R Notebook

Parametros:

Measure = F1 measure
Columns = sampling, weight_space, underbagging, learner
Performance = tuning_measure
Filter keys = imba.rate
Filter values = 0.05

```
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        :1230   Mode :logical
##  classif.randomForest:1230   FALSE:2952
##  classif.rusboost    :   0   TRUE :738
##  classif.xgboost     :1230   NA's :0
##
##
##
##                              measure       sampling    underbagging
##  Accuracy                        :   0   ADASYN: 738   Mode :logical
##  Area under the curve            :   0   FALSE :2214   FALSE:2952
##  F1 measure                      :3690   SMOTE : 738   TRUE :738
##  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.:0.3333   1st Qu.:0.1000   1st Qu.:0.07022
##  Median :0.8198   Median :0.5000   Median :0.32530
##  Mean   :0.6671   Mean   :0.4905   Mean   :0.39891
##  3rd Qu.:0.9848   3rd Qu.:0.8333   3rd Qu.:0.73016
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.00000
##  NA's   :51       NA's   :51       NA's   :51
##  iteration_count          dataset       imba.rate
##  Min.   :1       abalone      :  45   Min.   :0.05
##  1st Qu.:1       adult        :  45   1st Qu.:0.05
##  Median :2       annealing    :  45   Median :0.05
##  Mean   :2       arrhythmia   :  45   Mean   :0.05
##  3rd Qu.:3       balance-scale:  45   3rd Qu.:0.05
##  Max.   :3       bank         :  45   Max.   :0.05
##  NA's   :51      (Other)      :3420
```

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

```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$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] 82 15
```

```r
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                          0.9472249
## 2                          0.9611172
## 3                          0.9511782
## 4                          0.8095020
## 5                          1.0000000
## 6                          0.9769593
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.9401067
## 2                                         NA
## 3                                  0.9932657
## 4                                  0.9932778
## 5                                  1.0000000
## 6                                  0.9750455
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.9576632                         0.1290537
## 2                             0.9733028                         0.2772359
## 3                             0.9882364                         0.2927554
## 4                             0.9842866                         0.0000000
## 5                             1.0000000                         1.0000000
## 6                             0.9733838                         0.1247397
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                               0.005291005
## 2                               0.454977821
## 3                               0.727298407
## 4                               0.781040564
## 5                               1.000000000
## 6                               0.177957494
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.02289746                        0.1485313
## 2                           0.46619116                        0.2542338
## 3                           0.67464110                        0.3086281
## 4                           0.70432099                        0.1271359
## 5                           1.00000000                        0.9025814
## 6                           0.22381693                        0.1623156
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.1649924
## 2                                       NA
## 3                                0.4162512
## 4                                0.5370950
## 5                                0.9489338
## 6                                0.2908245
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.1616499                       0.12382963
## 2                           0.3103932                       0.28566897
## 3                           0.3827636                       0.32873851
## 4                           0.5873374                       0.00000000
## 5                           0.7294844                       1.00000000
## 6                           0.2858927                       0.09682558
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                              0.005291005
