R Notebook

Parametros:

Measure = Accuracy
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                        :10260   ADASYN:2052   Mode :logical
##  Area under the curve            :    0   FALSE :6156   FALSE:8208
##  F1 measure                      :    0   SMOTE :2052   TRUE :2052
##  G-mean                          :    0                 NA's :0
##  Matthews correlation coefficient:    0
##
##
##  tuning_measure    holdout_measure   holdout_measure_residual
##  Min.   :0.09041   Min.   :0.01517   Min.   :0.0346
##  1st Qu.:0.96185   1st Qu.:0.95349   1st Qu.:0.3809
##  Median :0.98796   Median :0.98113   Median :0.7239
##  Mean   :0.95509   Mean   :0.94933   Mean   :0.6600
##  3rd Qu.:0.99669   3rd Qu.:0.99347   3rd Qu.:0.9428
##  Max.   :1.00000   Max.   :1.00000   Max.   :1.0000
##  NA's   :204       NA's   :204       NA's   :204
##  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   :204     (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                          0.9677996
## 2                          0.9677996
## 3                          0.9175199
## 4                          0.8872222
## 5                          0.9819241
## 6                          0.9819241
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.9683959
## 2                                  0.9683959
## 3                                  0.9340159
## 4                                  0.9050000
## 5                                         NA
## 6                                  0.9841334
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                            0.9785331                          0.9898629
## 2                            0.9785331                          0.9898629
## 3                            0.9544937                          0.9476678
## 4                            0.9177778                          0.9227778
## 5                            0.9884180                          0.9892883
## 6                            0.9884180                          0.9892883
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.9910555
## 2                                 0.9910555
```

```
## 3                                 0.9709898
## 4                                 0.9500000
## 5                                        NA
## 6                                 0.9912968
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                            0.9910555                          0.5086464
## 2                            0.9910555                          0.5086464
## 3                            0.9709898                          0.6080774
## 4                            0.9500000                          0.5938889
## 5                            0.9918993                          0.8815023
## 6                            0.9918993                          0.8815023
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.4818128
## 2                                0.4818128
## 3                                0.6160410
## 4                                0.5933333
## 5                                0.7864364
## 6                                0.7864364
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.4812165                         0.9880739
## 2                           0.4812165                         0.9880739
## 3                           0.6427759                         0.9607509
## 4                           0.6255556                         0.9338889
## 5                           0.8075919                         0.9898239
## 6                           0.8075919                         0.9898239
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                                0.9910555
## 2                                0.9910555
## 3                                0.9709898
## 4                                0.9500000
## 5                                0.9914307
## 6                                0.9914307
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                           0.9910555                         0.9666070
## 2                           0.9910555                         0.9666070
## 3                           0.9709898                         0.9124005
## 4                           0.9500000                         0.8933333
## 5                           0.9914307                         0.9822588
## 6                           0.9914307                         0.9822588
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                0.9737627
## 2                                0.9737627
## 3                                0.9379977
## 4                                0.9088889
## 5                                0.9841334
## 6                                       NA
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                           0.9779368
## 2                           0.9779368
## 3                           0.9493743
## 4                           0.9188889
## 5                           0.9894892
## 6                           0.9894892
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.5434
##  1st Qu.:0.9577
##  Median :0.9801
##  Mean   :0.9665
##  3rd Qu.:0.9908
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.5030
##  1st Qu.:0.9675
##  Median :0.9866
##  Mean   :0.9707
##  3rd Qu.:0.9959
##  Max.   :1.0000
##  NA's   :26
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.5212                        Min.   :0.9228
##  1st Qu.:0.9687                        1st Qu.:0.9655
##  Median :0.9873                        Median :0.9808
##  Mean   :0.9708                        Mean   :0.9772
##  3rd Qu.:0.9960                        3rd Qu.:0.9916
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.9333
##  1st Qu.:0.9735
##  Median :0.9897
##  Mean   :0.9836
##  3rd Qu.:0.9954
##  Max.   :1.0000
##  NA's   :6
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.9333                       Min.   :0.05952
##  1st Qu.:0.9744                       1st Qu.:0.67881
##  Median :0.9900                       Median :0.94300
##  Mean   :0.9837                       Mean   :0.81710
##  3rd Qu.:0.9954                       3rd Qu.:0.98517
##  Max.   :1.0000                       Max.   :1.00000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.3923
##  1st Qu.:0.7907
##  Median :0.9070
##  Mean   :0.8653
##  3rd Qu.:0.9680
##  Max.   :1.0000
##  NA's   :5
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.3274                      Min.   :0.9333
##  1st Qu.:0.7912                      1st Qu.:0.9646
##  Median :0.9033                      Median :0.9804
```

