R Notebook

Parametros:

Measure = G-mean
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           :   0   FALSE :1080   FALSE:1440
##  F1 measure                     :   0   SMOTE : 360   TRUE :360
##  G-mean                         :1800                 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.:0.5895   1st Qu.:0.0000   1st Qu.:0.1104
##  Median :0.9629   Median :0.7066   Median :0.4187
##  Mean   :0.7515   Mean   :0.5605   Mean   :0.4386
##  3rd Qu.:0.9987   3rd Qu.:0.9645   3rd Qu.:0.7566
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##  NA's   :54       NA's   :54       NA's   :54
##  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   :54      (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$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] 40 15
```

```
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                         0.22988211
## 2                         0.20871555
## 3                         0.04517624
## 4                         0.10753762
## 5                         0.00000000
## 6                         0.09607398
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                 0.19704165
## 2                                         NA
## 3                                 0.08908051
## 4                                 0.30699147
## 5                                 0.17124090
## 6                                 0.47459064
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.1383185                         0.1284832
## 2                             0.4670462                         0.1892378
## 3                             0.2070537                         0.0000000
## 4                             0.3257022                         0.2694472
## 5                             0.4798531                         0.2507360
## 6                             0.5279607                         0.2088070
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                               0.009245003
## 2                                        NA
## 3                               0.000000000
## 4                               0.298676556
## 5                               0.265335457
## 6                               0.507000254
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.02231941                        0.5605192
## 2                           0.45120516                        0.6578023
## 3                           0.05824090                        0.6206804
## 4                           0.29363398                        0.7831986
## 5                           0.27712854                        0.6066726
## 6                           0.52654819                        0.4125283
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.5870339
## 2                                0.8082926
## 3                                0.7686628
## 4                                0.5265897
## 5                                0.9328799
## 6                                0.6820493
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.5874821                        0.1254198
## 2                           0.8136582                        0.1993466
## 3                           0.7545546                        0.0000000
## 4                           0.4857751                        0.2694472
## 5                           0.9287021                        0.2507360
## 6                           0.6580252                        0.2088070
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                              0.009245003
## 2                                       NA
## 3                              0.000000000
## 4                              0.296147782
## 5                              0.347787849
## 6                              0.502929386
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                         0.009245003                        0.22399174
## 2                         0.454617465                        0.21728496
## 3                         0.056224991                        0.05765257
## 4                         0.277358258                        0.17055729
## 5                         0.271242380                        0.04134491
## 6                         0.524550397                        0.08997243
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.1956080
## 2                                        NA
## 3                                 0.1334077
## 4                                 0.2961425
## 5                                 0.1410706
## 6                                 0.4673651
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.1399832
