June 3, 2022

The results below are generated from an R script.

```r
## Install a package manager and packages
if (!require("pacman")) {
  install.packages("pacman")
}
pacman::p_load(Rfast, foreach, doParallel, mvnfast, rstudioapi)
current_path = rstudioapi::getActiveDocumentContext()$path
setwd(dirname(current_path))
```

Error in setwd(dirname(current_path)): cannot change working directory

```r
pacman::p_load_gh("pkimes/sigclust2")
shc = get("shc", env = environment(shc))

source("sequential_function.R")

# k = 3 # number of clusters (3 or 10)
# uneven = FALSE #whether or not to have uneven weights
# distribution = 't' # t distribution or normal distribution?
# iterations = 50 # number of iterations


n = 500 # total number of samples
alpha = 0.05


if (distribution=='t'){
  distribution_name = 'True distribution components: t-distrbution (df=3) mixture distribution'
  samplefunc <- function(n, mu, sigma, w){
    rmixt(n = n,mu = mus,sigma = sigmas,w = w,df = 3)
  }
}else{
  distribution_name = 'True distribution: Normal mixture distribution'
  samplefunc <- function(n, mu, sigma, w){
  rmixn(n=n, mu=mus, sigma=sigmas, w=w)
}
}


# formulating d, delta (dimension and distance between clusters)
if (k == 10){
  a = c(2, 1, 2, 2, 2, 3, 2, 4, 2, 5, 2, 6, 2, 7, 2, 8, 2, 9) # dim2
  b = c(8, 1, 8, 2, 8, 3, 8, 4, 8, 5, 8, 6, 8, 7, 8, 8, 8, 9) # dim8
  d_delta = matrix(c(a, b) , ncol = 2, byrow = T)
} else if (k == 3){
```

```r
  a = c(2, 1, 2, 2, 2, 3, 2, 4, 2, 5, 2, 6, 2, 7, 2, 8, 2, 9) # dim2
  b = c(8, 1, 8, 2, 8, 3, 8, 4, 8, 5, 8, 6, 8, 7, 8, 8, 8, 9) # dim8
  d_delta = matrix(c(a, b) , ncol = 2, byrow = T)
} else {
  stop("k != 3 or 10")
}


#weights
w = rep.int(1, k)
if (uneven){
  w[1] = 1 / 4
  w[2] = 1 / 2
}
w = w / sum(w)


K = floor(sqrt(n / 2)) #num clusters to test
K = min(K, 14L) # to ensure not estimating too many clusters

coresToUse = floor(detectCores() / 2) # cores to use

# function which creates data and performs one iteration
simulation <- function(iteration) {
  # simulate data
  set.seed(18 + iteration)
  data = samplefunc(n=n, mu=mus, sigma=sigmas, w=w)


  D1 = data[1:floor(n / 2), ]
  D2 = data[(floor(n / 2) + 1):n, ]

  # Estimate no.clusters
  Cluster_numbers = estimate.cluster.all(D1, D2, alpha, K)
  sigclust_splits = sum(shc(data, alpha = alpha)$nd_type == "sig")
  return(c(unlist(Cluster_numbers, use.names = F), sigclust_splits + 1L))
}


meanEstimate = matrix(nrow = nrow(d_delta), ncol = iterations)
medianEstimate = meanEstimate
meanEstimatel2 = meanEstimate
medianEstimatel2 = meanEstimate
AICEstimate = meanEstimate
BICEstimate = meanEstimate
sigclustEstimate = meanEstimate
RIFThierEstimate = meanEstimate

# For parallel computing
cl <- makeCluster(coresToUse) #not to overload computer
registerDoParallel(cl)
```

```r
for (j in 1:nrow(d_delta)) {
  d = d_delta[j, 1]
  delta = d_delta[j, 2]


  #sigmas = lapply(c(3,1,1), function(x) diag(x, nrow=d))
  sigmas = lapply(rep.int(1, k), function(x)
    diag(x, nrow = d))


  #mus = zeros(k, d)
  #mus[1,1] = delta
  #mus[2,2] = -delta
  #mus[3,2] = delta
