

Package ‘manCULTA’

July 12, 2025

Title Common and Unique Latent Transition Analysis (CULTA) as a Way to Examine the Trait-State Dynamics of Alcohol Intoxication

Version 0.9.2

Description Research compendium for the manuscript
Pesigan, I. J. A., Russell, M. A., Chow, S.-M. (Under Review).
Common and Unique Latent Transition Analysis (CULTA) as a Way to Examine the Trait-State Dynamics of Alcohol Intoxication.
<[doi:10.0000/0000000000](https://doi.org/10.0000/0000000000)>.

URL <https://github.com/jeksterslab/manCULTA>,
<https://jeksterslab.github.io/manCULTA/>, <https://osf.io/gtdmr/>,
<https://doi.org/10.0000/0000000000>

BugReports <https://github.com/jeksterslab/manCULTA/issues>

License GPL (>= 3)

Encoding UTF-8

LazyData true

Roxygen list(markdown = TRUE)

Depends R (>= 4.0.0)

LinkingTo Rcpp, RcppArmadillo

Imports Rcpp

Suggests knitr, rmarkdown, testthat, lavaan

RoxygenNote 7.3.2

NeedsCompilation yes

Author Ivan Jacob Agaloos Pesigan [aut, cre, cph] (ORCID:
<<https://orcid.org/0000-0003-4818-8420>>)

Maintainer Ivan Jacob Agaloos Pesigan <r.jeksterslab@gmail.com>

Contents

AIC.fitcultu	2
anova.fitcultu	5
as.data.frame.simcultu	7
as.matrix.simcultu	8
BIC.fitcultu	10
coef.fitcultu	12
confint.fitcultu	14
converged	17
entropy	19
FitCULTA1Profile	22
FitCULTA2Profiles	24
FitLTA2Profiles	27
FitRILTA2Profiles	30
GenCULTA2Profiles	33
GenData	40
InputCULTA1Profile	40
InputCULTA2Profiles	43
InputLTA2Profiles	45
InputRILTA2Profiles	48
logLik.fitcultu	51
params	53
print.fitcultu	55
print.simcultu	57
Sim	59
SimFitCULTA2Profiles	59
SimFN	60
SimGenData	61
SimProj	62
summary.fitcultu	62
vcov.fitcultu	64
WriteData	67
Index	68

AIC.fitcultu	<i>Akaike's Information Criterion</i>
--------------	---------------------------------------

Description

Akaike's Information Criterion

Usage

```
## S3 method for class 'fitcultu'  
AIC(object, ...)
```

Arguments

object	Object of class fitcultla.
...	additional arguments.

Value

Returns Akaike's information criterion (AIC).

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
```

```

)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----

```

```
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
AIC(fit)

## End(Not run)
```

anova.fitcultu	<i>Compare Two Nested fitcultu Models Using Scaled Chi-Square Difference Test</i>
----------------	---

Description

This function compares two fitcultu models using the Satorra-Bentler scaled chi-square difference test based on log-likelihoods, number of free parameters, and scaling correction factors. It also returns model fit indices for both models, including AIC, BIC, adjusted BIC, and entropy.

Usage

```
## S3 method for class 'fitcultu'
anova(object, other, ...)
```

Arguments

object	Model object of class fitcultu.
other	Another model object of class fitcultu.
...	additional arguments.

Value

A list with two elements:

fit	A matrix summarizing model fit indices for both models, including: logLik, df (number of free parameters), correction (scaling factor), AIC, BIC, aBIC (adjusted BIC), and entropy.
diff	A named numeric vector with scaled chi-square difference, degrees of freedom difference, and p-value.

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
```

```

p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

```

```

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
one_profile <- FitCULTA1Profile(data = data)
two_profiles <- FitCULTA2Profiles(data = data)
anova(one_profile, two_profiles)

## End(Not run)

```

as.data.frame.simcult

Coerce an Object of Class simcult to a Data Frame

Description

Coerce an Object of Class simcult to a Data Frame

Usage

```

## S3 method for class 'simcult'
as.data.frame(x, ...)

```

Arguments

`x` Object of class `simcultu`.
`...` Additional arguments.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
x <- GenCULTA2Profiles(
  n = 10,
  m = 6,
  common_trait_loading = matrix(
    data = c(1, 1.25, 1.50, 1.75),
    ncol = 1
  ),
  common_state_loading = matrix(
    data = c(1, 1.5, 1.75, 2.00),
    ncol = 1
  ),
  mu_t = NULL,
  psi_t = NULL,
  mu_p = NULL,
  psi_p = NULL,
  theta = diag(4),
  mu_profile = cbind(
    c(-3, -3, -3, -3),
    c(3, 3, 3, 3)
  ),
  mu_x = 0,
  sigma_x = 1,
  nu_0 = -3.563,
  kappa_0 = 0.122,
  alpha_0 = -3.586,
  beta_00 = 2.250,
  gamma_00 = 0.063,
  gamma_10 = 0.094,
  phi_0 = 0.311,
  phi_1 = 0,
  psi_s0 = 0.151,
  psi_s = 0.290
)
as.data.frame(x)
```


Description

Coerce an Object of Class `simulta` to a Matrix

Usage

