Mixture Models

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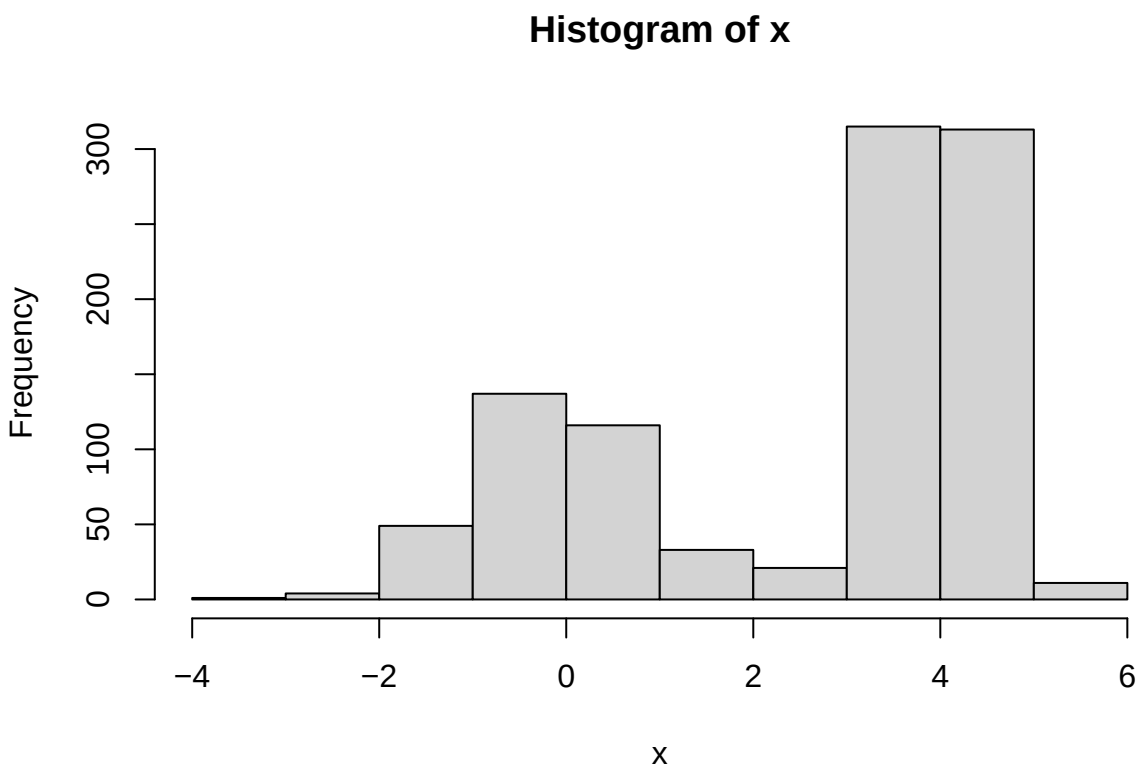
Exo1: 1D mixture of Gaussians

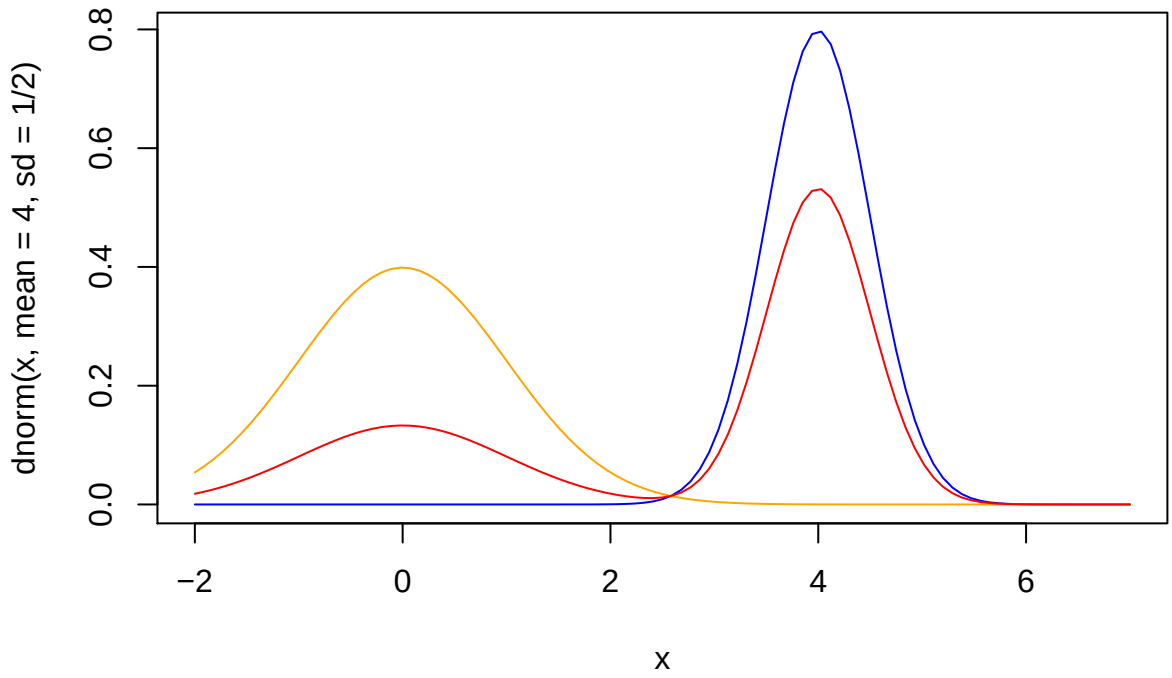
```
#a)
library(mclust)
```

```
## Package 'mclust' version 5.4.7
## Type 'citation("mclust")' for citing this R package in publications.
```

