R Notebook

Parametros:

Measure = G-mean
Columns = sampling, weight_space, underbagging, learner
Performance = tuning_measure
Filter keys = NULL
Filter values = NULL

```
library("scmamp")
library(dplyr)
```

Tratamento dos dados

Carregando data set compilado

```
ds = read.csv("/home/rodrigo/Dropbox/UNICAMP/IC/estudo_cost_learning/SummaryResults/summary_compilation_

ds = filter(ds, learner != "classif.rusboost")
summary(ds)
```

```
##                  learner      weight_space
##  classif.ksvm        :17100   Mode :logical
##  classif.randomForest:17100   FALSE:41040
##  classif.rusboost    :    0   TRUE :10260
##  classif.xgboost     :17100   NA's :0
##
##
##
##                             measure        sampling     underbagging
##  Accuracy                       :10260   ADASYN:10260   Mode :logical
##  Area under the curve           :10260   FALSE :30780   FALSE:41040
##  F1 measure                     :10260   SMOTE :10260   TRUE :10260
##  G-mean                         :10260                  NA's :0
##  Matthews correlation coefficient:10260
##
##
##  tuning_measure    holdout_measure   holdout_measure_residual
##  Min.   :-0.1277   Min.   :-0.2120   Min.   :-0.4658
##  1st Qu.: 0.6911   1st Qu.: 0.4001   1st Qu.: 0.1994
##  Median : 0.9700   Median : 0.8571   Median : 0.5581
##  Mean   : 0.7903   Mean   : 0.6718   Mean   : 0.5298
##  3rd Qu.: 0.9975   3rd Qu.: 0.9900   3rd Qu.: 0.8755
##  Max.   : 1.0000   Max.   : 1.0000   Max.   : 1.0000
##  NA's   :1077      NA's   :1077      NA's   :1077
##  iteration_count                      dataset        imba.rate
##  Min.   :1       abalone                 :  900   Min.   :0.0010
##  1st Qu.:1       adult                   :  900   1st Qu.:0.0100
##  Median :2       bank                    :  900   Median :0.0300
##  Mean   :2       car                     :  900   Mean   :0.0286
```

```
##  3rd Qu.:3       cardiotocography-10clases:  900   3rd Qu.:0.0500
##  Max.   :3       cardiotocography-3clases :  900   Max.   :0.0500
##  NA's   :1077    (Other)                  :45900
```

Filtrando pela metrica

```
ds = filter(ds, measure == params$measure)
```

Filtrando o data set

```
if(params$filter_keys != 'NULL' && !is.null(params$filter_keys)){
  dots = paste0(params$filter_keys," == '",params$filter_values,"'")
  ds = filter_(ds, .dots = dots)
}

summary(ds)
```

```
##                  learner     weight_space
##  classif.ksvm        :3420   Mode :logical
##  classif.randomForest:3420   FALSE:8208
##  classif.rusboost    :   0   TRUE :2052
##  classif.xgboost     :3420   NA's :0
##
##
##
##                             measure        sampling    underbagging
##  Accuracy                       :    0   ADASYN:2052   Mode :logical
##  Area under the curve           :    0   FALSE :6156   FALSE:8208
##  F1 measure                     :    0   SMOTE :2052   TRUE :2052
##  G-mean                         :10260                 NA's :0
##  Matthews correlation coefficient:    0
##
##
##  tuning_measure   holdout_measure  holdout_measure_residual
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.6205   1st Qu.:0.0000   1st Qu.:0.1683
##  Median :0.9426   Median :0.7071   Median :0.4879
##  Mean   :0.7570   Mean   :0.5918   Mean   :0.4829
##  3rd Qu.:0.9950   3rd Qu.:0.9547   3rd Qu.:0.7996
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##  NA's   :189      NA's   :189      NA's   :189
##  iteration_count                      dataset       imba.rate
##  Min.   :1       abalone                  : 180   Min.   :0.0010
##  1st Qu.:1       adult                    : 180   1st Qu.:0.0100
##  Median :2       bank                     : 180   Median :0.0300
##  Mean   :2       car                      : 180   Mean   :0.0286
##  3rd Qu.:3       cardiotocography-10clases: 180   3rd Qu.:0.0500
##  Max.   :3       cardiotocography-3clases : 180   Max.   :0.0500
##  NA's   :189     (Other)                  :9180
```

