R Notebook

Parametros:

Measure = Accuracy
Columns = sampling, weight_space, underbagging, learner
Performance = holdout_measure
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                        :1800   ADASYN: 360   Mode :logical
##  Area under the curve            :   0   FALSE :1080   FALSE:1440
##  F1 measure                      :   0   SMOTE : 360   TRUE :360
##  G-mean                          :   0                 NA's :0
##  Matthews correlation coefficient:   0
##
##
##  tuning_measure   holdout_measure   holdout_measure_residual
##  Min.   :0.1269   Min.   :0.01517   Min.   :0.03881
##  1st Qu.:0.9898   1st Qu.:0.98750   1st Qu.:0.38526
##  Median :0.9938   Median :0.99163   Median :0.75447
##  Mean   :0.9691   Mean   :0.96664   Mean   :0.66878
##  3rd Qu.:0.9990   3rd Qu.:0.99687   3rd Qu.:0.95350
##  Max.   :1.0000   Max.   :1.00000   Max.   :1.00000
##  NA's   :57       NA's   :57        NA's   :57
##  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   :57      (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                          0.9677996
## 2                          0.9819241
## 3                          0.9875000
## 4                          0.9937304
## 5                          0.9900000
## 6                          0.9929639
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.9683959
## 2                                  0.9841334
## 3                                  0.9887500
## 4                                  1.0000000
## 5                                  0.9916667
## 6                                  0.9991205
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.9785331                         0.9898629
## 2                             0.9884180                         0.9892883
## 3                             0.9812500                         0.9900000
## 4                             0.9989551                         0.9979101
## 5                             0.9908333                         0.9941667
## 6                             0.9956025                         0.9964820
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.9910555
## 2                                 0.9912968
## 3                                 0.9900000
## 4                                 1.0000000
## 5                                 0.9916667
## 6                                 1.0000000
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                            0.9910555                        0.5086464
## 2                            0.9918993                        0.8815023
## 3                            0.9900000                        0.4887500
## 4                            1.0000000                        1.0000000
## 5                            0.9925000                        0.9900000
## 6                            0.9982410                        0.9947230
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.4818128
## 2                                0.7864364
## 3                                0.8191667
## 4                                0.9864159
## 5                                0.8991667
## 6                                0.9920844
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.4812165                        0.9880739
## 2                           0.8075919                        0.9898239
## 3                           0.8166667                        0.9900000
## 4                           0.9592476                        0.9979101
## 5                           0.9033333                        0.9941667
## 6                           0.9700967                        0.9964820
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                                0.9910555
