Vianey Maravilla Pérez
5AM1
Analítica y Visualización de datos

Proyecto 03:

Programa en R que permita calcular la distancia de Mahalanobis sobre el conjunto de datos Iris, para las 3 clases de flores que están descritas en el conjunto de datos.

- Cuantificar el valor de la distancia de Mahalanobis entre las flores: Setosa, Versicolor y Virginica, tomando como base la longitud y anchura del sépalo y pétalo de cada flor.
- Graficar los valores de las distancias calculadas.

Codificación:

```r
# Vianey Maravilla Pérez
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# Proyecto 3
# Descripción:
# Programa en R que permita calcular la distancia de Mahalanobis sobre el conjunto de datos Iris, para las 3 clases
# de flores que están descritas en el conjunto de datos.

# Cuantificar el valor de la distancia de Mahalanobis entre las flores: Setosa, Versicolor y Virginica,
# tomando como base la longitud y anchura del sépalo y pétalo de cada flor.

# Graficar los valores de las distancias calculadas.



main <- function() {
  data <- data.frame(iris)
  flower_type = levels(factor(data$Species))
  setosa <- data.frame(data[data$Species == flower_type[1], c(1, 2, 3, 4, 5)])
  versicolor <- data.frame(data[data$Species == flower_type[2], c(1, 2, 3, 4, 5)])
  virginica <- data.frame(data[data$Species == flower_type[3], c(1, 2, 3, 4, 5)])
  View(setosa)
  View(versicolor)
  View(virginica)
  setosaD<- mahalanobis_dist(setosa[,1:4])
  versicolorD<- mahalanobis_dist(versicolor[,1:4])
  virginicaD<- mahalanobis_dist(virginica[,1:4])
  print(" Mahalanobis Setosa D.")
  print(setosaD)
  graficate(setosaD, "Mahalanobis Setosa D.")
  print("versicolor_mahalanobis")
  print(versicolorD)
  graficate(versicolorD, "Mahalanobis versicolor D.")
  print("virginica_mahalanobis")
  print(virginicaD)
  graficate(virginicaD, "Mahalanobis Virginica")
}

means <- function(data) {
  col_no <- dim(data)[2]
  row_no <- dim(data)[1]
  means_list <- list()
  for(i in 1:col_no) {
    suma <- 0
    for(j in 1:row_no) {
      suma <- suma + data[j,i]
    }
    means_list <- c(means_list, suma / row_no)
```

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```
      means_list <- c(means_list, suma / row_no)
    }
    return(means_list)
}

mult_mat <- function(mat1, mat2) {
    row_no1 <- dim(mat1)[1]
    row_no2 <- dim(mat2)[1]
    col_no1 <- dim(mat1)[2]
    col_no2 <- dim(mat2)[2]
    if(col_no1 == row_no2) {
      new_mat <- data.frame()
      for(a in 1:col_no2) {
        rown <- c()
        for(i in 1:row_no1) {
          suma <- 0
          for(j in 1:col_no1) {
            suma <- suma + (mat1[i,j] * mat2[j,a])
          }
          rown <- c(rown, suma)
        }
        if(dim(new_mat)[1] == 0) {
          new_mat <- cbind(rown)
        } else {
          new_mat <- cbind(new_mat, rown)
        }
      }
      return(new_mat)
    }
}

mahalanobis_dist <- function(data) {
    cov_matrix <- cov(data)
    means_data <- means(data)
    row_no <- dim(data)[1]
    col_no <- dim(data)[2]
    identity_matrix <- diag(row_no)
    ones_matrix <- matrix(1, row_no, row_no)
    identity_one <- identity_matrix - ((1 / row_no) * ones_matrix)
    t_data <- t(data)
    cov_matrix_inv <- solve(cov_matrix)
    first_step <- mult_mat(identity_one, data)
    second_step <- mult_mat(first_step, cov_matrix_inv)
    third_step <- mult_mat(second_step, t_data)
    four_step <- mult_mat(third_step, identity_one)
    mahalanobis_dists <- diag(four_step)
    return(mahalanobis_dists)
}

```

