R Notebook

Parametros:

Measure = F1 measure
Columns = sampling, weight_space, underbagging, learner
Performance = holdout_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                          0.0000000
## 2                          0.0000000
## 3                          0.0000000
## 4                          0.4333333
## 5                          0.0000000
## 6                          0.1666667
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.0000000
## 2                                         NA
## 3                                  0.0000000
## 4                                  1.0000000
## 5                                  0.4920635
## 6                                  1.0000000
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                            0.0000000                          0.00000000
## 2                            0.2353875                          0.01886792
## 3                            0.0000000                          0.00000000
## 4                            0.9523810                          0.83333333
## 5                            0.5833333                          0.57777778
## 6                            0.7746032                          0.70000000
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.0000000
## 2                                 0.4247251
```

```
## 3                                0.0000000
## 4                                1.0000000
## 5                                0.2666667
## 6                                0.9523810
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                            0.0000000                       0.02321195
## 2                            0.3636878                       0.06800533
## 3                            0.0000000                       0.04408668
## 4                            1.0000000                       1.00000000
## 5                            0.4000000                       0.00000000
## 6                            0.9047619                       0.43333333
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                              0.02668038
## 2                              0.07357207
## 3                              0.08902246
## 4                              0.63419913
## 5                              0.16893085
## 6                              0.67222222
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                          0.03142433                       0.00000000
## 2                          0.08240072                       0.01626016
## 3                          0.07465224                       0.00000000
## 4                          0.20767860                       0.83333333
## 5                          0.12934386                       0.57777778
## 6                          0.37662338                       0.70000000
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                              0.0000000
## 2                              0.3411866
## 3                              0.0000000
## 4                              1.0000000
## 5                              0.4000000
## 6                              0.9523810
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                          0.0000000                       0.00000000
## 2                          0.4037524                       0.02145474
## 3                          0.0000000                       0.00000000
## 4                          1.0000000                       0.60000000
## 5                          0.6412698                       0.13333333
## 6                          0.9047619                       0.16666667
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                              0.0000000
## 2                                     NA
## 3                              0.0000000
## 4                              1.0000000
## 5                              0.4444444
## 6                              0.9333333
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                          0.0000000
## 2                          0.2480555
## 3                          0.0000000
## 4                          1.0000000
## 5                          0.5873016
## 6                          0.8380952
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.0000
##  Mean   :0.1799
##  3rd Qu.:0.2830
##  Max.   :0.9432
##  NA's   :2
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1111
##  Median :0.5538
##  Mean   :0.5299
##  3rd Qu.:0.9333
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                        Min.   :0.0000
##  1st Qu.:0.2766                        1st Qu.:0.0000
##  Median :0.6364                        Median :0.2004
##  Mean   :0.5846                        Mean   :0.3350
##  3rd Qu.:0.9480                        3rd Qu.:0.6750
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.5778
##  Mean   :0.5086
##  3rd Qu.:0.9257
##  Max.   :1.0000
##  NA's   :2
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.00000                      Min.   :0.00000
##  1st Qu.:0.09226                      1st Qu.:0.04327
##  Median :0.56399                      Median :0.13333
##  Mean   :0.51197                      Mean   :0.31390
##  3rd Qu.:0.89771                      3rd Qu.:0.56534
##  Max.   :1.00000                      Max.   :1.00000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.02136
##  1st Qu.:0.07767
##  Median :0.18986
##  Mean   :0.31078
##  3rd Qu.:0.52095
##  Max.   :1.00000
##  NA's   :1
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.01227                     Min.   :0.0000
##  1st Qu.:0.07766                     1st Qu.:0.0000
##  Median :0.15082                     Median :0.1574
```

