# Práctica AE

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## 0. Cargamos los datos y eliminamos la columna train

```
# Cargamos los datos con separador de tabulador
datos <- read.delim("prostate.data.txt", header = TRUE, sep = "\t")

# Eliminamos la columna train
datos <- datos[, -ncol(datos)]
```

## 1. Exploración de datos

```
# Vemos las variables que hay
ncol(datos)
```

```
## [1] 10
```

```
# Eliminamos la columna id
datos <- datos[, -1]

# Comprobamos si hay NA
sum(is.na(datos))
```

```
## [1] 0
```

```
# Comprobamos si las variables estan estandarizadas
summary(datos)
```

```
##      lcavol           lweight           age             lbph        
##  Min.   :-1.3471   Min.   :2.375   Min.   :41.00   Min.   :-1.3863  
##  1st Qu.: 0.5128   1st Qu.:3.376   1st Qu.:60.00   1st Qu.:-1.3863  
##  Median : 1.4469   Median :3.623   Median :65.00   Median : 0.3001  
##  Mean   : 1.3500   Mean   :3.629   Mean   :63.87   Mean   : 0.1004  
##  3rd Qu.: 2.1270   3rd Qu.:3.876   3rd Qu.:68.00   3rd Qu.: 1.5581  
##  Max.   : 3.8210   Max.   :4.780   Max.   :79.00   Max.   : 2.3263  
##       svi              lcp             gleason          pgg45       
##  Min.   :0.0000   Min.   :-1.3863   Min.   :6.000   Min.   :  0.00  
##  1st Qu.:0.0000   1st Qu.:-1.3863   1st Qu.:6.000   1st Qu.:  0.00  
##  Median :0.0000   Median :-0.7985   Median :7.000   Median : 15.00  
##  Mean   :0.2165   Mean   :-0.1794   Mean   :6.753   Mean   : 24.38  
##  3rd Qu.:0.0000   3rd Qu.: 1.1787   3rd Qu.:7.000   3rd Qu.: 40.00  
##  Max.   :1.0000   Max.   : 2.9042   Max.   :9.000   Max.   :100.00  
##       lpsa        
##  Min.   :-0.4308  
##  1st Qu.: 1.7317
```

```
##  Median : 2.5915
##  Mean   : 2.4784
##  3rd Qu.: 3.0564
##  Max.   : 5.5829
```

```
dim(datos)
```

```
## [1] 97  9
```

```
names(datos)
```

```
## [1] "lcavol"  "lweight" "age"     "lbph"    "svi"     "lcp"     "gleason"
## [8] "pgg45"   "lpsa"
```

```
str(datos)
```

