

BNP Project

```
library(data.table)
library(FactoMineR)
library(factoextra)
library(gplots)
```

Exploratory data analysis for BNP Project

Categorical variables

Looking for correlated categorical variables(Correspondence Analysis)

```
correlated.cat.vars = c()
cats <- categorical.cols
for (col1 in cats) {
  cats <- cats[-1]
  for (col2 in cats) {
    tb <- train[, c(col1, col2), with=FALSE]
    ct <- table(tb) # contingency table
    ca <- CA(ct, graph = FALSE) # correspondence analysis
    trace <- sum(ca$eig$eigenvalue)
    if (sqrt(trace) > 1) {
      correlated.cat.vars <- rbind(correlated.cat.vars, c(col1, col2, sqrt(trace)))
    }
  }
}
correlated.cat.vars <- data.frame(correlated.cat.vars)
colnames(correlated.cat.vars) <- c("var1", "var2", "corr.coef")
correlated.cat.vars
```

```
##   var1 var2      corr.coef
## 1   v3  v31 1.00536863164762
## 2   v3  v56 1.17787966506551
## 3  v22  v30 1.22569142296392
## 4  v22  v47 1.31017670015523
## 5  v22  v52 1.43773531229448
## 6  v22  v56 4.78499658073927
## 7  v22  v71 1.01087626758596
## 8  v22  v79 1.83693501591518
## 9  v22  v91 1.0501783338625
## 10 v22 v107 1.05017833386251
## 11 v22 v112 4.53564951702748
## 12 v22 v113 2.6557782212823
## 13 v22 v125 9.12626440332216
## 14 v31  v47 1.0875267653298
## 15 v31  v56 1.30014952990685
## 16 v31  v79 1.2875527694955
## 17 v31 v110 1.08738978098615
## 18 v47  v56 2.09802658938753
## 19 v47  v79 2.64511047809333
```

```
## 20 v47 v110 1.4142135623731
## 21 v47 v113 1.10031513083776
## 22 v52 v91 1.00082056913307
## 23 v52 v107 1.00082056913307
## 24 v56 v79 2.58071022655841
## 25 v56 v110 1.05938850903617
## 26 v56 v113 1.20387335191441
## 27 v71 v75 1.30710030588841
## 28 v79 v110 1.41421356237309
## 29 v79 v113 1.13727058901571
## 30 v91 v107 2.64575131106459
## 31 v110 v113 1.06333008154547
## 32 v112 v125 4.69041575982343
```

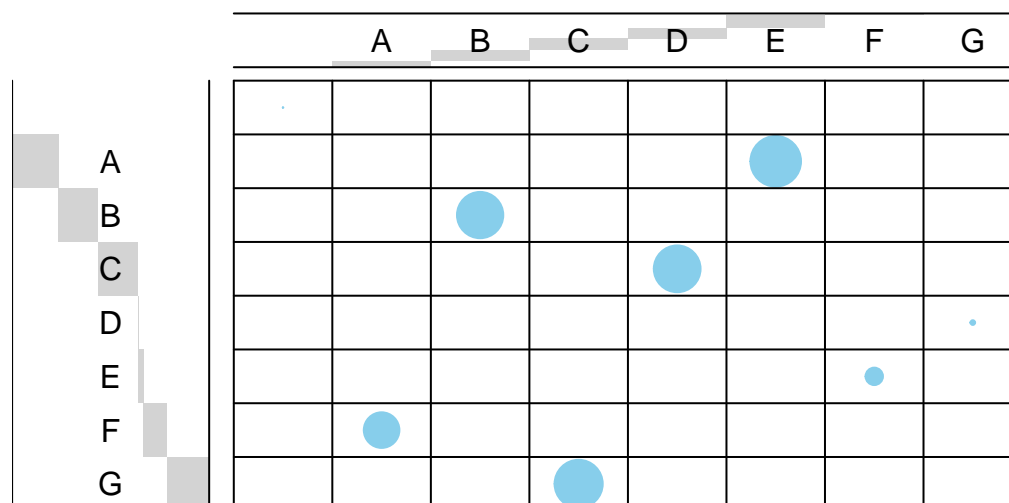
Categorical variables: v91-v107

```
# Contingency table
tab.v91.v107 <- table(train[,.(v91, v107),])
tab.v91.v107
```

```
##      v107
## v91      A      B      C      D      E      F      G
##      3      0      0      0      0      0      0      0
## A      0      0      0      0      0 27079      0      0
## B      0      0 22683      0      0      0      0      0
## C      0      0      0      0 23157      0      0      0
## D      0      0      0      0      0      0      0 230
## E      0      0      0      0      0      0 3206      0
## F      0 13418      0      0      0      0      0      0
## G      0      0      0 24545      0      0      0      0
```

```
# Draw balloon plot
balloonplot(t(tab.v91.v107), main = "Categorical variable: v91-107", xlab = "",
            ylab = "", label = FALSE, show.margins = FALSE)
```

Categorical variable: v91-107

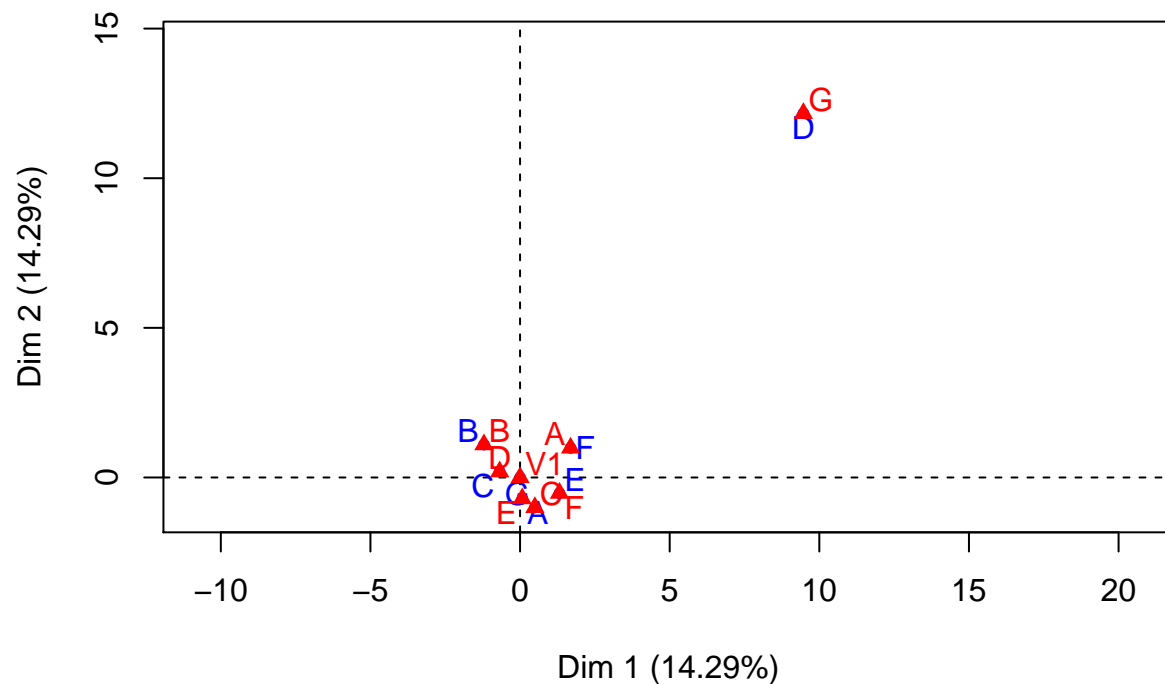


```
# Chi-squared test
chisq.test(tab.v91.v107)
```

```
##
## Pearson's Chi-squared test
##
## data: tab.v91.v107
## X-squared = 800250, df = 49, p-value < 2.2e-16
```

```
# Correspondence analysis(CA)
ca.v91.v107 <- CA(tab.v91.v107, graph=TRUE)
```

