

# Package ‘CoTiMA’

July 20, 2026

**Type** Package

**Title** Continuous Time Meta-Analysis ('CoTiMA')

**Version** 1.0.3

**Date** 2026-07-20

**Description** The 'CoTiMA' package performs meta-analyses of correlation matrices of repeatedly measured variables taken from studies that used different time intervals. Different time intervals between measurement occasions impose problems for meta-analyses because the effects (e.g. cross-lagged effects) cannot be simply aggregated, for example, by means of common fixed or random effects analysis. However, continuous time math, which is applied in 'CoTiMA', can be used to extrapolate or intrapolate the results from all studies to any desired time lag. By this, effects obtained in studies that used different time intervals can be meta-analyzed. 'CoTiMA' fits models to empirical data using the structural equation model (SEM) package 'ctsem', the effects specified in a SEM are related to parameters that are not directly included in the model (i.e., continuous time parameters; together, they represent the continuous time structural equation model, CTSEM). Statistical model comparisons and significance tests are then performed on the continuous time parameter estimates. 'CoTiMA' also allows analysis of publication bias (Egger's test, PET-PEESE estimates, zcurve analysis etc.) and analysis of statistical power (post hoc power, required sample sizes). See Dormann, C., Guthier, C., & Cortina, J. M. (2019) <doi:10.1177/1094428119847277>. and Guthier, C., Dormann, C., & Voelkle, M. C. (2020) <doi:10.1037/bul0000304>.

**License** GPL-3

**URL** <https://github.com/CoTiMA/CoTiMA>

**Encoding** UTF-8

**LazyData** true

**Depends** OpenMx (>= 2.22.11), ctsem (>= 3.11.1), lavaan (>= 0.6),  
foreach (>= 1.5.1), R (>= 4.5.0)

**Imports** Matrix ( $\geq 1.7.3$ ), MBESS ( $\geq 5.0.1$ ), crayon ( $\geq 1.3.4$ ), psych ( $\geq 1.9.12$ ), doParallel ( $\geq 1.0.15$ ), rootSolve ( $\geq 1.8.2$ ), abind ( $\geq 1.4-5$ ), RPushbullet ( $\geq 0.3.3$ ), openxlsx ( $\geq 4.2.2$ ), zcurve ( $\geq 1.0.7$ ), scholar ( $\geq 0.2.0$ ), stringi ( $\geq 1.0.7$ ), MASS, methods

**Config/roxygen2/version** 8.0.0

**NeedsCompilation** no

**Author** Christian Dormann [aut, cph],  
Markus Homberg [aut, com, cre],  
Olga Diener [ctb],  
Christina Guthier [ctb],  
Manuel Voelkle [ctb]

**Maintainer** Markus Homberg <cotima@uni-mainz.de>

**Repository** CRAN

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A128

*A128 example matrix*

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**Description**

A128 example matrix

**Usage**

A128

**Format**

An object of class `matrix` (inherits from `array`) with 2 rows and 2 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

A313

*A313 example matrix*

---

**Description**

A313 example matrix

**Usage**

A313

**Format**

An object of class `matrix` (inherits from `array`) with 2 rows and 2 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|       |                             |
|-------|-----------------------------|
| ageM1 | <i>ageM1 example vector</i> |
|-------|-----------------------------|

---

**Description**

ageM1 example vector

**Usage**

ageM1

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|         |                               |
|---------|-------------------------------|
| ageM128 | <i>ageM128 example vector</i> |
|---------|-------------------------------|

---

**Description**

ageM128 example vector

**Usage**

ageM128

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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ageM18

*ageM18 example vector*

---

**Description**

ageM18 example vector

**Usage**

ageM18

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

ageM201

*ageM201 example vector*

---

**Description**

ageM201 example vector

**Usage**

ageM201

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`ageM313`*ageM313 example vector*

---

**Description**

ageM313 example vector

**Usage**

`ageM313`

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`ageM32`*ageM32 example vector*

---

**Description**

ageM32 example vector

**Usage**

`ageM32`

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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ageM4

*ageM4 example vector*

---

**Description**

ageM4 example vector

**Usage**

ageM4

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

ageSD1

*ageSD1 example vector*

---

**Description**

ageSD1 example vector

**Usage**

ageSD1

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`ageSD128`*ageSD128 example vector*

---

**Description**

ageSD128 example vector

**Usage**

`ageSD128`

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`ageSD18`*ageSD18 example vector*

---

**Description**

ageSD18 example vector

**Usage**

`ageSD18`

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

ageSD201

*ageSD201 example vector*

---

**Description**

ageSD201 example vector

**Usage**

ageSD201

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

ageSD313

*ageSD313 example vector*

---

**Description**

ageSD313 example vector

**Usage**

ageSD313

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|         |                               |
|---------|-------------------------------|
| ageSD32 | <i>ageSD32 example vector</i> |
|---------|-------------------------------|

---

**Description**

ageSD32 example vector

**Usage**

ageSD32

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|        |                              |
|--------|------------------------------|
| ageSD4 | <i>ageSD4 example vector</i> |
|--------|------------------------------|

---

**Description**

ageSD4 example vector

**Usage**

ageSD4

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

alphas128

*alphas128 example vector*

---

**Description**

alphas128 example vector

**Usage**

alphas128

**Format**

An object of class `numeric` of length 9.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

alphas313

*alphas313 example vector*

---

**Description**

alphas313 example vector

**Usage**

alphas313

**Format**

An object of class `numeric` of length 6.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|          |                                |
|----------|--------------------------------|
| burnout1 | <i>burnout1 example vector</i> |
|----------|--------------------------------|

---

**Description**

burnout1 example vector

**Usage**

burnout1

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|            |                                  |
|------------|----------------------------------|
| burnout128 | <i>burnout128 example vector</i> |
|------------|----------------------------------|

---

**Description**

burnout128 example vector

**Usage**

burnout128

**Format**

An object of class character of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|           |                                 |
|-----------|---------------------------------|
| burnout18 | <i>burnout18 example vector</i> |
|-----------|---------------------------------|

---

**Description**

burnout18 example vector

**Usage**

burnout18

**Format**

An object of class character of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|            |                                  |
|------------|----------------------------------|
| burnout201 | <i>burnout201 example vector</i> |
|------------|----------------------------------|

---

**Description**

burnout201 example vector

**Usage**

burnout201

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|            |                                  |
|------------|----------------------------------|
| burnout313 | <i>burnout313 example vector</i> |
|------------|----------------------------------|

---

**Description**

burnout313 example vector

**Usage**

burnout313

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|           |                                 |
|-----------|---------------------------------|
| burnout32 | <i>burnout32 example vector</i> |
|-----------|---------------------------------|

---

**Description**

burnout32 example vector

**Usage**

burnout32

**Format**

An object of class character of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|          |                                |
|----------|--------------------------------|
| burnout4 | <i>burnout4 example vector</i> |
|----------|--------------------------------|

---

**Description**

burnout4 example vector

**Usage**

burnout4

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|                     |                                           |
|---------------------|-------------------------------------------|
| combineVariables128 | <i>combineVariables128 example vector</i> |
|---------------------|-------------------------------------------|

---

**Description**

combineVariables128 example vector

**Usage**

combineVariables128

**Format**

An object of class list of length 3.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`combineVariablesNames128`*combineVariablesNames128 example vector*

---

**Description**`combineVariablesNames128` example vector**Usage**`combineVariablesNames128`**Format**

An object of class character of length 3.

**Author(s)**

C. Dormann &amp; M. Homburg &lt;CoTiMA@uni-mainz.org&gt;

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`CoTiMABiG_D_B0`*ctmaBiG-object reproducing results of Guthier et al. (2020)*

---

**Description**`ctmaBiG`-object reproducing results of Guthier et al. (2020)**Usage**`CoTiMABiG_D_B0`**Format**An object of class `CoTiMAFit` of length 10.**Author(s)**

C. Guthier, C. Dormann &amp; J. Cortina &lt;CoTiMA@uni-mainz.org&gt;

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|                 |                                                         |
|-----------------|---------------------------------------------------------|
| CoTiMAFullFit_3 | <i>ctmaFit-object with a 'full' CoTiMA of 3 studies</i> |
|-----------------|---------------------------------------------------------|

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**Description**

ctmaFit-object with a 'full' CoTiMA of 3 studies

**Usage**

CoTiMAFullFit\_3

**Format**

An object of class CoTiMAFit of length 13.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|                 |                                                         |
|-----------------|---------------------------------------------------------|
| CoTiMAFullFit_6 | <i>ctmaFit-object with a 'full' CoTiMA of 6 studies</i> |
|-----------------|---------------------------------------------------------|

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**Description**

ctmaFit-object with a 'full' CoTiMA of 6 studies

**Usage**

CoTiMAFullFit\_6

**Format**

An object of class CoTiMAFit of length 10.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

CoTiMAFullFit\_6\_new     *ctmaFit-object with a 'full' CoTiMA of 6 studies*

---

**Description**

ctmaFit-object with a 'full' CoTiMA of 6 studies

**Usage**

CoTiMAFullFit\_6\_new

**Format**

An object of class CoTiMAFit of length 11.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

CoTiMAFullInv23Fit\_6     *1st fitted ctmaFit-object in a series of 2 to test equality of 2 cross effects*

---

**Description**

1st fitted ctmaFit-object in a series of 2 to test equality of 2 cross effects

**Usage**

CoTiMAFullInv23Fit\_6

**Format**

An object of class CoTiMAFit of length 12.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

CoTiMAFullInvEq23Fit\_6

*2nd fitted ctmaFit-object in a series of 2 to test equality of 2 cross effects*

---

### Description

2nd fitted ctmaFit-object in a series of 2 to test equality of 2 cross effects

### Usage

CoTiMAFullInvEq23Fit\_6

### Format

An object of class CoTiMAFit of length 11.

### Author(s)

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

CoTiMAInitFit\_3

*ctmaInit-object with of 3 primary studies*

---

### Description

ctmaInit-object with of 3 primary studies

### Usage

CoTiMAInitFit\_3

### Format

An object of class CoTiMAFit of length 17.

