

CIs on mxAlgebra

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Optimizer: SLSQP

```
require(OpenMx)

mxOption(NULL, "Default optimizer", "SLSQP")

yi <- c(-0.264,-0.230,0.166,0.173,0.225,0.291,0.309,0.435,0.476,0.617,
        0.651,0.718,0.740,0.745,0.758,0.922,0.938,0.962,1.522,1.844)
vi <- c(0.086,0.106,0.055,0.084,0.071,0.078,0.051,0.093,0.149,0.095,
        0.110,0.054,0.081,0.084,0.087,0.103,0.113,0.083,0.100,0.141)
my.df <- cbind(yi,vi)

wi <- 1/vi
s2 <- (length(yi)-1) * sum(wi) / (sum(wi)^2 - sum(wi^2))
## Fixed value
s2

## [1] 0.08486598

test <- mxModel("test", type="default",
  mxMatrix("Full", ncol=1, nrow=1, free=F, values=0, labels="data.vi", name="V"),
  mxMatrix("Full", ncol=1, nrow=1, free=T, values=0.1, lbound=0.0000001, name="Tau"),
  mxMatrix("Full", ncol=1, nrow=1, free=T, values=0.5, name="M"),
  ## S2 is fixed.
  mxMatrix("Full", ncol=1, nrow=1, free=F, values=s2, name="S2"),
  mxAlgebra(V+Tau, name="S"),
  mxAlgebra(Tau/(Tau+S2), name="Tau_2"),
  mxFitFunctionML(),
  mxExpectationNormal(covariance="S", means="M", dimnames=c("yi")),
  mxData(observed=my.df, type="raw"),
  ## CIs on Tau and Tau_2
  mxCI(c("Tau", "Tau_2"))
)
out <- mxRun(test, intervals = TRUE)
summary(out, verbose=TRUE)

## Summary of test
##
```

```

## data:
## $test.data
##      yi          vi
## Min.   :-0.2640  Min.   :0.05100
## 1st Qu.: 0.2745  1st Qu.:0.08025
## Median : 0.6340  Median :0.08650
## Mean   : 0.5999  Mean   :0.09120
## 3rd Qu.: 0.7990  3rd Qu.:0.10375
## Max.   : 1.8440  Max.   :0.14900
##
## free parameters:
##      name matrix row col Estimate Std.Error A lbound ubound
## 1 test.Tau[1,1]   Tau   1   1 0.1315197 0.07353605 1e-07
## 2 test.M[1,1]     M     1  yi 0.5790348 0.10510037
##
## confidence intervals:
##      lbound estimate ubound note
## test.Tau[1,1]  0.03486319 0.1315197 0.3642825
## test.Tau_2[1,1] 0.27625149 0.6078022 0.6748704
##
## CI details:
##      parameter side value fit diagnostic statusCode
## 1 test.Tau[1,1] upper 0.36428252 31.64053 success OK
## 2 test.Tau[1,1] lower 0.03486319 31.36203 success OK
## 3 test.Tau_2[1,1] lower 0.27625149 31.64053 success OK
## 4 test.Tau_2[1,1] upper 0.67487035 31.64063 success OK
##      method test.Tau[1,1] test.M[1,1]
## 1 neale-miller-1997 0.36428252 0.5859054
## 2 wu-neale-2012 0.03486319 0.5638545
## 3 neale-miller-1997 0.03239295 0.5632678
## 4 neale-miller-1997 0.17615598 0.7993611
##
## Model Statistics:
##      | Parameters | Degrees of Freedom | Fit (-2lnL units)
## Model: 2 18 27.79916
## Saturated: 2 18 NA
## Independence: 2 18 NA
## Number of observations/statistics: 20/20
##
## condition number of the information matrix: 2.046842
## maximum absolute gradient: 5.319734e-06 ( test.Tau[1,1] )
## chi-square: Chi^2 ( df=NA ) = NA, p = 1
## Information Criteria:
##      | df Penalty | Parameters Penalty | Sample-Size Adjusted
## AIC: -8.200837 31.79916 32.50505
## BIC: -26.124018 33.79063 27.62514
## CFI: NA
## TLI: 1 (also known as NNFI)
## RMSEA: 0 [95% CI (NA, NA)]
## Prob(RMSEA <= 0.05): NA
## To get additional fit indices, see help(mxRefModels)
## timestamp: 2019-06-16 15:56:13
## frontend time: 0.2130582 secs
## backend time: 0.01388741 secs