```
##  Mean   :0.23621                     Mean   :0.3322
##  3rd Qu.:0.28159                     3rd Qu.:0.6750
##  Max.   :1.00000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.5000
##  Mean   :0.5061
##  3rd Qu.:0.8978
##  Max.   :1.0000
##  NA's   :1
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                      Min.   :0.00000
##  1st Qu.:0.1551                      1st Qu.:0.00000
##  Median :0.6391                      Median :0.03174
##  Mean   :0.5282                      Mean   :0.21525
##  3rd Qu.:0.8744                      3rd Qu.:0.42013
##  Max.   :1.0000                      Max.   :1.00000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1667
##  Median :0.4444
##  Mean   :0.5187
##  3rd Qu.:0.9333
##  Max.   :1.0000
##  NA's   :7
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.0000
##  1st Qu.:0.2731
##  Median :0.6591
##  Mean   :0.5947
##  3rd Qu.:0.9246
##  Max.   :1.0000
##
```

Verificando a média de cada coluna selecionada

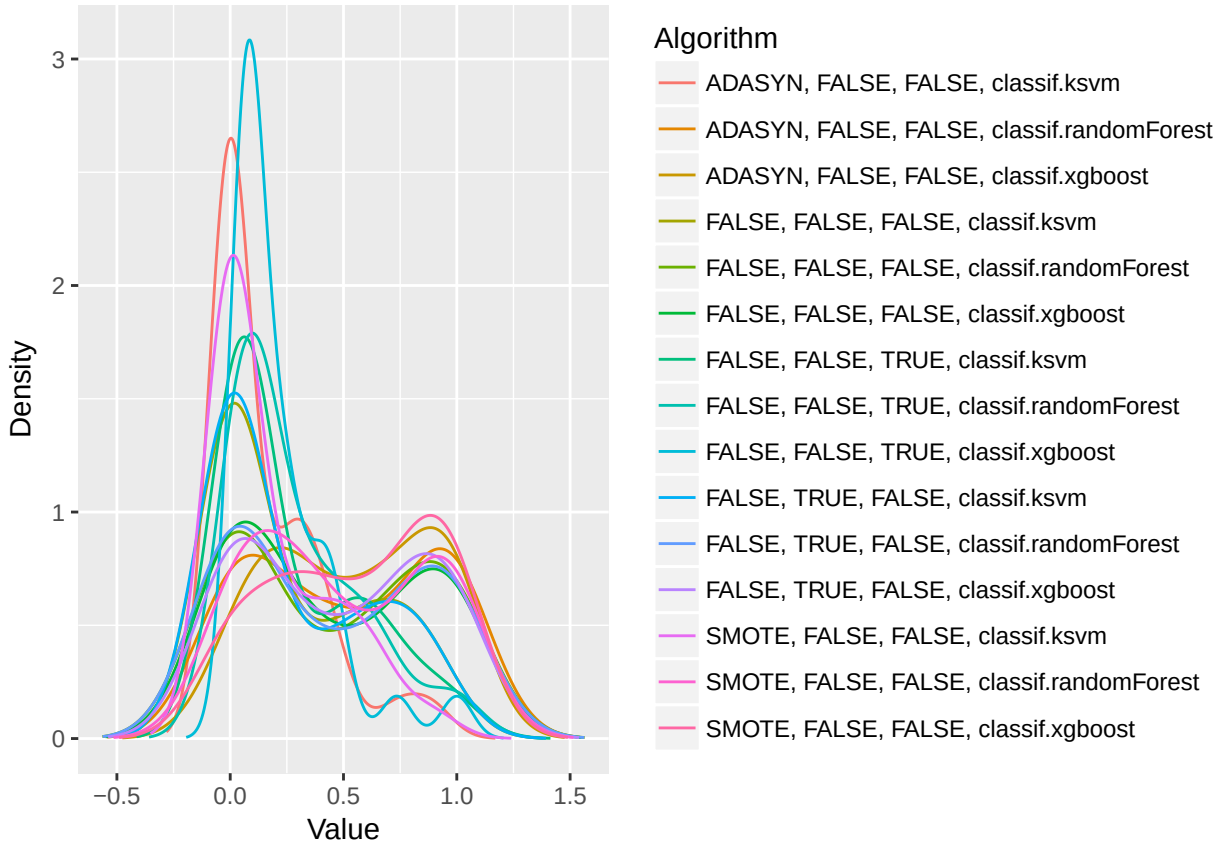
```
for(i in (1:dim(df)[2])){
  print(paste("Media da coluna ", colnames(df)[i], " = ", mean(df[,i], na.rm = TRUE), sep=""))
}
```

```
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.ksvm = 0.179897517848004"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.529900277444211"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.584604602979948"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.334954294254948"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.508625298951783"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.511965799752469"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.313895958425107"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.310779850825748"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.23621256422124"
```

```
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.332207992944352"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.50611263145112"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.528203570753324"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.215253414568032"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.518718477889089"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.594720225809504"
```

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 = 136.12, 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,]                              FALSE
##  [8,]                              FALSE
##  [9,]                              FALSE
## [10,]                              FALSE
## [11,]                               TRUE
## [12,]                               TRUE
## [13,]                              FALSE
## [14,]                               TRUE
## [15,]                               TRUE
##       ADASYN, FALSE, FALSE, classif.randomForest
##  [1,]                                       TRUE
##  [2,]                                      FALSE
##  [3,]                                      FALSE
##  [4,]                                      FALSE
##  [5,]                                      FALSE
##  [6,]                                      FALSE
##  [7,]                                      FALSE
##  [8,]                                      FALSE
##  [9,]                                      FALSE
## [10,]                                      FALSE
## [11,]                                      FALSE
## [12,]                                      FALSE
## [13,]                                       TRUE
## [14,]                                      FALSE
## [15,]                                      FALSE
##       ADASYN, FALSE, FALSE, classif.xgboost
##  [1,]                                  TRUE
##  [2,]                                 FALSE
##  [3,]                                 FALSE
##  [4,]                                  TRUE
##  [5,]                                 FALSE
##  [6,]                                 FALSE
##  [7,]                                  TRUE
##  [8,]                                  TRUE
##  [9,]                                  TRUE
## [10,]                                  TRUE
## [11,]                                 FALSE
## [12,]                                 FALSE
## [13,]                                  TRUE
## [14,]                                 FALSE
## [15,]                                 FALSE
```

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

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

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

Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                    11.4875
## ADASYN, FALSE, FALSE, classif.randomForest
##                                     7.3000
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                     4.2375
##          FALSE, FALSE, FALSE, classif.ksvm
##                                     9.8250
##  FALSE, FALSE, FALSE, classif.randomForest
##                                     7.4875
##       FALSE, FALSE, FALSE, classif.xgboost
##                                     6.5875
##           FALSE, FALSE, TRUE, classif.ksvm
##                                     8.5125
##   FALSE, FALSE, TRUE, classif.randomForest
##                                     8.8250
##        FALSE, FALSE, TRUE, classif.xgboost
##                                     9.1750
##           FALSE, TRUE, FALSE, classif.ksvm
##                                     9.8750
##   FALSE, TRUE, FALSE, classif.randomForest
##                                     7.0375
##        FALSE, TRUE, FALSE, classif.xgboost
##                                     6.1750
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                    11.5125
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                     7.5750
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                     4.3875
```

Plotando grafico de Critical Diference

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