```
## S3 method for class 'simulta'
as.matrix(x, ...)
```

Arguments

<code>x</code>	Object of class <code>simulta</code> .
<code>...</code>	Additional arguments.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
x <- GenCULTA2Profiles(
  n = 10,
  m = 6,
  common_trait_loading = matrix(
    data = c(1, 1.25, 1.50, 1.75),
    ncol = 1
  ),
  common_state_loading = matrix(
    data = c(1, 1.5, 1.75, 2.00),
    ncol = 1
  ),
  mu_t = NULL,
  psi_t = NULL,
  mu_p = NULL,
  psi_p = NULL,
  theta = diag(4),
  mu_profile = cbind(
    c(-3, -3, -3, -3),
    c(3, 3, 3, 3)
  ),
  mu_x = 0,
  sigma_x = 1,
  nu_0 = -3.563,
  kappa_0 = 0.122,
  alpha_0 = -3.586,
  beta_00 = 2.250,
  gamma_00 = 0.063,
  gamma_10 = 0.094,
  phi_0 = 0.311,
  phi_1 = 0,
  psi_s0 = 0.151,
  psi_s = 0.290)
```

```
)
as.matrix(x)
```

BIC.fitcultu

Bayesian Information Criterion

Description

Bayesian Information Criterion

Usage

```
## S3 method for class 'fitcultu'
BIC(object, adjust = FALSE, ...)
```

Arguments

object	Object of class fitcultu.
adjust	Logical. If adjust = TRUE, return the sample size adjusted BIC.
...	additional arguments.

Value

Returns Bayesian information criterion (BIC).

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
```

```

nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,

```

```
kappa_0 = kappa_0,
alpha_0 = alpha_0,
beta_00 = beta_00,
gamma_00 = gamma_00,
gamma_10 = gamma_10,
mu_t = mu_t,
psi_t = psi_t,
mu_p = mu_p,
psi_p = psi_p,
common_trait_loading = common_trait_loading,
common_state_loading = common_state_loading,
phi_0 = phi_0,
phi_1 = phi_1,
psi_s0 = psi_s0,
psi_s = psi_s,
theta = theta,
mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
BIC(fit)
BIC(fit, adjust = TRUE)

## End(Not run)
```

coef.fitcultla	<i>Parameter Estimates</i>
----------------	----------------------------

Description

Parameter Estimates

Usage

```
## S3 method for class 'fitcultla'
coef(object, ...)
```

Arguments

object Object of class fitcultla.
... additional arguments.

Value

Returns a vector of parameter estimates.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
```

```

    data = 1,
    nrow = p,
    ncol = 1
  )
  phi_0 <- 0.000
  phi_1 <- 0.311
  psi_s0 <- 1.00
  psi_s <- 0.25
  theta <- 0.15 * diag(p)

  # profile-specific means
  mu_profile <- cbind(
    c(2.253, 1.493, 1.574, 1.117),
    c(-0.278, -0.165, -0.199, -0.148)
  )

  # data generation -----
  data <- GenCULTA2Profiles(
    n = n,
    m = m,
    mu_x = mu_x,
    sigma_x = sigma_x,
    nu_0 = nu_0,
    kappa_0 = kappa_0,
    alpha_0 = alpha_0,
    beta_00 = beta_00,
    gamma_00 = gamma_00,
    gamma_10 = gamma_10,
    mu_t = mu_t,
    psi_t = psi_t,
    mu_p = mu_p,
    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # model fitting -----
  # NOTE: Model fitting takes time
  fit <- FitCULTA2Profiles(data = data)
  coef(fit)

  ## End(Not run)

```

confint.fitcultu

*Confidence Intervals for Parameter Estimates***Description**

Confidence Intervals for Parameter Estimates

Usage

```
## S3 method for class 'fitcultu'
confint(object, parm = NULL, level = 0.95, ...)
```

Arguments

object	Object of class fitcultu.
parm	a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered.
level	the confidence level required.
...	additional arguments.

Value

Returns a matrix of confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
```

```

alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,

```



```

    beta_00 = beta_00,
    gamma_00 = gamma_00,
    gamma_10 = gamma_10,
    mu_t = mu_t,
    psi_t = psi_t,
    mu_p = mu_p,
    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
confint(fit, level = 0.95)

## End(Not run)

```

converged

Convergence Status of a Model Fit

Description

Checks whether the model fitting procedure for an object of class `fitculta` has successfully converged based on the presence of the string "THE BEST LOGLIKELIHOOD VALUE HAS BEEN REPLICATED." in the Mplus output.

Usage

```
converged(object, ...)
```

Arguments

<code>object</code>	Object of class <code>fitculta</code> .
<code>...</code>	additional arguments.

Value

Logical. TRUE if the model has converged, FALSE otherwise.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
converged(fit)

## End(Not run)

```

entropy

Entropy

Description

Entropy

Usage

```
entropy(object, ...)
```

Arguments

```
object      Object of class fitcultu.
...         additional arguments.
```

Value

Returns Akaike's information criterion (AIC).

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
```

```

    psi_p_1,
    psi_p_2,
    psi_p_3,
    psi_p_4
  )
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,

```

```

    mu_profile = mu_profile
  )

  # model fitting -----
  # NOTE: Model fitting takes time
  fit <- FitCULTA2Profiles(data = data)
  entropy(fit)

  ## End(Not run)

```

FitCULTA1Profile

Fit the One-Profile CULTA Model (CUTS Model with AR)

Description

Fits the one-profile CULTA model using Mplus.

Usage

```
FitCULTA1Profile(data, wd = ".", mplus_bin = NULL, starts = 10)
```

Arguments

data	R object. Object of class simcult.
wd	Character string. Working directory.
mplus_bin	Character string. Path to Mplus binary. If mplus_bin = NULL, the function will try to find the appropriate binary.
starts	Positive integer. Number of initial stage starting values.

Value

Returns an object of class `fitcult`. which is a list with the following elements:

- call: Function call.
- fun: Function used ("FitCULTA1Profile").
- args: Function arguments.
- output: Mplus output files.
- elapsed: Elapsed time.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Model Fitting Functions: [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
FitCULTA1Profile(data = data)

## End(Not run)

```

FitCULTA2Profiles

Fit the Two-Profile CULTA Model

Description

Fits the two-profile CULTA model using Mplus.

