R Notebook

Parametros:

Measure = Area under the curve
Columns = sampling, weight_space, underbagging, learner
Performance = holdout_measure_residual
Filter keys = imba.rate
Filter values = 0.01

```
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           :1800   FALSE :1080   FALSE:1440
##  F1 measure                     :   0   SMOTE : 360   TRUE :360
##  G-mean                         :   0                 NA's :0
##  Matthews correlation coefficient:   0
##
##
##  tuning_measure   holdout_measure  holdout_measure_residual
##  Min.   :0.3866   Min.   :0.2139   Min.   :0.3092
##  1st Qu.:0.9529   1st Qu.:0.8909   1st Qu.:0.7392
##  Median :0.9993   Median :0.9916   Median :0.9067
##  Mean   :0.9498   Mean   :0.9120   Mean   :0.8469
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:0.9842
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##  NA's   :51       NA's   :51       NA's   :51
##  iteration_count                     dataset       imba.rate
##  Min.   :1       abalone                  :  45   Min.   :0.01
##  1st Qu.:1       adult                    :  45   1st Qu.:0.01
##  Median :2       bank                     :  45   Median :0.01
##  Mean   :2       car                      :  45   Mean   :0.01
##  3rd Qu.:3       cardiotocography-10clases:  45   3rd Qu.:0.01
##  Max.   :3       cardiotocography-3clases :  45   Max.   :0.01
##  NA's   :51      (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                          0.5136216
## 2                                 NA
## 3                          0.7583631
## 4                          0.9337170
## 5                          0.9224985
## 6                          0.8857046
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.6617140
## 2                                  0.8661754
## 3                                  0.8439311
## 4                                  0.7496955
## 5                                  0.9729017
## 6                                  0.7728464
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.6206414                          0.5133720
## 2                             0.8708447                          0.4549243
## 3                             0.8147400                          0.7469161
## 4                             0.6692242                          0.8590001
## 5                             0.9755048                          0.9703766
## 6                             0.8442439                          0.8672659
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.6224639
## 2                                 0.8601656
```

```
## 3                                0.8316542
## 4                                0.7703462
## 5                                0.9830413
## 6                                0.7798361
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.6375083                         0.6259505
## 2                           0.9023521                         0.7943273
## 3                           0.8204698                         0.7440871
## 4                           0.7190811                         0.8088235
## 5                           0.9625229                         0.6252906
## 6                           0.8821091                         0.6192346
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.6705058
## 2                                0.8795716
## 3                                0.8439155
## 4                                0.8157274
## 5                                0.9665499
## 6                                0.7516526
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.6359470                         0.5137510
## 2                           0.8885925                         0.5371265
## 3                           0.8108122                         0.7469161
## 4                           0.7154199                         0.8560772
## 5                           0.9734690                         0.9703766
## 6                           0.7777879                         0.8672659
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                                0.6178971
## 2                                       NA
## 3                                0.8268784
## 4                                0.7814974
## 5                                0.9817732
## 6                                0.7700843
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                           0.6375879                         0.5167415
## 2                           0.9015632                         0.6257369
## 3                           0.8206660                         0.7616514
## 4                           0.7242875                         0.9305505
## 5                           0.9627232                         0.9551922
## 6                           0.8864817                         0.8325538
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                0.6600339
## 2                                       NA
## 3                                0.8518726
## 4                                0.6328705
## 5                                0.9740197
## 6                                0.7605478
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                           0.6217660
## 2                           0.8685851
## 3                           0.8095652
## 4                           0.6792032
## 5                           0.9779298
## 6                           0.7812734
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.4882
##  1st Qu.:0.7250
##  Median :0.8243
##  Mean   :0.8102
##  3rd Qu.:0.9394
##  Max.   :1.0000
##  NA's   :3
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.6035
##  1st Qu.:0.8480
##  Median :0.9435
##  Mean   :0.8922
##  3rd Qu.:0.9805
##  Max.   :1.0000
##  NA's   :6
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.5704                        Min.   :0.4549
##  1st Qu.:0.7888                        1st Qu.:0.7339
##  Median :0.9261                        Median :0.8486
##  Mean   :0.8619                        Mean   :0.8197
##  3rd Qu.:0.9854                        3rd Qu.:0.9742
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.4953
##  1st Qu.:0.8222
##  Median :0.9411
##  Mean   :0.8726
##  3rd Qu.:0.9808
##  Max.   :1.0000
##  NA's   :1
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.5704                       Min.   :0.5009
##  1st Qu.:0.8118                       1st Qu.:0.6258
##  Median :0.9225                       Median :0.7851
##  Mean   :0.8761                       Mean   :0.7641
##  3rd Qu.:0.9855                       3rd Qu.:0.8949
##  Max.   :1.0000                       Max.   :0.9986
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.5415
##  1st Qu.:0.7837
##  Median :0.9200
##  Mean   :0.8658
##  3rd Qu.:0.9849
##  Max.   :1.0000
##  NA's   :1
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.5153                      Min.   :0.4988
##  1st Qu.:0.7695                      1st Qu.:0.7339
##  Median :0.9026                      Median :0.8471
```

```
##  Mean   :0.8594                     Mean   :0.8207
##  3rd Qu.:0.9755                     3rd Qu.:0.9742
##  Max.   :1.0000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.5008
##  1st Qu.:0.7928
##  Median :0.9506
##  Mean   :0.8801
##  3rd Qu.:0.9932
##  Max.   :1.0000
##  NA's   :2
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.5437                     Min.   :0.4858
##  1st Qu.:0.7935                     1st Qu.:0.6569
##  Median :0.9184                     Median :0.8160
##  Mean   :0.8725                     Mean   :0.7930
##  3rd Qu.:0.9794                     3rd Qu.:0.9451
##  Max.   :1.0000                     Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.5061
##  1st Qu.:0.7645
##  Median :0.9316
##  Mean   :0.8627
##  3rd Qu.:0.9883
##  Max.   :1.0000
##  NA's   :4
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.5112
##  1st Qu.:0.7790
##  Median :0.9260
##  Mean   :0.8617
##  3rd Qu.:0.9868
##  Max.   :1.0000
##
```

