R Notebook

Parametros:

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

```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

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

Filtrando o data set

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

summary(ds)
```

```
##                  learner     weight_space
##  classif.ksvm        :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

```r
ds = group_by(ds, learner , weight_space , measure , sampling , underbagging , dataset , imba.rate)
ds = summarise(ds, tuning_measure = mean(tuning_measure), holdout_measure = mean(holdout_measure),
               holdout_measure_residual = mean(holdout_measure_residual))

ds = as.data.frame(ds)
```

Criando dataframe

```
# 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
```

```
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                         0.11482128
## 2                         0.19240139
## 3                         0.42592593
## 4                         0.00000000
## 5                         1.00000000
## 6                         0.03333333
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.1101246
## 2                                         NA
## 3                                  0.7575092
## 4                                  0.2222222
## 5                                  1.0000000
## 6                                  0.3091016
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                            0.08612787                         0.1529369
## 2                            0.47906509                         0.2891669
## 3                            0.81663435                         0.3285714
## 4                            0.71111111                         0.0000000
## 5                            1.00000000                         1.0000000
## 6                            0.28633208                         0.2166694
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.0000000
## 2                                 0.4757640
## 3                                 0.7964052
## 4                                 0.5777778
## 5                                 1.0000000
## 6                                 0.2060694
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                           0.01960784                        0.1331912
## 2                           0.48854872                        0.2629873
## 3                           0.60916861                        0.3997910
## 4                           0.55555556                        0.1582959
## 5                           1.00000000                        0.9523810
## 6                           0.28650352                        0.1695055
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.1516397
## 2                                       NA
## 3                                0.4494949
## 4                                0.4219577
## 5                                0.9047619
## 6                                0.2964672
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.1572054                        0.1263895
## 2                           0.3164026                        0.3003710
## 3                           0.4472222                        0.3444444
## 4                           0.4656085                        0.0000000
## 5                           0.7555556                        1.0000000
## 6                           0.2999118                        0.1472620
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                                0.0000000