Usage

```
FitCULTA2Profiles(  
  data,  
  wd = ".",  
  ncores = 1L,  
  mplus_bin = NULL,  
  starts = c(20, 4),  
  stiterations = 10,  
  stscales = 5  
)
```

Arguments

data	R object. Object of class simcult.
wd	Character string. Working directory.
ncores	Positive integer. Number of cores to use.
mplus_bin	Character string. Path to Mplus binary. If mplus_bin = NULL, the function will try to find the appropriate binary.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscales	Positive integer. Random start scale.

Value

Returns an object of class `fitcult`, which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("FitCULTA2Profiles").
- `args`: Function arguments.
- `output`: Mplus output files.
- `elapsed`: Elapsed time.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

Examples

```

## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)

```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
FitCULTA2Profiles(data = data)

## End(Not run)

```

FitLTA2Profiles

Fit the Two-Profile LTA Model

Description

Fits the two-profile LTA model using Mplus.

Usage

```
FitLTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  mplus_bin = NULL,
  starts = c(20, 4),
  stiterations = 10,
  stscale = 5
)
```

Arguments

<code>data</code>	R object. Object of class <code>simcult</code> .
<code>wd</code>	Character string. Working directory.
<code>ncores</code>	Positive integer. Number of cores to use.
<code>mplus_bin</code>	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
<code>starts</code>	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
<code>stiterations</code>	Positive integer. Number of initial stage iterations.
<code>stscale</code>	Positive integer. Random start scale.

Value

Returns an object of class `fitcult`. which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("FitLTA2Profiles").
- `args`: Function arguments.
- `output`: Mplus output files.
- `elapsed`: Elapsed time.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
FitLTA2Profiles(data = data)

## End(Not run)

```

FitRILTA2Profiles

Fit the Two-Profile RI-LTA Model

Description

Fits the two-profile RI-LTA model using Mplus.

Usage

```
FitRILTA2Profiles(  
  data,  
  wd = ".",  
  ncores = 1L,  
  mplus_bin = NULL,  
  starts = c(20, 4),  
  stiterations = 10,  
  stscales = 5  
)
```

Arguments

<code>data</code>	R object. Object of class <code>simcult</code> .
<code>wd</code>	Character string. Working directory.
<code>ncores</code>	Positive integer. Number of cores to use.
<code>mplus_bin</code>	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
<code>starts</code>	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
<code>stiterations</code>	Positive integer. Number of initial stage iterations.
<code>stscales</code>	Positive integer. Random start scale.

Value

Returns an object of class `fitcult`. which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("FitRILTA2Profiles").
- `args`: Function arguments.
- `output`: Mplus output files.
- `elapsed`: Elapsed time.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```



```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
FitRILTA2Profiles(data = data)

## End(Not run)

```

Description

Generates data from a two-profile longitudinal CULTA model where profile membership, trait components, and state dynamics are influenced by an observed covariate. The function produces simulated responses incorporating covariate effects, individual differences, and time-varying fluctuations.

Usage

```
GenCULTA2Profiles(
  n,
  m,
  mu_x,
  sigma_x,
  nu_0,
  kappa_0,
  alpha_0,
  beta_00,
  gamma_00,
  gamma_10,
  mu_t,
  psi_t,
  mu_p,
  psi_p,
  common_trait_loading,
  common_state_loading,
  phi_0,
  phi_1,
  psi_s0,
  psi_s,
  theta,
  mu_profile
)
```

Arguments

n	Positive integer. Number of individuals.
m	Positive integer. Number of measurement occasions.
mu_x	Numeric. Mean of the covariate μ_X .
sigma_x	Numeric. Variance of the covariate σ_X .
nu_0	Numeric. Intercept ν_0 for the logistic model of initial profile membership.
kappa_0	Numeric. Covariate effect κ_0 on initial profile membership.
alpha_0	Numeric. Intercept α_0 for the logistic model of profile transitions across time.
beta_00	Numeric. Effect β_{00} for self-persistence in profile 0 transitions.
gamma_00	Numeric. Covariate effect γ_{00} on remaining in profile 0.
gamma_10	Numeric. Covariate effect γ_{10} on transitioning from profile 1 to profile 0.

mu_t	Numeric or vector of length q . Mean μ_t of the common trait factor. If mu_t = NULL, defaults to zero.
psi_t	Numeric matrix of size $q \times q$. Positive definite covariance matrix Ψ_t for the common trait factor.
mu_p	Numeric vector of length p . Mean vector μ_p for unique trait components. If mu_p = NULL, defaults to zero.
psi_p	Numeric matrix of size $p \times p$. Positive definite covariance matrix Ψ_p for unique trait components.
common_trait_loading	Numeric matrix of size $p \times q$. Factor loading matrix specifying the influence of the common trait on each observed item.
common_state_loading	Numeric matrix of size $p \times 1$. Factor loading matrix specifying the influence of the common state on each observed item.
phi_0	Numeric. Autoregressive coefficient ϕ_0 for the common state process in profile 0.
phi_1	Numeric. Autoregressive coefficient ϕ_1 for the common state process in profile 1.
psi_s0	Numeric. Variance ψ_{s0} of the initial common state.
psi_s	Numeric. Innovation variance ψ_s for the common state process.
theta	Numeric matrix of size $p \times p$. Positive definite covariance matrix Θ for unique state components.
mu_profile	Numeric matrix of size $p \times 2$. Profile-specific means for each observed item across two latent profiles.