Verificando a média de cada coluna selecionada

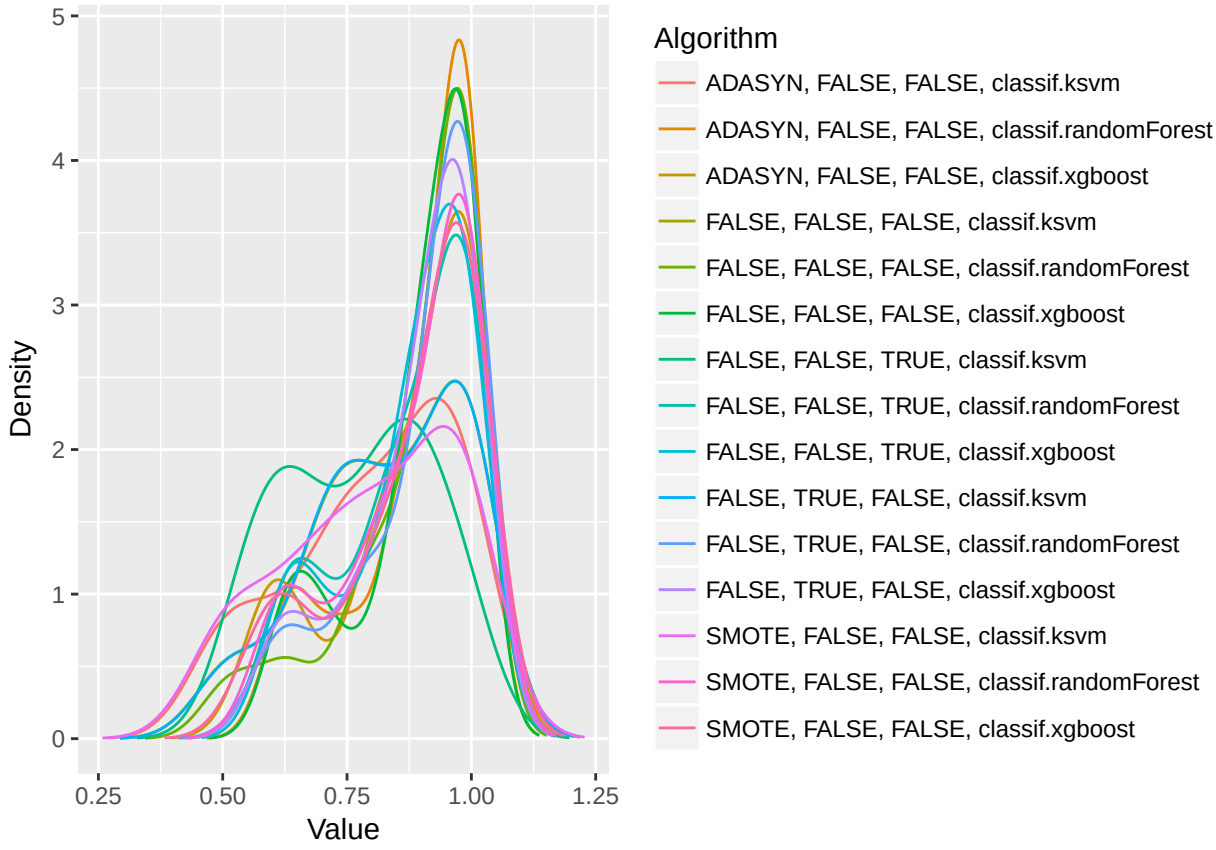
```
for(i in (1:dim(df)[2])){
  print(paste("Media da coluna ", colnames(df)[i], " = ", mean(df[,i], na.rm = TRUE), sep=""))
}
```

```
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.ksvm = 0.810192517620008"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.892226457440384"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.861931463889398"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.819684267348074"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.872551115921721"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.876095504804726"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.764052695360382"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.865787028371761"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.859448061063698"
```

```
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.820687355828643"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.880062700886546"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.872496664911349"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.792984752389399"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.862701109173019"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.861650382410199"
```

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 = 87.312, df = 14, p-value = 1.219e-12
```

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

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

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

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

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

Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                    10.2875
## ADASYN, FALSE, FALSE, classif.randomForest
##                                     7.0500
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                     7.0750
##          FALSE, FALSE, FALSE, classif.ksvm
##                                     8.9125
##  FALSE, FALSE, FALSE, classif.randomForest
##                                     6.2500
##       FALSE, FALSE, FALSE, classif.xgboost
##                                     6.4000
##           FALSE, FALSE, TRUE, classif.ksvm
##                                    12.2000
##   FALSE, FALSE, TRUE, classif.randomForest
##                                     7.5000
##        FALSE, FALSE, TRUE, classif.xgboost
##                                     8.3875
##           FALSE, TRUE, FALSE, classif.ksvm
##                                     8.9375
##   FALSE, TRUE, FALSE, classif.randomForest
##                                     5.8000
##        FALSE, TRUE, FALSE, classif.xgboost
##                                     6.7250
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                     9.9375
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                     7.3000
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                     7.2375
```

Plotando grafico de Critical Diference

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