CA factor map



```
summary(ca.v91.v107, nb.dec = 2, ncp = 2)
```

```
##
## Call:
## CA(X = tab.v91.v107, graph = TRUE)
##
## The chi square of independence between the two variables is equal to 800247 (p-value = 0 ).
##
## Eigenvalues
##          Dim.1  Dim.2  Dim.3  Dim.4  Dim.5  Dim.6  Dim.7
## Variance      1.00   1.00   1.00   1.00   1.00   1.00   1.00
## % of var.     14.29  14.29  14.29  14.29  14.29  14.29  14.29
## Cumulative % of var. 14.29 28.57 42.86 57.14 71.43 85.71 100.00
##
## Rows
##      Iner*1000  Dim.1  ctr  cos2  Dim.2  ctr  cos2
##      |      999.97 | 0.00 0.00 0.00 | 0.00 0.00 0.00 |
## A      |      763.13 | 0.07 0.12 0.00 | -0.71 11.86 0.16 |
```

```
## B |      801.59 |   -1.21  28.90   0.36 |    1.10  23.89   0.30 |
## C |      797.44 |   -0.68   9.39   0.12 |    0.19   0.76   0.01 |
## D |      997.99 |    9.47  18.04   0.18 |   12.17  29.79   0.30 |
## E |      971.96 |    1.32   4.87   0.05 |   -0.52   0.77   0.01 |
## F |      882.63 |    1.69  33.43   0.38 |    0.99  11.42   0.13 |
## G |      785.30 |    0.49   5.25   0.07 |   -1.00  21.52   0.27 |
##
## Columns
##      Iner*1000   Dim.1   ctr   cos2   Dim.2   ctr   cos2
## V1 |      999.97 |    0.00   0.00   0.00 |    0.00   0.00   0.00 |
## A |      882.63 |    1.69  33.43   0.38 |    0.99  11.42   0.13 |
## B |      801.59 |   -1.21  28.90   0.36 |    1.10  23.89   0.30 |
## C |      785.30 |    0.49   5.25   0.07 |   -1.00  21.52   0.27 |
## D |      797.44 |   -0.68   9.39   0.12 |    0.19   0.76   0.01 |
## E |      763.13 |    0.07   0.12   0.00 |   -0.71  11.86   0.16 |
## F |      971.96 |    1.32   4.87   0.05 |   -0.52   0.77   0.01 |
## G |      997.99 |    9.47  18.04   0.18 |   12.17  29.79   0.30 |
```

These two variables are duplicates. Just keep one of them.

Categorical variables: v47-v110

```
# Contingency table
tab.v47.v110 <- table(train[,.(v47, v110),])
tab.v47.v110

##      v110
## v47      A      B      C
## A      38      0      0
## B       0      0     50
## C       0 55425      0
## D       0      0 3157
## E    5301      0      0
## F    4322      0      0
## G    3946      0      0
## H       0      1      0
## I   39071      0      0
## J    3010      0      0

# Draw balloon plot
balloonplot(t(tab.v47.v110), main = "Categorical variable: v91-107", xlab = "",
            ylab = "", label = FALSE, show.margins = FALSE)
```

Categorical variable: v91–107

| | A | B | C |
|---|---|---|---|
| A | . | | |
| B | | | . |
| C | | | |
| D | | | . |
| E | . | | |
| F | . | | |
| G | . | | |
| H | | . | |
| I | . | | |
| J | . | | |

Chi-squared test

`chisq.test(tab.v47.v110)`

```
## Warning in chisq.test(tab.v47.v110): Chi-squared approximation may be
## incorrect
```

```
##
```

```
## Pearson's Chi-squared test
```

```
##
```

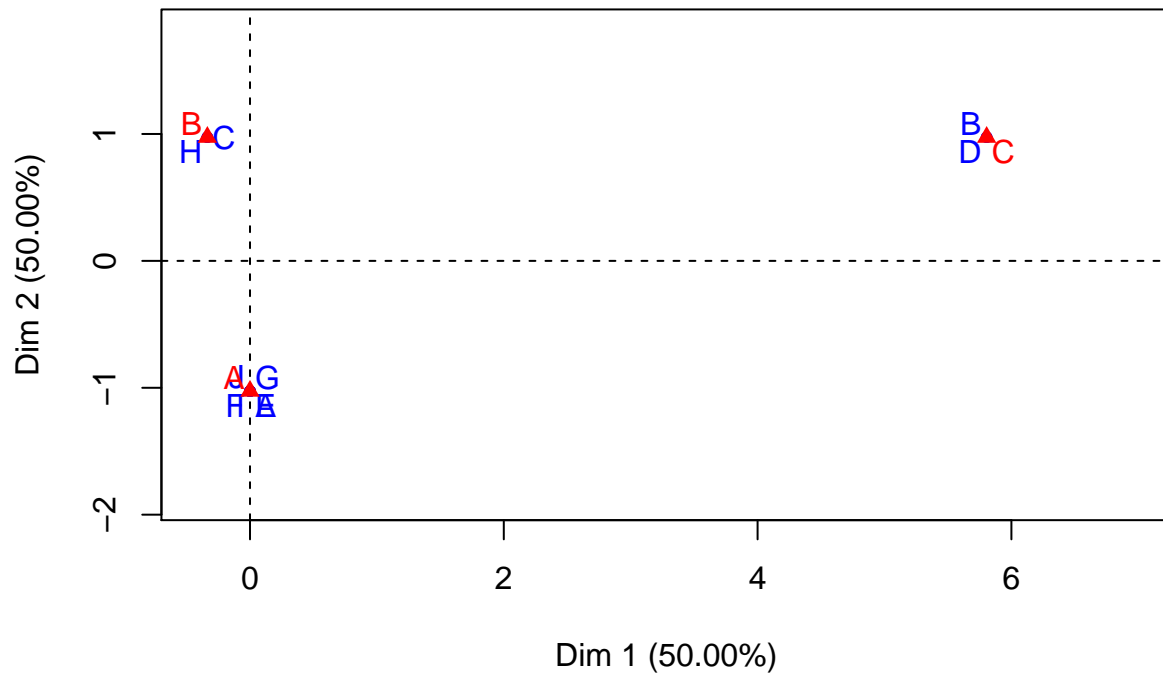
```
## data: tab.v47.v110
```

```
## X-squared = 228640, df = 18, p-value < 2.2e-16
```

