

famd

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Librerias

```
library("FactoMineR")
library("factoextra")

## Loading required package: ggplot2

## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa

load("~/Documents/GitHub/Mineria/DATA/dataaaaaaaaaaaa.RData")
data<-data_imputado
data <- data[data$group == "train", ]
data<- subset(data, select = -c(ID,Surname,group))
#Ahora dividimos la base de datos en train i test
train_index <- sample(1:nrow(data), 0.7 * nrow(data))
train <- data[train_index, ]
test <- data[-train_index, ]
summary(train)

##   Exited      Tenure      Gender      EducationLevel
## 0:3886    Min.   : 0.000  Female:2229  High School :1631
## 1:1014    1st Qu.: 2.000  Male   :2671   Other       : 224
##                   Median : 5.000          Postgraduate: 757
##                   Mean   : 4.973          University   :2288
##                   3rd Qu.: 7.000
##                   Max.   :10.000
## 
##   LoanStatus     NetPromoterScore TransactionFrequency      Age
##  Active loan :1418    Min.   : 0.000  Min.   :13.00        Min.   :18.00
##  Default risk: 501    1st Qu.: 4.000  1st Qu.:26.00        1st Qu.:32.00
##  No loan     :2981    Median : 8.000  Median :30.00        Median :37.00
##                   Mean   : 6.477  Mean   :30.03        Mean   :39.27
##                   3rd Qu.: 9.000  3rd Qu.:34.00        3rd Qu.:44.00
##                   Max.   :10.000  Max.   :52.00        Max.   :92.00
## 
##   Geography   ComplaintsCount HasCrCard EstimatedSalary      IsActiveMember
##  France      :2444    Min.   :0.0000  0:1455    Min.   : 11.58  0:2350
##  Germany     :1256    1st Qu.:0.0000  1:3445    1st Qu.: 49952.08 1:2550
##  Spain       :1200    Median :0.0000          Median : 99649.59
##                   Mean   :0.3624          Mean   :100216.05
##                   3rd Qu.:0.0000         3rd Qu.:149808.93
```

```

##          Max.    :5.0000          Max.    :199862.75
## AvgTransactionAmount      CustomerSegment MaritalStatus
## Min.    : 19.60      Affluent       :1445   Divorced: 712
## 1st Qu.: 70.53      High Net Worth: 924   Married :2519
## Median : 99.55      Mass Market    :2531   Single  :1434
## Mean   :112.09          Widowed     : 235
## 3rd Qu.:138.14
## Max.   :581.79

## DigitalEngagementScore CreditScore SavingsAccountFlag Balance
## Min.    : 5.00      Min.    :350.0  0:1660      Min.    : 0
## 1st Qu.: 50.00      1st Qu.:584.0  1:3240      1st Qu.: 0
## Median : 60.00      Median :651.0          Median : 98725
## Mean   : 59.64      Mean   :650.5          Mean   : 77717
## 3rd Qu.: 70.00      3rd Qu.:718.0          3rd Qu.:128428
## Max.   :100.00      Max.   :850.0          Max.   :250898

## NumOfProducts
## Min.    :1.000
## 1st Qu.:1.000
## Median :1.000
## Mean   :1.524
## 3rd Qu.:2.000
## Max.   :4.000

```

El análisis de datos mixtos mediante el método de Análisis Factorial de Datos Mixtos (FAMD, por sus siglas en inglés) es una técnica que permite analizar conjuntos de datos que contienen tanto variables cuantitativas como cualitativas. El FAMD combina elementos del Análisis de Componentes Principales (PCA) y el Análisis de Correspondencias Múltiples (MCA) para realizar esta tarea. Durante el análisis, se normalizan las variables cuantitativas y cualitativas para equilibrar su influencia. En este capítulo se presenta cómo realizar y visualizar el análisis factorial de datos mixtos utilizando los paquetes FactoMineR (para el análisis) y factoextra (para la visualización) en el entorno de programación R.

