left axis) · Reference: MALIGNANT (right axis)

Prediction: MALIGNANT
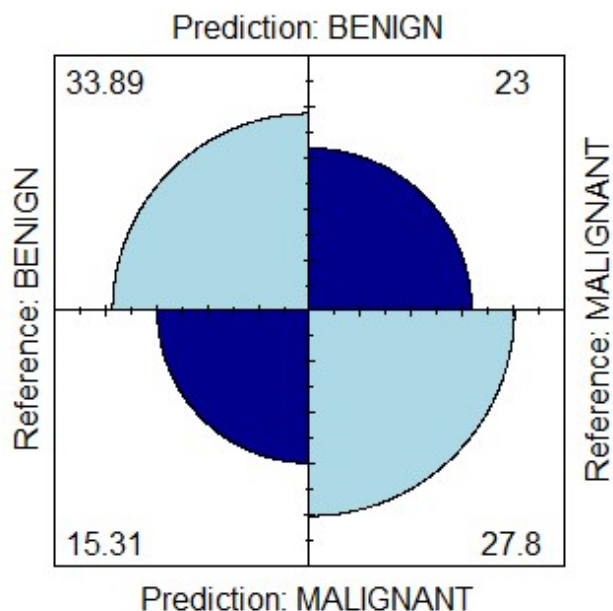
```
## [1] 0.5472973

## [1] 0.6888372

## [1] 0.6169336
```

Display info about rf model after 10-fold validation:

```
##
## Call:
##  randomForest(x = x, y = y, mtry = param$mtry)
##                Type of random forest: classification
##                      Number of trees: 500
## No. of variables tried at each split: 2
##
##          OOB estimate of  error rate: 32.57%
## Confusion matrix:
##            BENIGN MALIGNANT class.error
## BENIGN        434       211   0.3271318
## MALIGNANT     216       450   0.3243243

##    [1] 0.7059441 0.7132032 0.6955492 0.7725047 0.7270953 0.6146853
0.7891791
##    [8] 0.6659282 0.7570608 0.6976446 0.7317016 0.7383467 0.7066434
0.7460354
##   [15] 0.7141335 0.6882102 0.6965557 0.6270989 0.7124534 0.7074592
0.7090909
##   [22] 0.7053613 0.6669346 0.7999067 0.7503498 0.7406716 0.6692308
```

```
0.8010333
## [29] 0.7392724 0.6819347 0.7621922 0.7891608 0.6547112 0.6835938
0.7950994
## [36] 0.6694604 0.7268065 0.7430540 0.6909981 0.7020756 0.7099885
0.7053405
## [43] 0.7391504 0.7028918 0.7393939 0.7138921 0.6442397 0.6473881
0.7164179
## [50] 0.6564103 0.6967366 0.7498278 0.7051073 0.7439631 0.6644087
0.7481061
## [57] 0.6715270 0.7121212 0.7611888 0.6027285 0.7212121 0.6988636
0.7094145
## [64] 0.7969934 0.7086108 0.7225979 0.7247086 0.7772675 0.7001657
0.7475316
## [71] 0.7107008 0.7593284 0.6554338 0.6321678 0.6624709 0.7672790
0.7205511
## [78] 0.7350172 0.6794543 0.7636051 0.7539627 0.7686567 0.6638258
0.7105824
## [85] 0.6447062 0.7482204 0.6961538 0.6522254 0.7560634 0.6433069
0.6994172
## [92] 0.7818330 0.7454524 0.6983902 0.6744403 0.6961287 0.7804338
0.6646853
## [99] 0.7398393 0.7175660

## Cross-Validated (10 fold, repeated 10 times) Confusion Matrix
##
## (entries are percentual average cell counts across resamples)
##
##           Reference
## Prediction   BENIGN MALIGNANT
##   BENIGN      32.3      17.3
##   MALIGNANT   16.9      33.5
##
##  Accuracy (average) : 0.6581
```

Confusion Matrix rf

Prediction: BENIGN

| 32.27 | | 17.25 |

(Reference: BENIGN / Reference: MALIGNANT)

| 16.93 | | 33.55 |

Prediction: MALIGNANT
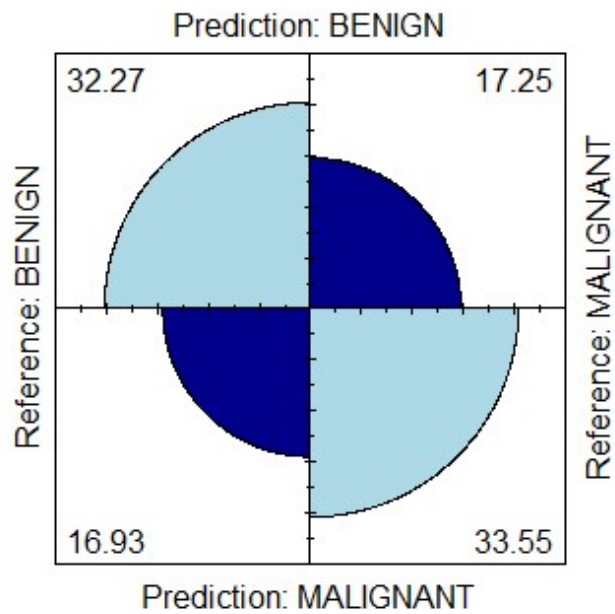
```
## [1] 0.6603604
```

```
## [1] 0.655814
```

```
## [1] 0.6581236
```

Specificity	0.6603604
Sensitivity	0.655814
Accuracy	0.6581236

Let us display ROC curves for the all created ML methods:
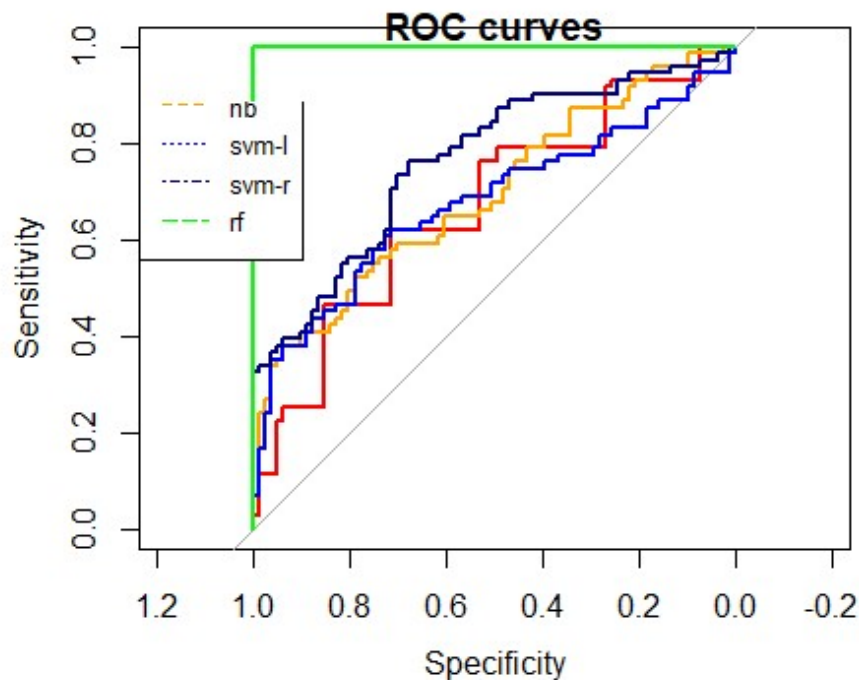
Compare ROC values of all models:

```
##          Resample  k-nn~ROC k-nn~Sens k-nn~Spec    nb~ROC   nb~Sens
nb~Spec
## 1   Fold01.Rep01 0.6605644 0.7500000 0.4776119 0.6709422 0.8593750
0.3731343
## 2   Fold01.Rep02 0.7206157 0.6562500 0.6417910 0.7326259 0.8593750
0.4477612
## 3   Fold01.Rep03 0.6046620 0.5076923 0.5909091 0.6659674 0.8153846
0.4393939
## 4   Fold01.Rep04 0.6286713 0.6307692 0.6363636 0.6874126 0.8769231
0.4848485
## 5   Fold01.Rep05 0.6455798 0.6461538 0.5522388 0.6833525 0.8461538
0.3880597
