R Notebook

Parametros:

Measure = F1 measure
Columns = sampling, weight_space, underbagging, learner
Performance = tuning_measure
Filter keys = imba.rate
Filter values = 0.001

```
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        :600   Mode :logical
##  classif.randomForest:600   FALSE:1440
##  classif.rusboost    :  0   TRUE :360
##  classif.xgboost     :600   NA's :0
##
##
##
##                              measure       sampling    underbagging
##  Accuracy                        :   0   ADASYN: 360   Mode :logical
##  Area under the curve            :   0   FALSE :1080   FALSE:1440
##  F1 measure                      :1800   SMOTE : 360   TRUE :360
##  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.:0.1444   1st Qu.:0.0000   1st Qu.:0.02254
##  Median :0.8072   Median :0.3333   Median :0.21133
##  Mean   :0.6196   Mean   :0.4116   Mean   :0.32573
##  3rd Qu.:0.9987   3rd Qu.:0.8000   3rd Qu.:0.59294
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.00000
##  NA's   :60       NA's   :60       NA's   :60
##  iteration_count                      dataset       imba.rate
##  Min.   :1       abalone                  :  45   Min.   :0.001
##  1st Qu.:1       adult                    :  45   1st Qu.:0.001
##  Median :2       bank                     :  45   Median :0.001
##  Mean   :2       car                      :  45   Mean   :0.001
##  3rd Qu.:3       cardiotocography-10clases:  45   3rd Qu.:0.001
##  Max.   :3       cardiotocography-3clases :  45   Max.   :0.001
##  NA's   :60      (Other)                  :1530
```

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] 40 15
```

```
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                          0.9855714
## 2                          0.9920578
## 3                          0.9988447
## 4                          1.0000000
## 5                          1.0000000
## 6                          0.9986680
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.9819986
## 2                                         NA
## 3                                  0.9956934
## 4                                  1.0000000
## 5                                  0.9973732
## 6                                  0.9992243
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.9864756                         0.00000000
## 2                             0.9941432                         0.03745141
## 3                             0.9932733                         0.00000000
## 4                             1.0000000                         0.82222222
## 5                             0.9974878                         0.50176367
## 6                             0.9993358                         0.61022928
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.0000000
## 2                                 0.3147376
```

```
## 3                                0.0000000
## 4                                1.0000000
## 5                                0.4629630
## 6                                0.8841190
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.00000000                        0.02691361
## 2                           0.31226618                        0.06037610
## 3                           0.02020202                        0.03542331
## 4                           0.98989899                        0.82892416
## 5                           0.59497354                        0.34858986
## 6                           0.84118042                        0.85101010
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                              0.02829182
## 2                              0.07459643
## 3                              0.08788294
## 4                              0.41177845
## 5                              0.15178778
## 6                              0.60674901
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                          0.03101175                       0.00000000
## 2                          0.07794380                       0.04852524
## 3                          0.07613248                       0.00000000
## 4                          0.43310820                       0.82222222
## 5                          0.11965033                       0.50176367
## 6                          0.37664313                       0.61022928
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                              0.00000000
## 2                              0.31382236
## 3                              0.02020202
## 4                              1.00000000
## 5                              0.45634921
## 6                              0.89955107
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                          0.00000000                         0.9847324
## 2                          0.30327271                         0.9930476
## 3                          0.02020202                         0.9986867
## 4                          0.98989899                         1.0000000
## 5                          0.58783069                         1.0000000
## 6                          0.84118042                         0.9986613
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                              0.9822771
## 2                                     NA
## 3                              0.9949524
## 4                              1.0000000
## 5                              0.9983175
## 6                              0.9996681
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                           0.9872957
## 2                           0.9947465
## 3                           0.9942732
## 4                           0.9997361
## 5                           0.9977955
## 6                           0.9994470
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.9262
##  1st Qu.:0.9958
##  Median :0.9988
##  Mean   :0.9953
##  3rd Qu.:0.9997
##  Max.   :1.0000
##  NA's   :2
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.9820
##  1st Qu.:0.9967
##  Median :0.9987
##  Mean   :0.9972
##  3rd Qu.:0.9995
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.6463                        Min.   :0.0000
##  1st Qu.:0.9940                        1st Qu.:0.0000
##  Median :0.9981                        Median :0.2007
##  Mean   :0.9878                        Mean   :0.3118
##  3rd Qu.:0.9994                        3rd Qu.:0.5289
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.00000
##  1st Qu.:0.03333
##  Median :0.46574
##  Mean   :0.47309
##  3rd Qu.:0.87630
##  Max.   :1.00000
##  NA's   :2
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.0000                       Min.   :0.02691
##  1st Qu.:0.1184                       1st Qu.:0.06207
##  Median :0.5549                       Median :0.29549
##  Mean   :0.5140                       Mean   :0.35232
##  3rd Qu.:0.8489                       3rd Qu.:0.62406
##  Max.   :1.0000                       Max.   :1.00000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.02829
##  1st Qu.:0.08293
##  Median :0.17271
##  Mean   :0.27835
##  3rd Qu.:0.38008
##  Max.   :1.00000
##  NA's   :1
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.02172                     Min.   :0.0000
##  1st Qu.:0.07767                     1st Qu.:0.0000
##  Median :0.14925                     Median :0.2007
```

