spamData.R

Admin

2021-01-31

```
#Código que mide la tasa de error en un modelo predictivo



library(kernlab)
```

```
## Warning: package 'kernlab' was built under R version 4.0.3
```

```
data(spam)
str(spam[,1:5])
```

```
## 'data.frame':    4601 obs. of  5 variables:
##  $ make   : num  0 0.21 0.06 0 0 0 0 0 0.15 0.06 ...
##  $ address: num  0.64 0.28 0 0 0 0 0 0 0 0.12 ...
##  $ all    : num  0.64 0.5 0.71 0 0 0 0 0 0.46 0.77 ...
##  $ num3d  : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ our    : num  0.32 0.14 1.23 0.63 0.63 1.85 1.92 1.88 0.61 0.19 ...
```

```
#generando subset de prueba
set.seed(3435)

# Distribución de variables en valores booleanos como trainIndicator
trainIndicator <- rbinom(4601, size = 1, prob = 0.5)
table(trainIndicator)
```

```
## trainIndicator
##    0    1
## 2314 2287
```

```
#Se separan el dataset en Test y Training dataset mediante
# distribución probabilística rbinom
trainSpam = spam[trainIndicator == 1,]
testSpam = spam[trainIndicator == 0,]

names(trainSpam)
```

```
##  [1] "make"              "address"           "all"
##  [4] "num3d"             "our"               "over"
##  [7] "remove"            "internet"          "order"
```

```
## [10] "mail"              "receive"           "will"
## [13] "people"            "report"            "addresses"
## [16] "free"              "business"          "email"
## [19] "you"               "credit"            "your"
## [22] "font"              "num000"            "money"
## [25] "hp"                "hpl"               "george"
## [28] "num650"            "lab"               "labs"
## [31] "telnet"            "num857"            "data"
## [34] "num415"            "num85"             "technology"
## [37] "num1999"           "parts"             "pm"
## [40] "direct"            "cs"                "meeting"
## [43] "original"          "project"           "re"
## [46] "edu"               "table"             "conference"
## [49] "charSemicolon"     "charRoundbracket"  "charSquarebracket"
## [52] "charExclamation"   "charDollar"        "charHash"
## [55] "capitalAve"        "capitalLong"       "capitalTotal"
## [58] "type"
```

```
head(trainSpam)
```