### Author(s)

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|                 |                                               |
|-----------------|-----------------------------------------------|
| CoTiMAInitFit_6 | <i>ctmaInit-object with 6 primary studies</i> |
|-----------------|-----------------------------------------------|

---

**Description**

ctmaInit-object with 6 primary studies

**Usage**

CoTiMAInitFit\_6

**Format**

An object of class CoTiMAFit of length 18.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                     |                                               |
|---------------------|-----------------------------------------------|
| CoTiMAInitFit_6_new | <i>ctmaInit-object with 6 primary studies</i> |
|---------------------|-----------------------------------------------|

---

**Description**

ctmaInit-object with 6 primary studies

**Usage**

CoTiMAInitFit\_6\_new

**Format**

An object of class CoTiMAFit of length 18.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|                      |                                                                             |
|----------------------|-----------------------------------------------------------------------------|
| CoTiMAInitFit_6_NUTS | <i>ctmaInit-object with a 'full' CoTiMA of 6 studies using NUTS sampler</i> |
|----------------------|-----------------------------------------------------------------------------|

---

**Description**

ctmaInit-object with a 'full' CoTiMA of 6 studies using NUTS sampler

**Usage**

CoTiMAInitFit\_6\_NUTS

**Format**

An object of class CoTiMAFit of length 17.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|                    |                                                                                 |
|--------------------|---------------------------------------------------------------------------------|
| CoTiMAInitFit_D_BO | <i>ctmaInit-object created by Guthier et al. (2020) with 48 primary studies</i> |
|--------------------|---------------------------------------------------------------------------------|

---

**Description**

ctmaInit-object created by Guthier et al. (2020) with 48 primary studies

**Usage**

CoTiMAInitFit\_D\_BO

**Format**

An object of class CoTiMAFit of length 12.

**Author(s)**

C. Guthier, C. Dormann & J. Cortina <CoTiMA@uni-mainz.org>

---

CoTiMAMod1onFullFit\_6 *ctmaFit-object with a categorical moderator of the full drift matrix*

---

**Description**

ctmaFit-object with a categorical moderator of the full drift matrix

**Usage**

CoTiMAMod1onFullFit\_6

**Format**

An object of class CoTiMAFit of length 13.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

CoTiMAMod1onFullFit\_6\_cats12  
*ctmaFit-object with a categorical moderator of the full drift matrix*

---

**Description**

ctmaFit-object with a categorical moderator of the full drift matrix

**Usage**

CoTiMAMod1onFullFit\_6\_cats12

**Format**

An object of class CoTiMAFit of length 11.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

CoTiMAMod2on23Fit\_6     *ctmaFit-object with a continuous moderator of 2 cross effects*

---

**Description**

ctmaFit-object with a continuous moderator of 2 cross effects

**Usage**

CoTiMAMod2on23Fit\_6

**Format**

An object of class CoTiMAFit of length 13.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

CoTiMAPart134Inv3Fit\_6  
*ctmaFit-object with with only one cross effect and this one set equal  
across primary studies*

---

**Description**

ctmaFit-object with with only one cross effect and this one set equal across primary studies

**Usage**

CoTiMAPart134Inv3Fit\_6

**Format**

An object of class CoTiMAFit of length 13.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                  |                                                                      |
|------------------|----------------------------------------------------------------------|
| CoTiMAPower_D_BO | <i>ctmaPower-object reproducing results of Guthier et al. (2020)</i> |
|------------------|----------------------------------------------------------------------|

---

**Description**

ctmaPower-object reproducing results of Guthier et al. (2020)

**Usage**

CoTiMAPower\_D\_BO

**Format**

An object of class CoTiMAFit of length 10.

**Author(s)**

C. Guthier, C. Dormann & J. Cortina <CoTiMA@uni-mainz.org>

---

|                  |                                  |
|------------------|----------------------------------|
| CoTiMAStanctArgs | <i>This are preset arguments</i> |
|------------------|----------------------------------|

---

**Description**

This are preset arguments  
 object created to store standard parameters passed forward to ctStanFit

**Usage**

CoTiMAStanctArgs

CoTiMAStanctArgs

**Format**

An object of class list of length 37.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                   |                                                       |
|-------------------|-------------------------------------------------------|
| CoTiMAstudyList_3 | <i>ctmaPrep-object created with 3 primary studies</i> |
|-------------------|-------------------------------------------------------|

---

**Description**

ctmaPrep-object created with 3 primary studies

**Usage**

CoTiMAstudyList\_3

**Format**

An object of class CoTiMAFit of length 28.

**Author(s)**

C. Guthier, C. Dormann & J. Cortina <CoTiMA@uni-mainz.org>

---

|                   |                                                       |
|-------------------|-------------------------------------------------------|
| CoTiMAstudyList_6 | <i>ctmaPrep-object created with 6 primary studies</i> |
|-------------------|-------------------------------------------------------|

---

**Description**

ctmaPrep-object created with 6 primary studies

**Usage**

CoTiMAstudyList\_6

**Format**

An object of class CoTiMAFit of length 30.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

CoTiMAstudyList\_6\_new *ctmaPrep-object created with 6 primary studies*

---

**Description**

ctmaPrep-object created with 6 primary studies

**Usage**

CoTiMAstudyList\_6\_new

**Format**

An object of class CoTiMAFit of length 30.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

country1 *country1 example vector*

---

**Description**

country1 example vector

**Usage**

country1

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`country128`*country128 example vector*

---

**Description**

country128 example vector

**Usage**

country128

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`country18`*country18 example vector*

---

**Description**

country18 example vector

**Usage**

country18

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|            |                                  |
|------------|----------------------------------|
| country201 | <i>country201 example vector</i> |
|------------|----------------------------------|

---

**Description**

country201 example vector

**Usage**

country201

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|            |                                  |
|------------|----------------------------------|
| country313 | <i>country313 example vector</i> |
|------------|----------------------------------|

---

**Description**

country313 example vector

**Usage**

country313

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

country32

*country32 example vector*

---

**Description**

country32 example vector

**Usage**

country32

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

country4

*country4 example vector*

---

**Description**

country4 example vector

**Usage**

country4

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

ctmaAllInvFit

*ctmaAllInvFit*


---

## Description

Fit a CoTiMA model with all params (drift, T0var, diffusion) invariant across primary studies

## Usage

```
ctmaAllInvFit(
  ctmaInitFit = NULL,
  activeDirectory = NULL,
  activateRPB = FALSE,
  digits = 4,
  drift = drift,
  coresToUse = c(1),
  n.manifest = 0,
  indVarying = FALSE,
  scaleTime = NULL,
  optimize = TRUE,
  priors = FALSE,
  finishsamples = NULL,
  iter = NULL,
  chains = NULL,
  verbose = NULL,
  loadAllInvFit = c(),
  saveAllInvFit = c(),
  silentOverwrite = FALSE,
  customPar = FALSE,
  T0means = 0,
  manifestMeans = 0,
  CoTiMAStanctArgs = NULL,
  lambda = NULL,
  manifestVars = NULL,
  indVaryingT0 = NULL
)
```

## Arguments

|                 |                                                                                                                                   |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| ctmaInitFit     | ctmaInitFit                                                                                                                       |
| activeDirectory | activeDirectory                                                                                                                   |
| activateRPB     | activateRPB                                                                                                                       |
| digits          | digits                                                                                                                            |
| drift           | Labels for drift effects. Have to be either of the type V1toV2 or 0 for effects to be excluded, which is usually not recommended) |

|                  |                                                                                                                                                                                                                            |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| coresToUse       | coresToUse                                                                                                                                                                                                                 |
| n.manifest       | Number of manifest variables of the model (if left empty it will assumed to be identical with n.latent).                                                                                                                   |
| indVarying       | Allows ct intercepts to vary at the individual level (random effects model, accounts for unobserved heterogeneity)                                                                                                         |
| scaleTime        | scaleTime                                                                                                                                                                                                                  |
| optimize         | optimize                                                                                                                                                                                                                   |
| priors           | priors (FALSE)                                                                                                                                                                                                             |
| finishsamples    | finishsamples                                                                                                                                                                                                              |
| iter             | iter                                                                                                                                                                                                                       |
| chains           | chains                                                                                                                                                                                                                     |
| verbose          | verbose                                                                                                                                                                                                                    |
| loadAllInvFit    | loadAllInvFit                                                                                                                                                                                                              |
| saveAllInvFit    | saveAllInvFit                                                                                                                                                                                                              |
| silentOverwrite  | silentOverwrite                                                                                                                                                                                                            |
| customPar        | logical. If set TRUE (default) leverages the first pass using priors and ensure that the drift diagonal cannot easily go too negative (helps since ctsem > 3.4)                                                            |
| T0means          | Default 0 (assuming standardized variables). Can be assigned labels to estimate them freely.                                                                                                                               |
| manifestMeans    | Default 0 (assuming standardized variables). Can be assigned labels to estimate them freely.                                                                                                                               |
| CoTiMAStanctArgs | parameters that can be set to improve model fitting of the <a href="#">ctStanFit</a> Function                                                                                                                              |
| lambda           | R-type matrix with pattern of fixed (=1) or free (any string) loadings.                                                                                                                                                    |
| manifestVars     | define the error variances of the manifests with a single time point using R-type lower triangular matrix with nrow=n.manifest & ncol=n.manifest.                                                                          |
| indVaryingT0     | Forces T0MEANS (T0 scores) to vary interindividually, which undos the nesting of T0(co-)variances in primary studies (default = TRUE). Was standard until Aug. 2022. Could provide better/worse estimates if set to FALSE. |

### Value

returns a fitted CoTiMA object, in which all drift parameters, Time 0 variances and covariances, and diffusion parameters were set invariant across primary studies

---

ctmaBiG

*ctmaBiG*


---

## Description

Analysis of publication bias and generalizability. The function takes a CoTiMA fit object (created with `ctmaInit`) and estimates fixed and random effects of single drift coefficients, heterogeneity (Q, I square, H square, tau square), PET-PEESE corrections, Egger's tests, and z-curve analysis yielding expected replication and detection rates (ERR, EDR).