Details

The [GenCULTA2Profiles\(\)](#) function generates data for a two-profile CULTA model with a covariate. The CULTA model incorporates a covariate, latent categorical variables, trait components, state components, and profile-specific means to simulate longitudinal data with latent profile transitions.

Let $i \in \{1, \dots, n\}$ denote the index for individuals, let $t \in \{0, \dots, m-1\}$ denote the index measurement occasions, let $k \in \{1, \dots, p\}$ denote the index items, and let $c \in \{0, 1\}$ be the index of the two latent profiles (profile 0 and profile 1). Let q be the trait dimension, $q = 1$ in this context.

Covariate

The covariate is generated from a normal distribution with mean μ_X and variance σ_X .

Latent Categorical Variables

Latent categorical variables represent profile membership for each individual at each measurement occasion. In a two-profile model, profile membership is influenced by a covariate and previous profile status, following a logistic formulation. We distinguish between:

- Initial profile membership (baseline time point)
- Profile transitions across subsequent time points

We describe both components below.

Initial Profile Membership

For the first measurement occasion ($t = 0$), profile membership is determined by the following log-odds for belonging to profile 0 (with profile 1 as the reference category):

$$\left(\begin{array}{cc} \nu_0 + \kappa_0 \times \text{Covariate} & 0 \end{array} \right).$$

The corresponding probability of belonging to each profile is given by:

$$\left(\begin{array}{cc} \frac{\exp(\nu_0 + \kappa_0 \times \text{Covariate})}{\exp(\nu_0 + \kappa_0 \times \text{Covariate}) + 1} & \frac{1}{\exp(\nu_0 + \kappa_0 \times \text{Covariate}) + 1} \end{array} \right).$$

Profile membership at the first occasion is sampled based on these probabilities.

Profile Transitions

For subsequent occasions ($t = 1, \dots, m-1$), profile transitions depend on the profile at the previous occasion and the covariate. The log-odds for transitioning to profile 0 at time t are given by:

$$\left(\begin{array}{cc} \alpha_0 + \beta_{00} + \gamma_{00} \times \text{Covariate} & 0 \\ \alpha_0 + \gamma_{10} \times \text{Covariate} & 0 \end{array} \right).$$

The probability of transitioning to each profile is computed as:

$$\left(\begin{array}{cc} \frac{\exp(\alpha_0 + \beta_{00} + \gamma_{00} \times \text{Covariate})}{\exp(\alpha_0 + \beta_{00} + \gamma_{00} \times \text{Covariate}) + 1} & \frac{1}{\exp(\alpha_0 + \beta_{00} + \gamma_{00} \times \text{Covariate}) + 1} \\ \frac{\exp(\alpha_0 + \gamma_{10} \times \text{Covariate})}{\exp(\alpha_0 + \gamma_{10} \times \text{Covariate}) + 1} & \frac{1}{\exp(\alpha_0 + \gamma_{10} \times \text{Covariate}) + 1} \end{array} \right).$$

Profile membership for each subsequent time point is sampled using these transition probabilities, based on the individual's covariate value and previous profile.

Trait Components

The trait variate captures between-person differences and is composed of a shared (common) component and item-specific (unique) components. The full decomposition is given by:

$$\text{Trait}_i = \text{Common Trait Loading} \times \text{Common Trait}_i + \text{Unique Trait}_i.$$

We describe each component below.

Common Trait

The common trait Common Trait_i represents shared individual differences that influence all items uniformly. It is drawn from a normal distribution with mean μ_t and variance ψ_t :

$$\text{Common Trait}_i \sim \mathcal{N}(\mu_t, \psi_t)$$

The influence of the common trait on each item is determined by the $p \times q$ common trait loading,

Unique Traits

The unique trait component $\text{Unique Trait}_{k,i}$ captures item-specific stable differences and is drawn from a multivariate normal distribution:

$$\text{Unique Trait}_i \sim \mathcal{N}(\boldsymbol{\mu}_p, \boldsymbol{\Psi}_{p \times p})$$

Combined Trait Variate

The trait variate for item k and individual i is obtained by combining the common and unique trait components:

$$\text{Trait}_{k,i} = \text{Common Trait Loading}_k \times \text{Common Trait}_i + \text{Unique Trait}_{k,i}.$$

The common trait component introduces shared variance across items, while the unique trait component allows for item-specific differences not explained by the common trait.

State Components

The state variate is composed of two parts: a common state shared across items, and unique states specific to each item. The full decomposition is given by:

$$\text{State}_{k,i,t} = \text{Common State Loading}_k \times \text{Common State}_{i,t} + \text{Unique State}_{k,i,t}.$$

We describe each component below.