## 6   Fold01.Rep06 0.6355350 0.6406250 0.5757576 0.6304451 0.8281250
0.3636364
## 7   Fold01.Rep07 0.5775058 0.5846154 0.5303030 0.5652681 0.7692308
0.3484848
## 8   Fold01.Rep08 0.6275058 0.6307692 0.5909091 0.6540793 0.8153846
0.4848485
## 9   Fold01.Rep09 0.6876457 0.7230769 0.5909091 0.7139860 0.8769231
0.4696970
## 10  Fold01.Rep10 0.6332860 0.7187500 0.5606061 0.5491241 0.8281250
0.3333333
## 11  Fold02.Rep01 0.5957520 0.6153846 0.5373134 0.5352468 0.7846154
0.3283582
```

```
## 12   Fold02.Rep02 0.6723414 0.6093750 0.6417910 0.6991604 0.8437500
0.4179104
## 13   Fold02.Rep03 0.7826493 0.7968750 0.6716418 0.7329757 0.9531250
0.4776119
## 14   Fold02.Rep04 0.5754025 0.6406250 0.5000000 0.5688920 0.8125000
0.3787879
## 15   Fold02.Rep05 0.6309468 0.7031250 0.4776119 0.6275653 0.9062500
0.3731343
## 16   Fold02.Rep06 0.6019176 0.7031250 0.5000000 0.6460701 0.8593750
0.4393939
## 17   Fold02.Rep07 0.7277462 0.7031250 0.6515152 0.6732955 0.8125000
0.4545455
## 18   Fold02.Rep08 0.5942235 0.5625000 0.5606061 0.6813447 0.8437500
0.4242424
## 19   Fold02.Rep09 0.6165956 0.6093750 0.5303030 0.6065341 0.8125000
0.3484848
## 20   Fold02.Rep10 0.5903263 0.6769231 0.4848485 0.5631702 0.8769231
0.3181818
## 21   Fold03.Rep01 0.6094406 0.5692308 0.5606061 0.6118881 0.8615385
0.4393939
## 22   Fold03.Rep02 0.6142365 0.6307692 0.6268657 0.6546498 0.8153846
0.4776119
## 23   Fold03.Rep03 0.6048220 0.7538462 0.4925373 0.5935706 0.8461538
0.3283582
## 24   Fold03.Rep04 0.6435132 0.6000000 0.5522388 0.6702641 0.8153846
0.4477612
## 25   Fold03.Rep05 0.5645989 0.5781250 0.5373134 0.6163713 0.8437500
0.3582090
## 26   Fold03.Rep06 0.6343823 0.5846154 0.5606061 0.6030303 0.8000000
0.4090909
## 27   Fold03.Rep07 0.6476690 0.6461538 0.5454545 0.6456876 0.8307692
0.3939394
## 28   Fold03.Rep08 0.6742071 0.5937500 0.7164179 0.6175373 0.7968750
0.4179104
## 29   Fold03.Rep09 0.5820513 0.5692308 0.4848485 0.5310023 0.7846154
0.3333333
## 30   Fold03.Rep10 0.6636051 0.5846154 0.6567164 0.6748565 0.8923077
0.4626866
## 31   Fold04.Rep01 0.6230177 0.6250000 0.5223881 0.6977612 0.8906250
0.4029851
## 32   Fold04.Rep02 0.6216783 0.6615385 0.5606061 0.5601399 0.7538462
0.3333333
## 33   Fold04.Rep03 0.6019814 0.6000000 0.5606061 0.6214452 0.8000000
0.4090909
## 34   Fold04.Rep04 0.5625000 0.5000000 0.5970149 0.5594683 0.6562500
0.3582090
## 35   Fold04.Rep05 0.5798368 0.5692308 0.5303030 0.5913753 0.7846154
0.3939394
## 36   Fold04.Rep06 0.6280317 0.6406250 0.5373134 0.6462220 0.8593750
0.3880597
```

```
## 37    Fold04.Rep07 0.6360505 0.7230769 0.4328358 0.5260620 0.8461538
0.2537313
## 38    Fold04.Rep08 0.6026406 0.6000000 0.5373134 0.6075775 0.8307692
0.3880597
## 39    Fold04.Rep09 0.5569030 0.5781250 0.5373134 0.5345149 0.7500000
0.3283582
## 40    Fold04.Rep10 0.6853042 0.7076923 0.5970149 0.6298507 0.8153846
0.4029851
## 41    Fold05.Rep01 0.6783217 0.6153846 0.6363636 0.6941725 0.8461538
0.4696970