Computando as médias das iteracoes

```
ds = group_by(ds, learner , weight_space , measure , sampling , underbagging , dataset , imba.rate)
ds = summarise(ds, tuning_measure = mean(tuning_measure), holdout_measure = mean(holdout_measure),
               holdout_measure_residual = mean(holdout_measure_residual))

ds = as.data.frame(ds)
```

Criando dataframe

```
# Dividindo o ds em n, um para cada técnica
splited_df = ds %>% group_by_at(.vars = params$columns) %>% do(vals = as.data.frame(.)) %>% select(vals)

# Juntando cada uma das partes horizontalmente em um data set
df_tec_wide = do.call("cbind", splited_df)

# Renomeando duplicacao de nomes
colnames(df_tec_wide) = make.unique(colnames(df_tec_wide))

# Selecionando apenas as medidas da performance escolhida
df_tec_wide_residual = select(df_tec_wide, matches(paste("^", params$performance, "$|", params$performa

# Renomeando colunas
new_names = NULL
for(i in (1:length(splited_df))){
  id = toString(sapply(splited_df[[i]][1, params$columns], as.character))
  new_names = c(new_names, id)
}
colnames(df_tec_wide_residual) = new_names

# Verificando a dimensao do df
dim(df_tec_wide_residual)
```

```
## [1] 228  15
```

```
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                          0.9853254
## 2                          0.9853254
## 3                          0.9592389
## 4                          0.9447230
## 5                          0.9920394
## 6                          0.9920394
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.9815988
## 2                                  0.9815988
## 3                                  0.9565473
## 4                                  0.9383475
## 5                                  0.9917039
## 6                                         NA
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                            0.9864427                          0.0000000
## 2                            0.9864427                          0.0000000
## 3                            0.9671729                          0.2301948
## 4                            0.9572437                          0.3574773
## 5                            0.9941441                          0.1484512
## 6                            0.9941441                          0.1484512
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                0.00000000
## 2                                0.00000000
```

```
## 3                                0.00000000
## 4                                0.01755665
## 5                                0.44811508
## 6                                        NA
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.00000000                         0.5502782
## 2                           0.00000000                         0.5502782
## 3                           0.00000000                         0.6590811
## 4                           0.07718019                         0.6189515
## 5                           0.43718890                         0.6354148
## 6                           0.43718890                         0.6354148
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.5895215
## 2                                0.5895215
## 3                                0.6679185
## 4                                0.6757496
## 5                                0.8106157
## 6                                0.8106157
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.6168405                         0.0000000
## 2                           0.6168405                         0.0000000
## 3                           0.6628393                         0.1889058
## 4                           0.6717735                         0.3446430
## 5                           0.8202719                         0.1661451
## 6                           0.8202719                         0.1661451
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                              0.00000000