  mus = outer(rep.int(1L, k), seq.int(d)) + delta * seq.int(0, k - 1L)

  estimates <-
    foreach(
      i = 1:iterations,
      .combine = cbind,
      .inorder = F,
      .packages = c("mclust", "Rfast", "mvnfast", "MASS"),
      .verbose = F
    ) %dopar% {
      simulation(i)
    }

  # format data into table
  meanEstimate[j, ] = estimates[1, ]
  medianEstimate[j, ] = estimates[2, ]
  meanEstimatel2[j, ] = estimates[3, ]
  medianEstimatel2[j, ] = estimates[4, ]
  BICEstimate[j, ] = estimates[5, ]
  AICEstimate[j, ] = estimates[6, ]
  RIFThierEstimate[j, ] = estimates[7, ]
  sigclustEstimate[j, ] = estimates[8, ]
  df = stack(data.frame(
    cbind(
      "Mean" = meanEstimate[j, ],
      "Meanl2" = meanEstimatel2[j, ],
      "Median" = medianEstimate[j, ],
      "Medianl2" = medianEstimatel2[j, ],
      "AIC" = AICEstimate[j, ],
      "BIC" = BICEstimate[j, ],
      "RIFT.hc" = RIFThierEstimate[j, ],
      "shc" = sigclustEstimate[j, ]
    )
  ))
  print(paste0("(dimension, delta) = (", d, ",", delta, ")"))
  colnames(df) = c("ESTIMATE" , "METHOD")
  tableEstimates = with(df, table(METHOD, ESTIMATE))
  print(tableEstimates)
```

```
}

## [1] "(dimension, delta) = (2,1)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8 14
##   Mean    68 25  6  1  0  0  0  0  0
##   Meanl2  68 25  6  1  0  0  0  0  0
##   Median   4 40 44  8  2  2  0  0  0
##   Medianl2 4 40 44  8  2  2  0  0  0
##   AIC     10 37 36 12  4  1  0  0  0
##   BIC     34 40 23  1  2  0  0  0  0
##   RIFT.hc 15 51 21  9  4  0  0  0  0
##   shc      0 13 40 22  8  8  6  2  1
## [1] "(dimension, delta) = (2,2)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11
##   Mean    61 24 14  1  0  0  0  0  0  0  0
##   Meanl2  62 23 14  1  0  0  0  0  0  0  0
##   Median   3 26 50 14  5  2  0  0  0  0  0
##   Medianl2 3 26 50 14  5  2  0  0  0  0  0
##   AIC      2 17 49 25  6  0  1  0  0  0  0
##   BIC     33 35 25  5  2  0  0  0  0  0  0
##   RIFT.hc 16 28 32 15  9  0  0  0  0  0  0
##   shc      0  0  0  2 16 22 30 12 12  5  1
## [1] "(dimension, delta) = (2,3)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14
##   Mean    53 23 18  6  0  0  0  0  0  0  0  0  0  0
##   Meanl2  53 23 18  6  0  0  0  0  0  0  0  0  0  0
##   Median   1 15 27 17  5  3  2  1  2  4  3  7  4  9
##   Medianl2 1 15 27 18  6  2  2  1  3  3  3  6  4  9
##   AIC      3 12 45 27  8  4  0  0  0  0  0  1  0  0
##   BIC     26 39 29  5  1  0  0  0  0  0  0  0  0  0
##   RIFT.hc 17 22 35 14 10  1  1  0  0  0  0  0  0  0
##   shc      0  0  0  0  0  1  5 10 34 33 14  2  1  0
## [1] "(dimension, delta) = (2,4)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14
##   Mean    33 17 19  7  5  2  2  2  3  4  2  2  0  2
##   Meanl2  33 17 19  7  5  2  2  2  3  4  2  2  0  2
##   Median   0  3  3  0  1  2  2  5 12 23 15 16  2 16
##   Medianl2 0  3  3  0  1  2  2  5 13 25 11 17  1 17
##   AIC      1  6 23 14  5  5  2  2  4  9  9  6  9  5
##   BIC     25 33 30 10  1  0  1  0  0  0  0  0  0  0
##   RIFT.hc 20 19 37 12 11  0  0  0  1  0  0  0  0  0
##   shc      0  0  0  0  0  0  0  3 19 62 14  2  0  0
## [1] "(dimension, delta) = (2,5)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14
##   Mean     8  9 10 10  6  7  6  6  9  8 10  6  4  1
##   Meanl2   8 10 10  8  6  7  7  7  9  8  9  6  4  1
##   Median   0  0  0  0  1  0  3 11 11 23 18 14  5 14
##   Medianl2 0  0  0  0  1  0  3 11 14 23 17 14  4 13
##   AIC      0  2  5  3  6  1  2  2  5 16 13 22 16  7
```