## 2                            0.4490729
## 3                            0.1968368
## 4                            0.2735386
## 5                            0.4329210
## 6                            0.5413780
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.00000
##  1st Qu.:0.00000
##  Median :0.07322
##  Mean   :0.19518
##  3rd Qu.:0.27125
##  Max.   :0.90232
##  NA's   :2
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1926
##  Median :0.4462
##  Mean   :0.4730
##  3rd Qu.:0.7420
##  Max.   :0.9999
##  NA's   :6
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.08138                       Min.   :0.0000
##  1st Qu.:0.28060                       1st Qu.:0.0000
##  Median :0.54412                       Median :0.1947
##  Mean   :0.54351                       Mean   :0.2570
##  3rd Qu.:0.78987                       3rd Qu.:0.3317
##  Max.   :0.99993                       Max.   :0.8910
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1032
##  Median :0.2987
##  Mean   :0.3786
##  3rd Qu.:0.5873
##  Max.   :0.9999
##  NA's   :1
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.0000                       Min.   :0.03782
##  1st Qu.:0.1438                       1st Qu.:0.47417
##  Median :0.3688                       Median :0.61368
##  Mean   :0.4181                       Mean   :0.59366
##  3rd Qu.:0.6290                       3rd Qu.:0.78184
##  Max.   :0.9999                       Max.   :0.93922
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.1064
##  1st Qu.:0.6573
##  Median :0.8129
##  Mean   :0.7512
##  3rd Qu.:0.9397
##  Max.   :0.9999
##
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.1499                      Min.   :0.0000
##  1st Qu.:0.6159                      1st Qu.:0.0000
##  Median :0.8175                      Median :0.1832
##  Mean   :0.7600                     Mean   :0.2517  
##  3rd Qu.:0.9319                     3rd Qu.:0.3317  
##  Max.   :0.9999                     Max.   :0.8910  
##                                                     
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000                         
##  1st Qu.:0.1014                         
##  Median :0.2935                         
##  Mean   :0.3567                         
##  3rd Qu.:0.5641                         
##  Max.   :0.9999                         
##  NA's   :2                              
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                     Min.   :0.00000                  
##  1st Qu.:0.1429                     1st Qu.:0.01074                  
##  Median :0.3658                     Median :0.12383                  
##  Mean   :0.4201                     Mean   :0.20003                  
##  3rd Qu.:0.6168                     3rd Qu.:0.26149                  
##  Max.   :0.9999                     Max.   :0.90233                  
##                                                                      
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000                          
##  1st Qu.:0.1411                          
##  Median :0.3339                          
##  Mean   :0.4316                          
##  3rd Qu.:0.6907                          
##  Max.   :1.0000                          
##  NA's   :7                               
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.0000                     
##  1st Qu.:0.2602                     
##  Median :0.5707                     
##  Mean   :0.5350                     
##  3rd Qu.:0.8230                     
##  Max.   :0.9999                     
## 
```

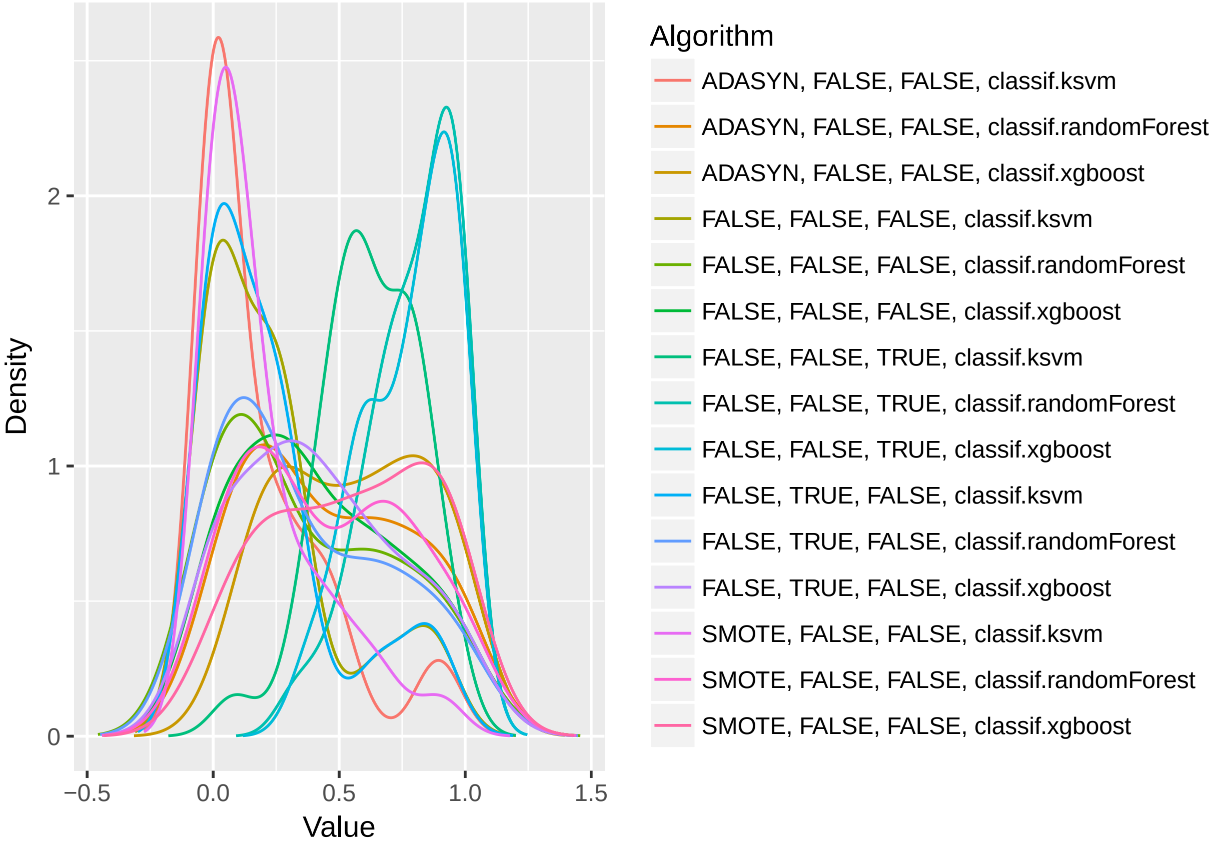
Verificando a média de cada coluna selecionada

```
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 = 0.19518305573556"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.472987865544968"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.543509498678387"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.256956550225041"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.378611154318336"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.418074011113785"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.593658779887989"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.751229302608325"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.759991987108657"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.251657162506451"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.356723766549773"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.420051794322392"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.200029031857121"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.431554535255285"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.535042975739401"