Data format

```
head(train)
```

```

##      Exited Tenure Gender EducationLevel LoanStatus NetPromoterScore
## 2463      0      4   Male    University    No loan           10
## 2511      1      5   Male    University Default risk            2
## 2227      0      1   Male    University    No loan            9
## 526       0      5 Female  High School Active loan            6
## 4291      0      7 Female  University    No loan            9
## 2986      0      1   Male    High School Active loan            5
##          TransactionFrequency Age Geography ComplaintsCount HasCrCard
## 2463                  37    20     Spain             0            1
## 2511                  30    32     Spain             0            1
## 2227                  33    33     Spain             0            0
## 526                   34    49  Germany            0            0
## 4291                  35    40  Germany            0            1
## 2986                  28    36   France            0            0
##      EstimatedSalary IsActiveMember AvgTransactionAmount CustomerSegment
## 2463 179291.85           1          104.50087      Affluent

```

```

## 2511      192127.22      1      99.91607      Affluent
## 2227      117834.91      0      78.31016      Mass Market
## 526       59748.19      1     183.89511  High Net Worth
## 4291      172629.67      1     167.07649      Mass Market
## 2986      133141.34      0     209.98678      Affluent
##   MaritalStatus DigitalEngagementScore CreditScore SavingsAccountFlag
## 2463       Single           62      729          1
## 2511       Married          49      743          0
## 2227       Married          86      495          1
## 526        Single           66      850          0
## 4291       Widowed          73      554          1
## 2986       Single           69      621          0
##   Balance NumOfProducts
## 2463    97268.1           2
## 2511   145729.7           1
## 2227    0.0               1
## 526     0.0               1
## 4291   137654.0           1
## 2986    0.0               2

```

```
str(train)
```

```

## 'data.frame': 4900 obs. of 21 variables:
## $ Exited                  : Factor w/ 2 levels "0","1": 1 2 1 1 1 1 1 1 1 2 ...
## $ Tenure                   : num  4 5 1 5 7 1 6 9 4 3 ...
## $ Gender                   : Factor w/ 2 levels "Female","Male": 2 2 2 1 1 2 2 2 2 2 ...
## $ EducationLevel           : Factor w/ 4 levels "High School",...: 4 4 4 1 4 1 3 4 4 1 ...
## $ LoanStatus                : Factor w/ 3 levels "Active loan",...: 3 2 3 1 3 1 1 3 2 3 ...
## $ NetPromoterScore          : num  10 2 9 6 9 5 3 8 1 9 ...
## $ TransactionFrequency      : num  37 30 33 34 35 28 36 27 32 36 ...
## $ Age                       : num  20 32 33 49 40 36 37 35 34 49 ...
## $ Geography                 : Factor w/ 3 levels "France","Germany",...: 3 3 3 2 2 1 2 3 1 1 ...
## $ ComplaintsCount           : num  0 0 0 0 0 0 1 0 2 0 ...
## $ HasCrCard                 : Factor w/ 2 levels "0","1": 2 2 1 1 2 1 2 1 2 2 ...
## $ EstimatedSalary            : num  179292 192127 117835 59748 172630 ...
## $ IsActiveMember              : Factor w/ 2 levels "0","1": 2 2 1 2 2 1 2 1 1 1 ...
## $ AvgTransactionAmount       : num  104.5 99.9 78.3 183.9 167.1 ...
## $ CustomerSegment             : Factor w/ 3 levels "Affluent","High Net Worth",...: 1 1 3 2 3 1 2 3 2 1 ...
## $ MaritalStatus               : Factor w/ 4 levels "Divorced","Married",...: 3 2 2 3 4 3 2 2 1 3 ...
## $ DigitalEngagementScore    : num  62 49 86 66 73 69 73 61 64 35 ...
## $ CreditScore                 : num  729 743 495 850 554 621 825 665 774 789 ...
## $ SavingsAccountFlag          : Factor w/ 2 levels "0","1": 2 1 2 1 2 1 2 2 1 2 ...
## $ Balance                     : num  97268 145730 0 0 137654 ...
## $ NumOfProducts                : num  2 1 1 1 1 2 1 1 1 1 ...

```

Este data frame contiene 4900 observaciones y 24 variables que describen clientes bancarios, incluyendo características demográficas, financieras y de comportamiento.

En total tenemos un numero de 13 variables de tipo factor i 11 de tipo numerica.

FAMD

```
res.famda <- FAMD(train,ncp = 20, graph = FALSE)
print(res.famda)

## *The results are available in the following objects:
##
##   name      description
## 1 "$eig"    "eigenvalues and inertia"
## 2 "$var"    "Results for the variables"
## 3 "$ind"    "results for the individuals"
## 4 "$quali.var" "Results for the qualitative variables"
## 5 "$quanti.var" "Results for the quantitative variables"
```

El 80% se explica con 18 dimensiones.