## Usage

```
ctmaBiG(
  ctmaInitFit = NULL,
  activeDirectory = NULL,
  PETPEESEalpha = 0.1,
  activateRPB = FALSE,
  digits = 4,
  finishsamples = 1000,
  zcurve = FALSE,
  undoTimeScaling = TRUE,
  dt = NULL,
  excludeStudies = c()
)
```

## Arguments

|                              |                                                                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <code>ctmaInitFit</code>     | fit object created with <code>ctmaInit</code> containing the fitted ctsem model of each primary study                               |
| <code>activeDirectory</code> | the directory where to save results (if not specified, it is taken from <code>ctmaInitFit</code> )                                  |
| <code>PETPEESEalpha</code>   | probability level (condition) below which to switch from PET to PEESE (cf. Stanley, 2017, p. 582, below Eq. 2; default $p = .10$ )  |
| <code>activateRPB</code>     | if TRUE, messages (warning, finished) could be send to smart phone (default = FALSE)                                                |
| <code>digits</code>          | rounding (default = 4)                                                                                                              |
| <code>finishsamples</code>   | number of samples to draw (either from hessian based covariance or posterior distribution) for dt computations (default = 1000).    |
| <code>zcurve</code>          | performs z-curve analysis. Could fail if too few studies (e.g. around 10) are supplied. default=FALSE                               |
| <code>undoTimeScaling</code> | if TRUE, the original time scale is used (timeScale argument possibly used in <code>ctmaInit</code> is undone )                     |
| <code>dt</code>              | A scalar indicating a time interval across which discrete time effects should be estimated and then used for <code>ctmaBiG</code> . |
| <code>excludeStudies</code>  | vector with studies to be excluded from <code>ctmaBiG</code> .                                                                      |

**Value**

ctmaBiG returns a list containing some arguments supplied, the results of analyses of publication bias and generalizability, model type, and the type of plot that could be performed with the returned object. The arguments in the returned object are `activeDirectory`, and `coresToUse`. Further arguments, which are just copied from the `init-fit` object supplied, are, `n.studies`, `n.latent`, `studyList`, `statisticsList`, `modelResults` (all parameter estimates and their standard error), and parameter names. All new results are returned as the list element "summary", which is printed if the `summary` function is applied to the returned object. The summary list element comprises a title (model='Analysis of Publication Bias & Generalizability') and "estimates", which is another list comprising "Fixed Effects of Drift Coefficients", "Heterogeneity", "Random Effects of Drift Coefficients", "PET-PEESE corrections", "Egger's tests" (constant of the WLS regression of drift coefficients on their standard errors (SE) with  $1/SE^2$  as weights), "Egger's tests Alt. Version" (constant of the OLS regression of the standard normal deviates of the drift coefficients on their precision), and "Z-Curve 2.0 Results". Plot type is `plot.type=c("funnel", "forest")` and `model.type="BiG"`.

**Examples**

```
## Not run:
# perform analyses of publication bias and generalizability
CoTiMAInitFit_D_B0$activeDirectory <- "/Users/tmp/" # adapt!
CoTiMABiG_D_B0 <- ctmaBiG(ctmaInitFit=CoTiMAInitFit_D_B0, zcurve=FALSE)

## End(Not run)

# display results
summary(CoTiMABiG_D_B0)

## Not run:
# get funnel & forest plots
CoTiMABiG_D_B0$activeDirectory <- "/Users/tmp/" # adapt!
plot(CoTiMABiG_D_B0)

## End(Not run)
```

---

ctmaBiGOMX

---

*ctmaBiGOMX*


---

**Description**

Analysis of publication bias and fixed and random effects analysis of single drift coefficients if OLD OpenMx fit files are supplied

**Usage**

```
ctmaBiGOMX(
  ctmaInitFit = NULL,
  activeDirectory = NULL,
  PETPEESEalpha = 0.1,
```

```
    activateRPB = FALSE,  
    digits = 4  
  )
```

**Arguments**

|                 |                                                                                                                                     |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| ctmaInitFit     | fit object created with ctmaInti containing the fitted ctsem model of each primary study                                            |
| activeDirectory | the directory where to save results (if not specified, it is taken from ctmaInitFit)                                                |
| PETPEESEalpha   | # probability level (condition) below which to switch from PET to PEESE (Stanley, 2017, SPPS,p. 582, below Eq. 2; (default p = .10) |
| activateRPB     | if TRUE, messages (warning, finishes) could be send to smart phone (default = FALSE)                                                |
| digits          | rounding (default = 4)                                                                                                              |

**Value**

returns a CoTiMA fit object with results of publication bias analysis, fixed and random effect analysis, Egger’s tests, PET-PEESE corrections.

---

|              |                     |
|--------------|---------------------|
| ctmaCombPRaw | <i>ctmaCombPRaw</i> |
|--------------|---------------------|

---

**Description**

Combine Pseudo Raw Data (extract them from 'CoTiMAFit object'\$studyFitList)

**Usage**

```
ctmaCombPRaw(listOfStudyFits = NULL, moderatorValues = NULL)
```

**Arguments**

|                 |                           |
|-----------------|---------------------------|
| listOfStudyFits | "Listobject of Studyfits" |
| moderatorValues | "Moderators"              |

**Value**

returns a pseudo raw data set that combines pseudo raw data and moderators of primary studies

---

|             |                    |
|-------------|--------------------|
| ctmaCompFit | <i>ctmaCompFit</i> |
|-------------|--------------------|

---

**Description**

Performs log-likelihood ratio tests to compare the fit of 2 models (CoTiMAFit objects created with [ctmaFit](#) or [ctmaEqual](#)), i.e., the difference between the two -2 times LLs between the first model and the more constrained second model. The nested structure of the two models is assumed to be given and not checked.

**Usage**

```
ctmaCompFit(model1 = NULL, model2 = NULL)
```

**Arguments**

|        |         |
|--------|---------|
| model1 | Model 1 |
| model2 | Model 2 |

**Value**

Returns the the difference between the two -2 times LLs (Diff\_Minus2LL), the associated difference in degrees of freedom (Diff\_df (= Diff\_n.params)), and the probability (prob).

**Examples**

```
minus2l1DiffTest <- ctmaCompFit(CoTiMAFullInv23Fit_6,  
                                CoTiMAFullInvEq23Fit_6)  
summary(minus2l1DiffTest)
```

---

|            |                   |
|------------|-------------------|
| ctmaCorRel | <i>ctmaCorRel</i> |
|------------|-------------------|

---

**Description**

Disattenuates the entries in a correlation matrix using a vector of reliabilities.

**Usage**

```
ctmaCorRel(empcov = NULL, alphas = NULL)
```

**Arguments**

|        |                              |
|--------|------------------------------|
| empcov | Empirical correlation matrix |
| alphas | Vector reliabilities         |

**Value**

A corrected correlation matrix (corEmpcov). Corrections leading to  $r > 1.0$  are set to 1.0.

**Examples**

```
empcov313new <- ctmaCorRel(empcov=empcov313, alphas=alphas313)
```

---

|            |                   |
|------------|-------------------|
| ctmaEmpCov | <i>ctmaEmpCov</i> |
|------------|-------------------|

---

**Description**

changes a full covariance matrix by selecting target variables, recoding them, combining them (compute the mean of two or more variables), and by adding rows/columns with NA if focal variables are not available.

**Usage**

```
ctmaEmpCov(
  targetVariables = NULL,
  recodeVariables = c(),
  combineVariables = c(),
  combineVariablesNames = c(),
  missingVariables = c(),
  n.latent = NULL,
  Tpoints = NULL,
  sampleSize = NULL,
  pairwiseN = NULL,
  empcov = NULL
)
```

**Arguments**

|                       |                                                                                                        |
|-----------------------|--------------------------------------------------------------------------------------------------------|
| targetVariables       | (col-/row-) number or names of the target variables                                                    |
| recodeVariables       | (col-/row-) number or names of the target variables require inverse coding                             |
| combineVariables      | list of vectors, which put together the targeted variables that should be used for composite variables |
| combineVariablesNames | new names for combined variables - not really important                                                |
| missingVariables      | missing variables                                                                                      |
| n.latent              | number of (latent) variables - actually it is the number of all variables                              |

|            |                                                                    |
|------------|--------------------------------------------------------------------|
| Tpoints    | number of time points.                                             |
| sampleSize | sample size                                                        |
| pairwiseN  | matrix of same dimensions as empcov containing possible pairwiseN. |
| empcov     | empirical correlation matrix                                       |

### Value

returns a list with two elements. The first element (results\$r) contains the adapted correlation matrix, and the second element (results\$pairwiseNNew) an adapted version of a matrix of pairwise N if pairwiseN was provided for the original correlation matrix supplied.

### Examples

```
source17 <- c()
delta_t17 <- c(12)
sampleSize17 <- 440
empcov17 <- matrix(
  c( 1.00, -0.60, -0.36,  0.20,  0.62, -0.47, -0.18,  0.20,
    -0.60,  1.00,  0.55, -0.38, -0.43,  0.52,  0.27, -0.21,
    -0.36,  0.55,  1.00, -0.47, -0.26,  0.37,  0.51, -0.28,
    0.20, -0.38, -0.47,  1.00,  0.15, -0.28, -0.35,  0.56,
    0.62, -0.43, -0.26,  0.15,  1.00, -0.63, -0.30,  0.27,
    -0.47,  0.52,  0.37, -0.28, -0.63,  1.00,  0.55, -0.37,
    -0.18,  0.27,  0.51, -0.35, -0.30,  0.55,  1.00, -0.51,
    0.20, -0.21, -0.28,  0.56,  0.27, -0.37, -0.51,  1.00),
  nrow=8, ncol=8)
moderator17 <- c(3, 2)
rownames(empcov17) <- colnames(empcov17) <-
  c("Workload_1", "Exhaustion_1", "Cynicism_1", "Values_1",
    "Workload_2", "Exhaustion_2", "Cynicism_2", "Values_2")
targetVariables17 <-
  c("Workload_1", "Exhaustion_1", "Cynicism_1",
    "Workload_2", "Exhaustion_2", "Cynicism_2")
recodeVariables17 <- c("Workload_1", "Workload_2")
combineVariables17 <- list("Workload_1", c("Exhaustion_1", "Cynicism_1"),
  "Workload_2", c("Exhaustion_2", "Cynicism_2"))
combineVariablesNames17 <- c("Demands_1", "Burnout_1",
  "Demands_2", "Burnout_2")
missingVariables17 <- c();
results17 <- ctmaEmpCov(targetVariables = targetVariables17,
  recodeVariables = recodeVariables17,
  combineVariables = combineVariables17,
  combineVariablesNames = combineVariablesNames17,
  missingVariables = missingVariables17,
  n.latent = 2, sampleSize = sampleSize17,
  Tpoints = 2, empcov = empcov17)
empcov17 <- results17$r
```

ctmaEqual

*ctmaEqual***Description**

test if the two or more invariant drift parameters in the CoTiMAFit object supplied are equal. The supplied CoTiMA fit-object (ctmaInvariantFit) has to be a model fitted with [ctmaFit](#) where at least two parameters were set invariant across primary studies (e.g., 2 cross effects). All parameters that are set invariant in the supplied model are then constrained to be equal by ctmaEqual (no user action required), the model is fitted, and a log-likelihood ratio test is performed informing about the probability that equality applies.

