June 3, 2022

The results below are generated from an R script.

```
## 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))

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){
  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)


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  9 10
##   Mean     61 25 13  1  0  0  0  0  0  0
##   Meanl2   63 24 13  0  0  0  0  0  0  0
##   Median    4 29 44 14  5  2  0  2  0  0
##   Medianl2  4 30 43 14  5  2  0  2  0  0
##   AIC       7 21 43 20  8  1  0  0  0  0
##   BIC      36 27 30  7  0  0  0  0  0  0
##   RIFT.hc  19 27 26 20  8  0  0  0  0  0
##   shc       0  2 39 26 11  4  8  6  2  2
## [1] "(dimension, delta) = (2,2)"
##           ESTIMATE
## METHOD      1  2  3  4  5  6  7  8  9 10 11 12 14 15
##   Mean     49 26 19  6  0  0  0  0  0  0  0  0  0  0
##   Meanl2   50 26 20  4  0  0  0  0  0  0  0  0  0  0
##   Median    3 16 42 24  5  5  2  2  0  0  0  0  1  0
##   Medianl2  3 16 43 25  5  4  2  1  0  0  0  0  1  0
##   AIC       1 11 33 33 16  5  0  0  0  1  0  0  0  0
##   BIC      20 31 30 16  3  0  0  0  0  0  0  0  0  0
##   RIFT.hc  13 19 34 24  8  2  0  0  0  0  0  0  0  0
##   shc       0  0  0  2  6 14 29 16 16  9  5  1  1  1
## [1] "(dimension, delta) = (2,3)"
##           ESTIMATE
## METHOD      1  2  3  4  5  6  7  8  9 10 11 12 13 14
##   Mean     46 34 11  7  0  0  1  0  0  0  1  0  0  0
##   Meanl2   46 34 11  7  0  0  1  0  0  0  1  0  0  0
##   Median    0  6 22 24  8  6  0  4  0  3  3  2  5 17
##   Medianl2  0  6 22 24  8  6  0  4  0  3  3  2  5 17
##   AIC       1 10 33 35 13  3  3  0  0  0  0  2  0  0
##   BIC      16 35 29 15  5  0  0  0  0  0  0  0  0  0
##   RIFT.hc  13 16 28 26 13  3  1  0  0  0  0  0  0  0
##   shc       0  0  0  0  0  0  0  8 21 47 21  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     22 21 21  7  3  3  3  1  1  7  7  3  1  0
##   Meanl2   22 23 20  7  2  3  3  1  1  7  7  3  1  0
##   Median    0  0  0  1  0  0  1  0  6 15 13  9  8 47
##   Medianl2  0  0  0  1  0  0  1  0  7 16 13  8  9 45
##   AIC       0  5  9 16 11  5  5  0  1  7 15  9 10  7
##   BIC      12 30 29 23  3  0  0  0  0  1  2  0  0  0
##   RIFT.hc  16 14 24 29 11  5  0  1  0  0  0  0  0  0
##   shc       0  0  0  0  0  0  0  0  5 77 18  0  0  0
## [1] "(dimension, delta) = (2,5)"
##           ESTIMATE
## METHOD      1  2  3  4  5  6  7  8  9 10 11 12 13 14
##   Mean     11 13  9  7  2  5  7  3  4 11 15  6  5  2
##   Meanl2   11 13  9  7  2  5  7  3  4 11 15  6  5  2
##   Median    0  1  2  0  0  0  0  1  5 15 13  9 10 44
##   Medianl2  0  1  2  0  0  0  0  1  6 16 13  7 10 44
##   AIC       0  0  3  9  2  2  2  0  2 20 14 15 17 14
##   BIC       5 17 18 15  5  1  0  0  0 16 11  4  6  2
```

```
##   RIFT.hc   9 19 21 30 14  4  2  1  0  0  0  0  0  0
##   shc       0  0  0  0  0  0  0  0  1 81 17  1  0  0
## [1] "(dimension, delta) = (2,6)"
##           ESTIMATE
## METHOD      1  2  3  4  5  6  7  8  9 10 11 12 13 14
##   Mean      7  4  4  9  1  2  9  5  6 11 25 11  3  3
##   Meanl2    7  4  4  9  1  2  9  5  6 11 25 11  3  3
##   Median    0  1  0  0  1  2  0  0  4 12 14 16 14 36
##   Medianl2  0  1  0  0  1  2  0  1  7 16  9 14 12 37
##   AIC       0  0  0  2  3  1  2  1  0 14 22 21 21 13
##   BIC       2  3  8  6  5  0  0  0  0 17 20 21 12  6
##   RIFT.hc   9 19 19 28 15  6  3  1  0  0  0  0  0  0
##   shc       0  0  0  0  0  0  0  0  0 87 12  1  0  0
## [1] "(dimension, delta) = (2,7)"
##           ESTIMATE
## METHOD      1  2  3  4  5  6  7  8  9 10 11 12 13 14
##   Mean      5  2  2  4  5  1  4  6  8 20 21 13  6  3
##   Meanl2    5  2  2  4  5  1  4  6  8 20 21 13  6  3
##   Median    0  0  0  1  0  0  0  0  5 18 18 14 10 34
##   Medianl2  0  0  0  1  0  0  0  0  6 22 17 11  9 34
##   AIC       0  0  0  0  3  2  0  1  0  8 32 18 22 14
##   BIC       2  3  1  5  1  1  0  0  0 12 30 16 19 10
##   RIFT.hc  11 15 24 22 18  8  2  0  0  0  0  0  0  0
##   shc       0  0  0  0  0  0  0  0  0 89 10  1  0  0
## [1] "(dimension, delta) = (2,8)"
##           ESTIMATE
## METHOD      1  2  3  4  5  6  7  8  9 10 11 12 13 14
##   Mean      2  0  3  3  2  5  5  6 12 18 17 10 10  7
##   Meanl2    2  0  3  3  2  5  5  6 12 18 16 11 10  7
##   Median    0  0  0  0  0  0  0  1  7 19 12 10 14 37
##   Medianl2  0  0  0  0  0  0  0  1  7 18 13  9 14 38
##   AIC       0  0  0  0  2  0  0  1  2 14 18 27 20 16
##   BIC       0  0  1  0  2  0  0  2  3 18 20 21 18 15
##   RIFT.hc   9 20 20 26 12  9  3  1  0  0  0  0  0  0
##   shc       0  0  0  0  0  0  0  0  0 91  8  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      4  1  1  1  3  2  5  8 13 23 12 11 11  5
##   Meanl2    4  1  1  1  3  2  5  8 13 23 13 10 11  5
##   Median    0  0  0  0  0  0  0  6 11 19 16 15  9 24
##   Medianl2  0  0  0  0  0  0  0  6 11 18 16 16  9 24
##   AIC       0  0  0  0  1  0  0  0  4 18 17 16 23 21
##   BIC       0  0  0  0  1  0  0  0  5 19 15 18 27 15
##   RIFT.hc   9 18 24 29 12  5  3  0  0  0  0  0  0  0
##   shc       0  0  0  0  0  0  0  0  0 91  8  1  0  0
## [1] "(dimension, delta) = (8,1)"
##           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 29
##   Mean     22 53 14  6  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 14  6  5  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    1 56 33  6  4  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  1 56 33  6  4  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       0  7 29 18 26  8  5  2  2  2  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