## 2                              0.00000000
## 3                              0.00000000
## 4                              0.01755665
## 5                              0.45012568
## 6                                      NA
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                          0.00000000                          0.9845000
## 2                          0.00000000                          0.9845000
## 3                          0.04583346                          0.9608493
## 4                          0.08755153                          0.9444674
## 5                          0.43375517                          0.9930521
## 6                          0.43375517                          0.9930521
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.9817433
## 2                                 0.9817433
## 3                                 0.9548872
## 4                                 0.9409278
## 5                                 0.9919342
## 6                                        NA
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.9872697
## 2                            0.9872697
## 3                            0.9659116
## 4                            0.9537588
## 5                            0.9947643
## 6                            0.9947643
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.7000
##  1st Qu.:0.9772
##  Median :0.9948
##  Mean   :0.9786
##  3rd Qu.:0.9987
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.6918
##  1st Qu.:0.9853
##  Median :0.9966
##  Mean   :0.9849
##  3rd Qu.:0.9992
##  Max.   :1.0000
##  NA's   :22
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.6674                        Min.   :0.0000
##  1st Qu.:0.9840                        1st Qu.:0.0000
##  Median :0.9940                        Median :0.2765
##  Mean   :0.9796                        Mean   :0.3487
##  3rd Qu.:0.9987                        3rd Qu.:0.6449
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2082
##  Median :0.6063
##  Mean   :0.5619
##  3rd Qu.:0.8944
##  Max.   :1.0000
##  NA's   :5
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.0000                       Min.   :0.3521
##  1st Qu.:0.3202                       1st Qu.:0.6169
##  Median :0.6876                       Median :0.7665
##  Mean   :0.6082                       Mean   :0.7403
##  3rd Qu.:0.9031                       3rd Qu.:0.8711
##  Max.   :1.0000                       Max.   :1.0000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.4493
##  1st Qu.:0.8136
##  Median :0.9107
##  Mean   :0.8758
##  3rd Qu.:0.9769
##  Max.   :1.0000
##  NA's   :5
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.4794                      Min.   :0.0000
##  1st Qu.:0.8014                      1st Qu.:0.0000
##  Median :0.9021                      Median :0.2637
```

```
##  Mean   :0.8613                     Mean   :0.3385
##  3rd Qu.:0.9629                     3rd Qu.:0.6124
##  Max.   :1.0000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2314
##  Median :0.5616
##  Mean   :0.5600
##  3rd Qu.:0.9101
##  Max.   :1.0000
##  NA's   :7
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                     Min.   :0.7097
##  1st Qu.:0.3007                     1st Qu.:0.9777
##  Median :0.6804                     Median :0.9952
##  Mean   :0.6061                     Mean   :0.9783
##  3rd Qu.:0.8990                     3rd Qu.:0.9994
##  Max.   :1.0000                     Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.6760
##  1st Qu.:0.9866
##  Median :0.9971
##  Mean   :0.9858
##  3rd Qu.:0.9995
##  Max.   :1.0000
##  NA's   :17
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.6787
##  1st Qu.:0.9851
##  Median :0.9948
##  Mean   :0.9848
##  3rd Qu.:0.9987
##  Max.   :1.0000
##
```

