Parkinson: Decorrelation-Based Feature Discovery

Jose Tamez

2022-10-04

Table of Contents

# Outputs Analysis and Graphics: Effect of GDSTM-Based Decorrelation on Feature Discovery

This will load the results of the Parkinson Analysis and create the outputs.

## From the original

Here we showcase of to use BSWiMS feature selection/modeling function coupled with Goal Driven Sparse Transformation Matrix (GDSTM) as a pre-processing step to decorrelate highly correlated features. The aim is to discover decorrelate features hidden between the highly correlated features.

This demo will use:

* FRESA.CAD::GDSTMDecorrelation(). For Decorrelation of Multidimensional data sets
  + FRESA.CAD::getDerivedCoefficients(). For the extraction of the decorrelated features.
* FRESA.CAD::randomCV() For the cross-validation of the Machine Learning models
* FRESA.CAD::BSWiMS.model(). For the generation of bootstrapped logistic models
  + FRESA.CAD::summary(). For the summary description of the BSWiMS model
* FRESA.CAD::predictionStats\_binary(). For describing the performance of the model
* heatmap.2(). For displaying the correlation matrix
* vioplot::vioplot(). For the display of the z-distribution of significant features.

### Loading the libraries

library("FRESA.CAD")  
library(readxl)  
library(vioplot)  
library(igraph)  
  
op <- par(no.readonly = TRUE)

## Material and Methods

### Signed Log Transform

The function will be used to transform all the continuous features of the data

signedlog <- function(x) { return (sign(x)\*log(abs(x)+1.0e-12))}

## Data: The Parkinson Data-Set

The data to process is described in:

Erdogdu Sakar, Betul, Gorkem Serbes, and C. Okan Sakar. “Analyzing the effectiveness of vocal features in early telediagnosis of Parkinson’s disease.” *PloS one* 12, no. 8 (2017): e0182428.

The data was obtained from the UCI ML repository:

<https://archive.ics.uci.edu/ml/datasets/Parkinson%27s+Disease+Classification>

I added a column to the data identifying the repeated experiments.

load(file="~/GitHub/FCA/ParkinsonDemo.RData")  
  
namecode <- read.csv("~/GitHub/FCA/Data/Parkinson\_names.csv")

### The Average of the Three Repetitions

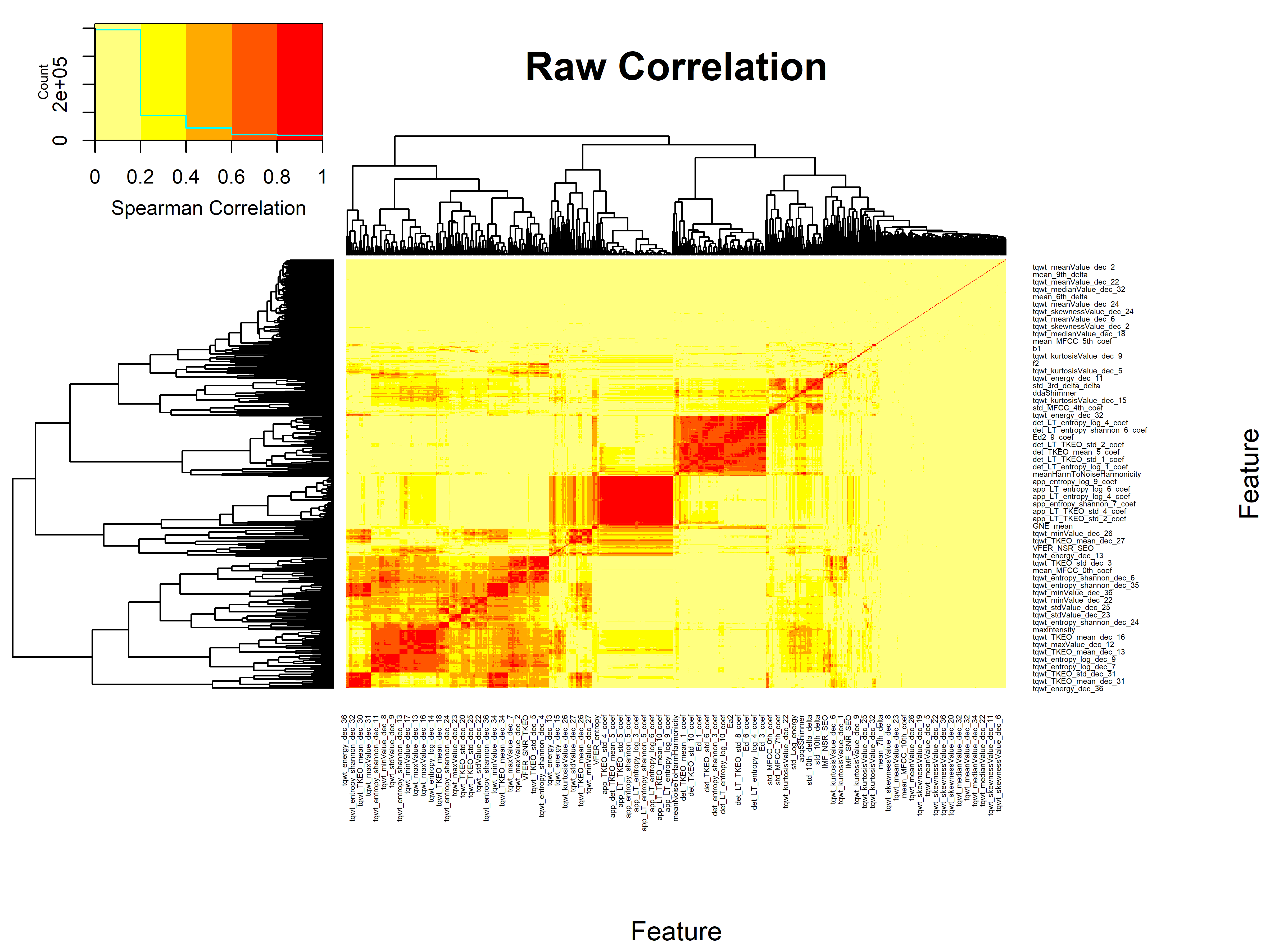
Each subject had three repeated observations. Here I’ll use the average of the three experiments per subject.

# rep1Parkison <- subset(pd\_speech\_features,RID==1)  
# rownames(rep1Parkison) <- rep1Parkison$id  
# rep1Parkison$id <- NULL  
# rep1Parkison$RID <- NULL  
# rep1Parkison[,1:ncol(rep1Parkison)] <- sapply(rep1Parkison,as.numeric)  
#   
# rep2Parkison <- subset(pd\_speech\_features,RID==2)  
# rownames(rep2Parkison) <- rep2Parkison$id  
# rep2Parkison$id <- NULL  
# rep2Parkison$RID <- NULL  
# rep2Parkison[,1:ncol(rep2Parkison)] <- sapply(rep2Parkison,as.numeric)  
#   
# rep3Parkison <- subset(pd\_speech\_features,RID==3)  
# rownames(rep3Parkison) <- rep3Parkison$id  
# rep3Parkison$id <- NULL  
# rep3Parkison$RID <- NULL  
# rep3Parkison[,1:ncol(rep3Parkison)] <- sapply(rep3Parkison,as.numeric)  
#   
# whof <- !(colnames(rep1Parkison) %in% c("gender","class"));  
# avgParkison <- rep1Parkison;  
# avgParkison[,whof] <- (rep1Parkison[,whof] + rep2Parkison[,whof] + rep3Parkison[,whof])/3  
# ## I apply the log transform to the data  
# avgParkison[,whof] <- signedlog(avgParkison[,whof])  
# pander::pander(table(avgParkison$class))

### Correlation Matrix of the Parkinson Data

The heat-map of the correlation:

cormat <- cor(avgParkison,method="spearman")  
gplots::heatmap.2(abs(cormat),  
 trace = "none",  
 scale = "none",  
 mar = c(10,10),  
 col=rev(heat.colors(5)),  
 main = "Raw Correlation",  
 cexRow = 0.35,  
 cexCol = 0.35,  
 key.title=NA,  
 key.xlab="Spearman Correlation",  
 xlab="Feature", ylab="Feature",  
# srtRow = 45,  
# srtCol = 45  
)



### Training and Testing Sets

We divided the data into training and testing sets.

# set.seed(2)  
# caseSet <- subset(avgParkison, class == 1)  
# controlSet <- subset(avgParkison, class == 0)  
# caseTrainSize <- nrow(caseSet)\*trainFraction;  
# controlTrainSize <- nrow(controlSet)\*trainFraction;  
# sampleCaseTrain <- sample(nrow(caseSet),caseTrainSize)  
# sampleControlTrain <- sample(nrow(controlSet),controlTrainSize)  
# trainSet <- rbind(caseSet[sampleCaseTrain,], controlSet[sampleControlTrain,])  
# testSet <- rbind(caseSet[-sampleCaseTrain,],controlSet[-sampleControlTrain,])  
pander::pander(table(trainSet$class))

| 0 | 1 |
| --- | --- |
| 41 | 122 |

pander::pander(table(testSet$class))

| 0 | 1 |
| --- | --- |
| 23 | 66 |

#### Decorrelation: Training and Testing Sets Creation

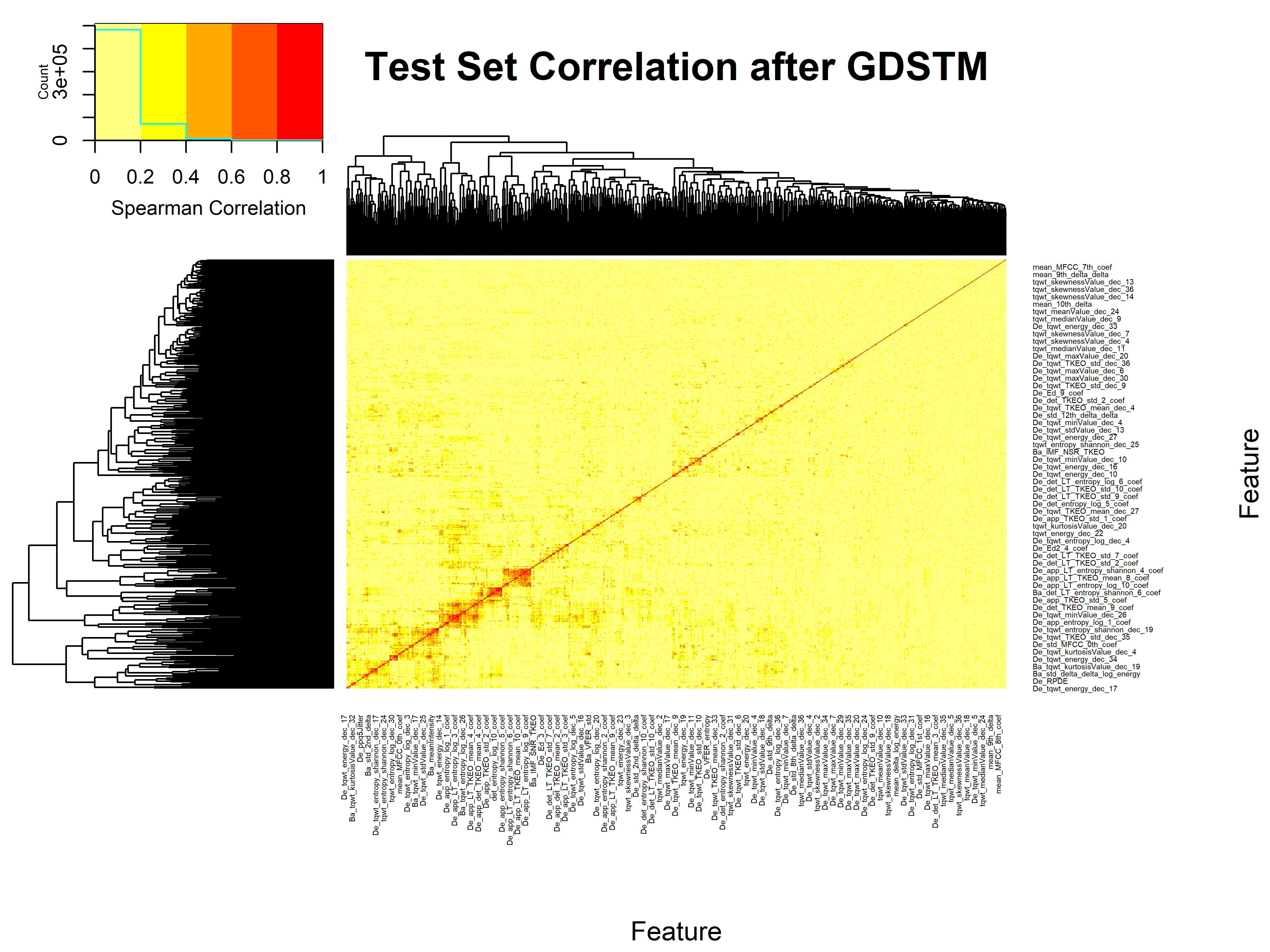
I compute a decorrelated version of the training and testing sets using the *GDSTMDecorrelation()* function of FRESA.CAD. The first decorrelation will be driven by features associated with the outcome. The second decorrelation will find the GDSTM without the outcome restriction.