**Usage**

```
ctmaEqual(
  ctmaInvariantFit = NULL,
  activeDirectory = NULL,
  activateRPB = FALSE,
  digits = 4,
  coresToUse = 2
)
```

**Arguments**

|                  |                                                                                                                                                                                                              |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ctmaInvariantFit | object to which a CoTiMA fit has been assigned to (i.e., what has been returned by <a href="#">ctmaFit</a> ). In most cases probably a model in which (only) two effects were specified with invariantDrift. |
| activeDirectory  | defines another active directory than the one used in ctmaInvariantFit                                                                                                                                       |
| activateRPB      | set to TRUE to receive push messages with CoTiMA notifications on your phone                                                                                                                                 |
| digits           | Number of digits used for rounding (in outputs)                                                                                                                                                              |
| coresToUse       | If neg., the value is subtracted from available cores, else value = cores to use                                                                                                                             |

**Value**

returns a model where two or more parameters were set equal across primary studies and a log-likelihood difference test informing about the probability that the equality assumption is correct.

**Examples**

```
# Fit a CoTiMA with a set of parameters set equal that were set
# invariant in a previous model (of which the fit object is
# supplied in argument ctmaInvariantFit)
## Not run:
CoTiMAFullInv23Fit_6$activeDirectory <- "/Users/tmp/" # adapt!
CoTiMAFullInvEq23Fit_6 <- ctmaEqual(ctmaInvariantFit=CoTiMAFullInv23Fit_6)
```

```
## End(Not run)
```

---

|             |                    |
|-------------|--------------------|
| ctmaExtract | <i>ctmaExtract</i> |
|-------------|--------------------|

---

**Description**

Extracts objects required for CoTiMA from list of results returned by [ctmaGenData](#) to be used afterwards with [ctmaPrep](#)

**Usage**

```
ctmaExtract(  
  activeDirectory = NULL,  
  ctmaGenDataList = NULL,  
  envir = NULL,  
  useRawData = FALSE  
)
```

**Arguments**

- activeDirectory        defines active directory where raw data files are saved. No default.
- ctmaGenDataList       list returned by [ctmaGenData](#).
- envir                  environment where objects should be extracted too. NULL by default. Typically one would use the global environment (envir = globalenv()). Has to be specified if ctmaExtract is set to TRUE.
- useRawData            if FALSE (default) empcov objects (empcov1, empcov2, etc.) are created in the global environment. If TRUE, raw data files are created in the activeDirectory and rawData objects (rawData1, rawData2, etc.) are created in the global environment. Note that corresponding empcov or rawData objects are deleted in the global environment if the respective other object is requested.

---

|         |                |
|---------|----------------|
| ctmaFit | <i>ctmaFit</i> |
|---------|----------------|

---

**Description**

Fits a ctsem model with invariant drift effects across primary studies, possible multiple moderators (but all of them of the the same type, either "cont" or "cat"), and possible cluster (e.g., countries where primary studies were conducted).

**Usage**

```
ctmaFit(  
  activateRPB = FALSE,  
  activeDirectory = NULL,  
  allInvModel = FALSE,  
  binaries = NULL,  
  catsToCompare = NULL,  
  chains = NULL,  
  cint = 0,  
  cluster = NULL,  
  coresToUse = c(2),  
  CoTiMAStanctArgs = NULL,  
  ctmaInitFit = NULL,  
  customPar = FALSE,  
  digits = 4,  
  drift = NULL,  
  driftsToCompare = NULL,  
  equalDrift = NULL,  
  experimental = FALSE,  
  finishsamples = NULL,  
  fit = TRUE,  
  ind.mod.names = NULL,  
  ind.mod.number = NULL,  
  ind.mod.type = "cont",  
  indVarying = FALSE,  
  indVaryingT0 = NULL,  
  inits = NULL,  
  invariantDrift = NULL,  
  iter = NULL,  
  lambda = NULL,  
  manifestMeans = 0,  
  manifestVars = 0,  
  mod.names = NULL,  
  mod.number = NULL,  
  mod.type = "cont",  
  moderatedDrift = NULL,  
  modsToCompare = NULL,  
  optimize = TRUE,  
  primaryStudyList = NULL,  
  priors = FALSE,  
  randomIntercepts = FALSE,  
  sameInitialTimes = FALSE,  
  scaleClus = TRUE,  
  scaleMod = TRUE,  
  scaleTI = FALSE,  
  scaleTime = NULL,  
  T0means = 0,  
  T0var = "auto",
```

```

    transfMod = NULL,
    useSampleFraction = NULL,
    verbose = 0,
    WEC = FALSE,
    WECnt = TRUE
)

```

## Arguments

|                  |                                                                                                                                                                                                                                                                    |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| activateRPB      | set to TRUE to receive push messages with 'CoTiMA' notifications on your phone                                                                                                                                                                                     |
| activeDirectory  | defines another active directory than the one used in ctmaInitFit                                                                                                                                                                                                  |
| allInvModel      | estimates a model with all parameters invariant (DRIFT, DIFFUSION, T0VAR) if set TRUE (default = FALSE)                                                                                                                                                            |
| binaries         | which manifest is a binary. Still experimental                                                                                                                                                                                                                     |
| catsToCompare    | when performing contrasts for categorical moderators, the categories (values, not positions) for which effects are set equal                                                                                                                                       |
| chains           | number of chains to sample, during HMC or post-optimization importance sampling.                                                                                                                                                                                   |
| cint             | default 'auto' (= 0). Are set free if random intercepts model with varying cints is requested (by indVarying='cint')                                                                                                                                               |
| cluster          | vector with cluster variables (e.g., countries). Has to be set up carefully. Will be included in <a href="#">ctmaPrep</a> in later 'CoTiMA' versions.                                                                                                              |
| coresToUse       | if negative, the value is subtracted from available cores, else value = cores to use                                                                                                                                                                               |
| CoTiMAStanctArgs | parameters that can be set to improve model fitting of the <a href="#">ctFit</a> Function                                                                                                                                                                          |
| ctmaInitFit      | object to which all single ctsem fits of primary studies has been assigned to (i.e., what has been returned by <a href="#">ctmaInit</a> )                                                                                                                          |
| customPar        | logical. If set TRUE leverages the first pass using priors and ensure that the drift diagonal cannot easily go too negative (helps since ctsem > 3.4)                                                                                                              |
| digits           | Number of digits used for rounding (in outputs)                                                                                                                                                                                                                    |
| drift            | labels for drift effects. Have to be either of the type 'V1toV2' or '0' for effects to be excluded.                                                                                                                                                                |
| driftsToCompare  | when performing contrasts for categorical moderators, the (subset of) drift effects analyzed                                                                                                                                                                       |
| equalDrift       | Constrains all listed effects to be equal (e.g., equalDrift = c("V1toV2", "V2toV1")). Note that this is not required for testing the assumption that two effects are equal in the population. Use the invariantDrift argument and then <a href="#">ctmaEqual</a> ) |
| experimental     | Adds main effect of ind. level moderators                                                                                                                                                                                                                          |
| finishesamples   | number of samples to draw (either from hessian based covariance or posterior distribution) for final results computation (default = 1000).                                                                                                                         |

|                  |                                                                                                                                                                                                                                                                                         |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| fit              | TRUE (default) fits the requested model. FALSE returns the ctsem-code Co-TiMA uses to set up the model, the ctsemmodelbase which can be modified to match users requirements, and the data set (in long format created). The model can then be fitted using <a href="#">ctStanFit</a> ) |
| ind.mod.names    | vector of names for individual level (!) moderators used in output                                                                                                                                                                                                                      |
| ind.mod.number   | which in the vector of individual level (!) moderator values shall be used (e.g., 2 for a single moderator or 1:3 for 3 moderators simultaneously)                                                                                                                                      |
| ind.mod.type     | 'cont' or 'cat' of the individual level (!) moderators (mixing them in a single model not yet possible)                                                                                                                                                                                 |
| indVarying       | allows continuous time intercepts to vary at the individual level (random intercepts model, accounts for unobserved heterogeneity)                                                                                                                                                      |
| indVaryingT0     | deprecated. Automatically set to NULL.                                                                                                                                                                                                                                                  |
| inits            | vector of start values                                                                                                                                                                                                                                                                  |
| invariantDrift   | drift labels for drift effects that are set invariant across primary studies (default = all drift effects).                                                                                                                                                                             |
| iter             | number of iterations (default = 1000). Sometimes larger values could be required from Bayesian estimation                                                                                                                                                                               |
| lambda           | R-type matrix with pattern of fixed (=1) or free (any string) loadings.                                                                                                                                                                                                                 |
| manifestMeans    | default = 0. Are automatically set free if indVarying is set to TRUE. Can be assigned labels to estimate them freely.                                                                                                                                                                   |
| manifestVars     | define the error variances (default = 0) of the manifests with a single time point using R-type lower triangular matrix with nrow=n.manifest & ncol=n.manifest.                                                                                                                         |
| mod.names        | vector of names for moderators used in output                                                                                                                                                                                                                                           |
| mod.number       | which in the vector of moderator values shall be used (e.g., 2 for a single moderator or 1:3 for 3 moderators simultaneously)                                                                                                                                                           |
| mod.type         | 'cont' or 'cat' (mixing them in a single model not yet possible)                                                                                                                                                                                                                        |
| moderatedDrift   | labels for drift effects that are moderated (default = all drift effects)                                                                                                                                                                                                               |
| modsToCompare    | when performing contrasts for categorical moderators, the moderator numbers (position in mod.number) that is used                                                                                                                                                                       |
| optimize         | if set to FALSE, Stan's Hamiltonian Monte Carlo sampler is used (default = TRUE = maximum a posteriori / importance sampling) .                                                                                                                                                         |
| primaryStudyList | could be a list of primary studies compiled with <a href="#">ctmaPrep</a> that defines the subset of studies in ctmaInitFit that should actually be used                                                                                                                                |
| priors           | if FALSE, any priors are disabled – sometimes desirable for optimization                                                                                                                                                                                                                |
| randomIntercepts | (default = FALSE) Experimental. Overrides ctsem's default mode for modelling indVarying cints.                                                                                                                                                                                          |
| sameInitialTimes | Only important for raw data. If TRUE (default=FALSE), T0MEANS occurs for every subject at the same time, rather than just at the earliest observation.                                                                                                                                  |
| scaleClus        | scale vector of cluster indicators - TRUE (default) yields avg. drift estimates, FALSE yields drift estimates of last cluster                                                                                                                                                           |