## 2                                       NA
## 3                              0.722524478
## 4                              0.651940035
## 5                              1.000000000
## 6                              0.177957494
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                          0.02420406                         0.9464710
## 2                          0.45160605                         0.9596461
## 3                          0.64215249                         0.9595356
## 4                          0.69400353                         0.7646842
## 5                          1.00000000                         1.0000000
## 6                          0.21351370                         0.9851804
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.9412533
## 2                                        NA
## 3                                 0.9877630
## 4                                 0.9933152
## 5                                 1.0000000
## 6                                 0.9766771
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.9540043
## 2                            0.9738483
## 3                            0.9896043
## 4                            0.9778476
## 5                            1.0000000
## 6                            0.9720548
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.7913
##  1st Qu.:0.9544
##  Median :0.9791
##  Mean   :0.9630
##  3rd Qu.:0.9947
##  Max.   :1.0000
##  NA's   :1
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.7179
##  1st Qu.:0.9739
##  Median :0.9920
##  Mean   :0.9770
##  3rd Qu.:0.9984
##  Max.   :1.0000
##  NA's   :5
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.7310                        Min.   :0.0000
##  1st Qu.:0.9666                        1st Qu.:0.0000
##  Median :0.9876                        Median :0.2281
##  Mean   :0.9720                        Mean   :0.2947
##  3rd Qu.:0.9962                        3rd Qu.:0.4719
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1984
##  Median :0.6329
##  Mean   :0.5394
##  3rd Qu.:0.8303
##  Max.   :1.0000
##  NA's   :1
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.0000                       Min.   :0.09246
##  1st Qu.:0.2468                       1st Qu.:0.19564
##  Median :0.6565                       Median :0.39808
##  Mean   :0.5765                       Mean   :0.43307
##  3rd Qu.:0.8417                       3rd Qu.:0.63027
##  Max.   :1.0000                       Max.   :0.98214
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.09861
##  1st Qu.:0.26788
##  Median :0.47097
##  Mean   :0.49105
##  3rd Qu.:0.71859
##  Max.   :1.00000
##  NA's   :3
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.09351                     Min.   :0.0000
##  1st Qu.:0.23896                     1st Qu.:0.0000
##  Median :0.43019                     Median :0.2065
##  Mean   :0.46400                     Mean   :0.2870
##  3rd Qu.:0.68242                     3rd Qu.:0.4463
##  Max.   :1.00000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2506
##  Median :0.5752
##  Mean   :0.5486
##  3rd Qu.:0.8651
##  Max.   :1.0000
##  NA's   :3
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                      Min.   :0.7607
##  1st Qu.:0.2960                      1st Qu.:0.9546
##  Median :0.6406                      Median :0.9784
##  Mean   :0.5741                      Mean   :0.9599
##  3rd Qu.:0.8384                      3rd Qu.:0.9931
##  Max.   :1.0000                      Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.7311
##  1st Qu.:0.9730
##  Median :0.9915
##  Mean   :0.9772
##  3rd Qu.:0.9978
##  Max.   :1.0000
##  NA's   :4
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.6908
##  1st Qu.:0.9684
##  Median :0.9877
##  Mean   :0.9747
##  3rd Qu.:0.9964
##  Max.   :1.0000
##
```

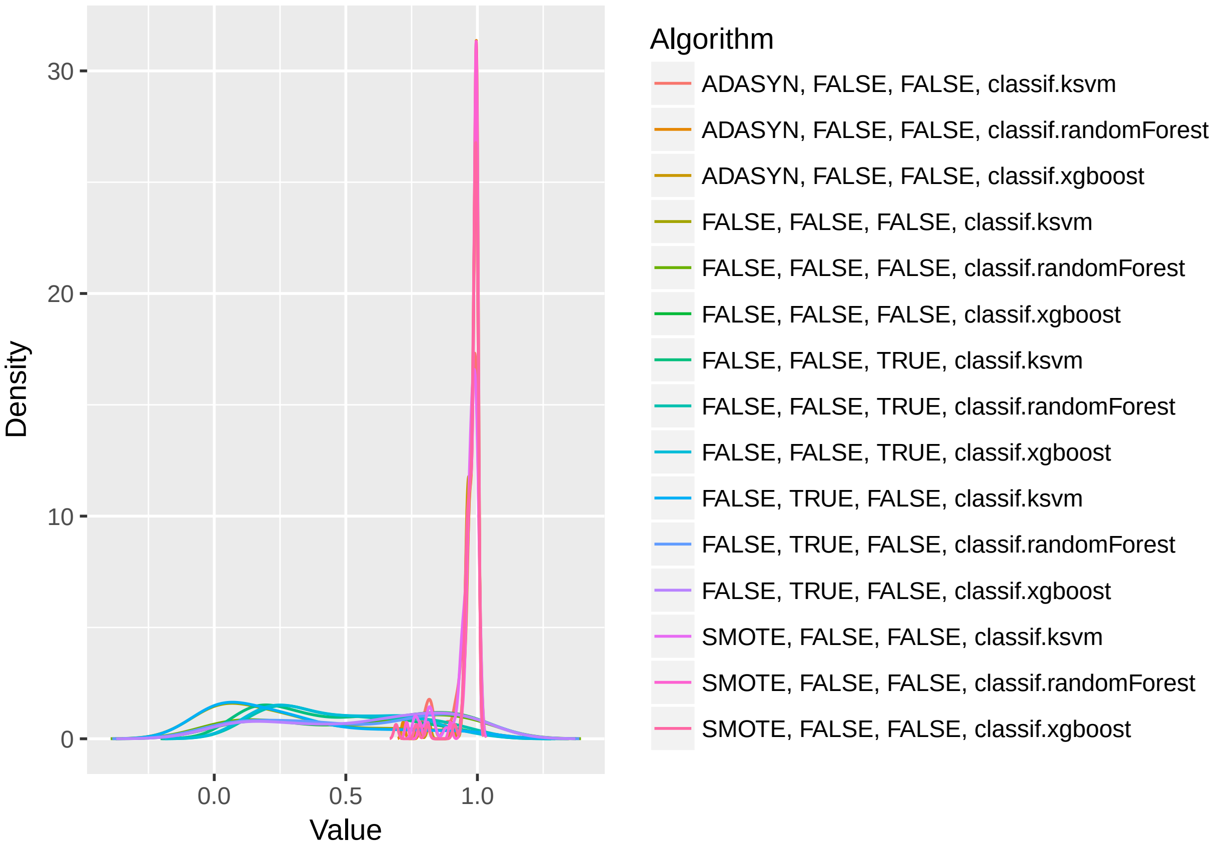
Verificando a média de cada coluna selecionada

```