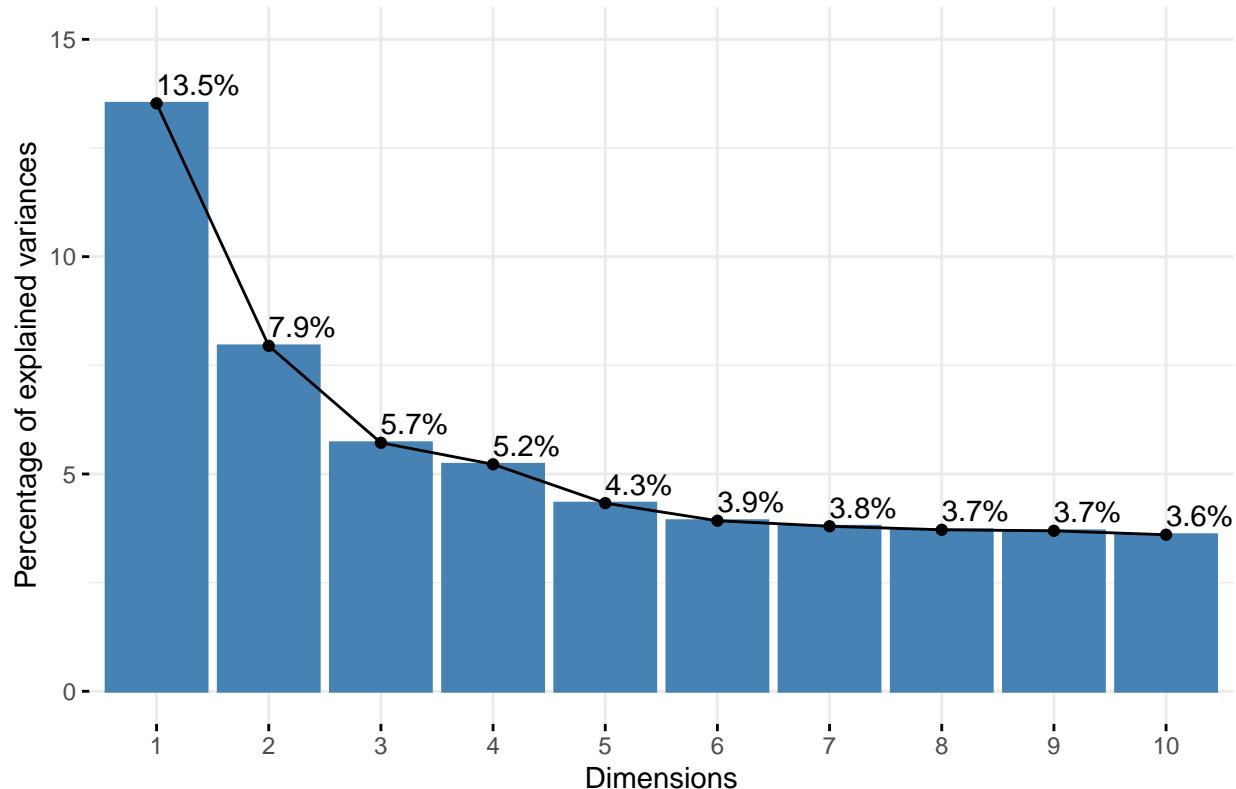
Visualization & Results

```
eig.val <- get_eigenvalue(res.famda)
eig.val

##          eigenvalue variance.percent cumulative.variance.percent
## Dim.1    3.7877449     13.527660            13.52766
## Dim.2    2.2253033      7.947512            21.47517
## Dim.3    1.6011134      5.718262            27.19343
## Dim.4    1.4623322      5.222615            32.41605
## Dim.5    1.2121456      4.329091            36.74514
## Dim.6    1.0989087      3.924674            40.66981
## Dim.7    1.0632721      3.797400            44.46721
## Dim.8    1.0405597      3.716285            48.18350
## Dim.9    1.0338009      3.692146            51.87565
## Dim.10   1.0085385      3.601923            55.47757
## Dim.11   1.0007440      3.574086            59.05165
## Dim.12   0.9812376      3.504420            62.55607
## Dim.13   0.9573674      3.419169            65.97524
## Dim.14   0.9385781      3.352065            69.32731
## Dim.15   0.9358939      3.342478            72.66979
## Dim.16   0.9157290      3.270461            75.94025
## Dim.17   0.7759848      2.771374            78.71162
## Dim.18   0.7352201      2.625786            81.33741
## Dim.19   0.6492771      2.318847            83.65625
## Dim.20   0.6322305      2.257966            85.91422

fviz_screepplot(res.famda, addlabels = TRUE, ylim = c(0, 15)) +
  ggtitle("Varianza explicada por dimensión (FAMD)")
```