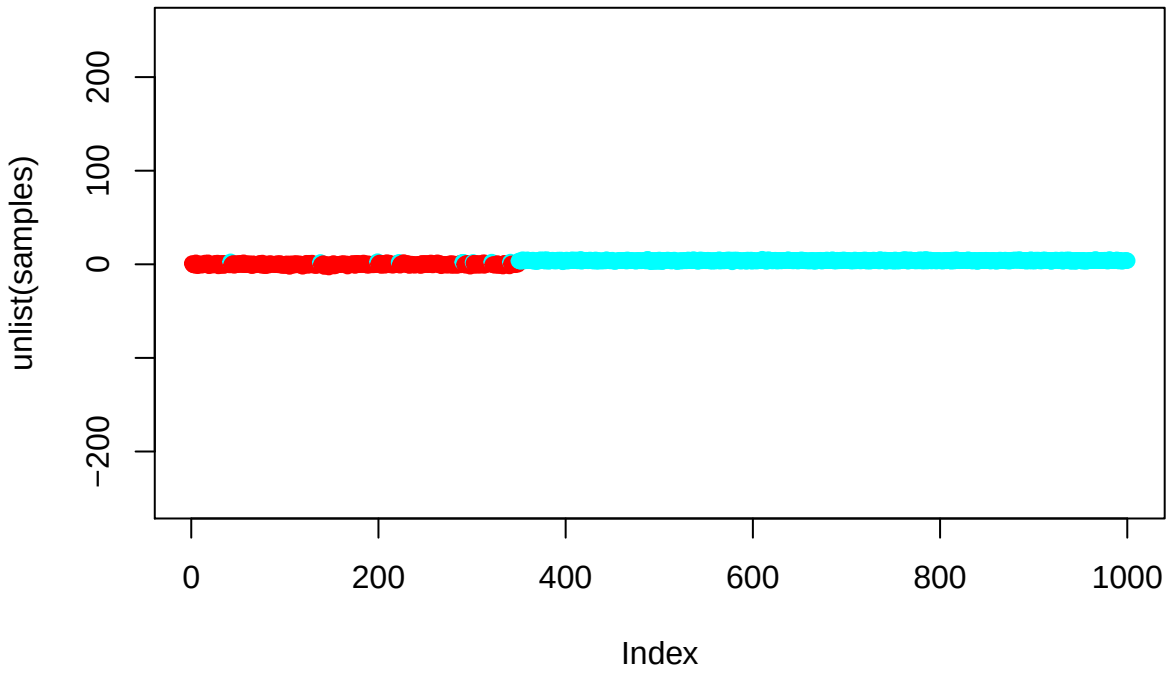
```
nks = rmultinom(1, 1000, prob = c(1/3, 2/3))
means = c(0,4)
sds = c(1,1/2)
samples = mapply(function(nk, mean, sd){rnorm(nk, mean, sd)}, nks, means, sds)
x = unlist(samples)
hist(x)
```



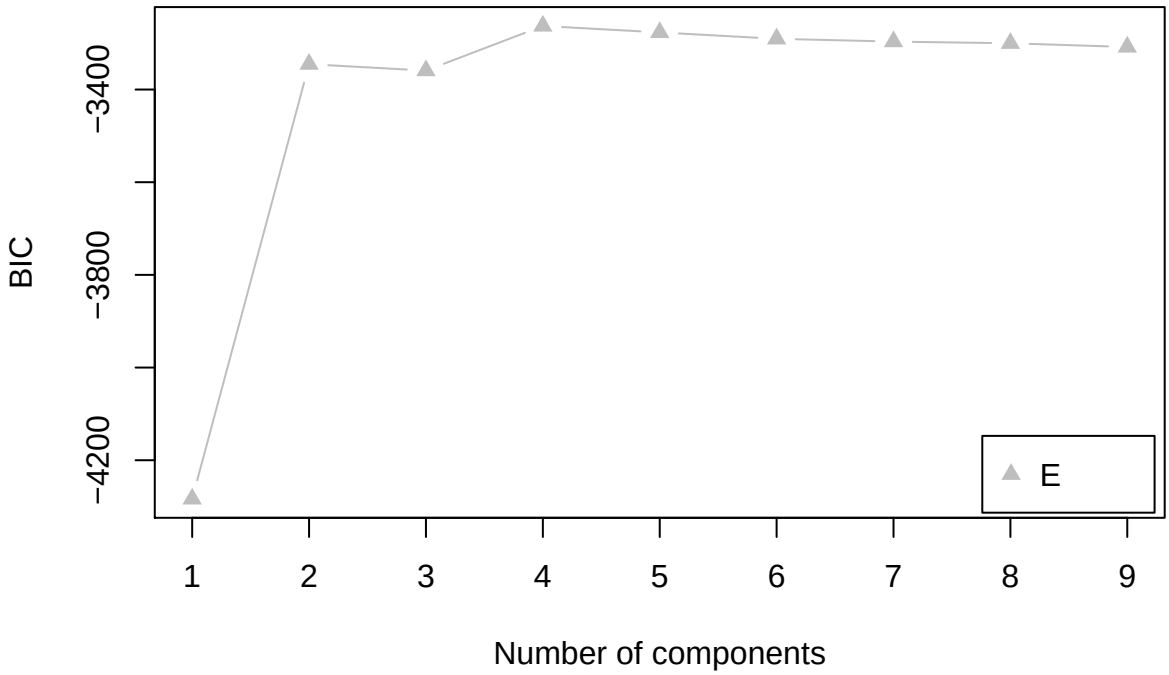
```r