|                   |                                                                                                                                                                                                                             |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| scaleMod          | scale moderator variables - TRUE (default) recommended for continuous and categorical moderators, to separate withing and between effects                                                                                   |
| scaleTI           | scale TI predictors (default = FALSE). Does not change aggregated results anyway, just interpretation of effects for dummies representing primary studies.                                                                  |
| scaleTime         | scale time (interval) - sometimes desirable to improve fitting                                                                                                                                                              |
| T0means           | Default 0 (assuming standardized variables). Can be assigned labels to estimate them freely.                                                                                                                                |
| T0var             | (default = 'auto')                                                                                                                                                                                                          |
| transfMod         | more general option to change moderator values. A vector as long as number of moderators analyzed (e.g., c("mean(x)", "x - median(x)"))                                                                                     |
| useSampleFraction | to speed up debugging. Provided as fraction (e.g., 1/10).                                                                                                                                                                   |
| verbose           | integer from 0 to 2. Higher values print more information during model fit – for debugging                                                                                                                                  |
| WEC               | (default = FALSE) Experimental. Uses sample-size weighted effect coding of TIpred representing the dummies of the primary studies. Returns drift matrices for all primary studies.                                          |
| WECnt             | (default = TRUE) Experimental. Applies only if WEC = TRUE. Uses sample-size x time points weighted effect coding of TIpred representing the dummies of the primary studies. Returns drift matrices for all primary studies. |

## Value

ctmaFit returns a list containing some arguments supplied, the fitted model, different elements summarizing the main results, model type, and the type of plot that could be performed with the returned object. The arguments in the returned object are activeDirectory, coresToUse, moderator names (mod.names), and moderator type (mod.type). Further arguments, which are just copied from the init-fit object supplied, are, n.latent, studyList, parameterNames, and statisticsList. The fitted model is found in studyFitList, which is a large list with many elements (e.g., the ctsem model specified by CoTiMA, the rstan model created by ctsem, the fitted rstan model etc.). Further results returned are n.studies = 1 (required for proper plotting), data (synthesised pseudo raw data), and a list with modelResults (i.e., DRIFT=model\_Drift\_Coeff, DIFFUSION=model\_Diffusion\_Coeff, T0VAR=model\_T0var\_Coeff, CINT=model\_Cint\_Coeff, MOD=modTI\_Coeff, and CLUS=clusTI\_Coeff). Possible invariance constraints are included in invariantDrift. The number of moderators simultaneously analyzed are included in 'n.moderators'. The most important new results are returned as the list element "summary", which is printed if the summary function is applied to the returned object. The summary list element comprises "estimates" (the aggregated effects), possible randomEffects (not yet fully working), the minus2ll value and its n.parameters, the opt.lag sensu Dormann & Griffin (2015) and the max.effects that occur at the opt.lag, clus.effects and mod.effects, and possible warning messages (message). Plot type is plot.type=c("drift") and model.type="ct" ("omx" was deprecated, "stanct" was used until ctsem version 3.10.2).

## Examples

```
## Not run:
# Example 1. Fit a CoTiMA to all primary studies previously fitted one by one
# with the fits assigned to CoTiMAInitFit_6
```

```

CoTiMAFullFit_6 <- ctmaFit(ctmaInitFit=CoTiMAInitFit_6)
summary(CoTiMAFullFit_6)

## End(Not run)

## Not run:
# Example 2. Fit a CoTiMA with only 2 cross effects invariant (not the auto
# effects) to all primary studies previously fitted one by one with the fits
# assigned to CoTiMAInitFit_6
CoTiMAInitFit_6$activeDirectory <- "/Users/tmp/" # adapt!
CoTiMAFullInv23Fit_6 <- ctmaFit(ctmaInitFit=CoTiMAInitFit_6,
                               invariantDrift=c("V1toV2", "V2toV1"))
summary(CoTiMAFullInv23Fit_6)

## End(Not run)

## Not run:
# Example 3. Fit a moderated CoTiMA
CoTiMAInitFit_6$activeDirectory <- "/Users/tmp/" # adapt!
CoTiMAMod1onFullFit_6 <- ctmaFit(ctmaInitFit=CoTiMAInitFit_6,
                                mod.number=1, mod.type="cont",
                                mod.names=c("Control"))
summary(CoTiMAMod1onFullFit_6)

## End(Not run)

```

---

ctmaFitList

*ctmaFitList*


---

## Description

Combines CoTiMAFit objects into a list with class CoTiMAFit to inform generic functions what to do

## Usage

```
ctmaFitList(...)
```

## Arguments

... any number of CoTiMAFit objects

## Value

a list that combines all objects supplied and is assigned the class 'CoTiMAFit'

**Examples**

```
## Not run:
CoTiMAInitFit_3$activeDirectory <- "/Users/tmp/" # adapt!
CoTiMAFullFit_3$activeDirectory <- "/Users/tmp/" # adapt!
plot(ctmaFitList(CoTiMAInitFit_3, CoTiMAFullFit_3),
     timeUnit="Months",
     timeRange=c(1, 144, 1) )

## End(Not run)
```

---

ctmaFitToPrep

*ctmaFitToPrep*


---

**Description**

Extracts information from fitted CoTiMA objects to (re-)create list of primary studies originally created with [ctmaPrep](#)

**Usage**

```
ctmaFitToPrep(ctmaFitObject = NULL, reUseEmprowData = FALSE)
```

**Arguments**

```
ctmaFitObject  ctmaFitObject
reUseEmprowData
                whether data should be transferred (will be re-used in subsequent fit attempts)
```

**Value**

list that could be used for fitting new CoTiMA models with [ctmaInit](#) or [ctmaFit](#).

**Examples**

```
newStudyList <- ctmaFitToPrep(CoTiMAInitFit_3)
```

---

ctmaGenData

*ctmaGenData*


---

## Description

Generates data from lists of parameters (drift, diffusion etc). Experimental!!

## Usage

```
ctmaGenData(
  activeDirectory = NULL,
  burnin = 0,
  cint = NULL,
  coresToUse = 2,
  ctmaExtract = FALSE,
  diff = NULL,
  digits = 4,
  doPar = FALSE,
  drift = NULL,
  empirical = TRUE,
  enviro = NULL,
  sampleSizes = 100,
  lambda = NULL,
  latentNames = NULL,
  manifestMeans = NULL,
  manifestVars = NULL,
  manifestNames = NULL,
  missings = NULL,
  modValues = 0,
  n.latent = NULL,
  n.manifest = NULL,
  randomIntercepts = NULL,
  T0means = 0,
  T0var = NULL,
  TIpreds = NULL,
  tpoints = 10,
  tpointTargets = NULL,
  useRawData = NULL
)
```

## Arguments

|                 |                                                                                                                                            |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| activeDirectory | defines active directory where files are saved. No default.                                                                                |
| burnin          | vector of initial time points to be deleted (default = 0)                                                                                  |
| cint            | list of cint matrices. By default (NULL), cint matrices will be used that create a steady-state (i.e., means at all time points = T0means) |

|                  |                                                                                                                                                                                                                                                                                                      |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| coresToUse       | if neg., the value is subtracted from available cores, else value = cores to use.                                                                                                                                                                                                                    |
| ctmaExtract      | if TRUE (default = FALSE) uses ctmaExtract to extract objects required for CoTiMA into the environment specified using the argument envir. Requires the argument useRawData to be set to TRUE or FALSE.                                                                                              |
| diff             | list of diffusion matrices. By default (NULL), diffusion matrices will be used that create a steady-state (i.e., covariance at all time points = T0var)                                                                                                                                              |
| digits           | number of digits used for rounding (in outputs).                                                                                                                                                                                                                                                     |
| doPar            | parallel generating of data. if TRUE, data are generated in coresToUse parallel loops during which no output is generated (screen remains silent).                                                                                                                                                   |
| drift            | list of drift matrices. No default (all = NULL).                                                                                                                                                                                                                                                     |
| empirical        | whether (default) or not generated data that should be independent as generally assumed (e.g., diffusions at different time points, T0var, etc) are truly independent. Allow for exact estimation of parameters (no random variance; not useful for MC simulations). May require large sample sizes. |
| envir            | environment where objects should be extracted too. NULL by default. Typically one would use the global environment (envir = globalenv()). Has to be specified if ctmaExtract is set to TRUE.                                                                                                         |
| sampleSizes      | vector of sample sizes. Default = 100.                                                                                                                                                                                                                                                               |
| lambda           | list of matrices. By default all are diagonal matrices with 1 in the diagonal.                                                                                                                                                                                                                       |
| latentNames      | names for latent variables (default = NULL using generic names)                                                                                                                                                                                                                                      |
| manifestMeans    | list of manifest mean matrices. By default all are = 0.                                                                                                                                                                                                                                              |
| manifestVars     | list of manifest error (co-)variances matrices. By default all are = 0.                                                                                                                                                                                                                              |
| manifestNames    | names for manifest variables (default = NULL using generic names)                                                                                                                                                                                                                                    |
| missings         | proportion of missings (default = 0, which does not delete any value)                                                                                                                                                                                                                                |
| modValues        | list of moderator values (possible used to generate the list of drift matrices provided). By default all are = 0.                                                                                                                                                                                    |
| n.latent         | number of latent variables of the model No default (all = NULL).                                                                                                                                                                                                                                     |
| n.manifest       | number of manifest variables of the model (if left empty it will assumed to be identical with n.latent).                                                                                                                                                                                             |
| randomIntercepts | list of (co-)variances matrices of TIpreds (traits). By default all are = 0.                                                                                                                                                                                                                         |
| T0means          | list of Time 0 mean levels. By default all are = 0.                                                                                                                                                                                                                                                  |
| T0var            | list of Time 0 (co-)variance matrices. No default (all = NULL).                                                                                                                                                                                                                                      |
| TIpreds          | list of time-independent predictors, e.g., the moderators that were used to create the drift matrices. No default (all = NULL).                                                                                                                                                                      |
| tpoints          | vector of number of tpoints to be generated (default = 10).                                                                                                                                                                                                                                          |
| tpointTargets    | list of vectors of tpoints to be selectd (default = burnin:tpoints).                                                                                                                                                                                                                                 |
| useRawData       | if TRUE (or FALSE) and ctmaExtract is also TRUE, creates rawData (or empcov) objects required for CoTiMA into the environment specified using the argument envir.                                                                                                                                    |

**Value**

ctmaGenData returns a list containing ...