```
##    BIC       19 28 26  8  5  1  1  0  1  3  3  3  2  0
##    RIFT.hc   20 24 25 20  7  4  0  0  0  0  0  0  0  0
##    shc        0  0  0  0  0  0  0  2 11 73 12  2  0  0
## [1] "(dimension, delta) = (2,6)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14
##    Mean    4  3  3  5  7  5  8 11 17 16 11  5  2  3
##    Meanl2  5  2  3  5  7  5  8 11 17 16 11  5  2  3
##    Median  0  0  0  0  0  0  0  7 28 24 19  7  3 12
##    Medianl2 0  0  0  0  0  0  1  7 30 26 19  5  1 11
##    AIC     0  1  1  0  0  0  0  4  7 21 24 13 14 15
##    BIC     9 14 12  7  2  1  1  0  6 18  9  8  5  8
##    RIFT.hc 20 28 26 15  4  6  1  0  0  0  0  0  0  0
##    shc     0  0  0  0  0  0  0  0  8 83  9  0  0  0
## [1] "(dimension, delta) = (2,7)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14
##    Mean    4  1  2  3  0  4  6 13 30 17  8  5  5  2
##    Meanl2  4  1  2  3  0  4  6 13 30 17  8  5  5  2
##    Median  0  0  0  0  0  0  0 11 28 27 19  8  6  1
##    Medianl2 0  0  0  0  0  0  0 12 28 28 19  8  4  1
##    AIC     0  0  0  0  0  0  0  3  7 14 25 18 17 16
##    BIC     4  5  2  4  0  0  0  1  7 17 21 13 11 15
##    RIFT.hc 19 28 27 17  4  5  0  0  0  0  0  0  0  0
##    shc     0  0  0  0  0  0  0  0  4 85 11  0  0  0
## [1] "(dimension, delta) = (2,8)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14
##    Mean    3  0  1  0  0  4  3  9 23 29 15  5  3  5
##    Meanl2  3  0  1  0  0  4  3  9 23 29 15  5  3  5
##    Median  0  0  0  0  1  0  0  9 35 28 10  6  5  6
##    Medianl2 0  0  0  0  1  0  0 10 38 28  7  4  5  7
##    AIC     0  0  0  0  0  0  0  3  6 32 12 18 11 18
##    BIC     1  1  2  0  0  0  0  3 11 32 16 13  7 14
##    RIFT.hc 16 26 30 18  5  3  1  0  1  0  0  0  0  0
##    shc     0  0  0  0  0  0  0  0  4 88  7  1  0  0
## [1] "(dimension, delta) = (2,9)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14
##    Mean    3  0  0  0  0  1  2  7 25 44  9  4  2  3
##    Meanl2  3  0  0  0  0  1  2  7 25 44  9  4  2  3
##    Median  0  0  0  0  0  0  1  5 36 37 13  3  3  2
##    Medianl2 0  0  0  0  0  0  1  5 38 38 10  3  3  2
##    AIC     0  0  0  0  0  0  0  0  9 34 17 10 15 15
##    BIC     0  0  0  0  0  0  0  1  9 37 19  8 13 13
##    RIFT.hc 21 31 21 18  8  1  0  0  0  0  0  0  0  0
##    shc     0  0  0  0  0  0  0  0  2 91  6  1  0  0
## [1] "(dimension, delta) = (8,1)"
##           ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 14 15 16 17 18 19 20 21 22 23 24 25 26
##    Mean   21 58  7  7  6  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##    Meanl2 21 58  7  7  6  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##    Median  1 62 22 12  3  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##    Medianl2 1 62 22 12  3  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

