R Notebook

Parametros:

Measure = G-mean
Columns = sampling, weight_space, underbagging, learner
Performance = holdout_measure_residual
Filter keys = imba.rate
Filter values = 0.03

```r
library("scmamp")
library(dplyr)
```

Tratamento dos dados

Carregando data set compilado

```r
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        :990   Mode :logical
##  classif.randomForest:990   FALSE:2376
##  classif.rusboost    :  0   TRUE :594
##  classif.xgboost     :990   NA's :0
##
##
##
##                              measure       sampling    underbagging
##  Accuracy                        :   0   ADASYN: 594   Mode :logical
##  Area under the curve            :   0   FALSE :1782   FALSE:2376
##  F1 measure                      :   0   SMOTE : 594   TRUE :594
##  G-mean                          :2970                 NA's :0
##  Matthews correlation coefficient:   0
##
##
##  tuning_measure   holdout_measure  holdout_measure_residual
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.6338   1st Qu.:0.2132   1st Qu.:0.1828
##  Median :0.9453   Median :0.7348   Median :0.4920
##  Mean   :0.7583   Mean   :0.6032   Mean   :0.4882
##  3rd Qu.:0.9933   3rd Qu.:0.9533   3rd Qu.:0.8073
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##  NA's   :48       NA's   :48       NA's   :48
##  iteration_count          dataset       imba.rate
##  Min.   :1       abalone      :  45   Min.   :0.03
##  1st Qu.:1       adult        :  45   1st Qu.:0.03
##  Median :2       annealing    :  45   Median :0.03
##  Mean   :2       arrhythmia   :  45   Mean   :0.03
##  3rd Qu.:3       balance-scale:  45   3rd Qu.:0.03
##  Max.   :3       bank         :  45   Max.   :0.03
##  NA's   :48      (Other)      :2700
```

