R Notebook

Parametros:

Measure = Accuracy
Columns = sampling, weight_space, underbagging, learner
Performance = holdout_measure
Filter keys = imba.rate
Filter values = 0.03

```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        :990   Mode :logical
##  classif.randomForest:990   FALSE:2376
##  classif.rusboost    :  0   TRUE :594
##  classif.xgboost     :990   NA's :0
##
##
##
##                               measure       sampling    underbagging
##  Accuracy                        :2970   ADASYN: 594   Mode :logical
##  Area under the curve            :   0   FALSE :1782   FALSE:2376
##  F1 measure                      :   0   SMOTE : 594   TRUE :594
##  G-mean                          :   0                 NA's :0
##  Matthews correlation coefficient:   0
##
##
##  tuning_measure    holdout_measure   holdout_measure_residual
##  Min.   :0.09041   Min.   :0.02655   Min.   :0.0346
##  1st Qu.:0.96926   1st Qu.:0.96647   1st Qu.:0.3599
##  Median :0.98130   Median :0.97619   Median :0.6882
##  Mean   :0.95405   Mean   :0.94750   Mean   :0.6478
##  3rd Qu.:0.99560   3rd Qu.:0.99045   3rd Qu.:0.9438
##  Max.   :1.00000   Max.   :1.00000   Max.   :1.0000
##  NA's   :57        NA's   :57        NA's   :57
##  iteration_count          dataset       imba.rate
##  Min.   :1       abalone      :  45   Min.   :0.03
##  1st Qu.:1       adult        :  45   1st Qu.:0.03
##  Median :2       annealing    :  45   Median :0.03
##  Mean   :2       arrhythmia   :  45   Mean   :0.03
##  3rd Qu.:3       balance-scale:  45   3rd Qu.:0.03
##  Max.   :3       bank         :  45   Max.   :0.03
##  NA's   :57      (Other)      :2700
```

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] 66 15
```

```
# Renomeando a variavel
df = df_tec_wide_residual

head(df)
```

```
##   ADASYN, FALSE, FALSE, classif.ksvm
## 1                          0.9175199
## 2                          0.9477612
## 3                          0.9571429
## 4                          0.9767442
## 5                          0.9898990
## 6                          0.9584860
##   ADASYN, FALSE, FALSE, classif.randomForest
## 1                                  0.9340159
## 2                                         NA
## 3                                  0.9714286
## 4                                  0.9689922
## 5                                  1.0000000
## 6                                         NA
##   ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
## 1                             0.9544937                         0.9476678
## 2                             0.9707384                         0.9658288
## 3                             0.9690476                         0.9690476
## 4                             0.9806202                         0.9767442
## 5                             1.0000000                         1.0000000
## 6                             0.9658120                         0.9711030
##   FALSE, FALSE, FALSE, classif.randomForest
## 1                                 0.9709898
## 2                                        NA
## 3                                 0.9833333
## 4                                 0.9728682
## 5                                 1.0000000
## 6                                 0.9715100
##   FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
## 1                            0.9709898                        0.6080774
## 2                            0.9764991                        0.9109715
## 3                            0.9690476                        0.9666667
## 4                            0.9767442                        0.8178295
## 5                            1.0000000                        0.9747475
## 6                            0.9702890                        0.3549044
##   FALSE, FALSE, TRUE, classif.randomForest
## 1                                0.6160410
## 2                                0.7896701
## 3                                0.8761905
## 4                                0.9186047
## 5                                0.9595960
## 6                                0.8156288
##   FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
## 1                           0.6427759                        0.9607509
## 2                           0.8133019                        0.9655669
## 3                           0.8333333                        0.9690476
## 4                           0.9108527                        0.9767442
## 5                           0.9040404                        1.0000000
## 6                           0.7952788                        0.9711030
##   FALSE, TRUE, FALSE, classif.randomForest
## 1                                0.9709898
## 2                                0.9768919
## 3                                0.9880952
## 4                                0.9806202
## 5                                1.0000000
## 6                                0.9706960
##   FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
## 1                           0.9709898                         0.9124005
## 2                           0.9779393                         0.9476957
## 3                           0.9714286                         0.9642857
## 4                           0.9806202                         0.9767442
## 5                           1.0000000                         0.9949495
## 6                           0.9702890                         0.9682540
##   SMOTE, FALSE, FALSE, classif.randomForest
## 1                                 0.9379977
## 2                                 0.9579733
## 3                                 0.9690476
## 4                                 0.9689922
## 5                                 1.0000000
## 6                                 0.9601140
##   SMOTE, FALSE, FALSE, classif.xgboost
## 1                            0.9493743
## 2                            0.9725714
## 3                            0.9666667
## 4                            0.9573643
## 5                            1.0000000
## 6                            0.9584860
```

