smote BRT

Yazhe 23/10/2016

```
new_test = test[sample(1:nrow(test), size = nrow(test)/10),]
new_train = train[sample(1:nrow(train), size = nrow(train)/10),]

new_train$def_flag = as.factor(as.logical(new_train$def_flag))
new_test$def_flag = as.factor(as.logical(new_test$def_flag))

Y = new_train[,8]
Y = as.numeric(Y)
X = new_train[,-8]
Y[which(Y==1)] = 0
Y[which(Y==2)] = 1
Y = as.factor(Y)
a = ubTomek(X, Y, verbose = TRUE)

## Instances removed 347 : 1.43 % of 0 class ; 1.4 % of training ; Time needed 0.03
un_train_set = cbind(a[[1]],def_flag = a[[2]])
```

un train set is a traing set which delete overlap

```
un_frac_BLSMOTE_sample = function (data, dupSize){
                                       "def_flag")],data$def_flag,K=5,C=5,dupSize=dupSize,method=c("ty
 a = BLSMOTE(data[,!(names(data) %in%
  names(a)[30]="def_flag"
  a$def_flag = as.character(a$def_flag)
  a$def_flag[which(a$def_flag == 1)] = 'yes'
  a$def_flag[which(a$def_flag == 0)] = 'no'
  return(a)
}
un_BLSMOTE_auc_frac = function(data,dupSize){
  un_train_set = un_frac_BLSMOTE_sample(data, dupSize)
  gbmGrid <- expand.grid(interaction.depth=(3:6), n.trees=(1:40)*100, shrinkage=.01)
  gbmGrid$n.minobsinnode = rep(10,nrow(gbmGrid))
  bootControl = trainControl(method='cv',classProbs = TRUE,number=3,summaryFunction =
                                                                                              twoClassSum
  gmbFit<- caret::train(def_flag~., data = un_train_set,</pre>
                        method = "gbm",
                        verbose = F,
                        trControl = bootControl,
                        bag.fraction=0.5,
                        metric="ROC",
                        tuneGrid=gbmGrid)
  predict=predict (gmbFit ,newdata = new_test, type='prob')
  temp = auc_calucator(predict[,2],new_test$def_flag)
```

```
auc = temp[[1]]
  return(auc)
}
un_BLSMOTE_auc_frac(data = un_train_set, dupSize = 1)
## [1] "Borderline-SMOTE done"
## [1] 0.8975862
no_cores <- detectCores() - 1
cl <- makeCluster(no_cores, type="FORK")</pre>
clusterEvalQ(cl, library(caret))
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clusterEvalQ(cl, library(unbalanced))
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clusterEvalQ(cl, library(randomForest))

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## [[7]]
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                                                         "methods"
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```

clusterEvalQ(cl, library(Rmisc))

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                                                         "methods"
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                                       "stats"
                                                      "graphics"
## [25] "grDevices"
                       "utils"
                                       "datasets"
                                                      "methods"
## [29] "base"
result = parLapply(cl, (1:3), function(x) {un_BLSMOTE_auc_frac(data = un_train_set, dupSize = x)})
stopCluster(cl)
data_smote1 = un_frac_BLSMOTE_sample(un_train_set,1);table(data_smote1$def_flag)
## [1] "Borderline-SMOTE done"
##
##
           yes
      no
## 23997
           432
data_smote2 = un_frac_BLSMOTE_sample(un_train_set,2);table(data_smote2$def_flag)
## [1] "Borderline-SMOTE done"
##
##
      no
           yes
## 23997
           506
data_smote3 = un_frac_BLSMOTE_sample(un_train_set,3);table(data_smote3$def_flag)
## [1] "Borderline-SMOTE done"
##
##
      no
           yes
## 23997
           580
un_frac_sample = function (data, frac){
 Y = data$def_flag
  X = data[,!(names(data) %in%
                                   "def_flag")]
  Y[which(Y=="no")] = 0
  Y[which(Y=="yes")] = 1
  under_sample = ubUnder(X,Y, perc = frac, method = "percPos")
  un_train_set = cbind(under_sample[[1]],def_flag = under_sample[[2]])
  un_train_set$def_flag = as.numeric(un_train_set$def_flag)
```

```
un_train_set$def_flag[which(un_train_set$def_flag == 2)] = 'yes'
  un_train_set$def_flag[which(un_train_set$def_flag == 1)] = 'no'
  return(un_train_set)
}
un_auc_frac = function(data, frac){
   un_train_set = un_frac_sample(data, frac)
   gbmGrid <- expand.grid(interaction.depth=(3:6), n.trees=(1:40)*100, shrinkage=.01)
   gbmGrid$n.minobsinnode = rep(10,nrow(gbmGrid))
   bootControl = trainControl(method='cv',classProbs = TRUE,number=3,summaryFunction =
   gmbFit<- caret::train(def_flag~., data = un_train_set,</pre>
               method = "gbm",
               verbose = F,
               trControl = bootControl,
               bag.fraction=0.5,
               metric="ROC",
               tuneGrid=gbmGrid)
   predict=predict (gmbFit ,newdata = new_test, type='prob')
   temp = auc_calucator(predict[,2],new_test$def_flag)
   auc = temp[[1]]
   return(auc)
}
ten_time_auc=function(data , frac){
  frac = rep(frac, 10)
  auc = lapply(frac, function(x) {un_auc_frac(data = data ,frac = x)})
  return(unlist(auc))
}
change to use parallel here
#ten_time_auc(data = data_smote1, 50)
no_cores <- detectCores() - 1</pre>
cl <- makeCluster(no_cores, type="FORK")</pre>
clusterEvalQ(cl, library(caret))
## [[1]]
## [1] "smotefamily"
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twoClassSu

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clusterEvalQ(cl, library(rpart))

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clusterEvalQ(cl, library(unbalanced))

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##
##
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##
                                         "iterators"
                                                         "ROCR"
##
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                                         "BBmisc"
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clusterEvalQ(cl, library(randomForest))
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                         "doParallel"
    [5] "unbalanced"
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                                                         "foreach"
```

```
"ROCR"
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                         "ParamHelpers"
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##
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                                         "BBmisc"
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                         "utils"
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##
## [[7]]
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##
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##
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                                                          "splines"
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                                                          "caret"
##
                                         "rpart"
                         "lattice"
## [21]
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                                         "stats"
                                                          "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
## [29] "base"
```