```

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 = 305.69, 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,]                              FALSE
##  [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,]                                      FALSE
##  [5,]                                      FALSE
##  [6,]                                      FALSE
##  [7,]                                      FALSE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [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,]                                  TRUE
##  [6,]                                 FALSE
##  [7,]                                 FALSE
##  [8,]                                 FALSE
##  [9,]                                 FALSE
## [10,]                                  TRUE
## [11,]                                  TRUE
## [12,]                                 FALSE
## [13,]                                  TRUE
## [14,]                                  TRUE
## [15,]                                 FALSE
##       FALSE, FALSE, FALSE, classif.ksvm
##  [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, FALSE, FALSE, classif.randomForest
##  [1,]                                     FALSE
##  [2,]                                     FALSE
##  [3,]                                      TRUE
##  [4,]                                     FALSE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                     FALSE
##  [8,]                                      TRUE
##  [9,]                                      TRUE
## [10,]                                     FALSE
## [11,]                                     FALSE
## [12,]                                     FALSE
## [13,]                                     FALSE
## [14,]                                     FALSE
## [15,]                                      TRUE
##       FALSE, FALSE, FALSE, classif.xgboost
##  [1,]                                 TRUE
##  [2,]                                FALSE
##  [3,]                                FALSE
##  [4,]                                FALSE
##  [5,]                                FALSE
##  [6,]                                FALSE
##  [7,]                                FALSE
##  [8,]                                 TRUE
##  [9,]                                 TRUE
## [10,]                                FALSE
## [11,]                                FALSE
## [12,]                                FALSE
## [13,]                                 TRUE
## [14,]                                FALSE
## [15,]                                FALSE
##       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,]                                    FALSE
##  [4,]                                     TRUE
##  [5,]                                     TRUE
##  [6,]                                     TRUE
##  [7,]                                     TRUE
##  [8,]                                    FALSE
##  [9,]                                    FALSE
## [10,]                                     TRUE
## [11,]                                     TRUE
## [12,]                                     TRUE
## [13,]                                     TRUE
## [14,]                                     TRUE
## [15,]                                    FALSE
##       FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  [1,]                                TRUE                            FALSE
##  [2,]                                TRUE                            FALSE
##  [3,]                               FALSE                             TRUE
##  [4,]                                TRUE                            FALSE
##  [5,]                                TRUE                            FALSE
##  [6,]                                TRUE                            FALSE
##  [7,]                                TRUE                             TRUE
##  [8,]                               FALSE                             TRUE
##  [9,]                               FALSE                             TRUE
## [10,]                                TRUE                            FALSE
## [11,]                                TRUE                            FALSE
## [12,]                                TRUE                            FALSE
## [13,]                                TRUE                            