Varianza explicada por dimensión (FAMD)



```
var <- get_famd_var(res.famd)
var
```

```
## FAMD results for variables
## -----
##   Name      Description
## 1 "$coord" "Coordinates"
## 2 "$cos2"   "Cos2, quality of representation"
## 3 "$contrib" "Contributions"

head(var$coord)

##                               Dim.1        Dim.2        Dim.3        Dim.4
## Tenure          0.0002842749 3.605791e-05 8.795493e-04 1.204783e-03
## NetPromoterScore 0.6412978745 7.628251e-03 6.081897e-03 5.953704e-05
## TransactionFrequency 0.0007705017 1.249224e-03 1.445843e-04 1.470969e-03
## Age            0.0005750231 4.707800e-05 1.313992e-03 8.111065e-02
## ComplaintsCount 0.6510655290 1.149389e-01 3.368562e-02 1.145063e-04
## EstimatedSalary 0.0007361672 2.883752e-05 4.578369e-05 1.189368e-02
##                               Dim.5        Dim.6        Dim.7        Dim.8
## Tenure          1.468769e-03 4.260647e-02 2.509994e-01 0.0314053449
## NetPromoterScore 3.980658e-04 6.937753e-05 1.315703e-04 0.0013655753
## TransactionFrequency 7.414020e-04 6.254980e-02 3.567523e-01 0.0016267623
## Age             2.477417e-01 7.123816e-02 3.279381e-02 0.0002454775
## ComplaintsCount 4.095133e-04 9.337024e-06 2.215917e-05 0.0008438769
```

```

## EstimatedSalary      9.605078e-05 1.610474e-02 1.614636e-01 0.0646815044
##                               Dim.9      Dim.10      Dim.11      Dim.12
## Tenure              3.616834e-02 1.062684e-01 1.342804e-03 0.1484964104
## NetPromoterScore   4.867756e-05 7.799997e-05 7.492707e-04 0.0003401170
## TransactionFrequency 6.356712e-02 2.495166e-03 5.417322e-03 0.0520039530
## Age                 2.558007e-01 1.480394e-02 4.901132e-05 0.0043619396
## ComplaintsCount    1.453686e-04 3.411538e-07 2.287322e-04 0.0003227599
## EstimatedSalary     2.853146e-02 3.093362e-02 2.808212e-01 0.2525189666
##                               Dim.13      Dim.14      Dim.15      Dim.16
## Tenure              3.323345e-01 8.363498e-03 0.0219731164 1.183819e-02
## NetPromoterScore   1.075964e-06 2.136361e-04 0.0036298727 9.394148e-06
## TransactionFrequency 2.444336e-01 8.013761e-02 0.0353551322 8.406161e-02
## Age                 9.343939e-04 8.074112e-03 0.0211681414 4.357825e-02
## ComplaintsCount    1.146990e-05 2.300572e-06 0.0008664298 2.384685e-04
## EstimatedSalary     5.227879e-03 7.825947e-03 0.0595081909 7.648775e-02
##                               Dim.17      Dim.18      Dim.19      Dim.20
## Tenure              0.0006617790 4.429114e-04 1.793069e-03 3.598804e-05
## NetPromoterScore   0.0335790374 2.378473e-04 2.056600e-03 2.416273e-03
## TransactionFrequency 0.0027620052 1.743629e-03 8.828980e-06 7.218063e-04
## Age                 0.0022732836 2.068786e-01 1.118322e-04 1.031742e-03
## ComplaintsCount    0.0029370466 2.359690e-04 8.625731e-04 5.332941e-08
## EstimatedSalary     0.0002008315 9.701832e-06 6.075149e-04 2.747137e-06