clusterEvalQ(cl, library(ROCR))

```
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                                         "BBmisc"
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                                                         "caret"
   [21] "ggplot2"
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                         "ParamHelpers"
                                         "parallel"
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                                         "datasets"
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##
## [[4]]
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                                                         "methods"
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##
    [5] "unbalanced"
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##
                         "ParamHelpers"
                                         "BBmisc"
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                         "gbm"
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                                                         "splines"
                                                         "caret"
## [17] "survival"
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                                         "rpart"
## [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
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                                                         "methods"
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##
## [[6]]
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```
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##
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##
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                         "rpart.plot"
                                         "rpart"
                                                          "caret"
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                         "lattice"
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                                                          "graphics"
##
  [25] "grDevices"
                         "utils"
                                         "datasets"
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## [29] "base"
##
  [[7]]
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        "mlr"
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                                         "rpart"
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##
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   [25]
                         "utils"
                                                          "methods"
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        "grDevices"
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```

clusterEvalQ(cl, library(gbm))

```
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                                                          "ROCR"
##
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                                                          "splines"
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                         "gbm"
                                          "parallel"
##
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                         "rpart.plot"
                                          "rpart"
                                                          "caret"
                         "lattice"
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                                                          "graphics"
   [25]
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                         "utils"
                                          "datasets"
                                                          "methods"
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##
##
  [[2]]
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##
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                         "doParallel"
                                          "iterators"
                                                          "foreach"
   [9] "mlr"
                                                          "ROCR"
                         "ParamHelpers"
                                          "BBmisc"
##
## [13]
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                         "gbm"
                                          "parallel"
                                                          "splines"
                                                          "caret"
##
   [17]
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                                                          "graphics"
                         "lattice"
                                          "stats"
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   [25] "grDevices"
                         "utils"
                                          "datasets"
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##
##
## [[3]]
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                                          "plyr"
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                                         "BBmisc"
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                                                          "foreach"
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```

```
"ROCR"
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##
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## [[5]]
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                         "lattice"
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"ROCR"
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##
## [[3]]
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                                                          "methods"
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## [[4]]
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                                         "BBmisc"
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                         "gbm"
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                         "lattice"
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                                                          "methods"
## [29] "base"
```

clusterEvalQ(cl, library(rpart))

```
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                         "Rmisc"
                                         "plyr"
                                                         "randomForest"
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                                                         "splines"
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                                         "rpart"
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                                                         "graphics"
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## [[5]]
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##
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                                                         "foreach"
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                         "ParamHelpers"
                                         "BBmisc"
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                                                         "caret"
## [17] "survival"
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## [25] "grDevices"
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                                         "datasets"
                                                         "methods"
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##
## [[6]]
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```
"plyr"
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                                                          "ROCR"
##
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        "survival"
                         "rpart.plot"
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                                                          "caret"
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                                                          "graphics"
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                         "utils"
                                         "datasets"
                                                          "methods"
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                                         "BBmisc"
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                                         "parallel"
                                                          "splines"
## [13]
        "gplots"
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        "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
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        "ggplot2"
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                                         "stats"
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   [25]
        "grDevices"
                         "utils"
                                                          "methods"
##
                                         "datasets"
  [29] "base"
```