## 42    Fold05.Rep02 0.6383759 0.6093750 0.5454545 0.6588542 0.7656250
0.5000000
## 43    Fold05.Rep03 0.5345644 0.5000000 0.5757576 0.5830966 0.7500000
0.3484848
## 44    Fold05.Rep04 0.5987371 0.6307692 0.5820896 0.6397245 0.8461538
0.3880597
## 45    Fold05.Rep05 0.6549674 0.5625000 0.6417910 0.6884328 0.8281250
0.4925373
## 46    Fold05.Rep06 0.6667049 0.5538462 0.6865672 0.6254879 0.7692308
0.4925373
## 47    Fold05.Rep07 0.5677472 0.6093750 0.5223881 0.6184701 0.7812500
0.4179104
## 48    Fold05.Rep08 0.6180253 0.6923077 0.4776119 0.6456946 0.8307692
0.4328358
## 49    Fold05.Rep09 0.6669776 0.6718750 0.5820896 0.6054104 0.7812500
0.3880597
## 50    Fold05.Rep10 0.6067708 0.6406250 0.5757576 0.5847538 0.7812500
0.3636364
## 51    Fold06.Rep01 0.6735322 0.6718750 0.6060606 0.5849905 0.8125000
0.3333333
## 52    Fold06.Rep02 0.5736597 0.6307692 0.4848485 0.4995338 0.7230769
0.3787879
## 53    Fold06.Rep03 0.6898967 0.6923077 0.5671642 0.6479908 0.8153846
0.4776119
## 54    Fold06.Rep04 0.6427239 0.7500000 0.4925373 0.6133396 0.8125000
0.3582090
## 55    Fold06.Rep05 0.7103456 0.6250000 0.6363636 0.7388731 0.8750000
0.4393939
## 56    Fold06.Rep06 0.6424799 0.6153846 0.5074627 0.6564868 0.8615385
0.3283582
## 57    Fold06.Rep07 0.6584386 0.7384615 0.5373134 0.6199770 0.8307692
0.3432836
## 58    Fold06.Rep08 0.6161381 0.7812500 0.4179104 0.6194030 0.9062500
0.3432836
## 59    Fold06.Rep09 0.6431903 0.5781250 0.5820896 0.6723414 0.8437500
0.4179104
## 60    Fold06.Rep10 0.6931114 0.6307692 0.6716418 0.7233065 0.8923077
0.4776119
## 61    Fold07.Rep01 0.6819030 0.5937500 0.5820896 0.6483209 0.7968750
0.5223881
```

```
## 62   Fold07.Rep02 0.6832377 0.6000000 0.6716418 0.6808266 0.8461538
0.3731343
## 63   Fold07.Rep03 0.5966651 0.5781250 0.5223881 0.6359608 0.7656250
0.3731343
## 64   Fold07.Rep04 0.6833022 0.7031250 0.5373134 0.6613806 0.8593750
0.4179104
## 65   Fold07.Rep05 0.6350816 0.5846154 0.6212121 0.5554779 0.7692308
0.3939394
## 66   Fold07.Rep06 0.6512360 0.6250000 0.6119403 0.6319963 0.7656250
0.3731343
## 67   Fold07.Rep07 0.5993470 0.5468750 0.5970149 0.7255131 0.8750000
0.4776119
## 68   Fold07.Rep08 0.6290246 0.5781250 0.6060606 0.6683239 0.7656250
0.3939394
## 69   Fold07.Rep09 0.6281286 0.6153846 0.5671642 0.6654420 0.8307692
0.3731343
## 70   Fold07.Rep10 0.5940998 0.6093750 0.5671642 0.6243004 0.7968750
0.4029851
## 71   Fold08.Rep01 0.6028451 0.5468750 0.5970149 0.6286147 0.8281250
0.2985075
## 72   Fold08.Rep02 0.7074627 0.7384615 0.5970149 0.7487945 0.9230769
0.4179104
## 73   Fold08.Rep03 0.5715951 0.7031250 0.4925373 0.6121735 0.7968750
0.3432836
## 74   Fold08.Rep04 0.6531469 0.6461538 0.5454545 0.6613054 0.8769231
0.3939394
## 75   Fold08.Rep05 0.6610723 0.5538462 0.6363636 0.6484848 0.8000000
0.4696970
## 76   Fold08.Rep06 0.6360505 0.6153846 0.5671642 0.6078071 0.8153846
0.4029851
## 77   Fold08.Rep07 0.6722158 0.6461538 0.6567164 0.7524684 0.8923077
0.4328358
## 78   Fold08.Rep08 0.6499534 0.6250000 0.5522388 0.6150886 0.8125000
0.4179104