## The GDSTM transformation driven by the Outcome  
  
# deTrain <- GDSTMDecorrelation(trainSet,Outcome="class",thr=0.8,verbose = TRUE)  
# deTest <- predictDecorrelate(deTrain,testSet)  
  
## The GDSTM transformation without outcome  
  
# deTrainU <- GDSTMDecorrelation(trainSet,thr=0.8,verbose = TRUE)  
# deTestU <- predictDecorrelate(deTrainU,testSet)

#### Correlation Matrix of the Decorrelated Test Data

The heat map of the testing set.

cormat <- cor(deTest,method="spearman")  
gplots::heatmap.2(abs(cormat),  
 trace = "none",  
 scale = "none",  
 mar = c(10,10),  
 col=rev(heat.colors(5)),  
 main = "Test Set Correlation after GDSTM",  
 cexRow = 0.35,  
 cexCol = 0.35,  
 key.title=NA,  
 key.xlab="Spearman Correlation",  
 xlab="Feature", ylab="Feature")



### Holdout Cross-Validation

Before doing the feature analysis. I’ll explore BSWiMS modeling using the Holdout cross validation method of FRESA.CAD. The purpose of the cross-validation is to observe and estimate the performance gain of decorrelation.

par(op)  
par(mfrow=c(1,3))  
  
## The Raw validation  
# cvBSWiMSRaw <- randomCV(avgParkison,  
# "class",  
# fittingFunction= BSWiMS.model,  
# classSamplingType = "Pro",  
# trainFraction = trainFraction,  
# repetitions = 150  
# )  
  
bpraw <- predictionStats\_binary(cvBSWiMSRaw$medianTest,"BSWiMS RAW",cex=0.60)

BSWiMS RAW

pander::pander(bpraw$CM.analysis$tab)

|  | Outcome + | Outcome - | Total |
| --- | --- | --- | --- |
| **Test +** | 147 | 18 | 165 |
| **Test -** | 41 | 46 | 87 |
| **Total** | 188 | 64 | 252 |

pander::pander(bpraw$accc)

|  | est | lower | upper |
| --- | --- | --- | --- |
| **5** | 0.7659 | 0.7086 | 0.8167 |

pander::pander(bpraw$aucs)

| est | lower | upper |
| --- | --- | --- |
| 0.8437 | 0.79 | 0.8973 |

pander::pander(bpraw$berror)

| 50% | 2.5% | 97.5% |
| --- | --- | --- |
| 0.2492 | 0.1875 | 0.309 |

## The validation with Outcome-driven Decorrelation  
# cvBSWiMSDeCor <- randomCV(avgParkison,  
# "class",  
# trainSampleSets= cvBSWiMSRaw$trainSamplesSets,  
# fittingFunction= filteredFit,  
# fitmethod=BSWiMS.model,  
# filtermethod=NULL,  
# DECOR = TRUE,  
# DECOR.control=list(Outcome="class",thr=0.8)  
# )  
  
bpDecor <- predictionStats\_binary(cvBSWiMSDeCor$medianTest,"BSWiMS Outcome-Driven GDSTM",cex=0.60)

BSWiMS Outcome-Driven GDSTM

pander::pander(bpDecor$CM.analysis$tab)

|  | Outcome + | Outcome - | Total |
| --- | --- | --- | --- |
| **Test +** | 168 | 14 | 182 |
| **Test -** | 20 | 50 | 70 |
| **Total** | 188 | 64 | 252 |

pander::pander(bpDecor$accc)

|  | est | lower | upper |
| --- | --- | --- | --- |
| **5** | 0.8651 | 0.8166 | 0.9047 |

pander::pander(bpDecor$aucs)

| est | lower | upper |
| --- | --- | --- |
| 0.8724 | 0.8152 | 0.9297 |

pander::pander(bpDecor$berror)

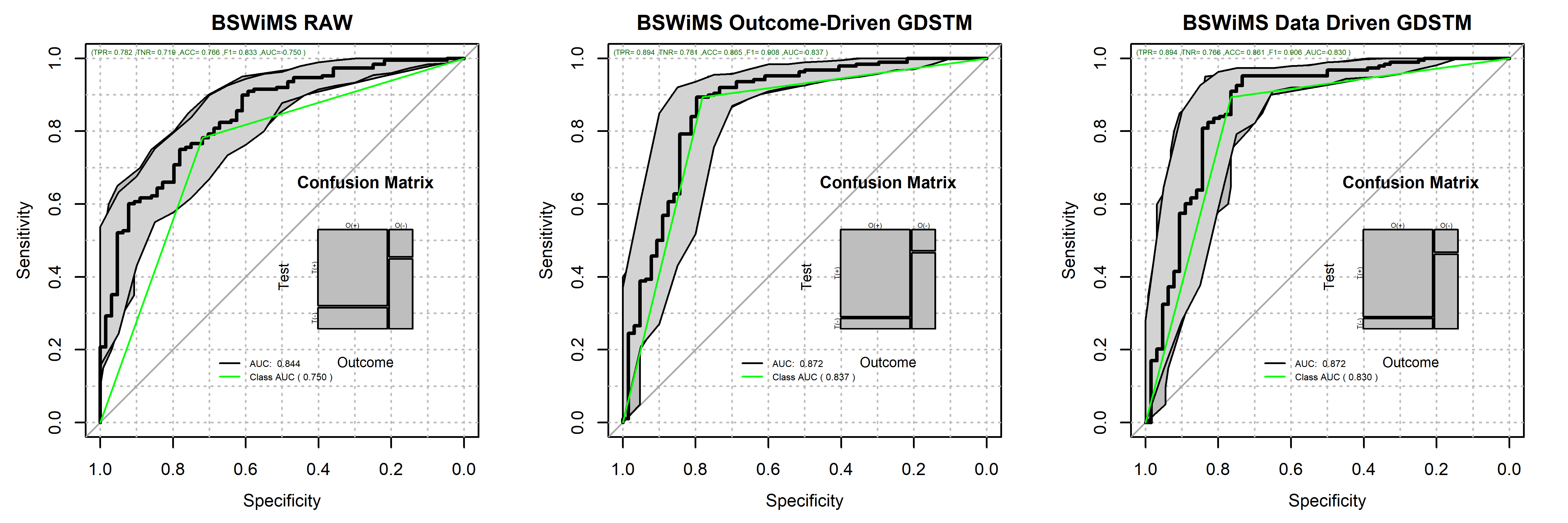
| 50% | 2.5% | 97.5% |
| --- | --- | --- |
| 0.1626 | 0.1094 | 0.2193 |

### Here we compute the probability that the outcome-driven decorrelation ROC is superior to the RAW ROC.   
pander::pander(roc.test(bpDecor$ROC.analysis$roc.predictor,bpraw$ROC.analysis$roc.predictor))

DeLong’s test for two correlated ROC curves: bpDecor$ROC.analysis$roc.predictor and bpraw$ROC.analysis$roc.predictor

| Test statistic | P value | Alternative hypothesis | AUC of roc1 | AUC of roc2 |
| --- | --- | --- | --- | --- |
| 1.986 | 0.04704 \* | two.sided | 0.8724 | 0.8437 |

## The validation of Decorrelation without the outcome restriction  
# cvBSWiMSDeCorU <- randomCV(avgParkison,  
# "class",  
# trainSampleSets= cvBSWiMSRaw$trainSamplesSets,  
# fittingFunction= filteredFit,  
# fitmethod=BSWiMS.model,  
# filtermethod=NULL,  
# DECOR = TRUE,  
# DECOR.control=list(thr=0.8)  
# )  
  
bpDecorU <- predictionStats\_binary(cvBSWiMSDeCorU$medianTest,"BSWiMS Data Driven GDSTM",cex=0.60)

BSWiMS Data Driven GDSTM 

pander::pander(bpDecorU$CM.analysis$tab)

|  | Outcome + | Outcome - | Total |
| --- | --- | --- | --- |
| **Test +** | 168 | 15 | 183 |
| **Test -** | 20 | 49 | 69 |
| **Total** | 188 | 64 | 252 |

pander::pander(bpDecorU$accc)

|  | est | lower | upper |
| --- | --- | --- | --- |
| **5** | 0.8611 | 0.8122 | 0.9013 |

pander::pander(bpDecorU$aucs)

| est | lower | upper |
| --- | --- | --- |
| 0.8721 | 0.813 | 0.9312 |

pander::pander(bpDecorU$berror)

| 50% | 2.5% | 97.5% |
| --- | --- | --- |
| 0.1714 | 0.1159 | 0.2302 |

### Here we compute the probability that the blind decorrelation ROC is superior to the RAW ROC.   
pander::pander(roc.test(bpDecorU$ROC.analysis$roc.predictor,bpraw$ROC.analysis$roc.predictor))

DeLong’s test for two correlated ROC curves: bpDecorU$ROC.analysis$roc.predictor and bpraw$ROC.analysis$roc.predictor

| Test statistic | P value | Alternative hypothesis | AUC of roc1 | AUC of roc2 |
| --- | --- | --- | --- | --- |
| 1.827 | 0.06767 | two.sided | 0.8721 | 0.8437 |

par(op)

## The Raw Model *vs.* the Decorrelated-Based Model

After demonstrating that decorrelation is able to improve BSWiMS model performance, I’ll focus is showcasing the ability to discover new features associated with the outcome.

First, I’ll compute the BSWiMS models for the original data, and for the decorrelated data-set. The model estimation will be done using the training set and tested on the holdout test set, and repeated 10 times. After that, I’ll compare the statistical difference of both ROC curves.

par(op)  
par(mfrow=c(1,3))  
  
# bm <- BSWiMS.model(class~.,trainSet,NumberofRepeats = 20)  
bpraw <- predictionStats\_binary(cbind(testSet$class,predict(bm,testSet)),"BSWiMS RAW",cex=0.60)

BSWiMS RAW

# bmd <- BSWiMS.model(class~.,deTrain,NumberofRepeats = 20)  
bpdecor <- predictionStats\_binary(cbind(deTest$class,predict(bmd,deTest)),"Outcome-Driven Decorrelation",cex=0.60)

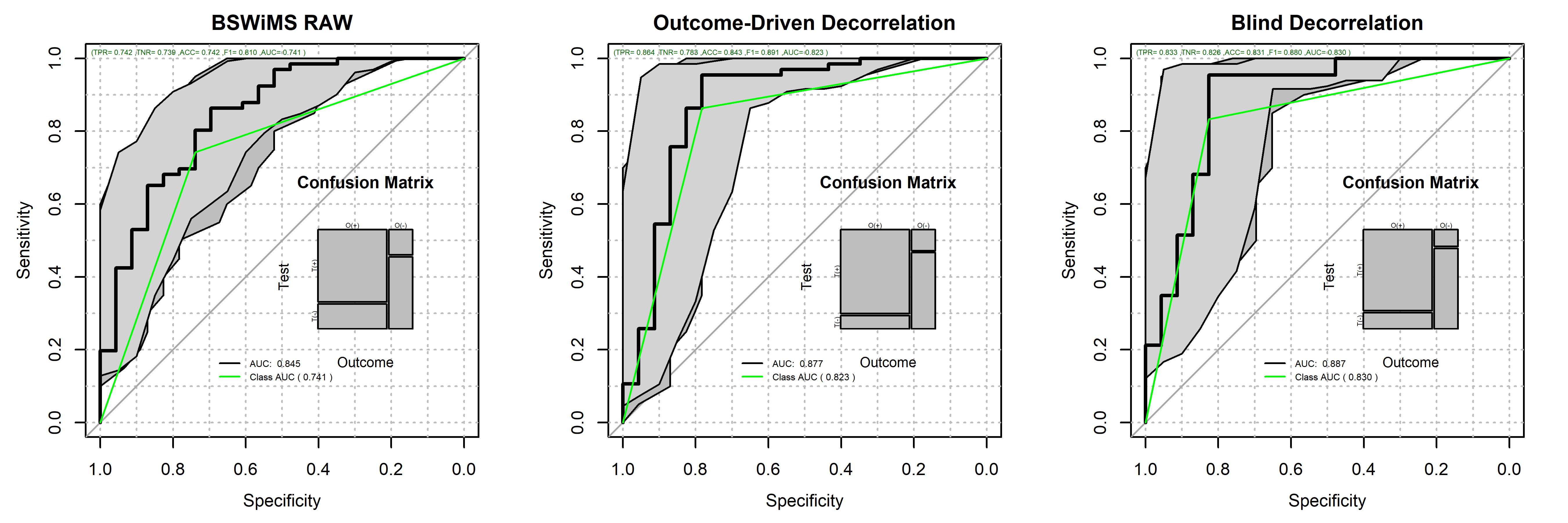
Outcome-Driven Decorrelation

pander::pander(roc.test(bpraw$ROC.analysis$roc.predictor,bpdecor$ROC.analysis$roc.predictor))

DeLong’s test for two correlated ROC curves: bpraw$ROC.analysis$roc.predictor and bpdecor$ROC.analysis$roc.predictor

| Test statistic | P value | Alternative hypothesis | AUC of roc1 | AUC of roc2 |
| --- | --- | --- | --- | --- |
| -1.259 | 0.2079 | two.sided | 0.8452 | 0.8775 |

# bmdU <- BSWiMS.model(class~.,deTrainU,NumberofRepeats = 20)  
bpdecorU <- predictionStats\_binary(cbind(deTest$class,predict(bmdU,deTestU)),"Blind Decorrelation",cex=0.60)

Blind Decorrelation 

pander::pander(roc.test(bpraw$ROC.analysis$roc.predictor,bpdecorU$ROC.analysis$roc.predictor))

DeLong’s test for two correlated ROC curves: bpraw$ROC.analysis$roc.predictor and bpdecorU$ROC.analysis$roc.predictor

| Test statistic | P value | Alternative hypothesis | AUC of roc1 | AUC of roc2 |
| --- | --- | --- | --- | --- |
| -1.685 | 0.09203 | two.sided | 0.8452 | 0.8867 |

par(op)

## The feature associations

par(op)  
par(mfrow=c(3,1))  
### The raw model  
  
pander::pander(nrow(bm$bagging$formulaNetwork))

*69*

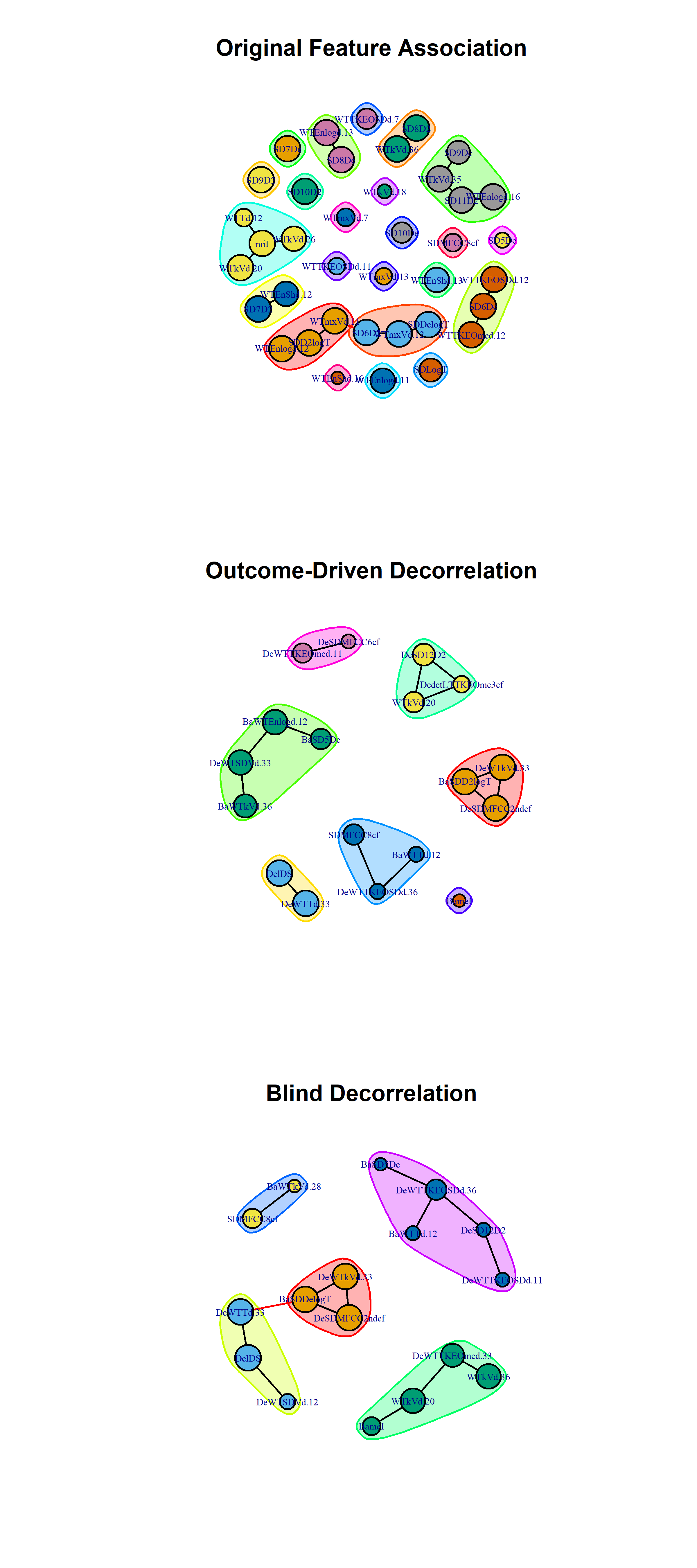
cmax <- apply(bm$bagging$formulaNetwork,2,max)  
cnames <- names(cmax[cmax>=0.5])  
cmax <- cmax[cmax>=0.5]  
adma <- bm$bagging$formulaNetwork[cnames,cnames]  
  
for (cx in c(1:nrow(namecode)))  
{  
 cnames <- str\_replace\_all(cnames,namecode[cx,1],namecode[cx,2])  
}  
cnames <- str\_replace\_all(cnames,"\_","")  
cnames <- str\_replace\_all(cnames,"th","")  
rownames(adma) <- cnames  
colnames(adma) <- cnames  
names(cmax) <- cnames  
adma[adma<0.25] <- 0;  
gr <- graph\_from\_adjacency\_matrix(adma,mode = "undirected",diag = FALSE,weighted=TRUE)  
gr$layout <- layout\_with\_fr  
  
fc <- cluster\_optimal(gr)  
plot(fc, gr,  
 vertex.size=20\*cmax,  
 vertex.label.cex=0.5,  
 vertex.label.dist=0,  
 main="Original Feature Association")  
  