```
##   AIC        0  5 21 25 36  6  3  2  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC        0 20 42 15 16  3  1  1  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc    2 36 39 21  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   shc        0  0  0  0  0  0  0  0  2  4  0  6  6  8  7  8 10  6 12  9  8  5  4  2  3
## [1] "(dimension, delta) = (8,2)"
##          ESTIMATE
## METHOD     1  2  3  4  5  6  7  8 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
##   Mean    22 53 11  9  5  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2  22 53 11  9  5  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   Median   0 62 23  9  4  1  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2 0 62 23  9  4  1  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC      0  6 23 23 29  9  1  4  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC      0 19 43 17 13  4  2  0  1  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc  1 55 41  2  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   shc      0  0  0  0  0  0  0  0  0  0  0  1  1  1 14  6 11 16 10 11 11  7  3  3  2  2
##          ESTIMATE
## METHOD    28
##   Mean     0
##   Meanl2   0
##   Median   0
##   Medianl2 0
##   AIC      0
##   BIC      0
##   RIFT.hc  0
##   shc      1
## [1] "(dimension, delta) = (8,3)"
##          ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 27
##   Mean    21 52 12  7  5  0  0  0  0  0  1  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2  21 52 12  7  5  0  0  0  0  0  1  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0
##   Median   0 17 14  4  5  3  2  0  1 10 10 18 11  5  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2 0 17 14  4  5  3  2  0  1  9 15 16 10  4  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC      0  6 20 22 29  6  2  2  1  0  2  3  2  5  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC      0 23 40 12 16  3  2  0  0  1  1  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc  3 49 46  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   shc      0  0  0  0  0  0  0  0  0  0  0  0  1  1  3  4  8 16 14 14 21  7  6  2  2  1
## [1] "(dimension, delta) = (8,4)"
##          ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 27
##   Mean    18 50 11 10  6  1  0  0  0  1  0  1  1  1  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2  18 50 11 10  6  1  0  0  0  1  0  1  1  1  0  0  0  0  0  0  0  0  0  0  0
##   Median   0  7  4  3  0  1  0  0  0  9 19 33 18  6  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2 0  7  4  3  0  1  0  0  1 15 19 30 17  3  0  0  0  0  0  0  0  0  0  0  0
##   AIC      0  6 26 16 20  3  3  1  0  0  3  8  6  8  0  0  0  0  0  0  0  0  0  0  0
##   BIC      0 20 40 14 14  1  1  2  0  1  2  3  1  1  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc  3 59 35  3  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   shc      0  0  0  0  0  0  0  0  0  0  0  0  1  1  6  8 10 11 13 19 18  6  4  2  1
## [1] "(dimension, delta) = (8,5)"
##          ESTIMATE
## METHOD     1  2  3  4  5  6  7  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 26 27
##   Mean    20 48 12  5  2  0  0  2  0  1  1  3  6  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2  20 48 12  5  2  0  0  2  0  1  1  3  6  0  0  0  0  0  0  0  0  0  0  0  0
##   Median   0  5  0  1  1  0  0  1 13 25 25 19 10  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2 0  5  0  1  1  0  0  2 19 24 25 16  7  0  0  0  0  0  0  0  0  0  0  0  0
```