Correspondence analysis(CA)

`ca.v47.v110 <- CA(tab.v47.v110, graph=TRUE)`

CA factor map



```
summary(ca.v47.v110, nb.dec = 2, ncp = 2)
```

```
##
## Call:
## CA(X = tab.v47.v110, graph = TRUE)
##
## The chi square of independence between the two variables is equal to 228642 (p-value = 0 ).
##
## Eigenvalues
##               Dim.1 Dim.2
## Variance           1     1
## % of var.          50    50
## Cumulative % of var. 50   100
##
## Rows
##      Iner*1000   Dim.1   ctr   cos2   Dim.2   ctr   cos2
## A |         0.35 |    0.00  0.00  0.00 |   -1.03  0.03  1.00 |
## B |        15.15 |    5.80  1.47  0.97 |    0.97  0.04  0.03 |
## C |       515.16 |   -0.34  5.47  0.11 |    0.97 46.05  0.89 |
## D |       956.79 |    5.80 93.06  0.97 |    0.97  2.62  0.03 |
## E |        48.82 |    0.00  0.00  0.00 |   -1.03  4.88  1.00 |
## F |        39.81 |    0.00  0.00  0.00 |   -1.03  3.98  1.00 |
## G |        36.34 |    0.00  0.00  0.00 |   -1.03  3.63  1.00 |
## H |         0.01 |   -0.34  0.00  0.11 |    0.97  0.00  0.89 |
## I |       359.84 |    0.00  0.00  0.00 |   -1.03 35.98  1.00 |
## J |        27.72 |    0.00  0.00  0.00 |   -1.03  2.77  1.00 |
##
## Columns
##      Iner*1000   Dim.1   ctr   cos2   Dim.2   ctr   cos2
## A |       512.88 |    0.00  0.00  0.00 |   -1.03 51.29  1.00 |
```

```
## B |      515.17 |   -0.34   5.47   0.11 |   0.97  46.05   0.89 |
## C |      971.95 |    5.80  94.53   0.97 |   0.97   2.66   0.03 |
```

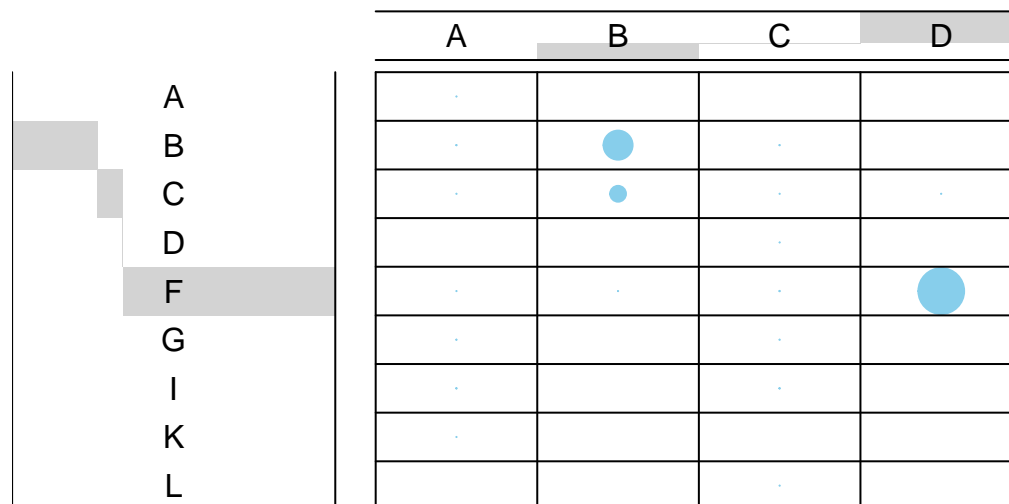
Categorical variables: v71-v75

```
# Contingency table
tab.v71.v75 <- table(train[,.(v71, v75),])
tab.v71.v75
```

```
##      v75
## v71    A      B      C      D
## A      1      0      0      0
## B      4 30247      4      0
## C      1  8944      1      1
## D      0      0      1      0
## F      1      1      6 75086
## G      3      0      2      0
## I      7      0      9      0
## K      1      0      0      0
## L      0      0      1      0
```

```
# Draw balloon plot
balloonplot(t(tab.v71.v75), main = "Categorical variable: v71-75", xlab = "",
            ylab = "", label = FALSE, show.margins = FALSE)
```

Categorical variable: v71-75



```
# Chi-squared test
chisq.test(tab.v71.v75)
```

```
## Warning in chisq.test(tab.v71.v75): Chi-squared approximation may be
## incorrect
```

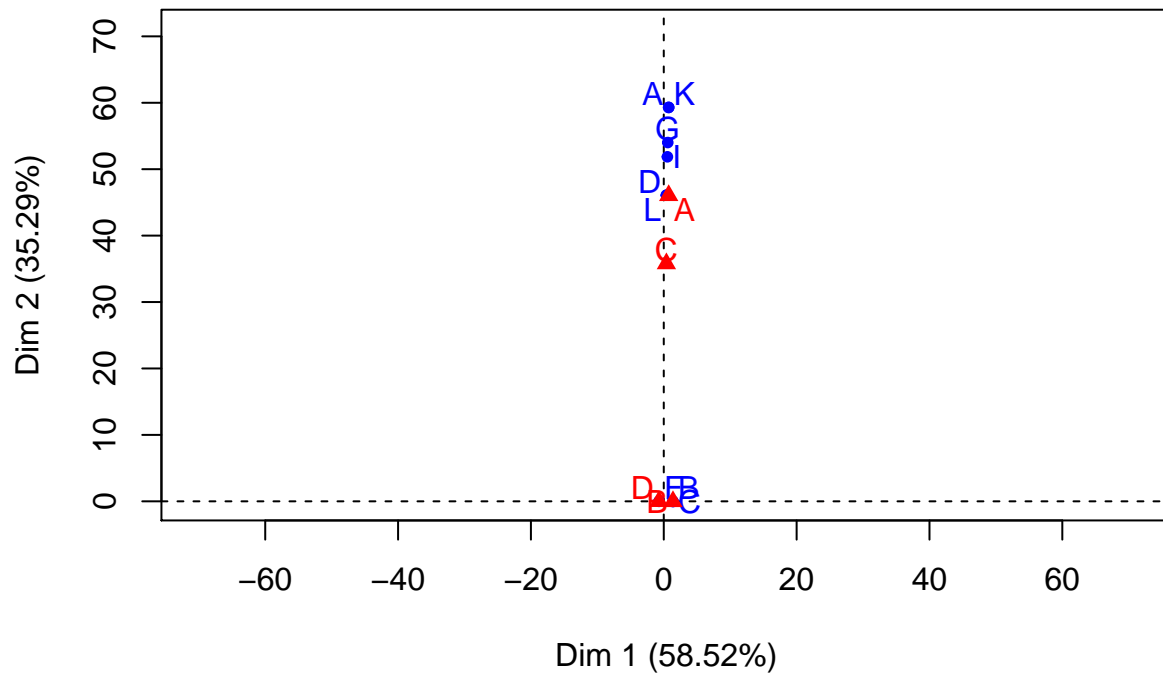
```
##
## Pearson's Chi-squared test
##
## data:  tab.v71.v75
```

```
## X-squared = 195320, df = 24, p-value < 2.2e-16
```

```
# Correspondence analysis(CA)
```

```
ca.v71.v75 <- CA(tab.v71.v75, graph=TRUE)
```