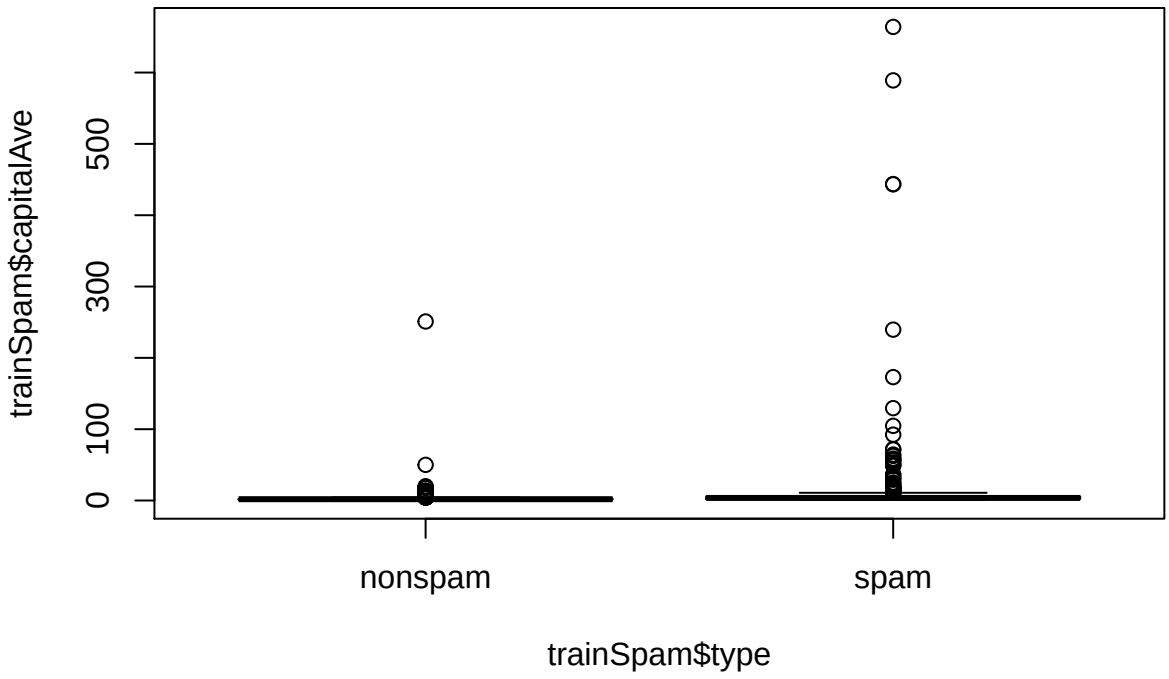
```
##    make address  all num3d  our over remove internet order mail receive will
## 1  0.00    0.64 0.64     0 0.32 0.00   0.00        0  0.00 0.00    0.00 0.64
## 7  0.00    0.00 0.00     0 1.92 0.00   0.00        0  0.00 0.64    0.96 1.28
## 9  0.15    0.00 0.46     0 0.61 0.00   0.30        0  0.92 0.76    0.76 0.92
## 12 0.00    0.00 0.25     0 0.38 0.25   0.25        0  0.00 0.00    0.12 0.12
## 14 0.00    0.00 0.00     0 0.90 0.00   0.90        0  0.00 0.90    0.90 0.00
## 16 0.00    0.42 0.42     0 1.27 0.00   0.42        0  0.00 1.27    0.00 0.00
##    people report addresses free business email  you credit your font num000
## 1    0.00      0         0 0.32        0  1.29 1.93   0.00 0.96    0      0
## 7    0.00      0         0 0.96        0  0.32 3.85   0.00 0.64    0      0
## 9    0.00      0         0 0.00        0  0.15 1.23   3.53 2.00    0      0
## 12   0.12      0         0 0.00        0  0.00 1.16   0.00 0.77    0      0
## 14   0.90      0         0 0.00        0  0.00 2.72   0.00 0.90    0      0
## 16   0.00      0         0 1.27        0  0.00 1.70   0.42 1.27    0      0
##    money hp hpl george num650 lab labs telnet num857 data num415 num85
## 1   0.00  0   0      0      0   0    0      0      0 0.00      0     0
## 7   0.00  0   0      0      0   0    0      0      0 0.00      0     0
## 9   0.15  0   0      0      0   0    0      0      0 0.15      0     0
## 12  0.00  0   0      0      0   0    0      0      0 0.00      0     0
## 14  0.00  0   0      0      0   0    0      0      0 0.00      0     0
## 16  0.42  0   0      0      0   0    0      0      0 0.00      0     0
##    technology num1999 parts pm direct cs meeting original project re edu table
## 1           0    0.00     0  0   0.00  0       0      0.0       0  0   0     0
## 7           0    0.00     0  0   0.00  0       0      0.0       0  0   0     0
## 9           0    0.00     0  0   0.00  0       0      0.3       0  0   0     0
## 12          0    0.00     0  0   0.00  0       0      0.0       0  0   0     0
## 14          0    0.00     0  0   0.00  0       0      0.0       0  0   0     0
## 16          0    1.27     0  0   0.42  0       0      0.0       0  0   0     0
##    conference charSemicolon charRoundbracket charSquarebracket charExclamation
## 1           0         0.000            0.000                 0           0.778
## 7           0         0.000            0.054                 0           0.164
## 9           0         0.000            0.271                 0           0.181
## 12          0         0.022            0.044                 0           0.663
## 14          0         0.000            0.000                 0           0.000
```

```
## 16          0         0.000            0.063                 0           0.572
##    charDollar charHash capitalAve capitalLong capitalTotal type
## 1       0.000    0.000      3.756          61          278 spam
## 7       0.054    0.000      1.671           4          112 spam
## 9       0.203    0.022      9.744         445         1257 spam
## 12      0.000    0.000      1.243          11          184 spam
## 14      0.000    0.000      2.083           7           25 spam
## 16      0.063    0.000      5.659          55          249 spam
```