# Draw the distribution
curve(dnorm(x, mean = 4, sd = 1/2), -2, 7, col = "blue")
curve(dnorm(x, mean = 0, sd = 1), -2, 7, add = TRUE, col = "orange") # add = true let 2 dist displays o

mixture = function(x){
  1/3*dnorm(x, mean = 0, sd = 1) + 2/3*dnorm(x, mean = 4, sd = 1/2)
}
curve(mixture(x),-2,7,add = TRUE, col = "red")
```



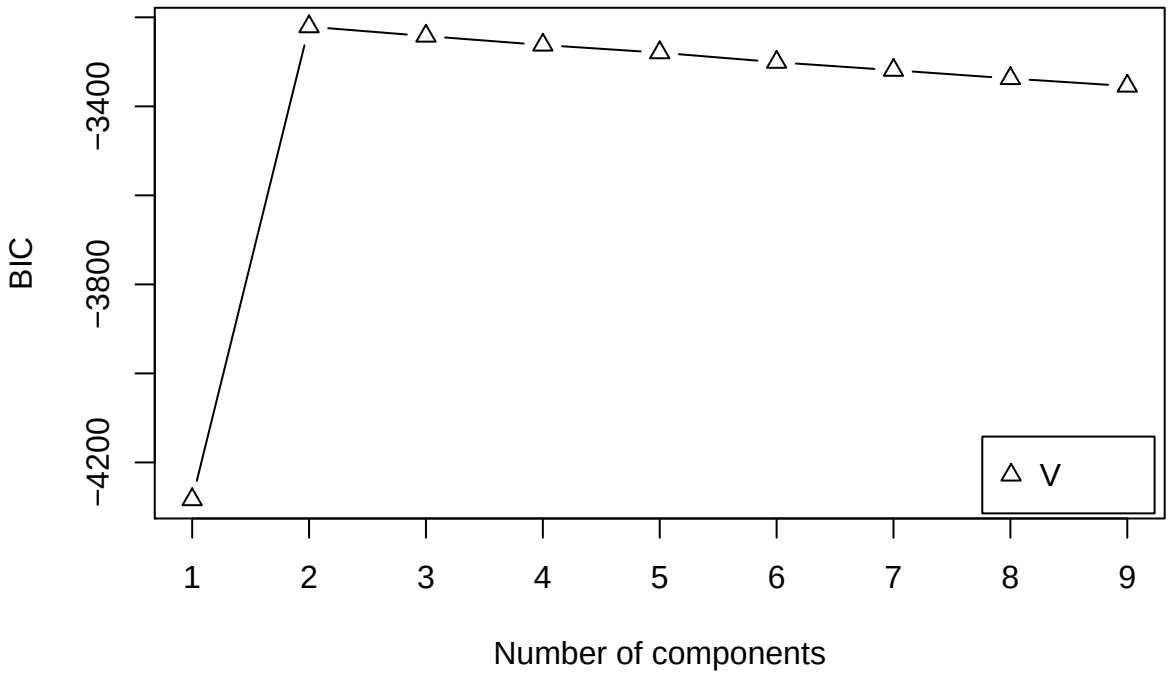

```r
#b)
res.kmeans = kmeans(unlist(samples), 2, nstart = 10)
plot(unlist(samples), asp = 1, pch = 19, col = rainbow(2)[res.kmeans$cluster])
```




```
list.of.cluster = split(data.frame(x), res.kmeans$cluster)
#4)
res.E = Mclust(x, modelNames = "E")
plot(res.E, "BIC") #7