```
##    AIC       0  7 17 20 15  5  1  0  1  5  4  9 16  0  0  0  0  0  0  0  0  0  0  0
##    BIC       0 24 36 15 11  3  0  0  1  4  2  3  1  0  0  0  0  0  0  0  0  0  0  0
##    RIFT.hc   3 51 40  6  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##    shc       0  0  0  0  0  0  0  0  0  0  0  0  1  2  6  6 11 21 10 15 10  8  4  4  1  1
## [1] "(dimension, delta) = (8,6)"
##         ESTIMATE
## METHOD     1  2  3  4  5  6  7  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 27
##    Mean   20 41  6  9  6  1  0  1  4  2  2  3  5  0  0  0  0  0  0  0  0  0  0  0
##    Meanl2 20 41  6  9  6  1  0  1  4  2  2  3  5  0  0  0  0  0  0  0  0  0  0  0
##    Median  0  2  1  0  0  0  1  4 18 29 20 16  9  0  0  0  0  0  0  0  0  0  0  0
##    Medianl2 0 2  1  0  0  0  1  6 22 33 20  7  8  0  0  0  0  0  0  0  0  0  0  0
##    AIC     0  5 15 19 15  2  2  0  0  7 14  8 13  0  0  0  0  0  0  0  0  0  0  0
##    BIC     0 26 30 18 10  0  1  0  0  6  4  3  2  0  0  0  0  0  0  0  0  0  0  0
##    RIFT.hc 2 56 36  6  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##    shc     0  0  0  0  0  0  0  0  0  0  0  0  1  3  4 11 11 14  8 21 11  7  6  2  1
## [1] "(dimension, delta) = (8,7)"
##         ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
##    Mean   18 37  9  6  3  1  0  1  2  4  4  7  2  6  0  0  0  0  0  0  0  0  0  0  0
##    Meanl2 18 37  9  6  3  1  0  1  2  4  4  7  2  6  0  0  0  0  0  0  0  0  0  0  0
##    Median  0  2  0  0  1  0  0  0  2 17 32 29  7 10  0  0  0  0  0  0  0  0  0  0  0
##    Medianl2 0 2  0  0  1  0  0  0  3 23 37 21  8  5  0  0  0  0  0  0  0  0  0  0  0
##    AIC     0  4  8 16 10  3  1  0  0  1  4 12 20 21  0  0  0  0  0  0  0  0  0  0  0
##    BIC     0 17 33 16 11  0  1  0  0  2  1 10  5  4  0  0  0  0  0  0  0  0  0  0  0
##    RIFT.hc 1 56 35  8  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##    shc     0  0  0  0  0  0  0  0  0  0  0  0  0  0  3  4 11  8 17 13 13 15  8  4  2  2
## [1] "(dimension, delta) = (8,8)"
##         ESTIMATE
## METHOD     1  2  3  4  5  6  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
##    Mean   18 25 12  7  3  1  6  4  6  5  4  9  0  0  0  0  0  0  0  0  0  0  0  0
##    Meanl2 18 25 12  7  3  1  6  4  6  5  4  9  0  0  0  0  0  0  0  0  0  0  0  0
##    Median  0  1  0  0  0  0  8 22 33 22  9  5  0  0  0  0  0  0  0  0  0  0  0  0
##    Medianl2 0 1  0  0  0  0  9 25 35 19  9  2  0  0  0  0  0  0  0  0  0  0  0  0
##    AIC     0  4  8 10 11  0  1  1 10  6 12 37  0  0  0  0  0  0  0  0  0  0  0  0
##    BIC     0 16 26 17  8  2  0  1  6  5  5 14  0  0  0  0  0  0  0  0  0  0  0  0
##    RIFT.hc 2 55 36  5  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##    shc     0  0  0  0  0  0  0  0  0  0  0  0  1  3 11 11 15 10 23 12  5  5  2  1  1
## [1] "(dimension, delta) = (8,9)"
##         ESTIMATE
## METHOD     1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
##    Mean   14 27  8  5  3  2  2  3  6  2  7  6  3 12  0  0  0  0  0  0  0  0  0  0  0
##    Meanl2 14 27  8  5  3  2  2  3  6  2  7  6  3 12  0  0  0  0  0  0  0  0  0  0  0
##    Median  0  0  0  0  0  0  0  0  6 29 36 13  7  9  0  0  0  0  0  0  0  0  0  0  0
##    Medianl2 0 0  0  0  0  0  0  0  6 33 33 14  6  8  0  0  0  0  0  0  0  0  0  0  0
##    AIC     0  5  9  6  6  2  1  0  1  1  7 11 16 35  0  0  0  0  0  0  0  0  0  0  0
##    BIC     0 16 27 11  5  1  1  0  0  2  3 12  8 14  0  0  0  0  0  0  0  0  0  0  0
##    RIFT.hc 3 54 36  5  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##    shc     0  0  0  0  0  0  0  0  0  0  0  0  0  2  2 11 10 13 13 28  7  5  6  2  1
```