CA factor map



```
summary(ca.v71.v75, nb.dec = 2, ncp = 2)
```

```
##
```

```
## Call:
```

```
## CA(X = tab.v71.v75, graph = TRUE)
```

```
##
```

```
## The chi square of independence between the two variables is equal to 195318.7 (p-value = 0 ).
```

```
##
```

```
## Eigenvalues
```

```
##           Dim.1  Dim.2  Dim.3
```

```
## Variance      1.00  0.60  0.11
```

```
## % of var.     58.52 35.29  6.19
```

```
## Cumulative % of var. 58.52 93.81 100.00
```

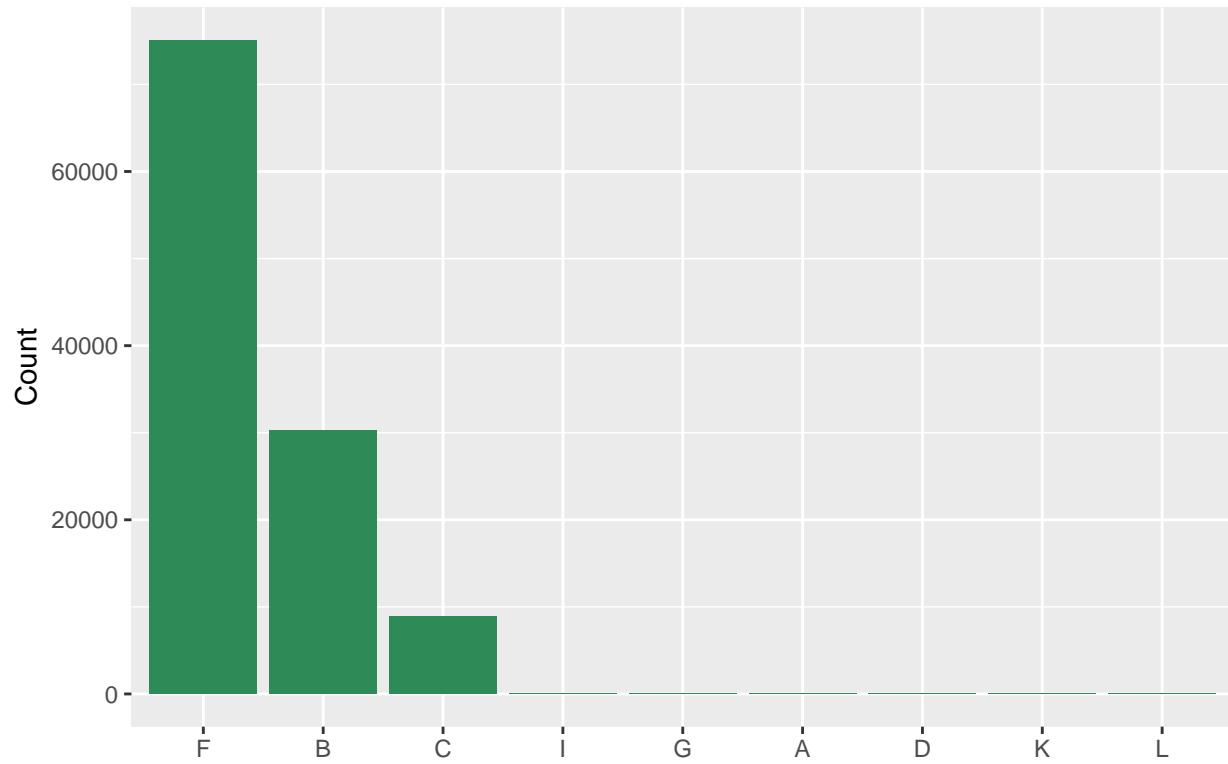
```
##
```

```
## Rows
```

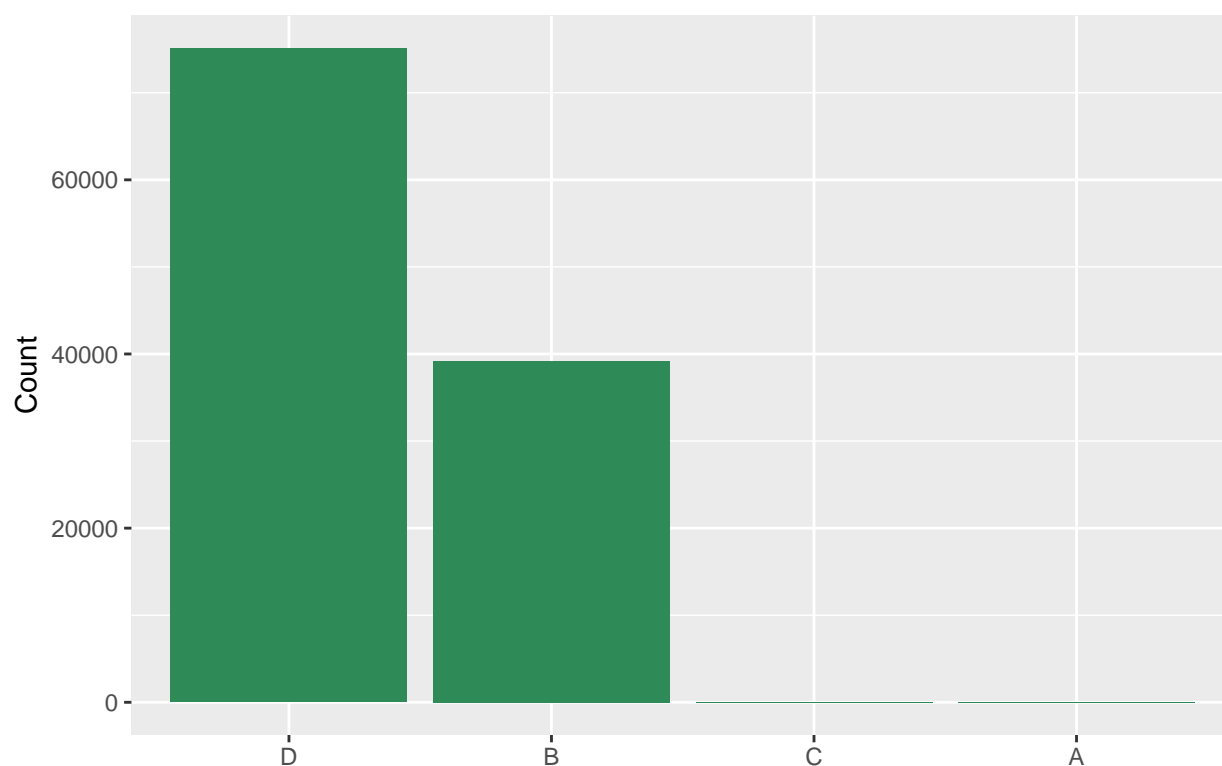
| | Iner*1000 | Dim.1 | ctr | cos2 | Dim.2 | ctr | cos2 |
|------|-----------|-------|-------|------|-------|-------|------|
| ## A | 55.55 | 0.74 | 0.00 | 0.00 | 59.30 | 5.10 | 0.55 |
| ## B | 506.96 | 1.38 | 50.70 | 1.00 | -0.02 | 0.02 | 0.00 |
| ## C | 149.88 | 1.38 | 14.99 | 1.00 | -0.02 | 0.01 | 0.00 |
| ## D | 41.66 | 0.40 | 0.00 | 0.00 | 46.08 | 3.08 | 0.45 |
| ## F | 343.03 | -0.72 | 34.31 | 1.00 | -0.01 | 0.01 | 0.00 |
| ## G | 133.29 | 0.60 | 0.00 | 0.00 | 54.01 | 21.16 | 0.96 |
| ## I | 380.94 | 0.55 | 0.00 | 0.00 | 51.87 | 62.44 | 0.99 |
| ## K | 55.55 | 0.74 | 0.00 | 0.00 | 59.30 | 5.10 | 0.55 |
| ## L | 41.66 | 0.40 | 0.00 | 0.00 | 46.08 | 3.08 | 0.45 |


```
##
## Columns
##      Iner*1000   Dim.1   ctr   cos2   Dim.2   ctr   cos2
## A |      381.13 |    0.74   0.01   0.00 |   46.05  55.37   0.88 |
## B |      656.87 |    1.38  65.68   1.00 |   -0.03   0.04   0.00 |
## C |      327.44 |    0.40   0.00   0.00 |   35.78  44.58   0.82 |
## D |      343.07 |   -0.72  34.31   1.00 |   -0.01   0.01   0.00 |
```

