R Notebook

Parametros:

Measure = Matthews correlation coefficient
Columns = sampling, weight_space, underbagging, learner
Performance = holdout_measure
Filter keys = NULL
Filter values = NULL

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

Tratamento dos dados

Carregando data set compilado

```
ds = read.csv("/home/rodrigo/Dropbox/UNICAMP/IC/estudo_cost_learning/SummaryResults/summary_compilation_

ds = filter(ds, learner != "classif.rusboost")
summary(ds)
```

```
##                learner      weight_space
##  classif.ksvm        :17100   Mode :logical
##  classif.randomForest:17100   FALSE:41040
##  classif.rusboost    :    0   TRUE :10260
##  classif.xgboost     :17100   NA's :0
##
##
##
##                             measure        sampling     underbagging
##  Accuracy                       :10260   ADASYN:10260   Mode :logical
##  Area under the curve           :10260   FALSE :30780   FALSE:41040
##  F1 measure                     :10260   SMOTE :10260   TRUE :10260
##  G-mean                         :10260                  NA's :0
##  Matthews correlation coefficient:10260
##
##
##  tuning_measure    holdout_measure   holdout_measure_residual
##  Min.   :-0.1277   Min.   :-0.2120   Min.   :-0.4658
##  1st Qu.: 0.6911   1st Qu.: 0.4001   1st Qu.: 0.1994
##  Median : 0.9700   Median : 0.8571   Median : 0.5581
##  Mean   : 0.7903   Mean   : 0.6718   Mean   : 0.5298
##  3rd Qu.: 0.9975   3rd Qu.: 0.9900   3rd Qu.: 0.8755
##  Max.   : 1.0000   Max.   : 1.0000   Max.   : 1.0000
##  NA's   :1077      NA's   :1077      NA's   :1077
##  iteration_count                        dataset        imba.rate
##  Min.   :1       abalone                    :  900   Min.   :0.0010
##  1st Qu.:1       adult                      :  900   1st Qu.:0.0100
##  Median :2       bank                       :  900   Median :0.0300
##  Mean   :2       car                        :  900   Mean   :0.0286
##  3rd Qu.:3       cardiotocography-10clases:  900   3rd Qu.:0.0500
##  Max.   :3       cardiotocography-3clases :  900   Max.   :0.0500
##  NA's   :1077    (Other)                  :45900
```

Filtrando pela metrica

```r
ds = filter(ds, measure == params$measure)
```

Filtrando o data set

```r
if(params$filter_keys != 'NULL' && !is.null(params$filter_keys)){
  dots = paste0(params$filter_keys," == '",params$filter_values,"'")
  ds = filter_(ds, .dots = dots)
}

summary(ds)
```

```
##                   learner     weight_space
##  classif.ksvm        :3420   Mode :logical
##  classif.randomForest:3420   FALSE:8208
##  classif.rusboost    :   0   TRUE :2052
##  classif.xgboost     :3420   NA's :0
##
##
##
##                             measure        sampling    underbagging
##  Accuracy                       :    0   ADASYN:2052   Mode :logical
##  Area under the curve           :    0   FALSE :6156   FALSE:8208
##  F1 measure                     :    0   SMOTE :2052   TRUE :2052
##  G-mean                         :    0                 NA's :0
##  Matthews correlation coefficient:10260
##
##
##  tuning_measure    holdout_measure   holdout_measure_residual
##  Min.   :-0.1277   Min.   :-0.2120   Min.   :-0.46576
##  1st Qu.: 0.3307   1st Qu.: 0.0000   1st Qu.: 0.03886
##  Median : 0.8174   Median : 0.4907   Median : 0.21377
##  Mean   : 0.6548   Mean   : 0.4657   Mean   : 0.30966
##  3rd Qu.: 0.9890   3rd Qu.: 0.8152   3rd Qu.: 0.53139
##  Max.   : 1.0000   Max.   : 1.0000   Max.   : 1.00000
##  NA's   :225       NA's   :225       NA's   :225
##  iteration_count                        dataset       imba.rate
##  Min.   :1       abalone                  : 180   Min.   :0.0010
##  1st Qu.:1       adult                    : 180   1st Qu.:0.0100
##  Median :2       bank                     : 180   Median :0.0300
##  Mean   :2       car                      : 180   Mean   :0.0286
##  3rd Qu.:3       cardiotocography-10clases: 180   3rd Qu.:0.0500
##  Max.   :3       cardiotocography-3clases : 180   Max.   :0.0500
##  NA's   :225     (Other)                  :9180
```

Computando as médias das iteracoes

```r
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