```
##   BIC       0 17 51 11 11  4  2  1  1  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc   1 23 38 29  9  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  2  3  3 10  7  8 17 14  7  4 11  3  2  5  2  2
## [1] "(dimension, delta) = (8,2)"
##           ESTIMATE
## METHOD     -1  1  2  3  4  5  6  7  8  9 10 12 13 14 15 16 17 18 19 20 21 22 23 24 25 27
##   Mean      1 20 46 25  5  2  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2    1 20 46 25  5  2  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    1  0 48 30 10  5  3  0  1  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  1  0 48 30 10  5  3  0  1  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       1  0  6 24 30 18  8  6  2  2  1  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC       1  0 19 46 15 10  2  4  1  1  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc   0  3 34 54  7  1  0  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  0  0  1  2  8  8 18 18 21  8  7  2  4  1
##           ESTIMATE
## METHOD     29 34
##   Mean      0  0
##   Meanl2    0  0
##   Median    0  0
##   Medianl2  0  0
##   AIC       0  0
##   BIC       0  0
##   RIFT.hc   0  0
##   shc       1  1
## [1] "(dimension, delta) = (8,3)"
##           ESTIMATE
## METHOD      1  2  3  4  5  6  7  8  9 11 12 13 14 15 16 17 18 19 20 21 22 23 24 30 34
##   Mean     18 52 14  8  3  2  1  0  0  1  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2   18 52 14  8  3  2  1  0  0  1  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    0 20 17 10  4  3  2  0  0  5 19 10 10  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  0 20 17 10  4  3  2  0  0  6 19 11  8  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       0  5 26 27 18  6  2  1  2  0  0  8  5  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC       0 16 44 21 12  3  0  0  1  0  0  3  0  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc   3 35 58  3  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  3  4 11 15 12 21  8 12  7  3  1  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 26 27
##   Mean     19 39 15  5  5  3  0  1  0  0  1  0  6  6  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2   19 39 15  5  5  3  0  1  0  0  1  0  6  6  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    0 11  5  5  4  1  0  0  0  4 10 16 28 16  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  0 11  5  5  4  1  0  0  0  7 12 18 25 12  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       0  6 14 20 12  5  2  3  1  1  1  3 12 20  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC       0 23 42 12 10  5  0  0  1  0  1  3  3  0  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc   4 35 52  8  1  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  2  8  7 10 13 11 14 12  7 11  2  1  1
##           ESTIMATE
## METHOD     28
##   Mean      0
##   Meanl2    0
##   Median    0
##   Medianl2  0
##   AIC       0
##   BIC       0
```