clusterEvalQ(cl, library(smotefamily))

```
## [[1]]
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                         "Rmisc"
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    [5] "unbalanced"
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                         "doParallel"
                                          "iterators"
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                                         "BBmisc"
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    [9]
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                                                          "splines"
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                         "gbm"
                                          "parallel"
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                                          "rpart"
                                                          "caret"
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                                          "stats"
                                                          "graphics"
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                                          "datasets"
                                                          "methods"
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##
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                                          "plyr"
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                                          "iterators"
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                                                          "methods"
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##
##
## [[3]]
                                                          "randomForest"
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    [1] "smotefamily"
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    [9]
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## [[4]]
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"ROCR"
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## [[5]]
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                                        "stats"
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                                                        "methods"
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## [[6]]
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## [13] "gplots"
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## [17] "survival"
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##
## [[7]]
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## [17] "survival"
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                        "lattice"
                                        "stats"
                                                        "graphics"
## [25] "grDevices"
                        "utils"
                                                        "methods"
                                        "datasets"
  [29] "base"
result1 = parLapply(cl, c(5,10,15,20,25,30), function(x) {ten_time_auc(data = data_smote1, x)})
stopCluster(cl)
result1
## [[1]]
    [1] 0.8981212 0.8997653 0.8982981 0.8989172 0.8985485 0.8994829 0.8979608
    [8] 0.8996014 0.8999235 0.8995090
##
##
## [[2]]
   [1] 0.9005264 0.8991894 0.9017424 0.9000559 0.8989684 0.8987629 0.9004465
##
    [8] 0.9006435 0.8992376 0.9011041
##
## [[3]]
    [1] 0.9017368 0.8993661 0.8993416 0.9008547 0.9009918 0.9017395 0.9010297
##
    [8] 0.8999823 0.8989269 0.9015689
##
```

```
## [[4]]
    [1] 0.9006953 0.9015291 0.9020129 0.9022971 0.9016987 0.9004115 0.8993895
    [8] 0.8993930 0.8998064 0.9008608
##
##
   [[5]]
    [1] 0.9007183 0.8995653 0.9001392 0.8994311 0.8981917 0.8983275 0.8998478
##
    [8] 0.9020118 0.9006684 0.8999263
##
##
## [[6]]
    [1] 0.8983945 0.9004555 0.8981528 0.9002274 0.8978542 0.8985575 0.9001888
##
    [8] 0.8996610 0.8985156 0.8963495
no cores <- detectCores() - 1
cl <- makeCluster(no_cores, type="FORK")</pre>
clusterEvalQ(cl, library(caret))
## [[1]]
##
   [1] "smotefamily"
                        "Rmisc"
                                                        "randomForest"
                                        "plyr"
    [5] "unbalanced"
                         "doParallel"
                                                        "foreach"
                                        "iterators"
##
   [9] "mlr"
                         "ParamHelpers"
                                        "BBmisc"
                                                        "ROCR"
## [13] "gplots"
                        "gbm"
                                        "parallel"
                                                        "splines"
## [17] "survival"
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                                                         "graphics"
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  [29] "base"
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##
## [[2]]
   [1] "smotefamily"
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    [5] "unbalanced"
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                         "doParallel"
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##
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## [[3]]
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  [[4]]
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## [25] "grDevices"
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## [29] "base"
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clusterEvalQ(cl, library(rpart))
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## [29] "base"
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  [[2]]
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   [9]
## [13] "gplots"
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## [17] "survival"
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```
## [[3]]
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## [25] "grDevices"
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                                         "datasets"
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## [[4]]
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## [13] "gplots"
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                                         "parallel"
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       "survival"
                                                         "caret"
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                                                         "graphics"
  [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
## [29] "base"
clusterEvalQ(cl, library(unbalanced))
## [[1]]
                                         "plyr"
## [1] "smotefamily"
                        "Rmisc"
                                                         "randomForest"
```

```
[5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
                                                          "ROCR."
##
    [9]
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                                         "BBmisc"
                         "gbm"
##
  [13] "gplots"
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  [17] "survival"
                                         "rpart"
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                         "rpart.plot"
##
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
##
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
## [[2]]
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##
                         "Rmisc"
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                         "ParamHelpers"
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##
        "gplots"
## [13]
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                                                          "caret"
##
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                                         "datasets"
                                                          "methods"
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##
##
   [[3]]
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                                                          "randomForest"
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                         "doParallel"
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                         "ParamHelpers"
                                         "BBmisc"
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##
## [13] "gplots"
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                                         "parallel"
   Γ17]
        "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
##
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                         "lattice"
                                         "stats"
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                         "utils"
                                         "datasets"
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##
##
## [[4]]
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##
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                                         "iterators"
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##
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##
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                                                          "methods"
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##
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##
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                         "gbm"
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                                                          "caret"
##
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##
##
##
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##
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                         "ParamHelpers" "BBmisc"
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## [13] "gplots"
                         "gbm"
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## [17] "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
```

```
## [21] "ggplot2"
                         "lattice"
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                         "utils"
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   [[7]]
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                         "ParamHelpers"
                                         "BBmisc"
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                                                         "caret"
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                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                                                         "methods"
                         "utils"
                                         "datasets"
  [29] "base"
```

clusterEvalQ(cl, library(randomForest))

```
## [[1]]
##
   [1] "smotefamily"
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                                                         "randomForest"
    [5] "unbalanced"
                         "doParallel"
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##
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                         "ParamHelpers"
                                         "BBmisc"
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       "gplots"
                         "gbm"
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                         "rpart.plot"
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##
##
## [[2]]
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                                         "plyr"
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                         "doParallel"
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   [9]
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                                         "BBmisc"
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                                                         "caret"
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                         "lattice"
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                                                         "graphics"
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                         "utils"
                                         "datasets"
                                                         "methods"
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##
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                         "doParallel"
                                         "iterators"
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##
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
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                         "utils"
                                         "datasets"
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##
##
##
  [[4]]
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                                                         "foreach"
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##
                         "ParamHelpers"
                                         "BBmisc"
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##
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                                         "stats"
                                                         "graphics"
## [21] "ggplot2"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
```

```
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##
## [13] "gplots"
                         "gbm"
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## [17] "survival"
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                                         "rpart"
##
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                         "lattice"
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                                                         "graphics"
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                         "utils"
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                                                         "methods"
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                                                         "foreach"
##
##
   [9]
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                         "ParamHelpers"
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                                                         "ROCR"
## [13]
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                                         "parallel"
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                                         "rpart"
                                                         "caret"
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                         "lattice"
                                         "stats"
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                         "utils"
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## [[7]]
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                                                         "foreach"
##
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                         "ParamHelpers"
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## [13] "gplots"
                         "gbm"
                                         "parallel"
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        "survival"
                         "rpart.plot"
                                                         "caret"
## [17]
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## [21]
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                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
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clusterEvalQ(cl, library(ROCR))
## [[1]]
                                         "plyr"
    [1] "smotefamily"
                         "Rmisc"
                                                         "randomForest"
                         "doParallel"
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##
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                         "ParamHelpers"
                                         "BBmisc"
                                                         "splines"
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                         "caret"
## [17] "survival"
                         "rpart.plot"
                                         "rpart"
## [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
## [29] "base"
##
  [[2]]
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                         "Rmisc"
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                                                         "randomForest"
##
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                         "doParallel"
                                         "iterators"
                                                         "foreach"
        "mlr"
                         "ParamHelpers"
                                        "BBmisc"
                                                         "ROCR"
##
   [9]
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
## [17] "survival"
                                                         "caret"
                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
                         "lattice"
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                                                          "graphics"
```

"datasets"

[25] "grDevices"

[29] "base"

##

"utils"