Common State

The common state $\text{Common State}_{i,t}$ evolves over time following a first-order autoregressive process:

$$\text{Common State}_{i,t} = \phi_c \times \text{Common State}_{i,t-1} + \zeta_{i,t}.$$

The initial common state is drawn from a normal distribution:

$$\text{Common State}_{i,0} \sim \mathcal{N}(0, \psi_{s_0}).$$

The innovation term $\zeta_{i,t}$ is normally distributed:

$$\zeta_{i,t} \sim \mathcal{N}(0, \psi_s).$$

The autoregressive parameter ϕ_c depends on latent profile membership c :

$$\phi_c = \phi_0 + (\phi_1 - \phi_0) c.$$

Here, ϕ_0 and ϕ_1 represent the autoregressive coefficients for profiles coded as 0 and 1, respectively.

Unique State

The unique state $\text{Unique State}_{k,i,t}$ captures item-specific deviations and is drawn from a multivariate normal distribution:

$$\text{Unique State}_{i,t} \sim \mathcal{N}(0, \boldsymbol{\theta})$$

where $\boldsymbol{\theta}$ is the item-level covariance matrix for the unique state component.

Combined State Variate

The state variate for item k , individual i , and time t combines the common and unique state components:

$$\text{State}_{k,i,t} = \text{Common State Loading}_k \times \text{Common State}_{i,t} + \text{Unique State}_{k,i,t}$$

The common state loading parameter $\text{Common State Loading}_k$ controls the influence of the shared state on each item.

Observed Variables

The observed variable is given by

$$Y_{k,i,t} = \mu_{k,c} + \text{Trait}_{k,i} + \text{State}_{k,i,t}$$

where $\mu_{k,c}$ is the profile specific mean, while $\text{Trait}_{k,i}$ and $\text{State}_{k,i,t}$ correspond to the trait and state components of the model.

Value

Returns an object of class `simcult`, which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("GenCULTA2Profiles").
- `args`: Function arguments.
- `id`: Vector of ID numbers.
- `covariate`: Vector of covariate values.
- `categorical`: Latent profiles.
- `common_trait`: Common trait.
- `unique_trait`: Unique trait.
- `common_state`: Common state.
- `trait`: Common trait + unique trait.
- `state`: Common state + unique state.
- `data`: Generated data which is a matrix of observed variables generated from the CULTA model with two-profiles.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Data Generation Functions: [GenData\(\)](#)

Examples

```
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 10 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
```

```

gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- diag(1)
mu_t <- 0
psi_p <- diag(p)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 0.151
psi_s <- 0.290
theta <- diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,

```

```
psi_s = psi_s,  
theta = theta,  
mu_profile = mu_profile  
)
```

GenData	<i>Simulate Data</i>
---------	----------------------

Description

The function simulates data using the [GenCULTA2Profiles\(\)](#) function.

Usage

```
GenData(taskid)
```

Arguments

taskid Positive integer. Task ID.

See Also

Other Data Generation Functions: [GenCULTA2Profiles\(\)](#)

Examples

```
## Not run:  
set.seed(42)  
sim <- GenData(taskid = 1)  
as.matrix(sim)  
  
## End(Not run)
```

InputCULTA1Profile	<i>Generate Mplus Inout file for the One-Profile CULTA Model (CUTS Model with AR)</i>
--------------------	---

Description

Generates Mplus input file for the one-profile CULTA model.

Usage

```
InputCULTA1Profile(data, wd = ".", starts = 10)
```


Arguments

data	R object. Object of class simcult.
wd	Character string. Working directory.
starts	Positive integer. Number of initial stage starting values.

Value

Writes data and input files in wd.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
```

```

psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,

```

```

    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # generate data and Mplus input files fitting -----
  InputCULTA1Profile(data = data)

## End(Not run)

```

InputCULTA2Profiles *Generate Mplus Input file for the Two-Profile CULTA Model*

Description

Generates Mplus input file for the two-profile CULTA model.

Usage

```

InputCULTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  starts = c(20, 4),
  stiterations = 10,
  stscale = 5
)

```

Arguments

data	R object. Object of class simcult.
wd	Character string. Working directory.
ncores	Positive integer. Number of cores to use.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscale	Positive integer. Random start scale.

Value

Writes data and input files in wd.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
```

```

common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# generate data and Mplus input files fitting -----
InputCULTA2Profiles(data = data)

## End(Not run)

```

Description

Generates Mplus input file for the two-profile LTA model.

Usage

```
InputLTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  starts = c(20, 4),
  stiterations = 10,
  stscales = 5
)
```

Arguments

data	R object. Object of class <code>simulta</code> .
wd	Character string. Working directory.
ncores	Positive integer. Number of cores to use.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscales	Positive integer. Random start scale.

Value

Writes data and input files in `wd`.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputILTA2Profiles\(\)](#)

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
```

```

p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

```

```

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# generate data and Mplus input files fitting -----
InputLTA2Profiles(data = data)

## End(Not run)

```

InputRILTA2Profiles *Generate Mplus Input file for the Two-Profile RI-LTA Model*

Description

Generates Mplus input file for the two-profile RI-LTA model.

Usage

```

InputRILTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  starts = c(20, 4),
  stiterations = 10,
  stscales = 5
)

```


Arguments

data	R object. Object of class <code>simcult</code> .
wd	Character string. Working directory.
ncores	Positive integer. Number of cores to use.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscale	Positive integer. Random start scale.

Value

Writes data and input files in `wd`.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#)

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
```

```

psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,

```

```

    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
)

# generate data and Mplus input files fitting -----
InputRILTA2Profiles(data = data)

## End(Not run)

```

logLik.fitcultu	<i>Extract Log-Likelihood</i>
-----------------	-------------------------------

Description

Extract Log-Likelihood

Usage

```
## S3 method for class 'fitcultu'
logLik(object, ...)
```

Arguments

object	Object of class fitcultu.
...	additional arguments.