```

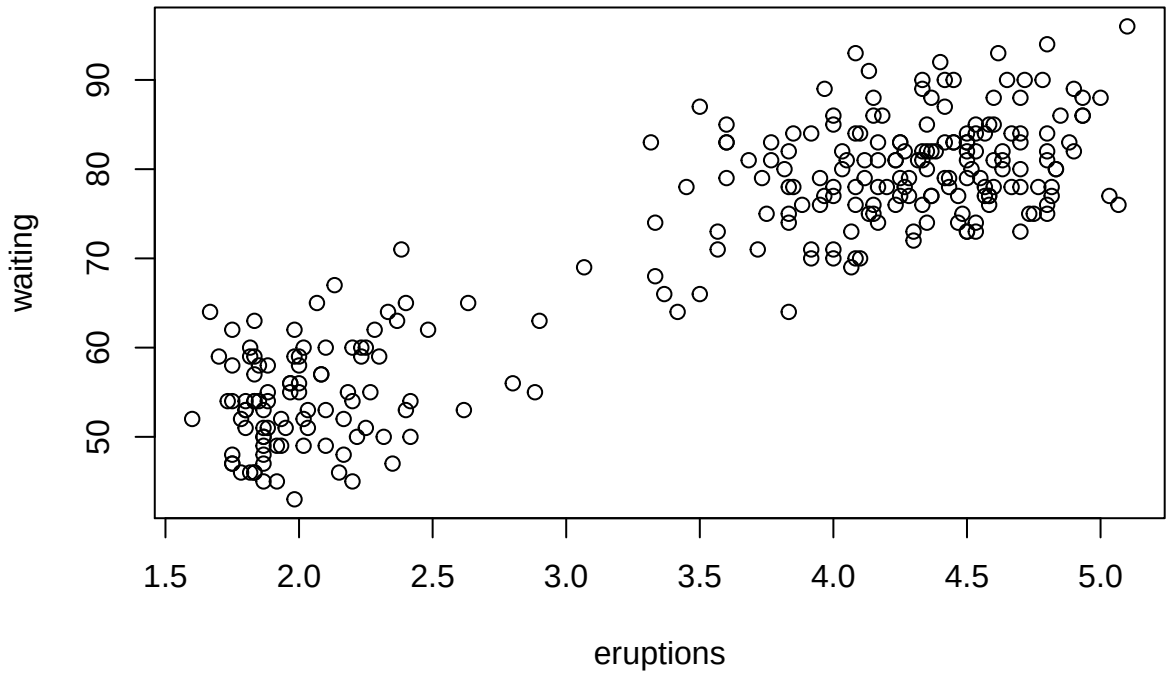



```
res.V = Mclust(x, modelNames = "V")
plot(res.V, "BIC") #2
```



Exo2: 2D Mixture

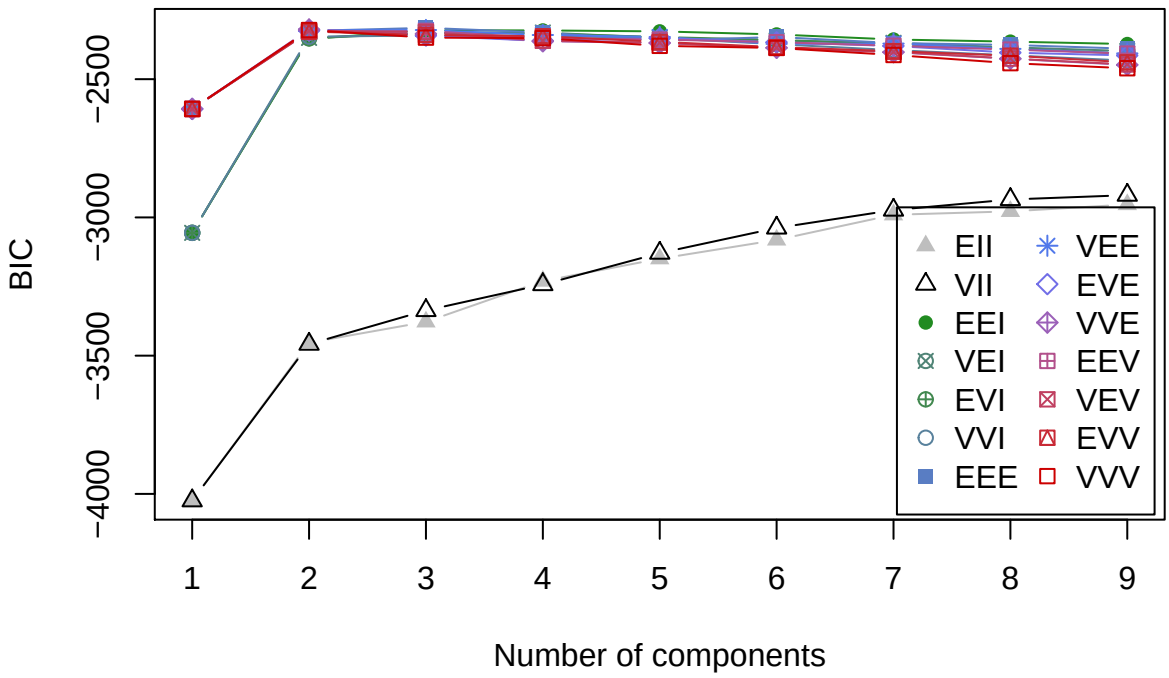
```
#1)
data("faithful")
#2)
plot(faithful)
```



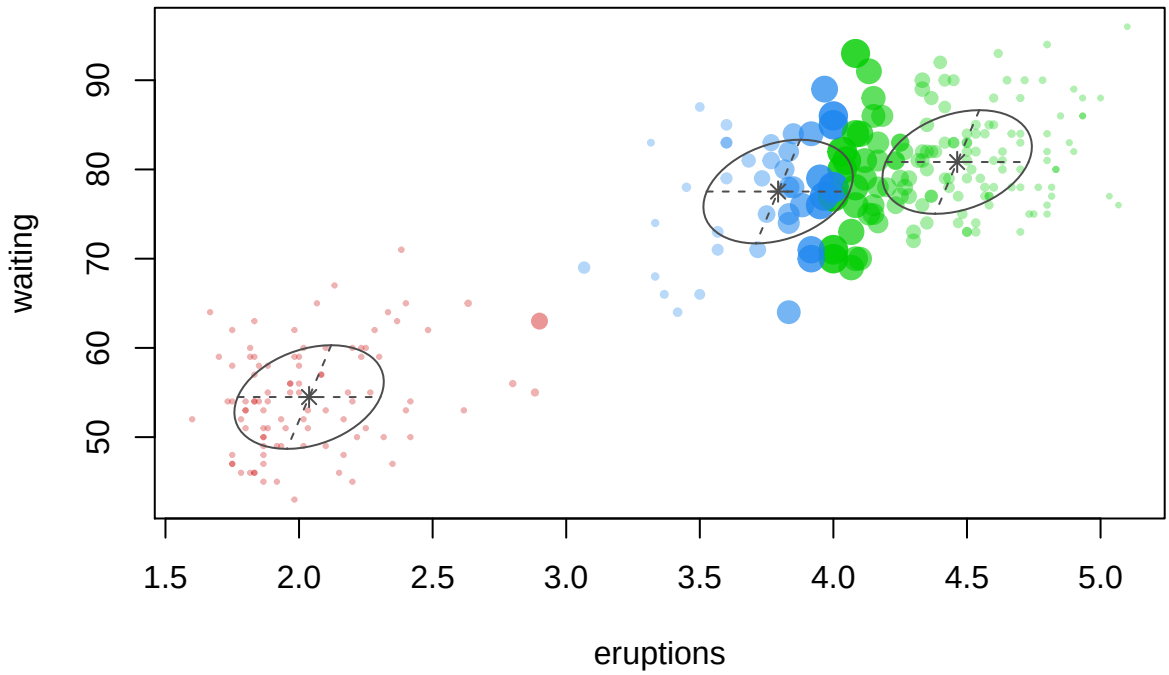
```r
#3)
res = Mclust(faithful)
summary(res)