```
##  Mean   :0.23227                     Mean   :0.3140
##  3rd Qu.:0.27661                     3rd Qu.:0.5289
##  Max.   :1.00000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.0636
##  Median :0.4506
##  Mean   :0.4684
##  3rd Qu.:0.8652
##  Max.   :1.0000
##  NA's   :1
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                      Min.   :0.9262
##  1st Qu.:0.1265                      1st Qu.:0.9979
##  Median :0.5195                      Median :0.9990
##  Mean   :0.5108                      Mean   :0.9959
##  3rd Qu.:0.8573                      3rd Qu.:1.0000
##  Max.   :1.0000                      Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.9823
##  1st Qu.:0.9971
##  Median :0.9993
##  Mean   :0.9974
##  3rd Qu.:1.0000
##  Max.   :1.0000
##  NA's   :7
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.9851
##  1st Qu.:0.9951
##  Median :0.9982
##  Mean   :0.9967
##  3rd Qu.:0.9995
##  Max.   :1.0000
##
```

Verificando a média de cada coluna selecionada

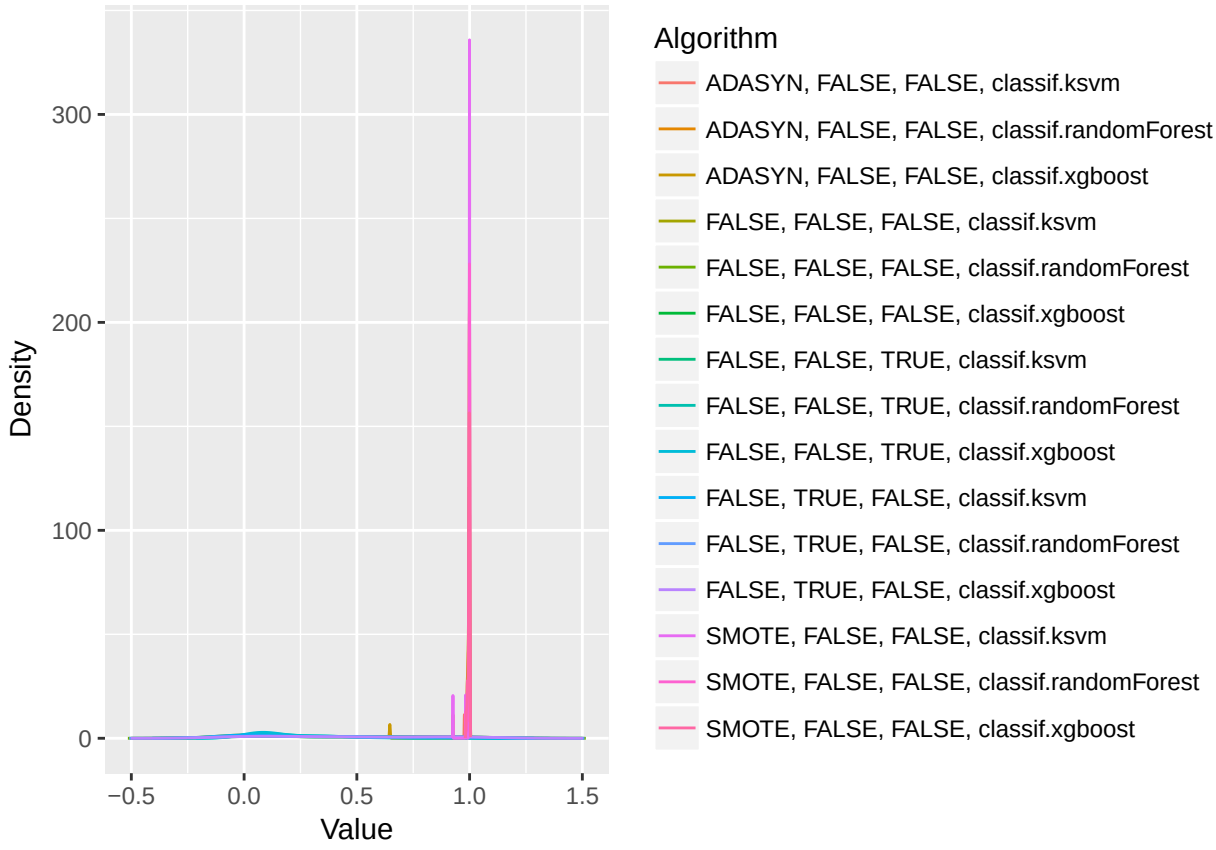
```
for(i in (1:dim(df)[2])){
  print(paste("Media da coluna ", colnames(df)[i], " = ", mean(df[,i], na.rm = TRUE), sep=""))
}
```