```
}

graficate <- function(data, name) {
  plot(density(data, bw = 0.5),
       main="Ditancias Mahalanobis") ; rug(data)
  qqplot(qchisq(ppoints(length(data)), df = 3), data,
         main = expression("Q-Q ploteo de Magalanobis quantiles" * ~ chi[3]^2))
  abline(0, 1, col = 'red')
}

main()
```

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Resultados:

```
> main()
[1] " Mahalanobis Setosa D."
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 0.4491138  2.0810942  1.2843351  1.7062070  0.7616854  3.7126474  3.4241961  0.3434392  2.9964765  3.2000859  1.8909526
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 2.0148794  2.9473331  7.0402099 10.2220770  7.6538032  5.7423687  0.6362547  5.1857747  1.6124127  5.3490587  2.7223552
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
11.0444280  7.2303753  9.7479738  3.7705104  2.5256872  0.8291292  1.3230148  2.1743957  1.9945061  4.8891115  7.6992784
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 5.2480239  1.2669810  3.3018243  5.7212698  3.0856490  3.2702461  0.5893473  1.6848472 12.3276387  4.2010386 12.3100577
      rown       rown       rown       rown       rown       rown
 8.6011598  2.1946518  2.7557423  1.4888677  1.2527278  0.4947559
[1] "versicolor_mahalanobis"
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 6.0916551  2.3973078  3.5631825  3.9178610  2.4558493  3.2527816  3.1179808  4.7361110  2.9112176  4.3762012  6.4308470
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 2.6553116  6.1610471  1.7677621  5.5411161  4.2747500  3.5278668  6.5262626 12.4894655  1.4082478  8.5146136  1.9491202
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 6.0671797  7.1337117  1.7597667  2.9199945  3.7736387  4.7325800  0.9725275  4.4510573  1.6366303  2.7631832  0.8492779
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 8.0889349  5.9027716  5.5893623  2.4805283  5.7578365  2.2875030  1.6242992  5.3823881  1.2944391  0.4976204  4.4743536
      rown       rown       rown       rown       rown       rown
 0.7543141  4.2302567  1.0676174  0.7725618 10.2907920  0.3783153
[1] "virginica_mahalanobis"
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 8.8020901  1.8944347  0.8333777  2.1093471  1.5855332  4.1651756  7.9943130  3.6681851  3.4851203  4.4487424  2.8049311
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 0.8882618  0.8501882  3.6451283  5.6123019  1.8765129  1.1395765  9.4800318 13.6690945  6.4187616  1.2650472  2.6139404
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 6.6556667  3.1866510  1.2983426  3.1886575  3.3050360  2.5594497  1.0711906  5.0318804  3.3292942 10.8263574  1.7500469
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 4.2847010  8.7844642  6.3042090  4.4726436  2.1692940  3.0674703  2.3114137  2.1721288  8.3131469  1.8944347  1.3352612
      rown       rown       rown       rown       rown       rown
 3.1401967  4.5454882  4.0076980  1.1118083  3.9418920  2.6910812
> source("C:/Users/viane/Music/ESCOM/Análisis y visualización de datos/Proyecto 03.R")
[1] " Mahalanobis Setosa D."
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 0.4491138  2.0810942  1.2843351  1.7062070  0.7616854  3.7126474  3.4241961  0.3434392  2.9964765  3.2000859  1.8909526
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 2.0148794  2.9473331  7.0402099 10.2220770  7.6538032  5.7423687  0.6362547  5.1857747  1.6124127  5.3490587  2.7223552
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
11.0444280  7.2303753  9.7479738  3.7705104  2.5256872  0.8291292  1.3230148  2.1743957  1.9945061  4.8891115  7.6992784
      rown       rown       rown       rown       rown       rown       rown       rown       rown       rown       rown
