

PCA

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```
library(MASS)
```

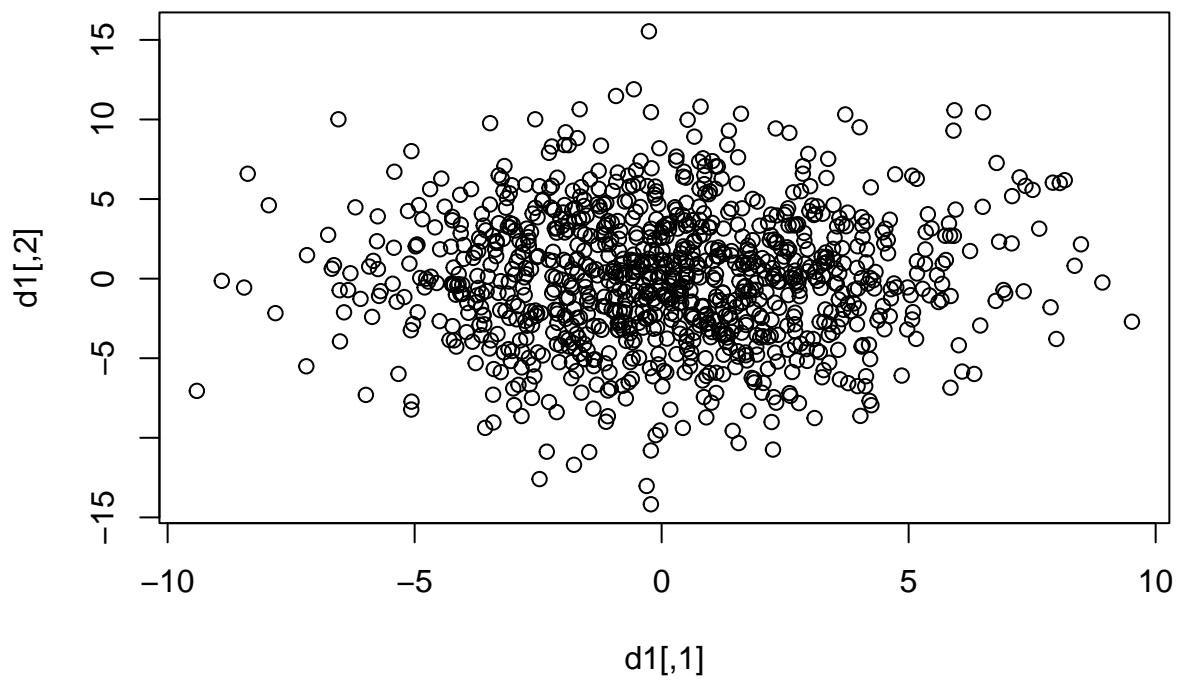
```
mu1 <- c(0,0)
sigma1 <- matrix(c(9,0,0,16), ncol = 2)

d1 <- mvrnorm(n=1000, mu=mu1, Sigma = sigma1)