**Examples**

```
# Fit a ctsem model to all three primary studies summarized in
# CoTiMAstudyList_3 and save the three fitted models
## Not run:
CoTiMAInitFit_3 <- ctmaInit(primaryStudies=CoTiMAstudyList_3,
                           n.latent=2,
                           checkSingleStudyResults=FALSE,
                           activeDirectory="/Users/tmp/") # adapt!

summary(CoTiMAInitFit_3)

## End(Not run)
```

---

ctmaGetPub

*ctmaGetPub*


---

**Description**

Retrieves publication and citation information from google scholar based on the supplied author names and their google ID (user)

**Usage**

```
ctmaGetPub(authorList = NULL, flush = FALSE, yearsToExclude = NULL)
```

**Arguments**

authorList      list of authors and googe scholar addresses  
flush            if TRUE, the cache will be cleared and the data reloaded from Google.  
yearsToExclude   the years to be excluded (default = current year)

**Value**

list with (cumulative) frequencies and (cumulative) citations in google scholar

**Note**

Set flush=TRUE only if retrieving is necessary (e.g., first retrieval on a day)

## Examples

```
## Not run:
pubList_8 <- ctmaGetPub(authorList = list( c("J; de Jonge",
      "https://scholar.google.de/citations?hl=de&user=0q27IckAAAAJ"),
      c("Arnold B.; Bakker", "user=FTl3bwUAAAAJ"),
      c("Evangelia; Demerouti", "user=9mj5LvMAAAAJ"),
      c("Joachim; Stoeber", "user=T9xdVusAAAAJ"),
      c("Claude; Fernet", "user=KwzjP4sAAAAJ"),
      c("Frederic; Guay", "user=99vnhX4AAAAJ"),
      c("Caroline; Senecal", "user=64ArFWQAAAAJ"),
      c("Stéphanie; Austin", "user=PPyTI7EAAAAJ")),
      flush=FALSE)

summary(pubList_8)

## End(Not run)
```

---

ctmaInit

*ctmaInit*


---

## Description

Fits ctsem models to each primary study in the supplied list of primary studies prepared by [ctmaPrep](#).

## Usage

```
ctmaInit(
  activateRPB = FALSE,
  activeDirectory = NULL,
  binaries = NULL,
  chains = NULL,
  checkSingleStudyResults = FALSE,
  cint = 0,
  coresToUse = c(2),
  CoTiMAStanctArgs = NULL,
  customPar = FALSE,
  diff = NULL,
  digits = 4,
  doPar = 1,
  drift = NULL,
  experimental = FALSE,
  finishsamples = NULL,
  fit = TRUE,
  indVarying = FALSE,
  indVaryingT0 = NULL,
  iter = NULL,
  lambda = NULL,
  loadSingleStudyModelFit = c(),
```

```

manifestMeans = 0,
manifestVars = NULL,
n.latent = NULL,
n.manifest = 0,
optimize = TRUE,
primaryStudies = NULL,
priors = FALSE,
randomIntercepts = FALSE,
sameInitialTimes = FALSE,
saveRawData = list(),
saveSingleStudyModelFit = c(),
scaleTI = NULL,
scaleTime = NULL,
silentOverwrite = FALSE,
T0means = 0,
T0var = "auto",
useSV = FALSE,
verbose = 0
)

```

## Arguments

|                         |                                                                                                                                                                                                                            |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| activateRPB             | set to TRUE to receive push messages with 'CoTiMA' notifications on your phone                                                                                                                                             |
| activeDirectory         | defines another active directory than the one used in <a href="#">ctmaPrep</a>                                                                                                                                             |
| binaries                | which manifest is a binary. Still experimental                                                                                                                                                                             |
| chains                  | number of chains to sample, during HMC or post-optimization importance sampling.                                                                                                                                           |
| checkSingleStudyResults | Displays estimates from single study ctsem models and waits for user input to continue. Useful to check estimates before they are saved.                                                                                   |
| cint                    | default 'auto' (= 0). Are set free if random intercepts model with varying cints is requested (by indVarying='cint')                                                                                                       |
| coresToUse              | if neg., the value is subtracted from available cores, else value = cores to use                                                                                                                                           |
| CoTiMAStanctArgs        | parameters that can be set to improve model fitting of the <a href="#">ctFit</a> Function                                                                                                                                  |
| customPar               | logical. If set TRUE leverages the first pass using priors and ensure that the drift diagonal cannot easily go too negative (helps since ctsem > 3.4)                                                                      |
| diff                    | labels for diffusion effects. Have to be either of the character strings of the type "diff_eta1" or "diff_eta2_eta1" (= freely estimated) or values (e.g., 0 for effects to be excluded, which is usually not recommended) |
| digits                  | number of digits used for rounding (in outputs)                                                                                                                                                                            |
| doPar                   | parallel and multiple fitting if single studies. A value > 1 will fit each study doPar times in parallel mode during which no output is generated (screen remains silent). Useful to obtain best fit.                      |

|                         |                                                                                                                                                                                                                                                                                     |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| drift                   | labels for drift effects. Have to be either of the character strings of the type V1toV2 (= freely estimated) or values (e.g., 0 for effects to be excluded, which is usually not recommended)                                                                                       |
| experimental            | used for debugging puposes (default = FALSE)                                                                                                                                                                                                                                        |
| finishsamples           | number of samples to draw (either from hessian based covariance or posterior distribution) for final results computation (default = 1000).                                                                                                                                          |
| fit                     | TRUE (default) fits the requested model. FALSE returns the ctsem-code Co-TiMA uses to set up the model, the ctsemmodelbase which can be modified to match users requirements, and the data set (in long format created). The model can then be fitted using <a href="#">ctFit</a> ) |
| indVarying              | control for unobserved heterogeneity by having randomly (inter-individually) varying manifest means                                                                                                                                                                                 |
| indVaryingT0            | deprecated. Automatically set to NULL.                                                                                                                                                                                                                                              |
| iter                    | number of interation (default = 1000). Sometimes larger values could be required fom Bayesian estimation                                                                                                                                                                            |
| lambda                  | R-type matrix with pattern of fixed (=1) or free (any string) loadings.                                                                                                                                                                                                             |
| loadSingleStudyModelFit | load the fit of single study ctsem models                                                                                                                                                                                                                                           |
| manifestMeans           | Default 0 (assuming standardized variables). Can be assigned labels to estimate them freely.                                                                                                                                                                                        |
| manifestVars            | define the error variances of the manifests within a single time point using R-type lower triangular matrix with nrow=n.manifest & ncol=n.manifest.                                                                                                                                 |
| n.latent                | number of latent variables of the model (hast to be specified)!                                                                                                                                                                                                                     |
| n.manifest              | number of manifest variables of the model (if left empty it will assumed to be identical with n.latent).                                                                                                                                                                            |
| optimize                | if set to FALSE, Stan's Hamiltonian Monte Carlo sampler is used (default = TRUE = maximum a posteriori / importance sampling) .                                                                                                                                                     |
| primaryStudies          | list of primary study information created with <a href="#">ctmaPrep</a>                                                                                                                                                                                                             |
| priors                  | if FALSE, any priors are disabled – sometimes desirable for optimization                                                                                                                                                                                                            |
| randomIntercepts        | (default = FALSE) Experimental. Overrides ctsem's default mode for modelling indVarying cintns.                                                                                                                                                                                     |
| sameInitialTimes        | Only important for raw data. If TRUE (default=FALSE), T0MEANS occurs for every subject at the same time, rather than just at the earliest observation.                                                                                                                              |
| saveRawData             | save (synthesised pseudo) raw date. List: saveRawData\$studyNumbers, \$fileName, \$row.names, col.names, \$sep, \$dec                                                                                                                                                               |
| saveSingleStudyModelFit | save the fit of single study ctsem models (could save a lot of time afterwards if the fit is loaded)                                                                                                                                                                                |
| scaleTI                 | scale TI predictors                                                                                                                                                                                                                                                                 |
| scaleTime               | scale time (interval) - sometimes desirable to improve fitting                                                                                                                                                                                                                      |

|                 |                                                                                              |
|-----------------|----------------------------------------------------------------------------------------------|
| silentOverwrite | overwrite old files without asking                                                           |
| T0means         | Default 0 (assuming standardized variables). Can be assigned labels to estimate them freely. |
| T0var           | (default = 'auto')                                                                           |
| useSV           | if TRUE (default=FALSE) start values will be used if provided in the list of primary studies |
| verbose         | integer from 0 to 2. Higher values print more information during model fit - for debugging   |

### Value

ctmaFit returns a list containing some arguments supplied, the fitted models, different elements summarizing the main results, model type, and the type of plot that could be performed with the returned object. The arguments in the returned object are activeDirectory, coresToUse, n.latent, n.manifest, and primaryStudyList. The study count is returned as n.studies, the created matrix of loadings of manifest on latent factors is returned as lambda, and a re-organized list of primary studies with some information omitted is returned as studyList. The fitted models for each primary study are found in studyFitList, which is a large list with many elements (e.g., the ctsem model specified by CoTiMA, the rstan model created by ctsem, the fitted rstan model etc.). Further results returned are emprawList (containing the synthesised raw data created), statisticsList (comprising basic stats such as average sample size, no. of measurement points, etc.), a list with modelResults (i.e., DRIFT=model\_Drift\_Coef, DIFFUSION=model\_Diffusion\_Coef, T0VAR=model\_T0var\_Coef, CINT=model\_Cint\_Coef), and the parameter names internally used. The summary list, which is printed if the summary function is applied to the returned object, comprises "estimates" (the aggregated effects), possible randomIntercepts, confidenceIntervals, the minus2ll value and its n.parameters, and possible warning messages (message). Plot type is plot.type=c("drift") and model.type="stanct" ("omx" was deprecated).