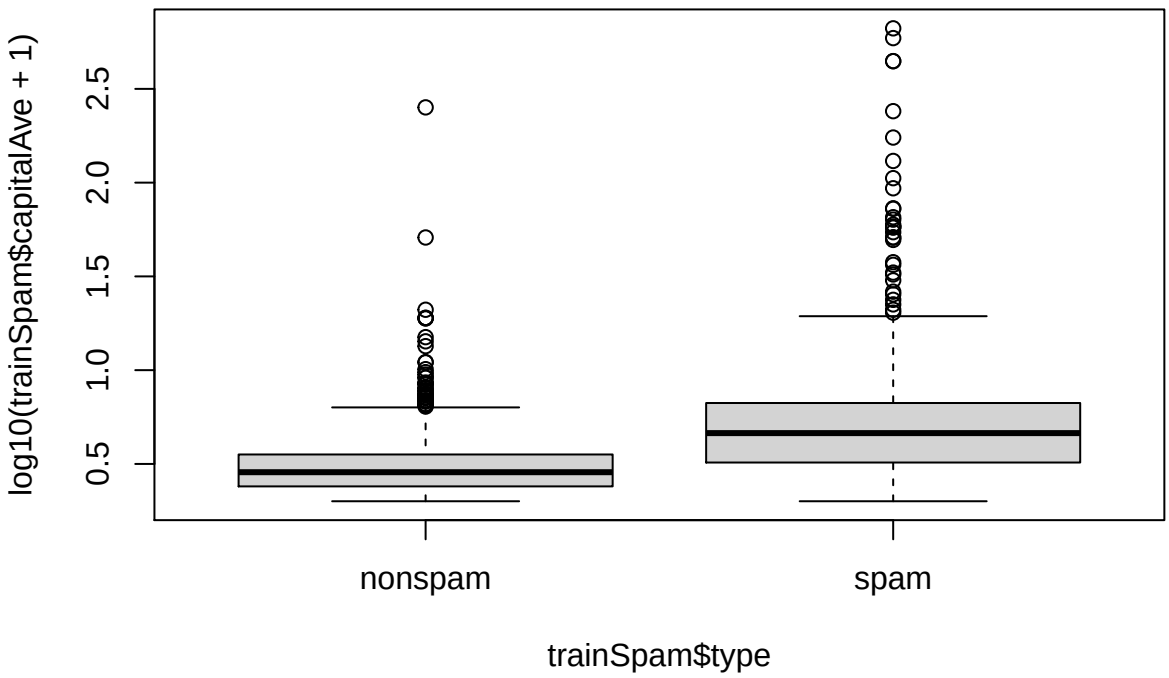
```
table(trainSpam$type)
```

```
##
## nonspam    spam
##    1381     906
```