## 2                                       NA
## 3                                0.7124871
## 4                                0.6555556
## 5                                1.0000000
## 6                                0.2060694
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                           0.0000000                         0.1426888
## 2                           0.4985972                         0.2291537
## 3                           0.5185185                         0.3619529
## 4                           0.7222222                         0.0000000
## 5                           1.0000000                         0.7666667
## 6                           0.2487880                         0.0932914
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.1244320
## 2                                        NA
## 3                                 0.8328431
## 4                                 0.3888889
## 5                                 1.0000000
## 6                                 0.2516727
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.1571411
## 2                            0.4810402
## 3                            0.8633987
## 4                            0.7777778
## 5                            1.0000000
## 6                            0.2902838
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.2222
##  Mean   :0.3346
##  3rd Qu.:0.6667
##  Max.   :1.0000
##  NA's   :1
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.3723
##  Median :0.6825
##  Mean   :0.5985
##  3rd Qu.:0.8792
##  Max.   :1.0000
##  NA's   :5
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                        Min.   :0.0000
##  1st Qu.:0.3803                        1st Qu.:0.0000
##  Median :0.7144                        Median :0.2056
##  Mean   :0.6182                        Mean   :0.3031
##  3rd Qu.:0.8746                        3rd Qu.:0.5500
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2222
##  Median :0.6000
##  Mean   :0.5554
##  3rd Qu.:0.8849
##  Max.   :1.0000
##  NA's   :1
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.0000                       Min.   :0.06515
##  1st Qu.:0.2494                       1st Qu.:0.17906
##  Median :0.6647                       Median :0.39119
##  Mean   :0.5784                       Mean   :0.43139
##  3rd Qu.:0.8476                       3rd Qu.:0.62527
##  Max.   :1.0000                       Max.   :0.98030
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.06886
##  1st Qu.:0.24500
##  Median :0.46174
##  Mean   :0.49703
##  3rd Qu.:0.74651
##  Max.   :1.00000
##  NA's   :3
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.07637                     Min.   :0.0000
##  1st Qu.:0.25815                     1st Qu.:0.0000
##  Median :0.41770                     Median :0.1865
##  Mean   :0.47140                     Mean   :0.2977
##  3rd Qu.:0.67242                     3rd Qu.:0.5303
##  Max.   :1.00000                     Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2222
##  Median :0.6556
##  Mean   :0.5623
##  3rd Qu.:0.8801
##  Max.   :1.0000
##  NA's   :3
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.0000                      Min.   :0.00000
##  1st Qu.:0.1944                      1st Qu.:0.01353
##  Median :0.6741                      Median :0.26698
##  Mean   :0.5596                      Mean   :0.33683
##  3rd Qu.:0.8617                      3rd Qu.:0.64701
##  Max.   :1.0000                      Max.   :1.00000
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.0000
##  1st Qu.:0.2801
##  Median :0.6974
##  Mean   :0.6011
##  3rd Qu.:0.9047
##  Max.   :1.0000
##  NA's   :4
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.0000
##  1st Qu.:0.3967
##  Median :0.7111
##  Mean   :0.6259
##  3rd Qu.:0.9211
##  Max.   :1.0000
##
```

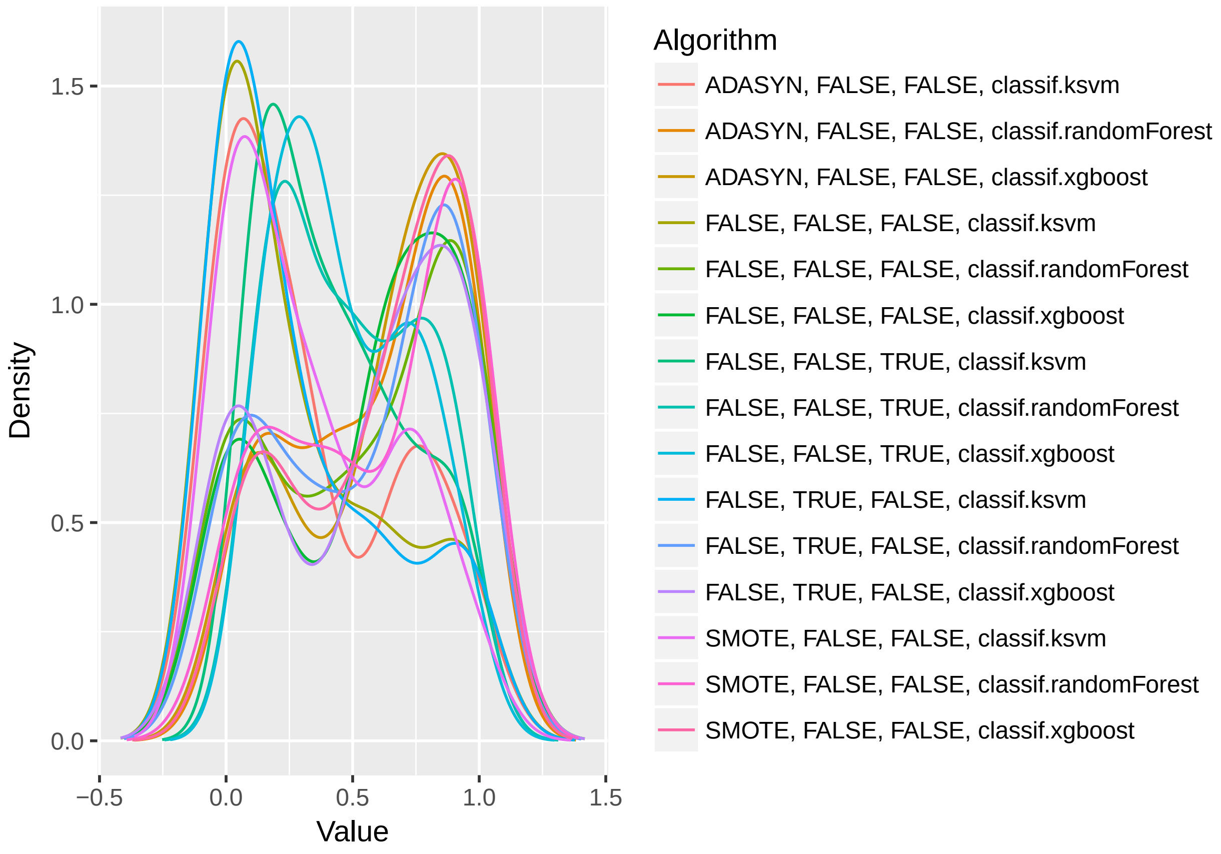
Verificando a média de cada coluna selecionada