"methods"

```
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                         "doParallel"
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                                                         "foreach"
    [9] "mlr"
                                        "BBmisc"
                                                         "ROCR."
##
                         "ParamHelpers"
                                         "parallel"
## [13] "gplots"
                         "gbm"
                                                         "splines"
## [17] "survival"
                                                         "caret"
                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                                         "methods"
                                         "datasets"
##
   [29] "base"
##
## [[4]]
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##
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                         "doParallel"
                                         "iterators"
                                                         "foreach"
                                                         "ROCR"
                                         "BBmisc"
##
   [9]
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                         "ParamHelpers"
## [13] "gplots"
                         "gbm"
                                                         "splines"
                                         "parallel"
## [17]
        "survival"
                         "rpart.plot"
                                         "rpart"
                                                         "caret"
   [21]
                         "lattice"
                                         "stats"
##
       "ggplot2"
                                                         "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
   [29] "base"
##
##
##
  [[5]]
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    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
##
    [9]
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                                         "BBmisc"
                                                         "ROCR"
##
                         "ParamHelpers"
## [13] "gplots"
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                                         "parallel"
                                                         "splines"
  [17] "survival"
                         "rpart.plot"
                                         "rpart"
                                                         "caret"
                         "lattice"
  [21] "ggplot2"
                                         "stats"
                                                         "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
## [29] "base"
##
## [[6]]
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##
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                         "doParallel"
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                                                         "foreach"
   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                         "ROCR"
##
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
       "survival"
                                                         "caret"
##
  [17]
                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
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                                         "datasets"
                                                         "methods"
## [29] "base"
##
## [[7]]
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    [5] "unbalanced"
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                         "doParallel"
                                         "iterators"
        "mlr"
                                         "BBmisc"
                                                         "ROCR"
##
   [9]
                         "ParamHelpers"
                                                         "splines"
## [13]
       "gplots"
                         "gbm"
                                         "parallel"
        "survival"
                                                         "caret"
## [17]
                         "rpart.plot"
                                         "rpart"
##
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                         "lattice"
                                         "stats"
                                                         "graphics"
  [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
## [29] "base"
clusterEvalQ(cl, library(gbm))
## [[1]]
## [1] "smotefamily"
                                         "plyr"
                        "Rmisc"
                                                         "randomForest"
```

```
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                                                          "foreach"
                                                          "ROCR."
##
    [9]
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                         "ParamHelpers"
                                         "BBmisc"
                         "gbm"
##
  [13] "gplots"
                                         "parallel"
                                                          "splines"
  [17] "survival"
                                         "rpart"
                                                          "caret"
                         "rpart.plot"
##
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
##
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
## [[2]]
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                                                          "randomForest"
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                         "Rmisc"
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                         "doParallel"
                                         "iterators"
                                                          "foreach"
    [9] "mlr"
                                                          "ROCR"
                         "ParamHelpers"
                                         "BBmisc"
##
## [13]
        "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
                                                          "caret"
##
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                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
   [[3]]
##
##
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                                                          "randomForest"
        "unbalanced"
                         "doParallel"
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    [5]
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    [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
##
## [13] "gplots"
                         "gbm"
                                                          "splines"
                                         "parallel"
   Γ17]
        "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
##
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
## [[4]]
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                         "Rmisc"
                                         "plyr"
    [5] "unbalanced"
##
                         "doParallel"
                                         "iterators"
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##
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                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
##
  [13] "gplots"
                         "gbm"
                                         "parallel"
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   [17] "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
##
##
   [29] "base"
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## [[5]]
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                         "doParallel"
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                                                          "foreach"
                                                          "ROCR"
##
   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
## [13]
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                                                          "splines"
                         "gbm"
                                         "parallel"
        "survival"
                                                          "caret"
##
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                         "utils"
                                                          "methods"
                                         "datasets"
   [29] "base"
##
##
##
   [[6]]
##
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                                         "iterators"
                                                          "foreach"
                         "ParamHelpers" "BBmisc"
                                                          "ROCR"
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## [13] "gplots"
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## [17] "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
```

```
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                         "utils"
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                                                         "methods"
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##
##
   [[7]]
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                         "Rmisc"
                                                         "randomForest"
##
                                         "plyr"
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                                                         "foreach"
                                         "iterators"
   [9] "mlr"
                                                         "ROCR."
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                         "ParamHelpers"
                                         "BBmisc"
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                                                         "caret"
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        "survival"
                         "rpart.plot"
                                         "rpart"
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                         "lattice"
                                         "stats"
                                                          "graphics"
                                                         "methods"
## [25]
        "grDevices"
                         "utils"
                                         "datasets"
  [29] "base"
```

clusterEvalQ(cl, library(Rmisc))

```
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                         "gbm"
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##
## [[2]]
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clusterEvalQ(cl, library(smotefamily))
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                       "lattice"
                                       "stats"
                                                       "graphics"
## [25] "grDevices"
                       "utils"
                                       "datasets"
                                                       "methods"
## [29] "base"
result2 = parLapply(cl, c(5,10,15,20,25,30), function(x) {ten_time_auc(data = data_smote2, x)})
stopCluster(cl)
result2
## [[1]]
   [1] 0.8993109 0.8999737 0.8984976 0.8996975 0.8986775 0.8996758 0.8991432
   [8] 0.9003516 0.8995926 0.8994351
##
##
## [[2]]
##
   [1] 0.8994126 0.8989091 0.8993822 0.9010425 0.8999546 0.8986857 0.8979720
##
    [8] 0.9006835 0.8987542 0.9014412
##
## [[3]]
  [1] 0.9010008 0.8974906 0.8969334 0.9010060 0.8993415 0.8950410 0.9010816
    [8] 0.8996760 0.9021653 0.9004129
##
## [[4]]
  [1] 0.8997467 0.8981375 0.8986893 0.9022647 0.8977578 0.8988563 0.9010450
  [8] 0.9021580 0.8997353 0.8979704
##
##
## [[5]]
  [1] 0.8993512 0.8996104 0.8956411 0.9000031 0.8980326 0.9011132 0.8979781
##
##
    [8] 0.9009035 0.9000388 0.8992826
##
## [[6]]
   [1] 0.8972737 0.8961742 0.8998780 0.9009451 0.8962361 0.8986949 0.8959055
##
    [8] 0.8976550 0.8971941 0.8964559
no_cores <- detectCores() - 1</pre>
cl <- makeCluster(no_cores, type="FORK")</pre>
clusterEvalQ(cl, library(caret))
## [[1]]
## [1] "smotefamily"
                       "Rmisc"
                                       "plyr"
                                                       "randomForest"
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                        "doParallel"
                                       "iterators"
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                                                       "ROCR"
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  [9] "mlr"
                       "ParamHelpers" "BBmisc"
## [13] "gplots"
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                         "gbm"
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## [17] "survival"
                                                         "caret"
                         "rpart.plot"
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                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                                         "methods"
                                         "datasets"
## [29] "base"
clusterEvalQ(cl, library(rpart))
## [[1]]
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  [29] "base"
##
##
## [[2]]
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##
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                         "Rmisc"
                                         "plyr"
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                         "doParallel"
                                         "iterators"
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                                         "BBmisc"
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##
## [13] "gplots"
                         "gbm"
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        "survival"
                                                         "caret"
## [17]
                         "rpart.plot"
                                         "rpart"
                                                         "graphics"
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                         "lattice"
                                         "stats"
##
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                                                         "methods"
##
   [29] "base"
##
##
  [[3]]
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##
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## [13] "gplots"
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## [25] "grDevices"
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## [[4]]
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                         "doParallel"
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##
## [13] "gplots"
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       "survival"
                                                         "caret"
##
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                                         "stats"
                                                         "graphics"
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                         "utils"
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[1] "smotefamily"

"Rmisc"

"randomForest"

"plyr"

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[5] "unbalanced"
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##
    [9]
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                         "ParamHelpers"
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  [17] "survival"
                                         "rpart"
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                         "rpart.plot"
##
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                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
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                                         "datasets"
                                                          "methods"
##
   [29] "base"
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##
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                                         "iterators"
                                                          "foreach"
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                                         "BBmisc"
##
## [13]
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                                                          "caret"
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        "survival"
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                                         "stats"
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                                                          "methods"
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    [1] "smotefamily"
                         "Rmisc"
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                                                          "randomForest"
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                         "doParallel"
##
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                                                          "foreach"
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                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
##
## [13] "gplots"
                         "gbm"
                                                          "splines"
                                         "parallel"
   Γ17]
        "survival"
                                                          "caret"
                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
## [29] "base"
```

