R Notebook

Parametros:

Measure = Area under the curve
Columns = sampling, weight_space, underbagging, learner
Performance = holdout_measure_residual
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            :3690   FALSE :2214   FALSE:2952
##  F1 measure                      :   0   SMOTE : 738   TRUE :738
##  G-mean                          :   0                 NA's :0
##  Matthews correlation coefficient:   0
##
##
##  tuning_measure   holdout_measure  holdout_measure_residual
##  Min.   :0.3977   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.9145   1st Qu.:0.8175   1st Qu.:0.6976
##  Median :0.9932   Median :0.9755   Median :0.8806
##  Mean   :0.9282   Mean   :0.8846   Mean   :0.8211
##  3rd Qu.:0.9997   3rd Qu.:0.9992   3rd Qu.:0.9784
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##  NA's   :84       NA's   :84       NA's   :84
##  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   :84      (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$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] 82 15
```

```r
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                          0.5948389
## 2                                 NA
## 3                          0.8072758
## 4                          0.5739972
## 5                          0.8808254
## 6                          0.7789270
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.6927146
## 2                                  0.8809462
## 3                                  0.9771092
## 4                                  0.9574689
## 5                                  0.6068844
## 6                                  0.8810023
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.6819788                         0.6479328
## 2                             0.9062335                                NA
## 3                             0.9730628                         0.8307921
## 4                             0.9066390                         0.5000000
## 5                             0.5451291                         0.8701104
## 6                             0.8740440                         0.7816640
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.6678776
## 2                                 0.8941163
## 3                                 0.9909297
## 4                                 0.9052559
## 5                                 0.6190888
## 6                                 0.8897089
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                            0.6806404                        0.6628553
## 2                            0.9180063                        0.8251103
## 3                            0.9843616                        0.7774846
## 4                            0.9567773                        0.6625173
## 5                            0.5881527                        0.7139014
## 6                            0.8668094                        0.7655071
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.6966937
## 2                                       NA
## 3                                0.9798655
## 4                                0.9508990
## 5                                0.6253509
## 6                                0.8738974
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.6898095                               NA
## 2                           0.9053025                               NA
## 3                           0.9546681                        0.8307921
## 4                           0.9595436                        0.5000000
## 5                           0.6214361                        0.8701104
## 6                           0.8644446                        0.7816640
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                                0.6678776
## 2                                0.8932671
## 3                                0.9890531
## 4                                0.9747580
## 5                                0.6037495
## 6                                0.8897089
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                           0.6830128                         0.5862406
## 2                           0.9193893                                NA
## 3                           0.9848307                         0.8195129
## 4                           0.9591978                         0.5276625
## 5                           0.5881527                         0.8969212
## 6                           0.8644223                         0.7748179
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.6991028
## 2                                        NA
## 3                                 0.9889749
## 4                                 0.9132089
## 5                                 0.6350599
## 6                                 0.8895640
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.6722286