### Examples

```
# Fit a ctsem model to all three primary studies summarized in
# CoTiMAstudyList_3 and save the three fitted models
## Not run:
CoTiMAInitFit_3 <- ctmaInit(primaryStudies=CoTiMAstudyList_3,
                           n.latent=2,
                           checkSingleStudyResults=FALSE,
                           activeDirectory="/Users/tmp/") # adapt!

summary(CoTiMAInitFit_3)

## End(Not run)
```

**Description**

used for consistent labeling of names and parameters

**Usage**

```
ctmaLabels(  
  n.latent = NULL,  
  n.manifest = 0,  
  lambda = NULL,  
  manifestVars = NULL,  
  drift = NULL,  
  diff = NULL,  
  invariantDrift = NULL,  
  moderatedDrift = NULL,  
  equalDrift = NULL,  
  T0means = 0,  
  manifestMeans = 0  
)
```

**Arguments**

|                |                |
|----------------|----------------|
| n.latent       | n.latent       |
| n.manifest     | n.manifest     |
| lambda         | lambda         |
| manifestVars   | manifestVar    |
| drift          | drift          |
| diff           | diffusion      |
| invariantDrift | invariantDrift |
| moderatedDrift | moderatedDrift |
| equalDrift     | equalDrift     |
| T0means        | T0means        |
| manifestMeans  | manifestMeans  |

**Value**

returns consistently named parameters (e.g., "V1toV2") as well as their symbolic values, which are used to fix or free parameters when fitting a 'CoTiMA' model

---

ctmaLCS

*ctmaLCS*


---

## Description

Transforms estimates obtained with `ctmaFit` into LCS (latent change score) terminology. LCS models can be estimated with CT CLPM, but results have to be transformed. When time intervals vary much between and within persons, LCS models are virtually impossible to fit. However, CT CLPM models can be fitted, and the results - after transformation - show what LCS estimates would have been (cf Voelke & Oud, 2015; their terminology to label LCS effects is used in the output created by `ctmaLCS`)

## Usage

```
ctmaLCS(
  CoTiMAFit = NULL,
  undoTimeScaling = TRUE,
  digits = 4,
  activateRPB = FALSE
)
```

## Arguments

|                              |                                                                                                                                          |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <code>CoTiMAFit</code>       | Fitted CoTiMA object.                                                                                                                    |
| <code>undoTimeScaling</code> | Whether (TRUE) or not (FALSE) LCS results should be provided ignoring the <code>scaleTime</code> argument used in <code>ctmaFit</code> . |
| <code>digits</code>          | Number of digits used for rounding (in outputs)                                                                                          |
| <code>activateRPB</code>     | set to TRUE to receive push messages with 'CoTiMA' notifications on your phone                                                           |

## Value

Returns LCS effects derived from CT CoTiMA CLPM estimates.

## Examples

```
## Not run:
LCSresults <- ctmaLCS(CoTiMAFullFit_6)

## End(Not run)
```

---

ctmaMMtoCINT

*ctmaMMtoCINT*


---

### Description

Compute covariance of CINT-based random intercepts obtained with a MANIFESTMEANS model specification and vice versa.

### Usage

```
ctmaMMtoCINT(
  ctmaFitObject = NULL,
  undoTimeScaling = FALSE,
  digits = 4,
  cintCov = NULL,
  mmCov = NULL,
  drift = NULL
)
```

### Arguments

|                 |                                                                                                                                           |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| ctmaFitObject   | fit object created with ctmaInit or ctmaFit (or with ctStanFit)                                                                           |
| undoTimeScaling | if FALSE (default), results will correspond to the \$randomIntercepts part of the summary of the equivalent model with indVarying="CINT"  |
| digits          | digits used for rounding                                                                                                                  |
| cintCov         | Covariance matrix of continuous time intercepts and T0MEANS (default NULL). Requires drift matrix of same dimensions to be supplied, too. |
| mmCov           | Covariance matrix of manifest means and T0MEANS (default NULL). Requires drift matrix of same dimensions to be supplied, too.             |
| drift           | matrix of drift parameters (default NULL). When drift together with cintCov or mmCov is supplied, any ctmaFitObject supplied is ignored.  |

### Value

returns covariance of CINT-based random intercepts.

### Examples

```
## Not run:
RI_cov <- ctmaMMtoCINT(ctmaFitObject=CoTiMAFullFit_3)
print(RI_cov)

## End(Not run)
```

---

|                 |                        |
|-----------------|------------------------|
| ctmaOptimizeFit | <i>ctmaOptimizeFit</i> |
|-----------------|------------------------|

---

## Description

Replaces deprecated `ctmaOptimizeInit`, which was limited to initial fitting (i.e., applies `ctmaInit`) of a primary study reFits times to capitalize on chance for obtaining a hard-to-find optimal fit. Now, optimizing a CoTiMA model generated with `ctmaFit` can also be done. Using `ctmaOptimizeFit` could be helpful if a model yields out-of-range estimates, which could happen if the fitting algorithm unfortunately used random start values that resulted in a locally but not globally optimal fit. Essentially, using `ctmaOptimizeFit` is like gambling, hoping that at least one set of starting values (the number it tries is specified in the `reFits` argument) enables finding the global optimal fit.

## Usage

```
ctmaOptimizeFit(
  activateRPB = FALSE,
  activeDirectory = NULL,
  coresToUse = c(2),
  CoTiMAStanctArgs = NULL,
  ctmaFitFit = NULL,
  ctmaInitFit = NULL,
  ctStanFit = NULL,
  ctStanData = NULL,
  customPar = FALSE,
  finishsamples = NULL,
  iter = 5000,
  primaryStudies = NULL,
  problemStudy = NULL,
  randomIV = FALSE,
  randomPar = FALSE,
  randomRI = FALSE,
  randomScaleTI = FALSE,
  randomScaleTime = c(1, 1),
  saveModelFits = FALSE,
  shuffleStudyList = FALSE,
  reFits = NULL,
  scaleTime = NULL,
  scaleTI = NULL,
  verbose = 1,
  ctStanFitArgs = list(stanmodeltext = NA, iter = 1000, intoverstates = TRUE, binomial =
    FALSE, fit = TRUE, intoverpop = "auto", sameInitialTimes = FALSE, stationary = FALSE,
    plot = FALSE, derrind = NA, optimize = TRUE, optimcontrol = list(), nlcontrol =
    list(), nopriors = NA, priors = FALSE, chains = 2, inits = NULL, compileArgs =
    list(), forcerecompile = FALSE, saveCompile = TRUE, savescores = FALSE,
    savesubjectmatrices = FALSE, saveComplexPars = FALSE, gendata = FALSE, control =
    list(), vb = FALSE)
```

)

**Arguments**

|                  |                                                                                                                                                                                                               |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| activateRPB      | set to TRUE to receive push messages with 'CoTiMA' notifications on your phone                                                                                                                                |
| activeDirectory  | activeDirectory                                                                                                                                                                                               |
| coresToUse       | if neg., the value is subtracted from available cores, else value = cores to use                                                                                                                              |
| CoTiMAStanctArgs | parameters that can be set to improve model fitting of the <code>ctStanFit</code> Function                                                                                                                    |
| ctmaFitFit       | a object fitted with <code>ctmaFit</code>                                                                                                                                                                     |
| ctmaInitFit      | the <code>ctmaInitFit</code> object that was used to create the <code>ctmaFitFit</code> object with <code>ctmaFit</code>                                                                                      |
| ctStanFit        | a fit object created with <code>ctStanFit</code> (default=NULL)                                                                                                                                               |
| ctStanData       | data to be used for <code>ctStanFit</code> (default=NULL)                                                                                                                                                     |
| customPar        | logical. If set TRUE leverages the first pass using priors and ensure that the drift diagonal cannot easily go too negative (helps since <code>ctsem</code> > 3.4)                                            |
| finishesamples   | number of samples to draw (either from hessian based covariance or posterior distribution) for final results computation (default = 1000).                                                                    |
| iter             | number of iterations (default = 5000)                                                                                                                                                                         |
| primaryStudies   | list of primary study information created with <code>ctmaPrep</code> or <code>ctmaFitToPrep</code>                                                                                                            |
| problemStudy     | number (position in list) where the problem study in <code>primaryStudies</code> is found                                                                                                                     |
| randomIV         | logical (default = FALSE). randomly varies between "indVarying='MANIFEST'" and "indVarying='CINT'"                                                                                                            |
| randomPar        | logical (default = FALSE). Overrides arguments used for <code>customPar</code> and randomly sets <code>customPar</code> either TRUE or FALSE                                                                  |
| randomRI         | logical (default = FALSE). randomly varies between "randomIntercepts='MANIFEST'" and "randomIntercepts='CINT'"                                                                                                |
| randomScaleTI    | logical (default = FALSE). Overrides arguments used for <code>scaleTI</code> and randomly sets <code>scaleTI</code> either TRUE or FALSE                                                                      |
| randomScaleTime  | lower and upper limit (default = <code>c(1,1)</code> ) of uniform distribution from which <code>timeScale</code> argument for <code>ctmaInit</code> is uniformly shuffled (integer)                           |
| saveModelFits    | save the fit of each Fit attempt (default = FALSE).                                                                                                                                                           |
| shuffleStudyList | (default = FALSE) randomly re-arranges studies in <code>primaryStudyList</code> . We encountered a few cases where this mattered, even though it should not. Only works if <code>ctmaFit</code> is optimized. |
| reFits           | how many reFits should be done                                                                                                                                                                                |
| scaleTime        | scale time (interval) - sometimes desirable to improve fitting                                                                                                                                                |
| scaleTI          | scale TI predictors - not recommended until version 0.5.3.1. Does not change aggregated results anyways, just interpretation of effects for dummies representing primary studies.                             |

|               |                                                                                                            |
|---------------|------------------------------------------------------------------------------------------------------------|
| verbose       | integer from 0 to 2. Higher values print more information during model fit – for debugging                 |
| ctStanFitArgs | list of arguments passed forward to ctStanFit except datalong, ctstanmodel, cores & verbose (default=NULL) |

### Value

returns a list with bestFit (= the best fit achieved), all\_minus2ll (= all -2ll values for all fitted models), and summary, which is printed if the summary function is applied to the returned object, and which shows the summary information of the ctsem model with the best fit.