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$performan

# 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] 66 15
```

```
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                         0.33453836
## 2                         0.37818667
## 3                         0.53318651
## 4                         0.00000000
## 5                         0.06267509
## 6                         0.28934649
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.3302646
## 2                                         NA
## 3                                  0.7886262
## 4                                  0.0000000
## 5                                  0.3076081
## 6                                  0.3363493
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.2179843                        0.27960010
## 2                             0.5555551                        0.37894057
## 3                             0.6343650                        0.32769371
## 4                             0.8007776                        0.00000000
## 5                             0.3182947                        0.30230195
## 6                             0.3567264                        0.06265226
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.0000000
## 2                                        NA
## 3                                 0.7250538
## 4                                 0.6666667
## 5                                 0.3334183
## 6                                 0.1867466
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.05945454                        0.6303596
## 2                           0.51668086                        0.7581606
## 3                           0.59370900                        0.7253062
## 4                           0.33169532                        0.2877302
## 5                           0.23748840                        0.3524105
## 6                           0.22763650                        0.5829965
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.6425348
## 2                                0.8169188
## 3                                0.9135006
## 4                                0.9564408
## 5                                0.4677355
## 6                                0.8023520
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.6355059                       0.25068766
## 2                           0.8203033                       0.38112845
## 3                           0.8077970                       0.32769371
## 4                           0.9650136                       0.00000000
## 5                           0.4710386                       0.30230195
## 6                           0.7854455                       0.06265226
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                               0.01631688
## 2                                       NA
## 3                               0.72628965
## 4                               0.33004918
## 5                               0.33611275
## 6                               0.18089459
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                          0.01630274                         0.3256847
## 2                          0.51604886                         0.3875660
## 3                          0.58801237                         0.4649288
## 4                          0.23570226                         0.0000000
## 5                          0.23748840                         0.2206087
## 6                          0.21826982                         0.1151854
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.3399340
## 2                                        NA
## 3                                 0.7389501
## 4                                 0.0000000
## 5                                 0.3321527
## 6                                 0.3541204
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.2325349
## 2                            0.5472862
## 3                            0.6436009
## 4                            0.2345440
## 5                            0.3182947
## 6                            0.3544623
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.00000
##  1st Qu.:0.06152
##  Median :0.23505
##  Mean   :0.29941
##  3rd Qu.:0.43582
##  Max.   :0.93658
##  NA's   :2
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2922
##  Median :0.5020
##  Mean   :0.5209
##  3rd Qu.:0.7565
##  Max.   :0.9999
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.1159                        Min.   :0.00000
##  1st Qu.:0.3359                        1st Qu.:0.02855
##  Median :0.6272                        Median :0.19604
##  Mean   :0.5949                        Mean   :0.28228
##  3rd Qu.:0.8579                        3rd Qu.:0.37211
##  Max.   :1.0000                        Max.   :0.97624
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1440
##  Median :0.4242
##  Mean   :0.4676
##  3rd Qu.:0.7622
##  Max.   :1.0000
##  NA's   :1
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.0000                       Min.   :0.09623
##  1st Qu.:0.1606                       1st Qu.:0.35911
##  Median :0.5247                       Median :0.58534
##  Mean   :0.4793                       Mean   :0.57035
##  3rd Qu.:0.7284                       3rd Qu.:0.75784
##  Max.   :1.0000                       Max.   :0.98933
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.2294
##  1st Qu.:0.6400
##  Median :0.8321
##  Mean   :0.7601
##  3rd Qu.:0.9465
##  Max.   :0.9999
##  NA's   :1
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.2111                      Min.   :0.000000
##  1st Qu.:0.5867                      1st Qu.:0.004324
##  Median :0.8141                      Median :0.193975
##  Mean   :0.7329                      Mean   :0.269673
##  3rd Qu.:0.9270                      3rd Qu.:0.364723
##  Max.   :0.9999                      Max.   :0.976240
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1506
##  Median :0.4189
##  Mean   :0.4572
##  3rd Qu.:0.7346
##  Max.   :0.9999
##  NA's   :2
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                      Min.   :0.00000
##  1st Qu.:0.1609                      1st Qu.:0.04287
##  Median :0.5392                      Median :0.20835
##  Mean   :0.4822                      Mean   :0.27166
##  3rd Qu.:0.7363                      3rd Qu.:0.40696
##  Max.   :1.0000                      Max.   :0.98106
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2714
##  Median :0.5726
##  Mean   :0.5482
##  3rd Qu.:0.8389
##  Max.   :1.0000
##  NA's   :3
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.1090
##  1st Qu.:0.3197
##  Median :0.5890
##  Mean   :0.5895
##  3rd Qu.:0.8641
##  Max.   :1.0000
##
```

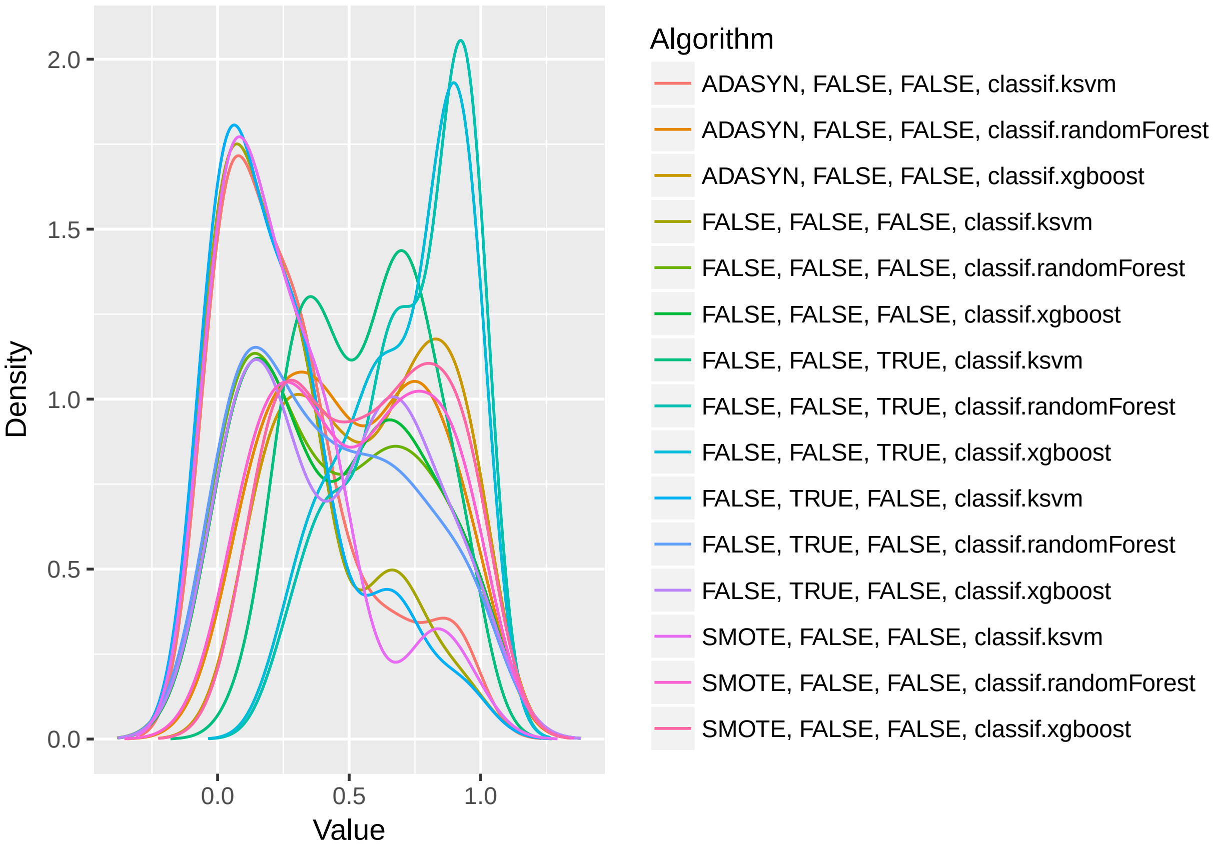
Verificando a média de cada coluna selecionada