FALSE
## [14,]                                TRUE                            FALSE
## [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,]                               FALSE
##  [4,]                               FALSE
##  [5,]                               FALSE
##  [6,]                               FALSE
##  [7,]                               FALSE
##  [8,]                                TRUE
##  [9,]                                TRUE
## [10,]                               FALSE
## [11,]                               FALSE
## [12,]                               FALSE
## [13,]                                TRUE
## [14,]                               FALSE
## [15,]                               FALSE
##       SMOTE, FALSE, FALSE, classif.ksvm
##  [1,]                             FALSE
##  [2,]                              TRUE
##  [3,]                              TRUE
##  [4,]                             FALSE
##  [5,]                             FALSE
##  [6,]                              TRUE
##  [7,]                              TRUE
##  [8,]                              TRUE
##  [9,]                              TRUE
## [10,]                             FALSE
## [11,]                             FALSE
## [12,]                              TRUE
## [13,]                             FALSE
## [14,]                             FALSE
## [15,]                              TRUE
##       SMOTE, FALSE, FALSE, classif.randomForest
##  [1,]                                      TRUE
##  [2,]                                     FALSE
##  [3,]                                      TRUE
##  [4,]                                     FALSE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                     FALSE
##  [8,]                                      TRUE
##  [9,]                                      TRUE
## [10,]                                     FALSE
## [11,]                                     FALSE
## [12,]                                     FALSE
## [13,]                                     FALSE
## [14,]                                     FALSE
## [15,]                                      TRUE
##       SMOTE, FALSE, FALSE, classif.xgboost
##  [1,]                                 TRUE
##  [2,]                                FALSE
##  [3,]                                FALSE
##  [4,]                                 TRUE
##  [5,]                                 TRUE
##  [6,]                                FALSE
##  [7,]                                FALSE
##  [8,]                                FALSE
##  [9,]                                FALSE
## [10,]                                 TRUE
## [11,]                                 TRUE
## [12,]                                FALSE
## [13,]                                 TRUE
## [14,]                                 TRUE
## [15,]                                FALSE
```

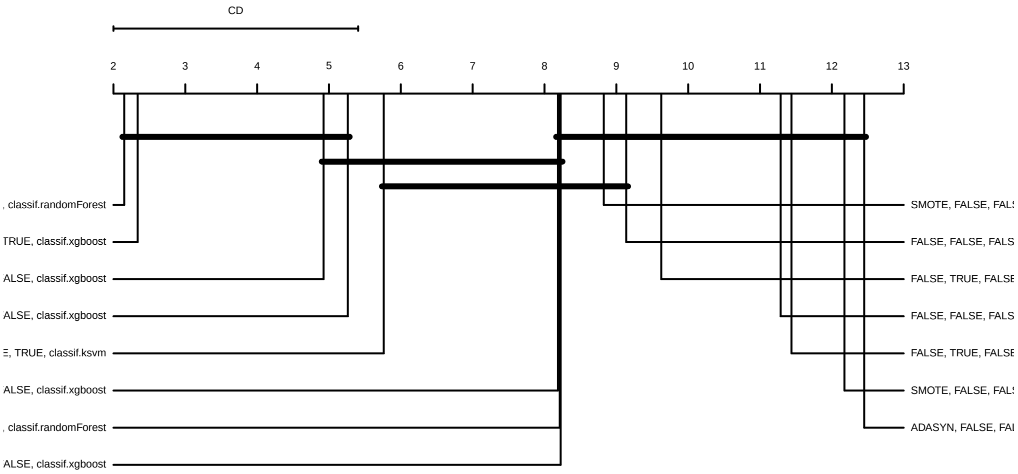
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                    12.4500
## ADASYN, FALSE, FALSE, classif.randomForest
##                                     8.2125
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                     4.9250
##          FALSE, FALSE, FALSE, classif.ksvm
##                                    11.2875
##  FALSE, FALSE, FALSE, classif.randomForest
##                                     9.1375
##       FALSE, FALSE, FALSE, classif.xgboost
##                                     8.1875
##           FALSE, FALSE, TRUE, classif.ksvm
##                                     5.7625
##   FALSE, FALSE, TRUE, classif.randomForest
##                                     2.1500
##        FALSE, FALSE, TRUE, classif.xgboost
##                                     2.3375
##           FALSE, TRUE, FALSE, classif.ksvm
##                                    11.4375
##   FALSE, TRUE, FALSE, classif.randomForest
##                                     9.6250
##        FALSE, TRUE, FALSE, classif.xgboost
##                                     8.2250
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                    12.1750
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                     8.8250
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                     5.2625
```

Plotando grafico de Critical Diference

```r
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
ALSE, classif.xgboost
, classif.randomForest
ALSE, classif.xgboost
SMOTE, FALSE, FALS
FALSE, FALSE, FALS
FALSE, TRUE, FALSE
FALSE, FALSE, FALS
FALSE, TRUE, FALSE
SMOTE, FALSE, FALS
ADASYN, FALSE, FAI