## 79   Fold08.Rep09 0.6193182 0.5625000 0.6212121 0.6647727 0.8125000
0.4090909
## 80   Fold08.Rep10 0.7547808 0.7500000 0.6417910 0.7628265 0.9218750
0.4925373
## 81   Fold09.Rep01 0.6596737 0.6615385 0.5303030 0.6314685 0.8000000
0.4242424
## 82   Fold09.Rep02 0.5741004 0.6562500 0.4848485 0.5958807 0.8437500
0.3939394
## 83   Fold09.Rep03 0.6258741 0.6153846 0.5151515 0.5703963 0.8153846
0.4090909
## 84   Fold09.Rep04 0.6879735 0.6406250 0.5909091 0.7208807 0.8750000
0.4848485
## 85   Fold09.Rep05 0.6520522 0.6406250 0.5522388 0.6168377 0.7812500
0.4179104
## 86   Fold09.Rep06 0.6629162 0.6461538 0.5970149 0.6808266 0.8769231
0.4477612
```

```
## 87   Fold09.Rep07 0.6399254 0.5468750 0.6567164 0.6161381 0.8437500
0.4477612
## 88   Fold09.Rep08 0.6660839 0.6461538 0.6212121 0.6673660 0.8461538
0.4696970
## 89   Fold09.Rep09 0.5932262 0.5692308 0.5522388 0.6539610 0.7846154
0.4029851
## 90   Fold09.Rep10 0.5981810 0.5625000 0.5373134 0.6483209 0.6875000
0.4328358
## 91   Fold10.Rep01 0.6003444 0.6769231 0.5223881 0.6190586 0.7692308
0.4328358
## 92   Fold10.Rep02 0.5370802 0.5625000 0.4477612 0.5363806 0.8125000
0.3283582
## 93   Fold10.Rep03 0.6245336 0.5937500 0.5373134 0.6483209 0.8437500
0.4179104
## 94   Fold10.Rep04 0.6041332 0.6153846 0.5522388 0.6312285 0.8000000
0.3731343
## 95   Fold10.Rep05 0.6568312 0.6615385 0.6119403 0.5940299 0.8153846
0.3582090
## 96   Fold10.Rep06 0.6131629 0.6562500 0.5151515 0.6602746 0.7968750
0.3939394
## 97   Fold10.Rep07 0.6118608 0.6406250 0.5454545 0.5859375 0.7500000
0.4090909
## 98   Fold10.Rep08 0.6086108 0.5230769 0.5820896 0.6208955 0.8307692
0.3283582
## 99   Fold10.Rep09 0.7696900 0.7384615 0.6865672 0.7267509 0.9076923
0.5223881
## 100 Fold10.Rep10 0.5525641 0.6153846 0.4848485 0.5862471 0.7538462
0.3939394
##      svm-l~ROC svm-l~Sens svm-l~Spec svm-r~ROC svm-r~Sens svm-r~Spec
rf~ROC
## 1    0.6683769  0.8125000  0.4925373 0.6581157  0.6718750  0.5522388
0.7460354
## 2    0.7066231  0.7968750  0.5522388 0.7546642  0.8281250  0.5820896
0.7725047
## 3    0.7051282  0.8153846  0.5151515 0.6769231  0.6307692  0.6212121
0.7090909
## 4    0.6559441  0.7846154  0.5151515 0.6834499  0.6000000  0.6212121
0.6967366
## 5    0.6594719  0.7692308  0.4776119 0.6753157  0.6307692  0.6268657
0.7099885
## 6    0.5968277  0.7500000  0.3787879 0.6254735  0.7031250  0.4696970
0.7621922
## 7    0.5745921  0.7230769  0.4090909 0.6279720  0.6461538  0.5151515
0.7212121
## 8    0.6951049  0.7538462  0.5151515 0.6820513  0.6153846  0.6060606
0.6994172
## 9    0.6680653  0.8000000  0.4848485 0.6916084  0.7230769  0.5303030
0.7539627
## 10   0.6115057  0.7656250  0.4393939 0.6789773  0.7656250  0.5303030
0.7107008
```

```
## 11  0.5588978   0.7384615   0.4029851  0.6190586   0.7230769   0.4925373
0.6965557
## 12  0.6681437   0.8281250   0.5074627  0.7126866   0.6718750   0.5820896
0.7891791
## 13  0.7583955   0.8750000   0.5820896  0.7961754   0.8437500   0.6567164
0.7999067