```r
# Dividindo o ds em n, um para cada técnica
splited_df = ds %>% group_by_at(.vars = params$columns) %>% do(vals = as.data.frame(.)) %>% select(vals

# Juntando cada uma das partes horizontalmente em um data set
df_tec_wide = do.call("cbind", splited_df)

# Renomeando duplicacao de nomes
colnames(df_tec_wide) = make.unique(colnames(df_tec_wide))

# Selecionando apenas as medidas da performance escolhida
df_tec_wide_residual = select(df_tec_wide, matches(paste("^", params$performance, "$|", params$performa

# Renomeando colunas
new_names = NULL
for(i in (1:length(splited_df))){
  id = toString(sapply(splited_df[[i]][1, params$columns], as.character))
  new_names = c(new_names, id)
}
colnames(df_tec_wide_residual) = new_names

# Verificando a dimensao do df
dim(df_tec_wide_residual)
```

```
## [1] 228  15
```

```r
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                      -0.0144995162
## 2                      -0.0144995162
## 3                       0.0004984056
## 4                       0.0591905572
## 5                      -0.0090811368
## 6                      -0.0090811368
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                               -0.014400108
## 2                               -0.014400108
## 3                               -0.003266437
## 4                                0.061760519
## 5                                0.082634119
## 6                                0.075351145
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                           -0.01055500                    -0.002681154
## 2                           -0.01055500                    -0.002681154
## 3                            0.03051619                    -0.007549758
## 4                            0.04406711                     0.103707362
## 5                            0.24298950                     0.011520780
## 6                            0.24298950                     0.011520780
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.0000000
## 2                                 0.0000000
## 3                                0.0000000
## 4                                0.0000000
## 5                                0.3603999
## 6                                       NA
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                          0.000000000                       0.03648651
## 2                          0.000000000                       0.03648651
## 3                         -0.003371752                       0.08179207
## 4                          0.055778009                       0.12220615
## 5                          0.449276758                       0.11251890
## 6                          0.449276758                       0.11251890
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                               0.05301455
## 2                               0.05301455
## 3                               0.08784083
## 4                               0.13468493
## 5                               0.14841422
## 6                               0.14841422
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                          0.07848644                     -0.004028968
## 2                          0.07848644                     -0.004028968
## 3                          0.13692293                      0.023040142
## 4                          0.14541727                      0.075853035
## 5                          0.16753202                      0.009851304
## 6                          0.16753202                      0.009851304
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                                        0
## 2                                        0
## 3                                        0
## 4                                        0
## 5                                       NA
## 6                                       NA
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                         0.000000000                       -0.01502422