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 = 0.963045110849921"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.976993535327279"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.971972609222412"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.294747069679735"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.539379103154103"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.576466997099341"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.43307502070709"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.491051630464319"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.464002478013471"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.287034479003018"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.548585456558965"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.574089095970635"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.959902879940769"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.977181342299523"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.974658612182877"
```

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 = 770.48, 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,]                              FALSE
##  [3,]                              FALSE
##  [4,]                               TRUE
##  [5,]                               TRUE
##  [6,]                               TRUE
##  [7,]                               TRUE
##  [8,]                               TRUE
##  [9,]                               TRUE
## [10,]                               TRUE
## [11,]                               TRUE
## [12,]                               TRUE
## [13,]                              FALSE
## [14,]                              FALSE
## [15,]                              FALSE
##       ADASYN, FALSE, FALSE, classif.randomForest
##  [1,]                                      FALSE
##  [2,]                                      FALSE
##  [3,]                                      FALSE
##  [4,]                                       TRUE
##  [5,]                                       TRUE
##  [6,]                                       TRUE
##  [7,]                                       TRUE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                       TRUE
## [11,]                                       TRUE
## [12,]                                       TRUE
## [13,]                                      FALSE
## [14,]                                      FALSE
## [15,]                                      FALSE
##       ADASYN, FALSE, FALSE, classif.xgboost
##  [1,]                                 FALSE
##  [2,]                                 FALSE
##  [3,]                                 FALSE
##  [4,]                                  TRUE
##  [5,]                                  TRUE
##  [6,]                                  TRUE
##  [7,]                                  TRUE
##  [8,]                                  TRUE
##  [9,]                                  TRUE
## [10,]                                  TRUE
## [11,]                                  TRUE
## [12,]                                  TRUE
## [13,]                                 FALSE
## [14,]                                 FALSE
## [15,]                                 FALSE
##       FALSE, FALSE, FALSE, 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, FALSE, classif.randomForest
##  [1,]                                      TRUE
##  [2,]                                      TRUE
##  [3,]                                      TRUE
##  [4,]                                      TRUE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                     FALSE
##  [8,]                                     FALSE
##  [9,]                                     FALSE
## [10,]                                      TRUE
## [11,]                                     FALSE
## [12,]                                     FALSE
## [13,]                                      TRUE
## [14,]                                      TRUE
## [15,]                                      TRUE
##       FALSE, FALSE, FALSE, classif.xgboost
##  [1,]                                 TRUE
##  [2,]                                 TRUE
##  [3,]                                 TRUE
##  [4,]                                 TRUE
##  [5,]                                FALSE
##  [6,]                                FALSE
##  [7,]                                FALSE
##  [8,]                                FALSE
##  [9,]                                FALSE
## [10,]                                 TRUE
## [11,]                                FALSE
## [12,]                                FALSE
## [13,]                                 TRUE
## [14,]                                 TRUE
## [15,]                                 TRUE
##       FALSE, FALSE, TRUE, classif.ksvm
##  [1,]                             TRUE
##  [2,]                             TRUE
##  [3,]                             TRUE
##  [4,]                            FALSE
##  [5,]                            FALSE
##  [6,]                            FALSE
##  [7,]                            FALSE
##  [8,]                            FALSE
##  [9,]                            FALSE
## [10,]                            FALSE
## [11,]                            FALSE
## [12,]                            FALSE
## [13,]                             TRUE
## [14,]                             TRUE
## [15,]                             TRUE
##       FALSE, FALSE, TRUE, classif.randomForest
##  [1,]                                     TRUE
##  [2,]                                     TRUE
##  [3,]                                     TRUE
##  [4,]                                    FALSE
##  [5,]                                    FALSE
##  [6,]                                    FALSE
##  [7,]                                    FALSE
##  [8,]                                    FALSE
##  [9,]                                    FALSE
## [10,]                                    FALSE
## [11,]                                    FALSE
## [12,]                                    FALSE
## [13,]                                     TRUE
## [14,]                                     TRUE
## [15,]                                     TRUE
##       FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  [1,]                                TRUE                             TRUE
##  [2,]                                TRUE                             TRUE
##  [3,]                                TRUE                             TRUE
##  [4,]                               FALSE                            FALSE
##  [5,]                               FALSE                             TRUE
##  [6,]                               FALSE                             TRUE
##  [7,]                               FALSE                            FALSE
##  [8,]                               FALSE                            FALSE
##  [9,]                               FALSE                            FALSE
## [10,]                               FALSE                            FALSE
## [11,]                               FALSE                             TRUE
## [12,]                               FALSE                             TRUE
## [13,]                                TRUE                             TRUE
## [14,]                                TRUE                             TRUE
## [15,]                                TRUE                             TRUE
##       FALSE, TRUE, FALSE, classif.randomForest
##  [1,]                                     TRUE
##  [2,]                                     TRUE
##  [3,]                                     TRUE
##  [4,]                                     TRUE
##  [5,]                                    FALSE
##  [6,]                                    FALSE
##  [7,]                                    FALSE
##  [8,]                                    FALSE
##  [9,]                                    FALSE
## [10,]                                     TRUE
## [11,]                                    FALSE
## [12,]                                    FALSE
## [13,]                                     TRUE
## [14,]                                     TRUE
## [15,]                                     TRUE
##       FALSE, TRUE, FALSE, classif.xgboost
##  [1,]                                TRUE
##  [2,]                                TRUE
##  [3,]                                TRUE
##  [4,]                                TRUE
##  [5,]                               FALSE
##  [6,]                               FALSE
##  [7,]                               