## 14  0.5485322   0.7187500   0.4242424  0.6633523   0.7343750   0.4242424
0.7439631
## 15  0.6023787   0.8437500   0.4477612  0.6644123   0.7812500   0.4776119
0.7028918
## 16  0.6711648   0.7968750   0.4848485  0.6422822   0.6093750   0.5606061
0.6835938
## 17  0.6576705   0.7656250   0.5454545  0.7286932   0.7500000   0.5303030
0.7969934
## 18  0.6534091   0.7656250   0.5000000  0.6313920   0.7031250   0.5151515
0.6983902
## 19  0.5916193   0.7343750   0.4090909  0.6399148   0.7187500   0.5000000
0.7105824
## 20  0.5762238   0.8307692   0.3333333  0.6512821   0.6615385   0.5303030
0.6321678
## 21  0.6421911   0.8153846   0.4696970  0.6881119   0.7692308   0.5303030
0.7074592
## 22  0.6867968   0.7076923   0.5223881  0.6681975   0.6461538   0.6119403
0.7132032
## 23  0.5653272   0.8000000   0.3880597  0.6247991   0.7846154   0.4776119
0.6692308
## 24  0.6615385   0.7384615   0.5522388  0.6975890   0.7076923   0.5820896
0.6715270
## 25  0.6464552   0.7500000   0.4328358  0.6576493   0.7500000   0.4776119
0.6442397
## 26  0.5871795   0.8153846   0.4242424  0.7114219   0.7846154   0.5151515
0.7268065
## 27  0.6554779   0.7692308   0.5000000  0.6986014   0.6307692   0.6363636
0.7247086
## 28  0.6110075   0.7187500   0.4925373  0.6574160   0.7031250   0.5074627
0.7804338
## 29  0.5223776   0.7230769   0.4090909  0.6326340   0.7692308   0.4393939
0.6961538
## 30  0.7067738   0.8307692   0.5970149  0.7053961   0.7230769   0.6567164
0.7205511
## 31  0.6753731   0.8281250   0.4925373  0.7252799   0.7343750   0.5373134
0.6976446
## 32  0.5191142   0.6615385   0.3636364  0.5990676   0.6615385   0.4242424
0.7059441
## 33  0.5988345   0.7538462   0.4696970  0.6552448   0.6769231   0.5606061
0.6819347
## 34  0.5820896   0.6406250   0.4626866  0.5645989   0.5156250   0.5820896
0.6027285
## 35  0.6116550   0.7384615   0.4545455  0.6668998   0.6615385   0.5303030
0.6564103
```

```
## 36  0.6261660  0.7656250  0.4776119 0.6303638  0.7343750  0.4477612
0.7020756
## 37  0.5547646  0.7538462  0.3582090 0.6500574  0.8307692  0.3731343
0.7475316
## 38  0.6149254  0.7692308  0.4328358 0.6165327  0.6461538  0.5223881
0.7175660
## 39  0.5872201  0.7031250  0.4029851 0.5606343  0.5625000  0.4776119
0.6433069
## 40  0.6213548  0.6923077  0.4925373 0.6675086  0.6615385  0.5522388
0.7636051
## 41  0.6808858  0.7384615  0.5303030 0.7020979  0.7692308  0.6060606
0.7066434
## 42  0.6524621  0.7187500  0.5909091 0.7005208  0.6718750  0.6060606
0.6955492
## 43  0.5660511  0.6406250  0.5151515 0.6304451  0.6093750  0.5454545
0.6547112
## 44  0.5834673  0.7846154  0.4179104 0.6043628  0.7384615  0.4477612
0.6669346
## 45  0.6788713  0.7187500  0.5820896 0.6588153  0.6093750  0.6417910
0.7051073
## 46  0.6360505  0.6923077  0.5522388 0.6521240  0.6615385  0.5970149
0.7391504
## 47  0.6154384  0.6875000  0.5074627 0.6770056  0.6562500  0.5223881
0.6554338
## 48  0.6195178  0.7538462  0.5074627 0.6675086  0.6615385  0.5970149
0.7094145
