R Notebook

Parametros:

Measure = G-mean
Columns = sampling, weight_space, underbagging, learner
Performance = holdout_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                          0.0000000
## 2                          0.0000000
## 3                          0.1570779
## 4                          0.3634746
## 5                          0.0000000
## 6                          0.0000000
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.0000000
## 2                                  0.0000000
## 3                                  0.2696244
## 4                                  0.3308746
## 5                                  0.2505456
## 6                                         NA
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                            0.0000000                          0.00000000
## 2                            0.0000000                          0.00000000
## 3                            0.1604060                          0.19012012
## 4                            0.2664758                          0.41880678
## 5                            0.4236795                          0.08202566
## 6                            0.4236795                          0.08202566
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.0000000
## 2                                 0.0000000
```

```
## 3                                0.0000000
## 4                                0.0000000
## 5                                0.5396421
## 6                                       NA
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.0000000                         0.5587283
## 2                           0.0000000                         0.5587283
## 3                           0.0000000                         0.6183473
## 4                           0.0606977                         0.6449588
## 5                           0.4769822                         0.6875628
## 6                           0.4769822                         0.6875628
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                             0.6129433
## 2                             0.6129433
## 3                             0.6228767
## 4                             0.6496529
## 5                             0.8247649
## 6                             0.8247649
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.6692660                         0.00000000
## 2                           0.6692660                         0.00000000
## 3                           0.6800788                         0.23641729
## 4                           0.6590354                         0.37651118
## 5                           0.8515676                         0.06713144
## 6                           0.8515676                         0.06713144
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                              0.00000
## 2                              0.00000
## 3                              0.00000
## 4                              0.00000
## 5                              0.47264
## 6                                   NA
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                           0.0000000                         0.0000000
## 2                           0.0000000                         0.0000000
## 3                           0.0000000                         0.2337788
## 4                           0.0000000                         0.4067937
## 5                           0.5147004                         0.1144564
## 6                           0.5147004                         0.1144564
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                             0.0000000
## 2                             0.0000000
## 3                             0.1919372
## 4                             0.3554756
## 5                             0.2846110
## 6                                    NA
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                           0.0000000
## 2                           0.0000000
## 3                           0.1601916
## 4                           0.3687932
## 5                           0.4189175
## 6                           0.4189175
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.2357
##  Mean   :0.3219
##  3rd Qu.:0.5714
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.4352
##  Median :0.7451
##  Mean   :0.6429
##  3rd Qu.:0.9388
##  Max.   :1.0000
##  NA's   :22
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                        Min.   :0.0000
##  1st Qu.:0.5626                        1st Qu.:0.0000
##  Median :0.8287                        Median :0.2715
##  Mean   :0.7203                        Mean   :0.3612
##  3rd Qu.:0.9667                        3rd Qu.:0.6667
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2034
##  Median :0.6667
##  Mean   :0.5749
##  3rd Qu.:0.9359
##  Max.   :1.0000
##  NA's   :5
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.0000                       Min.   :0.02351
##  1st Qu.:0.2603                       1st Qu.:0.57558
##  Median :0.7071                       Median :0.76604
##  Mean   :0.5965                       Mean   :0.71411
##  3rd Qu.:0.9297                       3rd Qu.:0.89193
##  Max.   :1.0000                       Max.   :1.00000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.2962
##  1st Qu.:0.8260
##  Median :0.9236
##  Mean   :0.8760
##  3rd Qu.:0.9814
##  Max.   :1.0000
##  NA's   :5
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.2897                      Min.   :0.0000
##  1st Qu.:0.8283                      1st Qu.:0.0000
##  Median :0.9091                      Median :0.2357
```