```
##   RIFT.hc   0
##   shc       1
## [1] "(dimension, delta) = (8,5)"
##           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 28
##   Mean     16 39  8  4  4  2  1  0  0  3  2  2 11  8  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2   16 39  8  4  4  2  1  0  0  3  2  2 11  8  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    0  4  2  1  2  1  0  0  0  5 14 24 21 26  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  0  4  2  1  2  1  0  0  0  7 23 19 23 18  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       0  3 10 16  5  4  3  4  1  0  2  4 21 27  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC       0 26 30 17  9  4  2  0  0  0  2  3  6  1  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc   4 37 52  7  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  0  1  5  6 10 16 11 14 16 10  7  1  1  2
## [1] "(dimension, delta) = (8,6)"
##           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 25 27 29
##   Mean     14 22 10  7  7  1  1  0  0  2  4  7 11 14  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2   14 22 10  7  7  1  1  0  0  2  4  7 11 14  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    0  3  0  1  1  0  0  0  0  9 16 26 24 20  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  0  3  0  1  1  0  0  0  1  9 18 30 21 16  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       0  3  4  5  4  3  1  1  1  1  1 12 20 44  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC       0 26 21 11 10  4  0  0  1  0  2  8  8  9  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc   3 36 57  4  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  5  7  6 19 13 18 12 12  2  2  1  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 26
##   Mean     14 21  9  8  4  1  2  2  1  4  4  4 12 14  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2   14 21  9  8  4  1  2  2  1  4  4  4 12 14  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    0  2  0  1  1  0  0  0  0  5 21 22 27 21  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  0  2  0  1  1  0  0  0  0  9 25 25 22 15  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       0  1  4  6  6  0  2  2  0  1  6  9 27 36  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC       0 18 18 12  6  2  1  0  0  1  7 10 17  8  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc   5 31 61  3  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  0  3 10  9 18 13 12 15  8  5  1  3  1
##           ESTIMATE
## METHOD     27
##   Mean      0
##   Meanl2    0
##   Median    0
##   Medianl2  0
##   AIC       0
##   BIC       0
##   RIFT.hc   0
##   shc       1
## [1] "(dimension, delta) = (8,8)"
##           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 26
##   Mean     14 14  1  4  4  0  1  1  1  8  9 11 18 14  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2   14 14  1  4  4  0  1  1  1  8  9 11 18 14  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    0  0  0  0  0  0  0  0  0  9 17 31 24 19  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  0  0  0  0  0  0  0  0  0 16 25 24 23 12  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       0  1  1  3  7  1  1  1  0  0  3 14 34 34  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC       0 15 11  6  6  1  1  0  0  2  6 18 25  9  0  0  0  0  0  0  0  0  0  0  0  0
```