```
## 'data.frame':    97 obs. of  9 variables:
##  $ lcavol : num  -0.58 -0.994 -0.511 -1.204 0.751 ...
##  $ lweight: num  2.77 3.32 2.69 3.28 3.43 ...
##  $ age    : int  50 58 74 58 62 50 64 58 47 63 ...
##  $ lbph   : num  -1.39 -1.39 -1.39 -1.39 -1.39 ...
##  $ svi    : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ lcp    : num  -1.39 -1.39 -1.39 -1.39 -1.39 ...
##  $ gleason: int  6 6 7 6 6 6 6 6 6 6 ...
##  $ pgg45  : int  0 0 20 0 0 0 0 0 0 0 ...
##  $ lpsa   : num  -0.431 -0.163 -0.163 -0.163 0.372 ...
```

```
summary(datos)
```

```
##      lcavol           lweight           age              lbph
##  Min.   :-1.3471   Min.   :2.375   Min.   :41.00   Min.   :-1.3863
##  1st Qu.: 0.5128   1st Qu.:3.376   1st Qu.:60.00   1st Qu.:-1.3863
##  Median : 1.4469   Median :3.623   Median :65.00   Median : 0.3001
##  Mean   : 1.3500   Mean   :3.629   Mean   :63.87   Mean   : 0.1004
##  3rd Qu.: 2.1270   3rd Qu.:3.876   3rd Qu.:68.00   3rd Qu.: 1.5581
##  Max.   : 3.8210   Max.   :4.780   Max.   :79.00   Max.   : 2.3263
##       svi              lcp             gleason          pgg45
##  Min.   :0.0000   Min.   :-1.3863   Min.   :6.000   Min.   :  0.00
##  1st Qu.:0.0000   1st Qu.:-1.3863   1st Qu.:6.000   1st Qu.:  0.00
##  Median :0.0000   Median :-0.7985   Median :7.000   Median : 15.00
##  Mean   :0.2165   Mean   :-0.1794   Mean   :6.753   Mean   : 24.38
##  3rd Qu.:0.0000   3rd Qu.: 1.1787   3rd Qu.:7.000   3rd Qu.: 40.00
##  Max.   :1.0000   Max.   : 2.9042   Max.   :9.000   Max.   :100.00
##       lpsa
##  Min.   :-0.4308
##  1st Qu.: 1.7317
##  Median : 2.5915
##  Mean   : 2.4784
##  3rd Qu.: 3.0564
##  Max.   : 5.5829
```

- Hay 10 variables, 9 si quitamos el id del paciente
- Las variables son numéricas
- La variable correspondiente al identificador del paciente es la primera columna
- No hay valores nulos
- Las variables no están ni normalizadas ni estandarizadas
- Hay variables que están en escala logarítmica ya que algunas variables tienen valores negativos a pesar de estar definidas estrictamente positivas, como la concentración en ng/m

## 2

```
attach(datos)

datos$svi <- as.factor(datos$svi)

datos$gleason <- as.factor(datos$gleason)

datos$age <- as.factor(datos$age)



str(datos)
```

```
## 'data.frame':    97 obs. of  9 variables:
##  $ lcavol : num  -0.58 -0.994 -0.511 -1.204 0.751 ...
##  $ lweight: num  2.77 3.32 2.69 3.28 3.43 ...
##  $ age    : Factor w/ 31 levels "41","43","44",..: 6 11 27 11 15 6 17 11 4 16 ...
##  $ lbph   : num  -1.39 -1.39 -1.39 -1.39 -1.39 ...
##  $ svi    : Factor w/ 2 levels "0","1": 1 1 1 1 1 1 1 1 1 1 ...
##  $ lcp    : num  -1.39 -1.39 -1.39 -1.39 -1.39 ...
##  $ gleason: Factor w/ 4 levels "6","7","8","9": 1 1 2 1 1 1 1 1 1 1 ...
##  $ pgg45  : int  0 0 20 0 0 0 0 0 0 0 ...
##  $ lpsa   : num  -0.431 -0.163 -0.163 -0.163 0.372 ...
```