```
##  Mean   :0.8656                     Mean   :0.3497
##  3rd Qu.:0.9716                     3rd Qu.:0.6574
##  Max.   :1.0000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1925
##  Median :0.6630
##  Mean   :0.5706
##  3rd Qu.:0.9249
##  Max.   :1.0000
##  NA's   :7
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                     Min.   :0.0000
##  1st Qu.:0.2622                     1st Qu.:0.0000
##  Median :0.7223                     Median :0.2357
##  Mean   :0.5944                     Mean   :0.3373
##  3rd Qu.:0.9314                     3rd Qu.:0.6276
##  Max.   :1.0000                     Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.3454
##  Median :0.7345
##  Mean   :0.6441
##  3rd Qu.:0.9552
##  Max.   :1.0000
##  NA's   :17
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.0000
##  1st Qu.:0.5608
##  Median :0.8390
##  Mean   :0.7132
##  3rd Qu.:0.9606
##  Max.   :1.0000
##
```

Verificando a média de cada coluna selecionada

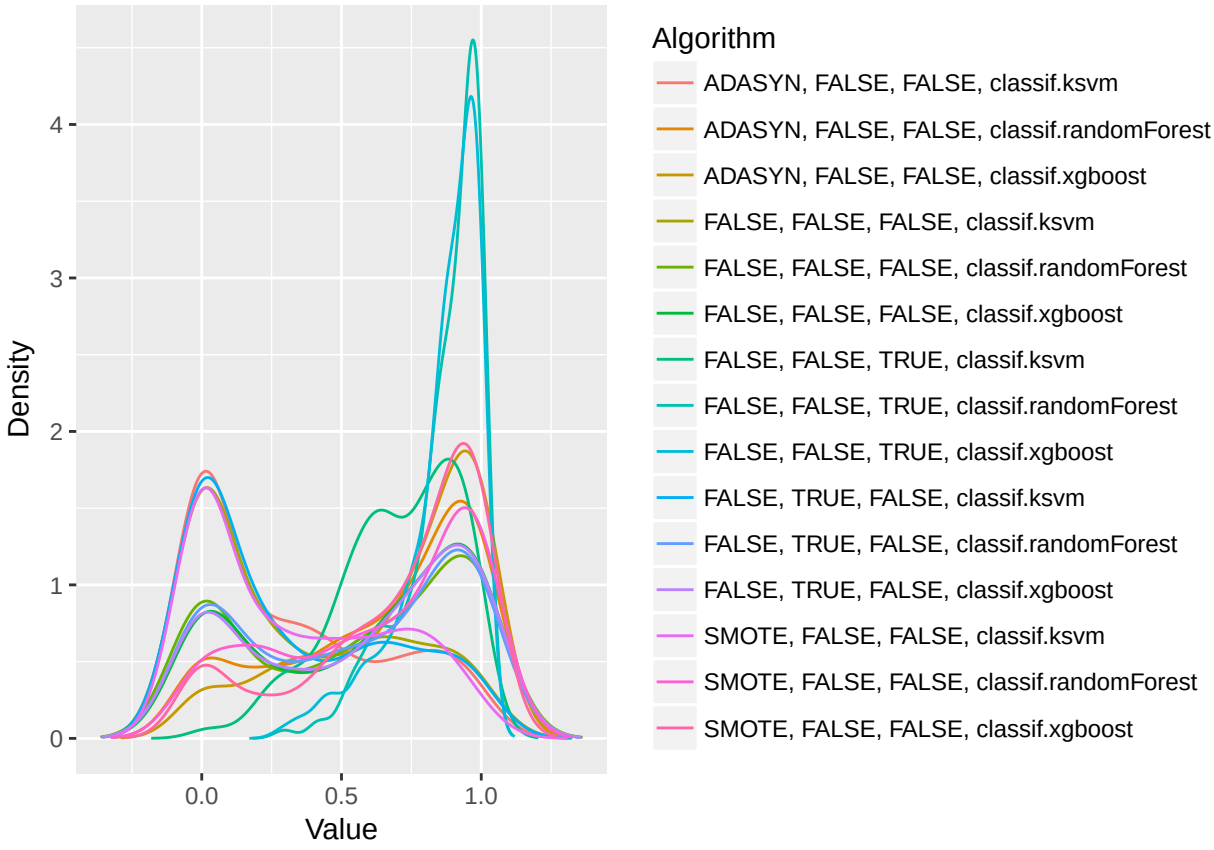
```
for(i in (1:dim(df)[2])){
  print(paste("Media da coluna ", colnames(df)[i], " = ", mean(df[,i], na.rm = TRUE), sep=""))
}
```

```
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.ksvm = 0.321897326051667"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.64293314065937"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.720317334817348"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.361159697459419"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.574916411982247"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.596496355175027"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.714109845020695"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.875955159601207"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.865585473722251"
```

```
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.34968048276683"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.570566749590246"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.59438748494294"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.337346959940751"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.644149000287062"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.713243245623303"
```

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 = 1268.2, 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,]                               TRUE
##  [3,]                               TRUE
##  [4,]                              FALSE
##  [5,]                               TRUE
##  [6,]                               TRUE
##  [7,]                               TRUE
##  [8,]                               TRUE
##  [9,]                               TRUE
## [10,]                              FALSE
## [11,]                               TRUE
## [12,]                               TRUE
## [13,]                              FALSE
## [14,]                               TRUE
## [15,]                               TRUE
##       ADASYN, FALSE, FALSE, classif.randomForest
##  [1,]                                       TRUE
##  [2,]                                      FALSE
##  [3,]                                       TRUE
##  [4,]                                       TRUE
##  [5,]                                      FALSE
##  [6,]                                      FALSE
##  [7,]                                      FALSE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                       TRUE
## [11,]                                      FALSE
## [12,]                                      FALSE
## [13,]                                       TRUE
## [14,]                                      FALSE
## [15,]                                       TRUE
##       ADASYN, FALSE, FALSE, classif.xgboost
##  [1,]                                  TRUE
##  [2,]                                  TRUE
##  [3,]                                 FALSE
##  [4,]                                  TRUE
##  [5,]                                  TRUE
##  [6,]                                  TRUE
##  [7,]                                 FALSE
##  [8,]                                  TRUE
##  [9,]                                  TRUE
## [10,]                                  TRUE
## [11,]                                  TRUE
## [12,]                                  TRUE
## [13,]                                  TRUE
## [14,]                                  TRUE
## [15,]                                 FALSE
```

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

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

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

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

Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                   11.835526
## ADASYN, FALSE, FALSE, classif.randomForest
##                                    7.616228
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                    5.407895
##          FALSE, FALSE, FALSE, classif.ksvm
##                                   11.392544
##  FALSE, FALSE, FALSE, classif.randomForest
##                                    8.942982
##       FALSE, FALSE, FALSE, classif.xgboost
##                                    8.078947
##           FALSE, FALSE, TRUE, classif.ksvm
##                                    6.554825
##   FALSE, FALSE, TRUE, classif.randomForest
##                                    3.298246
##        FALSE, FALSE, TRUE, classif.xgboost
##                                    3.574561
##           FALSE, TRUE, FALSE, classif.ksvm
##                                   11.475877
##   FALSE, TRUE, FALSE, classif.randomForest
##                                    8.872807
##        FALSE, TRUE, FALSE, classif.xgboost
##                                    8.094298
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                   11.796053
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                    7.504386
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                    5.554825
```

Plotando grafico de Critical Diference

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