```

```

## independent submodels time: 7.081032e-05 secs
## cpu time: 0.2270164 secs
## Wall clock time: 0.2270164 secs
## OpenMx version number: 2.13.2
## Need help? See help(mxSummary)

Tau <- out$output$confidenceIntervals["test.Tau[1,1]", ]
rbind(Tau2_correct=Tau/(Tau+s2),
      Tau2_mxCI=out$output$confidenceIntervals["test.Tau_2[1,1]", ])

##           lbound estimate ubound
## Tau2_correct 0.2911838 0.6078022 0.8110514
## Tau2_mxCI    0.2762515 0.6078022 0.6748704

```

Optimizer: CSOLNP

```

mxOption(NULL, "Default optimizer", "CSOLNP")

out <- mxRun(test, intervals = TRUE)

## Running test with 2 parameters

summary(out, verbose=TRUE)

## Summary of test
##
## data:
## $test.data
##      yi          vi
## Min.  :-0.2640  Min.  :0.05100
## 1st Qu.: 0.2745  1st Qu.:0.08025
## Median : 0.6340  Median :0.08650
## Mean   : 0.5999  Mean   :0.09120
## 3rd Qu.: 0.7990  3rd Qu.:0.10375
## Max.   : 1.8440  Max.   :0.14900
##
## free parameters:
##      name matrix row col Estimate Std.Error A lbound ubound
## 1 test.Tau[1,1]  Tau  1  1 0.1315197 0.07353602 1e-07
## 2 test.M[1,1]    M   1  yi 0.5790347 0.10510037
##
## confidence intervals:
##      lbound estimate ubound note
## test.Tau[1,1]  0.03481267 0.1315197 0.3654117
## test.Tau_2[1,1] 0.27484529 0.6078022 0.8112579
##
## CI details:
##      parameter side value fit diagnostic statusCode
## 1 test.Tau[1,1] upper 0.36541165 31.66406 success OK
## 2 test.Tau[1,1] lower 0.03481267 31.36755 success OK
## 3 test.Tau_2[1,1] lower 0.27484529 31.66708 success OK
## 4 test.Tau_2[1,1] upper 0.81125790 31.65046 success OK
##      method test.Tau[1,1] test.M[1,1]
## 1 neale-miller-1997 0.36541165 0.5894536

```

```

## 2      wu-neale-2012      0.03481267  0.5638420
## 3 neale-miller-1997      0.03216557  0.5630879
## 4 neale-miller-1997      0.36477390  0.5894397
##
## Model Statistics:
##           | Parameters | Degrees of Freedom | Fit (-2lnL units)
##      Model:           2              18              27.79916
##      Saturated:       2              18              NA
## Independence:        2              18              NA
## Number of observations/statistics: 20/20
##
## condition number of the information matrix: 2.046844
## maximum absolute gradient: 1.864301e-05 ( test.Tau[1,1] )
## chi-square: Chi2 ( df=NA ) = NA, p = 1
## Information Criteria:
##           | df Penalty | Parameters Penalty | Sample-Size Adjusted
##      AIC:      -8.200837              31.79916              32.50505
##      BIC:      -26.124018              33.79063              27.62514
##      CFI: NA
##      TLI: 1 (also known as NNFI)
##      RMSEA: 0 [95% CI (NA, NA)]
##      Prob(RMSEA <= 0.05): NA
## To get additional fit indices, see help(mxRefModels)
## timestamp: 2019-06-16 15:56:13
## frontend time: 0.03572607 secs
## backend time: 0.02622199 secs
## independent submodels time: 1.001358e-05 secs
## cpu time: 0.06195807 secs
## Wall clock time: 0.06195807 secs
## OpenMx version number: 2.13.2
## Need help? See help(mxSummary)

```

```

Tau <- out$output$confidenceIntervals["test.Tau[1,1]", ]
rbind(Tau2_correct=Tau/(Tau+s2),
      Tau2_mxCI=out$output$confidenceIntervals["test.Tau_2[1,1]", ])

```

```

##           lbound estimate ubound
## Tau2_correct 0.2908846 0.6078022 0.8115252
## Tau2_mxCI    0.2748453 0.6078022 0.8112579