## 2                         0.000000000                       -0.01502422
## 3                        -0.007158714                        0.01880716
## 4                        -0.015555676                        0.09021363
## 5                         0.369946759                        0.01260881
## 6                         0.369946759                        0.01260881
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                               -0.01255696
## 2                               -0.01255696
## 3                                0.02384633
## 4                                0.07211080
## 5                                        NA
## 6                                0.11233773
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                          -0.01079014
## 2                          -0.01079014
## 3                           0.02496716
## 4                           0.11731966
## 5                           0.26695234
## 6                           0.26695234
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :-0.06657
##  1st Qu.: 0.00000
##  Median : 0.16917
##  Mean   : 0.27983
##  3rd Qu.: 0.48522
##  Max.   : 1.00000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :-0.05198
##  1st Qu.: 0.23129
##  Median : 0.60454
##  Mean   : 0.55423
##  3rd Qu.: 0.89244
##  Max.   : 1.00000
##  NA's   :25
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :-0.06053                      Min.   :-0.04044
##  1st Qu.: 0.32126                      1st Qu.: 0.00000
##  Median : 0.69693                      Median : 0.19993
##  Mean   : 0.60211                      Mean   : 0.32962
##  3rd Qu.: 0.91772                      3rd Qu.: 0.63626
##  Max.   : 1.00000                      Max.   : 1.00000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :-0.02449
##  1st Qu.: 0.08717
##  Median : 0.64741
##  Mean   : 0.53999
##  3rd Qu.: 0.87917
##  Max.   : 1.00000
##  NA's   :6
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :-0.03192                     Min.   :-0.0266
##  1st Qu.: 0.18970                     1st Qu.: 0.1289
##  Median : 0.66518                     Median : 0.3341
##  Mean   : 0.56276                     Mean   : 0.3896
##  3rd Qu.: 0.88876                     3rd Qu.: 0.6294
##  Max.   : 1.00000                     Max.   : 1.0000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :-0.06927
##  1st Qu.: 0.20180
##  Median : 0.40785
##  Mean   : 0.44846
##  3rd Qu.: 0.66970
##  Max.   : 1.00000
##  NA's   :6
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :-0.06218                    Min.   :-0.03836
##  1st Qu.: 0.21955                    1st Qu.: 0.00000
##  Median : 0.37522                    Median : 0.19061
##  Mean   : 0.42007                      Mean   : 0.31993
##  3rd Qu.: 0.59865                      3rd Qu.: 0.63475
##  Max.   : 1.00000                      Max.   : 1.00000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :-0.02177
##  1st Qu.: 0.12704
##  Median : 0.62299
##  Mean   : 0.54024
##  3rd Qu.: 0.89006
##  Max.   : 1.00000
##  NA's   :11
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :-0.01983                    Min.   :-0.05605
##  1st Qu.: 0.19181                    1st Qu.: 0.00000
##  Median : 0.66660                    Median : 0.17796
##  Mean   : 0.55830                    Mean   : 0.28889
##  3rd Qu.: 0.88419                    3rd Qu.: 0.55644
##  Max.   : 1.00000                    Max.   : 1.00000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :-0.0748
##  1st Qu.: 0.1891
##  Median : 0.6299
##  Mean   : 0.5582
##  3rd Qu.: 0.9360
##  Max.   : 1.0000
##  NA's   :20
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :-0.03402
##  1st Qu.: 0.31873
##  Median : 0.70793
##  Mean   : 0.61125
##  3rd Qu.: 0.92233
##  Max.   : 1.00000
##
```

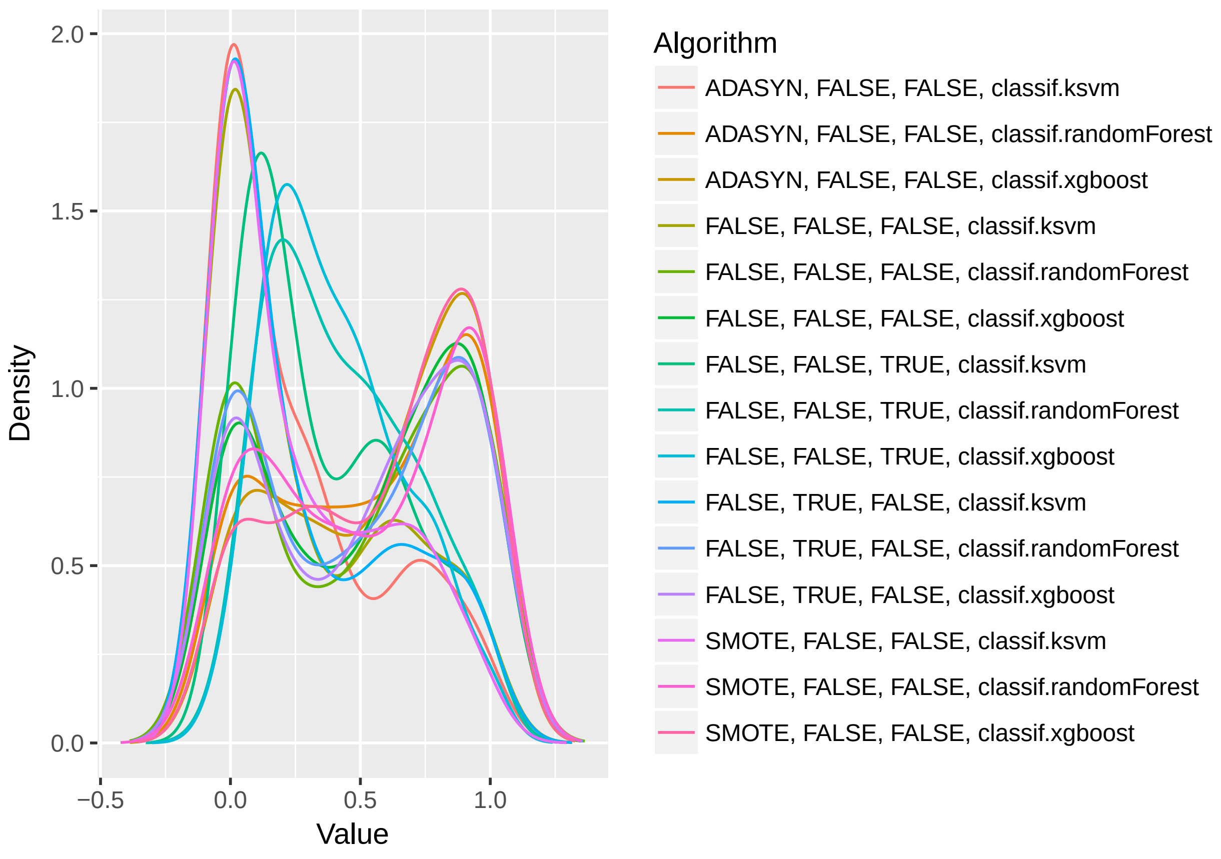
Verificando a média de cada coluna selecionada