Categorical variable v71



Categorical variable v75



Categorical variables: v71-v79

```
# Contingency table
tab.v71.v79 <- table(train[,.(v71, v79),])
tab.v71.v79
```

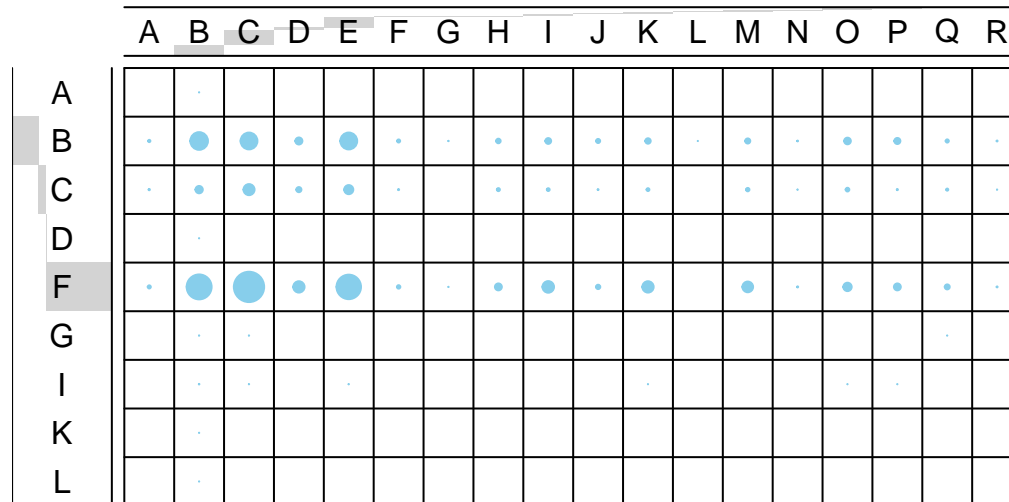
```
##      v79
## v71    A    B    C    D    E    F    G    H    I    J    K
## A      0     1     0     0     0     0     0     0     0     0     0
## B    130  8135  7389  1286  7422   243     4   533   867   427   752
## C      40  1400  3189   677  2152    26     0   233   203    20   210
## D       0     1     0     0     0     0     0     0     0     0     0
## F    247 16252 23979  3339 15680   302     2  1238  3491   486  3345
## G       0     2     2     0     0     0     0     0     0     0     0
## I       0     8     2     0     3     0     0     0     0     0     1
## K       0     1     0     0     0     0     0     0     0     0     0
## L       0     1     0     0     0     0     0     0     0     0     0
##      v79
## v71    L    M    N    O    P    Q    R
## A      0     0     0     0     0     0     0
## B      1   666   17  1152   951   257   23
## C      0   299    3   351    31   111    2
## D      0     0     0     0     0     0     0
## F      0  2981   29  1827  1234   637   25
## G      0     0     0     0     0     1     0
## I      0     0     0     1     1     0     0
## K      0     0     0     0     0     0     0
```

```
## L 0 0 0 0 0 0 0
```

```
# Draw balloon plot
```

```
balloonplot(t(tab.v71.v79), main = "Categorical variable: v71-79", xlab = "",
            ylab = "", label = FALSE, show.margins = FALSE)
```

Categorical variable: v71-79



Numerical variables

Dealing with missing values

```
library(caret)
```

```
## Loading required package: lattice
```

```
library(mice)
```

```
# Pattern of missing values
```

```
md.pattern(train.num)
```

```
##      v38 v62 v72 v129 v14 v114 v10 v12 v50 v34 v40 v21  v8  v25  v46
## 62561  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 306    1  1  1  1  1  1  1  1  1  1  1  0  1  1  1
## 15     1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 615    1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 22     1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 1      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 2      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 1      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 3      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 31     1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 13     1  1  1  1  1  1  0  0  0  0  0  0  1  1  1
## 1      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 5      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 1      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
```

| | | | | | | | | | | | | | | | | |
|----|-------|-----|-----|-----|------|---|----|----|-----|-----|-----|------|------|-------|-------|-------|
| ## | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 874 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 36 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 2051 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 47715 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| ## | 30 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| ## | | 0 | 0 | 0 | 0 | 4 | 30 | 84 | 86 | 86 | 111 | 111 | 611 | 48619 | 48619 | 48619 |
| ## | | v54 | v63 | v89 | v124 | | | v5 | v36 | v81 | v82 | v108 | v109 | v117 | | |
| ## | 62561 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 306 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 15 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 615 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 22 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 31 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 13 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
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| ## | | v128 | v70 | v98 | v105 | v87 | v2 | v4 | v17 | v44 | v48 | v59 |
| ## | 62561 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
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| ## | | v61 | v64 | v76 | v101 | v106 | v1 | v6 | v7 | v13 | v18 | v26 |
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| ## | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
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| ## | | v27 | v28 | v29 | v32 | v33 | v35 | v41 | v42 | v45 | v49 | v55 |
| ## | 62561 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
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| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| ## | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| ## | 874 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 2051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 47715 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | | 49836 | 49836 | 49836 | 49836 | 49836 | 49836 | 49836 | 49840 | 49840 | 49840 | 49843 |
| ## | | v37 | v92 | v95 | v97 | v118 | v130 | v9 | v80 | v122 | v16 | v69 |
| ## | 62561 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 306 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 15 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 615 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 22 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| ## | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 31 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |

| | | | | | | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ## | 13 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| ## | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| ## | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| ## | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| ## | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| ## | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| ## | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| ## | 874 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ## | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 2051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 47715 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ## | | 49843 | 49843 | 49843 | 49843 | 49843 | 49843 | 49851 | 49851 | 49851 | 49895 | 49895 |
| ## | | v78 | v115 | v131 | v23 | v51 | v123 | v119 | v85 | v102 | | |
| ## | 62561 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | |
| ## | 306 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| ## | 15 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| ## | 615 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | |
| ## | 22 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | |
| ## | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | |
| ## | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 5 | |
| ## | 31 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | |
| ## | 13 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 6 | |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 6 | |
| ## | 5 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | |
| ## | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 6 | |
| ## | 6 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 6 | |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | |
| ## | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | |
| ## | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | |
| ## | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | |
| ## | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 9 | |
| ## | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 9 | |
| ## | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 9 | |
| ## | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 9 | |

```
##      2      0      0      0      1      1      1      1      0      0      10
##      5      1      1      1      1      1      1      1      1      1      11
##      1      0      0      0      1      1      1      1      1      1      12
##      1      0      0      0      1      1      1      1      1      0      13
##      1      0      0      0      1      1      1      1      1      0      13
##      2      0      0      0      1      1      1      1      1      1      15
##      5      0      0      0      1      1      1      1      1      0      16
##      1      0      0      0      1      0      0      0      0      0      17
##    874      1      1      1      0      0      0      0      0      0      25
##      1      0      0      0      1      1      1      0      0      0      32
##      1      0      0      0      1      1      1      0      0      0      33
##      2      0      0      0      1      0      0      0      0      0      35
##     36      0      0      0      1      1      1      1      1      1      64
##   2051      0      0      0      0      0      0      0      0      0      81
##  47715      0      0      0      0      0      0      0      0      0      100
##     30      0      0      0      0      0      0      0      0      0      103
##      49895 49895 49895 50675 50678 50678 50680 50682 51316 4967293
```

```
# Imputing missing values with mean
```

```
impute.mean <- function(x) {
  x[is.na(x)] <- mean(x, na.rm = TRUE)
  x
}
imputed.train.num <- train.num[, lapply(.SD, impute.mean)]
imputed.train.num
```

```
##           v1           v2           v4           v5           v6           v7           v8
##    1: 1.3357394 8.727474 3.921026 7.915266 2.599278 3.176895 0.01294147
##    2: 1.6306857 7.464411 4.145098 9.191265 2.436402 2.483921 2.30163049
##    3: 0.9438769 5.310079 4.410969 5.326159 3.979592 3.928571 0.01964513
##    4: 0.7974146 8.304757 4.225930 11.627438 2.097700 1.987549 0.17194670
##    5: 1.6306857 7.464411 4.145098 8.742359 2.436402 2.483921 1.49656859
##    ---
## 114317: 1.6306857 7.464411 4.145098 8.742359 2.436402 2.483921 1.49656859
## 114318: 1.6306857 7.464411 4.145098 8.742359 2.436402 2.483921 1.49656859
## 114319: 1.6306857 7.464411 4.145098 10.069277 2.436402 2.483921 0.32332423
## 114320: 1.6306857 7.464411 4.145098 10.106144 2.436402 2.483921 0.30922647
## 114321: 1.6197631 7.932978 4.640085 8.473141 2.351470 2.826766 3.47975411
##           v9           v10          v11          v12          v13          v14          v15
##    1: 9.999999 0.5032815 16.43411 6.085711 2.866830 11.636387 1.355013
##    2: 9.031859 1.3129099 15.44741 6.507647 3.798396 11.636386 2.080911
##    3: 12.666667 0.7658640 14.75610 6.384670 2.505589 9.603542 1.984127
##    4: 8.965516 6.5426695 16.34748 9.646653 3.903302 14.094723 1.945044
##    5: 9.031859 1.0503284 15.44741 6.320087 3.798396 10.991098 2.080911
##    ---
## 114317: 9.031859 1.4442006 15.44741 6.368061 3.798396 11.865255 2.080911
## 114318: 9.031859 6.2363237 15.44741 9.443324 3.798396 14.924483 2.080911
## 114319: 9.031859 2.0787749 15.44741 6.698925 3.798396 12.269012 2.080911
## 114320: 9.031859 1.2910286 15.44741 6.692204 3.798396 12.573678 2.080911
## 114321: 9.629630 0.8533913 14.95979 6.306396 4.195219 11.967826 2.422481
##           v16          v17          v18          v19          v20          v21
##    1: 8.571429 3.670350 0.1067204 0.1488831 18.86928 7.730923
##    2: 4.923222 3.832270 0.8410455 0.2223005 17.77359 6.763110
##    3: 5.882353 3.170847 0.2445410 0.1442584 17.95233 5.245035
##    4: 5.517242 3.610789 1.2241139 0.2316304 18.37641 7.517125
```

```

##      5: 4.923222 3.832270 0.8410455 0.2223005 17.77359 6.414567
##      ---
## 114317: 4.923222 3.832270 0.8410455 0.2223005 17.77359 7.088172
## 114318: 4.923222 3.832270 0.8410455 0.2223005 17.77359 8.455263
## 114319: 4.923222 3.832270 0.8410455 0.2223005 17.77359 6.570625
## 114320: 4.923222 3.832270 0.8410455 0.2223005 17.77359 7.730751
## 114321: 3.168318 4.892720 0.5943879 0.1625732 18.85523 7.496000
##      v23      v25      v26      v27      v28      v29
##      1: -1.716131e-08 0.1394116 1.720818 3.393503 0.5901219 8.880867
##      2: 1.093088e+00 3.0561440 1.876031 2.743454 5.0933280 8.206416
##      3: -2.785053e-07 0.1139970 2.244897 5.306122 0.8360052 7.499999
##      4: -4.805344e-07 0.1488431 1.308269 2.303640 8.9266621 8.874521
##      5: 1.093088e+00 1.6981288 1.876031 2.743454 5.0933280 8.206416
##      ---
## 114317: 1.093088e+00 1.6981288 1.876031 2.743454 5.0933280 8.206416
## 114318: 1.093088e+00 1.6981288 1.876031 2.743454 5.0933280 8.206416
## 114319: 1.093088e+00 0.2965358 1.876031 2.743454 5.0933280 8.206416
## 114320: 1.093088e+00 0.4713505 1.876031 2.743454 5.0933280 8.206416
## 114321: 5.483099e-08 2.3725858 2.224306 3.277048 3.4167206 8.067542
##      v32      v33      v34      v35      v36      v37 v38
##      1: 1.083033 1.010829 7.270147 8.375452 11.32659 0.4545457 0
##      2: 1.622151 2.161633 3.615077 8.122387 14.57948 0.7414708 0
##      3: 1.454082 1.734693 4.043864 7.959184 12.73052 0.2597401 0
##      4: 1.587644 1.666667 8.703550 8.898468 11.30280 0.4337346 0
##      5: 1.622151 2.161633 6.083151 8.122387 13.37560 0.7414708 0
##      ---
## 114317: 1.622151 2.161633 7.281489 8.122387 13.37560 0.7414708 0
## 114318: 1.622151 2.161633 6.721720 8.122387 13.37560 0.7414708 0
## 114319: 1.622151 2.161633 3.029508 8.122387 13.68885 0.7414708 0
## 114320: 1.622151 2.161633 5.089198 8.122387 12.11553 0.7414708 0
## 114321: 1.707317 2.526579 6.533439 7.179488 15.21767 0.6194700 0
##      v39      v40      v41      v42      v43      v44      v45
##      1: 4.01208777 7.711453 7.653429 12.70758 2.015505 10.498338 9.848672
##      2: 1.23718376 14.305766 7.182551 12.92497 2.216597 10.795169 9.142231
##      3: 7.37896421 13.077201 6.173469 12.34694 2.926830 8.897561 5.343819
##      4: 0.28732173 11.523045 7.931035 12.93582 1.470878 12.708574 9.670823
##      5: 1.23718376 10.138920 7.182551 12.92497 2.216597 10.795169 9.142231
##      ---
## 114317: 1.23718376 8.640475 7.182551 12.92497 2.216597 10.795169 9.142231
## 114318: 1.23718376 14.348455 7.182551 12.92497 2.216597 10.795169 9.142231
## 114319: 1.23718376 16.002461 7.182551 12.92497 2.216597 10.795169 9.142231
## 114320: 1.23718376 11.952825 7.182551 12.92497 2.216597 10.795169 9.142231
## 114321: 0.07718111 9.228710 6.979363 12.55785 2.600536 12.199975 6.733072
##      v46      v48      v49      v50      v51      v53      v54
##      1: 0.1135606 12.17173 8.086643 0.8994200 7.277792 16.74797 0.03709633
##      2: 2.4499589 12.53802 8.016547 1.3792101 7.198159 15.71130 1.12946855
##      3: 0.1260346 12.71133 6.836734 0.6045041 9.637627 15.10204 0.08557286
##      4: 0.1083869 12.19485 8.591954 3.3291765 4.780357 16.62169 0.13972117
##      5: 1.6305254 12.53802 8.016547 1.3645359 7.198159 15.71130 1.25385626
##      ---
## 114317: 1.6305254 12.53802 8.016547 2.0350670 7.198159 15.71130 1.25385626
## 114318: 1.6305254 12.53802 8.016547 3.2690201 7.198159 15.71130 1.25385626
## 114319: 0.2514433 12.53802 8.016547 2.4106815 7.198159 15.71130 0.06681885
## 114320: 0.4590391 12.53802 8.016547 0.8216566 7.198159 15.71130 0.37975392