Value

Returns an object of class logLik. This is a number with at the attribute, "df" (degrees of freedom), giving the number of (estimated) parameters in the model, and "correction" which is the scaling correction factor for MLR.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
logLik(fit, level = 0.95)

## End(Not run)

```

params

Simulation Parameters

Description

Simulation Parameters

Usage

```
data(params)
```

Format

A dataframe with 9 rows and 39 columns:

taskid Simulation Task ID.

n Sample size.

separation Level of separation. 0 for moderate, -1 for low, and 1 for strong.

m Measurement occasions.

mu_x μ_{u_x} parameter. Mean of the covariate.

sigma_x σ_{u_x} parameter. Variance of the covariate.

mu_10 $\mu_{u_{10}}$ parameter. Profile specific mean for profile 0 and item 1.

mu_20 $\mu_{u_{20}}$ parameter. Profile specific mean for profile 0 and item 2.

mu_30 $\mu_{u_{30}}$ parameter. Profile specific mean for profile 0 and item 3.

mu_40 $\mu_{u_{40}}$ parameter. Profile specific mean for profile 0 and item 4.

lambda_t2 $\lambda_{u_{t2}}$ parameter. Factor loading for the common trait and item 2.

lambda_s2 $\lambda_{u_{s2}}$ parameter. Factor loading for the common state and item 2.

lambda_t3 $\lambda_{u_{t3}}$ parameter. Factor loading for the common trait and item 3.

lambda_s3 $\lambda_{u_{s3}}$ parameter. Factor loading for the common state and item 3.

lambda_t4 $\lambda_{u_{t4}}$ parameter. Factor loading for the common trait and item 4.

lambda_s4 $\lambda_{u_{s4}}$ parameter. Factor loading for the common state and item 4.

theta_11 $\theta_{u_{11}}$ parameter. Unique state variance for item 1.

theta_22 $\theta_{u_{22}}$ parameter. Unique state variance for item 2.

theta_33 $\theta_{u_{33}}$ parameter. Unique state variance for item 3.

theta_44 $\theta_{u_{44}}$ parameter. Unique state variance for item 4.

phi_0 ϕ_{i_0} parameter. Autoregressive coefficient for profile 0.

psi_t ψ_{i_t} parameter. Variance in the common trait; reflects stable between-person differences.

psi_p_11 $\psi_{i_{p11}}$ parameter. Trait-specific item 1 variance.

psi_p_22 $\psi_{i_{p22}}$ parameter. Trait-specific item 2 variance.

psi_p_33 $\psi_{i_{p33}}$ parameter. Trait-specific item 3 variance.

psi_p_44 $\psi_{i_{p44}}$ parameter. Trait-specific item 4 variance.

psi_s0 $\psi_{i_{s0}}$ parameter. Initial-day variance of the common state; reflects variability in intoxication levels at observation start.

psi_s ψ_{i_s} parameter. Residual state variance over days; captures within-person daily fluctuations not explained by trait or AR effects.

mu_11 $\mu_{u_{11}}$ parameter. Profile specific mean for profile 1 and item 1.

mu_21 $\mu_{u_{21}}$ parameter. Profile specific mean for profile 1 and item 2.

- mu_31** μ_{31} parameter. Profile specific mean for profile 1 and item 3.
- mu_41** μ_{41} parameter. Profile specific mean for profile 1 and item 4.
- phi_1** ϕ_1 parameter. Autoregressive coefficient for profile 1.
- nu_0** ν_0 parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when $X = 0$.
- alpha_0** α_0 parameter. Baseline log-odds of being in profile 0 across days.
- kappa_0** κ_0 parameter. Covariate effect on initial profile membership; higher X increases odds of profile 0.
- beta_00** β_{00} parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- gamma_00** γ_{00} parameter. Covariate effect on staying in profile 0; higher X increases persistence.
- gamma_10** γ_{10} parameter. Covariate effect on switching from state to profile 0; higher X increases transition odds.

Author(s)

Ivan Jacob Agaloos Pesigan

print.fitcultu	<i>Print Method for an Object of Class fitcultu</i>
----------------	---

Description

Print Method for an Object of Class fitcultu

Usage

```
## S3 method for class 'fitcultu'
print(x, alpha = NULL, digits = 4, ...)
```

Arguments

x	Object of class fitcultu.
alpha	Numeric vector. Significance level α . If alpha = NULL, use alpha = 0.05.
digits	Digits to print.
...	additional arguments.

Value

Prints a matrix of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```



```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
print(fit)

## End(Not run)

```

print.simculta

Print Method for an Object of Class simculta

Description

Print Method for an Object of Class simculta

Usage