```
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 = 0.334574489595268"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.598483955405256"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.618226612863882"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.303114132133715"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.555409954365357"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.578430313726661"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.43138644517747"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.497026798711374"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.471402297071855"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.297729388148578"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.562325380993278"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.559558409430232"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.336827506230979"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.601108904055108"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.625878252923021"
```

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 = 273.03, 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,]                               TRUE
##  [3,]                               TRUE
##  [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,]                                      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
##       ADASYN, FALSE, FALSE, classif.xgboost
##  [1,]                                  TRUE
##  [2,]                                 FALSE
##  [3,]                                 FALSE
##  [4,]                                  TRUE
##  [5,]                                 FALSE
##  [6,]                                 FALSE
##  [7,]                                  TRUE
##  [8,]                                  TRUE
##  [9,]                                  TRUE
## [10,]                                  TRUE
## [11,]                                 FALSE
## [12,]                                 FALSE
## [13,]                                  TRUE
## [14,]                                 FALSE
## [15,]                                 FALSE
##         FALSE, FALSE, FALSE, classif.ksvm
##  [1,]                             FALSE
##  [2,]                              TRUE
##  [3,]                              TRUE
##  [4,]                             FALSE
##  [5,]                              TRUE
##  [6,]                              TRUE
##  [7,]                             FALSE
##  [8,]                              TRUE
##  [9,]                              TRUE
## [10,]                             FALSE
## [11,]                              TRUE
## [12,]                              TRUE
## [13,]                             FALSE
## [14,]                              TRUE
## [15,]                              TRUE
##         FALSE, FALSE, FALSE, classif.randomForest
##  [1,]                                      TRUE
##  [2,]                                     FALSE
##  [3,]                                     FALSE
##  [4,]                                      TRUE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                     FALSE
##  [8,]                                     FALSE
##  [9,]                                     FALSE
## [10,]                                      TRUE
## [11,]                                     FALSE
## [12,]                                     FALSE
## [13,]                                      TRUE
## [14,]                                     FALSE
## [15,]                                      TRUE
##         FALSE, FALSE, FALSE, classif.xgboost
##  [1,]                                 TRUE
##  [2,]                                FALSE
##  [3,]                                FALSE
##  [4,]                                 TRUE
##  [5,]                                FALSE
##  [6,]                                FALSE
##  [7,]                                 TRUE
##  [8,]                                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,]                            FALSE
##  [6,]                             TRUE
##  [7,]                            FALSE
##  [8,]                            FALSE
##  [9,]                            FALSE
## [10,]                            FALSE
## [11,]                            FALSE
## [12,]                            FALSE
## [13,]                            FALSE
## [14,]                             TRUE
## [15,]                             TRUE
##       FALSE, FALSE, TRUE, classif.randomForest
##  [1,]                                    FALSE
##  [2,]                                    FALSE
##  [3,]                                     TRUE
##  [4,]                                     TRUE
##  [5,]                                    FALSE
##  [6,]                                    FALSE
##  [7,]                                    FALSE
##  [8,]                                    FALSE
##  [9,]                                    FALSE
## [10,]                                     TRUE
## [11,]                                    FALSE
## [12,]                                    FALSE
## [13,]                                    FALSE
## [14,]                                     TRUE
## [15,]                                     TRUE
##       FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  [1,]                               FALSE                            FALSE
##  [2,]                               FALSE                             TRUE
##  [3,]                                TRUE                             TRUE
##  [4,]                                TRUE                            FALSE
##  [5,]                               FALSE                             TRUE
##  [6,]                               FALSE                             TRUE
##  [7,]                               FALSE                            FALSE
##  [8,]                               FALSE                             TRUE
##  [9,]                               FALSE                             TRUE
## [10,]                                TRUE                            FALSE
## [11,]                               FALSE                             TRUE
## [12,]                               FALSE                             TRUE
## [13,]                               FALSE                            FALSE
## [14,]                                TRUE                             TRUE
## [15,]                                TRUE                             TRUE
##       FALSE, TRUE, FALSE, classif.randomForest
##  [1,]                                     TRUE
##  [2,]                                    FALSE
##  [3,]                                    FALSE
##  [4,]                                     TRUE
##  [5,]                                    FALSE
##  [6,]                                    FALSE
##  [7,]                                    FALSE
##  [8,]                                    FALSE
##  [9,]                                    FALSE
## [10,]                                     TRUE
## [11,]                                    FALSE
## [12,]                                    FALSE
## [13,]                                     TRUE
## [14,]                                    FALSE
## [15,]                                     TRUE
##        FALSE, TRUE, FALSE, classif.xgboost
##  [1,]                                TRUE
##  [2,]                               FALSE
##  [3,]                               FALSE
##  [4,]                                TRUE
##  [5,]                               FALSE
##  [6,]                               FALSE
##  [7,]                               FALSE
##  [8,]                               FALSE
##  [9,]                               FALSE
## [10,]                                TRUE
## [11,]                               FALSE
## [12,]                               FALSE
## [13,]                                TRUE
## [14,]                               FALSE
## [15,]                                TRUE
##        SMOTE, FALSE, FALSE, classif.ksvm
##  [1,]                             FALSE
##  [2,]                              TRUE
##  [3,]                              TRUE
##  [4,]                             FALSE
##  [5,]                              TRUE
##  [6,]                              TRUE
##  [7,]                             FALSE
##  [8,]                             FALSE
##  [9,]                             FALSE
## [10,]                             FALSE
## [11,]                              TRUE
## [12,]                              TRUE
## [13,]                             FALSE
## [14,]                              TRUE
## [15,]                              TRUE
##        SMOTE, 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
##        SMOTE, FALSE, FALSE, classif.xgboost
##  [1,]                                 TRUE
##  [2,]                               FALSE
##  [3,]                               FALSE
##  [4,]                                TRUE
##  [5,]                                TRUE
##  [6,]                               FALSE
##  [7,]                                TRUE
##  [8,]                                TRUE
##  [9,]                                TRUE
## [10,]                                TRUE
## [11,]                                TRUE
## [12,]                                TRUE
## [13,]                                TRUE
## [14,]                               FALSE
## [15,]                               FALSE
```