head(d1)
```

```
##           [,1]      [,2]
## [1,] -2.5290826  1.3489619
## [2,] -1.5963697  3.7672303
## [3,]  4.4139774 -2.3317790
## [4,]  1.6485162  1.0402952
## [5,]  2.3269414  3.9682235
## [6,] -0.2702153 -0.9148756
```

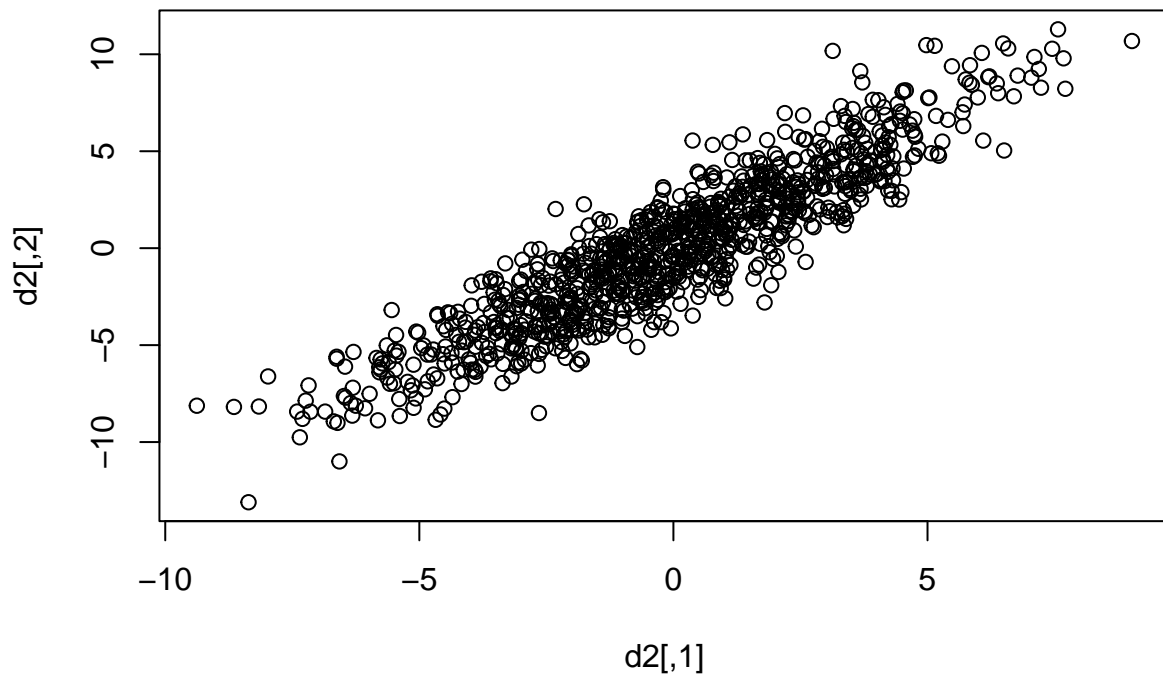
```
plot(d1)
```



```
sigma2 <- matrix(c(9,11,11,16), ncol = 2)

d2 <- mvrnorm(n=1000, mu=mu1, Sigma = sigma2)

plot(d2)
```



```
sigma3 <- matrix(c(1,-2,0,-2,5,0,0,0,2), ncol = 3)
sigma3
```

```
##      [,1] [,2] [,3]
## [1,]    1   -2    0
## [2,]   -2    5    0
## [3,]    0    0    2
```

```
eigen(sigma3)
```

```
## eigen() decomposition
## $values
## [1] 5.8284271 2.0000000 0.1715729
##
## $vectors
##      [,1] [,2] [,3]
## [1,] -0.3826834    0 0.9238795
## [2,] 0.9238795    0 0.3826834
## [3,] 0.0000000    1 0.0000000
```

```
sigma4 <- diag(c(3,4,20,43,10))
sigma4
```

```
##      [,1] [,2] [,3] [,4] [,5]
```

```
## [1,] 3 0 0 0 0
## [2,] 0 4 0 0 0
## [3,] 0 0 20 0 0
## [4,] 0 0 0 43 0
## [5,] 0 0 0 0 10
```

```
eigen(sigma4)
```

```
## eigen() decomposition
## $values
## [1] 43 20 10 4 3
##
## $vectors
##      [,1] [,2] [,3] [,4] [,5]
## [1,] 0 0 0 0 1
## [2,] 0 0 0 1 0
## [3,] 0 1 0 0 0
## [4,] 1 0 0 0 0
## [5,] 0 0 1 0 0
```

```
sigma5 <- matrix(c(rep(0.8,16)), ncol = 4)
sigma5
```

```
##      [,1] [,2] [,3] [,4]
## [1,] 0.8 0.8 0.8 0.8
## [2,] 0.8 0.8 0.8 0.8
## [3,] 0.8 0.8 0.8 0.8
## [4,] 0.8 0.8 0.8 0.8
```

```
diag(sigma5) <- rep(1,4)
sigma5
```

```
##      [,1] [,2] [,3] [,4]
## [1,] 1.0 0.8 0.8 0.8
## [2,] 0.8 1.0 0.8 0.8
## [3,] 0.8 0.8 1.0 0.8
## [4,] 0.8 0.8 0.8 1.0
```

```
eigen(sigma5)
```

```
## eigen() decomposition
## $values
## [1] 3.4 0.2 0.2 0.2
##
## $vectors
##      [,1]      [,2]      [,3]      [,4]
## [1,] -0.5 -0.06822276 -0.5341329 0.6782682
## [2,] -0.5 -0.64743846 -0.1532401 -0.5543834
## [3,] -0.5 -0.04222164 0.8206449 0.2734213
## [4,] -0.5 0.75788286 -0.1332720 -0.3973061
```