```

```
## ----------------------------------------------------
## Gaussian finite mixture model fitted by EM algorithm
## ----------------------------------------------------
##
## Mclust EEE (ellipsoidal, equal volume, shape and orientation) model with 3
## components:
##
##  log-likelihood   n df       BIC       ICL
##       -1126.326 272 11 -2314.316 -2357.824
##
## Clustering table:
##   1   2   3
##  40  97 135
```

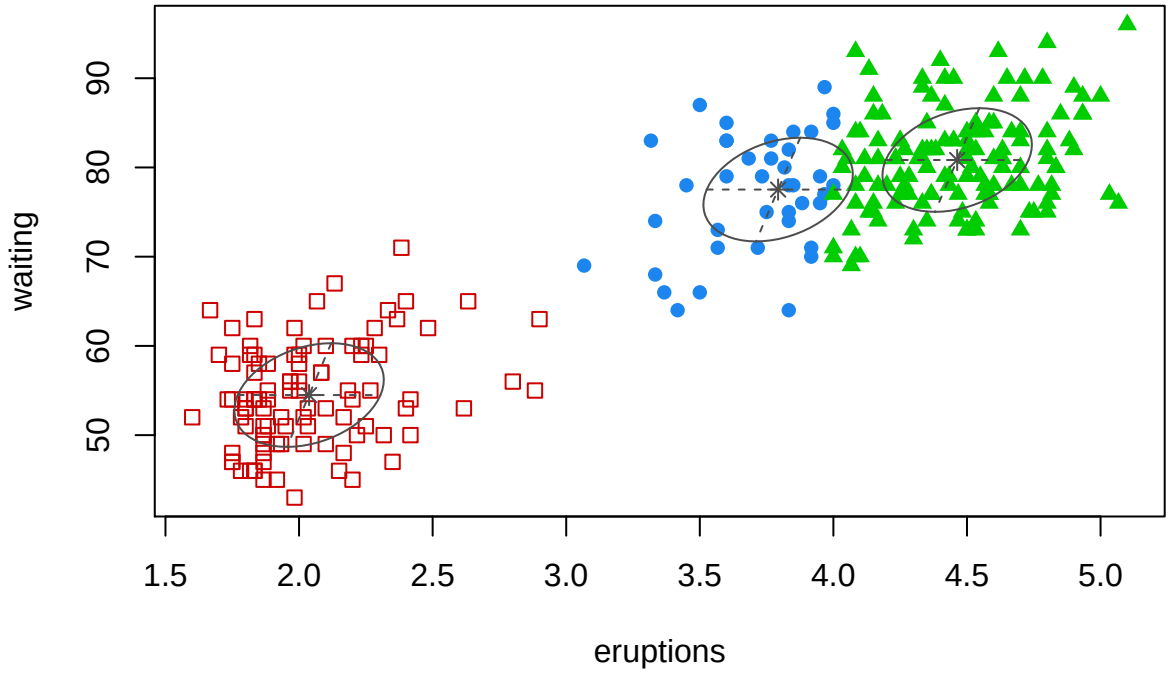
```r
#4)
plot(res, "BIC")
```



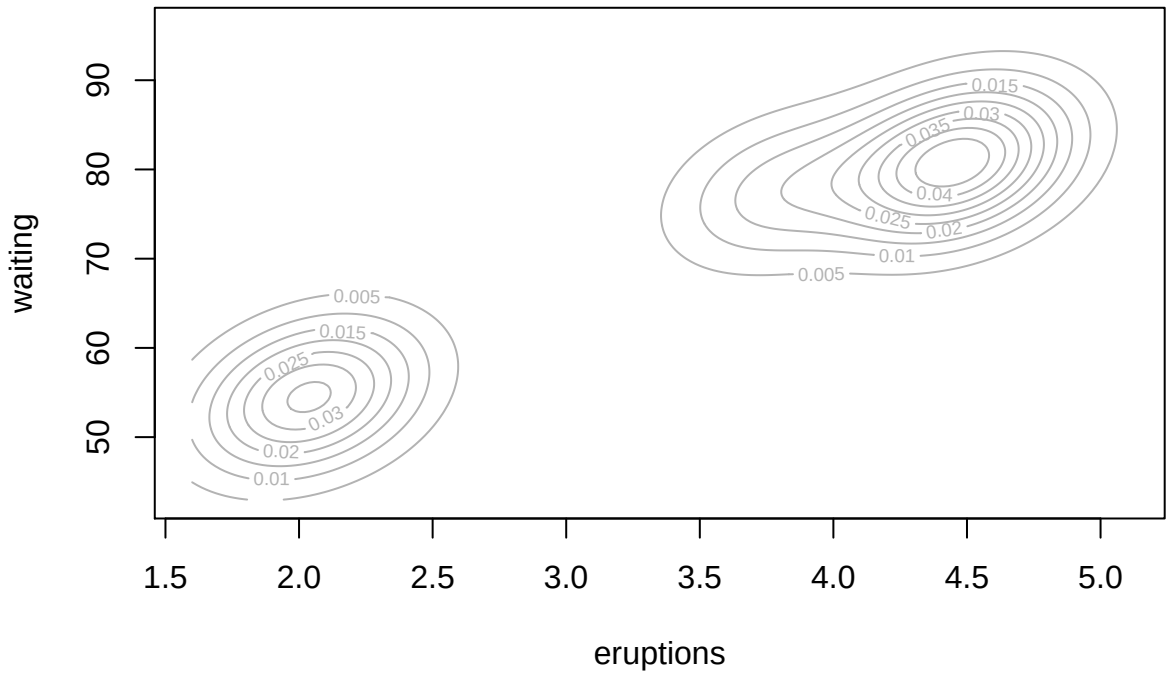

```r
plot(res, "uncertainty")
```



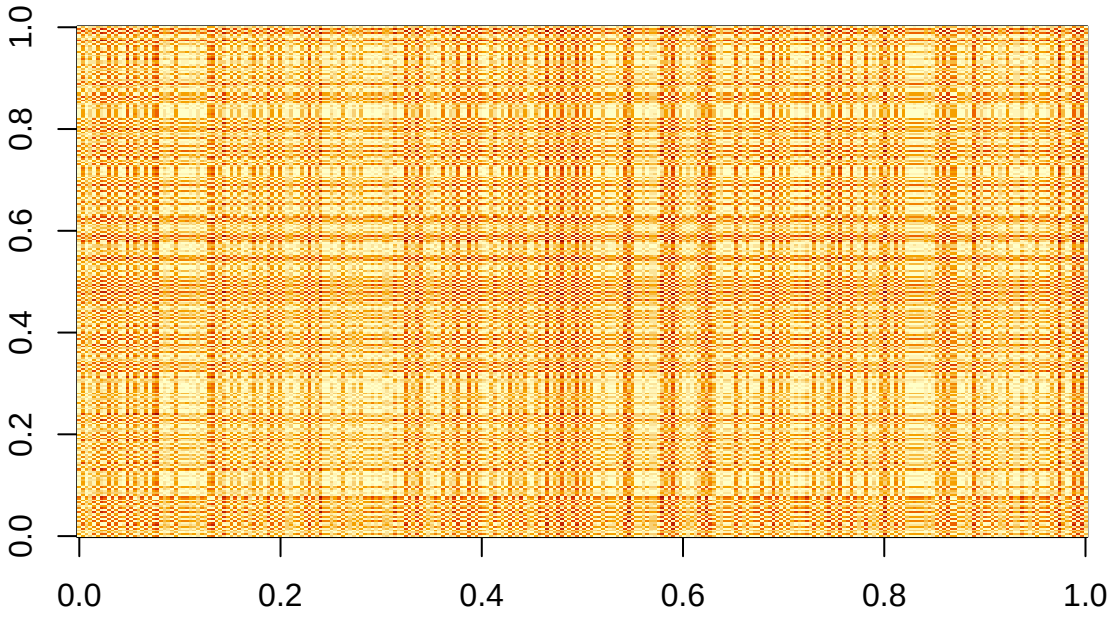

```