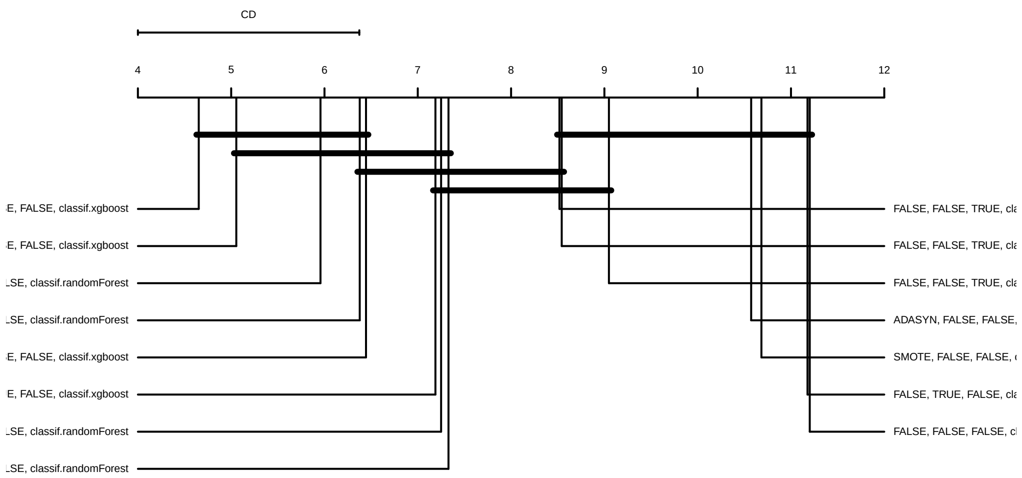
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm 
##                                  10.573171 
## ADASYN, FALSE, FALSE, classif.randomForest 
##                                   6.378049 
##      ADASYN, FALSE, FALSE, classif.xgboost 
##                                   5.054878 
##          FALSE, FALSE, FALSE, classif.ksvm 
##                                  11.201220 
##  FALSE, FALSE, FALSE, classif.randomForest 
##                                   7.250000 
##       FALSE, FALSE, FALSE, classif.xgboost 
##                                   6.445122 
##           FALSE, FALSE, TRUE, classif.ksvm 
##                                   9.048780 
##   FALSE, FALSE, TRUE, classif.randomForest 
##                                   8.518293 
##        FALSE, FALSE, TRUE, classif.xgboost 
##                                   8.542683 
##           FALSE, TRUE, FALSE, classif.ksvm 
##                                  11.176829 
##   FALSE, TRUE, FALSE, classif.randomForest 
##                                   7.329268 
##        FALSE, TRUE, FALSE, classif.xgboost 
##                                   7.189024 
##          SMOTE, FALSE, FALSE, classif.ksvm 
##                                  10.682927 
##  SMOTE, FALSE, FALSE, classif.randomForest 
##                                   5.957317 
##       SMOTE, FALSE, FALSE, classif.xgboost 
##                                   4.652439
```

Plotando grafico de Critical Diference

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


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