## 3

```
a <- datos[datos$gleason == "7", ]

b <- a[a$svi == "0", ]

num.a <- dim(a)[1]

num.b <- dim(b)[1]

porcentaje.ab <- num.b / (num.a) * 100

c <- datos[datos$svi == "0", ]

d <- c[c$gleason == "7", ]

num.c <- dim(c)[1]

num.d <- dim(d)[1]

porcentaje.cd <- num.d / (num.c) * 100


tabla <- table(svi, gleason)

addmargins(prop.table(tabla,1),2)*100
```

```
##    gleason
```

```
## svi          6          7          8          9        Sum
##   0  46.052632  48.684211   1.315789   3.947368 100.000000
##   1   0.000000  90.476190   0.000000   9.523810 100.000000
```

```
addmargins(prop.table(tabla,2),1)*100
```

```
##      gleason
## svi           6         7         8         9
##   0   100.00000  66.07143 100.00000  60.00000
##   1     0.00000  33.92857   0.00000  40.00000
##   Sum 100.00000 100.00000 100.00000 100.00000
```

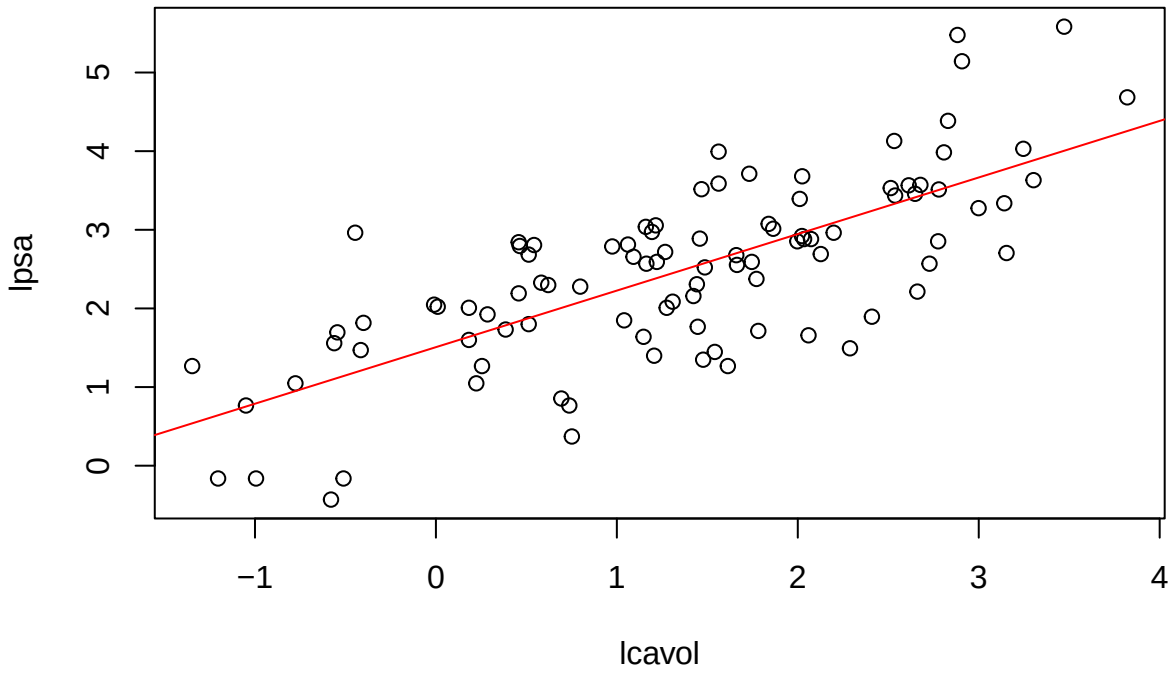
# 4

```
recta <- lm(lpsa ~ lcavol)

summary(recta)
```

```
##
## Call:
## lm(formula = lpsa ~ lcavol)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.67624 -0.41648  0.09859  0.50709  1.89672
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.50730    0.12194   12.36   <2e-16 ***
## lcavol       0.71932    0.06819   10.55   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7875 on 95 degrees of freedom
## Multiple R-squared:  0.5394, Adjusted R-squared:  0.5346
## F-statistic: 111.3 on 1 and 95 DF,  p-value: < 2.2e-16
```

```
plot(lcavol, lpsa)
abline(recta, col = "red")
```




```
confint(recta, level = 0.95)
```

```
##                 2.5 %    97.5 %
## (Intercept) 1.2652222 1.7493727
## lcavol      0.5839404 0.8547004
```

```
r1 <- residuals(recta)
sqrt(sum(r1^2) / (dim(datos)[1] - 2)) # RSE
```

```
## [1] 0.7874996
```

## 5

```
library(corrplot)
```

```
## corrplot 0.95 loaded
```

```
datos
```

```
##          lcavol  lweight age        lbph svi         lcp gleason pgg45
## 1  -0.579818495 2.769459  50 -1.38629436   0 -1.38629436       6     0
## 2  -0.994252273 3.319626  58 -1.38629436   0 -1.38629436       6     0
## 3  -0.510825624 2.691243  74 -1.38629436   0 -1.38629436       7    20
## 4  -1.203972804 3.282789  58 -1.38629436   0 -1.38629436       6     0
## 5   0.751416089 3.432373  62 -1.38629436   0 -1.38629436       6     0
## 6  -1.049822124 3.228826  50 -1.38629436   0 -1.38629436       6     0
## 7   0.737164066 3.473518  64  0.61518564   0 -1.38629436       6     0
## 8   0.693147181 3.539509  58  1.53686722   0 -1.38629436       6     0
## 9  -0.776528789 3.539509  47 -1.38629436   0 -1.38629436       6     0
## 10  0.223143551 3.244544  63 -1.38629436   0 -1.38629436       6     0
## 11  0.254642218 3.604138  65 -1.38629436   0 -1.38629436       6     0
## 12 -1.347073648 3.598681  63  1.26694760   0 -1.38629436       6     0
## 13  1.613429934 3.022861  63 -1.38629436   0 -0.59783700       7    30
## 14  1.477048724 2.998229  67 -1.38629436   0 -1.38629436       7     5
```