## 49  0.5909515  0.7031250  0.4179104 0.5888526  0.6093750  0.5671642
0.7454524
## 50  0.5416667  0.7187500  0.4393939 0.5788352  0.6093750  0.4848485
0.6638258
## 51  0.5939867  0.7656250  0.4393939 0.6747159  0.6718750  0.5909091
0.6882102
## 52  0.5533800  0.6769231  0.3939394 0.4920746  0.4769231  0.4090909
0.6146853
## 53  0.6110218  0.7692308  0.4776119 0.6399541  0.7538462  0.4477612
0.6694604
## 54  0.5886194  0.7968750  0.3880597 0.6765392  0.7500000  0.4328358
0.7406716
## 55  0.7019413  0.8437500  0.5454545 0.7438447  0.7500000  0.5454545
0.7481061
## 56  0.6865672  0.8307692  0.4626866 0.6466131  0.6307692  0.5223881
0.7138921
## 57  0.6204363  0.7846154  0.4179104 0.6766935  0.7384615  0.5820896
0.7672790
## 58  0.6082090  0.7968750  0.4029851 0.6877332  0.8125000  0.4925373
0.7225979
## 59  0.6765392  0.8125000  0.5671642 0.7070896  0.6875000  0.6716418
0.6961287
## 60  0.6964409  0.8461538  0.5522388 0.6537313  0.5846154  0.6268657
0.7482204
```

```
## 61  0.6515858  0.7343750  0.5373134 0.6639459  0.5781250  0.6417910
0.7124534
## 62  0.6376579  0.8153846  0.4477612 0.6955224  0.6923077  0.6119403
0.7570608
## 63  0.6177705  0.7031250  0.4925373 0.6448228  0.6875000  0.5373134
0.6909981
## 64  0.6681437  0.7968750  0.4626866 0.6646455  0.8125000  0.4626866
0.7392724
## 65  0.5738928  0.7384615  0.4090909 0.6400932  0.7076923  0.5000000
0.7611888
## 66  0.5697295  0.6562500  0.5223881 0.6452892  0.6562500  0.4776119
0.7164179
## 67  0.6958955  0.7812500  0.5820896 0.6392257  0.6093750  0.6417910
0.6794543
## 68  0.6690341  0.7500000  0.4393939 0.6761364  0.7500000  0.5454545
0.7001657
## 69  0.6211251  0.7846154  0.4925373 0.6769231  0.6769231  0.5671642
0.7398393
## 70  0.6014459  0.7343750  0.4029851 0.6389925  0.6718750  0.5522388
0.7560634
## 71  0.6007463  0.7656250  0.3880597 0.6436567  0.7812500  0.4029851
0.6659282
## 72  0.6789897  0.8461538  0.5074627 0.6948335  0.8461538  0.5223881
0.7383467
## 73  0.6359608  0.7500000  0.4179104 0.6690765  0.6718750  0.5373134
0.7053405
## 74  0.6664336  0.8307692  0.5303030 0.7312354  0.7230769  0.6363636
0.7891608
## 75  0.6463869  0.7076923  0.5303030 0.6624709  0.6000000  0.6515152
0.7053613
## 76  0.6289323  0.7538462  0.4776119 0.6721010  0.6461538  0.6119403
0.7498278
## 77  0.7143513  0.8153846  0.5074627 0.7501722  0.8615385  0.5522388
0.7686567
## 78  0.6112407  0.7343750  0.5074627 0.7285448  0.7343750  0.6417910
0.7593284
## 79  0.6747159  0.7812500  0.5454545 0.6690341  0.6093750  0.6515152
0.6988636
## 80  0.7280784  0.8593750  0.5671642 0.7651586  0.8125000  0.6417910
0.7818330
## 81  0.6470862  0.7076923  0.5151515 0.6571096  0.6000000  0.6060606
0.7317016
## 82  0.6500947  0.7500000  0.5000000 0.6815814  0.5937500  0.6515152
0.7141335
## 83  0.6240093  0.7384615  0.4545455 0.6317016  0.5692308  0.5757576
0.7393939
## 84  0.7308239  0.7656250  0.5909091 0.6960227  0.6562500  0.6212121
0.7950994
## 85  0.6103078  0.7500000  0.4925373 0.6415578  0.6718750  0.5522388
0.7503498
