Matrices y vectores aleatorios

Ileana Parra

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1.

```
x=matrix(c(1,6,8,4,2,3,3,6,3),ncol=3)
b=c(1,1,1)
c=c(1,2,-3)
X=matrix(c(b%*%t(x),c%*%t(x)),ncol=2)
```

##Vector de medias de X

```
colMeans(X)
```

```
## [1] 12 -1
```

##Matriz de var-covarianza de X

```
cov(X)
```

```
##      [,1] [,2]
## [1,]   12   -3
## [2,]   -3   43
```

Determinante de S

```
det(cov(X))
```

```
## [1] 507
```

Valores y vectores propios

```
lambda <- eigen(cov(X))
lambda$values
```

```
## [1] 43.28765 11.71235
```

```
lambda$vectors
```

```
##             [,1]        [,2]
## [1,] -0.09544671 -0.99543454
## [2,]  0.99543454 -0.09544671
```

##Matriz de correlaciones de X

```
cor(X)
```

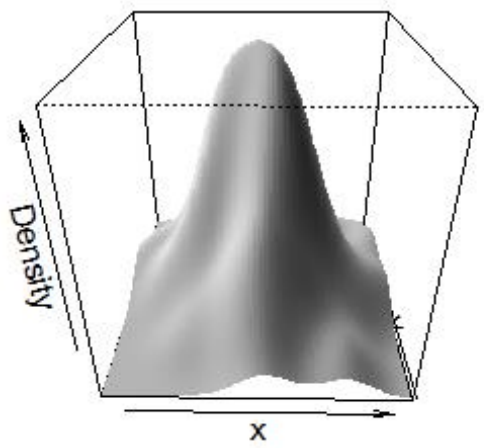
```
##             [,1]       [,2]
## [1,]  1.0000000 -0.1320676
## [2,] -0.1320676  1.0000000
```

2.

```
library(MVN)
```

```
## Warning: package 'MVN' was built under R version 4.0.5
```

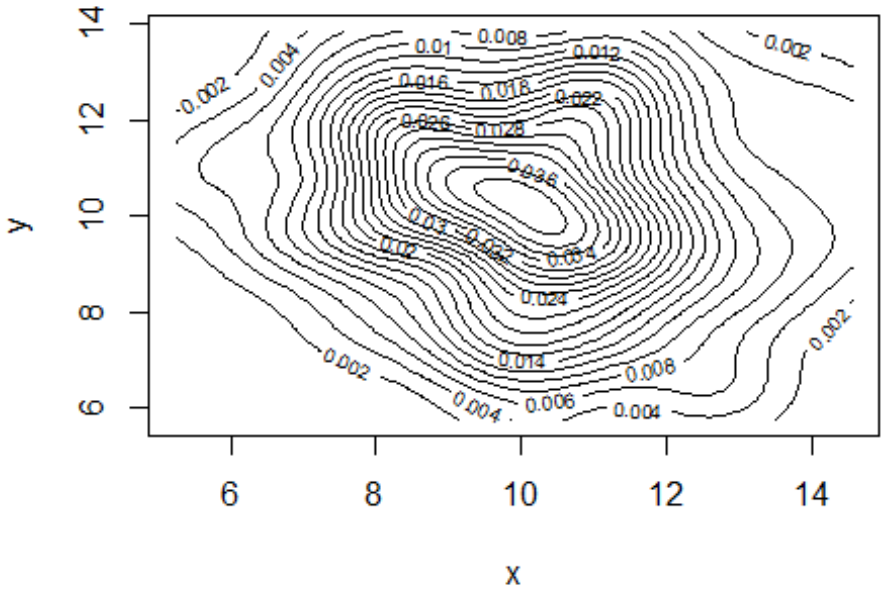
```
x=rnorm(100,10,2)
y=rnorm(100,10,2)
datos=data.frame(x,y)
mvn(datos,mvnTest="hz",multivariatePlot="persp")
```




```
## $multivariateNormality
##             Test        HZ   p value MVN
## 1 Henze-Zirkler 0.3181865 0.9389184 YES
##
## $univariateNormality
##               Test  Variable Statistic   p value Normality
## 1 Anderson-Darling     x        0.2236    0.8206    YES
## 2 Anderson-Darling     y        0.2523    0.7307    YES
##
## $Descriptives
##     n     Mean  Std.Dev   Median      Min      Max     25th     75th
## x 100 10.10353 1.862518 10.12771 5.246243 14.55975 8.722724 11.24352
```

```
## y 100 10.33202 1.817154 10.37747 5.767603 13.85320 9.278428 11.65749
##          Skew   Kurtosis
## x  0.05440333 -0.0601273
## y -0.18909689 -0.5213764
```

```
mvn(datos,mvnTest="hz",multivariatePlot="contour")
```




```
## $multivariateNormality
##            Test        HZ   p value MVN
## 1 Henze-Zirkler 0.3181865 0.9389184 YES
##
## $univariateNormality
##               Test  Variable Statistic   p value Normality
## 1 Anderson-Darling     x        0.2236    0.8206    YES
## 2 Anderson-Darling     y        0.2523    0.7307    YES
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## $Descriptives
##     n     Mean  Std.Dev   Median      Min      Max     25th     75th
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##          Skew   Kurtosis
## x  0.05440333 -0.0601273
## y -0.18909689 -0.5213764
```

