R Notebook

Parametros:

Measure = F1 measure
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                     :10260   SMOTE :2052   TRUE :2052
##  G-mean                         :    0                 NA's :0
##  Matthews correlation coefficient:    0
##
##
##  tuning_measure   holdout_measure  holdout_measure_residual
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.00000
##  1st Qu.:0.2739   1st Qu.:0.0000   1st Qu.:0.04287
##  Median :0.8197   Median :0.4500   Median :0.28466
##  Mean   :0.6468   Mean   :0.4554   Mean   :0.36600
##  3rd Qu.:0.9944   3rd Qu.:0.8075   3rd Qu.:0.68235
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.00000
##  NA's   :216      NA's   :216      NA's   :216
##  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   :216     (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                         0.00000000
## 2                         0.00000000
## 3                         0.03849057
## 4                         0.11482128
## 5                         0.00000000
## 6                         0.00000000
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                 0.00000000
## 2                                 0.00000000
## 3                                 0.03100775
## 4                                 0.11012455
## 5                                         NA
## 6                                         NA
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                           0.00000000                          0.00000000
## 2                           0.00000000                          0.00000000
## 3                           0.05000000                          0.04164767
## 4                           0.08612787                          0.15293690
## 5                           0.23538749                          0.01886792
## 6                           0.23538749                          0.01886792
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.0000000
## 2                                 0.0000000
```

```
## 3                                0.0000000
## 4                                0.0000000
## 5                                0.4247251
## 6                                0.4247251
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.00000000                        0.02321195
## 2                           0.00000000                        0.02321195
## 3                           0.00000000                        0.08464646
## 4                           0.01960784                        0.13319121
## 5                           0.36368775                        0.06800533
## 6                           0.36368775                        0.06800533
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                               0.02668038
## 2                               0.02668038
## 3                               0.08826039
## 4                               0.15163972
## 5                               0.07357207
## 6                               0.07357207
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                          0.03142433                        0.00000000
## 2                          0.03142433                        0.00000000
## 3                          0.10173486                        0.06740848
## 4                          0.15720540                        0.12638946
## 5                          0.08240072                        0.01626016
## 6                          0.08240072                        0.01626016
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                               0.0000000
## 2                               0.0000000
## 3                               0.0000000
## 4                               0.0000000
## 5                               0.3411866
## 6                                      NA
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                           0.0000000                         0.00000000
## 2                           0.0000000                         0.00000000
## 3                           0.0000000                         0.05409754
## 4                           0.0000000                         0.14268879
## 5                           0.4037524                         0.02145474
## 6                           0.4037524                         0.02145474
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                               0.00000000
## 2                               0.00000000
## 3                               0.05626016
## 4                               0.12443200
## 5                                       NA
## 6                               0.11925074
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                           0.00000000
## 2                           0.00000000
## 3                           0.04679803
## 4                           0.15714105
## 5                           0.24805550
## 6                           0.24805550
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.1667
##  Mean   :0.2736
##  3rd Qu.:0.4333
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2222
##  Median :0.6389
##  Mean   :0.5660
##  3rd Qu.:0.9048
##  Max.   :1.0000
##  NA's   :27
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                        Min.   :0.0000
##  1st Qu.:0.3175                        1st Qu.:0.0000
##  Median :0.6986                        Median :0.2056
##  Mean   :0.6061                        Mean   :0.3220
##  3rd Qu.:0.9229                        3rd Qu.:0.5938
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1141
##  Median :0.6084
##  Mean   :0.5317
##  3rd Qu.:0.8876
##  Max.   :1.0000
##  NA's   :5
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.0000                       Min.   :0.0000
##  1st Qu.:0.1667                       1st Qu.:0.1030
##  Median :0.6556                       Median :0.2919
##  Mean   :0.5488                       Mean   :0.3695
##  3rd Qu.:0.8889                       3rd Qu.:0.5942
##  Max.   :1.0000                       Max.   :1.0000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.02136
##  1st Qu.:0.14917
##  Median :0.34326
##  Mean   :0.40804
##  3rd Qu.:0.65516
##  Max.   :1.00000
##  NA's   :6
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.01227                     Min.   :0.0000
##  1st Qu.:0.13304                     1st Qu.:0.0000
##  Median :0.30011                     Median :0.1667
```