```

```
head(var$cos2)
```

```

##                               Dim.1      Dim.2      Dim.3      Dim.4
## Tenure              8.081223e-08 1.300173e-09 7.736070e-07 1.451503e-06
## NetPromoterScore   4.112630e-01 5.819021e-05 3.698947e-05 3.544659e-09
## TransactionFrequency 5.936729e-07 1.560562e-06 2.090463e-08 2.163751e-06
## Age                 3.306516e-07 2.216338e-09 1.726574e-06 6.578938e-03
## ComplaintsCount    4.238863e-01 1.321094e-02 1.134721e-03 1.311170e-08
## EstimatedSalary     5.419422e-07 8.316028e-10 2.096147e-09 1.414597e-04
##                               Dim.5      Dim.6      Dim.7      Dim.8
## Tenure              2.157283e-06 1.815312e-03 6.300072e-02 9.862957e-04
## NetPromoterScore   1.584564e-07 4.813242e-09 1.731075e-08 1.864796e-06
## TransactionFrequency 5.496769e-07 3.912477e-03 1.272722e-01 2.646355e-06
## Age                 6.137594e-02 5.074875e-03 1.075434e-03 6.025919e-08
## ComplaintsCount    1.677011e-07 8.718003e-11 4.910287e-10 7.121283e-07
## EstimatedSalary     9.225751e-09 2.593625e-04 2.607049e-02 4.183697e-03
##                               Dim.9      Dim.10      Dim.11      Dim.12
## Tenure              1.308149e-03 1.129296e-02 1.803121e-06 2.205118e-02
## NetPromoterScore   2.369505e-09 6.083995e-09 5.614065e-07 1.156796e-07
## TransactionFrequency 4.040779e-03 6.225853e-06 2.934738e-05 2.704411e-03
## Age                 6.543401e-02 2.191566e-04 2.402110e-09 1.902652e-05
## ComplaintsCount    2.113202e-08 1.163859e-13 5.231842e-08 1.041740e-07
## EstimatedSalary     8.140443e-04 9.568890e-04 7.886055e-02 6.376583e-02
##                               Dim.13      Dim.14      Dim.15      Dim.16
## Tenure              1.104462e-01 6.994810e-05 4.828178e-04 1.401427e-04
## NetPromoterScore   1.157698e-12 4.564038e-08 1.317598e-05 8.825002e-11
## TransactionFrequency 5.974779e-02 6.422037e-03 1.249985e-03 7.066354e-03
## Age                 8.730919e-07 6.519128e-05 4.480902e-04 1.899064e-03
## ComplaintsCount    1.315587e-10 5.292633e-12 7.507006e-07 5.686724e-08
## EstimatedSalary     2.733072e-05 6.124545e-05 3.541225e-03 5.850376e-03
##                               Dim.17      Dim.18      Dim.19      Dim.20

```

```

## Tenure           4.379515e-07 1.961705e-07 3.215098e-06 1.295139e-09
## NetPromoterScore 1.127552e-03 5.657134e-08 4.229605e-06 5.838376e-06
## TransactionFrequency 7.628673e-06 3.040242e-06 7.795090e-11 5.210043e-07
## Age              5.167818e-06 4.279877e-02 1.250643e-08 1.064493e-06
## ComplaintsCount 8.626243e-06 5.568138e-08 7.440323e-07 2.844026e-15
## EstimatedSalary   4.033327e-08 9.412555e-11 3.690744e-07 7.546760e-12

head(var$contrib)

##                               Dim.1      Dim.2      Dim.3      Dim.4
## Tenure           0.007505123 0.001620359 0.054933602 0.082387805
## NetPromoterScore 16.930862306 0.342795996 0.379854198 0.004071376
## TransactionFrequency 0.020341965 0.056137265 0.009030237 0.100590642
## Age              0.015181147 0.002115577 0.082067362 5.546663904
## ComplaintsCount 17.188737501 5.165087367 2.103887205 0.007830392
## EstimatedSalary   0.019435501 0.001295892 0.002859491 0.813336537
##                               Dim.5      Dim.6      Dim.7      Dim.8
## Tenure           0.12117104 3.8771621662 23.606323678 3.01812036
## NetPromoterScore 0.03283977 0.0063133119 0.012374097 0.13123469
## TransactionFrequency 0.06116444 5.6919922510 33.552301411 0.15633531
## Age              20.43827759 6.4826275794 3.084235258 0.02359091
## ComplaintsCount 0.03378417 0.0008496633 0.002084054 0.08109837
## EstimatedSalary   0.00792403 1.4655207537 15.185537867 6.21602998
##                               Dim.9      Dim.10     Dim.11     Dim.12
## Tenure           3.498579105 1.053687e+01 0.134180522 15.13358284
## NetPromoterScore 0.004708601 7.733961e-03 0.074871365 0.03466204
## TransactionFrequency 6.148874958 2.474041e-01 0.541329465 5.29983270
## Age              24.743711758 1.467861e+00 0.004897488 0.44453448
## ComplaintsCount 0.014061562 3.382655e-05 0.022856216 0.03289314
## EstimatedSalary   2.759860465 3.067173e+00 28.061243457 25.73474127
##                               Dim.13     Dim.14     Dim.15     Dim.16
## Tenure           3.471337e+01 0.8910817473 2.34782122 1.292761191
## NetPromoterScore 1.123878e-04 0.0227616748 0.38785086 0.001025866
## TransactionFrequency 2.553185e+01 8.5381931711 3.77768578 9.179748096
## Age              9.760034e-02 0.8602493290 2.26180987 4.758858869
## ComplaintsCount 1.198067e-03 0.0002451125 0.09257778 0.026041389
## EstimatedSalary   5.460682e-01 0.8338088812 6.35843321 8.352663023
##                               Dim.17     Dim.18     Dim.19     Dim.20
## Tenure           0.08528247 0.060242018 0.276163982 5.692234e-03
## NetPromoterScore 4.32728018 0.032350490 0.316752351 3.821823e-01
## TransactionFrequency 0.35593547 0.237157396 0.001359817 1.141682e-01
## Age              0.29295464 28.138325923 0.017224104 1.631909e-01
## ComplaintsCount 0.37849279 0.032095017 0.132851304 8.435121e-06
## EstimatedSalary   0.02588085 0.001319582 0.093567896 4.345151e-04

fviz_famda_var(res.famda, repel = TRUE)