## 2                            0.9034426
## 3                            0.9711862
## 4                            0.9343015
## 5                            0.6556320
## 6                            0.8809182
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.3506
##  1st Qu.:0.6630
##  Median :0.8385
##  Mean   :0.7949
##  3rd Qu.:0.9657
##  Max.   :0.9999
##  NA's   :5
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.3880
##  1st Qu.:0.7603
##  Median :0.9269
##  Mean   :0.8538
##  3rd Qu.:0.9855
##  Max.   :1.0000
##  NA's   :3
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.4087                        Min.   :0.4167
##  1st Qu.:0.6880                        1st Qu.:0.6353
##  Median :0.8681                        Median :0.8295
##  Mean   :0.8256                        Mean   :0.7861
##  3rd Qu.:0.9788                        3rd Qu.:0.9560
##  Max.   :0.9999                        Max.   :1.0000
##                                        NA's   :4
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.3885
##  1st Qu.:0.7914
##  Median :0.9147
##  Mean   :0.8524
##  3rd Qu.:0.9806
##  Max.   :1.0000
##  NA's   :2
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.4229                       Min.   :0.3869
##  1st Qu.:0.7144                       1st Qu.:0.6528
##  Median :0.8960                       Median :0.7696
##  Mean   :0.8399                       Mean   :0.7629
##  3rd Qu.:0.9753                       3rd Qu.:0.9024
##  Max.   :1.0000                       Max.   :0.9997
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.3757
##  1st Qu.:0.7087
##  Median :0.8839
##  Mean   :0.8247
##  3rd Qu.:0.9686
##  Max.   :1.0000
##  NA's   :3
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.3653                      Min.   :0.4167
##  1st Qu.:0.6900                      1st Qu.:0.6394
##  Median :0.8747                      Median :0.8295
##  Mean   :0.8170                      Mean   :0.7855
##  3rd Qu.:0.9724                      3rd Qu.:0.9560
##  Max.   :1.0000                      Max.   :1.0000
##                                      NA's   :4
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.4130
##  1st Qu.:0.7698
##  Median :0.9312
##  Mean   :0.8511
##  3rd Qu.:0.9829
##  Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.4143                      Min.   :0.3945
##  1st Qu.:0.7155                      1st Qu.:0.6722
##  Median :0.8900                      Median :0.8195
##  Mean   :0.8377                      Mean   :0.7914
##  3rd Qu.:0.9759                      3rd Qu.:0.9520
##  Max.   :1.0000                      Max.   :1.0000
##                                      NA's   :3
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.4036
##  1st Qu.:0.7712
##  Median :0.9152
##  Mean   :0.8534
##  3rd Qu.:0.9864
##  Max.   :1.0000
##  NA's   :4
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.4457
##  1st Qu.:0.7202
##  Median :0.8740
##  Mean   :0.8375
##  3rd Qu.:0.9797
##  Max.   :0.9999
##
```

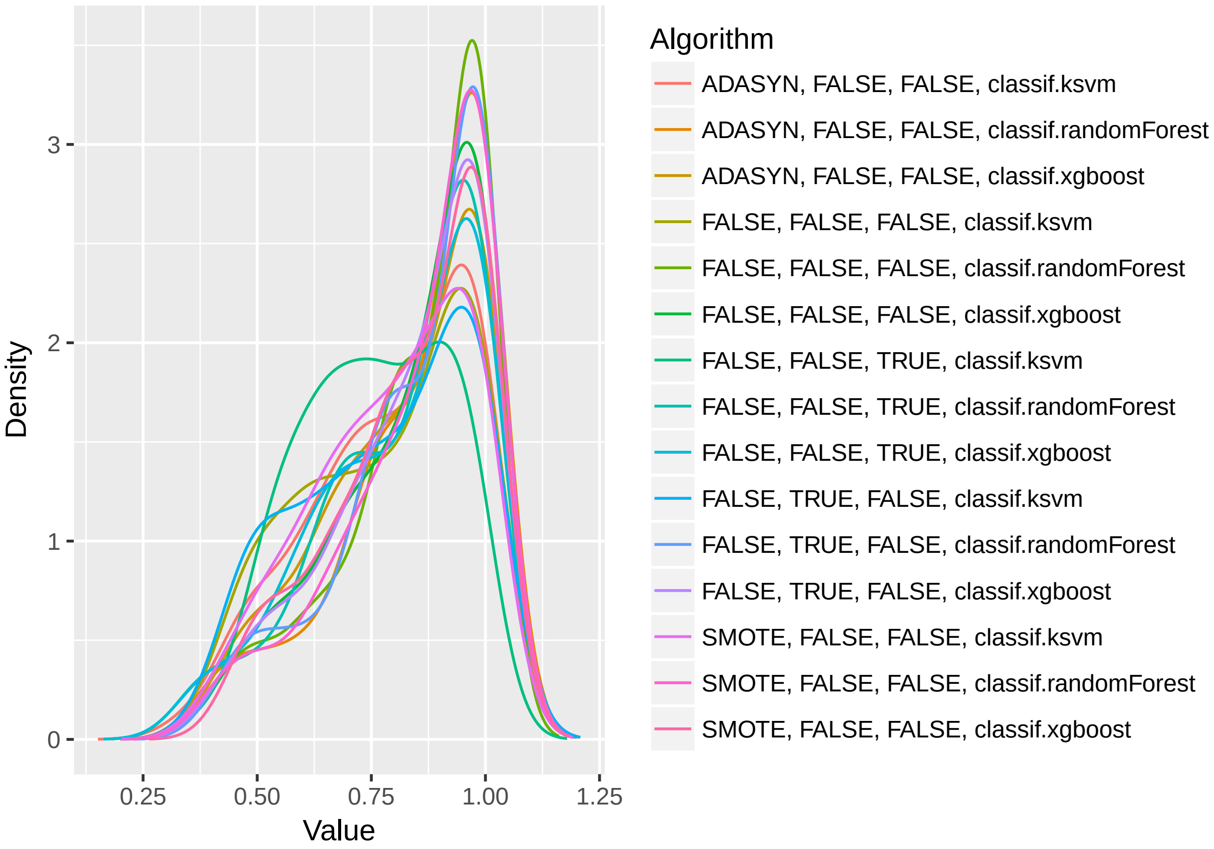
Verificando a média de cada coluna selecionada

```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 = 0.794908244987678"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.853807377275889"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.825635026660744"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.78605256570506"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.852398353253037"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.839899674001894"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.762887851728796"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.824740957713654"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.817013259180041"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.785507595146507"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.85112000282138"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.837668718003242"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.791392698052683"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.85342624969326"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.837479958094399"
```

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 = 206.47, 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,]                              FALSE