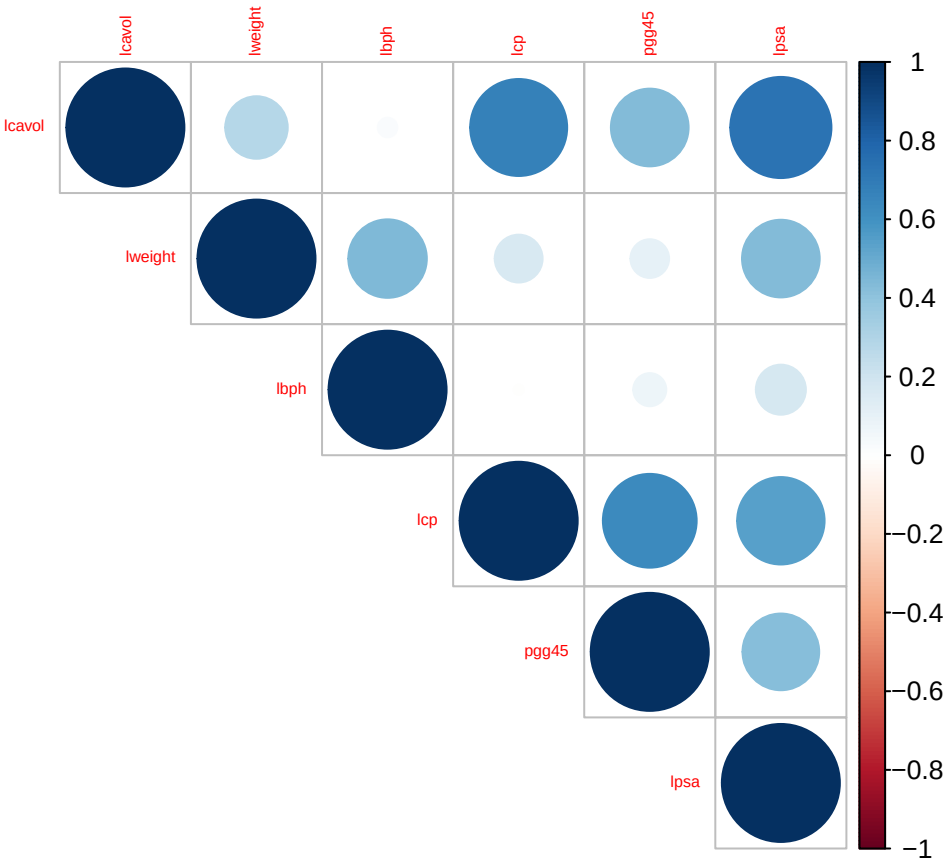
```
## 15  1.205970807 3.442019  57 -1.38629436   0 -0.43078292       7     5
## 16  1.541159072 3.061052  66 -1.38629436   0 -1.38629436       6     0
## 17 -0.415515444 3.516013  70  1.24415459   0 -0.59783700       7    30
## 18  2.288486169 3.649359  66 -1.38629436   0  0.37156356       6     0
## 19 -0.562118918 3.267666  41 -1.38629436   0 -1.38629436       6     0
## 20  0.182321557 3.825375  70  1.65822808   0 -1.38629436       6     0
## 21  1.147402453 3.419365  59 -1.38629436   0 -1.38629436       6     0
## 22  2.059238834 3.501043  60  1.47476301   0  1.34807315       7    20
## 23 -0.544727175 3.375880  59 -0.79850770   0 -1.38629436       6     0
## 24  1.781709133 3.451574  63  0.43825493   0  1.17865500       7    60
## 25  0.385262401 3.667400  69  1.59938758   0 -1.38629436       6     0
## 26  1.446918983 3.124565  68  0.30010459   0 -1.38629436       6     0
## 27  0.512823626 3.719651  65 -1.38629436   0 -0.79850770       7    70
## 28 -0.400477567 3.865979  67  1.81645208   0 -1.38629436       7    20
## 29  1.040276712 3.128951  67  0.22314355   0  0.04879016       7    80
## 30  2.409644165 3.375880  65 -1.38629436   0  1.61938824       6     0
## 31  0.285178942 4.090169  65  1.96290773   0 -0.79850770       6     0
## 32  0.182321557 3.804438  65  1.70474809   0 -1.38629436       6     0
## 33  1.275362800 3.037354  71  1.26694760   0 -1.38629436       6     0
## 34  0.009950331 3.267666  54 -1.38629436   0 -1.38629436       6     0
## 35 -0.010050336 3.216874  63 -1.38629436   0 -0.79850770       6     0
## 36  1.308332820 4.119850  64  2.17133681   0 -1.38629436       7     5
## 37  1.423108334 3.657131  73 -0.57981850   0  1.65822808       8    15
## 38  0.457424847 2.374906  64 -1.38629436   0 -1.38629436       7    15
## 39  2.660958594 4.085136  68  1.37371558   1  1.83258146       7    35
## 40  0.797507196 3.013081  56  0.93609336   0 -0.16251893       7     5
## 41  0.620576488 3.141995  60 -1.38629436   0 -1.38629436       9    80
## 42  1.442201993 3.682610  68 -1.38629436   0 -1.38629436       7    10
## 43  0.582215620 3.865979  62  1.71379793   0 -0.43078292       6     0
## 44  1.771556762 3.896909  61 -1.38629436   0  0.81093022       7     6
## 45  1.486139696 3.409496  66  1.74919985   0 -0.43078292       7    20
## 46  1.663926098 3.392829  61  0.61518564   0 -1.38629436       7    15
## 47  2.727852828 3.995445  79  1.87946505   1  