```
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 = 0.279829884673111"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.554228194573526"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.602108220680284"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.329621774060411"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.539987503010754"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.562761901495153"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.389559127733891"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.448457719824821"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.420065766646077"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.319931271475548"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.540235884982955"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.55829817503019"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.288890409106331"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.558193276234751"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.611248577729462"
```

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 = 705.58, 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,]                               TRUE
## [12,]                               TRUE
## [13,]                              FALSE
## [14,]                               TRUE
## [15,]                               TRUE
##       ADASYN, FALSE, FALSE, classif.randomForest
##  [1,]                                       TRUE
##  [2,]                                      FALSE
##  [3,]                                       TRUE
##  [4,]                                       TRUE
##  [5,]                                      FALSE
##  [6,]                                      FALSE
##  [7,]                                       TRUE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                       TRUE
## [11,]                                      FALSE
## [12,]                                      FALSE
## [13,]                                       TRUE
## [14,]                                      FALSE
## [15,]                                       TRUE
##       ADASYN, FALSE, FALSE, classif.xgboost
##  [1,]                                  TRUE
##  [2,]                                  TRUE
##  [3,]                                 FALSE
##  [4,]                                  TRUE
##  [5,]                                  TRUE
##  [6,]                                 FALSE
##  [7,]                                  TRUE
##  [8,]                                  TRUE
##  [9,]                                  TRUE
## [10,]                                  TRUE
## [11,]                                  TRUE
## [12,]                                 FALSE
## [13,]                                  TRUE
## [14,]                                  TRUE
## [15,]                                 FALSE
##       FALSE, FALSE, FALSE, 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, FALSE, classif.randomForest
##  [1,]                                      TRUE
##  [2,]                                     FALSE
##  [3,]                                      TRUE
##  [4,]                                      TRUE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                      TRUE
##  [8,]                                     FALSE
##  [9,]                                      TRUE
## [10,]                                      TRUE
## [11,]                                     FALSE
## [12,]                                     FALSE
## [13,]                                      TRUE
## [14,]                                     FALSE
## [15,]                                      TRUE
##       FALSE, 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, TRUE, classif.ksvm
##  [1,]                             TRUE
##  [2,]                             TRUE
##  [3,]                             TRUE
##  [4,]                            FALSE
##  [5,]                             TRUE
##  [6,]                             TRUE
##  [7,]                            FALSE
##  [8,]                            FALSE
##  [9,]                            FALSE
## [10,]                            FALSE
## [11,]                             TRUE
## [12,]                             TRUE
## [13,]                             TRUE
## [14,]                             TRUE
## [15,]                             TRUE
##       FALSE, FALSE, TRUE, classif.randomForest
##  [1,]                                     TRUE
##  [2,]                                     TRUE
##  [3,]                                     TRUE
##  [4,]                                     TRUE
##  [5,]                                    FALSE
##  [6,]                                     TRUE
##  [7,]                                    FALSE
##  [8,]                                    FALSE
##  [9,]                                    FALSE
## [10,]                                     TRUE
## [11,]                                    FALSE
## [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,]                                TRUE                              TRUE
##  [4,]                                TRUE                             FALSE
##  [5,]                                TRUE                              TRUE
##  [6,]                                TRUE                              TRUE
##  [7,]                               FALSE                             FALSE
##  [8,]                               FALSE                              TRUE
##  [9,]                               FALSE                              TRUE
## [10,]                                TRUE                             FALSE
## [11,]                                TRUE                              TRUE
## [12,]                                TRUE                              TRUE
## [13,]                                TRUE                             FALSE
## [14,]                                TRUE                              TRUE
## [15,]                                TRUE                              TRUE
##       FALSE, TRUE, FALSE, classif.randomForest
##  [1,]                                     TRUE
##  [2,]                                    FALSE
##  [3,]                                     TRUE
##  [4,]                                     TRUE
##  [5,]                                    FALSE
##  [6,]                                    FALSE
##  [7,]                                     TRUE
##  [8,]                                    FALSE
##  [9,]                                     TRUE
## [10,]                                     TRUE
## [11,]                                    FALSE
## [12,]                                    FALSE
## [13,]                                     TRUE
## [14,]                                    FALSE
## [15,]                                     TRUE
##       FALSE, TRUE, 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
##       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,]                              TRUE
## [12,]                              TRUE
## [13,]                             FALSE
## [14,]                              TRUE
## [15,]                              TRUE
##       SMOTE, FALSE, FALSE, classif.randomForest
##  [1,]                                      TRUE
##  [2,]                                     FALSE
##  [3,]                                      TRUE
##  [4,]                                      TRUE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                      TRUE
##  [8,]                                      TRUE
##  [9,]                                      TRUE
## [10,]                                      TRUE
## [11,]                                     FALSE
## [12,]                                     FALSE
## [13,]                                      TRUE
## [14,]                                     FALSE
## [15,]                                      TRUE
##       SMOTE, FALSE, FALSE, classif.xgboost
##  [1,]                                 TRUE
##  [2,]                               TRUE
##  [3,]                              FALSE
##  [4,]                               TRUE
##  [5,]                               TRUE
##  [6,]                              FALSE
##  [7,]                               TRUE
##  [8,]                               TRUE
##  [9,]                               TRUE
## [10,]                               TRUE
## [11,]                               TRUE
## [12,]                              FALSE
## [13,]                               TRUE
## [14,]                               TRUE
## [15,]                              FALSE
```