```

```
## 86   0.6727899   0.8153846   0.4776119 0.7242250   0.7384615   0.5820896
0.6644087
## 87   0.6149720   0.7656250   0.5223881 0.6522854   0.5312500   0.5671642
0.6447062
## 88   0.6200466   0.7692308   0.5303030 0.6937063   0.6769231   0.5151515
0.6624709
## 89   0.6326062   0.7384615   0.5223881 0.6766935   0.6461538   0.6268657
0.7086108
## 90   0.6543843   0.6562500   0.5522388 0.6679104   0.5937500   0.6119403
0.6744403
## 91   0.5995408   0.6923077   0.5074627 0.6617681   0.7076923   0.5074627
0.7270953
## 92   0.5643657   0.7187500   0.4179104 0.5736940   0.6250000   0.4776119
0.6270989
## 93   0.6177705   0.7656250   0.4477612 0.6632463   0.7187500   0.4626866
0.6473881
## 94   0.6332951   0.7692308   0.4626866 0.6957520   0.6615385   0.6119403
0.7430540
## 95   0.5850746   0.7538462   0.4328358 0.6831228   0.7692308   0.4029851
0.8010333
## 96   0.6453598   0.7343750   0.5000000 0.7308239   0.7656250   0.5454545
0.7121212
## 97   0.5991951   0.7500000   0.4545455 0.6335227   0.6406250   0.5151515
0.6522254
## 98   0.6130884   0.7692308   0.4925373 0.6826636   0.7230769   0.5373134
0.7350172
## 99   0.7336395   0.8307692   0.5522388 0.7901263   0.7384615   0.6268657
0.7772675
## 100 0.5883450   0.6769231   0.4242424 0.6363636   0.7076923   0.4393939
0.6646853
##       rf~Sens    rf~Spec
## 1    0.6875000 0.6865672
## 2    0.6562500 0.7014925
## 3    0.5538462 0.6666667
## 4    0.6153846 0.6969697
## 5    0.6461538 0.6417910
## 6    0.7343750 0.6969697
## 7    0.7384615 0.6363636
## 8    0.6153846 0.6515152
## 9    0.7384615 0.6212121
## 10   0.6875000 0.6515152
## 11   0.6923077 0.6119403
## 12   0.6406250 0.7910448
## 13   0.7656250 0.6417910
## 14   0.7812500 0.6212121
## 15   0.6250000 0.6119403
## 16   0.6406250 0.6969697
## 17   0.7812500 0.6969697
## 18   0.5468750 0.6818182
## 19   0.6406250 0.6515152
```

```
## 20   0.6153846 0.5909091
## 21   0.6769231 0.6363636
## 22   0.6153846 0.7164179
## 23   0.7538462 0.5074627
## 24   0.4923077 0.7014925
## 25   0.6093750 0.5970149
## 26   0.7076923 0.6212121
## 27   0.6000000 0.6363636
## 28   0.6562500 0.7014925
## 29   0.6615385 0.6212121
## 30   0.6307692 0.6567164
## 31   0.6406250 0.6716418
## 32   0.6615385 0.6818182
## 33   0.5692308 0.6818182
## 34   0.5312500 0.5820896
## 35   0.6307692 0.5757576
## 36   0.6875000 0.6865672
## 37   0.7384615 0.6417910
## 38   0.7076923 0.5820896
## 39   0.6250000 0.6119403
## 40   0.6615385 0.6865672
## 41   0.6153846 0.6212121
## 42   0.6093750 0.6060606
## 43   0.5937500 0.6818182
## 44   0.5692308 0.6268657
## 45   0.6875000 0.7164179
## 46   0.6461538 0.7313433
## 47   0.5625000 0.6268657
## 48   0.7076923 0.6716418
## 49   0.7968750 0.6119403
## 50   0.7031250 0.5909091
## 51   0.6406250 0.6212121
## 52   0.6000000 0.5606061
## 53   0.6153846 0.5970149
## 54   0.7031250 0.5970149
## 55   0.6093750 0.6666667
## 56   0.6461538 0.6567164
## 57   0.6769231 0.6716418
## 58   0.7656250 0.5970149
## 59   0.5781250 0.7313433
## 60   0.6307692 0.7611940
## 61   0.6875000 0.6865672
## 62   0.7076923 0.7014925
## 63   0.6406250 0.6417910
## 64   0.6875000 0.6567164
## 65   0.6769231 0.7272727
## 66   0.6562500 0.6417910
## 67   0.6093750 0.6716418
## 68   0.6562500 0.6666667
## 69   0.6153846 0.7462687
```