clusterEvalQ(cl, library(unbalanced))

```
## [[1]]
##
    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
        "unbalanced"
                         "doParallel"
                                                          "foreach"
##
    [5]
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    [9]
        "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
## [13] "gplots"
                         "gbm"
                                                          "splines"
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                         "rpart.plot"
                                         "rpart"
                                                          "caret"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
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                         "utils"
                                                          "methods"
                                         "datasets"
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##
##
## [[2]]
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                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
    [5] "unbalanced"
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                                         "iterators"
                                                          "foreach"
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                                                          "ROCR"
##
    [9]
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                         "ParamHelpers"
                                         "BBmisc"
##
  [13] "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
   [17] "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
                         "utils"
                                                          "methods"
   [25] "grDevices"
                                         "datasets"
##
   [29] "base"
##
##
## [[3]]
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                         "Rmisc"
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    [5] "unbalanced"
                         "doParallel"
                                                          "foreach"
                                         "iterators"
    [9] "mlr"
                         "ParamHelpers" "BBmisc"
                                                          "ROCR"
##
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"parallel"
## [13] "gplots"
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  [17] "survival"
                                                         "caret"
                         "rpart.plot"
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                                         "stats"
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                         "lattice"
                                                         "graphics"
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                         "utils"
                                                         "methods"
                                         "datasets"
   [29] "base"
##
##
## [[4]]
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##
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                         "Rmisc"
                                         "plyr"
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                         "doParallel"
                                         "iterators"
                                                         "foreach"
        "mlr"
                                                         "ROCR"
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   [9]
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                         "gbm"
                                         "parallel"
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                                                         "caret"
  [17] "survival"
                         "rpart.plot"
                                         "rpart"
##
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                         "utils"
                                         "datasets"
                                                         "methods"
## [29] "base"
##
## [[5]]
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                         "doParallel"
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                                                         "foreach"
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    [9] "mlr"
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##
                         "ParamHelpers"
                                        "BBmisc"
       "gplots"
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  [17] "survival"
                                         "rpart"
                                                         "caret"
                         "rpart.plot"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
   [29] "base"
##
## [[6]]
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                         "Rmisc"
                                         "plyr"
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##
                                                         "foreach"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
        "mlr"
                                                         "ROCR"
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   [9]
                         "ParamHelpers"
                                         "BBmisc"
## [13]
        "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
##
   [17]
        "survival"
                         "rpart.plot"
                                         "rpart"
                                                         "caret"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
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                         "utils"
                                         "datasets"
                                                         "methods"
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##
##
## [[7]]
##
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    [5] "unbalanced"
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                                                         "ROCR"
##
   [9]
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                                         "BBmisc"
## [13] "gplots"
                         "gbm"
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                                         "parallel"
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                         "rpart.plot"
                                         "rpart"
                                                         "caret"
                                                         "graphics"
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        "ggplot2"
                         "lattice"
                                         "stats"
        "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
## [25]
## [29] "base"
clusterEvalQ(cl, library(randomForest))
## [[1]]
                                                         "randomForest"
##
   [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
                                                         "ROCR"
##
   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                         "gbm"
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                                         "parallel"
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"rpart"

"rpart.plot"

"caret"

[17] "survival"