```
##   RIFT.hc   5 34 57  3  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  1  0  5 11  7 12 15 14 15  8  8  1  1  1
##           ESTIMATE
## METHOD     27
##   Mean      0
##   Meanl2    0
##   Median    0
##   Medianl2  0
##   AIC       0
##   BIC       0
##   RIFT.hc   0
##   shc       1
## [1] "(dimension, delta) = (8,9)"
##           ESTIMATE
## METHOD      1  2  3  4  5  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 27 28
##   Mean     14 15  2  4  1  3  3  5  9 11 19 14  0  0  0  0  0  0  0  0  0  0  0  0
##   Meanl2   14 15  2  4  1  3  3  5  9 11 19 14  0  0  0  0  0  0  0  0  0  0  0  0
##   Median    0  0  0  0  0  0  0  6 20 33 23 18  0  0  0  0  0  0  0  0  0  0  0  0
##   Medianl2  0  0  0  0  0  0  0  8 27 36 16 13  0  0  0  0  0  0  0  0  0  0  0  0
##   AIC       0  1  2  4  1  1  0  2  2 17 37 33  0  0  0  0  0  0  0  0  0  0  0  0
##   BIC       0  8  6  8  3  1  0  2  3 25 28 16  0  0  0  0  0  0  0  0  0  0  0  0
##   RIFT.hc   4 34 56  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  1  0  5 11  8  9 14 14 17  8  8  3  1  1

#stop cluster (parallel computing)
stopCluster(cl)

print(distribution_name )

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

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

## [1] "10 true clusters:"

print('Cluster weights:')

## [1] "Cluster weights:"

print(w)

##  [1] 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1
```

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

```
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] sigclust_1.1.0     mixtools_1.2.0     gridExtra_2.3      ggplot2_3.3.5
##  [5] MASS_7.3-54        pracma_2.3.6       mclust_5.4.9       sigclust2_1.2.4
##  [9] mvnfast_0.2.7      doParallel_1.0.16  iterators_1.0.13   foreach_1.5.1
## [13] Rfast_2.0.6        RcppZiggurat_0.1.6 Rcpp_1.0.8         rstudioapi_0.13
## [17] knitr_1.37         pacman_0.5.1
##
## loaded via a namespace (and not attached):
##  [1] segmented_1.3-4        bitops_1.0-7           matrixStats_0.61.0
##  [4] bit64_4.0.5            RColorBrewer_1.1-2     httr_1.4.2
##  [7] GenomeInfoDb_1.30.1    dynamicTreeCut_1.63-1  tools_4.1.2
## [10] backports_1.4.1        utf8_1.2.2             R6_2.5.1
## [13] rpart_4.1-15           Hmisc_4.6-0            DBI_1.1.2
## [16] BiocGenerics_0.40.0    colorspace_2.0-2       nnet_7.3-16
## [19] withr_2.4.3            tidyselect_1.1.1       bit_4.0.4
## [22] compiler_4.1.2         preprocessCore_1.56.0  WGCNA_1.70-3
## [25] cli_3.2.0              Biobase_2.54.0         htmlTable_2.4.0
## [28] ggdendro_0.1.23        scales_1.1.1           checkmate_2.0.0
## [31] stringr_1.4.0          digest_0.6.29          foreign_0.8-81
## [34] XVector_0.34.0         base64enc_0.1-3        jpeg_0.1-9
## [37] pkgconfig_2.0.3        htmltools_0.5.2        fastmap_1.1.0
## [40] highr_0.9              ggthemes_4.2.4         htmlwidgets_1.5.4
## [43] rlang_1.0.2            RSQLite_2.2.10         impute_1.68.0
## [46] generics_0.1.1         dplyr_1.0.7            RCurl_1.98-1.6
## [49] magrittr_2.0.2         GO.db_3.14.0           GenomeInfoDbData_1.2.7
## [52] Formula_1.2-4          Matrix_1.3-4           munsell_0.5.0
## [55] S4Vectors_0.32.3       fansi_0.5.0            lifecycle_1.0.1
## [58] stringi_1.7.6          zlibbioc_1.40.0        blob_1.2.2
## [61] crayon_1.4.2           lattice_0.20-45        Biostrings_2.62.0
## [64] splines_4.1.2          KEGGREST_1.34.0        pillar_1.6.4
## [67] fastcluster_1.2.3      codetools_0.2-18       stats4_4.1.2
## [70] glue_1.6.1             evaluate_0.15          latticeExtra_0.6-29
## [73] data.table_1.14.2      png_0.1-7              vctrs_0.4.1
## [76] gtable_0.3.0           purrr_0.3.4            kernlab_0.9-29
## [79] cachem_1.0.6           xfun_0.30              survival_3.2-13
## [82] tibble_3.1.6           AnnotationDbi_1.56.2   memoise_2.0.1
## [85] IRanges_2.28.0         cluster_2.1.2          ellipsis_0.3.2
```

```
Sys.time()
```

```
## [1] "2022-06-03 14:49:37 BST"
```