```
## S3 method for class 'simculta'  
print(x, ...)
```

Arguments

x	Object of class simculta.
...	Additional arguments.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
x <- GenCULTA2Profiles(  
  n = 10,  
  m = 6,  
  common_trait_loading = matrix(  
    data = c(1, 1.25, 1.50, 1.75),  
    ncol = 1  
  ),  
  common_state_loading = matrix(  
    data = c(1, 1.5, 1.75, 2.00),  
    ncol = 1  
  ),  
  mu_t = NULL,  
  psi_t = NULL,  
  mu_p = NULL,  
  psi_p = NULL,  
  theta = diag(4),  
  mu_profile = cbind(  
    c(-3, -3, -3, -3),  
    c(3, 3, 3, 3)  
  ),  
  mu_x = 0,  
  sigma_x = 1,  
  nu_0 = -3.563,  
  kappa_0 = 0.122,  
  alpha_0 = -3.586,  
  beta_00 = 2.250,  
  gamma_00 = 0.063,  
  gamma_10 = 0.094,  
  phi_0 = 0.311,  
  phi_1 = 0,  
  psi_s0 = 0.151,  
  psi_s = 0.290  
)  
print(x)
```

Sim	<i>Simulation Replication</i>
-----	-------------------------------

Description

Simulation Replication

Usage

Sim(taskid, repid, output_folder, overwrite, integrity, seed)

Arguments

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
seed	Integer. Random seed.

Value

The output is saved as an external file in output_folder.

Author(s)

Ivan Jacob Agaloos Pesigan

SimFitCULTA2Profiles	<i>Simulation Replication - FitCULTA2Profiles</i>
----------------------	---

Description

Simulation Replication - FitCULTA2Profiles

Usage

```
SimFitCULTA2Profiles(  
  taskid,  
  repid,  
  output_folder,  
  seed,  
  suffix,  
  overwrite,  
  integrity  
)
```

Arguments

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
seed	Integer. Random seed.
suffix	Character string. Output of <code>manCTMed::SimSuffix()</code> .
overwrite	Logical. Overwrite existing output in <code>output_folder</code> .
integrity	Logical. If <code>integrity = TRUE</code> , check for the output file integrity when <code>overwrite = FALSE</code> .

Details

This function is executed via the `Sim` function.

Value

The output is saved as an external file in `output_folder`.

Author(s)

Ivan Jacob Agaloos Pesigan

SimFN

Simulation File Name

Description

Simulation File Name

Usage

```
SimFN(output_type, output_folder, suffix)
```

Arguments

output_type	Character string. Output type.
output_folder	Character string. Output folder.
suffix	Character string. Output of <code>manCTMed::SimSuffix()</code> .

Value

Returns a character string file name with the `output_folder` in the OS-specific format.

SimGenData	<i>Simulation Replication - GenData</i>
------------	---

Description

Simulation Replication - GenData

Usage

SimGenData(taskid, repid, output_folder, seed, suffix, overwrite, integrity)

Arguments

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
seed	Integer. Random seed.
suffix	Character string. Output of manCTMed:::SimSuffix().
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.

Details

This function is executed via the Sim function.

Value

The output is saved as an external file in output_folder.

Author(s)

Ivan Jacob Agaloos Pesigan

SimProj	<i>Simulation Project Name</i>
---------	--------------------------------

Description

Simulation Project Name

Usage

SimProj()

Value

Returns the project name as a character string.

Author(s)

Ivan Jacob Agaloos Pesigan

summary.fitculta	<i>Summary Method for an Object of Class fitculta</i>
------------------	---

Description

Summary Method for an Object of Class fitculta

Usage

```
## S3 method for class 'fitculta'
summary(object, alpha = NULL, digits = 4, ...)
```

Arguments

object	Object of class fitculta.
alpha	Numeric vector. Significance level α . If alpha = NULL, use alpha = 0.05.
digits	Digits to print.
...	additional arguments.

Value

Returns a matrix of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
summary(fit)

## End(Not run)

```

vcov.fitcultla

Sampling Covariance Matrix

Description

Sampling Covariance Matrix

Usage

```
## S3 method for class 'fitcultu'  
vcov(object, ...)
```

Arguments

object	Object of class fitcultu.
...	additional arguments.

Value

Returns a matrix of the variance-covariance matrix of parameter estimates.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:  
# complete list of R function arguments -----  
  
# random seed for reproducibility  
set.seed(42)  
  
# dimensions  
n <- 1000 # number of individuals  
m <- 6 # measurement occasions  
p <- 4 # number of items  
q <- 1 # common trait dimension  
  
# covariate parameters  
mu_x <- 11.4009  
sigma_x <- 24.67566  
  
# profile membership and transition parameters  
nu_0 <- -3.563  
kappa_0 <- 0.122  
alpha_0 <- -3.586  
beta_00 <- 2.250  
gamma_00 <- 0.063  
gamma_10 <- 0.094  
  
# trait parameters  
psi_t <- 0.10 * diag(1)  
mu_t <- 0  
psi_p <- diag(p)  
psi_p_1 <- 0.10  
psi_p_2 <- 0.10  
psi_p_3 <- 0.50  
psi_p_4 <- 0.50
```

```

diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,

```

```

    theta = theta,
    mu_profile = mu_profile
  )

  # model fitting -----
  # NOTE: Model fitting takes time
  fit <- FitCULTA2Profiles(data = data)
  vcov(fit)

  ## End(Not run)

```

WriteData

Write Data to File

Description

Generic function to write data to file.

Usage

```

WriteData(x, file, ...)

## S3 method for class 'simcult'
WriteData(x, file, ...)

```

Arguments

x	Object of class <code>simcult</code> .
file	Character string. File name.
...	Additional arguments.

Value

Invisibly returns `NULL`. Writes data to file as a side effect.

Methods (by class)

- `WriteData(simcult)`: Method for objects of class `simcult`.