```

```

## 114321: 2.7336173 11.10409 7.379612 1.0006610 6.315512 14.85271 2.07959069
##          v55      v57      v58      v59      v60      v61 v62
##      1: 1.2996383 3.971118 0.5298022 10.890984 1.588448 15.85815 1
##      2: 1.5595562 4.077828 7.7016531 10.587945 1.714294 14.58303 2
##      3: 0.7653052 4.030613 4.2774557 9.105481 2.151361 16.07560 1
##      4: 1.1781613 3.965517 1.7321022 11.777912 1.229246 15.92739 1
##      5: 1.5595562 4.077828 7.7016531 10.587945 1.714294 14.58303 1
##      ---
## 114317: 1.5595562 4.077828 7.7016531 10.587945 1.714294 14.58303 1
## 114318: 1.5595562 4.077828 7.7016531 10.587945 1.714294 14.58303 1
## 114319: 1.5595562 4.077828 7.7016531 10.587945 1.714294 14.58303 1
## 114320: 1.5595562 4.077828 7.7016531 10.587945 1.714294 14.58303 1
## 114321: 1.8386485 4.015009 16.4090371 9.197136 2.063790 15.90806 1
##          v63      v64      v65      v67      v68      v69      v70
##      1: 0.1534611 6.363189 18.30393 9.314079 15.23179 17.142857 11.784549
##      2: 2.5447365 6.343713 15.84756 9.287275 17.56412 9.449335 12.053353
##      3: 0.1236432 5.517949 16.37721 8.367347 11.04046 5.882353 8.460654
##      4: 0.1402597 6.292979 17.01165 9.703065 18.56813 9.425288 13.594728
##      5: 1.6873273 6.343713 15.84756 9.287275 17.56412 9.449335 12.269960
##      ---
## 114317: 1.6873273 6.343713 15.84756 9.287275 17.56412 9.449335 12.269960
## 114318: 1.6873273 6.343713 15.84756 9.287275 17.56412 9.449335 12.269960
## 114319: 0.2818862 6.343713 15.84756 9.287275 17.56412 9.449335 9.402630
## 114320: 0.4628394 6.343713 15.84756 9.287275 17.56412 9.449335 15.058248
## 114321: 2.1350054 7.924031 16.02907 9.330831 19.16766 9.702969 13.346576
##          v72      v73      v76      v77      v78      v80      v81
##      1: 1 1.614988 2.230940 7.292418 8.571429 3.000000 7.528326
##      2: 2 2.433303 2.405056 7.307366 13.334482 2.209700 7.277655
##      3: 3 2.413618 1.963971 5.918368 11.764705 3.333334 10.194433
##      4: 2 2.272541 2.188198 8.213602 13.448277 1.947261 4.797873
##      5: 1 2.433303 2.405056 7.307366 13.334482 2.209700 7.287174
##      ---
## 114317: 1 2.433303 2.405056 7.307366 13.334482 2.209700 7.287174
## 114318: 2 2.433303 2.405056 7.307366 13.334482 2.209700 7.287174
## 114319: 3 2.433303 2.405056 7.307366 13.334482 2.209700 6.070124
## 114320: 1 2.433303 2.405056 7.307366 13.334482 2.209700 4.947657
## 114321: 1 2.541331 3.103171 7.404627 15.643565 1.693121 8.249026
##          v82      v83      v84      v85      v86      v87      v88
##      1: 8.861647 0.6498199 1.299638 1.707317 0.8664262 9.551836 3.321300
##      2: 3.430691 2.1738077 1.607956 2.822253 1.2201841 9.848004 1.924184
##      3: 8.266200 1.5306113 1.530613 2.429906 1.0714292 8.447465 3.367346
##      4: 13.315819 1.6810343 1.379310 1.587045 1.2428166 10.747144 1.408046
##      5: 6.208356 2.1738077 1.607956 2.822253 1.2201841 10.180216 1.924184
##      ---
## 114317: 6.208356 2.1738077 1.607956 2.822253 1.2201841 10.180216 1.924184
## 114318: 6.208356 2.1738077 1.607956 2.822253 1.2201841 10.180216 1.924184
## 114319: 3.380753 2.1738077 1.607956 2.822253 1.2201841 11.603652 1.924184
## 114320: 2.522596 2.1738077 1.607956 2.822253 1.2201841 15.415573 1.924184
## 114321: 3.411930 2.9643522 1.200751 2.869380 1.4071285 10.326888 1.425892
##          v89      v90      v92      v93      v94      v95
##      1: 0.09567836 0.9053423 0.4422517 5.814018 3.517720 0.4620187
##      2: 2.67858429 0.9669126 0.5823668 5.475185 3.852883 0.6657576
##      3: 0.11138775 0.8114466 0.2714800 5.156559 4.214944 0.3096565
##      4: 0.03905132 1.0424254 0.7639246 5.498902 3.423944 0.8325182

