Multivariate Analysis for the Behavioral Sciences, Second Edition (Chapman and Hall/CRC, 2019)

Exercises of Chapter 14: Multidimensional Scaling and Correspondence Analysis

Kimmo Vehkalahti and Brian S. Everitt

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Exercises

Exercise 14.2

Use the matrix gdist below, modifying the related R code given in the **Examples of Chapter 14**.

```
galaxies <- c("I", "SBc", "Sc", "Sbb", "Sb", "Sba", "Sa", "SBO", "SO", "E")

g0 <- matrix(c(
0.00,0   ,0   ,0   ,0   ,0   ,0   ,0   ,0   ,0   ,
3.29,0.00,0   ,0   ,0   ,0   ,0   ,0   ,0   ,0   ,
2.79,1.13,0.00,0   ,0   ,0   ,0   ,0   ,0   ,0   ,
3.52,1.75,1.45,0.00,0   ,0   ,0   ,0   ,0   ,0   ,
3.77,2.97,1.71,2.02,0.00,0   ,0   ,0   ,0   ,0   ,
3.27,3.01,2.13,1.89,1.27,0.00,0   ,0   ,0   ,0   ,
3.93,3.72,3.00,2.25,1.86,0.68,0.00,0   ,0   ,0   ,
3.86,5.12,4.11,3.24,3.15,1.59,1.51,0.00,0   ,0   ,
3.77,5.70,4.85,3.85,3.41,1.74,2.05,0.91,0.00,0   ,
4.12,6.88,6.02,7.03,5.38,4.09,4.03,2.24,1.87,0.00)
, nrow = 10, ncol = 10, byrow = TRUE, dimnames = list(galaxies, galaxies))

gdist <- g0 + t(g0)
gdist
```

```
##        I  SBc   Sc  Sbb   Sb  Sba   Sa  SBO   SO    E
## I   0.00 3.29 2.79 3.52 3.77 3.27 3.93 3.86 3.77 4.12
## SBc 3.29 0.00 1.13 1.75 2.97 3.01 3.72 5.12 5.70 6.88
## Sc  2.79 1.13 0.00 1.45 1.71 2.13 3.00 4.11 4.85 6.02
## Sbb 3.52 1.75 1.45 0.00 2.02 1.89 2.25 3.24 3.85 7.03
## Sb  3.77 2.97 1.71 2.02 0.00 1.27 1.86 3.15 3.41 5.38
## Sba 3.27 3.01 2.13 1.89 1.27 0.00 0.68 1.59 1.74 4.09
## Sa  3.93 3.72 3.00 2.25 1.86 0.68 0.00 1.51 2.05 4.03
## SBO 3.86 5.12 4.11 3.24 3.15 1.59 1.51 0.00 0.91 2.24
## SO  3.77 5.70 4.85 3.85 3.41 1.74 2.05 0.91 0.00 1.87
## E   4.12 6.88 6.02 7.03 5.38 4.09 4.03 2.24 1.87 0.00
```

Exercise 14.3

Use the matrix P12 below, modifying the related R code given in the **Examples of Chapter 14**.

```
countries <- c("Brazil", "Zaire", "Cuba", "Egypt", "France", "India",
               "Israel", "Japan", "China", "USSR", "USA", "Yugoslavia")

    cntrs <- c("Brz", "Zai", "Cub", "Egy", "Fra", "Ind",
               "Isr", "Jpn", "Chi", "USSR", "USA", "Yug")

P0 <- matrix(c(
0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,
4.83,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,
5.28,4.26,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,
3.44,5.00,5.17,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,
4.72,4.00,4.11,4.78,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,
4.50,4.83,4.00,5.83,3.44,0.00,0.00,0.00,0.00,0.00,0.00,0.00,
3.83,3.33,3.61,4.67,4.00,4.11,0.00,0.00,0.00,0.00,0.00,0.00,
3.50,3.39,2.94,9.84,4.11,4.50,4.83,0.00,0.00,0.00,0.00,0.00,
2.39,4.00,5.50,4.39,3.67,4.11,3.00,4.17,0.00,0.00,0.00,0.00,
3.06,3.39,5.44,4.39,5.06,4.50,4.17,4.61,5.72,0.00,0.00,0.00,
5.39,2.39,3.17,3.33,5.94,4.28,5.94,6.06,2.56,5.00,0.00,0.00,
3.17,3.50,5.11,4.28,4.72,4.00,4.44,4.28,5.06,6.67,3.56,0.00)
, nrow = 12, byrow = TRUE, dimnames = list(countries, cntrs))

P12 <- P0 + t(P0)
P12
```

```
##             Brz  Zai  Cub  Egy  Fra  Ind  Isr  Jpn  Chi USSR  USA  Yug
## Brazil     0.00 4.83 5.28 3.44 4.72 4.50 3.83 3.50 2.39 3.06 5.39 3.17
## Zaire      4.83 0.00 4.26 5.00 4.00 4.83 3.33 3.39 4.00 3.39 2.39 3.50
## Cuba       5.28 4.26 0.00 5.17 4.11 4.00 3.61 2.94 5.50 5.44 3.17 5.11
## Egypt      3.44 5.00 5.17 0.00 4.78 5.83 4.67 9.84 4.39 4.39 3.33 4.28
## France     4.72 4.00 4.11 4.78 0.00 3.44 4.00 4.11 3.67 5.06 5.94 4.72
## India      4.50 4.83 4.00 5.83 3.44 0.00 4.11 4.50 4.11 4.50 4.28 4.00
## Israel     3.83 3.33 3.61 4.67 4.00 4.11 0.00 4.83 3.00 4.17 5.94 4.44
## Japan      3.50 3.39 2.94 9.84 4.11 4.50 4.83 0.00 4.17 4.61 6.06 4.28
## China      2.39 4.00 5.50 4.39 3.67 4.11 3.00 4.17 0.00 5.72 2.56 5.06
## USSR       3.06 3.39 5.44 4.39 5.06 4.50 4.17 4.61 5.72 0.00 5.00 6.67
## USA        5.39 2.39 3.17 3.33 5.94 4.28 5.94 6.06 2.56 5.00 0.00 3.56
## Yugoslavia 3.17 3.50 5.11 4.28 4.72 4.00 4.44 4.28 5.06 6.67 3.56 0.00
```

Exercise 14.4

Use the table EyeHair below, modifying the related R code given in the **Examples of Chapter 14** to visualize and analyse the data.

Source of the data: Fisher, R. A. (1940). The precision of discriminant functions. *Annals of Eugenics*, 10, 422–429. (Table on p.426: "Tocher's data for Caithness compiled by K. Maung of the Galton Laboratory"). https://doi.org/10.1111/j.1469-1809.1940.tb02264.x

```
EyeHair <- as.table(rbind(
              c(326,  38, 241, 110,  3),
              c(688, 116, 584, 188,  4),
              c(343,  84, 909, 412, 26),
              c( 98,  48, 403, 681, 85)
           ))

dimnames(EyeHair) <- list(EyeColor = c("Blue", "Light", "Medium", "Dark"),
                          HairColor = c("Fair", "Red", "Medium", "Dark", "Black"))
EyeHair
```

```
##         HairColor
## EyeColor Fair Red Medium Dark Black
##   Blue    326  38    241  110     3
##   Light   688 116    584  188     4
##   Medium  343  84    909  412    26
##   Dark     98  48    403  681    85
```