```
##  Mean   :0.8551                     Mean   :0.9773
##  3rd Qu.:0.9553                     3rd Qu.:0.9916
##  Max.   :1.0000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.9333
##  1st Qu.:0.9734
##  Median :0.9900
##  Mean   :0.9835
##  3rd Qu.:0.9961
##  Max.   :1.0000
##  NA's   :6
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.9380                     Min.   :0.5447
##  1st Qu.:0.9744                     1st Qu.:0.9579
##  Median :0.9898                     Median :0.9791
##  Mean   :0.9836                     Mean   :0.9672
##  3rd Qu.:0.9958                     3rd Qu.:0.9907
##  Max.   :1.0000                     Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.5333
##  1st Qu.:0.9668
##  Median :0.9878
##  Mean   :0.9714
##  3rd Qu.:0.9970
##  Max.   :1.0000
##  NA's   :18
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.5152
##  1st Qu.:0.9667
##  Median :0.9868
##  Mean   :0.9717
##  3rd Qu.:0.9971
##  Max.   :1.0000
##
```

Verificando a média de cada coluna selecionada

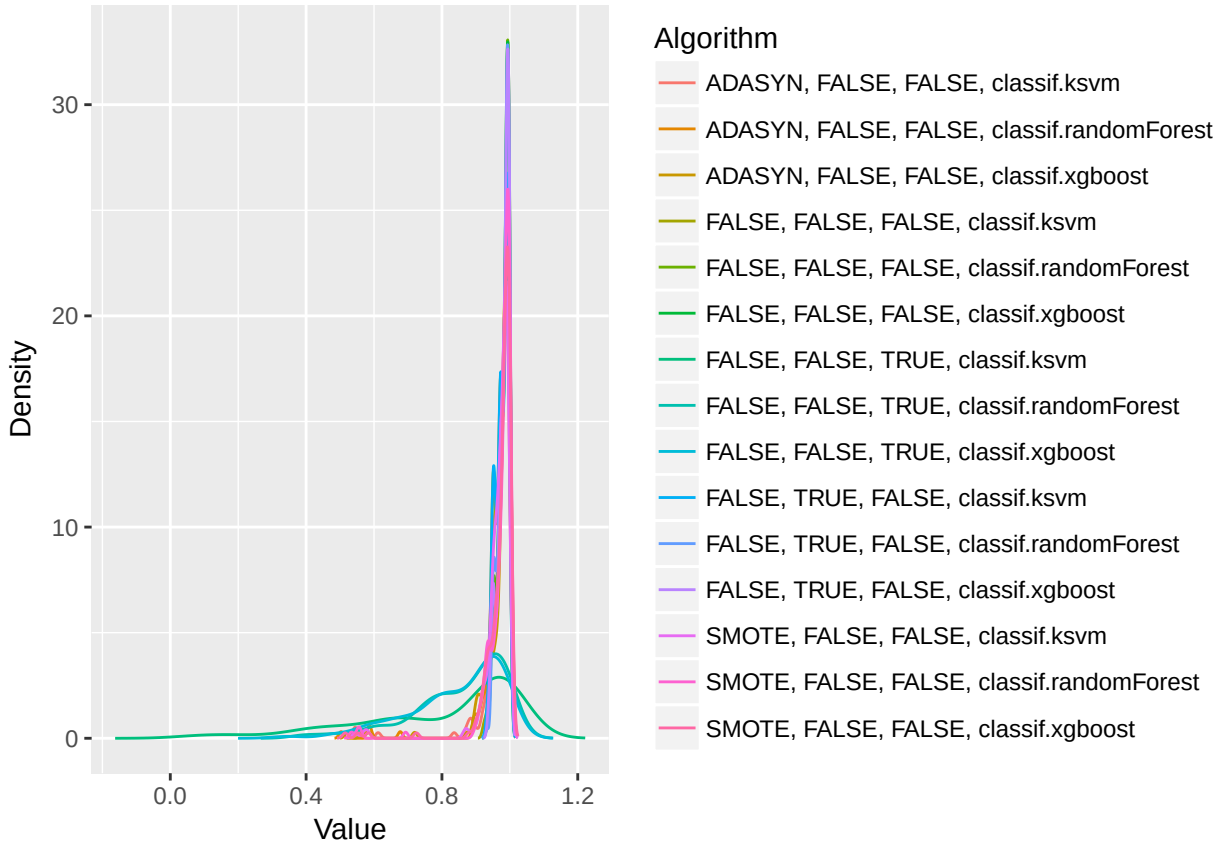
```
for(i in (1:dim(df)[2])){
  print(paste("Media da coluna ", colnames(df)[i], " = ", mean(df[,i], na.rm = TRUE), sep=""))
}
```