```

Variables – FAMD



```

```{r}
var <- get_famd_var(res.famd)
var

FAMD results for variables
=====
Name Description
1 "$coord" "Coordinates"
2 "$cos2" "Cos2, quality of representation"
3 "$contrib" "Contributions"

head(var$coord)

Dim.1 Dim.2 Dim.3 Dim.4
Tenure 0.0002842749 3.605791e-05 8.795493e-04 1.204783e-03
NetPromoterScore 0.6412978745 7.628251e-03 6.081897e-03 5.953704e-05
TransactionFrequency 0.0007705017 1.249224e-03 1.445843e-04 1.470969e-03
Age 0.0005750231 4.707800e-05 1.313992e-03 8.111065e-02
ComplaintsCount 0.6510655290 1.149389e-01 3.368562e-02 1.145063e-04
EstimatedSalary 0.0007361672 2.883752e-05 4.578369e-05 1.189368e-02
Dim.5 Dim.6 Dim.7 Dim.8
Tenure 1.468769e-03 4.260647e-02 2.509994e-01 0.0314053449
NetPromoterScore 3.980658e-04 6.937753e-05 1.315703e-04 0.00136555753

```

```

TransactionFrequency 7.414020e-04 6.254980e-02 3.567523e-01 0.0016267623
Age 2.477417e-01 7.123816e-02 3.279381e-02 0.0002454775
ComplaintsCount 4.095133e-04 9.337024e-06 2.215917e-05 0.0008438769
EstimatedSalary 9.605078e-05 1.610474e-02 1.614636e-01 0.0646815044
Dim.9 Dim.10 Dim.11 Dim.12
Tenure 3.616834e-02 1.062684e-01 1.342804e-03 0.1484964104
NetPromoterScore 4.867756e-05 7.799997e-05 7.492707e-04 0.0003401170
TransactionFrequency 6.356712e-02 2.495166e-03 5.417322e-03 0.0520039530
Age 2.558007e-01 1.480394e-02 4.901132e-05 0.0043619396
ComplaintsCount 1.453686e-04 3.411538e-07 2.287322e-04 0.0003227599
EstimatedSalary 2.853146e-02 3.093362e-02 2.808212e-01 0.2525189666
Dim.13 Dim.14 Dim.15 Dim.16
Tenure 3.323345e-01 8.363498e-03 0.0219731164 1.183819e-02
NetPromoterScore 1.075964e-06 2.136361e-04 0.0036298727 9.394148e-06
TransactionFrequency 2.444336e-01 8.013761e-02 0.0353551322 8.406161e-02
Age 9.343939e-04 8.074112e-03 0.0211681414 4.357825e-02
ComplaintsCount 1.146990e-05 2.300572e-06 0.0008664298 2.384685e-04
EstimatedSalary 5.227879e-03 7.825947e-03 0.0595081909 7.648775e-02
Dim.17 Dim.18 Dim.19 Dim.20
Tenure 0.0006617790 4.429114e-04 1.793069e-03 3.598804e-05
NetPromoterScore 0.0335790374 2.378473e-04 2.056600e-03 2.416273e-03
TransactionFrequency 0.0027620052 1.743629e-03 8.828980e-06 7.218063e-04
Age 0.0022732836 2.068786e-01 1.118322e-04 1.031742e-03
ComplaintsCount 0.0029370466 2.359690e-04 8.625731e-04 5.332941e-08
EstimatedSalary 0.0002008315 9.701832e-06 6.075149e-04 2.747137e-06

```