Author(s)

Ivan Jacob Agaloos Pesigan

Index

* Data Generation Functions

GenCULTA2Profiles, [33](#)
GenData, [40](#)

* Model Fitting Functions

FitCULTA1Profile, [22](#)
FitCULTA2Profiles, [24](#)
FitLTA2Profiles, [27](#)
FitRILTA2Profiles, [30](#)
InputCULTA1Profile, [40](#)
InputCULTA2Profiles, [43](#)
InputLTA2Profiles, [45](#)
InputRILTA2Profiles, [48](#)

* culta

FitCULTA1Profile, [22](#)
FitCULTA2Profiles, [24](#)
FitLTA2Profiles, [27](#)
FitRILTA2Profiles, [30](#)
GenCULTA2Profiles, [33](#)
InputCULTA1Profile, [40](#)
InputCULTA2Profiles, [43](#)
InputLTA2Profiles, [45](#)
InputRILTA2Profiles, [48](#)

* data

params, [53](#)

* fit

FitCULTA1Profile, [22](#)
FitCULTA2Profiles, [24](#)
FitLTA2Profiles, [27](#)
FitRILTA2Profiles, [30](#)
SimFitCULTA2Profiles, [59](#)

* gendata

GenData, [40](#)
SimGenData, [61](#)

* input

InputCULTA1Profile, [40](#)
InputCULTA2Profiles, [43](#)
InputLTA2Profiles, [45](#)
InputRILTA2Profiles, [48](#)

* manCULTA

FitCULTA1Profile, [22](#)
FitCULTA2Profiles, [24](#)
FitLTA2Profiles, [27](#)
FitRILTA2Profiles, [30](#)
GenCULTA2Profiles, [33](#)
GenData, [40](#)
InputCULTA1Profile, [40](#)
InputCULTA2Profiles, [43](#)
InputLTA2Profiles, [45](#)
InputRILTA2Profiles, [48](#)
Sim, [59](#)
SimFitCULTA2Profiles, [59](#)
SimFN, [60](#)
SimGenData, [61](#)
SimProj, [62](#)

* methods

AIC.fitcult, [2](#)
anova.fitcult, [5](#)
as.data.frame.simcult, [7](#)
as.matrix.simcult, [8](#)
BIC.fitcult, [10](#)
coef.fitcult, [12](#)
confint.fitcult, [15](#)
converged, [17](#)
entropy, [19](#)
logLik.fitcult, [51](#)
print.fitcult, [55](#)
print.simcult, [57](#)
summary.fitcult, [62](#)
vcov.fitcult, [64](#)
WriteData, [67](#)

* mixture

FitCULTA1Profile, [22](#)
FitCULTA2Profiles, [24](#)
FitLTA2Profiles, [27](#)
FitRILTA2Profiles, [30](#)
GenCULTA2Profiles, [33](#)
InputCULTA1Profile, [40](#)
InputCULTA2Profiles, [43](#)

- InputLTA2Profiles, 45
- InputRILTA2Profiles, 48
- * **parameters**
 - params, 53
- * **simulation**
 - Sim, 59
 - SimFitCULTA2Profiles, 59
 - SimFN, 60
 - SimGenData, 61
 - SimProj, 62
- * **sim**
 - GenCULTA2Profiles, 33
- * **state**
 - FitCULTA1Profile, 22
 - FitCULTA2Profiles, 24
 - FitLTA2Profiles, 27
 - FitRILTA2Profiles, 30
 - GenCULTA2Profiles, 33
 - InputCULTA1Profile, 40
 - InputCULTA2Profiles, 43
 - InputLTA2Profiles, 45
 - InputRILTA2Profiles, 48
- * **trait**
 - FitCULTA1Profile, 22
 - FitCULTA2Profiles, 24
 - FitLTA2Profiles, 27
 - FitRILTA2Profiles, 30
 - GenCULTA2Profiles, 33
 - InputCULTA1Profile, 40
 - InputCULTA2Profiles, 43
 - InputLTA2Profiles, 45
 - InputRILTA2Profiles, 48
- AIC.fitcultla, 2
- anova.fitcultla, 5
- as.data.frame.simcultla, 7
- as.matrix.simcultla, 8
- BIC.fitcultla, 10
- coef.fitcultla, 12
- confint.fitcultla, 14
- converged, 17
- entropy, 19
- FitCULTA1Profile, 22, 25, 28, 31, 41, 44, 46, 49
- FitCULTA2Profiles, 22, 24, 28, 31, 41, 44, 46, 49
- FitLTA2Profiles, 22, 25, 27, 31, 41, 44, 46, 49
- FitRILTA2Profiles, 22, 25, 28, 30, 41, 44, 46, 49
- GenCULTA2Profiles, 33, 40
- GenCULTA2Profiles(), 35, 40
- GenData, 38, 40
- InputCULTA1Profile, 22, 25, 28, 31, 40, 44, 46, 49
- InputCULTA2Profiles, 22, 25, 28, 31, 41, 43, 46, 49
- InputLTA2Profiles, 22, 25, 28, 31, 41, 44, 45, 49
- InputRILTA2Profiles, 22, 25, 28, 31, 41, 44, 46, 48
- logLik.fitcultla, 51
- params, 53
- print.fitcultla, 55
- print.simcultla, 57
- Sim, 59
- SimFitCULTA2Profiles, 59
- SimFN, 60
- SimGenData, 61
- SimProj, 62
- summary.fitcultla, 62
- vcov.fitcultla, 64
- WriteData, 67