```
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.ksvm = 0.966484094215529"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.970664035566509"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.970789412950372"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.977243499205512"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.983614207207356"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.983670715189815"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.817099154557508"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.865321100923035"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.855110064686301"
```

```
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.9772910564921"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.983491584295252"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.983551326917539"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.967214856359944"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.971349974972477"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.971721812591086"
```

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 = 1282.7, 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,]                               TRUE
##  [5,]                               TRUE
##  [6,]                               TRUE
##  [7,]                               TRUE
##  [8,]                               TRUE
##  [9,]                               TRUE
## [10,]                               TRUE
## [11,]                               TRUE
## [12,]                               TRUE
## [13,]                              FALSE
## [14,]                               TRUE
## [15,]                               TRUE
##       ADASYN, FALSE, FALSE, classif.randomForest
##  [1,]                                       TRUE
##  [2,]                                      FALSE
##  [3,]                                      FALSE
##  [4,]                                      FALSE
##  [5,]                                       TRUE
##  [6,]                                       TRUE
##  [7,]                                       TRUE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                      FALSE
## [11,]                                       TRUE
## [12,]                                       TRUE
## [13,]                                       TRUE
## [14,]                                      FALSE
## [15,]                                      FALSE
##       ADASYN, FALSE, FALSE, classif.xgboost
##  [1,]                                  TRUE
##  [2,]                                 FALSE
##  [3,]                                 FALSE
##  [4,]                                 FALSE
##  [5,]                                  TRUE
##  [6,]                                  TRUE
##  [7,]                                  TRUE
##  [8,]                                  TRUE
##  [9,]                                  TRUE
## [10,]                                 FALSE
## [11,]                                  TRUE
## [12,]                                  TRUE
## [13,]                                  TRUE
## [14,]                                 FALSE
## [15,]                                 FALSE
```

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

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

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

Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                   9.392544
## ADASYN, FALSE, FALSE, classif.randomForest
##                                   7.625000
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                   6.791667
##          FALSE, FALSE, FALSE, classif.ksvm
##                                   7.537281
##  FALSE, FALSE, FALSE, classif.randomForest
##                                   5.269737
##       FALSE, FALSE, FALSE, classif.xgboost
##                                   4.706140
##           FALSE, FALSE, TRUE, classif.ksvm
##                                  11.839912
##   FALSE, FALSE, TRUE, classif.randomForest
##                                  12.927632
##        FALSE, FALSE, TRUE, classif.xgboost
##                                  13.333333
##           FALSE, TRUE, FALSE, classif.ksvm
##                                   7.543860
##   FALSE, TRUE, FALSE, classif.randomForest
##                                   5.247807
##        FALSE, TRUE, FALSE, classif.xgboost
##                                   4.835526
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                   9.412281
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                   7.054825
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                   6.482456
```

Plotando grafico de Critical Diference

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