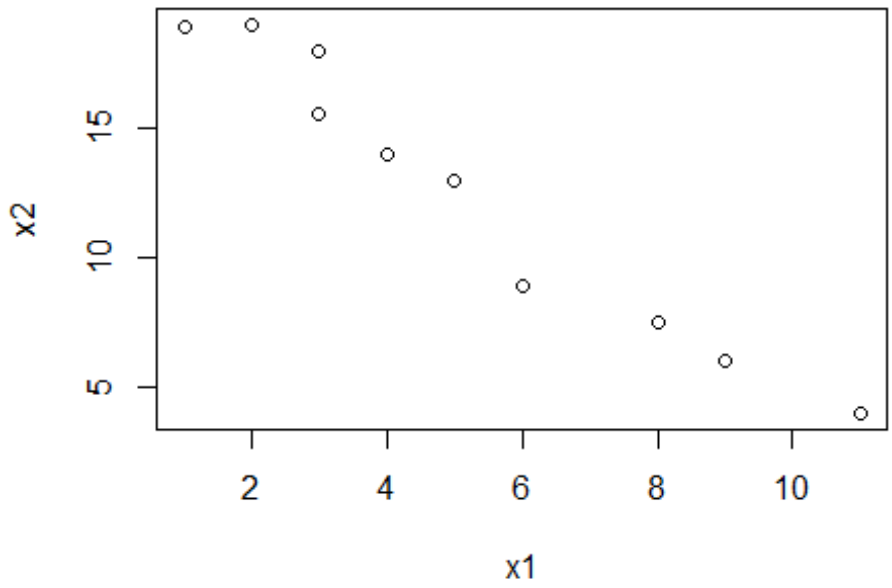
La prueba de Anderson Darling indica que los datos se comportan como una normal. Los contornos no se comportan como círculos ni como elipses.

3.

```
x1=c(1,2,3,3,4,5,6,8,9,11)
x2=c(18.95,19,17.95,15.54,14,12.95,8.94,7.49,6,3.99)
```

Diagrama de dispersión

```
plot(x1,x2)
```



la covarianza parece tener un signo negativo (-) ya que los puntos parecen caer en el segundo y cuarto cuadrante.

```
A=matrix(c(x1,x2),ncol = 2)
s=cov(A)
D2=mahalanobis(A,colMeans(A),s)
print(D2)
```

```
##  [1] 1.8753045 2.0203262 2.9009088 0.7352659 0.3105192 0.0176162
3.7329012
##  [8] 0.8165401 1.3753379 4.2152799
```

```
qchisq(0.5,9)
```

```
## [1] 8.342833
```

```
sort(D2)
```

```
##  [1] 0.0176162 0.3105192 0.7352659 0.8165401 1.3753379 1.8753045
2.0203262
##  [8] 2.9009088 3.7329012 4.2152799
```

```
plot(sort(D2))
```