  
  
### The Outcome Driven Model  
  
pander::pander(nrow(bmd$bagging$formulaNetwork))

*40*

cmax <- apply(bmd$bagging$formulaNetwork,2,max)  
cnames <- names(cmax[cmax>=0.5])  
cmax <- cmax[cmax>=0.5]  
adma <- bmd$bagging$formulaNetwork[cnames,cnames]  
  
for (cx in c(1:nrow(namecode)))  
{  
 cnames <- str\_replace\_all(cnames,namecode[cx,1],namecode[cx,2])  
}  
cnames <- str\_replace\_all(cnames,"\_","")  
cnames <- str\_replace\_all(cnames,"th","")  
rownames(adma) <- cnames  
colnames(adma) <- cnames  
names(cmax) <- cnames  
adma[adma<0.25] <- 0;  
gr <- graph\_from\_adjacency\_matrix(adma,mode = "undirected",diag = FALSE,weighted=TRUE)  
gr$layout <- layout\_with\_fr  
  
fc <- cluster\_optimal(gr)  
plot(fc, gr,  
 vertex.size=20\*cmax,  
 vertex.label.cex=0.5,  
 vertex.label.dist=0,  
 main="Outcome-Driven Decorrelation")  
  
  
### The Blind Decorrelation  
  
pander::pander(nrow(bmdU$bagging$formulaNetwork))

*38*

cmax <- apply(bmdU$bagging$formulaNetwork,2,max)  
cnames <- names(cmax[cmax>=0.5])  
cmax <- cmax[cmax>=0.5]  
adma <- bmdU$bagging$formulaNetwork[cnames,cnames]  
  
for (cx in c(1:nrow(namecode)))  
{  
 cnames <- str\_replace\_all(cnames,namecode[cx,1],namecode[cx,2])  
}  
cnames <- str\_replace\_all(cnames,"\_","")  
cnames <- str\_replace\_all(cnames,"th","")  
rownames(adma) <- cnames  
colnames(adma) <- cnames  
names(cmax) <- cnames  
adma[adma<0.25] <- 0;  
gr <- graph\_from\_adjacency\_matrix(adma,mode = "undirected",diag = FALSE,weighted=TRUE)  
gr$layout <- layout\_with\_fr  
  
fc <- cluster\_optimal(gr)  
plot(fc, gr,  
 vertex.size=20\*cmax,  
 vertex.label.cex=0.5,  
 vertex.label.dist=0,  
 main="Blind Decorrelation")



### Feature Analysis of Models

The analysis of the features required to predict the outcome will use the following:

1. Analysis of the BSWiMS bagged model using the summary function.
2. Analysis of the sparse GDSMT
3. Analysis of the univariate association of the model features of both models
4. Report the new features not found by the Original data analysis

par(op)  
par(mfrow=c(1,1))  
## 1 Get the Model Features  
smOriginal <- summary(bm)  
rawnames <- rownames(smOriginal$coefficients)  
  
### From Drived Decorrelation  
smDecor <- summary(bmd)  
decornames <- rownames(smDecor$coefficients)  
  
### From Blind Decorrelation  
smDecorU <- summary(bmdU)  
decornamesU <- rownames(smDecorU$coefficients)  
  
  
  
## 2 Get the decorrelation matrix formulas  
dc <- getDerivedCoefficients(deTrain)  
### 2a Get only the ones that were decorrelated by the decorrelation-based model  
deNames\_in\_dc <- decornames[decornames %in% names(dc)]  
selectedlist <- dc[deNames\_in\_dc]  
pander::pander(selectedlist)

* **De\_tqwt\_energy\_dec\_33**:

| * tqwt\_energy\_dec\_31 | * tqwt\_energy\_dec\_33 |
| --- | --- |
| * -0.907 | * 1 |

* **De\_std\_MFCC\_2nd\_coef**:

| * std\_MFCC\_2nd\_coef | * std\_2nd\_delta |
| --- | --- |
| * 1 | * -0.8278 |

* **De\_tqwt\_stdValue\_dec\_33**:

| * tqwt\_TKEO\_mean\_dec\_35 | * tqwt\_stdValue\_dec\_32 | * tqwt\_stdValue\_dec\_33 |
| --- | --- | --- |
| * -0.131 | * -0.7154 | * 1 |

* **De\_locDbShimmer**:

| * locDbShimmer | * ddaShimmer |
| --- | --- |
| * 1 | * -0.9626 |

* **De\_std\_12th\_delta\_delta**:

| * std\_MFCC\_12th\_coef | * std\_12th\_delta\_delta |
| --- | --- |
| * -0.9139 | * 1 |

* **De\_tqwt\_kurtosisValue\_dec\_33**:

| * tqwt\_kurtosisValue\_dec\_32 | * tqwt\_kurtosisValue\_dec\_33 |
| --- | --- |
| * -0.8834 | * 1 |

* **De\_tqwt\_TKEO\_mean\_dec\_17**:

| * tqwt\_TKEO\_mean\_dec\_17 | * tqwt\_minValue\_dec\_17 |
| --- | --- |
| * 1 | * 2.316 |

* **De\_tqwt\_TKEO\_std\_dec\_11**:
* Table continues below

| * tqwt\_TKEO\_mean\_dec\_10 | * tqwt\_TKEO\_mean\_dec\_11 | * tqwt\_TKEO\_std\_dec\_11 |
| --- | --- | --- |
| * 0.7128 | * -0.6442 | * 1 |

| * tqwt\_stdValue\_dec\_10 | * tqwt\_minValue\_dec\_17 |
| --- | --- |
| * -1.64 | * 0.3142 |

* **De\_tqwt\_minValue\_dec\_7**:

| * tqwt\_minValue\_dec\_7 | * tqwt\_minValue\_dec\_17 | * tqwt\_maxValue\_dec\_8 |
| --- | --- | --- |
| * 1 | * -0.01864 | * 0.967 |

* **De\_tqwt\_kurtosisValue\_dec\_2**:

| * tqwt\_kurtosisValue\_dec\_2 | * tqwt\_kurtosisValue\_dec\_3 |
| --- | --- |
| * 1 | * -0.9796 |

* **De\_tqwt\_TKEO\_std\_dec\_36**:

| * tqwt\_TKEO\_mean\_dec\_35 | * tqwt\_TKEO\_std\_dec\_36 |
| --- | --- |
| * -0.9259 | * 1 |

* **De\_tqwt\_maxValue\_dec\_28**:

| * tqwt\_stdValue\_dec\_28 | * tqwt\_maxValue\_dec\_28 |
| --- | --- |
| * -0.7034 | * 1 |

* **De\_tqwt\_TKEO\_std\_dec\_17**:

| * tqwt\_TKEO\_std\_dec\_17 | * tqwt\_minValue\_dec\_17 |
| --- | --- |
| * 1 | * 2.127 |

* **De\_tqwt\_maxValue\_dec\_29**:

| * tqwt\_stdValue\_dec\_28 | * tqwt\_maxValue\_dec\_29 |
| --- | --- |
| * -0.5549 | * 1 |

* **De\_tqwt\_entropy\_log\_dec\_1**:

| * tqwt\_entropy\_log\_dec\_1 | * tqwt\_entropy\_log\_dec\_2 |
| --- | --- |
| * 1 | * -0.8485 |

* **De\_det\_LT\_TKEO\_mean\_3\_coef**:

| * Ed2\_3\_coef | * det\_LT\_TKEO\_mean\_1\_coef | * det\_LT\_TKEO\_mean\_3\_coef |
| --- | --- | --- |
| * -0.8897 | * -0.08343 | * 1 |

* **De\_tqwt\_TKEO\_std\_dec\_7**:

| * tqwt\_TKEO\_std\_dec\_7 | * tqwt\_stdValue\_dec\_7 | * tqwt\_minValue\_dec\_17 |
| --- | --- | --- |
| * 1 | * -1.662 | * 0.1454 |

* **De\_tqwt\_entropy\_log\_dec\_35**:

| * tqwt\_entropy\_log\_dec\_35 | * tqwt\_TKEO\_mean\_dec\_35 |
| --- | --- |
| * 1 | * -0.1063 |

names(selectedlist) <- NULL  
### 2b Get the the names of the original features  
  
allDevar <- unique(c(names(unlist(selectedlist)),decornames))  
allDevar <- allDevar[!str\_detect(allDevar,"De\_")]  
allDevar <- str\_remove(allDevar,"Ba\_")  
allDevar <- unique(allDevar)  
  
  
# The analysis of the blind decorrelation  
  
dcU <- getDerivedCoefficients(deTrainU)  
### 2a Get only the ones that were decorrelated by the decorrelation-based model  
deNames\_in\_dcU <- decornamesU[decornamesU %in% names(dcU)]  
selectedlistU <- dcU[deNames\_in\_dcU]  
pander::pander(selectedlistU)

* **De\_tqwt\_energy\_dec\_33**:

| * tqwt\_energy\_dec\_31 | * tqwt\_energy\_dec\_33 |
| --- | --- |
| * -0.907 | * 1 |

* **De\_std\_MFCC\_2nd\_coef**:

| * std\_MFCC\_2nd\_coef | * std\_2nd\_delta |
| --- | --- |
| * 1 | * -0.8278 |

* **De\_locDbShimmer**:

| * locDbShimmer | * ddaShimmer |
| --- | --- |
| * 1 | * -0.9626 |

* **De\_tqwt\_maxValue\_dec\_28**:

| * tqwt\_stdValue\_dec\_28 | * tqwt\_maxValue\_dec\_28 |
| --- | --- |
| * -0.7034 | * 1 |

* **De\_tqwt\_kurtosisValue\_dec\_33**:

| * tqwt\_kurtosisValue\_dec\_32 | * tqwt\_kurtosisValue\_dec\_33 |
| --- | --- |
| * -0.8834 | * 1 |

* **De\_tqwt\_TKEO\_mean\_dec\_17**:

| * tqwt\_TKEO\_mean\_dec\_17 | * tqwt\_minValue\_dec\_17 |
| --- | --- |
| * 1 | * 2.316 |

* **De\_tqwt\_TKEO\_std\_dec\_36**:

| * tqwt\_TKEO\_mean\_dec\_35 | * tqwt\_TKEO\_std\_dec\_36 |
| --- | --- |
| * -0.9259 | * 1 |

* **De\_tqwt\_TKEO\_std\_dec\_11**:

| * tqwt\_TKEO\_std\_dec\_11 | * tqwt\_stdValue\_dec\_10 | * tqwt\_minValue\_dec\_17 |
| --- | --- | --- |
| * 1 | * -1.64 | * 0.3142 |

* **De\_tqwt\_TKEO\_mean\_dec\_33**:

| * tqwt\_TKEO\_mean\_dec\_33 | * tqwt\_TKEO\_mean\_dec\_35 | * tqwt\_stdValue\_dec\_32 |
| --- | --- | --- |
| * 1 | * -0.2479 | * -1.492 |

* **De\_tqwt\_TKEO\_std\_dec\_7**:

| * tqwt\_TKEO\_std\_dec\_7 | * tqwt\_stdValue\_dec\_7 | * tqwt\_minValue\_dec\_17 |
| --- | --- | --- |
| * 1 | * -1.662 | * 0.1454 |

* **De\_tqwt\_TKEO\_std\_dec\_17**:

| * tqwt\_TKEO\_std\_dec\_17 | * tqwt\_minValue\_dec\_17 |
| --- | --- |
| * 1 | * 2.127 |

* **De\_det\_LT\_TKEO\_mean\_3\_coef**:

| * Ed2\_3\_coef | * det\_LT\_TKEO\_mean\_1\_coef | * det\_LT\_TKEO\_mean\_3\_coef |
| --- | --- | --- |
| * -0.8897 | * -0.08343 | * 1 |

* **De\_tqwt\_minValue\_dec\_7**:

| * tqwt\_minValue\_dec\_7 | * tqwt\_minValue\_dec\_17 | * tqwt\_maxValue\_dec\_8 |
| --- | --- | --- |
| * 1 | * -0.01864 | * 0.967 |

* **De\_tqwt\_entropy\_log\_dec\_35**:

| * tqwt\_entropy\_log\_dec\_35 | * tqwt\_TKEO\_mean\_dec\_35 |
| --- | --- |
| * 1 | * -0.1063 |

names(selectedlistU) <- NULL  
### 2b Get the the names of the original features  
  
allDevarU <- unique(c(names(unlist(selectedlistU)),decornamesU))  
allDevarU <- allDevarU[!str\_detect(allDevarU,"De\_")]  
allDevarU <- str\_remove(allDevarU,"Ba\_")  
allDevarU <- unique(allDevarU)  
  
pander::pander(c(length(rawnames),length(decornames),length(decornamesU)))