2.65675691       9   100
## 48  1.163150810 4.035125  68  1.71379793   0 -0.43078292       7    40
## 49  1.745715531 3.498022  43 -1.38629436   0 -1.38629436       6     0
## 50  1.220829921 3.568123  70  1.37371558   0 -0.79850770       6     0
## 51  1.091923301 3.993603  68 -1.38629436   0 -1.38629436       7    50
## 52  1.660131027 4.234831  64  2.07317193   0 -1.38629436       6     0
## 53  0.512823626 3.633631  64  1.49290410   0  0.04879016       7    70
## 54  2.127040520 4.121473  68  1.76644166   0  1.44691898       7    40
## 55  3.153590358 3.516013  59 -1.38629436   0 -1.38629436       7     5
## 56  1.266947603 4.280132  66  2.12226154   0 -1.38629436       7    15
## 57  0.974559640 2.865054  47 -1.38629436   0  0.50077529       7     4
## 58  0.463734016 3.764682  49  1.42310833   0 -1.38629436       6     0
## 59  0.542324291 4.178226  70  0.43825493   0 -1.38629436       7    20
## 60  1.061256502 3.851211  61  1.29472717   0 -1.38629436       7    40
## 61  0.457424847 4.524502  73  2.32630162   0 -1.38629436       6     0
## 62  1.997417706 3.719651  63  1.61938824   1  1.90954250       7    40
## 63  2.775708850 3.524889  72 -1.38629436   0  1.55814462       9    95
## 64  2.034705648 3.917011  66  2.00821403   1  2.11021320       7    60
## 65  2.073171929 3.623007  64 -1.38629436   0 -1.38629436       6     0
## 66  1.458615023 3.836221  61  1.32175584   0 -0.43078292       7    20
## 67  2.022871190 3.878466  68  1.78339122   0  1.32175584       7    70
## 68  2.198335072 4.050915  72  2.30757263   0 -0.43078292       7    10
```

```
## 69 -0.446287103 4.408547  69 -1.38629436   0 -1.38629436       6     0
## 70  1.193922468 4.780383  72  2.32630162   0 -0.79850770       7     5
## 71  1.864080131 3.593194  60 -1.38629436   1  1.32175584       7    60
## 72  1.160020917 3.341093  77  1.74919985   0 -1.38629436       7    25
## 73  1.214912744 3.825375  69 -1.38629436   1  0.22314355       7    20
## 74  1.838961071 3.236716  60  0.43825493   1  1.17865500       9    90
## 75  2.999226163 3.849083  69 -1.38629436   1  1.90954250       7    20
## 76  3.141130476 3.263849  68 -0.05129329   1  2.42036813       7    50
## 77  2.010894999 4.433789  72  2.12226154   0  0.50077529       7    60
## 78  2.537657215 4.354784  78  2.32630162   0 -1.38629436       7    10
## 79  2.648300197 3.582129  69 -1.38629436   1  2.58399755       7    70
## 80  2.779440197 3.823192  63 -1.38629436   0  0.37156356       7    50
## 81  1.467874348 3.070376  66  0.55961579   0  0.22314355       7    40
## 82  2.513656063 3.473518  57  0.43825493   0  2.32727771       7    60
## 83  2.613006652 3.888754  77 -0.52763274   1  0.55961579       7    30
## 84  2.677590994 3.838376  65  1.11514159   0  1.74919985       