```
head(var$cos2)
```

```

Dim.1 Dim.2 Dim.3 Dim.4
Tenure 8.081223e-08 1.300173e-09 7.736070e-07 1.451503e-06
NetPromoterScore 4.112630e-01 5.819021e-05 3.698947e-05 3.544659e-09
TransactionFrequency 5.936729e-07 1.560562e-06 2.090463e-08 2.163751e-06
Age 3.306516e-07 2.216338e-09 1.726574e-06 6.578938e-03
ComplaintsCount 4.238863e-01 1.321094e-02 1.134721e-03 1.311170e-08
EstimatedSalary 5.419422e-07 8.316028e-10 2.096147e-09 1.414597e-04
Dim.5 Dim.6 Dim.7 Dim.8
Tenure 2.157283e-06 1.815312e-03 6.300072e-02 9.862957e-04
NetPromoterScore 1.584564e-07 4.813242e-09 1.731075e-08 1.864796e-06
TransactionFrequency 5.496769e-07 3.912477e-03 1.272722e-01 2.646355e-06
Age 6.137594e-02 5.074875e-03 1.075434e-03 6.025919e-08
ComplaintsCount 1.677011e-07 8.718003e-11 4.910287e-10 7.121283e-07
EstimatedSalary 9.225751e-09 2.593625e-04 2.607049e-02 4.183697e-03
Dim.9 Dim.10 Dim.11 Dim.12
Tenure 1.308149e-03 1.129296e-02 1.803121e-06 2.205118e-02
NetPromoterScore 2.369505e-09 6.083995e-09 5.614065e-07 1.156796e-07
TransactionFrequency 4.040779e-03 6.225853e-06 2.934738e-05 2.704411e-03
Age 6.543401e-02 2.191566e-04 2.402110e-09 1.902652e-05
ComplaintsCount 2.113202e-08 1.163859e-13 5.231842e-08 1.041740e-07
EstimatedSalary 8.140443e-04 9.568890e-04 7.886055e-02 6.376583e-02
Dim.13 Dim.14 Dim.15 Dim.16
Tenure 1.104462e-01 6.994810e-05 4.828178e-04 1.401427e-04
NetPromoterScore 1.157698e-12 4.564038e-08 1.317598e-05 8.825002e-11
TransactionFrequency 5.974779e-02 6.422037e-03 1.249985e-03 7.066354e-03
Age 8.730919e-07 6.519128e-05 4.480902e-04 1.899064e-03

```

```

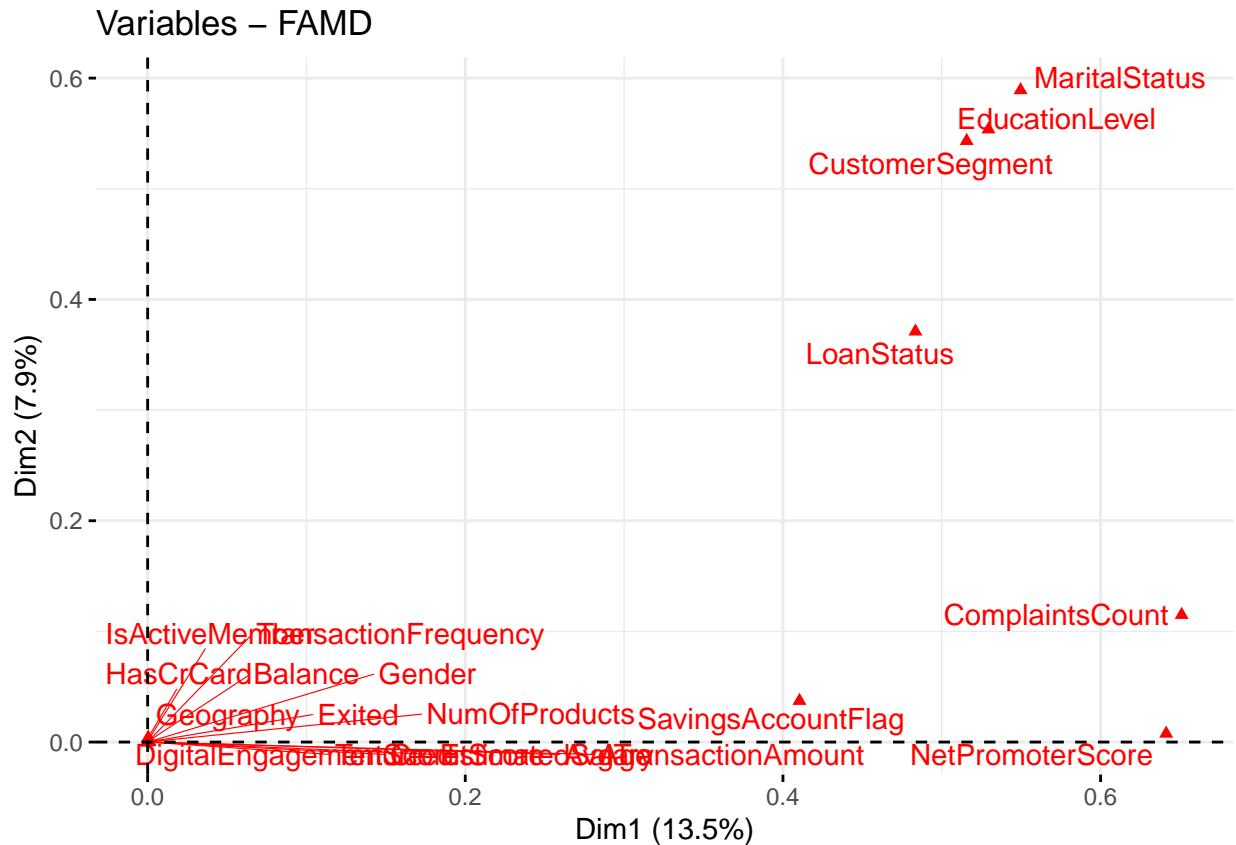
ComplaintsCount 1.315587e-10 5.292633e-12 7.507006e-07 5.686724e-08
EstimatedSalary 2.733072e-05 6.124545e-05 3.541225e-03 5.850376e-03
Dim.17 Dim.18 Dim.19 Dim.20
Tenure 4.379515e-07 1.961705e-07 3.215098e-06 1.295139e-09
NetPromoterScore 1.127552e-03 5.657134e-08 4.229605e-06 5.838376e-06
TransactionFrequency 7.628673e-06 3.040242e-06 7.795090e-11 5.210043e-07
Age 5.167818e-06 4.279877e-02 1.250643e-08 1.064493e-06
ComplaintsCount 8.626243e-06 5.568138e-08 7.440323e-07 2.844026e-15
EstimatedSalary 4.033327e-08 9.412555e-11 3.690744e-07 7.546760e-12