*59*, *33* and *30*

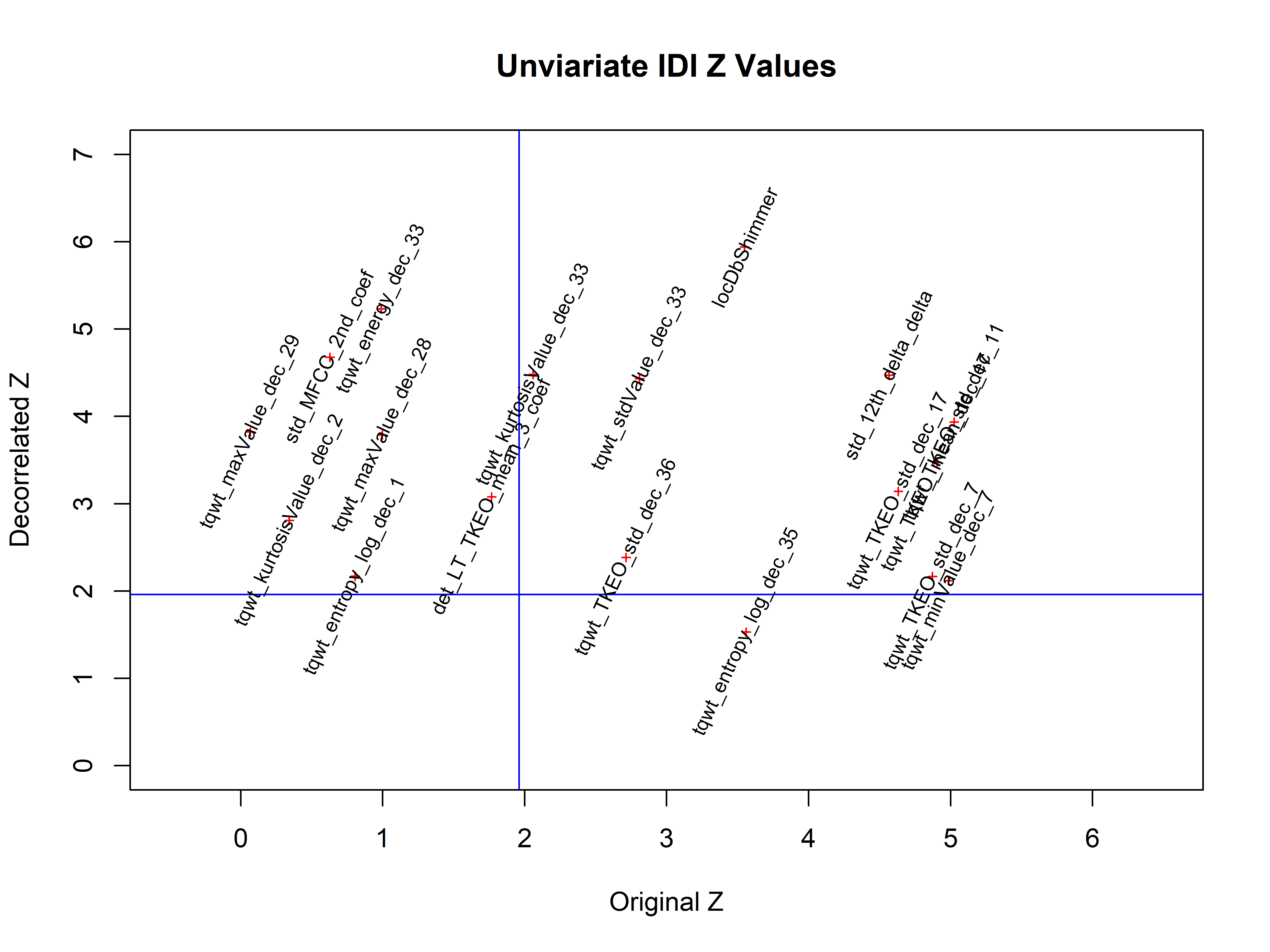
pander::pander(c(length(rawnames),length(allDevar),length(allDevarU)))

*59*, *49* and *40*

### 2c Get only the new feautres not found in the original analysis  
dvar <- allDevar[!(allDevar %in% rawnames)]   
  
### 2d Get the decorrelated variables that have new features  
newvars <- character();  
for (cvar in deNames\_in\_dc)  
{  
 lvar <- dc[cvar]  
 names(lvar) <- NULL  
 lvar <- names(unlist(lvar))  
 if (length(lvar[lvar %in% dvar]) > 0)  
 {  
 newvars <- append(newvars,cvar)  
 }  
}  
  
## 3 Here is the univariate z values of the orignal set  
#pander::pander(bm$univariate[dvar,])  
## 4 Here is the univariate z values of the decorrelated set  
#pander::pander(bmd$univariate[newvars,])  
  
## 4a The scater plot of the decorrelated vs original Univariate values  
  
zvalueNew <- bmd$univariate[newvars,]  
rownames(zvalueNew) <- str\_remove(rownames(zvalueNew),"De\_")  
rownames(zvalueNew) <- str\_remove(rownames(zvalueNew),"Ba\_")  
  
zvaluePrePost <- bm$univariate[rownames(zvalueNew),c(1,3)]  
zvaluePrePost$Name <- NULL  
zvaluePrePost$NewZ <- zvalueNew[rownames(zvaluePrePost),"ZUni"]  
pander::pander(zvaluePrePost)

|  | ZUni | NewZ |
| --- | --- | --- |
| **tqwt\_energy\_dec\_33** | 0.9895 | 5.23 |
| **std\_MFCC\_2nd\_coef** | 0.6278 | 4.676 |
| **tqwt\_stdValue\_dec\_33** | 2.81 | 4.433 |
| **locDbShimmer** | 3.548 | 5.94 |
| **std\_12th\_delta\_delta** | 4.566 | 4.471 |
| **tqwt\_kurtosisValue\_dec\_33** | 2.06 | 4.48 |
| **tqwt\_TKEO\_mean\_dec\_17** | 4.905 | 3.471 |
| **tqwt\_TKEO\_std\_dec\_11** | 5.025 | 3.935 |
| **tqwt\_minValue\_dec\_7** | 4.986 | 2.116 |
| **tqwt\_kurtosisValue\_dec\_2** | 0.3412 | 2.809 |
| **tqwt\_TKEO\_std\_dec\_36** | 2.714 | 2.384 |
| **tqwt\_maxValue\_dec\_28** | 0.9968 | 3.786 |
| **tqwt\_TKEO\_std\_dec\_17** | 4.631 | 3.14 |
| **tqwt\_maxValue\_dec\_29** | 0.06766 | 3.821 |
| **tqwt\_entropy\_log\_dec\_1** | 0.8049 | 2.169 |
| **det\_LT\_TKEO\_mean\_3\_coef** | 1.767 | 3.076 |
| **tqwt\_TKEO\_std\_dec\_7** | 4.872 | 2.165 |
| **tqwt\_entropy\_log\_dec\_35** | 3.561 | 1.531 |

plot(zvaluePrePost,  
 xlim=c(-0.5,6.5),  
 ylim=c(0,7),  
 xlab="Original Z",  
 ylab="Decorrelated Z",  
 main="Unviariate IDI Z Values",  
 pch=3,cex=0.5,  
 col="red")  
abline(v=1.96,col="blue")  
abline(h=1.96,col="blue")  
text(zvaluePrePost$ZUni,zvaluePrePost$NewZ,rownames(zvaluePrePost),srt=65,cex=0.75)



### The Summary of the Decorrelated-based Model

Here I will print the summary statistics of the Logistic models found by BSWiMS, using the original and transformed dataset. After that, I will show the characteristics of the features not found by the original analysis.

pander::pander(smOriginal$coefficients)

Table continues below

|  | Estimate | lower | OR | upper |
| --- | --- | --- | --- | --- |
| **std\_6th\_delta\_delta** | 0.3473 | 1.287 | 1.415 | 1.557 |
| **minIntensity** | -0.7948 | 0.3583 | 0.4517 | 0.5693 |
| **tqwt\_TKEO\_mean\_dec\_12** | -0.02331 | 0.9703 | 0.977 | 0.9837 |
| **std\_delta\_delta\_log\_energy** | 0.1137 | 1.081 | 1.12 | 1.161 |
| **std\_delta\_log\_energy** | 0.1024 | 1.07 | 1.108 | 1.147 |
| **std\_7th\_delta** | 0.2537 | 1.196 | 1.289 | 1.389 |
| **tqwt\_maxValue\_dec\_13** | -0.0368 | 0.9536 | 0.9639 | 0.9742 |
| **tqwt\_entropy\_shannon\_dec\_16** | -0.0156 | 0.9797 | 0.9845 | 0.9894 |
| **std\_7th\_delta\_delta** | 0.2333 | 1.173 | 1.263 | 1.359 |
| **tqwt\_TKEO\_std\_dec\_12** | -0.02589 | 0.9662 | 0.9744 | 0.9828 |
| **meanIntensity** | -0.09387 | 0.8816 | 0.9104 | 0.9402 |
| **tqwt\_kurtosisValue\_dec\_18** | 0.1252 | 1.087 | 1.133 | 1.182 |
| **IMF\_SNR\_entropy** | 0.02888 | 1.019 | 1.029 | 1.04 |
| **std\_6th\_delta** | 0.2553 | 1.18 | 1.291 | 1.412 |
| **tqwt\_entropy\_log\_dec\_11** | -0.2267 | 0.7396 | 0.7971 | 0.8591 |
| **std\_5th\_delta** | 0.1669 | 1.123 | 1.182 | 1.243 |
| **tqwt\_maxValue\_dec\_11** | -0.06872 | 0.9112 | 0.9336 | 0.9565 |
| **std\_8th\_delta\_delta** | 0.2405 | 1.175 | 1.272 | 1.376 |
| **tqwt\_TKEO\_std\_dec\_11** | -0.01655 | 0.978 | 0.9836 | 0.9892 |
| **std\_11th\_delta\_delta** | 0.2271 | 1.165 | 1.255 | 1.352 |
| **std\_9th\_delta\_delta** | 0.2101 | 1.146 | 1.234 | 1.329 |
| **std\_9th\_delta** | 0.1926 | 1.133 | 1.212 | 1.298 |
| **tqwt\_maxValue\_dec\_12** | -0.05444 | 0.9285 | 0.947 | 0.9659 |
| **std\_MFCC\_6th\_coef** | 0.1082 | 1.073 | 1.114 | 1.157 |
| **tqwt\_entropy\_shannon\_dec\_13** | -0.02409 | 0.9689 | 0.9762 | 0.9836 |
| **tqwt\_TKEO\_std\_dec\_7** | -0.02082 | 0.9722 | 0.9794 | 0.9867 |
| **tqwt\_maxValue\_dec\_7** | -0.03834 | 0.949 | 0.9624 | 0.976 |
| **tqwt\_entropy\_shannon\_dec\_12** | -0.02188 | 0.9709 | 0.9784 | 0.9858 |
| **apq11Shimmer** | 0.004624 | 1.003 | 1.005 | 1.006 |
| **tqwt\_maxValue\_dec\_10** | -0.01165 | 0.9841 | 0.9884 | 0.9927 |
| **tqwt\_energy\_dec\_12** | -0.01981 | 0.9736 | 0.9804 | 0.9872 |
| **tqwt\_entropy\_log\_dec\_12** | -0.1676 | 0.7936 | 0.8457 | 0.9011 |
| **tqwt\_energy\_dec\_6** | -0.00857 | 0.9882 | 0.9915 | 0.9947 |
| **locAbsJitter** | 0.008339 | 1.005 | 1.008 | 1.012 |
| **IMF\_SNR\_SEO** | 0.007054 | 1.004 | 1.007 | 1.01 |
| **tqwt\_entropy\_log\_dec\_16** | -0.09974 | 0.8744 | 0.9051 | 0.9368 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.1769 | 1.115 | 1.194 | 1.278 |
| **tqwt\_stdValue\_dec\_11** | -0.00466 | 0.9935 | 0.9954 | 0.9972 |
| **std\_8th\_delta** | 0.1823 | 1.117 | 1.2 | 1.289 |
| **tqwt\_entropy\_log\_dec\_13** | -0.1237 | 0.844 | 0.8837 | 0.9252 |
| **std\_10th\_delta\_delta** | 0.156 | 1.101 | 1.169 | 1.24 |
| **tqwt\_kurtosisValue\_dec\_26** | -0.03381 | 0.9538 | 0.9668 | 0.9799 |
| **tqwt\_kurtosisValue\_dec\_27** | -0.006251 | 0.9915 | 0.9938 | 0.996 |
| **std\_Log\_energy** | 0.07057 | 1.044 | 1.073 | 1.103 |
| **tqwt\_meanValue\_dec\_11** | 0.0003269 | 1 | 1 | 1 |
| **std\_12th\_delta\_delta** | 0.06456 | 1.039 | 1.067 | 1.095 |
| **std\_10th\_delta** | 0.128 | 1.079 | 1.137 | 1.198 |
| **tqwt\_kurtosisValue\_dec\_35** | 0.05382 | 1.032 | 1.055 | 1.079 |
| **std\_MFCC\_8th\_coef** | 0.1245 | 1.076 | 1.133 | 1.193 |
| **tqwt\_kurtosisValue\_dec\_36** | 0.03107 | 1.018 | 1.032 | 1.045 |
| **IMF\_NSR\_TKEO** | -0.04642 | 0.9363 | 0.9546 | 0.9733 |
| **tqwt\_kurtosisValue\_dec\_28** | -0.008126 | 0.9885 | 0.9919 | 0.9954 |
| **tqwt\_TKEO\_mean\_dec\_11** | -0.003406 | 0.9952 | 0.9966 | 0.998 |
| **tqwt\_maxValue\_dec\_1** | -0.005412 | 0.9922 | 0.9946 | 0.997 |
| **tqwt\_kurtosisValue\_dec\_34** | 0.01239 | 1.007 | 1.012 | 1.018 |
| **tqwt\_kurtosisValue\_dec\_17** | 0.0235 | 1.013 | 1.024 | 1.035 |
| **f1** | -0.01215 | 0.9823 | 0.9879 | 0.9935 |
| **tqwt\_kurtosisValue\_dec\_33** | 0.01029 | 1.005 | 1.01 | 1.015 |
| **mean\_MFCC\_2nd\_coef** | 0.006311 | 1.003 | 1.006 | 1.009 |