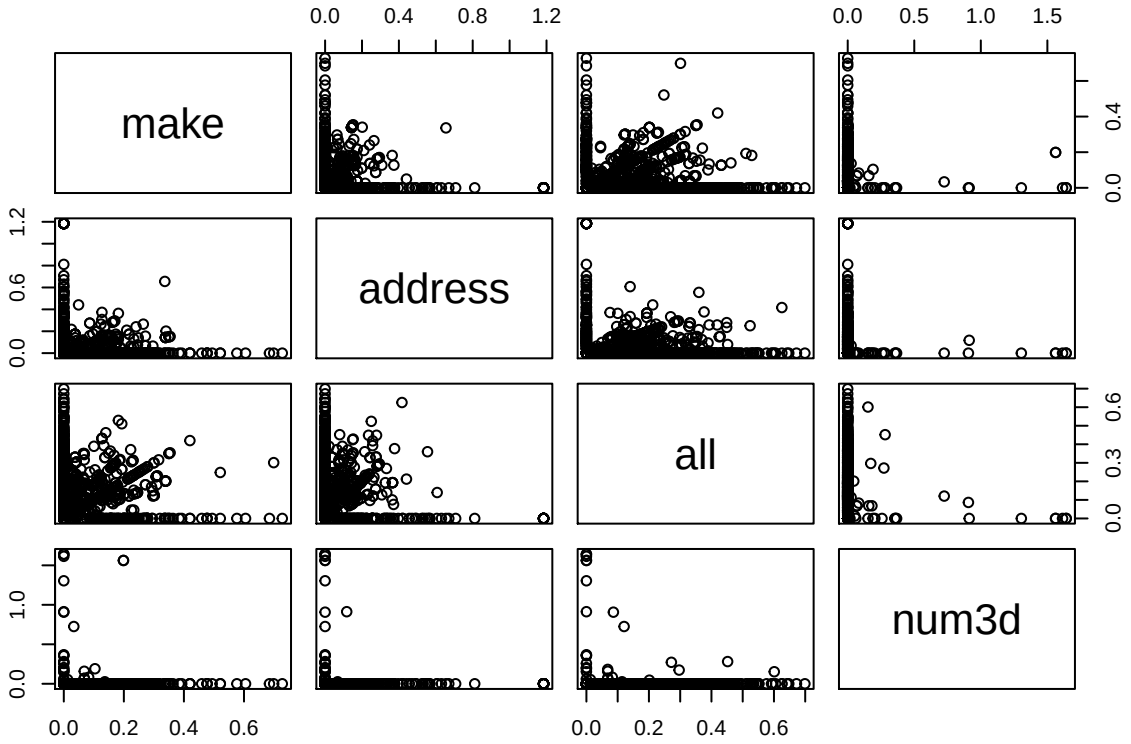
```
#Se grafica incidencia entre correos spam que contienen mayor promedio de
# letras mayúsculas en su contenido
plot(trainSpam$capitalAve ~ trainSpam$type)
```




```
#en logaritmo base 10 para mejor visualización.
plot(log10(trainSpam$capitalAve+1) ~ trainSpam$type)
```

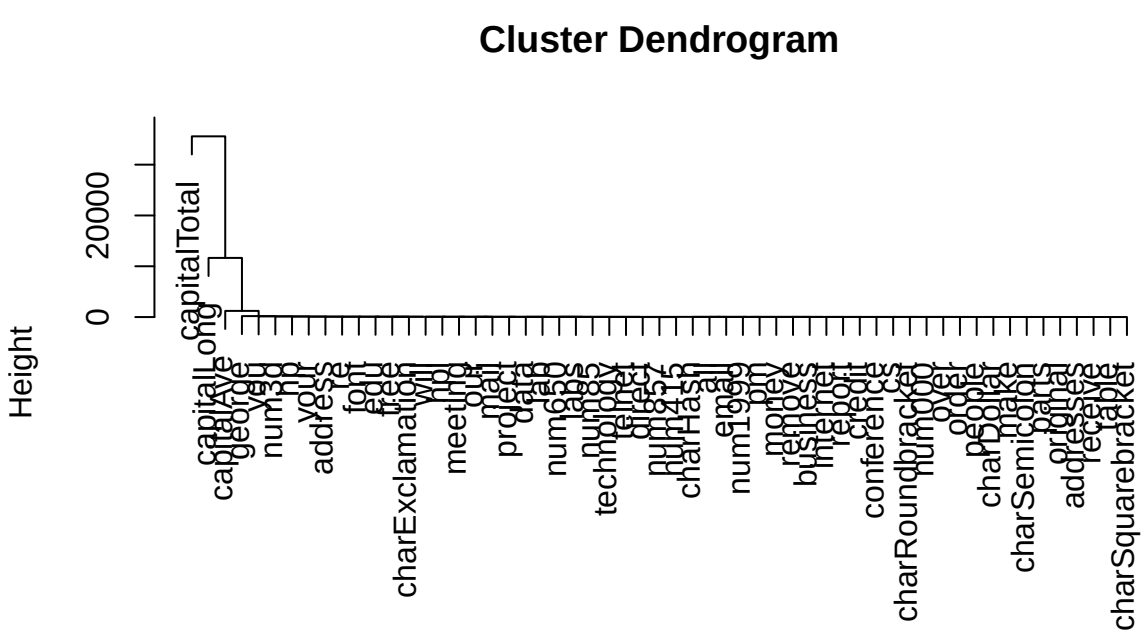



```
#Se eliminan los valores en cero para visualización
plot(log10(trainSpam[,1:4] + 1))
```