##  [4,]                              FALSE
##  [5,]                               TRUE
##  [6,]                               TRUE
##  [7,]                              FALSE
##  [8,]                              FALSE
##  [9,]                              FALSE
## [10,]                              FALSE
## [11,]                               TRUE
## [12,]                               TRUE
## [13,]                              FALSE
## [14,]                               TRUE
## [15,]                               TRUE
##       ADASYN, FALSE, FALSE, classif.randomForest
##  [1,]                                       TRUE
##  [2,]                                      FALSE
##  [3,]                                       TRUE
##  [4,]                                       TRUE
##  [5,]                                      FALSE
##  [6,]                                      FALSE
##  [7,]                                       TRUE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                       TRUE
## [11,]                                      FALSE
## [12,]                                      FALSE
## [13,]                                       TRUE
## [14,]                                      FALSE
## [15,]                                      FALSE
##       ADASYN, FALSE, FALSE, classif.xgboost
##  [1,]                                 FALSE
##  [2,]                                  TRUE
##  [3,]                                 FALSE
##  [4,]                                 FALSE
##  [5,]                                 FALSE
##  [6,]                                 FALSE
##  [7,]                                  TRUE
##  [8,]                                 FALSE
##  [9,]                                 FALSE
## [10,]                                 FALSE
## [11,]                                  TRUE
## [12,]                                 FALSE
## [13,]                                 FALSE
## [14,]                                  TRUE
## [15,]                                 FALSE
##       FALSE, FALSE, FALSE, classif.ksvm
##  [1,]                             FALSE
##  [2,]                              TRUE
##  [3,]                             FALSE
##  [4,]                             FALSE
##  [5,]                              TRUE
##  [6,]                              TRUE
##  [7,]                             FALSE
##  [8,]                             FALSE
##  [9,]                             FALSE
## [10,]                             FALSE
## [11,]                              TRUE
## [12,]                              TRUE
## [13,]                             FALSE
## [14,]                              TRUE
## [15,]                              TRUE
##       FALSE, FALSE, FALSE, classif.randomForest
##  [1,]                                      TRUE
##  [2,]                                     FALSE
##  [3,]                                     FALSE
##  [4,]                                      TRUE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                      TRUE
##  [8,]                                      TRUE
##  [9,]                                      TRUE
## [10,]                                      TRUE
## [11,]                                     FALSE
## [12,]                                     FALSE
## [13,]                                      TRUE
## [14,]                                     FALSE
## [15,]                                     FALSE
##       FALSE, FALSE, FALSE, classif.xgboost
##  [1,]                                 TRUE
##  [2,]                                FALSE
##  [3,]                                FALSE
##  [4,]                                 TRUE
##  [5,]                                FALSE
##  [6,]                                FALSE
##  [7,]                                 TRUE
##  [8,]                                FALSE
##  [9,]                                FALSE
## [10,]                                 TRUE
## [11,]                                FALSE
## [12,]                                FALSE
## [13,]                                 TRUE
## [14,]                                FALSE
## [15,]                                FALSE
##       FALSE, FALSE, TRUE, 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, TRUE, classif.randomForest
##  [1,]                                    FALSE
##  [2,]                                     TRUE
##  [3,]                                    FALSE
##  [4,]                                    FALSE
##  [5,]                                     TRUE
##  [6,]                                    FALSE
##  [7,]                                     TRUE
##  [8,]                                    FALSE
##  [9,]                                    FALSE
## [10,]                                    FALSE
## [11,]                                     TRUE
## [12,]                                    FALSE
## [13,]                                    FALSE
## [14,]                                     TRUE
## [15,]                                    FALSE
##       FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  [1,]                               FALSE                            FALSE
##  [2,]                                TRUE                             TRUE
##  [3,]                               FALSE                            FALSE
##  [4,]                               FALSE                            