```r
summary(df)
```

```
##  ADASYN, FALSE, FALSE, classif.ksvm
##  Min.   :0.5458
##  1st Qu.:0.9637
##  Median :0.9729
##  Mean   :0.9641
##  3rd Qu.:0.9831
##  Max.   :1.0000
##  NA's   :2
##  ADASYN, FALSE, FALSE, classif.randomForest
##  Min.   :0.5839
##  1st Qu.:0.9672
##  Median :0.9817
##  Mean   :0.9714
##  3rd Qu.:0.9948
##  Max.   :1.0000
##  NA's   :7
##  ADASYN, FALSE, FALSE, classif.xgboost FALSE, FALSE, FALSE, classif.ksvm
##  Min.   :0.5861                        Min.   :0.9457
##  1st Qu.:0.9622                        1st Qu.:0.9709
##  Median :0.9860                        Median :0.9759
##  Mean   :0.9719                        Mean   :0.9777
##  3rd Qu.:0.9951                        3rd Qu.:0.9831
##  Max.   :1.0000                        Max.   :1.0000
##
##  FALSE, FALSE, FALSE, classif.randomForest
##  Min.   :0.9633
##  1st Qu.:0.9746
##  Median :0.9835
##  Mean   :0.9837
##  3rd Qu.:0.9937
##  Max.   :1.0000
##  NA's   :2
##  FALSE, FALSE, FALSE, classif.xgboost FALSE, FALSE, TRUE, classif.ksvm
##  Min.   :0.9633                       Min.   :0.05952
##  1st Qu.:0.9739                       1st Qu.:0.66525
##  Median :0.9846                       Median :0.94300
##  Mean   :0.9840                       Mean   :0.79717
##  3rd Qu.:0.9937                       3rd Qu.:0.97562
##  Max.   :1.0000                       Max.   :1.00000
##
##  FALSE, FALSE, TRUE, classif.randomForest
##  Min.   :0.3923
##  1st Qu.:0.8055
##  Median :0.9158
##  Mean   :0.8631
##  3rd Qu.:0.9658
##  Max.   :1.0000
##  NA's   :2
##  FALSE, FALSE, TRUE, classif.xgboost FALSE, TRUE, FALSE, classif.ksvm
##  Min.   :0.3274                      Min.   :0.9496
##  1st Qu.:0.7733                      1st Qu.:0.9708
##  Median :0.9107                      Median :0.9752
##  Mean   :0.8508                      Mean   :0.9778
##  3rd Qu.:0.9586                      3rd Qu.:0.9832
##  Max.   :1.0000                      Max.   :1.0000
##
##  FALSE, TRUE, FALSE, classif.randomForest
##  Min.   :0.9596
##  1st Qu.:0.9747
##  Median :0.9817
##  Mean   :0.9838
##  3rd Qu.:0.9934
##  Max.   :1.0000
##  NA's   :1
##  FALSE, TRUE, FALSE, classif.xgboost SMOTE, FALSE, FALSE, classif.ksvm
##  Min.   :0.9633                      Min.   :0.5447
##  1st Qu.:0.9747                      1st Qu.:0.9698
##  Median :0.9827                      Median :0.9726
##  Mean   :0.9840                      Mean   :0.9649
##  3rd Qu.:0.9936                      3rd Qu.:0.9818
##  Max.   :1.0000                      Max.   :0.9990
##
##  SMOTE, FALSE, FALSE, classif.randomForest
##  Min.   :0.5534
##  1st Qu.:0.9664
##  Median :0.9808
##  Mean   :0.9708
##  3rd Qu.:0.9937
##  Max.   :1.0000
##  NA's   :5
##  SMOTE, FALSE, FALSE, classif.xgboost
##  Min.   :0.5534
##  1st Qu.:0.9600
##  Median :0.9839
##  Mean   :0.9714
##  3rd Qu.:0.9961
##  Max.   :1.0000
##
```

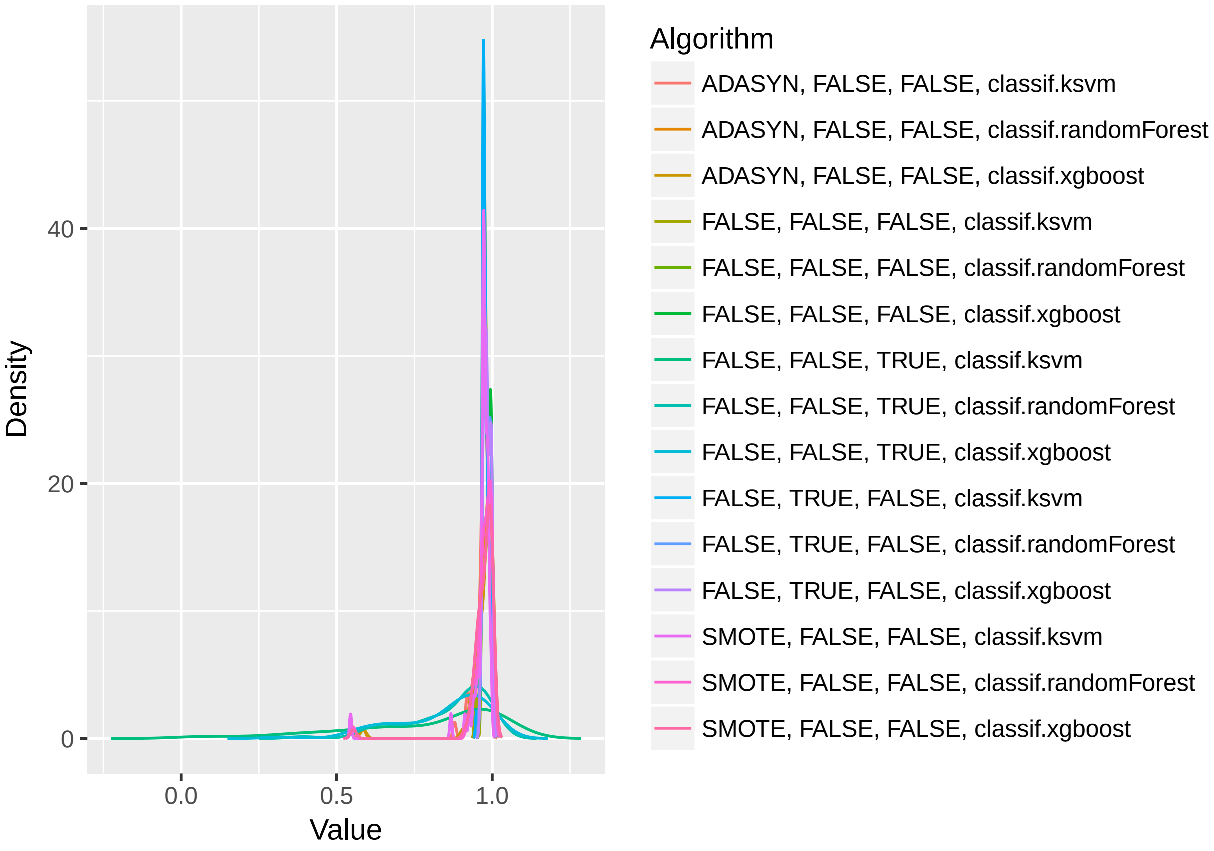
Verificando a média de cada coluna selecionada