```
## [21] "ggplot2"
                         "lattice"
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                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
##
   [[2]]
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                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
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    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
                                                          "ROCR."
   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
##
                         "gbm"
## [13]
        "gplots"
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                                                          "splines"
                                                          "caret"
  [17]
        "survival"
##
                         "rpart.plot"
                                         "rpart"
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                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                                          "methods"
                                         "datasets"
   [29] "base"
##
##
## [[3]]
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                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
       "unbalanced"
                         "doParallel"
                                                          "foreach"
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    [5]
                                         "iterators"
                                                          "ROCR"
##
   [9]
       "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                         "parallel"
## [13] "gplots"
                         "gbm"
                                                          "splines"
                                                          "caret"
  [17] "survival"
                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
##
                         "lattice"
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                                                          "graphics"
  [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
## [29] "base"
##
## [[4]]
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                         "Rmisc"
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                                                          "foreach"
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                         "doParallel"
                                         "iterators"
##
    [9]
        "mlr"
                                         "BBmisc"
                                                          "ROCR"
##
                         "ParamHelpers"
## [13]
       "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
                                                          "caret"
## [17]
        "survival"
                         "rpart.plot"
                                         "rpart"
                         "lattice"
   [21]
        "ggplot2"
                                         "stats"
                                                          "graphics"
   [25]
       "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
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##
   [[5]]
    [1] "smotefamily"
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    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
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   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
## [13]
        "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
                                                          "caret"
  [17] "survival"
                         "rpart.plot"
                                         "rpart"
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   [21] "ggplot2"
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                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
## [[6]]
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    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
        "unbalanced"
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    [5]
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                                         "iterators"
                                                          "foreach"
##
   [9]
        "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
                                                          "caret"
   [17] "survival"
                         "rpart.plot"
                                         "rpart"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
##
## [25] "grDevices"
                         "utils"
                                                          "methods"
                                         "datasets"
## [29] "base"
```

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## [[7]]
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                         "Rmisc"
                         "doParallel"
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    [5] "unbalanced"
                                                         "foreach"
   [9] "mlr"
                         "ParamHelpers"
                                        "BBmisc"
                                                         "ROCR."
##
                                         "parallel"
## [13] "gplots"
                         "gbm"
                                                         "splines"
## [17]
       "survival"
                                                         "caret"
                         "rpart.plot"
                                         "rpart"
## [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                                         "methods"
                                         "datasets"
## [29] "base"
clusterEvalQ(cl, library(ROCR))
## [[1]]
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                                                         "randomForest"
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                         "Rmisc"
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                         "doParallel"
                                         "iterators"
                                                         "foreach"
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                         "ParamHelpers"
                                        "BBmisc"
                                                         "ROCR"
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## [13] "gplots"
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## [17] "survival"
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                         "lattice"
                                         "stats"
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                                                         "methods"
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##
##
## [[2]]
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                         "ParamHelpers"
                                         "BBmisc"
                                                         "ROCR"
##
## [13] "gplots"
                         "gbm"
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        "survival"
                                                         "caret"
## [17]
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                                                         "graphics"
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        "ggplot2"
                         "lattice"
                                         "stats"
##
   [25] "grDevices"
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                                         "datasets"
                                                         "methods"
##
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##
##
  [[3]]
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                                                         "foreach"
##
                         "doParallel"
                                         "iterators"
##
    [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                         "ROCR"
## [13] "gplots"
                         "gbm"
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                                                         "caret"
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                         "rpart.plot"
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                         "lattice"
  [21] "ggplot2"
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                                                         "graphics"
                                                         "methods"
  [25] "grDevices"
                         "utils"
                                         "datasets"
## [29] "base"
##
## [[4]]
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                         "Rmisc"
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                         "doParallel"
##
   [5] "unbalanced"
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                                                         "foreach"
                                                         "ROCR"
   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
##
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
       "survival"
                                                         "caret"
##
  [17]
                         "rpart.plot"
                                         "rpart"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
## [29] "base"
##
## [[5]]
```

[1] "smotefamily"

"Rmisc"

"randomForest"

"plyr"

```
[5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
                                                          "ROCR."
##
    [9]
       "mlr"
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
  [17] "survival"
                                         "rpart"
                                                          "caret"
                         "rpart.plot"
##
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
##
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
## [[6]]
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                                                          "randomForest"
##
                         "Rmisc"
                                         "plyr"
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                                         "iterators"
                                                          "foreach"
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                                                          "ROCR"
                         "ParamHelpers"
                                         "BBmisc"
##
## [13]
        "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
                                                          "caret"
## [17]
        "survival"
                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
   [[7]]
##
##
    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
    [5] "unbalanced"
                         "doParallel"
##
                                         "iterators"
                                                          "foreach"
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                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
##
## [13] "gplots"
                         "gbm"
                                                          "splines"
                                         "parallel"
   Γ17]
        "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
## [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
## [29] "base"
```

clusterEvalQ(cl, library(gbm))

```
## [[1]]
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                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
                         "doParallel"
        "unbalanced"
                                                          "foreach"
##
    [5]
                                         "iterators"
                                                          "ROCR"
    [9]
        "mlr"
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                         "gbm"
                                                          "splines"
                                         "parallel"
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        "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                                          "methods"
                                         "datasets"
   [29] "base"
##
##
## [[2]]
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                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
##
        "mlr"
                                                          "ROCR"
##
   [9]
                         "ParamHelpers"
                                         "BBmisc"
##
  [13] "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
   [17] "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
                         "utils"
                                         "datasets"
                                                          "methods"
   [25] "grDevices"
##
##
   [29] "base"
##
## [[3]]
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                                         "plyr"
                                                          "randomForest"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
    [9] "mlr"
                         "ParamHelpers" "BBmisc"
                                                          "ROCR"
##
```

```
"parallel"
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                         "gbm"
                                                         "splines"
  [17] "survival"
                                                         "caret"
                         "rpart.plot"
                                         "rpart"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
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                         "utils"
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                                         "datasets"
##
   [29] "base"
##
## [[4]]
                                                          "randomForest"
##
   [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
##
    [5]
       "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
        "mlr"
                                                         "ROCR"
##
   [9]
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                         "gbm"
                                         "parallel"
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                                                          "caret"
  [17] "survival"
                         "rpart.plot"
                                         "rpart"
##
   [21] "ggplot2"
                         "lattice"
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                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                                         "methods"
                                         "datasets"
## [29] "base"
##
## [[5]]
    [1] "smotefamily"
                         "Rmisc"
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    [5] "unbalanced"
                                         "iterators"
                                                         "foreach"
##
                         "doParallel"
    [9] "mlr"
                                                         "ROCR"
##
                         "ParamHelpers"
                                        "BBmisc"
       "gplots"
## [13]
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                                         "rpart"
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                                         "datasets"
                                                          "methods"
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##
## [[6]]
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    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
        "mlr"
                                                         "ROCR"
##
   [9]
                         "ParamHelpers"
                                         "BBmisc"
## [13]
        "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
##
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                         "lattice"
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                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
## [[7]]
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    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
                                                         "ROCR"
##
   [9]
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                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                                                         "splines"
                         "gbm"
                                         "parallel"
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                         "rpart.plot"
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                                                          "graphics"
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                         "lattice"
                                         "stats"
        "grDevices"
                                         "datasets"
                                                         "methods"
## [25]
                         "utils"
## [29] "base"
clusterEvalQ(cl, library(Rmisc))
## [[1]]
                                                         "randomForest"
##
   [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
                                                         "ROCR"
##
   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                         "gbm"
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                                         "parallel"
```