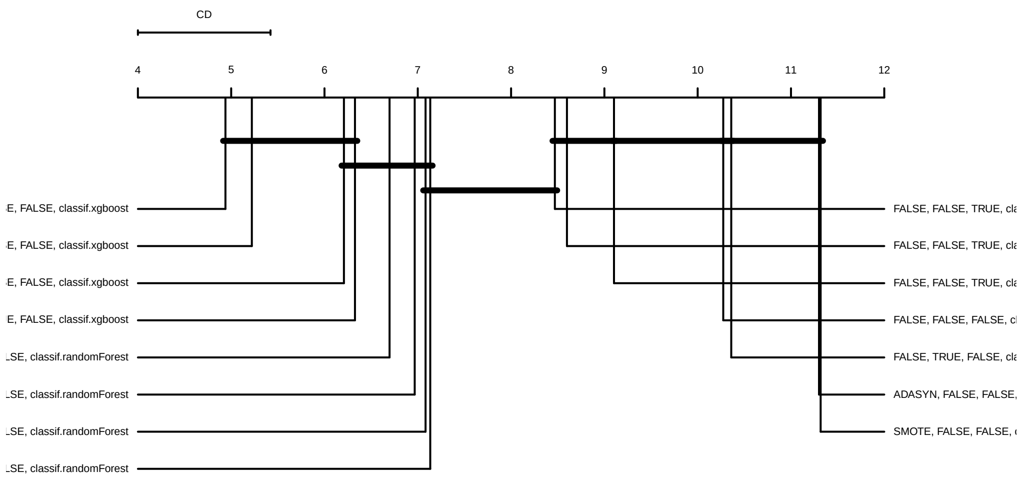
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm 
##                                  11.300439 
## ADASYN, FALSE, FALSE, classif.randomForest 
##                                   6.967105 
##      ADASYN, FALSE, FALSE, classif.xgboost 
##                                   5.221491 
##          FALSE, FALSE, FALSE, classif.ksvm 
##                                  10.274123 
##  FALSE, FALSE, FALSE, classif.randomForest 
##                                   7.083333 
##       FALSE, FALSE, FALSE, classif.xgboost 
##                                   6.208333 
##           FALSE, FALSE, TRUE, classif.ksvm 
##                                   9.103070 
##   FALSE, FALSE, TRUE, classif.randomForest 
##                                   8.469298 
##        FALSE, FALSE, TRUE, classif.xgboost 
##                                   8.598684 
##           FALSE, TRUE, FALSE, classif.ksvm 
##                                  10.359649 
##   FALSE, TRUE, FALSE, classif.randomForest 
##                                   7.133772 
##        FALSE, TRUE, FALSE, classif.xgboost 
##                                   6.326754 
##          SMOTE, FALSE, FALSE, classif.ksvm 
##                                  11.317982 
##  SMOTE, FALSE, FALSE, classif.randomForest 
##                                   6.697368 
##       SMOTE, FALSE, FALSE, classif.xgboost 
##                                   4.938596
```

Plotando grafico de Critical Diference

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


CD
E, FALSE, classif.xgboost
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.SE, classif.randomForest
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FALSE, TRUE, FALSE, cla
ADASYN, FALSE, FALSE,
SMOTE, FALSE, FALSE, c