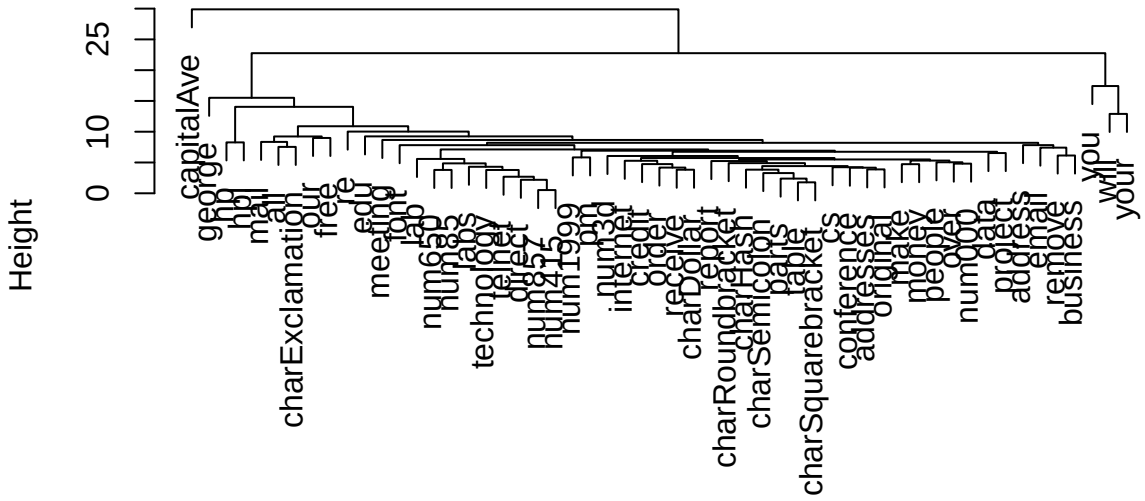



```
#Cluster que identifica las variables con mayor incidencia en agrupación
hCluster <- hclust(dist(t(trainSpam[,1:57])))

#Gráfico de dendograma de cluster
plot(hCluster)
```




```
# Log Base 10
hClusterUpdated <- hclust(dist(t(log10(trainSpam[,1:55] + 1))))
#dendograma
plot(hClusterUpdated)
```




```
##### STATISTICAL PREDICTION MODELLING ######################

trainSpam$numtype = as.numeric(trainSpam$type) -1
costFunction = function(x,y) sum(x != (y > 0.5))
cvError = rep(NA,55)
library(boot)
for (i in 1:55){
  lmFormula = reformulate(names(trainSpam)[i],response = "numtype")
  glmFit = glm(lmFormula, family = "binomial", data = trainSpam)
  cvError[i] = cv.glm(trainSpam, glmFit,costFunction,2)$delta[2]
}
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred

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```

```r
# Cual predictor tiene un menor error de validación cruzada?
names(trainSpam)[which.min(cvError)]
```

```
## [1] "charDollar"
```

```r
#Modelo de regresión logística
predictionModel = glm(numtype ~ charDollar, family = "binomial", data = trainSpam)
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```r
## hacer predicciones sobre el set de prueba
predictionTest = predict(predictionModel, testSpam)
predictedSpam = rep("nonspam", dim(testSpam)[1])

#Clasificar como spam aquellos con una probabilidad mayor a 0.5
predictedSpam[predictionModel$fitted > 0.5] = "spam"

#Obtener una medida de incertidumbre
table(predictedSpam, testSpam$type)
```

```
##
## predictedSpam nonspam spam
##       nonspam    1346  458
##       spam         61  449
```

```r
#tasa de error
(61 + 458)/(1346 + 458 + 61 + 449)
```

```
## [1] 0.2242869
```