hSSALT Examples

Yao Lu

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```
library(hSSALT)
##Dataset
hSSALTdata
```

```
## $data
##  [1]  1.46  2.22  3.92  4.24  5.47  5.60  6.12  6.56  8.01  8.10  8.22  8.30
## [13]  8.59  8.77  8.80  8.80  8.84  8.90  8.97  8.98  9.43  9.62  9.87 11.14
## [25] 11.85 12.14 13.49 14.19 14.33 15.28 16.58 17.80 21.09 26.34 28.66
##
## $tau
## [1] 8
##
## $n
## [1] 35
##
## $params
##  theta1 theta21 theta22       p
##   33.12    0.82    7.39    0.40
##
## $complete
## [1] TRUE
```

```
##Example 1: hSSALT for Type-II censoring
##Randomly generate an hSSALT dataset
n <- 35
tau <- 8
theta1 <- exp(3.5)
theta21 <- exp(-0.2)
theta22 <- exp(2)
p <- 0.4
r <- 30
set.seed(2)
sample <- rhSSALT(n, 2, r = r, tau = tau, theta1 = theta1, theta21 = theta21,
                  theta22 = theta22, p = p, monitoring = "continuous")
sample
```

```
## $Censored_dat
##  [1]  0.130467  2.641626  2.964700  4.856469  5.183571  5.974896  6.321527
##  [8]  8.035280  8.055845  8.165853  8.167157  8.187456  8.202034  8.264082
## [15]  8.278173  8.304254  8.402209  8.421843  8.471051  8.506770  9.153089
## [22]  9.648603  9.656929 10.890242 11.071031 11.190387 11.532220 11.737867
## [29] 11.788091 14.282426
##
## $Censored_num_level
```

```
## [1]  7 23
##
## $Full_dat
##  [1]  0.130467  2.641626  2.964700  4.856469  5.183571  5.974896  6.321527
##  [8]  8.035280  8.055845  8.165853  8.167157  8.187456  8.202034  8.264082
## [15]  8.278173  8.304254  8.402209  8.421843  8.471051  8.506770  9.153089
## [22]  9.648603  9.656929 10.890242 11.071031 11.190387 11.532220 11.737867
## [29] 11.788091 14.282426 16.236865 17.762597 22.346551 34.293163 35.795214
##
## $Full_num_level
## [1]  7 28
```

```
##Compute MLE
resMLE <- MLEhSSALT(sample$Censored_dat, n, 2, r = r, tau = tau, theta21 = theta21,
                    theta22 = theta22, p = p,language = "R", monitoring = "continuous")
resMLE
```

```
## The EM algorithm converged after 38 iterations.
## Log-likelihood: -47.805812
##
## Maximum Likelihood Estimates:
##        p1        p2    theta1   theta21   theta22
##  0.389519  0.610481 36.010465  0.281487  5.189165
```

```
##Compute BCa CI
CI_cpp <- CIhSSALT(sample$Censored_dat, n, 2, r = r, tau = tau, MLEhSSALT_Obj = resMLE,
                   language = "CPP", monitoring = "continuous", CImethod = "bca")
CI_cpp
```

```
## BCa confidence intervals for theta1, theta21, theta22 and p
## Significance level: alpha = 0.05
## Valid bootstrap replications: B = 1000
## Total bootstrap replications: j = 1006
##
## -------------------------------------------------
## theta1  (13.055059, 91.450160)
## theta21 (0.007533, 0.811659)
## theta22 (1.135356, 10.202595)
## p       (0.020996, 0.635695)
```

```
##Homogeneity test
homotest <- HomohSSALT(data = sample$Censored_dat, n = n, 2, r = r, tau = tau)
homotest
```

```
##
## Homogeneity Test for hSSALT
##
## data:  Second stress level data
## Test Statistic = 23.0811, Critical Value = 15.083, alpha =  0.050
## alternative hypothesis: Data are heterogeneous under second stress level
##
## Decision: Reject H0, data under the second stress level is heterogeneous
```

```
##Example 2: hSSALT for Interval monitoring
##Randomly generate an hSSALT dataset for interval monitoring
set.seed(2)
tau_int <- c(8, 20)
```

```r
delta <- 0.5
sample_int <- rhSSALT(n, 1, tau = tau_int, theta1 = theta1, theta21 = theta21,
                      theta22 = theta22, p = p, monitoring = "interval", delta = delta)
sample_int
```