```
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 = 0.964062348299677"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.randomForest = 0.971404284902596"
## [1] "Media da coluna ADASYN, FALSE, FALSE, classif.xgboost = 0.971895708302867"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.ksvm = 0.97772953557104"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.randomForest = 0.983664863584591"
## [1] "Media da coluna FALSE, FALSE, FALSE, classif.xgboost = 0.984003603270289"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.ksvm = 0.797170131347226"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.randomForest = 0.863073202585973"
## [1] "Media da coluna FALSE, FALSE, TRUE, classif.xgboost = 0.850793979840824"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.ksvm = 0.977762884889045"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.randomForest = 0.983770098293553"
## [1] "Media da coluna FALSE, TRUE, FALSE, classif.xgboost = 0.98402308460922"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.ksvm = 0.964911242264743"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.randomForest = 0.970753550509565"
## [1] "Media da coluna SMOTE, FALSE, FALSE, classif.xgboost = 0.971398212090727"
```

Fazendo teste de normalidade

```r
plotDensities(data = na.omit(df))
```



Testando as diferencas

```r
friedmanTest(df)
```

```
##
##  Friedman's rank sum test
##
## data:  df
## Friedman's chi-squared = 403.4, 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,]                               TRUE
##  [4,]                              FALSE
##  [5,]                               TRUE
##  [6,]                               TRUE
##  [7,]                              FALSE
##  [8,]                               TRUE
##  [9,]                               TRUE
## [10,]                              FALSE
## [11,]                               TRUE
## [12,]                               TRUE
## [13,]                              FALSE
## [14,]                              FALSE
## [15,]                               TRUE
##       ADASYN, FALSE, FALSE, classif.randomForest
##  [1,]                                      FALSE
##  [2,]                                      FALSE
##  [3,]                                      FALSE
##  [4,]                                      FALSE
##  [5,]                                      FALSE
##  [6,]                                       TRUE
##  [7,]                                       TRUE
##  [8,]                                       TRUE
##  [9,]                                       TRUE
## [10,]                                      FALSE
## [11,]                                      FALSE
## [12,]                                       TRUE
## [13,]                                      FALSE
## [14,]                                      FALSE
## [15,]                                      FALSE
##       ADASYN, 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, FALSE, classif.ksvm
##  [1,]                             FALSE
##  [2,]                             FALSE
##  [3,]                             FALSE
##  [4,]                             FALSE
##  [5,]                             FALSE
##  [6,]                              TRUE
##  [7,]                              TRUE
##  [8,]                              TRUE
##  [9,]                              TRUE
## [10,]                             FALSE
## [11,]                             FALSE
## [12,]                              TRUE
## [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,]                                 TRUE
##  [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, TRUE, classif.ksvm
##  [1,]                            FALSE
##  [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.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                             TRUE
##  [7,]                               FALSE                             TRUE
##  [8,]                               FALSE                             TRUE
##  [9,]                               FALSE                             TRUE
## [10,]                                TRUE                            FALSE
## [11,]                                TRUE                            FALSE
## [12,]                                TRUE                             TRUE
## [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,]                                TRUE
##  [3,]                               FALSE
##  [4,]                                TRUE
##  [5,]                               FALSE
##  [6,]                               FALSE
##  [7,]                                TRUE
##  [8,]                                TRUE
##  [9,]                                TRUE
## [10,]                                TRUE
## [11,]                               FALSE
## [12,]                               FALSE
## [13,]                                TRUE
## [14,]                                TRUE
## [15,]                               FALSE
##       SMOTE, FALSE, FALSE, classif.ksvm
##  [1,]                             FALSE
##  [2,]                             FALSE
##  [3,]                              TRUE
##  [4,]                             FALSE
##  [5,]                              TRUE
##  [6,]                              TRUE
##  [7,]                              TRUE
##  [8,]                              TRUE
##  [9,]                              TRUE
## [10,]                             FALSE
## [11,]                              TRUE
## [12,]                              TRUE
## [13,]                             FALSE
## [14,]                             FALSE
## [15,]                              TRUE
##       SMOTE, FALSE, FALSE, classif.randomForest
##  [1,]                                     FALSE
##  [2,]                                     FALSE
##  [3,]                                     FALSE
##  [4,]                                     FALSE
##  [5,]                                     FALSE
##  [6,]                                     FALSE
##  [7,]                                      TRUE
##  [8,]                                      TRUE
##  [9,]                                      TRUE
## [10,]                                     FALSE
## [11,]                                     FALSE
## [12,]                                      TRUE
## [13,]                                     FALSE
## [14,]                                     FALSE
## [15,]                                     FALSE
##       SMOTE, 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
```

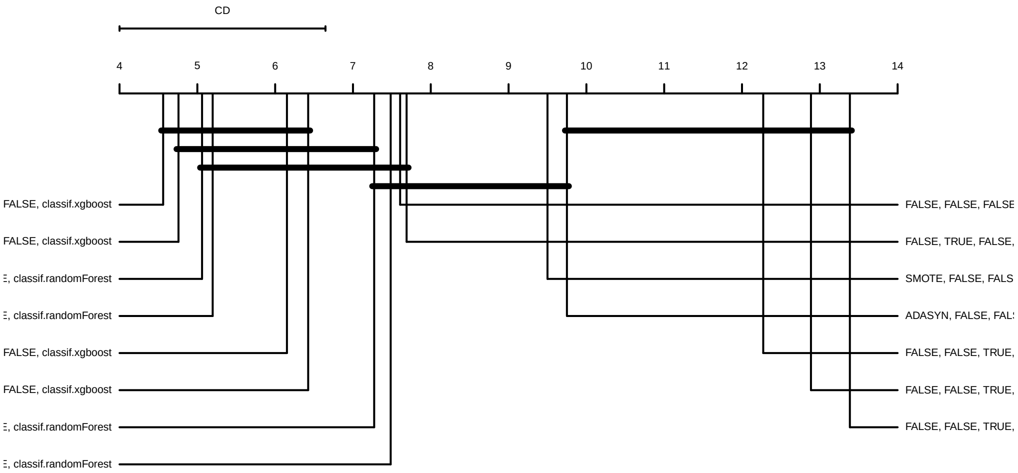
Plotando os ranks

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