```
## 70  0.6875000 0.6865672
## 71  0.6093750 0.6417910
## 72  0.6615385 0.6716418
## 73  0.6718750 0.6865672
## 74  0.6461538 0.7727273
## 75  0.5846154 0.7121212
## 76  0.5846154 0.7761194
## 77  0.6923077 0.7014925
## 78  0.7656250 0.6119403
## 79  0.6250000 0.6969697
## 80  0.7187500 0.7462687
## 81  0.6461538 0.6969697
## 82  0.7500000 0.5454545
## 83  0.6769231 0.6818182
## 84  0.7500000 0.7121212
## 85  0.6875000 0.6567164
## 86  0.5692308 0.6268657
## 87  0.5937500 0.6567164
## 88  0.6615385 0.6363636
## 89  0.6461538 0.6716418
## 90  0.6093750 0.7014925
## 91  0.6923077 0.6119403
## 92  0.6250000 0.5970149
## 93  0.5937500 0.5970149
## 94  0.6307692 0.7164179
## 95  0.7384615 0.7761194
## 96  0.6562500 0.6666667
## 97  0.5937500 0.6212121
## 98  0.6153846 0.7761194
## 99  0.7692308 0.6567164
## 100 0.6769231 0.5909091
##
## Call:
## summary.resamples(object = res)
##
## Models: k-nn, nb, svm-l, svm-r, rf
## Number of resamples: 100
##
## ROC
##            Min.   1st Qu.    Median      Mean   3rd Qu.      Max. NA's
## k-nn  0.5345644 0.6019654 0.6299857 0.6336994 0.6615332 0.7826493    0
## nb    0.4995338 0.6062532 0.6317324 0.6361215 0.6688089 0.7628265    0
## svm-l 0.5191142 0.5983328 0.6250877 0.6313611 0.6681437 0.7583955    0
## svm-r 0.4920746 0.6411917 0.6672042 0.6668712 0.6921329 0.7961754    0
## rf    0.6027285 0.6870561 0.7106416 0.7134846 0.7455982 0.8010333    0
##
## Sens
##            Min.   1st Qu.    Median      Mean   3rd Qu.      Max. NA's
## k-nn  0.5000000 0.5846154 0.6250000 0.6311587 0.6615385 0.7968750    0
```

```
## nb     0.6562500 0.7968750 0.8153846 0.8229207 0.8494591 0.9531250      0
## svm-l 0.6406250 0.7315505 0.7597356 0.7598101 0.7968750 0.8750000      0
## svm-r 0.4769231 0.6381611 0.6769231 0.6888293 0.7384615 0.8615385      0
## rf    0.4923077 0.6153846 0.6461538 0.6558558 0.6887019 0.7968750      0
##
## Spec
##             Min.   1st Qu.   Median     Mean   3rd Qu.      Max. NA's
## k-nn  0.4179104 0.5303030 0.5606061 0.5669380 0.6060606 0.7164179      0
## nb    0.2537313 0.3707598 0.4029851 0.4048168 0.4393939 0.5223881      0
## svm-l 0.3333333 0.4328358 0.4886929 0.4793917 0.5223881 0.5970149      0
## svm-r 0.3731343 0.5000000 0.5454545 0.5472886 0.6075305 0.6716418      0
## rf    0.5074627 0.6212121 0.6567164 0.6603121 0.6969697 0.7910448      0
```

Obtained results can be visualized:

ROC

Confidence Level: 0.95
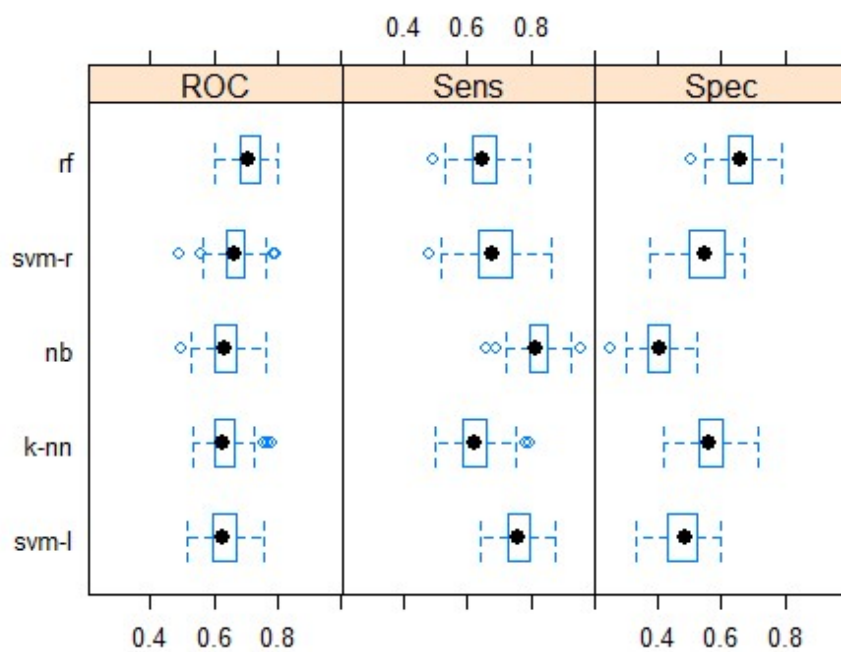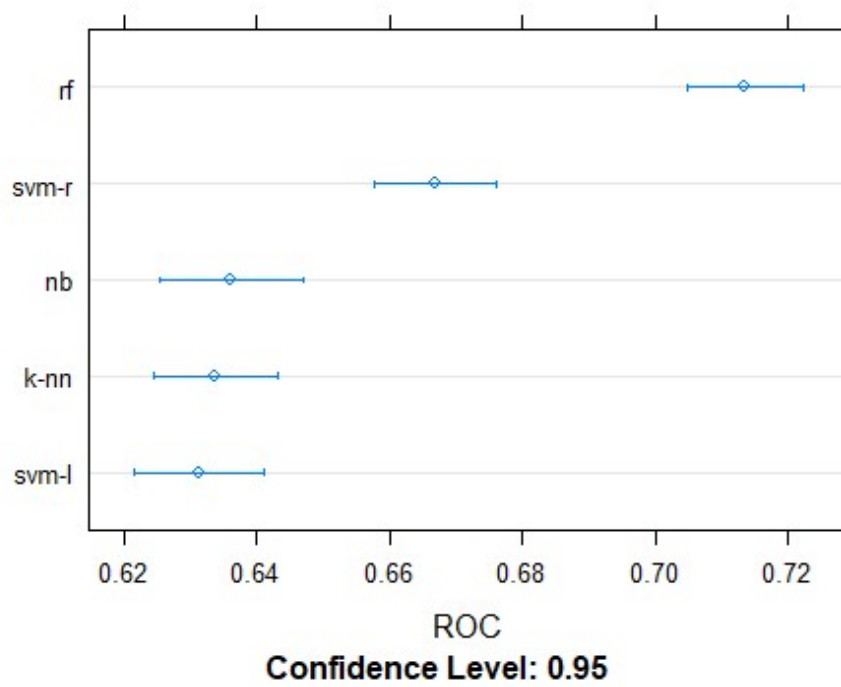
Moreover, calculated ROC distributions should be visualized:

ROC distribution by model
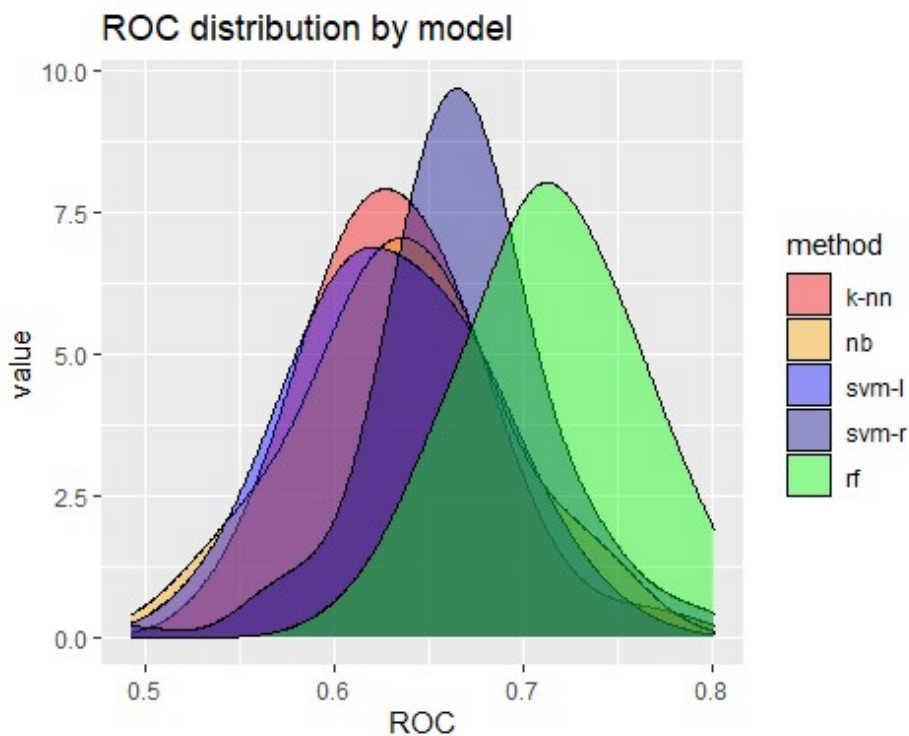
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