```r
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 = 0.299411504550748"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.520934760616434"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.594929504937969"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.282279187238992"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.467572106238412"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.47925141449756"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.570345699459489"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.76014513516345"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.732852110282045"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.269672553427394"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.457188650737349"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.482208738315524"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.271661823893925"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.5482213375776"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.589463437013953"
```

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 = 475.94, df = 14, p-value < 2.2e-16
```

Testando as diferencas par a par

```
test <- nemenyiTest (df, alpha=0.05)
abs(test$diff.matrix) > test$statistic
```

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

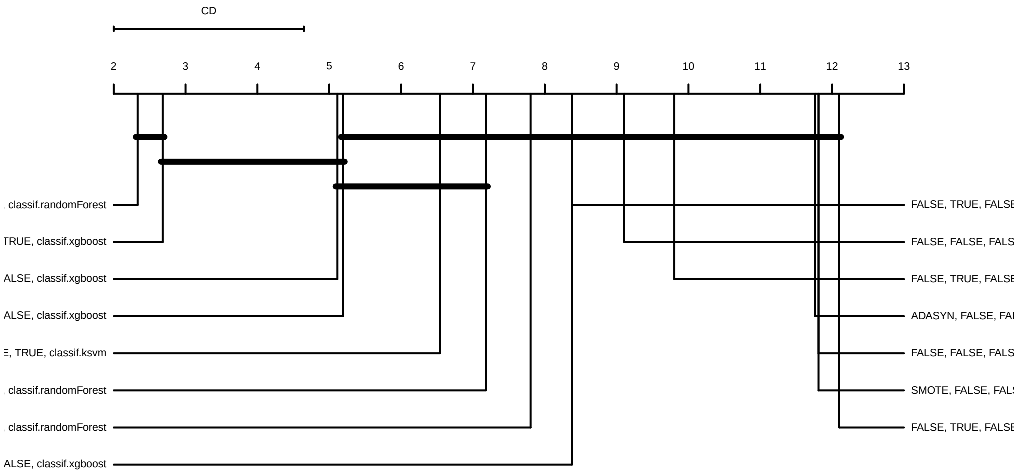
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                  11.765152
## ADASYN, FALSE, FALSE, classif.randomForest
##                                   7.803030
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                   5.189394
##          FALSE, FALSE, FALSE, classif.ksvm
##                                  11.810606
##  FALSE, FALSE, FALSE, classif.randomForest
##                                   9.106061
##       FALSE, FALSE, FALSE, classif.xgboost
##                                   8.378788
##           FALSE, FALSE, TRUE, classif.ksvm
##                                   6.545455
##   FALSE, FALSE, TRUE, classif.randomForest
##                                   2.333333
##        FALSE, FALSE, TRUE, classif.xgboost
##                                   2.681818
##           FALSE, TRUE, FALSE, classif.ksvm
##                                  12.098485
##   FALSE, TRUE, FALSE, classif.randomForest
##                                   9.803030
##        FALSE, TRUE, FALSE, classif.xgboost
##                                   8.378788
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                  11.810606
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                   7.181818
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                   5.113636
```

Plotando grafico de Critical Diference

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


CD
, classif.randomForest
TRUE, classif.xgboost
ALSE, classif.xgboost
ALSE, classif.xgboost
E, TRUE, classif.ksvm
, classif.randomForest
, classif.randomForest
ALSE, classif.xgboost
FALSE, TRUE, FALSE
FALSE, FALSE, FALS
FALSE, TRUE, FALSE
ADASYN, FALSE, FAI
FALSE, FALSE, FALS
SMOTE, FALSE, FALS
FALSE, TRUE, FALSE