Table continues below

|  | u.Accuracy | r.Accuracy | full.Accuracy |
| --- | --- | --- | --- |
| **std\_6th\_delta\_delta** | 0.6682 | 0.711 | 0.7502 |
| **minIntensity** | 0.6112 | 0.7047 | 0.7028 |
| **tqwt\_TKEO\_mean\_dec\_12** | 0.7255 | 0.6723 | 0.7221 |
| **std\_delta\_delta\_log\_energy** | 0.7174 | 0.7166 | 0.7518 |
| **std\_delta\_log\_energy** | 0.7087 | 0.7048 | 0.7409 |
| **std\_7th\_delta** | 0.675 | 0.6888 | 0.7166 |
| **tqwt\_maxValue\_dec\_13** | 0.6807 | 0.6791 | 0.6936 |
| **tqwt\_entropy\_shannon\_dec\_16** | 0.6783 | 0.6951 | 0.6874 |
| **std\_7th\_delta\_delta** | 0.691 | 0.7058 | 0.722 |
| **tqwt\_TKEO\_std\_dec\_12** | 0.7261 | 0.6658 | 0.7319 |
| **meanIntensity** | 0.6065 | 0.6855 | 0.7112 |
| **tqwt\_kurtosisValue\_dec\_18** | 0.6543 | 0.6424 | 0.6986 |
| **IMF\_SNR\_entropy** | 0.6201 | 0.655 | 0.7136 |
| **std\_6th\_delta** | 0.6333 | 0.7209 | 0.7318 |
| **tqwt\_entropy\_log\_dec\_11** | 0.6959 | 0.6521 | 0.7206 |
| **std\_5th\_delta** | 0.6228 | 0.6776 | 0.7133 |
| **tqwt\_maxValue\_dec\_11** | 0.6917 | 0.694 | 0.7439 |
| **std\_8th\_delta\_delta** | 0.6896 | 0.7 | 0.7238 |
| **tqwt\_TKEO\_std\_dec\_11** | 0.6724 | 0.6828 | 0.7199 |
| **std\_11th\_delta\_delta** | 0.6882 | 0.6575 | 0.7363 |
| **std\_9th\_delta\_delta** | 0.6912 | 0.7091 | 0.734 |
| **std\_9th\_delta** | 0.6669 | 0.6905 | 0.7233 |
| **tqwt\_maxValue\_dec\_12** | 0.7139 | 0.6922 | 0.7439 |
| **std\_MFCC\_6th\_coef** | 0.5787 | 0.6916 | 0.7178 |
| **tqwt\_entropy\_shannon\_dec\_13** | 0.688 | 0.6889 | 0.6986 |
| **tqwt\_TKEO\_std\_dec\_7** | 0.646 | 0.6803 | 0.7135 |
| **tqwt\_maxValue\_dec\_7** | 0.6394 | 0.6631 | 0.6841 |
| **tqwt\_entropy\_shannon\_dec\_12** | 0.7176 | 0.6737 | 0.7106 |
| **apq11Shimmer** | 0.6571 | 0.6908 | 0.6693 |
| **tqwt\_maxValue\_dec\_10** | 0.6579 | 0.6562 | 0.7006 |
| **tqwt\_energy\_dec\_12** | 0.6722 | 0.6382 | 0.7107 |
| **tqwt\_entropy\_log\_dec\_12** | 0.7417 | 0.6989 | 0.7445 |
| **tqwt\_energy\_dec\_6** | 0.6 | 0.7025 | 0.75 |
| **locAbsJitter** | 0.6396 | 0.6537 | 0.6942 |
| **IMF\_SNR\_SEO** | 0.6067 | 0.7025 | 0.7368 |
| **tqwt\_entropy\_log\_dec\_16** | 0.6894 | 0.6817 | 0.7144 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.6695 | 0.6617 | 0.7114 |
| **tqwt\_stdValue\_dec\_11** | 0.6691 | 0.6601 | 0.699 |
| **std\_8th\_delta** | 0.6609 | 0.7124 | 0.7138 |
| **tqwt\_entropy\_log\_dec\_13** | 0.711 | 0.6725 | 0.716 |
| **std\_10th\_delta\_delta** | 0.6784 | 0.6983 | 0.7071 |
| **tqwt\_kurtosisValue\_dec\_26** | 0.7618 | 0.6594 | 0.721 |
| **tqwt\_kurtosisValue\_dec\_27** | 0.6901 | 0.6204 | 0.7188 |
| **std\_Log\_energy** | 0.6678 | 0.6927 | 0.7062 |
| **tqwt\_meanValue\_dec\_11** | 0.6135 | 0.6592 | 0.7074 |
| **std\_12th\_delta\_delta** | 0.6579 | 0.6536 | 0.6819 |
| **std\_10th\_delta** | 0.6554 | 0.6844 | 0.7067 |
| **tqwt\_kurtosisValue\_dec\_35** | 0.6435 | 0.7017 | 0.7497 |
| **std\_MFCC\_8th\_coef** | 0.6528 | 0.6706 | 0.7148 |
| **tqwt\_kurtosisValue\_dec\_36** | 0.6779 | 0.7015 | 0.7401 |
| **IMF\_NSR\_TKEO** | 0.6249 | 0.7111 | 0.7734 |
| **tqwt\_kurtosisValue\_dec\_28** | 0.6787 | 0.6828 | 0.7188 |
| **tqwt\_TKEO\_mean\_dec\_11** | 0.6405 | 0.6681 | 0.7132 |
| **tqwt\_maxValue\_dec\_1** | 0.636 | 0.6699 | 0.6937 |
| **tqwt\_kurtosisValue\_dec\_34** | 0.6209 | 0.68 | 0.7318 |
| **tqwt\_kurtosisValue\_dec\_17** | 0.6286 | 0.6748 | 0.7399 |
| **f1** | 0.5957 | 0.6479 | 0.6767 |
| **tqwt\_kurtosisValue\_dec\_33** | 0.5378 | 0.7104 | 0.7481 |
| **mean\_MFCC\_2nd\_coef** | 0.6865 | 0.7086 | 0.762 |

Table continues below

|  | u.AUC | r.AUC | full.AUC | IDI |
| --- | --- | --- | --- | --- |
| **std\_6th\_delta\_delta** | 0.7016 | 0.718 | 0.7757 | 0.1526 |
| **minIntensity** | 0.6831 | 0.6636 | 0.735 | 0.1416 |
| **tqwt\_TKEO\_mean\_dec\_12** | 0.7068 | 0.6565 | 0.73 | 0.1323 |
| **std\_delta\_delta\_log\_energy** | 0.7252 | 0.7224 | 0.7662 | 0.1301 |
| **std\_delta\_log\_energy** | 0.7166 | 0.7206 | 0.7609 | 0.1219 |
| **std\_7th\_delta** | 0.709 | 0.6897 | 0.7328 | 0.1245 |
| **tqwt\_maxValue\_dec\_13** | 0.7142 | 0.6413 | 0.7255 | 0.116 |
| **tqwt\_entropy\_shannon\_dec\_16** | 0.7355 | 0.6067 | 0.7327 | 0.1171 |
| **std\_7th\_delta\_delta** | 0.7168 | 0.6958 | 0.7339 | 0.1203 |
| **tqwt\_TKEO\_std\_dec\_12** | 0.7203 | 0.693 | 0.7537 | 0.115 |
| **meanIntensity** | 0.6886 | 0.6679 | 0.7175 | 0.1142 |
| **tqwt\_kurtosisValue\_dec\_18** | 0.6765 | 0.6685 | 0.715 | 0.1161 |
| **IMF\_SNR\_entropy** | 0.6125 | 0.6918 | 0.7148 | 0.1162 |
| **std\_6th\_delta** | 0.6657 | 0.7158 | 0.7532 | 0.1163 |
| **tqwt\_entropy\_log\_dec\_11** | 0.6929 | 0.6818 | 0.7427 | 0.1079 |
| **std\_5th\_delta** | 0.6569 | 0.6805 | 0.733 | 0.1155 |
| **tqwt\_maxValue\_dec\_11** | 0.7049 | 0.7147 | 0.7703 | 0.1026 |
| **std\_8th\_delta\_delta** | 0.7121 | 0.6998 | 0.7448 | 0.116 |
| **tqwt\_TKEO\_std\_dec\_11** | 0.6783 | 0.6798 | 0.7333 | 0.1075 |
| **std\_11th\_delta\_delta** | 0.7077 | 0.6777 | 0.7509 | 0.111 |
| **std\_9th\_delta\_delta** | 0.7199 | 0.7162 | 0.7471 | 0.1101 |
| **std\_9th\_delta** | 0.706 | 0.698 | 0.7431 | 0.1085 |
| **tqwt\_maxValue\_dec\_12** | 0.7328 | 0.7094 | 0.7696 | 0.0975 |
| **std\_MFCC\_6th\_coef** | 0.6034 | 0.6711 | 0.7356 | 0.1054 |
| **tqwt\_entropy\_shannon\_dec\_13** | 0.714 | 0.6548 | 0.7232 | 0.1025 |
| **tqwt\_TKEO\_std\_dec\_7** | 0.6776 | 0.6688 | 0.7357 | 0.1051 |
| **tqwt\_maxValue\_dec\_7** | 0.6807 | 0.6678 | 0.7139 | 0.1033 |
| **tqwt\_entropy\_shannon\_dec\_12** | 0.7178 | 0.7003 | 0.7287 | 0.0997 |
| **apq11Shimmer** | 0.6624 | 0.587 | 0.686 | 0.09958 |
| **tqwt\_maxValue\_dec\_10** | 0.6928 | 0.6738 | 0.7317 | 0.09638 |
| **tqwt\_energy\_dec\_12** | 0.6737 | 0.6823 | 0.7288 | 0.09375 |
| **tqwt\_entropy\_log\_dec\_12** | 0.7318 | 0.7145 | 0.7582 | 0.09242 |
| **tqwt\_energy\_dec\_6** | 0.6291 | 0.7182 | 0.7585 | 0.09649 |
| **locAbsJitter** | 0.6576 | 0.6885 | 0.7062 | 0.09542 |
| **IMF\_SNR\_SEO** | 0.5997 | 0.7251 | 0.7473 | 0.09643 |
| **tqwt\_entropy\_log\_dec\_16** | 0.6973 | 0.6808 | 0.7369 | 0.09194 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.6889 | 0.6868 | 0.7358 | 0.09293 |
| **tqwt\_stdValue\_dec\_11** | 0.6791 | 0.6839 | 0.7217 | 0.08883 |
| **std\_8th\_delta** | 0.6849 | 0.7105 | 0.7356 | 0.09973 |
| **tqwt\_entropy\_log\_dec\_13** | 0.7132 | 0.6848 | 0.7323 | 0.08986 |
| **std\_10th\_delta\_delta** | 0.6925 | 0.6934 | 0.7279 | 0.09411 |
| **tqwt\_kurtosisValue\_dec\_26** | 0.6619 | 0.6972 | 0.7227 | 0.09015 |
| **tqwt\_kurtosisValue\_dec\_27** | 0.6628 | 0.68 | 0.7146 | 0.08672 |
| **std\_Log\_energy** | 0.691 | 0.6888 | 0.7212 | 0.09489 |
| **tqwt\_meanValue\_dec\_11** | 0.6527 | 0.6675 | 0.7211 | 0.08418 |
| **std\_12th\_delta\_delta** | 0.6716 | 0.686 | 0.7118 | 0.0874 |
| **std\_10th\_delta** | 0.6807 | 0.7008 | 0.7294 | 0.08609 |
| **tqwt\_kurtosisValue\_dec\_35** | 0.6677 | 0.7205 | 0.7606 | 0.0794 |
| **std\_MFCC\_8th\_coef** | 0.6723 | 0.6887 | 0.7405 | 0.08302 |
| **tqwt\_kurtosisValue\_dec\_36** | 0.7092 | 0.7191 | 0.7537 | 0.08454 |
| **IMF\_NSR\_TKEO** | 0.5936 | 0.723 | 0.7871 | 0.07308 |
| **tqwt\_kurtosisValue\_dec\_28** | 0.6715 | 0.7082 | 0.7396 | 0.07906 |
| **tqwt\_TKEO\_mean\_dec\_11** | 0.6473 | 0.6791 | 0.7392 | 0.07575 |
| **tqwt\_maxValue\_dec\_1** | 0.6753 | 0.6753 | 0.7149 | 0.07564 |
| **tqwt\_kurtosisValue\_dec\_34** | 0.6411 | 0.6985 | 0.7411 | 0.06581 |
| **tqwt\_kurtosisValue\_dec\_17** | 0.6731 | 0.7078 | 0.7604 | 0.0602 |
| **f1** | 0.5963 | 0.6741 | 0.7087 | 0.06699 |
| **tqwt\_kurtosisValue\_dec\_33** | 0.5871 | 0.7197 | 0.7529 | 0.05797 |
| **mean\_MFCC\_2nd\_coef** | 0.6537 | 0.7284 | 0.7649 | 0.05711 |

|  | NRI | z.IDI | z.NRI | Frequency |
| --- | --- | --- | --- | --- |
| **std\_6th\_delta\_delta** | 0.751 | 6.531 | 6.418 | 1 |
| **minIntensity** | 0.6889 | 6.297 | 6.082 | 1 |
| **tqwt\_TKEO\_mean\_dec\_12** | 0.7503 | 6.011 | 6.434 | 1 |
| **std\_delta\_delta\_log\_energy** | 0.6705 | 5.941 | 5.665 | 1 |
| **std\_delta\_log\_energy** | 0.6221 | 5.731 | 5.185 | 1 |
| **std\_7th\_delta** | 0.7934 | 5.724 | 6.911 | 1 |
| **tqwt\_maxValue\_dec\_13** | 0.6852 | 5.655 | 5.91 | 0.65 |
| **tqwt\_entropy\_shannon\_dec\_16** | 0.7338 | 5.606 | 6.492 | 0.5 |
| **std\_7th\_delta\_delta** | 0.6954 | 5.603 | 5.914 | 1 |
| **tqwt\_TKEO\_std\_dec\_12** | 0.7325 | 5.597 | 6.287 | 1 |
| **meanIntensity** | 0.7005 | 5.593 | 6.292 | 0.15 |
| **tqwt\_kurtosisValue\_dec\_18** | 0.676 | 5.55 | 5.711 | 0.55 |
| **IMF\_SNR\_entropy** | 0.6734 | 5.525 | 5.689 | 0.25 |
| **std\_6th\_delta** | 0.6023 | 5.517 | 4.984 | 1 |
| **tqwt\_entropy\_log\_dec\_11** | 0.7236 | 5.514 | 6.178 | 0.95 |
| **std\_5th\_delta** | 0.5216 | 5.475 | 4.301 | 0.6 |
| **tqwt\_maxValue\_dec\_11** | 0.5362 | 5.45 | 4.416 | 1 |
| **std\_8th\_delta\_delta** | 0.6759 | 5.44 | 5.715 | 1 |
| **tqwt\_TKEO\_std\_dec\_11** | 0.544 | 5.415 | 4.474 | 0.65 |
| **std\_11th\_delta\_delta** | 0.6249 | 5.415 | 5.231 | 1 |
| **std\_9th\_delta\_delta** | 0.6593 | 5.327 | 5.567 | 1 |
| **std\_9th\_delta** | 0.6785 | 5.294 | 5.76 | 0.9 |
| **tqwt\_maxValue\_dec\_12** | 0.6126 | 5.27 | 5.17 | 1 |
| **std\_MFCC\_6th\_coef** | 0.5533 | 5.256 | 4.581 | 0.4 |
| **tqwt\_entropy\_shannon\_dec\_13** | 0.6625 | 5.237 | 5.623 | 0.95 |
| **tqwt\_TKEO\_std\_dec\_7** | 0.5611 | 5.221 | 4.674 | 0.8 |
| **tqwt\_maxValue\_dec\_7** | 0.6588 | 5.208 | 5.585 | 0.7 |
| **tqwt\_entropy\_shannon\_dec\_12** | 0.6742 | 5.106 | 5.692 | 0.95 |
| **apq11Shimmer** | 0.4689 | 5.092 | 3.839 | 0.1 |
| **tqwt\_maxValue\_dec\_10** | 0.5967 | 5.089 | 4.969 | 0.25 |
| **tqwt\_energy\_dec\_12** | 0.6063 | 5.064 | 5.043 | 0.7 |
| **tqwt\_entropy\_log\_dec\_12** | 0.6892 | 5.048 | 5.863 | 1 |
| **tqwt\_energy\_dec\_6** | 0.6705 | 5.023 | 5.678 | 0.2 |
| **locAbsJitter** | 0.5262 | 4.958 | 4.304 | 0.2 |
| **IMF\_SNR\_SEO** | 0.6639 | 4.952 | 5.52 | 0.1 |
| **tqwt\_entropy\_log\_dec\_16** | 0.5677 | 4.918 | 4.703 | 1 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.66 | 4.91 | 5.553 | 1 |
| **tqwt\_stdValue\_dec\_11** | 0.5202 | 4.894 | 4.252 | 0.15 |
| **std\_8th\_delta** | 0.6605 | 4.892 | 5.537 | 1 |
| **tqwt\_entropy\_log\_dec\_13** | 0.632 | 4.868 | 5.298 | 1 |
| **std\_10th\_delta\_delta** | 0.54 | 4.847 | 4.442 | 1 |
| **tqwt\_kurtosisValue\_dec\_26** | 0.552 | 4.825 | 4.91 | 0.95 |
| **tqwt\_kurtosisValue\_dec\_27** | 0.459 | 4.812 | 3.76 | 0.25 |
| **std\_Log\_energy** | 0.465 | 4.8 | 3.89 | 0.9 |
| **tqwt\_meanValue\_dec\_11** | 0.6057 | 4.751 | 5.082 | 0.2 |
| **std\_12th\_delta\_delta** | 0.5636 | 4.732 | 4.655 | 0.45 |
| **std\_10th\_delta** | 0.4309 | 4.666 | 3.517 | 0.8 |
| **tqwt\_kurtosisValue\_dec\_35** | 0.6034 | 4.662 | 5.024 | 1 |
| **std\_MFCC\_8th\_coef** | 0.5642 | 4.634 | 4.642 | 0.7 |
| **tqwt\_kurtosisValue\_dec\_36** | 0.7205 | 4.617 | 6.144 | 1 |
| **IMF\_NSR\_TKEO** | 0.463 | 4.575 | 3.793 | 0.45 |
| **tqwt\_kurtosisValue\_dec\_28** | 0.6066 | 4.477 | 5.037 | 0.3 |
| **tqwt\_TKEO\_mean\_dec\_11** | 0.4828 | 4.45 | 3.955 | 0.2 |
| **tqwt\_maxValue\_dec\_1** | 0.5475 | 4.369 | 4.578 | 0.15 |
| **tqwt\_kurtosisValue\_dec\_34** | 0.5174 | 4.221 | 4.237 | 0.25 |
| **tqwt\_kurtosisValue\_dec\_17** | 0.4131 | 4.18 | 3.431 | 0.15 |
| **f1** | 0.2934 | 4.076 | 2.345 | 0.1 |
| **tqwt\_kurtosisValue\_dec\_33** | 0.5148 | 3.976 | 4.253 | 0.15 |
| **mean\_MFCC\_2nd\_coef** | 0.5508 | 3.813 | 4.565 | 0.1 |

pander::pander(smDecor$coefficients)