head(var$contrib)

Dim.1 Dim.2 Dim.3 Dim.4
Tenure 0.007505123 0.001620359 0.054933602 0.082387805
NetPromoterScore 16.930862306 0.342795996 0.379854198 0.004071376
TransactionFrequency 0.020341965 0.056137265 0.009030237 0.100590642
Age 0.015181147 0.002115577 0.082067362 5.546663904
ComplaintsCount 17.188737501 5.165087367 2.103887205 0.007830392
EstimatedSalary 0.019435501 0.001295892 0.002859491 0.813336537
Dim.5 Dim.6 Dim.7 Dim.8
Tenure 0.12117104 3.8771621662 23.606323678 3.01812036
NetPromoterScore 0.03283977 0.0063133119 0.012374097 0.13123469
TransactionFrequency 0.06116444 5.6919922510 33.552301411 0.15633531
Age 20.43827759 6.4826275794 3.084235258 0.02359091
ComplaintsCount 0.03378417 0.0008496633 0.002084054 0.08109837
EstimatedSalary 0.00792403 1.4655207537 15.185537867 6.21602998
Dim.9 Dim.10 Dim.11 Dim.12
Tenure 3.498579105 1.053687e+01 0.134180522 15.13358284
NetPromoterScore 0.004708601 7.733961e-03 0.074871365 0.03466204
TransactionFrequency 6.148874958 2.474041e-01 0.541329465 5.29983270
Age 24.743711758 1.467861e+00 0.004897488 0.44453448
ComplaintsCount 0.014061562 3.382655e-05 0.022856216 0.03289314
EstimatedSalary 2.759860465 3.067173e+00 28.061243457 25.73474127
Dim.13 Dim.14 Dim.15 Dim.16
Tenure 3.471337e+01 0.8910817473 2.34782122 1.292761191
NetPromoterScore 1.123878e-04 0.0227616748 0.38785086 0.001025866
TransactionFrequency 2.553185e+01 8.5381931711 3.77768578 9.179748096
Age 9.760034e-02 0.8602493290 2.26180987 4.758858869
ComplaintsCount 1.198067e-03 0.0002451125 0.09257778 0.026041389
EstimatedSalary 5.460682e-01 0.8338088812 6.35843321 8.352663023
Dim.17 Dim.18 Dim.19 Dim.20
Tenure 0.08528247 0.060242018 0.276163982 5.692234e-03
NetPromoterScore 4.32728018 0.032350490 0.316752351 3.821823e-01
TransactionFrequency 0.35593547 0.237157396 0.001359817 1.141682e-01
Age 0.29295464 28.138325923 0.017224104 1.631909e-01
ComplaintsCount 0.37849279 0.032095017 0.132851304 8.435121e-06
EstimatedSalary 0.02588085 0.001319582 0.093567896 4.345151e-04

```

```
fviz_famda(res.famda, repel = TRUE)
```



```
fviz_contrib(res.famda, "var", axes = 1)
```

## Contribution of variables to Dim-1