 5.2480239  1.2669810  3.3018243  5.7212698  3.0856490  3.2702461  0.5893473  1.6848472 12.3276387  4.2010386 12.3100577
      rown       rown       rown       rown       rown       rown
 8.6011598  2.1946518  2.7557423  1.4888677  1.2527278  0.4947559
```

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```
[1] "versicolor_mahalanobis"
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 6.0916551 2.3973078 3.5631825 3.9178610 2.4558493 3.2527816 3.1179808 4.7361110 2.9112176 4.3762012 6.4308470
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 2.6553116 6.1610471 1.7677621 5.5411161 4.2747500 3.5278668 6.5262626 12.4894655 1.4082478 8.5146136 1.9491202
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 6.0671797 7.1337117 1.7597667 2.9199945 3.7736387 4.7325800 0.9725275 4.4510573 1.6366303 2.7631832 0.8492779
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 8.0889349 5.9027716 5.5893623 2.4805283 5.7578365 2.2875030 1.6242992 5.3823881 1.2944391 0.4976204 4.4743536
     rown      rown      rown      rown      rown      rown
 0.7543141 4.2302567 1.0676174 0.7725618 10.2907920 0.3783153
[1] "virginica_mahalanobis"
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 8.8020901 1.8944347 0.8333777 2.1093471 1.5855332 4.1651756 7.9943130 3.6681851 3.4851203 4.4487424 2.8049311
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 0.8882618 0.8501882 3.6451283 5.6123019 1.8765129 1.1395765 9.4800318 13.6690945 6.4187616 1.2650472 2.6139404
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 6.6556667 3.1866510 1.2983426 3.1886575 3.3050360 2.5594497 1.0711906 5.0318804 3.3292942 10.8263574 1.7500469
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 4.2847010 8.7844642 6.3042090 4.4726436 2.1692940 3.0674703 2.3114137 2.1721288 8.3131469 1.8944347 1.3352612
     rown      rown      rown      rown      rown      rown
 3.1401967 4.5454882 4.0076980 1.1118083 3.9418920 2.6910812
> main()
[1] " Mahalanobis Setosa D."
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 0.4491138 2.0810942 1.2843351 1.7062070 0.7616854 3.7126474 3.4241961 0.3434392 2.9964765 3.2000859 1.8909526
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 2.0148794 2.9473331 7.0402099 10.2220770 7.6538032 5.7423687 0.6362547 5.1857747 1.6124127 5.3490587 2.7223552
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
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 2.6553116 6.1610471 1.7677621 5.5411161 4.2747500 3.5278668 6.5262626 12.4894655 1.4082478 8.5146136 1.9491202
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 6.0671797 7.1337117 1.7597667 2.9199945 3.7736387 4.7325800 0.9725275 4.4510573 1.6366303 2.7631832 0.8492779
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 8.0889349 5.9027716 5.5893623 2.4805283 5.7578365 2.2875030 1.6242992 5.3823881 1.2944391 0.4976204 4.4743536
     rown      rown      rown      rown      rown      rown
 0.7543141 4.2302567 1.0676174 0.7725618 10.2907920 0.3783153
```

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     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 0.8882618 0.8501882 3.6451283 5.6123019 1.8765129 1.1395765 9.4800318 13.6690945 6.4187616 1.2650472 2.6139404
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 6.6556667 3.1866510 1.2983426 3.1886575 3.3050360 2.5594497 1.0711906 5.0318804 3.3292942 10.8263574 1.7500469
     rown      rown      rown      rown      rown      rown      rown      rown      rown      rown      rown
 4.2847010 8.7844642 6.3042090 4.4726436 2.1692940 3.0674703 2.3114137 2.1721288 8.3131469 1.8944347 1.3352612
     rown      rown      rown      rown      rown      rown
 3.1401967 4.5454882 4.0076980 1.1118083 3.9418920 2.6910812
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