## 2                                0.9914307
## 3                                0.9900000
## 4                                1.0000000
## 5                                0.9925000
## 6                                0.9991205
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                           0.9910555                         0.9666070
## 2                           0.9914307                         0.9822588
## 3                           0.9900000                         0.9879167
## 4                           1.0000000                         0.9958203
## 5                           0.9950000                         0.9908333
## 6                           0.9982410                         0.9929639
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.9737627
## 2                                        NA
## 3                                 0.9870833
## 4                                 1.0000000
## 5                                 0.9916667
## 6                                 0.9991205
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.9779368
## 2                            0.9894892
## 3                            0.9816667
## 4                            1.0000000
## 5                            0.9933333
## 6                            0.9973615
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.9678
##  1st Qu.:0.9900
##  Median :0.9909
##  Mean   :0.9903
##  3rd Qu.:0.9926
##  Max.   :0.9990
##  NA's   :2
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.9684
##  1st Qu.:0.9884
##  Median :0.9922
##  Mean   :0.9921
##  3rd Qu.:0.9990
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.9767                        Min.   :0.9893
##  1st Qu.:0.9878                        1st Qu.:0.9902
##  Median :0.9939                        Median :0.9916
##  Mean   :0.9919                        Mean   :0.9931
##  3rd Qu.:0.9990                        3rd Qu.:0.9960
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.9883
##  1st Qu.:0.9911
##  Median :0.9944
##  Mean   :0.9946
##  3rd Qu.:0.9987
##  Max.   :1.0000
##  NA's   :1
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.9850                       Min.   :0.1817
##  1st Qu.:0.9916                       1st Qu.:0.7045
##  Median :0.9943                       Median :0.9807
##  Mean   :0.9945                       Mean   :0.8455
##  3rd Qu.:0.9981                       3rd Qu.:0.9944
##  Max.   :1.0000                       Max.   :1.0000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.4818
##  1st Qu.:0.7981
##  Median :0.9246
##  Mean   :0.8825
##  3rd Qu.:0.9714
##  Max.   :1.0000
##
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.4812                      Min.   :0.9881
##  1st Qu.:0.8058                      1st Qu.:0.9903
##  Median :0.9091                      Median :0.9917
##  Mean   :0.8703                      Mean   :0.9931
##  3rd Qu.:0.9556                      3rd Qu.:0.9960
##  Max.   :1.0000                      Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.9867
##  1st Qu.:0.9911
##  Median :0.9933
##  Mean   :0.9945
##  3rd Qu.:0.9988
##  Max.   :1.0000
##  NA's   :2
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.9867                      Min.   :0.9666
##  1st Qu.:0.9912                      1st Qu.:0.9900
##  Median :0.9946                      Median :0.9910
##  Mean   :0.9946                      Mean   :0.9907
##  3rd Qu.:0.9983                      3rd Qu.:0.9935
##  Max.   :1.0000                      Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.9738
##  1st Qu.:0.9900
##  Median :0.9950
##  Mean   :0.9927
##  3rd Qu.:0.9990
##  Max.   :1.0000
##  NA's   :7
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.9617
##  1st Qu.:0.9878
##  Median :0.9933
##  Mean   :0.9915
##  3rd Qu.:0.9991
##  Max.   :1.0000
##
```

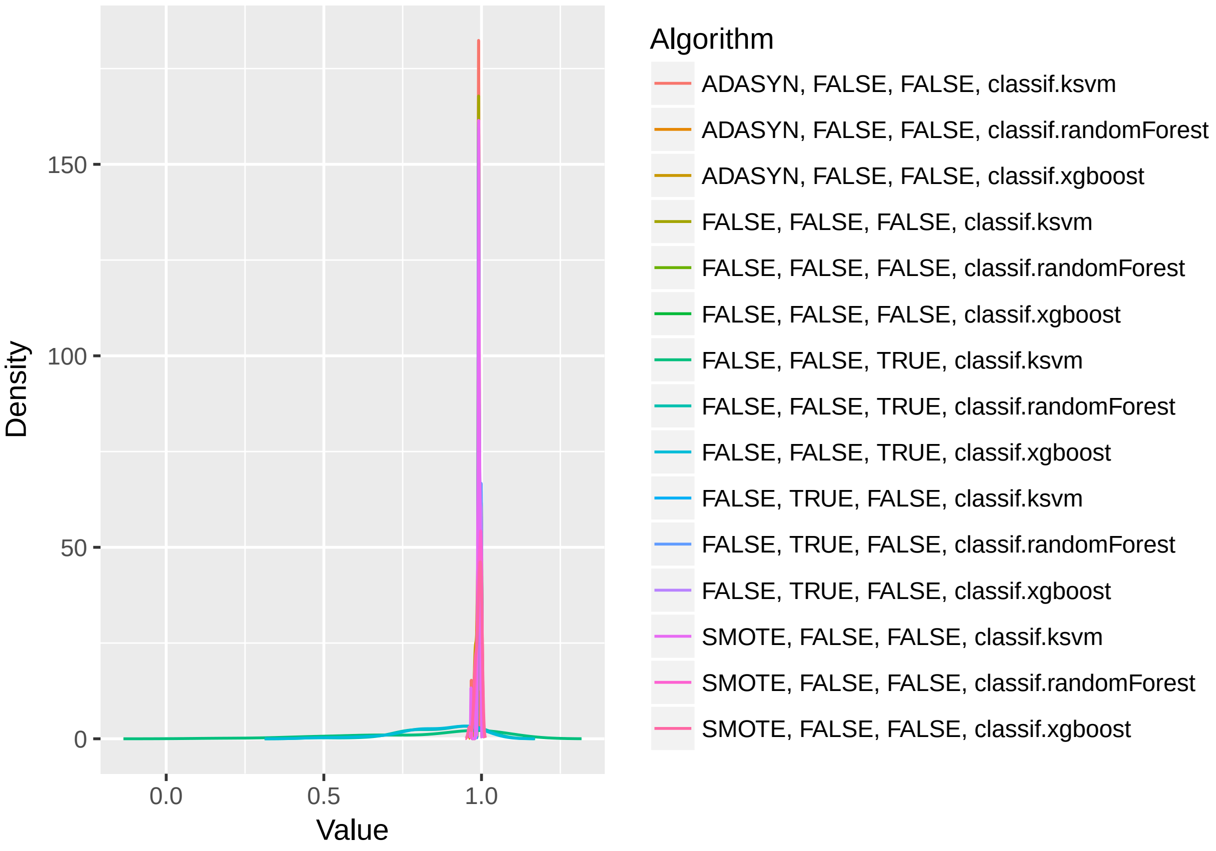
Verificando a média de cada coluna selecionada