Table continues below

|  | Estimate | lower | OR | upper |
| --- | --- | --- | --- | --- |
| **Ba\_tqwt\_kurtosisValue\_dec\_36** | 0.1268 | 1.099 | 1.135 | 1.172 |
| **Ba\_std\_delta\_delta\_log\_energy** | 0.4133 | 1.35 | 1.512 | 1.693 |
| **De\_tqwt\_energy\_dec\_33** | -0.213 | 0.761 | 0.8082 | 0.8583 |
| **Ba\_tqwt\_entropy\_log\_dec\_12** | -0.5102 | 0.518 | 0.6004 | 0.6958 |
| **De\_tqwt\_TKEO\_mean\_dec\_11** | -0.04846 | 0.9392 | 0.9527 | 0.9664 |
| **Ba\_std\_5th\_delta** | 0.5343 | 1.45 | 1.706 | 2.008 |
| **Ba\_tqwt\_energy\_dec\_12** | -0.05163 | 0.9337 | 0.9497 | 0.966 |
| **De\_std\_MFCC\_2nd\_coef** | -1.323 | 0.1693 | 0.2664 | 0.4194 |
| **Ba\_tqwt\_kurtosisValue\_dec\_26** | -0.03697 | 0.9516 | 0.9637 | 0.976 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | -0.04704 | 0.9395 | 0.9541 | 0.9688 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.5161 | 1.403 | 1.675 | 2.001 |
| **Ba\_meanIntensity** | -0.8961 | 0.3021 | 0.4082 | 0.5513 |
| **De\_tqwt\_stdValue\_dec\_33** | -0.7531 | 0.3644 | 0.4709 | 0.6085 |
| **De\_locDbShimmer** | 1.076 | 2.095 | 2.932 | 4.103 |
| **De\_std\_12th\_delta\_delta** | 0.8266 | 1.711 | 2.285 | 3.053 |
| **De\_std\_MFCC\_6th\_coef** | 0.2945 | 1.209 | 1.342 | 1.49 |
| **std\_MFCC\_8th\_coef** | 0.5452 | 1.425 | 1.725 | 2.088 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 0.09085 | 1.059 | 1.095 | 1.132 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.6153 | 1.479 | 1.85 | 2.315 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | -0.09541 | 0.8768 | 0.909 | 0.9424 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | -0.08994 | 0.8834 | 0.914 | 0.9456 |
| **De\_tqwt\_minValue\_dec\_7** | 0.1421 | 1.093 | 1.153 | 1.216 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | -0.04213 | 0.9432 | 0.9587 | 0.9745 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.1271 | 1.083 | 1.136 | 1.19 |
| **tqwt\_meanValue\_dec\_11** | 0.0007165 | 1 | 1.001 | 1.001 |
| **De\_tqwt\_maxValue\_dec\_28** | -0.05188 | 0.9305 | 0.9494 | 0.9687 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | -0.09314 | 0.8785 | 0.9111 | 0.9449 |
| **Ba\_locAbsJitter** | 0.007216 | 1.004 | 1.007 | 1.01 |
| **De\_tqwt\_maxValue\_dec\_29** | -0.02535 | 0.9648 | 0.975 | 0.9852 |
| **De\_tqwt\_entropy\_log\_dec\_1** | 1.228 | 2.045 | 3.413 | 5.696 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | -0.3077 | 0.637 | 0.7351 | 0.8484 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | -0.05254 | 0.9253 | 0.9488 | 0.9729 |
| **De\_tqwt\_entropy\_log\_dec\_35** | -0.1983 | 0.7422 | 0.8201 | 0.9062 |

Table continues below

|  | u.Accuracy | r.Accuracy | full.Accuracy |
| --- | --- | --- | --- |
| **Ba\_tqwt\_kurtosisValue\_dec\_36** | 0.6786 | 0.6924 | 0.774 |
| **Ba\_std\_delta\_delta\_log\_energy** | 0.716 | 0.762 | 0.8146 |
| **De\_tqwt\_energy\_dec\_33** | 0.7477 | 0.7133 | 0.7794 |
| **Ba\_tqwt\_entropy\_log\_dec\_12** | 0.7415 | 0.6892 | 0.7623 |
| **De\_tqwt\_TKEO\_mean\_dec\_11** | 0.6418 | 0.6212 | 0.7243 |
| **Ba\_std\_5th\_delta** | 0.6221 | 0.7139 | 0.7418 |
| **Ba\_tqwt\_energy\_dec\_12** | 0.6723 | 0.697 | 0.7654 |
| **De\_std\_MFCC\_2nd\_coef** | 0.7021 | 0.7802 | 0.8191 |
| **Ba\_tqwt\_kurtosisValue\_dec\_26** | 0.7629 | 0.6699 | 0.7573 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 0.6791 | 0.7204 | 0.7536 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.6732 | 0.71 | 0.7589 |
| **Ba\_meanIntensity** | 0.6104 | 0.706 | 0.7407 |
| **De\_tqwt\_stdValue\_dec\_33** | 0.6818 | 0.7068 | 0.7793 |
| **De\_locDbShimmer** | 0.7127 | 0.7523 | 0.7832 |
| **De\_std\_12th\_delta\_delta** | 0.6946 | 0.722 | 0.7561 |
| **De\_std\_MFCC\_6th\_coef** | 0.5794 | 0.6667 | 0.7306 |
| **std\_MFCC\_8th\_coef** | 0.654 | 0.7061 | 0.7508 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 0.631 | 0.6991 | 0.727 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.6925 | 0.7726 | 0.818 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.6429 | 0.6945 | 0.7448 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.7021 | 0.6856 | 0.734 |
| **De\_tqwt\_minValue\_dec\_7** | 0.5679 | 0.7021 | 0.7521 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | 0.6826 | 0.7382 | 0.7697 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.639 | 0.7053 | 0.7639 |
| **tqwt\_meanValue\_dec\_11** | 0.6135 | 0.7125 | 0.7571 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.6479 | 0.7252 | 0.7613 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.6262 | 0.7178 | 0.7358 |
| **Ba\_locAbsJitter** | 0.6405 | 0.5926 | 0.6791 |
| **De\_tqwt\_maxValue\_dec\_29** | 0.6393 | 0.7227 | 0.7595 |
| **De\_tqwt\_entropy\_log\_dec\_1** | 0.6074 | 0.7413 | 0.7691 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.6107 | 0.7128 | 0.7467 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.5982 | 0.719 | 0.7429 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.5746 | 0.6941 | 0.7329 |

Table continues below

|  | u.AUC | r.AUC | full.AUC | IDI |
| --- | --- | --- | --- | --- |
| **Ba\_tqwt\_kurtosisValue\_dec\_36** | 0.7079 | 0.6989 | 0.7705 | 0.1514 |
| **Ba\_std\_delta\_delta\_log\_energy** | 0.724 | 0.7556 | 0.817 | 0.1482 |
| **De\_tqwt\_energy\_dec\_33** | 0.7354 | 0.7353 | 0.778 | 0.1414 |
| **Ba\_tqwt\_entropy\_log\_dec\_12** | 0.7307 | 0.7038 | 0.7686 | 0.1365 |
| **De\_tqwt\_TKEO\_mean\_dec\_11** | 0.6467 | 0.6423 | 0.7519 | 0.1312 |
| **Ba\_std\_5th\_delta** | 0.6601 | 0.7061 | 0.7583 | 0.1284 |
| **Ba\_tqwt\_energy\_dec\_12** | 0.6743 | 0.7083 | 0.7818 | 0.1081 |
| **De\_std\_MFCC\_2nd\_coef** | 0.6861 | 0.7764 | 0.8205 | 0.1142 |
| **Ba\_tqwt\_kurtosisValue\_dec\_26** | 0.6625 | 0.6979 | 0.7569 | 0.1125 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 0.6733 | 0.7252 | 0.7622 | 0.1177 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.6898 | 0.7181 | 0.769 | 0.1121 |
| **Ba\_meanIntensity** | 0.6905 | 0.6946 | 0.757 | 0.1105 |
| **De\_tqwt\_stdValue\_dec\_33** | 0.6844 | 0.7253 | 0.7714 | 0.1063 |
| **De\_locDbShimmer** | 0.7364 | 0.7401 | 0.7808 | 0.09588 |
| **De\_std\_12th\_delta\_delta** | 0.6757 | 0.7287 | 0.7631 | 0.1146 |
| **De\_std\_MFCC\_6th\_coef** | 0.6046 | 0.6721 | 0.7572 | 0.1098 |
| **std\_MFCC\_8th\_coef** | 0.6731 | 0.7086 | 0.7633 | 0.1075 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 0.6745 | 0.7067 | 0.7423 | 0.09773 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.6795 | 0.7686 | 0.8196 | 0.08713 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.6684 | 0.7218 | 0.753 | 0.0999 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.7006 | 0.711 | 0.7446 | 0.09456 |
| **De\_tqwt\_minValue\_dec\_7** | 0.5811 | 0.7165 | 0.7658 | 0.0962 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | 0.6347 | 0.7512 | 0.7868 | 0.0908 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.6119 | 0.7166 | 0.7704 | 0.08253 |
| **tqwt\_meanValue\_dec\_11** | 0.6527 | 0.7156 | 0.7713 | 0.08992 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.6482 | 0.7411 | 0.7734 | 0.09125 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.6283 | 0.724 | 0.7382 | 0.09375 |
| **Ba\_locAbsJitter** | 0.6505 | 0.6469 | 0.6974 | 0.08774 |
| **De\_tqwt\_maxValue\_dec\_29** | 0.657 | 0.7362 | 0.7665 | 0.08167 |
| **De\_tqwt\_entropy\_log\_dec\_1** | 0.6318 | 0.745 | 0.7764 | 0.07968 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.6234 | 0.7202 | 0.7565 | 0.0639 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.5967 | 0.7423 | 0.7619 | 0.06496 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.5615 | 0.7157 | 0.7439 | 0.04788 |

|  | NRI | z.IDI | z.NRI | Frequency |
| --- | --- | --- | --- | --- |
| **Ba\_tqwt\_kurtosisValue\_dec\_36** | 0.8403 | 6.638 | 7.437 | 0.9 |
| **Ba\_std\_delta\_delta\_log\_energy** | 0.7933 | 6.546 | 6.857 | 1 |
| **De\_tqwt\_energy\_dec\_33** | 0.7818 | 6.217 | 6.735 | 1 |
| **Ba\_tqwt\_entropy\_log\_dec\_12** | 0.8319 | 6.12 | 7.319 | 0.95 |
| **De\_tqwt\_TKEO\_mean\_dec\_11** | 0.6452 | 6.039 | 5.399 | 0.75 |
| **Ba\_std\_5th\_delta** | 0.6504 | 5.868 | 5.512 | 0.8 |
| **Ba\_tqwt\_energy\_dec\_12** | 0.653 | 5.653 | 5.483 | 0.6 |
| **De\_std\_MFCC\_2nd\_coef** | 0.7175 | 5.653 | 6.114 | 1 |
| **Ba\_tqwt\_kurtosisValue\_dec\_26** | 0.5862 | 5.635 | 5.248 | 0.25 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 0.7282 | 5.603 | 6.201 | 0.45 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.7801 | 5.574 | 6.729 | 0.8 |
| **Ba\_meanIntensity** | 0.6918 | 5.562 | 6.155 | 0.5 |
| **De\_tqwt\_stdValue\_dec\_33** | 0.6587 | 5.531 | 5.561 | 0.95 |
| **De\_locDbShimmer** | 0.8134 | 5.524 | 7.143 | 1 |
| **De\_std\_12th\_delta\_delta** | 0.6629 | 5.47 | 5.576 | 0.85 |
| **De\_std\_MFCC\_6th\_coef** | 0.5809 | 5.426 | 4.846 | 0.55 |
| **std\_MFCC\_8th\_coef** | 0.7006 | 5.375 | 5.946 | 0.8 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 0.5754 | 5.185 | 4.775 | 0.2 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.5539 | 5.115 | 4.622 | 1 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.7475 | 5.09 | 6.384 | 0.2 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.7233 | 5.063 | 6.174 | 0.25 |
| **De\_tqwt\_minValue\_dec\_7** | 0.7003 | 5.044 | 5.924 | 0.25 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | 0.6448 | 5.011 | 5.553 | 0.15 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.6369 | 4.986 | 5.377 | 0.6 |
| **tqwt\_meanValue\_dec\_11** | 0.6131 | 4.971 | 5.151 | 0.15 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.6262 | 4.939 | 5.261 | 0.1 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.6951 | 4.907 | 5.876 | 0.15 |
| **Ba\_locAbsJitter** | 0.4738 | 4.745 | 3.835 | 0.1 |
| **De\_tqwt\_maxValue\_dec\_29** | 0.6721 | 4.631 | 5.634 | 0.1 |
| **De\_tqwt\_entropy\_log\_dec\_1** | 0.642 | 4.53 | 5.43 | 0.25 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.625 | 4.106 | 5.233 | 0.65 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.5656 | 4.04 | 4.662 | 0.2 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.6251 | 3.698 | 5.27 | 0.15 |

pander::pander(smDecorU$coefficients)