Verificando a média de cada coluna selecionada

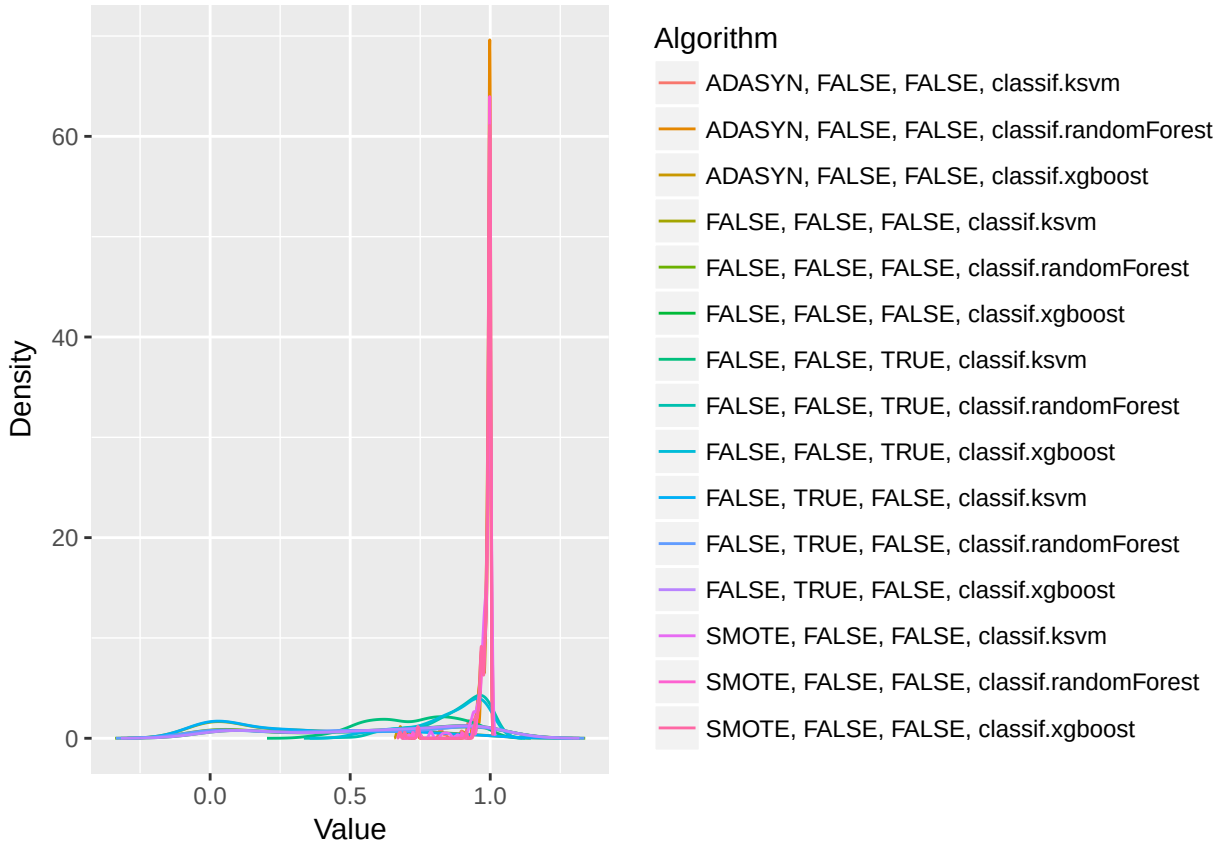
```
for(i in (1:dim(df)[2])){
  print(paste("Media da coluna ", colnames(df)[i], " = ", mean(df[,i], na.rm = TRUE), sep=""))
}
```

```
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.ksvm = 0.978567943379877"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.984877155968814"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.979586724290639"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.348723686105921"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.561931298896259"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.608150448036422"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.740325217225188"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.875791183504656"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.861338451020602"
```

```
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.338506105906646"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.560002840503865"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.606070183340777"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.978280106172245"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.985825082661221"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.984807584020767"
```

Fazendo teste de normalidade

```
plotDensities(data = na.omit(df))
```



Testando as diferencas

```
friedmanTest(df)
```

```
##
##  Friedman's rank sum test
##
## data:  df
## Friedman's chi-squared = 2104.8, df = 14, p-value < 2.2e-16
```