9    70
## 85  1.562346305 3.709907  60  1.69561561   0  0.81093022       7    30
## 86  3.302849259 3.518980  64 -1.38629436   1  2.32727771       7    60
## 87  2.024193067 3.731699  58  1.63899671   0 -1.38629436       6     0
## 88  1.731655545 3.369018  62 -1.38629436   1  0.30010459       7    30
## 89  2.807593831 4.718052  65 -1.38629436   1  2.46385324       7    60
## 90  1.562346305 3.695110  76  0.93609336   1  0.81093022       7    75
## 91  3.246490992 4.101817  68 -1.38629436   0 -1.38629436       6     0
## 92  2.532902848 3.677566  61  1.34807315   1 -1.38629436       7    15
## 93  2.830267834 3.876396  68 -1.38629436   1  1.32175584       7    60
## 94  3.821003607 3.896909  44 -1.38629436   1  2.16905370       7    40
## 95  2.907447359 3.396185  52 -1.38629436   1  2.46385324       7    10
## 96  2.882563575 3.773910  68  1.55814462   1  1.55814462       7    80
## 97  3.471966453 3.974998  68  0.43825493   1  2.90416508       7    20
##          lpsa
## 1  -0.4307829
## 2  -0.1625189
## 3  -0.1625189
## 4  -0.1625189
## 5   0.3715636
## 6   0.7654678
## 7   0.7654678
## 8   0.8544153
## 9   1.0473190
## 10  1.0473190
## 11  1.2669476
## 12  1.2669476
## 13  1.2669476
## 14  1.3480731
## 15  1.3987169
## 16  1.4469190
## 17  1.4701758
## 18  1.4929041
## 19  1.5581446
## 20  1.5993876
## 21  1.6389967
## 22  1.6582281
## 23  1.6956156
## 24  1.7137979
```

```
## 25  1.7316555
## 26  1.7664417
## 27  1.8000583
## 28  1.8164521
## 29  1.8484548
## 30  1.8946169
## 31  1.9242487
## 32  2.0082140
## 33  2.0082140
## 34  2.0215476
## 35  2.0476928
## 36  2.0856721
## 37  2.1575593
## 38  2.1916535
## 39  2.2137539
## 40  2.2772673
## 41  2.2975726
## 42  2.3075726
## 43  2.3272777
## 44  2.3749058
## 45  2.5217206
## 46  2.5533438
## 47  2.5687881
## 48  2.5687881
## 49  2.5915164
## 50  2.5915164
## 51  2.6567569
## 52  2.6775910
## 53  2.6844403
## 54  2.6912431
## 55  2.7047113
## 56  2.7180005
## 57  2.7880929
## 58  2.7942279
## 59  2.8063861
## 60  2.8124102
## 61  2.8419982
## 62  2.8535925
## 63  2.8535925
## 64  2.8820035
## 65  2.8820035
## 66  2.8875901
## 67  2.9204698
## 68  2.9626924
## 69  2.9626924
## 70  2.9729753
## 71  3.0130809
## 72  3.0373539
## 73  3.0563569
## 74  3.0750055
## 75  3.2752562
## 76  3.3375474
## 77  3.3928291
## 78  3.4355988
```

```
## 79  3.4578927
## 80  3.5130369
## 81  3.5160131
## 82  3.5307626
## 83  3.5652984
## 84  3.5709402
## 85  3.5876769
## 86  3.6309855
## 87  3.6800909
## 88  3.7123518
## 89  3.9843437
## 90  3.9936030
## 91  4.0298060
## 92  4.1295508
## 93  4.3851468
## 94  4.6844434
## 95  5.1431245
## 96  5.4775090
## 97  5.5829322
```

```
corrplot(cor(datos[,c(-3,-5,-7)]),type="upper",tl.cex=0.5)
```




```
mul <- 0
```