```
##  Mean   :0.36805                     Mean   :0.3133
##  3rd Qu.:0.54753                     3rd Qu.:0.5853
##  Max.   :1.00000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1111
##  Median :0.6333
##  Mean   :0.5317
##  3rd Qu.:0.8807
##  Max.   :1.0000
##  NA's   :7
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                      Min.   :0.0000
##  1st Qu.:0.1667                      1st Qu.:0.0000
##  Median :0.6413                      Median :0.1667
##  Mean   :0.5505                      Mean   :0.2817
##  3rd Qu.:0.8865                      3rd Qu.:0.5273
##  Max.   :1.0000                      Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1795
##  Median :0.6374
##  Mean   :0.5681
##  3rd Qu.:0.9278
##  Max.   :1.0000
##  NA's   :20
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.0000
##  1st Qu.:0.3200
##  Median :0.6956
##  Mean   :0.6126
##  3rd Qu.:0.9324
##  Max.   :1.0000
##
```

Verificando a média de cada coluna selecionada

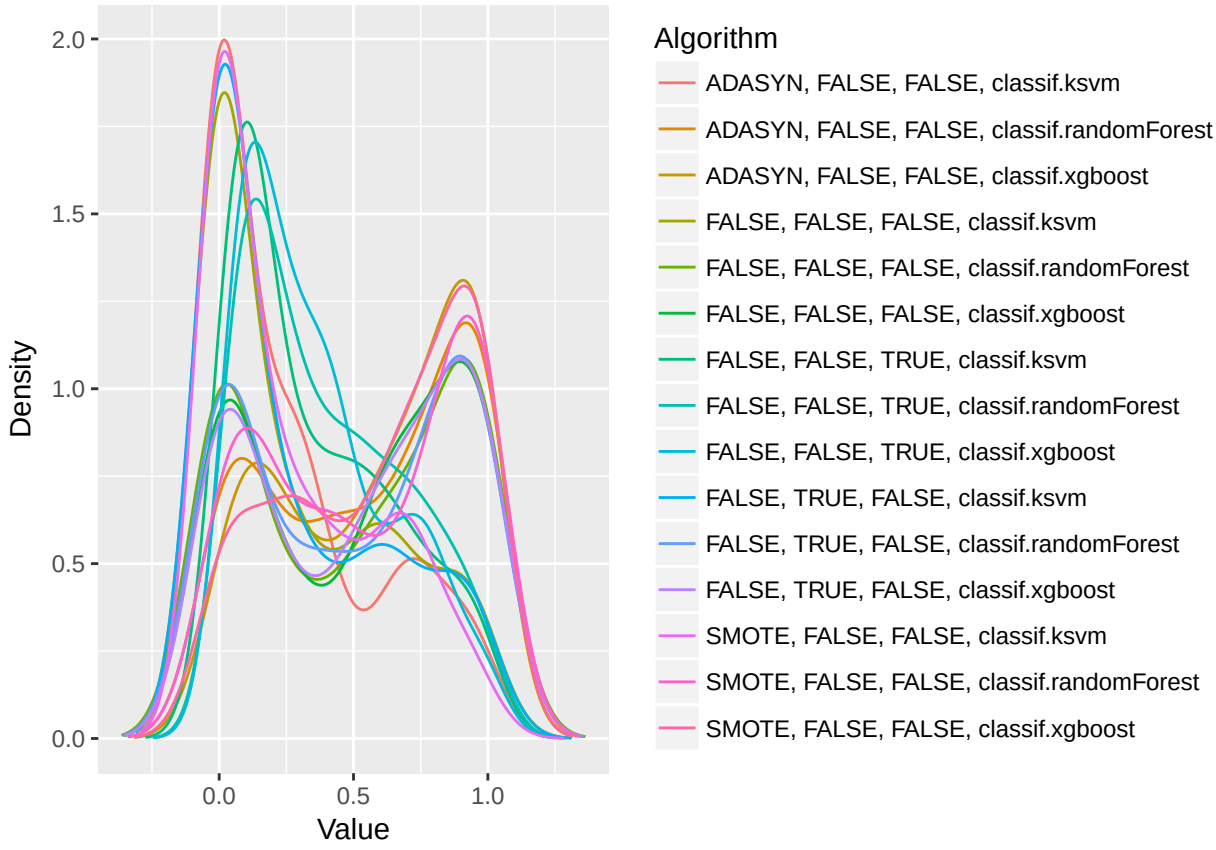
```
for(i in (1:dim(df)[2])){
  print(paste("Media da coluna ", colnames(df)[i], " = ", mean(df[,i], na.rm = TRUE), sep=""))
}
```

```
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.ksvm = 0.273565164999428"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.566003047237143"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.606083540351536"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.322029397181557"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.531706972216012"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.548797217471997"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.369515673127528"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.408044694894222"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.368052388403102"
```

```
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.313261523689142"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.531659101661382"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.550509756610902"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.281747266122444"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.568142671435832"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.61263631673472"
```

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 = 774.82, 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,]                                       TRUE
##  [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,]                                  TRUE
##  [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,]                                     FALSE
## [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,]                             TRUE
##  [3,]                             TRUE
##  [4,]                             TRUE
##  [5,]                             TRUE
```

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

```
##  [2,]                                TRUE
##  [3,]                               FALSE
##  [4,]                                TRUE
##  [5,]                                TRUE
##  [6,]                                TRUE
##  [7,]                                TRUE
##  [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
##                                   11.111842
## ADASYN, FALSE, FALSE, classif.randomForest
##                                    6.789474
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                    4.660088
##          FALSE, FALSE, FALSE, classif.ksvm
##                                   10.491228
##  FALSE, FALSE, FALSE, classif.randomForest
##                                    7.311404
##       FALSE, FALSE, FALSE, classif.xgboost
##                                    6.541667
##           FALSE, FALSE, TRUE, classif.ksvm
##                                    9.006579
##   FALSE, FALSE, TRUE, classif.randomForest
##                                    8.739035
##        FALSE, FALSE, TRUE, classif.xgboost
##                                    8.958333
##           FALSE, TRUE, FALSE, classif.ksvm
##                                   10.578947
##   FALSE, TRUE, FALSE, classif.randomForest
##                                    7.282895
##        FALSE, TRUE, FALSE, classif.xgboost
##                                    6.396930
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                   11.153509
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                    6.510965
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                    4.467105
```

Plotando grafico de Critical Diference

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