Testando as diferencas par a par

```
test <- nemenyiTest (df, alpha=0.05)
abs(test$diff.matrix) > test$statistic
```

```
##       ADASYN, FALSE, FALSE, classif.ksvm
##  [1,]                               FALSE
##  [2,]                               FALSE
##  [3,]                               FALSE
##  [4,]                                TRUE
##  [5,]                                TRUE
##  [6,]                                TRUE
##  [7,]                                TRUE
##  [8,]                                TRUE
##  [9,]                                TRUE
## [10,]                                TRUE
## [11,]                                TRUE
## [12,]                                TRUE
## [13,]                               FALSE
## [14,]                               FALSE
## [15,]                               FALSE
##       ADASYN, FALSE, FALSE, classif.randomForest
##  [1,]                                      FALSE
##  [2,]                                      FALSE
##  [3,]                                      FALSE
##  [4,]                                       TRUE
##  [5,]                                       TRUE
##  [6,]                                       TRUE
##  [7,]                                       TRUE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                       TRUE
## [11,]                                       TRUE
## [12,]                                       TRUE
## [13,]                                      FALSE
## [14,]                                      FALSE
## [15,]                                      FALSE
##       ADASYN, FALSE, FALSE, classif.xgboost
##  [1,]                                 FALSE
##  [2,]                                 FALSE
##  [3,]                                 FALSE
##  [4,]                                  TRUE
##  [5,]                                  TRUE
##  [6,]                                  TRUE
##  [7,]                                  TRUE
##  [8,]                                  TRUE
##  [9,]                                  TRUE
## [10,]                                  TRUE
## [11,]                                  TRUE
## [12,]                                  TRUE
## [13,]                                 FALSE
## [14,]                                 FALSE
## [15,]                                 FALSE
```

```
##       FALSE, FALSE, FALSE, classif.ksvm
##  [1,]                              TRUE
##  [2,]                              TRUE
##  [3,]                              TRUE
##  [4,]                             FALSE
##  [5,]                              TRUE
##  [6,]                              TRUE
##  [7,]                              TRUE
##  [8,]                              TRUE
##  [9,]                              TRUE
## [10,]                             FALSE
## [11,]                              TRUE
## [12,]                              TRUE
## [13,]                              TRUE
## [14,]                              TRUE
## [15,]                              TRUE
##       FALSE, FALSE, FALSE, classif.randomForest
##  [1,]                                       TRUE
##  [2,]                                       TRUE
##  [3,]                                       TRUE
##  [4,]                                       TRUE
##  [5,]                                      FALSE
##  [6,]                                      FALSE
##  [7,]                                      FALSE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                       TRUE
## [11,]                                      FALSE
## [12,]                                      FALSE
## [13,]                                       TRUE
## [14,]                                       TRUE
## [15,]                                       TRUE
##       FALSE, FALSE, FALSE, classif.xgboost
##  [1,]                                  TRUE
##  [2,]                                  TRUE
##  [3,]                                  TRUE
##  [4,]                                  TRUE
##  [5,]                                 FALSE
##  [6,]                                 FALSE
##  [7,]                                 FALSE
##  [8,]                                  TRUE
##  [9,]                                  TRUE
## [10,]                                  TRUE
## [11,]                                 FALSE
## [12,]                                 FALSE
## [13,]                                  TRUE
## [14,]                                  TRUE
## [15,]                                  TRUE
##       FALSE, FALSE, TRUE, classif.ksvm
##  [1,]                              TRUE
##  [2,]                              TRUE
##  [3,]                              TRUE
##  [4,]                              TRUE
##  [5,]                             FALSE
```

```
##  [6,]                            FALSE
##  [7,]                            FALSE
##  [8,]                             TRUE
##  [9,]                             TRUE
## [10,]                             TRUE
## [11,]                             TRUE
## [12,]                            FALSE
## [13,]                             TRUE
## [14,]                             TRUE
## [15,]                             TRUE
##       FALSE, FALSE, TRUE, classif.randomForest
##  [1,]                                     TRUE
##  [2,]                                     TRUE
##  [3,]                                     TRUE
##  [4,]                                     TRUE
##  [5,]                                     TRUE
##  [6,]                                     TRUE
##  [7,]                                     TRUE
##  [8,]                                    FALSE
##  [9,]                                    FALSE
## [10,]                                     TRUE
## [11,]                                     TRUE
## [12,]                                     TRUE
## [13,]                                     TRUE
## [14,]                                     TRUE
## [15,]                                     TRUE
##       FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  [1,]                                TRUE                               TRUE
##  [2,]                                TRUE                               TRUE
##  [3,]                                TRUE                               