plot(res, "classification")
```



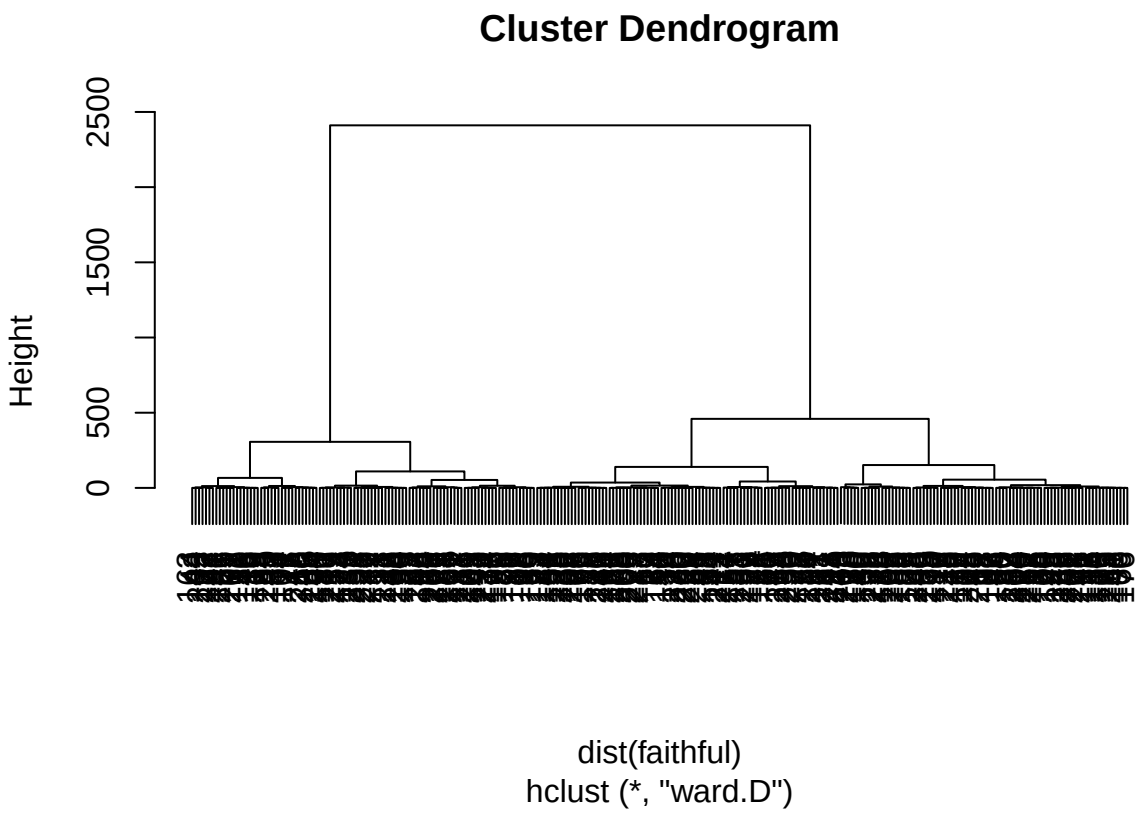

```
plot(res, "density")
```




```
#5)
image(as.matrix(dist(faithful)))
```




```
res = hclust(dist(faithful), method = "ward.D")
plot(res)
```


Cluster Dendrogram
Height
0
500
1500
2500
dist(faithful)
hclust (*, "ward.D")

```
#6)
```