"rpart"

"rpart.plot"

"caret"

[17] "survival"

```
## [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
##
   [[2]]
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                         "Rmisc"
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                                                          "randomForest"
##
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
   [9] "mlr"
                                                          "ROCR."
                                         "BBmisc"
##
                         "ParamHelpers"
## [13]
        "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
  [17]
        "survival"
                                                          "caret"
##
                         "rpart.plot"
                                         "rpart"
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                         "lattice"
                                         "stats"
                                                          "graphics"
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                         "utils"
                                                          "methods"
                                         "datasets"
   [29] "base"
##
##
## [[3]]
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                         "Rmisc"
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       "unbalanced"
                         "doParallel"
                                                          "foreach"
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    [5]
                                         "iterators"
                                                          "ROCR"
##
   [9]
       "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                         "parallel"
## [13] "gplots"
                         "gbm"
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                                                          "caret"
  [17] "survival"
                         "rpart.plot"
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  [21] "ggplot2"
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                                         "stats"
                                                          "graphics"
  [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
## [29] "base"
##
## [[4]]
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                         "doParallel"
                                         "iterators"
##
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                                         "BBmisc"
                                                          "ROCR"
##
                         "ParamHelpers"
## [13]
        "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
                                                          "caret"
## [17]
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                         "rpart.plot"
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   [21]
        "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25]
       "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
##
   [[5]]
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                                         "plyr"
                                                          "randomForest"
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##
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
##
   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
## [13]
        "gplots"
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                                         "parallel"
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                                                          "caret"
  [17] "survival"
                         "rpart.plot"
                                         "rpart"
##
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
## [[6]]
                                                          "randomForest"
    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
##
    [5]
        "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
##
   [9]
        "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
                                                          "caret"
   [17] "survival"
                         "rpart.plot"
                                         "rpart"
   [21]
       "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
##
## [25] "grDevices"
                         "utils"
                                                          "methods"
                                         "datasets"
## [29] "base"
```

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## [[7]]
    [1] "smotefamily"
                                         "plyr"
                                                         "randomForest"
                         "Rmisc"
                         "doParallel"
                                         "iterators"
    [5] "unbalanced"
                                                         "foreach"
   [9] "mlr"
                         "ParamHelpers"
                                        "BBmisc"
                                                         "ROCR."
##
                                         "parallel"
## [13] "gplots"
                         "gbm"
                                                         "splines"
       "survival"
                                                         "caret"
## [17]
                         "rpart.plot"
                                         "rpart"
## [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                                         "methods"
                                         "datasets"
## [29] "base"
clusterEvalQ(cl, library(rpart))
## [[1]]
                                                         "randomForest"
    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
    [9] "mlr"
                         "ParamHelpers"
                                        "BBmisc"
                                                         "ROCR"
##
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
## [17] "survival"
                                         "rpart"
                                                         "caret"
                         "rpart.plot"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
  [29] "base"
##
##
## [[2]]
                                                         "randomForest"
##
   [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                         "foreach"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
   [9]
       "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                         "ROCR"
##
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
        "survival"
                                                         "caret"
## [17]
                         "rpart.plot"
                                         "rpart"
                                                         "graphics"
   [21]
        "ggplot2"
                         "lattice"
                                         "stats"
##
   [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
##
   [29] "base"
##
##
  [[3]]
    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                         "randomForest"
   [5] "unbalanced"
                                                         "foreach"
##
                         "doParallel"
                                         "iterators"
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    [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                         "ROCR"
                         "gbm"
## [13] "gplots"
                                         "parallel"
                                                         "splines"
                                                         "caret"
  [17] "survival"
                         "rpart.plot"
                                         "rpart"
                         "lattice"
  [21] "ggplot2"
                                         "stats"
                                                         "graphics"
                                                         "methods"
  [25] "grDevices"
                         "utils"
                                         "datasets"
## [29] "base"
##
## [[4]]
    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                         "randomForest"
                         "doParallel"
##
   [5] "unbalanced"
                                         "iterators"
                                                         "foreach"
                                                         "ROCR"
   [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
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                                         "parallel"
                                                         "splines"
       "survival"
                                                         "caret"
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  [17]
                         "rpart.plot"
                                         "rpart"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                         "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
## [29] "base"
##
## [[5]]
```

"randomForest"

"plyr"

[1] "smotefamily"

"Rmisc"

```
[5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
                                                          "ROCR."
##
    [9]
       "mlr"
                         "ParamHelpers"
                                         "BBmisc"
  [13] "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
  [17] "survival"
                                         "rpart"
                                                          "caret"
                         "rpart.plot"
##
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
                                                          "methods"
##
   [25] "grDevices"
                         "utils"
                                         "datasets"
   [29] "base"
##
##
## [[6]]
   [1] "smotefamily"
                                                          "randomForest"
##
                         "Rmisc"
                                         "plyr"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
    [9] "mlr"
                                                          "ROCR"
                         "ParamHelpers"
                                         "BBmisc"
##
## [13]
        "gplots"
                         "gbm"
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                                                          "caret"
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  [17]
        "survival"
                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
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                                         "datasets"
                                                          "methods"
   [29] "base"
##
##
   [[7]]
##
##
    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
    [5] "unbalanced"
                         "doParallel"
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                                                          "foreach"
    [9] "mlr"
                         "ParamHelpers"
                                         "BBmisc"
                                                          "ROCR"
##
## [13] "gplots"
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                                         "parallel"
   Γ17]
        "survival"
                                         "rpart"
                                                          "caret"
                         "rpart.plot"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
## [25] "grDevices"
                         "utils"
                                         "datasets"
                                                          "methods"
## [29] "base"
```

clusterEvalQ(cl, library(smotefamily))