```r
#stop cluster (parallel computing)
stopCluster(cl)

print(distribution_name )
```

```
## [1] "True distribution components: t-distrbution (df=3) mixture distribution"
```

```r
print(paste(k, 'true clusters:'))

## [1] "10 true clusters:"

print('Cluster weights:')

## [1] "Cluster weights:"

print(w)

##  [1] 0.02857143 0.05714286 0.11428571 0.11428571 0.11428571 0.11428571 0.11428571
##  [8] 0.11428571 0.11428571 0.11428571
```

The R session information (including the OS info, R version and all packages used):

```r
sessionInfo()

## R version 4.1.2 (2021-11-01)
## Platform: x86_64-apple-darwin17.0 (64-bit)
## Running under: macOS Monterey 12.0.1
##
## Matrix products: default
## LAPACK: /Library/Frameworks/R.framework/Versions/4.1/Resources/lib/libRlapack.dylib
##
## locale:
## [1] en_GB.UTF-8/en_GB.UTF-8/en_GB.UTF-8/C/en_GB.UTF-8/en_GB.UTF-8
##
## attached base packages:
## [1] grid      parallel  stats     graphics  grDevices utils     datasets  methods
## [9] base
##
## other attached packages:
##  [1] arm_1.12-2         lme4_1.1-27.1     Matrix_1.3-4       knitr_1.37
##  [5] sigclust_1.1.0     mixtools_1.2.0    gridExtra_2.3      ggplot2_3.3.5
##  [9] MASS_7.3-54        pracma_2.3.6      mclust_5.4.9       sigclust2_1.2.4
## [13] rstudioapi_0.13    mvnfast_0.2.7     doParallel_1.0.16  iterators_1.0.13
## [17] foreach_1.5.1      Rfast_2.0.6       RcppZiggurat_0.1.6 Rcpp_1.0.8
## [21] pacman_0.5.1
##
## loaded via a namespace (and not attached):
##  [1] minqa_1.2.4          colorspace_2.0-2   ellipsis_0.3.2
##  [4] dynamicTreeCut_1.63-1 htmlTable_2.4.0    XVector_0.34.0
##  [7] base64enc_0.1-3      ggdendro_0.1.23    bit64_4.0.5
## [10] AnnotationDbi_1.56.2 fansi_0.5.0        codetools_0.2-18
## [13] splines_4.1.2        cachem_1.0.6       impute_1.68.0
## [16] Formula_1.2-4        nloptr_1.2.2.3     broom_0.7.12
## [19] WGCNA_1.70-3         cluster_2.1.2      kernlab_0.9-29
## [22] GO.db_3.14.0         png_0.1-7          compiler_4.1.2
## [25] httr_1.4.2           backports_1.4.1    fastmap_1.1.0
## [28] htmltools_0.5.2      tools_4.1.2        coda_0.19-4
## [31] gtable_0.3.0         glue_1.6.1         GenomeInfoDbData_1.2.7
## [34] dplyr_1.0.7          ggthemes_4.2.4     Biobase_2.54.0
## [37] vctrs_0.4.1          Biostrings_2.62.0  preprocessCore_1.56.0
## [40] nlme_3.1-153         xfun_0.30          fastcluster_1.2.3
## [43] stringr_1.4.0        lifecycle_1.0.1    zlibbioc_1.40.0
```

```
## [46] scales_1.1.1            RColorBrewer_1.1-2     yaml_2.3.4
## [49] memoise_2.0.1           rpart_4.1-15           segmented_1.3-4
## [52] latticeExtra_0.6-29     stringi_1.7.6          RSQLite_2.2.10
## [55] highr_0.9               S4Vectors_0.32.3       blme_1.0-5
## [58] checkmate_2.0.0         BiocGenerics_0.40.0    boot_1.3-28
## [61] GenomeInfoDb_1.30.1     rlang_1.0.2            pkgconfig_2.0.3
## [64] matrixStats_0.61.0      bitops_1.0-7           evaluate_0.15
## [67] lattice_0.20-45         purrr_0.3.4            htmlwidgets_1.5.4
## [70] bit_4.0.4               tidyselect_1.1.1       magrittr_2.0.2
## [73] R6_2.5.1                IRanges_2.28.0         generics_0.1.1
## [76] Hmisc_4.6-0             DBI_1.1.2              pillar_1.6.4
## [79] foreign_0.8-81          withr_2.4.3            survival_3.2-13
## [82] KEGGREST_1.34.0         abind_1.4-5            RCurl_1.98-1.6
## [85] nnet_7.3-16             tibble_3.1.6           crayon_1.4.2
## [88] utf8_1.2.2              rmarkdown_2.13         jpeg_0.1-9
## [91] data.table_1.14.2       blob_1.2.2             forcats_0.5.1
## [94] digest_0.6.29           tidyr_1.1.4            stats4_4.1.2
## [97] munsell_0.5.0
```

```
Sys.time()
```

```
## [1] "2022-06-03 05:01:13 BST"
```