R Notebook

Parametros:

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

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

Tratamento dos dados

Carregando data set compilado

```r
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        :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

```
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] 228  15
```

```
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                          0.9711549
## 2                          0.9711549
## 3                          0.9202676
## 4                          0.8927019
## 5                          0.9840938
## 6                          0.9840938
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.9639089
## 2                                  0.9639089
## 3                                  0.9103009
## 4                                  0.8782120
## 5                                  0.9843147
## 6                                  0.9834259
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.9729427                       -0.00331073
## 2                             0.9729427                       -0.00331073
## 3                             0.9344153                        0.02820236
## 4                             0.9147539                        0.08104013
## 5                             0.9882984                        0.03130559
## 6                             0.9882984                        0.03130559
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                0.00000000
## 2                                0.00000000
## 3                                0.02094578
## 4                                0.00000000
## 5                                0.37926532
## 6                                        NA
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                          0.000000000                       0.03775174
## 2                          0.000000000                       0.03775174
## 3                          0.005814705                       0.11727958
## 4                          0.023309858                       0.10888103
## 5                          0.398092630                       0.09124314
## 6                          0.398092630                       0.09124314
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                               0.04138595
## 2                               0.04138595
## 3                               0.12340753
## 4                               0.15998927
## 5                               0.16003091
## 6                               0.16003091
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                          0.05606272                     -0.002739151
## 2                          0.05606272                     -0.002739151
## 3                          0.11122935                      0.017467773
## 4                          0.15929430                      0.075901705
## 5                          0.15758863                      0.043297878
## 6                          0.15758863                      0.043297878
##   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                          0.00000000                         0.9694672
## 2                          0.00000000                         0.9694672
## 3                          0.05558296                         0.9235585
## 4                          0.02060981                         0.8913934
## 5                          0.41553378                         0.9861198
## 6                          0.41553378                         0.9861198
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.9644783
## 2                                 0.9644783
## 3                                 0.9052261
## 4                                 0.8809365
## 5                                        NA
## 6                                 0.9842461
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.9745849
## 2                            0.9745849
## 3                            0.9357333
## 4                            0.9077481
## 5                            0.9895432
## 6                            0.9895432
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.5483
##  1st Qu.:0.9557
##  Median :0.9899
##  Mean   :0.9620
##  3rd Qu.:0.9975
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.4102
##  1st Qu.:0.9716
##  Median :0.9934
##  Mean   :0.9723
##  3rd Qu.:0.9984
##  Max.   :1.0000
##  NA's   :25
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.4273                        Min.   :-0.003311
##  1st Qu.:0.9683                        1st Qu.: 0.000000
##  Median :0.9883                        Median : 0.210174
##  Mean   :0.9665                        Mean   : 0.310733
##  3rd Qu.:0.9974                        3rd Qu.: 0.565760
##  Max.   :1.0000                        Max.   : 1.000000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.1832
##  Median :0.5472
##  Mean   :0.5307
##  3rd Qu.:0.8672
##  Max.   :1.0000
##  NA's   :6
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :-0.004855                    Min.   :0.01683
##  1st Qu.: 0.242927                    1st Qu.:0.15656
##  Median : 0.643131                    Median :0.39562
##  Mean   : 0.570498                    Mean   :0.41145
##  3rd Qu.: 0.855521                    3rd Qu.:0.64835
##  Max.   : 1.000000                    Max.   :1.00000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.006784
##  1st Qu.:0.221089
##  Median :0.395617
##  Mean   :0.440705
##  3rd Qu.:0.637303
##  Max.   :1.000000
##  NA's   :6
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.004119                    Min.   :-0.002739
##  1st Qu.:0.198170                    1st Qu.: 0.000000
##  Median :0.366367                    Median : 0.199159
##  Mean   :0.405539                    Mean   : 0.304707
##  3rd Qu.:0.579288                    3rd Qu.: 0.536926
##  Max.   :1.000000                    Max.   : 1.000000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :-0.002022
##  1st Qu.: 0.157423
##  Median : 0.527450
##  Mean   : 0.527645
##  3rd Qu.: 0.873868
##  Max.   : 1.000000
##  NA's   :11
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :-0.001833                   Min.   :0.5423
##  1st Qu.: 0.245642                   1st Qu.:0.9570
##  Median : 0.633868                   Median :0.9905
##  Mean   : 0.570643                   Mean   :0.9616
##  3rd Qu.: 0.859893                   3rd Qu.:0.9988
##  Max.   : 1.000000                   Max.   :1.0000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.4552
##  1st Qu.:0.9708
##  Median :0.9926
##  Mean   :0.9729
##  3rd Qu.:0.9989
##  Max.   :1.0000
##  NA's   :20
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.3909
##  1st Qu.:0.9702
##  Median :0.9899
##  Mean   :0.9715
##  3rd Qu.:0.9974
##  Max.   :1.0000
##
```

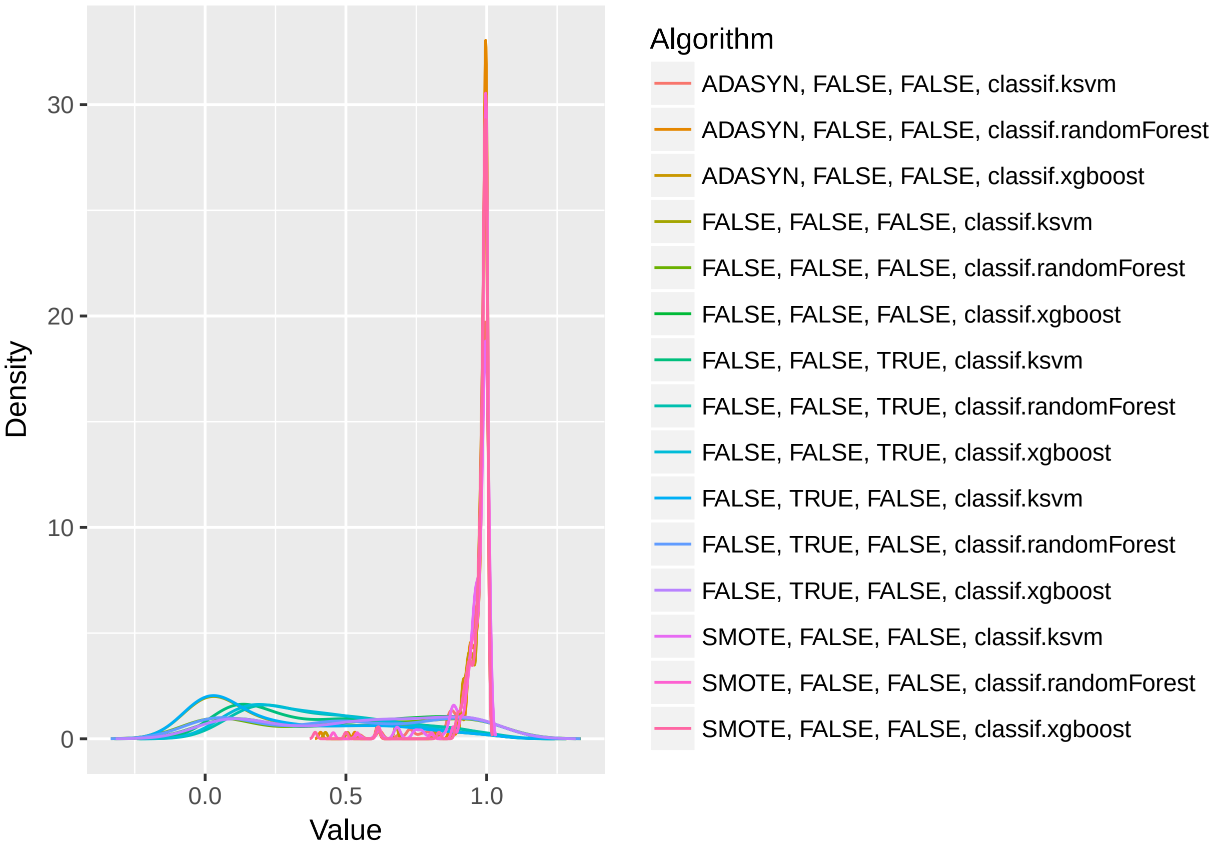
Verificando a média de cada coluna selecionada