FALSE
##  [5,]                                TRUE                             TRUE
##  [6,]                               FALSE                             TRUE
##  [7,]                                TRUE                            FALSE
##  [8,]                               FALSE                            FALSE
##  [9,]                               FALSE                            FALSE
## [10,]                               FALSE                            FALSE
## [11,]                                TRUE                             TRUE
## [12,]                               FALSE                             TRUE
## [13,]                               FALSE                            FALSE
## [14,]                                TRUE                             TRUE
## [15,]                               FALSE                             TRUE
##       FALSE, TRUE, 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,]                                    FALSE
##       FALSE, TRUE, FALSE, classif.xgboost
##  [1,]                                TRUE
##  [2,]                               FALSE
##  [3,]                               FALSE
##  [4,]                                TRUE
##  [5,]                               FALSE
##  [6,]                               FALSE
##  [7,]                                TRUE
##  [8,]                               FALSE
##  [9,]                               FALSE
## [10,]                                TRUE
## [11,]                               FALSE
## [12,]                               FALSE
## [13,]                               FALSE
## [14,]                               FALSE
## [15,]                               FALSE
##       SMOTE, FALSE, FALSE, classif.ksvm
##  [1,]                             FALSE
##  [2,]                              TRUE
##  [3,]                             FALSE
##  [4,]                             FALSE
##  [5,]                              TRUE
##  [6,]                              TRUE
##  [7,]                             FALSE
##  [8,]                             FALSE
##  [9,]                             FALSE
## [10,]                             FALSE
## [11,]                              TRUE
## [12,]                             FALSE
## [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,]                                     FALSE
##       SMOTE, FALSE, FALSE, classif.xgboost
##  [1,]                                 TRUE
##  [2,]                                FALSE
##  [3,]                                FALSE
##  [4,]                                 TRUE
##  [5,]                                FALSE
##  [6,]                                FALSE
##  [7,]                                 TRUE
##  [8,]                                FALSE
##  [9,]                                FALSE
## [10,]                                 TRUE
## [11,]                                FALSE
## [12,]                                FALSE
## [13,]                                 TRUE
## [14,]                                FALSE
## [15,]                                FALSE
```

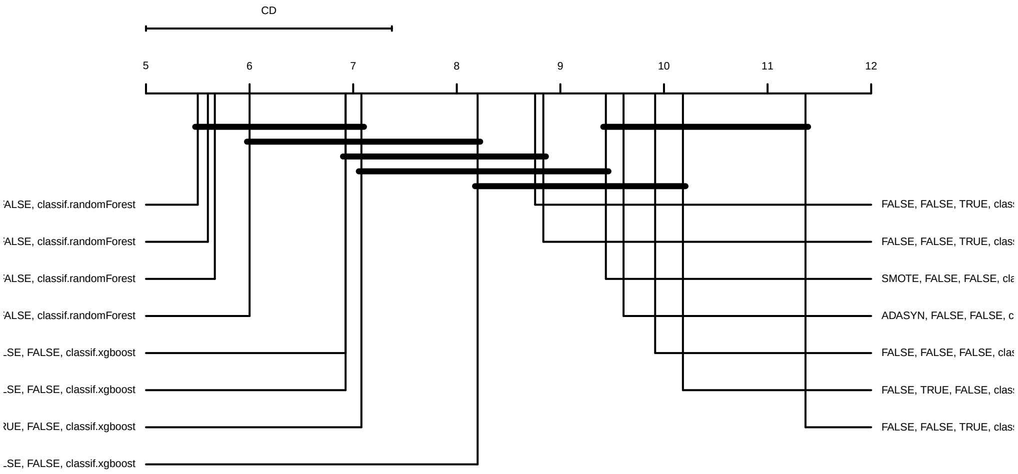
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                   9.609756
## ADASYN, FALSE, FALSE, classif.randomForest
##                                   5.597561
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                   8.201220
##          FALSE, FALSE, FALSE, classif.ksvm
##                                   9.914634
##  FALSE, FALSE, FALSE, classif.randomForest
##                                   6.000000
##       FALSE, FALSE, FALSE, classif.xgboost
##                                   6.926829
##           FALSE, FALSE, TRUE, classif.ksvm
##                                  11.365854
##   FALSE, FALSE, TRUE, classif.randomForest
##                                   8.835366
##        FALSE, FALSE, TRUE, classif.xgboost
##                                   8.756098
##           FALSE, TRUE, FALSE, classif.ksvm
##                                  10.182927
##   FALSE, TRUE, FALSE, classif.randomForest
##                                   5.664634
##        FALSE, TRUE, FALSE, classif.xgboost
##                                   7.079268
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                   9.439024
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                   5.500000
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                   6.926829
```

Plotando grafico de Critical Diference

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


CD
ALSE, classif.randomForest
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LSE, FALSE, classif.xgboost
FALSE, FALSE, TRUE, clas
FALSE, FALSE, TRUE, clas
SMOTE, FALSE, FALSE, cla
ADASYN, FALSE, FALSE, c
FALSE, FALSE, FALSE, clas
FALSE, TRUE, FALSE, clas
FALSE, FALSE, TRUE, clas