```
## $Censored_dat
##
##   (0,0.5]   (0.5,1]   (1,1.5]   (1.5,2]   (2,2.5]   (2.5,3]   (3,3.5]   (3.5,4]
##         1         0         0         0         0         2         0         0
##   (4,4.5]   (4.5,5]   (5,5.5]   (5.5,6]   (6,6.5]   (6.5,7]   (7,7.5]   (7.5,8]
##         0         1         1         1         1         0         0         0
##   (8,8.5]   (8.5,9]   (9,9.5]  (9.5,10] (10,10.5] (10.5,11] (11,11.5] (11.5,12]
##        12         1         1         2         0         1         2         3
## (12,12.5] (12.5,13] (13,13.5] (13.5,14] (14,14.5] (14.5,15] (15,15.5] (15.5,16]
##         0         0         0         0         1         0         0         0
## (16,16.5] (16.5,17] (17,17.5] (17.5,18] (18,18.5] (18.5,19] (19,19.5] (19.5,20]
##         1         0         0         1         0         0         0         0
##
## $Censored_num_level
## [1]  7 25
##
## $Full_dat
##
##   (0,0.5]   (0.5,1]   (1,1.5]   (1.5,2]   (2,2.5]   (2.5,3]   (3,3.5]   (3.5,4]
##         1         0         0         0         0         2         0         0
##   (4,4.5]   (4.5,5]   (5,5.5]   (5.5,6]   (6,6.5]   (6.5,7]   (7,7.5]   (7.5,8]
##         0         1         1         1         1         0         0         0
##   (8,8.5]   (8.5,9]   (9,9.5]  (9.5,10] (10,10.5] (10.5,11] (11,11.5] (11.5,12]
##        12         1         1         2         0         1         2         3
## (12,12.5] (12.5,13] (13,13.5] (13.5,14] (14,14.5] (14.5,15] (15,15.5] (15.5,16]
##         0         0         0         0         1         0         0         0
## (16,16.5] (16.5,17] (17,17.5] (17.5,18] (18,18.5] (18.5,19] (19,19.5] (19.5,20]
##         1         0         0         1         0         0         0         0
## (20,20.5] (20.5,21] (21,21.5] (21.5,22] (22,22.5] (22.5,23] (23,23.5] (23.5,24]
##         0         0         0         0         1         0         0         0
## (24,24.5] (24.5,25] (25,25.5] (25.5,26] (26,26.5] (26.5,27] (27,27.5] (27.5,28]
##         0         0         0         0         0         0         0         0
## (28,28.5] (28.5,29] (29,29.5] (29.5,30] (30,30.5] (30.5,31] (31,31.5] (31.5,32]
##         0         0         0         0         0         0         0         0
## (32,32.5] (32.5,33] (33,33.5] (33.5,34] (34,34.5] (34.5,35] (35,35.5] (35.5,36]
##         0         0         0         0         1         0         0         1
##
## $Full_num_level
## [1]  7 28
```

```r
##Compute MLE
resMLE_int <- MLEhSSALT(sample_int$Censored_dat, n, 1, tau = tau_int, theta21 = theta21,
                        theta22 = theta22, p = p, monitoring = "interval", delta = delta)
resMLE_int
```

```
## The EM algorithm converged after 76 iterations.
## Log-likelihood: -69.008121
##
## Maximum Likelihood Estimates:
##        p1        p2    theta1   theta21   theta22
```

```
##  0.379048  0.620952 35.963717  0.024366  6.015768
```

```
##Compute BCa CI
CI_int <- CIhSSALT(sample_int$Censored_dat, n, 1, tau = tau_int, MLEhSSALT_Obj = resMLE_int,
                   language = "CPP", monitoring = "interval", delta = delta, CImethod = "bca")
CI_int
```

```
## BCa confidence intervals for theta1, theta21, theta22 and p
## Significance level: alpha = 0.05
## Valid bootstrap replications: B = 1000
## Total bootstrap replications: j = 1004
##
## --------------------------------------------------
## theta1  (12.967171, 91.249776)
## theta21 (0.000000, 0.540031)
## theta22 (1.939269, 11.845664)
## p       (0.075671, 0.593628)
```