```r
for(i in (1:dim(df)[2])){
  print(paste("Media da coluna ", colnames(df)[i], " = ", mean(df[,i], na.rm = TRUE), sep=""))
}
```

```
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.ksvm = 0.990333702309785"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.992119561214041"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.991900833888037"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.993062611875091"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.994602890223125"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.994517387753698"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.845512595070107"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.882542177532805"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.870291997455697"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.993085687368942"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.99450628133624"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.99457547143972"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.99071256401121"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.99273159207166"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.991476571878267"
```

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 = 206.15, df = 14, p-value < 2.2e-16
```

Testando as diferencas par a par

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

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

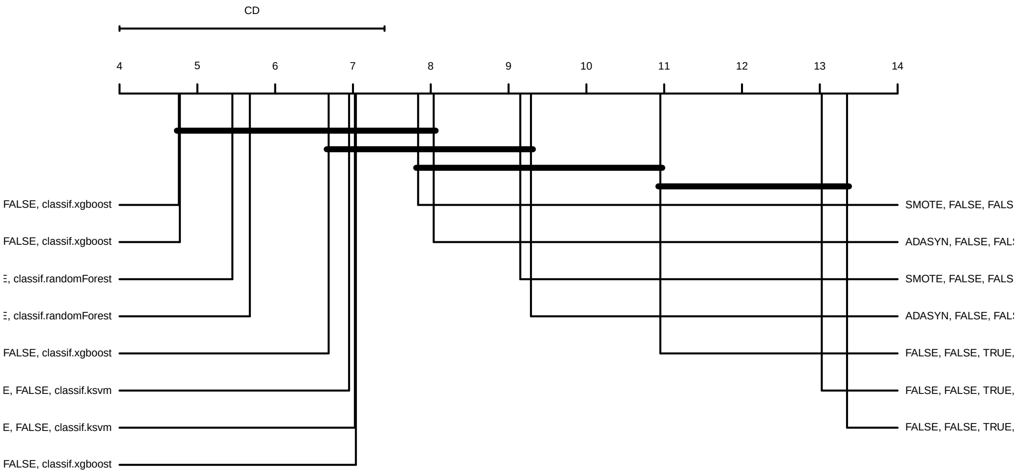
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                     9.2875
## ADASYN, FALSE, FALSE, classif.randomForest
##                                     8.0375
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                     7.0375
##          FALSE, FALSE, FALSE, classif.ksvm
##                                     7.0250
##  FALSE, FALSE, FALSE, classif.randomForest
##                                     5.4500
##       FALSE, FALSE, FALSE, classif.xgboost
##                                     4.7625
##           FALSE, FALSE, TRUE, classif.ksvm
##                                    10.9500
##   FALSE, FALSE, TRUE, classif.randomForest
##                                    13.0250
##        FALSE, FALSE, TRUE, classif.xgboost
##                                    13.3500
##           FALSE, TRUE, FALSE, classif.ksvm
##                                     6.9500
##   FALSE, TRUE, FALSE, classif.randomForest
##                                     5.6750
##        FALSE, TRUE, FALSE, classif.xgboost
##                                     4.7750
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                     9.1500
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                     7.8375
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                     6.6875
```

Plotando grafico de Critical Diference

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


CD
FALSE, classif.xgboost
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Ξ, classif.randomForest
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