```

Optimizer: NPSOL

```
mxOption(NULL, "Default optimizer", "NPSOL")
```

```
out <- mxRun(test, intervals = TRUE)
```

```
## Running test with 2 parameters
```

```
summary(out, verbose=TRUE)
```

```
## Summary of test
```

```
##
```

```
## data:
```

```
## $test.data
```

```

##          yi          vi
## Min.      :-0.2640   Min.      :0.05100
## 1st Qu.: 0.2745    1st Qu.:0.08025
## Median : 0.6340    Median :0.08650
## Mean    : 0.5999    Mean    :0.09120
## 3rd Qu.: 0.7990    3rd Qu.:0.10375
## Max.    : 1.8440    Max.    :0.14900
##
## free parameters:
##          name matrix row col Estimate Std.Error A lbound ubound
## 1 test.Tau[1,1]   Tau    1   1 0.1315197 0.07353607 1e-07
## 2 test.M[1,1]     M      1  yi 0.5790348 0.10510038
##
## confidence intervals:
##          lbound estimate ubound note
## test.Tau[1,1] 0.0348127 0.1315197 0.3654117
## test.Tau_2[1,1] 0.2748456 0.6078023 0.8112579
##
## CI details:
##          parameter side value fit diagnostic statusCode
## 1 test.Tau[1,1] upper 0.3654117 31.66406 success OK
## 2 test.Tau[1,1] lower 0.0348127 31.36754 success nonzero gradient/red
## 3 test.Tau_2[1,1] lower 0.2748456 31.66707 success nonzero gradient/red
## 4 test.Tau_2[1,1] upper 0.8112579 31.65046 success nonzero gradient/red
##          method test.Tau[1,1] test.M[1,1]
## 1 neale-miller-1997 0.36541170 0.5894537
## 2 wu-neale-2012 0.03481270 0.5638401
## 3 neale-miller-1997 0.03216563 0.5630879
## 4 neale-miller-1997 0.36477394 0.5894395
##
## Model Statistics:
##          | Parameters | Degrees of Freedom | Fit (-2lnL units)
## Model:          2          18          27.79916
## Saturated:      2          18          NA
## Independence:   2          18          NA
## Number of observations/statistics: 20/20
##
## condition number of the information matrix: 2.046841
## maximum absolute gradient: 2.585857e-06 ( test.Tau[1,1] )
## chi-square: Chi^2 ( df=NA ) = NA, p = 1
## Information Criteria:
##          | df Penalty | Parameters Penalty | Sample-Size Adjusted
## AIC:      -8.200837          31.79916          32.50505
## BIC:      -26.124018          33.79063          27.62514
## CFI: NA
## TLI: 1 (also known as NNFI)
## RMSEA: 0 [95% CI (NA, NA)]
## Prob(RMSEA <= 0.05): NA
## To get additional fit indices, see help(mxRefModels)
## timestamp: 2019-06-16 15:56:13
## frontend time: 0.03401423 secs
## backend time: 0.006989956 secs
## independent submodels time: 1.049042e-05 secs
## cpu time: 0.04101467 secs

```

```

## Wall clock time: 0.04101467 secs
## OpenMx version number: 2.13.2
## Need help? See help(mxSummary)

Tau <- out$output$confidenceIntervals["test.Tau[1,1]", ]
rbind(Tau2_correct=Tau/(Tau+s2),
      Tau2_mxCI=out$output$confidenceIntervals["test.Tau_2[1,1]", ])

##           lbound estimate ubound
## Tau2_correct 0.2908848 0.6078023 0.8115252
## Tau2_mxCI    0.2748456 0.6078023 0.8112579

sessionInfo()

## R version 3.6.0 (2019-04-26)
## Platform: x86_64-pc-linux-gnu (64-bit)
## Running under: Linux Mint 19.1
##
## Matrix products: default
## BLAS: /usr/lib/x86_64-linux-gnu/openblas/libblas.so.3
## LAPACK: /usr/lib/x86_64-linux-gnu/libopenblas-r0.2.20.so
##
## locale:
## [1] LC_CTYPE=C.UTF-8      LC_NUMERIC=C           LC_TIME=C.UTF-8
## [4] LC_COLLATE=C.UTF-8    LC_MONETARY=C.UTF-8   LC_MESSAGES=C.UTF-8
## [7] LC_PAPER=C.UTF-8     LC_NAME=C             LC_ADDRESS=C
## [10] LC_TELEPHONE=C       LC_MEASUREMENT=C.UTF-8 LC_IDENTIFICATION=C
##
## attached base packages:
## [1] stats      graphics  grDevices  utils      datasets  methods   base
##
## other attached packages:
## [1] OpenMx_2.13.2
##
## loaded via a namespace (and not attached):
## [1] Rcpp_1.0.1      lattice_0.20-38 digest_0.6.19  MASS_7.3-51.4
## [5] grid_3.6.0     magrittr_1.5   evaluate_0.13  stringi_1.4.3
## [9] Matrix_1.2-17  rmarkdown_1.12 tools_3.6.0    stringr_1.4.0
## [13] xfun_0.6       yaml_2.2.0     parallel_3.6.0 compiler_3.6.0
## [17] htmltools_0.3.6 knitr_1.22

```