FALSE
##  [8,]                               FALSE
##  [9,]                               FALSE
## [10,]                                TRUE
## [11,]                               FALSE
## [12,]                               FALSE
## [13,]                                TRUE
## [14,]                                TRUE
## [15,]                                TRUE
##       SMOTE, FALSE, FALSE, classif.ksvm
##  [1,]                             FALSE
##  [2,]                             FALSE
##  [3,]                             FALSE
##  [4,]                              TRUE
##  [5,]                              TRUE
##  [6,]                              TRUE
##  [7,]                              TRUE
##  [8,]                              TRUE
##  [9,]                              TRUE
## [10,]                              TRUE
## [11,]                              TRUE
## [12,]                              TRUE
## [13,]                             FALSE
## [14,]                             FALSE
## [15,]                             FALSE
##       SMOTE, FALSE, FALSE, classif.randomForest
##  [1,]                                     FALSE
##  [2,]                                     FALSE
##  [3,]                                     FALSE
##  [4,]                                      TRUE
##  [5,]                                      TRUE
##  [6,]                                      TRUE
##  [7,]                                      TRUE
##  [8,]                                      TRUE
##  [9,]                                      TRUE
## [10,]                                      TRUE
## [11,]                                      TRUE
## [12,]                                      TRUE
## [13,]                                     FALSE
## [14,]                                     FALSE
## [15,]                                     FALSE
##       SMOTE, FALSE, FALSE, classif.xgboost
##  [1,]                                FALSE
##  [2,]                                FALSE
##  [3,]                                FALSE
##  [4,]                                 TRUE
##  [5,]                                 TRUE
##  [6,]                                 TRUE
##  [7,]                                 TRUE
##  [8,]                                 TRUE
##  [9,]                                 TRUE
## [10,]                                 TRUE
## [11,]                                 TRUE
## [12,]                                 TRUE
## [13,]                                FALSE
## [14,]                                FALSE
## [15,]                                FALSE
```

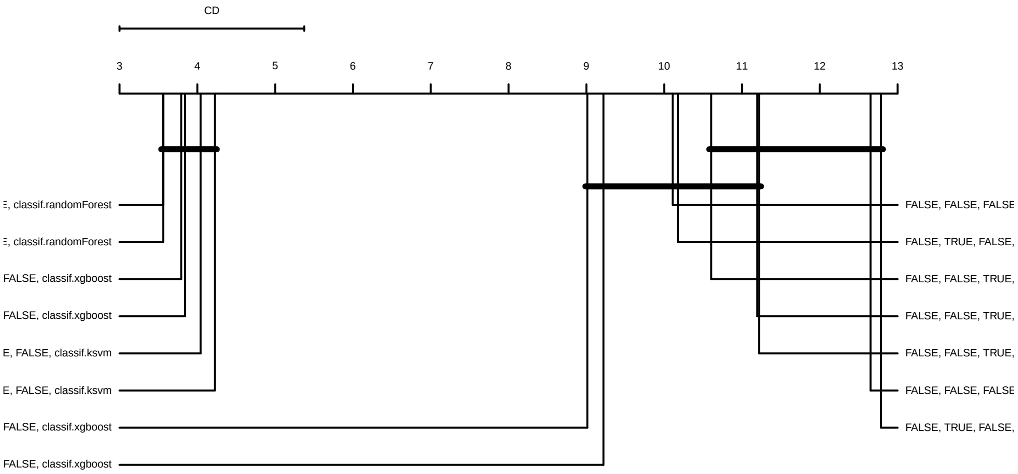
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                   4.225610
## ADASYN, FALSE, FALSE, classif.randomForest
##                                   3.560976
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                   3.841463
##          FALSE, FALSE, FALSE, classif.ksvm
##                                  12.652439
##  FALSE, FALSE, FALSE, classif.randomForest
##                                  10.109756
##       FALSE, FALSE, FALSE, classif.xgboost
##                                   9.012195
##           FALSE, FALSE, TRUE, classif.ksvm
##                                  11.195122
##   FALSE, FALSE, TRUE, classif.randomForest
##                                  10.603659
##        FALSE, FALSE, TRUE, classif.xgboost
##                                  11.219512
##           FALSE, TRUE, FALSE, classif.ksvm
##                                  12.786585
##   FALSE, TRUE, FALSE, classif.randomForest
##                                  10.176829
##        FALSE, TRUE, FALSE, classif.xgboost
##                                   9.219512
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                   4.042683
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                   3.560976
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                   3.792683
```

Plotando grafico de Critical Diference

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


CD
E, classif.randomForest
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FALSE, classif.xgboost
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