```
## [[1]]
##
    [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
                         "doParallel"
        "unbalanced"
                                                          "foreach"
##
    [5]
                                         "iterators"
                                                          "ROCR"
    [9]
        "mlr"
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                         "gbm"
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                                         "parallel"
   [17]
        "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
  [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
   [25] "grDevices"
                         "utils"
                                                          "methods"
                                         "datasets"
   [29] "base"
##
##
## [[2]]
   [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
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        "mlr"
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    [9]
                         "ParamHelpers"
                                         "BBmisc"
##
  [13] "gplots"
                         "gbm"
                                         "parallel"
                                                          "splines"
   [17] "survival"
                         "rpart.plot"
                                         "rpart"
                                                          "caret"
   [21] "ggplot2"
                         "lattice"
                                         "stats"
                                                          "graphics"
                         "utils"
                                         "datasets"
                                                          "methods"
   [25] "grDevices"
##
##
   [29] "base"
##
## [[3]]
##
   [1] "smotefamily"
                         "Rmisc"
                                         "plyr"
                                                          "randomForest"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                          "foreach"
    [9] "mlr"
                         "ParamHelpers" "BBmisc"
                                                          "ROCR"
##
```

```
"parallel"
## [13] "gplots"
                         "gbm"
                                                         "splines"
## [17] "survival"
                                                         "caret"
                         "rpart.plot"
                                         "rpart"
  [21] "ggplot2"
                        "lattice"
                                         "stats"
                                                         "graphics"
   [25] "grDevices"
                        "utils"
                                                         "methods"
                                         "datasets"
##
   [29] "base"
##
## [[4]]
##
   [1] "smotefamily"
                        "Rmisc"
                                         "plyr"
                                                         "randomForest"
##
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
       "mlr"
                        "ParamHelpers"
                                                         "ROCR"
##
   [9]
                                        "BBmisc"
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
                                                         "caret"
## [17] "survival"
                        "rpart.plot"
                                         "rpart"
   [21] "ggplot2"
                        "lattice"
                                         "stats"
                                                         "graphics"
  [25] "grDevices"
                        "utils"
                                                         "methods"
                                         "datasets"
## [29] "base"
##
## [[5]]
    [1] "smotefamily"
                        "Rmisc"
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   [5] "unbalanced"
                                         "iterators"
                                                         "foreach"
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                         "doParallel"
    [9] "mlr"
                                                         "ROCR"
##
                         "ParamHelpers" "BBmisc"
## [13] "gplots"
                        "gbm"
                                         "parallel"
                                                         "splines"
## [17] "survival"
                                         "rpart"
                                                         "caret"
                         "rpart.plot"
                        "lattice"
## [21] "ggplot2"
                                         "stats"
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  [25] "grDevices"
                         "utils"
                                         "datasets"
                                                         "methods"
  [29] "base"
##
##
## [[6]]
                        "Rmisc"
                                         "plyr"
                                                         "randomForest"
##
    [1] "smotefamily"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
                                                         "ROCR"
##
   [9]
        "mlr"
                         "ParamHelpers"
                                         "BBmisc"
## [13] "gplots"
                         "gbm"
                                         "parallel"
                                                         "splines"
##
   [17]
        "survival"
                         "rpart.plot"
                                        "rpart"
                                                         "caret"
   [21] "ggplot2"
                        "lattice"
                                         "stats"
                                                         "graphics"
                                         "datasets"
   [25] "grDevices"
                         "utils"
                                                         "methods"
   [29] "base"
##
##
## [[7]]
##
   [1] "smotefamily"
                        "Rmisc"
                                         "plyr"
                                                         "randomForest"
    [5] "unbalanced"
                         "doParallel"
                                         "iterators"
                                                         "foreach"
##
                                                         "ROCR"
   [9] "mlr"
                        "ParamHelpers"
                                        "BBmisc"
##
## [13] "gplots"
                         "gbm"
                                                         "splines"
                                         "parallel"
## [17] "survival"
                         "rpart.plot"
                                         "rpart"
                                                         "caret"
                                                         "graphics"
## [21]
       "ggplot2"
                        "lattice"
                                         "stats"
        "grDevices"
                        "utils"
                                         "datasets"
                                                         "methods"
## [25]
## [29] "base"
result3 = parLapply(cl, c(5,10,15,20,25,30), function(x) {ten_time_auc(data = data_smote3, x)})
stopCluster(cl)
result3
## [[1]]
   [1] 0.8991674 0.8988595 0.8985762 0.8985791 0.8993352 0.8992872 0.8990062
    [8] 0.8982467 0.9004945 0.8988716
```

```
##
## [[2]]
## [1] 0.8986254 0.9006411 0.8991321 0.9001352 0.8983128 0.9013481 0.8999809
## [8] 0.9001708 0.9001934 0.8990551
## [[3]]
## [1] 0.9005765 0.8996142 0.9000499 0.8979536 0.8976530 0.8990698 0.9010800
## [8] 0.8999848 0.8968901 0.8995972
##
## [[4]]
## [1] 0.9005480 0.8994987 0.9002129 0.9002613 0.9007766 0.8977562 0.8981102
## [8] 0.8990877 0.9002971 0.8993854
## [[5]]
## [1] 0.9001996 0.9003711 0.8985507 0.8996516 0.8960490 0.8992961 0.9022389
## [8] 0.8988115 0.8999040 0.9010943
##
## [[6]]
## [1] 0.8988959 0.9001849 0.9017667 0.8981849 0.8993737 0.8973279 0.9001109
## [8] 0.8978659 0.8983715 0.8964974
```