Table continues below

|  | Estimate | lower | OR | upper |
| --- | --- | --- | --- | --- |
| **tqwt\_kurtosisValue\_dec\_36** | 0.1468 | 1.118 | 1.158 | 1.199 |
| **De\_std\_12th\_delta\_delta** | 0.5456 | 1.506 | 1.726 | 1.978 |
| **Ba\_std\_delta\_log\_energy** | 0.5088 | 1.446 | 1.663 | 1.914 |
| **Ba\_std\_5th\_delta** | 0.3072 | 1.236 | 1.36 | 1.495 |
| **Ba\_meanIntensity** | -1.653 | 0.1162 | 0.1914 | 0.3154 |
| **De\_tqwt\_energy\_dec\_33** | -0.221 | 0.7501 | 0.8017 | 0.8568 |
| **De\_std\_MFCC\_2nd\_coef** | -1.663 | 0.1098 | 0.1895 | 0.3271 |
| **De\_tqwt\_stdValue\_dec\_12** | -0.07333 | 0.911 | 0.9293 | 0.948 |
| **De\_locDbShimmer** | 1.276 | 2.451 | 3.584 | 5.24 |
| **std\_MFCC\_8th\_coef** | 0.5765 | 1.484 | 1.78 | 2.135 |
| **Ba\_tqwt\_energy\_dec\_12** | -0.05442 | 0.9305 | 0.947 | 0.9639 |
| **tqwt\_kurtosisValue\_dec\_26** | -0.0155 | 0.9798 | 0.9846 | 0.9895 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.6321 | 1.511 | 1.882 | 2.344 |
| **De\_tqwt\_maxValue\_dec\_28** | -0.07283 | 0.9061 | 0.9298 | 0.954 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.682 | 1.56 | 1.978 | 2.508 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | -0.04369 | 0.9429 | 0.9573 | 0.9718 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | -0.09453 | 0.8789 | 0.9098 | 0.9418 |
| **tqwt\_kurtosisValue\_dec\_27** | -0.01207 | 0.9835 | 0.988 | 0.9925 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 0.2757 | 1.189 | 1.317 | 1.459 |
| **mean\_MFCC\_2nd\_coef** | 0.03438 | 1.021 | 1.035 | 1.049 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.1938 | 1.124 | 1.214 | 1.311 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | -0.1138 | 0.8514 | 0.8925 | 0.9355 |
| **De\_tqwt\_TKEO\_mean\_dec\_33** | -0.2869 | 0.6663 | 0.7506 | 0.8454 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | -0.1358 | 0.8244 | 0.873 | 0.9245 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | -0.09369 | 0.8759 | 0.9106 | 0.9467 |
| **tqwt\_meanValue\_dec\_11** | 0.0007881 | 1 | 1.001 | 1.001 |
| **De\_std\_MFCC\_6th\_coef** | 0.06594 | 1.038 | 1.068 | 1.099 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | -0.1581 | 0.7942 | 0.8538 | 0.9177 |
| **De\_tqwt\_minValue\_dec\_7** | 0.1682 | 1.095 | 1.183 | 1.279 |
| **De\_tqwt\_entropy\_log\_dec\_35** | -0.3754 | 0.5704 | 0.687 | 0.8273 |

Table continues below

|  | u.Accuracy | r.Accuracy | full.Accuracy |
| --- | --- | --- | --- |
| **tqwt\_kurtosisValue\_dec\_36** | 0.678 | 0.6825 | 0.7637 |
| **De\_std\_12th\_delta\_delta** | 0.6571 | 0.6847 | 0.7448 |
| **Ba\_std\_delta\_log\_energy** | 0.7098 | 0.7579 | 0.8199 |
| **Ba\_std\_5th\_delta** | 0.6188 | 0.6953 | 0.7259 |
| **Ba\_meanIntensity** | 0.6078 | 0.6769 | 0.7293 |
| **De\_tqwt\_energy\_dec\_33** | 0.7466 | 0.7255 | 0.786 |
| **De\_std\_MFCC\_2nd\_coef** | 0.7034 | 0.7717 | 0.8275 |
| **De\_tqwt\_stdValue\_dec\_12** | 0.7243 | 0.7512 | 0.7627 |
| **De\_locDbShimmer** | 0.7167 | 0.7494 | 0.7854 |
| **std\_MFCC\_8th\_coef** | 0.6537 | 0.7003 | 0.7452 |
| **Ba\_tqwt\_energy\_dec\_12** | 0.6701 | 0.6875 | 0.7565 |
| **tqwt\_kurtosisValue\_dec\_26** | 0.7595 | 0.6605 | 0.7317 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.6695 | 0.69 | 0.7593 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.6519 | 0.7182 | 0.7542 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.6944 | 0.768 | 0.8252 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 0.676 | 0.7023 | 0.7352 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.6445 | 0.6825 | 0.7405 |
| **tqwt\_kurtosisValue\_dec\_27** | 0.69 | 0.6744 | 0.7493 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 0.6309 | 0.7282 | 0.7744 |
| **mean\_MFCC\_2nd\_coef** | 0.663 | 0.7022 | 0.746 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.6396 | 0.7152 | 0.7565 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.6569 | 0.6925 | 0.7448 |
| **De\_tqwt\_TKEO\_mean\_dec\_33** | 0.6547 | 0.7097 | 0.7652 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.5956 | 0.7253 | 0.7702 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.6307 | 0.6491 | 0.7063 |
| **tqwt\_meanValue\_dec\_11** | 0.6135 | 0.7064 | 0.7356 |
| **De\_std\_MFCC\_6th\_coef** | 0.5761 | 0.7209 | 0.7491 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.6037 | 0.6942 | 0.7342 |
| **De\_tqwt\_minValue\_dec\_7** | 0.5654 | 0.719 | 0.7544 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.5666 | 0.7575 | 0.7796 |

Table continues below

|  | u.AUC | r.AUC | full.AUC | IDI |
| --- | --- | --- | --- | --- |
| **tqwt\_kurtosisValue\_dec\_36** | 0.7081 | 0.6947 | 0.7695 | 0.1573 |
| **De\_std\_12th\_delta\_delta** | 0.6695 | 0.6898 | 0.7583 | 0.1619 |
| **Ba\_std\_delta\_log\_energy** | 0.7134 | 0.7501 | 0.8153 | 0.1505 |
| **Ba\_std\_5th\_delta** | 0.6548 | 0.67 | 0.7319 | 0.1336 |
| **Ba\_meanIntensity** | 0.6891 | 0.6891 | 0.7627 | 0.1278 |
| **De\_tqwt\_energy\_dec\_33** | 0.7328 | 0.74 | 0.7835 | 0.1278 |
| **De\_std\_MFCC\_2nd\_coef** | 0.685 | 0.7651 | 0.8207 | 0.1252 |
| **De\_tqwt\_stdValue\_dec\_12** | 0.7202 | 0.6739 | 0.7648 | 0.1281 |
| **De\_locDbShimmer** | 0.7371 | 0.7397 | 0.7826 | 0.1035 |
| **std\_MFCC\_8th\_coef** | 0.6744 | 0.7088 | 0.7603 | 0.1192 |
| **Ba\_tqwt\_energy\_dec\_12** | 0.6729 | 0.7027 | 0.7686 | 0.112 |
| **tqwt\_kurtosisValue\_dec\_26** | 0.6612 | 0.6836 | 0.7414 | 0.1098 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.6889 | 0.7215 | 0.7788 | 0.1042 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.6455 | 0.7286 | 0.7586 | 0.1093 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.68 | 0.7689 | 0.8183 | 0.09371 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 0.6705 | 0.6829 | 0.747 | 0.1082 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.6714 | 0.7235 | 0.7517 | 0.1037 |
| **tqwt\_kurtosisValue\_dec\_27** | 0.6601 | 0.6854 | 0.7575 | 0.09854 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 0.6716 | 0.7391 | 0.7878 | 0.09516 |
| **mean\_MFCC\_2nd\_coef** | 0.6415 | 0.7126 | 0.7618 | 0.09289 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.6091 | 0.7242 | 0.764 | 0.08217 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.661 | 0.7077 | 0.7569 | 0.08268 |
| **De\_tqwt\_TKEO\_mean\_dec\_33** | 0.6637 | 0.7331 | 0.7722 | 0.07517 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.5938 | 0.7527 | 0.7919 | 0.07813 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.628 | 0.6895 | 0.7185 | 0.08382 |
| **tqwt\_meanValue\_dec\_11** | 0.6527 | 0.7019 | 0.7477 | 0.07731 |
| **De\_std\_MFCC\_6th\_coef** | 0.6034 | 0.7431 | 0.7684 | 0.079 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.6193 | 0.7125 | 0.7528 | 0.06872 |
| **De\_tqwt\_minValue\_dec\_7** | 0.582 | 0.7389 | 0.7676 | 0.06834 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.5563 | 0.77 | 0.7925 | 0.05178 |

|  | NRI | z.IDI | z.NRI | Frequency |
| --- | --- | --- | --- | --- |
| **tqwt\_kurtosisValue\_dec\_36** | 0.84 | 6.816 | 7.44 | 0.95 |
| **De\_std\_12th\_delta\_delta** | 0.8379 | 6.739 | 7.369 | 0.55 |
| **Ba\_std\_delta\_log\_energy** | 0.7592 | 6.612 | 6.534 | 1 |
| **Ba\_std\_5th\_delta** | 0.7016 | 6.052 | 6.028 | 0.5 |
| **Ba\_meanIntensity** | 0.7314 | 6.02 | 6.476 | 0.7 |
| **De\_tqwt\_energy\_dec\_33** | 0.7466 | 5.898 | 6.422 | 1 |
| **De\_std\_MFCC\_2nd\_coef** | 0.7631 | 5.881 | 6.553 | 1 |
| **De\_tqwt\_stdValue\_dec\_12** | 0.6814 | 5.851 | 5.788 | 0.6 |
| **De\_locDbShimmer** | 0.802 | 5.818 | 7.014 | 1 |
| **std\_MFCC\_8th\_coef** | 0.6699 | 5.722 | 5.623 | 0.75 |
| **Ba\_tqwt\_energy\_dec\_12** | 0.6352 | 5.589 | 5.306 | 0.55 |
| **tqwt\_kurtosisValue\_dec\_26** | 0.6546 | 5.435 | 6.036 | 0.15 |
| **tqwt\_kurtosisValue\_dec\_20** | 0.7377 | 5.418 | 6.305 | 0.95 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.718 | 5.378 | 6.132 | 0.15 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.5762 | 5.296 | 4.815 | 1 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 0.6548 | 5.283 | 5.538 | 0.5 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.7746 | 5.273 | 6.665 | 0.2 |
| **tqwt\_kurtosisValue\_dec\_27** | 0.623 | 5.157 | 5.191 | 0.15 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 0.6383 | 5.156 | 5.391 | 0.3 |
| **mean\_MFCC\_2nd\_coef** | 0.623 | 5.014 | 5.216 | 0.15 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.5984 | 4.838 | 4.983 | 0.8 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.7076 | 4.625 | 5.978 | 0.55 |
| **De\_tqwt\_TKEO\_mean\_dec\_33** | 0.5617 | 4.612 | 4.678 | 0.9 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.6384 | 4.583 | 5.323 | 0.35 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.647 | 4.567 | 5.435 | 0.15 |
| **tqwt\_meanValue\_dec\_11** | 0.6344 | 4.462 | 5.338 | 0.2 |
| **De\_std\_MFCC\_6th\_coef** | 0.6246 | 4.301 | 5.295 | 0.1 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.5338 | 4.169 | 4.42 | 0.25 |
| **De\_tqwt\_minValue\_dec\_7** | 0.6525 | 4.105 | 5.515 | 0.3 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.6957 | 3.862 | 6.067 | 0.25 |

## Let focus on the new features  
  
decorCoeff <- smDecor$coefficients[newvars,];  
ncoef <- dc[newvars]  
cnames <- lapply(ncoef,names)  
names(cnames) <- NULL;  
decorCoeff$Elements <- lapply(cnames,paste,collapse="+")  
pander::pander(decorCoeff)

Table continues below

|  | Estimate | lower | OR | upper |
| --- | --- | --- | --- | --- |
| **De\_tqwt\_energy\_dec\_33** | -0.213 | 0.761 | 0.8082 | 0.8583 |
| **De\_std\_MFCC\_2nd\_coef** | -1.323 | 0.1693 | 0.2664 | 0.4194 |
| **De\_tqwt\_stdValue\_dec\_33** | -0.7531 | 0.3644 | 0.4709 | 0.6085 |
| **De\_locDbShimmer** | 1.076 | 2.095 | 2.932 | 4.103 |
| **De\_std\_12th\_delta\_delta** | 0.8266 | 1.711 | 2.285 | 3.053 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.6153 | 1.479 | 1.85 | 2.315 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | -0.09541 | 0.8768 | 0.909 | 0.9424 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | -0.08994 | 0.8834 | 0.914 | 0.9456 |
| **De\_tqwt\_minValue\_dec\_7** | 0.1421 | 1.093 | 1.153 | 1.216 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | -0.04213 | 0.9432 | 0.9587 | 0.9745 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.1271 | 1.083 | 1.136 | 1.19 |
| **De\_tqwt\_maxValue\_dec\_28** | -0.05188 | 0.9305 | 0.9494 | 0.9687 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | -0.09314 | 0.8785 | 0.9111 | 0.9449 |
| **De\_tqwt\_maxValue\_dec\_29** | -0.02535 | 0.9648 | 0.975 | 0.9852 |
| **De\_tqwt\_entropy\_log\_dec\_1** | 1.228 | 2.045 | 3.413 | 5.696 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | -0.3077 | 0.637 | 0.7351 | 0.8484 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | -0.05254 | 0.9253 | 0.9488 | 0.9729 |
| **De\_tqwt\_entropy\_log\_dec\_35** | -0.1983 | 0.7422 | 0.8201 | 0.9062 |

Table continues below

|  | u.Accuracy | r.Accuracy | full.Accuracy |
| --- | --- | --- | --- |
| **De\_tqwt\_energy\_dec\_33** | 0.7477 | 0.7133 | 0.7794 |
| **De\_std\_MFCC\_2nd\_coef** | 0.7021 | 0.7802 | 0.8191 |
| **De\_tqwt\_stdValue\_dec\_33** | 0.6818 | 0.7068 | 0.7793 |
| **De\_locDbShimmer** | 0.7127 | 0.7523 | 0.7832 |
| **De\_std\_12th\_delta\_delta** | 0.6946 | 0.722 | 0.7561 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.6925 | 0.7726 | 0.818 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.6429 | 0.6945 | 0.7448 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.7021 | 0.6856 | 0.734 |
| **De\_tqwt\_minValue\_dec\_7** | 0.5679 | 0.7021 | 0.7521 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | 0.6826 | 0.7382 | 0.7697 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.639 | 0.7053 | 0.7639 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.6479 | 0.7252 | 0.7613 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.6262 | 0.7178 | 0.7358 |
| **De\_tqwt\_maxValue\_dec\_29** | 0.6393 | 0.7227 | 0.7595 |
| **De\_tqwt\_entropy\_log\_dec\_1** | 0.6074 | 0.7413 | 0.7691 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.6107 | 0.7128 | 0.7467 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.5982 | 0.719 | 0.7429 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.5746 | 0.6941 | 0.7329 |