```
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 = 0.961994214551935"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.972321766303781"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.966487678836997"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.310732475445047"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.530722387890025"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.570498273934176"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.411452317406682"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.440704888393628"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.405539345310321"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.304706805868436"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.5276454220385"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.570643543424285"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.961561133969507"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.972927544506485"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.971525555426833"
```

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 = 1939.3, 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,]                              TRUE
##  [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,]                                      TRUE
## [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,]                                 TRUE
##  [8,]                                 TRUE
##  [9,]                                 TRUE
## [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,]                             TRUE
##  [7,]                            FALSE
##  [8,]                            FALSE
##  [9,]                            FALSE
## [10,]                             TRUE
## [11,]                            FALSE
## [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                             TRUE
##  [2,]                                TRUE                             TRUE
##  [3,]                                TRUE                             TRUE
##  [4,]                               FALSE                            FALSE
##  [5,]                                TRUE                             TRUE
##  [6,]                                TRUE                             TRUE
##  [7,]                               FALSE                             TRUE
##  [8,]                               FALSE                             TRUE
##  [9,]                               FALSE                            FALSE
## [10,]                               FALSE                            FALSE
## [11,]                               FALSE                             TRUE
## [12,]                                TRUE                             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,]                                TRUE
##  [8,]                                TRUE
##  [9,]                                TRUE
## [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
```