```
##         ADASYN, FALSE, FALSE, classif.ksvm 
##                                   9.750000 
## ADASYN, FALSE, FALSE, classif.randomForest 
##                                   7.484848 
##      ADASYN, FALSE, FALSE, classif.xgboost 
##                                   6.151515 
##          FALSE, FALSE, FALSE, classif.ksvm 
##                                   7.606061 
##  FALSE, FALSE, FALSE, classif.randomForest 
##                                   5.196970 
##       FALSE, FALSE, FALSE, classif.xgboost 
##                                   4.757576 
##           FALSE, FALSE, TRUE, classif.ksvm 
##                                  12.272727 
##   FALSE, FALSE, TRUE, classif.randomForest 
##                                  12.886364 
##        FALSE, FALSE, TRUE, classif.xgboost 
##                                  13.386364 
##           FALSE, TRUE, FALSE, classif.ksvm 
##                                   7.689394 
##   FALSE, TRUE, FALSE, classif.randomForest 
##                                   5.060606 
##        FALSE, TRUE, FALSE, classif.xgboost 
##                                   4.560606 
##          SMOTE, FALSE, FALSE, classif.ksvm 
##                                   9.500000 
##  SMOTE, FALSE, FALSE, classif.randomForest 
##                                   7.272727 
##       SMOTE, FALSE, FALSE, classif.xgboost 
##                                   6.424242
```

Plotando grafico de Critical Diference

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


CD
FALSE, classif.xgboost
FALSE, classif.xgboost
Ξ, classif.randomForest
Ξ, classif.randomForest
FALSE, classif.xgboost
FALSE, classif.xgboost
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FALSE, FALSE, FALSE
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ADASYN, FALSE, FAL!
FALSE, FALSE, TRUE,
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FALSE, FALSE, TRUE,