Table continues below

|  | u.AUC | r.AUC | full.AUC | IDI |
| --- | --- | --- | --- | --- |
| **De\_tqwt\_energy\_dec\_33** | 0.7354 | 0.7353 | 0.778 | 0.1414 |
| **De\_std\_MFCC\_2nd\_coef** | 0.6861 | 0.7764 | 0.8205 | 0.1142 |
| **De\_tqwt\_stdValue\_dec\_33** | 0.6844 | 0.7253 | 0.7714 | 0.1063 |
| **De\_locDbShimmer** | 0.7364 | 0.7401 | 0.7808 | 0.09588 |
| **De\_std\_12th\_delta\_delta** | 0.6757 | 0.7287 | 0.7631 | 0.1146 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.6795 | 0.7686 | 0.8196 | 0.08713 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.6684 | 0.7218 | 0.753 | 0.0999 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.7006 | 0.711 | 0.7446 | 0.09456 |
| **De\_tqwt\_minValue\_dec\_7** | 0.5811 | 0.7165 | 0.7658 | 0.0962 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | 0.6347 | 0.7512 | 0.7868 | 0.0908 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.6119 | 0.7166 | 0.7704 | 0.08253 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.6482 | 0.7411 | 0.7734 | 0.09125 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.6283 | 0.724 | 0.7382 | 0.09375 |
| **De\_tqwt\_maxValue\_dec\_29** | 0.657 | 0.7362 | 0.7665 | 0.08167 |
| **De\_tqwt\_entropy\_log\_dec\_1** | 0.6318 | 0.745 | 0.7764 | 0.07968 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.6234 | 0.7202 | 0.7565 | 0.0639 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.5967 | 0.7423 | 0.7619 | 0.06496 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.5615 | 0.7157 | 0.7439 | 0.04788 |

Table continues below

|  | NRI | z.IDI | z.NRI | Frequency |
| --- | --- | --- | --- | --- |
| **De\_tqwt\_energy\_dec\_33** | 0.7818 | 6.217 | 6.735 | 1 |
| **De\_std\_MFCC\_2nd\_coef** | 0.7175 | 5.653 | 6.114 | 1 |
| **De\_tqwt\_stdValue\_dec\_33** | 0.6587 | 5.531 | 5.561 | 0.95 |
| **De\_locDbShimmer** | 0.8134 | 5.524 | 7.143 | 1 |
| **De\_std\_12th\_delta\_delta** | 0.6629 | 5.47 | 5.576 | 0.85 |
| **De\_tqwt\_kurtosisValue\_dec\_33** | 0.5539 | 5.115 | 4.622 | 1 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | 0.7475 | 5.09 | 6.384 | 0.2 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | 0.7233 | 5.063 | 6.174 | 0.25 |
| **De\_tqwt\_minValue\_dec\_7** | 0.7003 | 5.044 | 5.924 | 0.25 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | 0.6448 | 5.011 | 5.553 | 0.15 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | 0.6369 | 4.986 | 5.377 | 0.6 |
| **De\_tqwt\_maxValue\_dec\_28** | 0.6262 | 4.939 | 5.261 | 0.1 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | 0.6951 | 4.907 | 5.876 | 0.15 |
| **De\_tqwt\_maxValue\_dec\_29** | 0.6721 | 4.631 | 5.634 | 0.1 |
| **De\_tqwt\_entropy\_log\_dec\_1** | 0.642 | 4.53 | 5.43 | 0.25 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | 0.625 | 4.106 | 5.233 | 0.65 |
| **De\_tqwt\_TKEO\_std\_dec\_7** | 0.5656 | 4.04 | 4.662 | 0.2 |
| **De\_tqwt\_entropy\_log\_dec\_35** | 0.6251 | 3.698 | 5.27 | 0.15 |

|  | Elements |
| --- | --- |
| **De\_tqwt\_energy\_dec\_33** | tqwt\_energy\_dec\_31+tqwt\_energy\_dec\_33 |
| **De\_std\_MFCC\_2nd\_coef** | std\_MFCC\_2nd\_coef+std\_2nd\_delta |
| **De\_tqwt\_stdValue\_dec\_33** | tqwt\_TKEO\_mean\_dec\_35+tqwt\_stdValue\_dec\_32+tqwt\_stdValue\_dec\_33 |
| **De\_locDbShimmer** | locDbShimmer+ddaShimmer |
| **De\_std\_12th\_delta\_delta** | std\_MFCC\_12th\_coef+std\_12th\_delta\_delta |
| **De\_tqwt\_kurtosisValue\_dec\_33** | tqwt\_kurtosisValue\_dec\_32+tqwt\_kurtosisValue\_dec\_33 |
| **De\_tqwt\_TKEO\_mean\_dec\_17** | tqwt\_TKEO\_mean\_dec\_17+tqwt\_minValue\_dec\_17 |
| **De\_tqwt\_TKEO\_std\_dec\_11** | tqwt\_TKEO\_mean\_dec\_10+tqwt\_TKEO\_mean\_dec\_11+tqwt\_TKEO\_std\_dec\_11+tqwt\_stdValue\_dec\_10+tqwt\_minValue\_dec\_17 |
| **De\_tqwt\_minValue\_dec\_7** | tqwt\_minValue\_dec\_7+tqwt\_minValue\_dec\_17+tqwt\_maxValue\_dec\_8 |
| **De\_tqwt\_kurtosisValue\_dec\_2** | tqwt\_kurtosisValue\_dec\_2+tqwt\_kurtosisValue\_dec\_3 |
| **De\_tqwt\_TKEO\_std\_dec\_36** | tqwt\_TKEO\_mean\_dec\_35+tqwt\_TKEO\_std\_dec\_36 |
| **De\_tqwt\_maxValue\_dec\_28** | tqwt\_stdValue\_dec\_28+tqwt\_maxValue\_dec\_28 |
| **De\_tqwt\_TKEO\_std\_dec\_17** | tqwt\_TKEO\_std\_dec\_17+tqwt\_minValue\_dec\_17 |
| **De\_tqwt\_maxValue\_dec\_29** | tqwt\_stdValue\_dec\_28+tqwt\_maxValue\_dec\_29 |
| **De\_tqwt\_entropy\_log\_dec\_1** | tqwt\_entropy\_log\_dec\_1+tqwt\_entropy\_log\_dec\_2 |
| **De\_det\_LT\_TKEO\_mean\_3\_coef** | Ed2\_3\_coef+det\_LT\_TKEO\_mean\_1\_coef+det\_LT\_TKEO\_mean\_3\_coef |
| **De\_tqwt\_TKEO\_std\_dec\_7** | tqwt\_TKEO\_std\_dec\_7+tqwt\_stdValue\_dec\_7+tqwt\_minValue\_dec\_17 |
| **De\_tqwt\_entropy\_log\_dec\_35** | tqwt\_entropy\_log\_dec\_35+tqwt\_TKEO\_mean\_dec\_35 |

## Differences Between Blind vs Outcome-Drive Decorrelation

In this section I will show the differences in unaltered basis vectors between the Outcome driven Transformation vs the blind decorrelated transformation

par(op)  
par(mfrow=c(1,1))  
  
  
smDecorU <- summary(bmdU)  
decornamesU <- rownames(smDecorU$coefficients)  
  
get\_De\_names <- decornames[!str\_detect(decornames,"De\_")]  
get\_De\_namesU <- decornamesU[!str\_detect(decornamesU,"De\_")]  
  
unn <- bmd$univariate[,3]  
names(unn) <- rownames(bmd$univariate)  
pander::pander(as.matrix(unn[get\_De\_names]))

|  |  |
| --- | --- |
| **Ba\_tqwt\_kurtosisValue\_dec\_36** | 5.826 |
| **Ba\_std\_delta\_delta\_log\_energy** | 6.152 |
| **Ba\_tqwt\_entropy\_log\_dec\_12** | 5.376 |
| **Ba\_std\_5th\_delta** | 4.277 |
| **Ba\_tqwt\_energy\_dec\_12** | 4.446 |
| **Ba\_tqwt\_kurtosisValue\_dec\_26** | 3.877 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 4.511 |
| **tqwt\_kurtosisValue\_dec\_20** | 4.85 |
| **Ba\_meanIntensity** | 5.337 |
| **std\_MFCC\_8th\_coef** | 4.397 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 4.265 |
| **tqwt\_meanValue\_dec\_11** | 3.67 |
| **Ba\_locAbsJitter** | 4.114 |

pander::pander(summary(unn[get\_De\_names]))

| Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
| --- | --- | --- | --- | --- | --- |
| 3.67 | 4.265 | 4.446 | 4.7 | 5.337 | 6.152 |

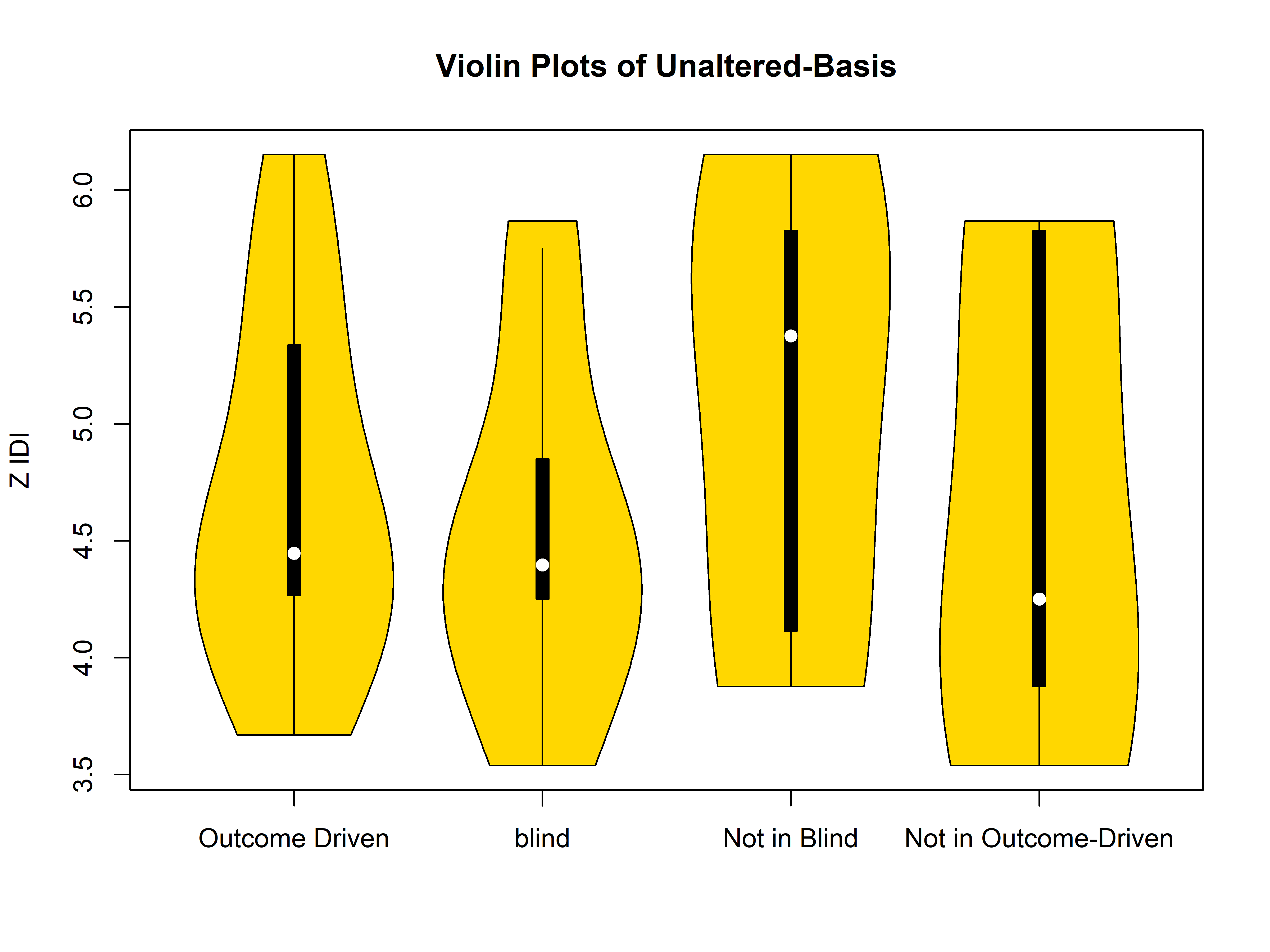
unnU <- bmdU$univariate[,3]  
names(unnU) <- rownames(bmdU$univariate)  
pander::pander(as.matrix(unnU[get\_De\_namesU]))

|  |  |
| --- | --- |
| **tqwt\_kurtosisValue\_dec\_36** | 5.826 |
| **Ba\_std\_delta\_log\_energy** | 5.867 |
| **Ba\_std\_5th\_delta** | 4.277 |
| **Ba\_meanIntensity** | 5.337 |
| **std\_MFCC\_8th\_coef** | 4.397 |
| **Ba\_tqwt\_energy\_dec\_12** | 4.446 |
| **tqwt\_kurtosisValue\_dec\_26** | 3.877 |
| **tqwt\_kurtosisValue\_dec\_20** | 4.85 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 4.511 |
| **tqwt\_kurtosisValue\_dec\_27** | 4.25 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 4.265 |
| **mean\_MFCC\_2nd\_coef** | 3.538 |
| **tqwt\_meanValue\_dec\_11** | 3.67 |

pander::pander(summary(unnU[get\_De\_namesU]))

| Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
| --- | --- | --- | --- | --- | --- |
| 3.538 | 4.25 | 4.397 | 4.547 | 4.85 | 5.867 |

#boxplot(unn[get\_De\_names],unnU[get\_De\_namesU],xlab=c("Method"),ylab="Z",main="Z Values of Basis Features")  
  
x1 <- unn[get\_De\_names]  
x2 <- unnU[get\_De\_namesU]  
X3 <- x1[!(get\_De\_names %in% get\_De\_namesU)]  
X4 <- x2[!(get\_De\_namesU %in% get\_De\_names)]  
vioplot(x1, x2, X3,X4, names=c("Outcome Driven", "blind","Not in Blind","Not in Outcome-Driven"),ylab="Z IDI",  
 col="gold")  
title("Violin Plots of Unaltered-Basis")



sameFeatures <- get\_De\_names[get\_De\_names %in% get\_De\_namesU]  
pander::pander(as.matrix(unn[sameFeatures]))

|  |  |
| --- | --- |
| **Ba\_std\_5th\_delta** | 4.277 |
| **Ba\_tqwt\_energy\_dec\_12** | 4.446 |
| **Ba\_tqwt\_kurtosisValue\_dec\_28** | 4.511 |
| **tqwt\_kurtosisValue\_dec\_20** | 4.85 |
| **Ba\_meanIntensity** | 5.337 |
| **std\_MFCC\_8th\_coef** | 4.397 |
| **Ba\_tqwt\_kurtosisValue\_dec\_17** | 4.265 |
| **tqwt\_meanValue\_dec\_11** | 3.67 |

## The features by Outcome Drive not in blind  
pander::pander(as.matrix(x1[!(get\_De\_names %in% get\_De\_namesU)]))

|  |  |
| --- | --- |
| **Ba\_tqwt\_kurtosisValue\_dec\_36** | 5.826 |
| **Ba\_std\_delta\_delta\_log\_energy** | 6.152 |
| **Ba\_tqwt\_entropy\_log\_dec\_12** | 5.376 |
| **Ba\_tqwt\_kurtosisValue\_dec\_26** | 3.877 |
| **Ba\_locAbsJitter** | 4.114 |

## The features not in outcome driven  
pander::pander(as.matrix(x2[!(get\_De\_namesU %in% get\_De\_names)]))

|  |  |
| --- | --- |
| **tqwt\_kurtosisValue\_dec\_36** | 5.826 |
| **Ba\_std\_delta\_log\_energy** | 5.867 |
| **tqwt\_kurtosisValue\_dec\_26** | 3.877 |
| **tqwt\_kurtosisValue\_dec\_27** | 4.25 |
| **mean\_MFCC\_2nd\_coef** | 3.538 |