TRUE
##  [4,]                                TRUE                              FALSE
##  [5,]                                TRUE                               TRUE
##  [6,]                                TRUE                               TRUE
##  [7,]                                TRUE                               TRUE
##  [8,]                               FALSE                               TRUE
##  [9,]                               FALSE                               TRUE
## [10,]                                TRUE                              FALSE
## [11,]                                TRUE                               TRUE
## [12,]                                TRUE                               TRUE
## [13,]                                TRUE                               TRUE
## [14,]                                TRUE                               TRUE
## [15,]                                TRUE                               TRUE
##       FALSE, TRUE, FALSE, classif.randomForest
##  [1,]                                     TRUE
##  [2,]                                     TRUE
##  [3,]                                     TRUE
##  [4,]                                     TRUE
##  [5,]                                    FALSE
##  [6,]                                    FALSE
##  [7,]                                     TRUE
##  [8,]                                     TRUE
##  [9,]                                     TRUE
## [10,]                                     TRUE
## [11,]                                    FALSE
```

```
## [12,]                                    FALSE
## [13,]                                     TRUE
## [14,]                                     TRUE
## [15,]                                     TRUE
##       FALSE, TRUE, FALSE, classif.xgboost
##  [1,]                                   TRUE
##  [2,]                                   TRUE
##  [3,]                                   TRUE
##  [4,]                                   TRUE
##  [5,]                                  FALSE
##  [6,]                                  FALSE
##  [7,]                                  FALSE
##  [8,]                                   TRUE
##  [9,]                                   TRUE
## [10,]                                   TRUE
## [11,]                                  FALSE
## [12,]                                  FALSE
## [13,]                                   TRUE
## [14,]                                   TRUE
## [15,]                                   TRUE
##       SMOTE, FALSE, FALSE, classif.ksvm
##  [1,]                                FALSE
##  [2,]                                FALSE
##  [3,]                                FALSE
##  [4,]                                 TRUE
##  [5,]                                 TRUE
##  [6,]                                 TRUE
##  [7,]                                 TRUE
##  [8,]                                 TRUE
##  [9,]                                 TRUE
## [10,]                                 TRUE
## [11,]                                 TRUE
## [12,]                                 TRUE
## [13,]                                FALSE
## [14,]                                FALSE
## [15,]                                FALSE
##       SMOTE, FALSE, FALSE, classif.randomForest
##  [1,]                                      FALSE
##  [2,]                                      FALSE
##  [3,]                                      FALSE
##  [4,]                                       TRUE
##  [5,]                                       TRUE
##  [6,]                                       TRUE
##  [7,]                                       TRUE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                       TRUE
## [11,]                                       TRUE
## [12,]                                       TRUE
## [13,]                                      FALSE
## [14,]                                      FALSE
## [15,]                                      FALSE
##       SMOTE, FALSE, FALSE, classif.xgboost
##  [1,]                                 FALSE
```

```
##  [2,]                                FALSE
##  [3,]                                FALSE
##  [4,]                                 TRUE
##  [5,]                                 TRUE
##  [6,]                                 TRUE
##  [7,]                                 TRUE
##  [8,]                                 TRUE
##  [9,]                                 TRUE
## [10,]                                 TRUE
## [11,]                                 TRUE
## [12,]                                 TRUE
## [13,]                                FALSE
## [14,]                                FALSE
## [15,]                                FALSE
```

Plotando os ranks

```
print(colMeans(rankMatrix(df)))
```

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                   4.214912
## ADASYN, FALSE, FALSE, classif.randomForest
##                                   4.467105
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                   4.188596
##          FALSE, FALSE, FALSE, classif.ksvm
##                                  13.208333
##  FALSE, FALSE, FALSE, classif.randomForest
##                                  11.243421
##       FALSE, FALSE, FALSE, classif.xgboost
##                                  10.368421
##           FALSE, FALSE, TRUE, classif.ksvm
##                                   9.969298
##   FALSE, FALSE, TRUE, classif.randomForest
##                                   7.594298
##        FALSE, FALSE, TRUE, classif.xgboost
##                                   7.914474
##           FALSE, TRUE, FALSE, classif.ksvm
##                                  13.282895
##   FALSE, TRUE, FALSE, classif.randomForest
##                                  11.434211
##        FALSE, TRUE, FALSE, classif.xgboost
##                                  10.407895
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                   3.631579
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                   4.078947
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                   3.995614
```

Plotando grafico de Critical Diference

```
result = tryCatch({
    plotCD(df, alpha=0.05, cex = 0.35)
}, error = function(e) {})
```