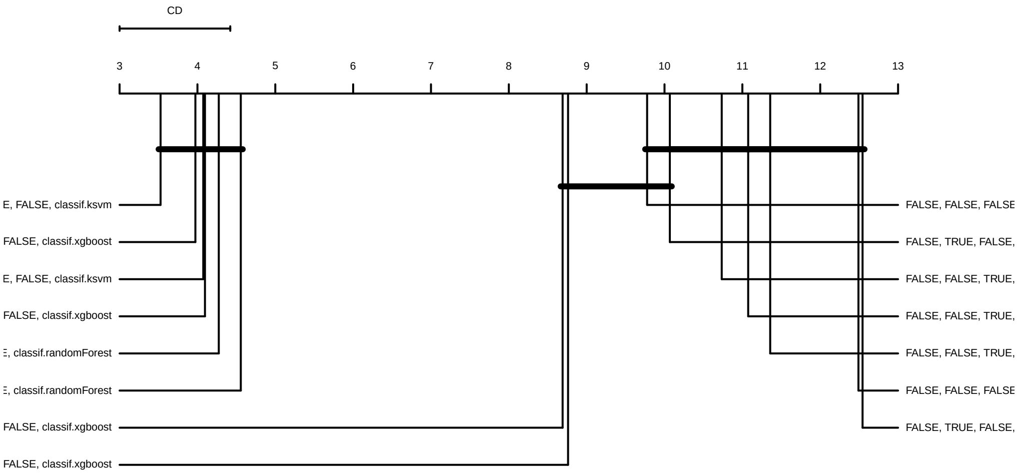
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm
##                                   4.074561
## ADASYN, FALSE, FALSE, classif.randomForest
##                                   4.557018
##      ADASYN, FALSE, FALSE, classif.xgboost
##                                   4.096491
##          FALSE, FALSE, FALSE, classif.ksvm
##                                  12.491228
##  FALSE, FALSE, FALSE, classif.randomForest
##                                   9.776316
##       FALSE, FALSE, FALSE, classif.xgboost
##                                   8.760965
##           FALSE, FALSE, TRUE, classif.ksvm
##                                  11.074561
##   FALSE, FALSE, TRUE, classif.randomForest
##                                  10.734649
##        FALSE, FALSE, TRUE, classif.xgboost
##                                  11.357456
##           FALSE, TRUE, FALSE, classif.ksvm
##                                  12.543860
##   FALSE, TRUE, FALSE, classif.randomForest
##                                  10.067982
##        FALSE, TRUE, FALSE, classif.xgboost
##                                   8.690789
##          SMOTE, FALSE, FALSE, classif.ksvm
##                                   3.526316
##  SMOTE, FALSE, FALSE, classif.randomForest
##                                   4.274123
##       SMOTE, FALSE, FALSE, classif.xgboost
##                                   3.973684
```

Plotando grafico de Critical Diference

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


CD
E, FALSE, classif.ksvm
FALSE, classif.xgboost
E, FALSE, classif.ksvm
FALSE, classif.xgboost
E, classif.randomForest
E, classif.randomForest
FALSE, classif.xgboost
FALSE, classif.xgboost
FALSE, FALSE, FALSE
FALSE, TRUE, FALSE,
FALSE, FALSE, TRUE,
FALSE, FALSE, TRUE,
FALSE, FALSE, TRUE,
FALSE, FALSE, FALSE
FALSE, TRUE, FALSE,