```
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.ksvm = 0.995330429724085"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.997196791633994"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.98782122586447"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.311775261644857"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.473089147893671"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.513998364516779"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.352315136446539"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.27835322954136"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.232274034990772"
```

```
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.313988670601455"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.46841339160819"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.510842978406284"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.995896011179904"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.997353883127272"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.996656410384335"
```

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 = 302.67, 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,]                                      FALSE
##  [7,]                                       TRUE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                       TRUE
## [11,]                                       TRUE
## [12,]                                      FALSE
## [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,]                               FALSE
##  [6,]                                TRUE
##  [7,]                               FALSE
##  [8,]                               FALSE
##  [9,]                               FALSE
## [10,]                               FALSE
## [11,]                               FALSE
## [12,]                                TRUE
## [13,]                                TRUE
## [14,]                                TRUE
## [15,]                                TRUE
##       FALSE, FALSE, FALSE, classif.randomForest
##  [1,]                                      TRUE
##  [2,]                                      TRUE
##  [3,]                                      TRUE
##  [4,]                                     FALSE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                     FALSE
##  [8,]                                     FALSE
##  [9,]                                     FALSE
## [10,]                                     FALSE
## [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,]                                FALSE
##  [8,]                                FALSE
##  [9,]                                FALSE
## [10,]                                 TRUE
## [11,]                                FALSE
## [12,]                                FALSE
## [13,]                                 TRUE
## [14,]                                FALSE
## [15,]                                 TRUE
##       FALSE, FALSE, TRUE, classif.ksvm
##  [1,]                               TRUE
##  [2,]                               TRUE
##  [3,]                               TRUE
##  [4,]                              FALSE
##  [5,]                              FALSE
```

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

```
## [12,]                                    FALSE
## [13,]                                     TRUE
## [14,]                                     TRUE
## [15,]                                     TRUE
##       FALSE, TRUE, FALSE, classif.xgboost
##  [1,]                                TRUE
##  [2,]                               FALSE
##  [3,]                                TRUE
##  [4,]                                TRUE
##  [5,]                               FALSE
##  [6,]                               FALSE
##  [7,]                               FALSE
##  [8,]                               FALSE
##  [9,]                               FALSE
## [10,]                                TRUE
## [11,]                               FALSE
## [12,]                               FALSE
## [13,]                                TRUE
## [14,]                               FALSE
## [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,]                                     FALSE
##  [7,]                                      TRUE
##  [8,]                                      TRUE
##  [9,]                                      TRUE
## [10,]                                      TRUE
## [11,]                                      TRUE
## [12,]                                     FALSE
## [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
##                                     3.6875
## ADASYN, FALSE, FALSE, classif.randomForest
##                                     5.7625
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                     4.3000
##          FALSE, FALSE, FALSE, classif.ksvm
##                                    12.0125
##  FALSE, FALSE, FALSE, classif.randomForest
##                                     9.6125
##       FALSE, FALSE, FALSE, classif.xgboost
##                                     8.4500
##           FALSE, FALSE, TRUE, classif.ksvm
##                                    10.3250
##   FALSE, FALSE, TRUE, classif.randomForest
##                                    11.3250
##        FALSE, FALSE, TRUE, classif.xgboost
##                                    11.5625
##           FALSE, TRUE, FALSE, classif.ksvm
##                                    11.9500
##   FALSE, TRUE, FALSE, classif.randomForest
##                                     9.9000
##        FALSE, TRUE, FALSE, classif.xgboost
##                                     8.5125
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                     2.9500
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                     5.4750
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                     4.1750
```

Plotando grafico de Critical Diference

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