```

```

##      5: 1.51842520 0.9669126 0.5823668 5.475185 3.852883 0.6657576
##      ---
## 114317: 1.51842520 0.9669126 0.5823668 5.475185 3.852883 0.6657576
## 114318: 1.51842520 0.9669126 0.5823668 5.475185 3.852883 0.6657576
## 114319: 0.25759035 0.9669126 0.5823668 5.475185 3.852883 0.6657576
## 114320: 0.42636864 0.9669126 0.5823668 5.475185 3.852883 0.6657576
## 114321: 2.41545188 0.7567042 0.4535285 6.735038 3.417862 0.5321365
##      v96      v97      v98      v99      v100      v101      v102
##      1: 7.436824 5.454545 8.877414 1.191337 19.47020 8.389237 2.757375
##      2: 6.457952 7.622554 8.303967 1.250721 12.09162 6.866414 2.890289
##      3: 5.663265 5.974026 11.588858 0.841837 15.49133 5.879353 3.292788
##      4: 7.375480 6.746988 6.942002 1.334611 18.25635 8.507281 2.503055
##      5: 6.457952 7.622554 7.667624 1.250721 12.09162 6.866414 2.890289
##      ---
## 114317: 6.457952 7.622554 7.667624 1.250721 12.09162 6.866414 2.890289
## 114318: 6.457952 7.622554 7.667624 1.250721 12.09162 6.866414 2.890289
## 114319: 6.457952 7.622554 11.939015 1.250721 12.09162 6.866414 2.890289
## 114320: 6.457952 7.622554 6.702722 1.250721 12.09162 6.866414 2.890289
## 114321: 5.991245 7.964602 5.930010 1.421721 3.51962 5.715783 4.115456
##      v103      v104      v105      v106      v108      v109
##      1: 4.374296 1.574039 0.007293816 12.57918 2.382692 3.930922
##      2: 5.296716 2.642828 1.505334661 11.79136 1.825361 4.247858
##      3: 5.924457 1.668401 0.008274619 11.67057 1.375753 1.184211
##      4: 4.872157 2.573664 0.113967370 12.55427 2.230754 1.990131
##      5: 5.296716 2.642828 1.081045222 11.79136 2.152620 4.181284
##      ---
## 114317: 5.296716 2.642828 1.081045222 11.79136 2.152620 4.181284
## 114318: 5.296716 2.642828 1.081045222 11.79136 2.152620 4.181284
## 114319: 5.296716 2.642828 0.251911633 11.79136 2.458328 5.834772
## 114320: 5.296716 2.642828 0.337262290 11.79136 3.311224 11.175868
## 114321: 3.630999 2.576789 2.103316936 13.91935 1.397909 3.051251
##      v111      v114      v115      v116      v117      v118
##      1: 0.4332129 15.634907 2.857144 1.951220 6.592012 5.909091
##      2: 3.3653137 10.308044 10.548051 2.291218 10.595357 8.364651
##      3: 3.3673476 11.205561 12.941177 3.129253 3.478911 6.233767
##      4: 2.6436782 13.777666 10.574713 1.511063 4.949609 7.180722
##      5: 3.3653137 14.097099 10.548051 2.291218 8.303857 8.364651
##      ---
## 114317: 3.3653137 15.392866 10.548051 2.291218 8.303857 8.364651
## 114318: 3.3653137 11.248736 10.548051 2.291218 8.303857 8.364651
## 114319: 3.3653137 8.893134 10.548051 2.291218 12.743060 8.364651
## 114320: 3.3653137 12.381113 10.548051 2.291218 15.357450 8.364651
## 114321: 3.9024390 14.635298 10.297030 2.790698 8.969215 8.584070
##      v119      v120      v121      v122      v123      v124
##      1: -6.297423e-07 1.0596026 0.8035719 8.000000 1.989780 0.035753685
##      2: 3.168970e+00 1.2912179 2.7375960 6.822439 3.549938 0.598895646
##      3: -2.792745e-07 2.1387283 2.2388065 9.333333 2.477596 0.013451914
##      4: 5.655086e-01 1.1662808 1.9565207 7.018256 1.812795 0.002267384
##      5: 3.168970e+00 1.2912179 2.7375960 6.822439 3.549938 0.919811985
##      ---
## 114317: 3.168970e+00 1.2912179 2.7375960 6.822439 3.549938 0.919811985
## 114318: 3.168970e+00 1.2912179 2.7375960 6.822439 3.549938 0.919811985
## 114319: 3.168970e+00 1.2912179 2.7375960 6.822439 3.549938 0.156764229
## 114320: 3.168970e+00 1.2912179 2.7375960 6.822439 3.549938 0.490657553

```

```
## 114321: 7.093470e-01 0.7372185 4.0169483 7.936508 2.944285 3.135204728
##          v126      v127      v128 v129      v130      v131
##      1: 1.804126 3.113719 2.024285    0 0.6363645 2.857144
##      2: 1.672658 3.239542 1.957825    0 1.9257635 1.739389
##      3: 1.773709 3.922193 1.120468    2 0.8831175 1.176472
##      4: 1.415230 2.954381 1.990847    1 1.6771076 1.034483
##      5: 1.672658 3.239542 2.030373    0 1.9257635 1.739389
##      ---
## 114317: 1.672658 3.239542 2.030373    0 1.9257635 1.739389
## 114318: 1.672658 3.239542 2.030373    1 1.9257635 1.739389
## 114319: 1.672658 3.239542 2.417606    2 1.9257635 1.739389
## 114320: 1.672658 3.239542 3.526650    0 1.9257635 1.739389
## 114321: 1.943149 4.385553 1.604493    0 1.7876103 1.386138
```

```
findLinearCombos(imputed.train.num)$linearCombos # Remove 110
```

```
## [[1]]
## [1] 110 33 54 62
```

```
findLinearCombos(imputed.train.num[,c(-110),])
```

```
## $linearCombos
## list()
##
## $remove
## NULL
```

References:

1. <http://www.sthda.com/english/wiki/correspondence-analysis-in-r-the-ultimate-guide-for-the-analysis-the-visualization-a-correspondence-analysis-ca>