### Examples

```
## Not run:
optimFit313 <- ctmaOptimizeFit(primaryStudies=CoTiMAstudyList_3,
                             activeDirectory="/Users/tmp/", # adapt!
                             problemStudy=which(CoTiMAstudyList_3$studyNumbers == 313),
                             reFits=10,
                             n.latent=2)

summary(optimFit313)

## End(Not run)
```

---

|                  |                         |
|------------------|-------------------------|
| ctmaOptimizeInit | <i>ctmaOptimizeInit</i> |
|------------------|-------------------------|

---

### Description

Initial fitting (i.e., applies [ctmaInit](#)) to a primary study reFit times to capitalize on chance for obtaining a hard-to-find optimal fit. This could be very helpful if a primary yields out-of-range estimates, which could happen if the fitting algorithm unfortunately used random start values that resulted in a locally but not globally optimal fit. Essentially, using ctmaOptimizeInit is like gambling, hoping that at least one set of starting values (the number of tries is specified in the reFits argument) enables finding the global optimal fit. On unix-like machines (e.g. MacOS), this could be done in parallel mode if coresToUse > 1.

### Usage

```
ctmaOptimizeInit(
  primaryStudies = NULL,
  activeDirectory = NULL,
  problemStudy = NULL,
  reFits = NULL,
  finishsamples = NULL,
  n.latent = NULL,
  coresToUse = c(1),
  indVarying = FALSE,
```

```

    randomScaleTime = c(1, 1),
    activateRPB = FALSE,
    checkSingleStudyResults = FALSE,
    customPar = FALSE,
    T0means = 0,
    manifestMeans = 0,
    manifestVars = NULL,
    CoTiMAStanctArgs = NULL,
    scaleTime = NULL
  )

```

## Arguments

|                                      |                                                                                                                                                                                  |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>primaryStudies</code>          | list of primary study information created with <a href="#">ctmaPrep</a> or <a href="#">ctmaFitToPrep</a>                                                                         |
| <code>activeDirectory</code>         | <code>activeDirectory</code>                                                                                                                                                     |
| <code>problemStudy</code>            | number (position in list) where the problem study in <code>primaryStudies</code> is found                                                                                        |
| <code>reFits</code>                  | how many <code>reFits</code> should be done                                                                                                                                      |
| <code>finishsamples</code>           | number of samples to draw (either from hessian based covariance or posterior distribution) for final results computation (default = 1000).                                       |
| <code>n.latent</code>                | number of latent variables of the model (has to be specified)!                                                                                                                   |
| <code>coresToUse</code>              | if neg., the value is subtracted from available cores, else value = cores to use                                                                                                 |
| <code>indVarying</code>              | control for unobserved heterogeneity by having randomly (inter-individually) varying manifest means                                                                              |
| <code>randomScaleTime</code>         | lower and upper limit of uniform distribution from which <code>timeScale</code> argument for <code>ctmaInit</code> is uniformly shuffled (integer)                               |
| <code>activateRPB</code>             | set to TRUE to receive push messages with 'CoTiMA' notifications on your phone                                                                                                   |
| <code>checkSingleStudyResults</code> | displays estimates from single study 'ctsem' models and waits for user input to continue. Useful to check estimates before they are saved.                                       |
| <code>customPar</code>               | logical. If set TRUE (default) leverages the first pass using priors and ensure that the drift diagonal cannot easily go too negative (helps since <code>ctsem &gt; 3.4</code> ) |
| <code>T0means</code>                 | Default 0 (assuming standardized variables). Can be assigned labels to estimate them freely.                                                                                     |
| <code>manifestMeans</code>           | Default 0 (assuming standardized variables). Can be assigned labels to estimate them freely.                                                                                     |
| <code>manifestVars</code>            | define the error variances of the manifests with a single time point using R-type lower triangular matrix with <code>nrow=n.manifest</code> & <code>ncol=n.manifest</code> .     |
| <code>CoTiMAStanctArgs</code>        | parameters that can be set to improve model fitting of the <a href="#">ctStanFit</a> Function                                                                                    |
| <code>scaleTime</code>               | scale time (interval) - sometimes desirable to improve fitting                                                                                                                   |

**Value**

returns a list with bestFit (= the best fit achieved), all\_minus2ll (= all -2ll values for all fitted models), and summary, which is printed if the summary function is applied to the returned object, and which shows the summary information of the ctsem model with the best fit.

**Note**

All but one of multiple cores are used on unix-type machines for parallel fitting  
During fitting, not output is generated. Be patient.

**Examples**

```
## Not run:
optimFit313 <- ctmaOptimizeInit(primaryStudies=CoTiMAstudyList_3,
                               activeDirectory="/Users/tmp/", # adapt!
                               problemStudy=which(CoTiMAstudyList_3$studyNumbers == 313),
                               reFits=10,
                               n.latent=2)

summary(optimFit313)

## End(Not run)
```

---

ctmaOTL

*ctmaOTL*


---

**Description**

Numerically determines the optimal time lag (largest effect magnitude)

**Usage**

```
ctmaOTL(
  ctmaFitFit = NULL,
  timeRange = NULL,
  driftMat = NULL,
  undoTimeScaling = NULL,
  digits = 4
)
```

**Arguments**

|                 |                                                                             |
|-----------------|-----------------------------------------------------------------------------|
| ctmaFitFit      | fit object created with ctmaFit                                             |
| timeRange       | time range across which to search for the optimal lag                       |
| driftMat        | drift matrix. Either a ctmaFit object or a drift matrix has to be supplied  |
| undoTimeScaling | undos time scaling in case the the scaleTime argument was used with ctmaFit |
| digits          | digits used for rounding                                                    |

Value

A corrected correlation matrix (corEmpcov). Corrections leading to  $r > 1.0$  are set to 1.0.

Examples

```
## Not run:
OTL <- ctmaOTL(ctmaFitFit=CoTiMA::CoTiMAFullFit_6_new)
print(OTL)

## End(Not run)
```

---

|          |                 |
|----------|-----------------|
| ctmaPlot | <i>ctmaPlot</i> |
|----------|-----------------|

---

Description

Forest plot, funnel plots, plots of discrete time cross-lagged and autoregressive effect, and plots of required sample sizes

Usage

```
ctmaPlot(
  ctmaFitObject = NULL,
  activeDirectory = NULL,
  saveFilePrefix = "ctmaPlot",
  activateRPB = FALSE,
  plotCrossEffects = TRUE,
  plotAutoEffects = TRUE,
  timeUnit = "timeUnit (not specified)",
  timeRange = c(),
  yLimitsForEffects = c(),
  mod.number = 1,
  mod.values = -2:2,
  aggregateLabel = "",
  xLabels = NULL,
  undoTimeScaling = TRUE,
  ...
)
```

Arguments

- ctmaFitObject    'CoTiMA' Fit object
- activeDirectory        defines another active directory than the one used in ctmaInitFit
- saveFilePrefix    Prefix used for saved plots

|                   |                                                                                                                    |
|-------------------|--------------------------------------------------------------------------------------------------------------------|
| activateRPB       | set to TRUE to receive push messages with 'CoTiMA' notifications on your phone                                     |
| plotCrossEffects  | logical                                                                                                            |
| plotAutoEffects   | logical                                                                                                            |
| timeUnit          | label for x-axis when plotting discrete time plots                                                                 |
| timeRange         | vector describing the time range for x-axis as sequence from/to/stepSize (e.g., c(1, 144, 1))                      |
| yLimitsForEffects | range for y-axis                                                                                                   |
| mod.number        | moderator number that should be used for plots                                                                     |
| mod.values        | moderator values that should be used for plots                                                                     |
| aggregateLabel    | label to indicate aggregated discrete time effects                                                                 |
| xLabels           | labes used for x-axis                                                                                              |
| undoTimeScaling   | if TRUE, the original time scale is used (timeScale argument possibly used in <a href="#">ctmaInit</a> is undone ) |
| ...               | arguments passed through to plot()                                                                                 |

## Value

depending on the CoTiMA fit object supplied, generates funnel plots, forest plots, discrete time plots of autoregressive and cross-lagged effects, plots of required samples sizes across a range of discrete time intervals to achieve desired levels of statistical power, and post hoc power of primary studies. Plots are saved to disk.

## Examples

```
## Not run:
# cannot run without proper activeDirectory specified. Adapt!
CoTiMAFullFit_3$activeDirectory <- "/Users/tmp/" # adapt!
plot(ctmaFitList(CoTiMAInitFit_3, CoTiMAFullFit_3),
     timeUnit="Months", timeRange=c(1, 144, 1),
     plotAutoEffects=FALSE)

## End(Not run)

## Not run:
# cannot run without proper activeDirectory specified. Adapt!
CoTiMABiG_D_B0$activeDirectory <- "/Users/tmp/" # adapt!
plot(CoTiMABiG_D_B0)

## End(Not run)
```

---

|                  |                         |
|------------------|-------------------------|
| ctmaPlotCtsemMod | <i>ctmaPlotCtsemMod</i> |
|------------------|-------------------------|

---

## Description

Plots moderator models using ctsem-fit objects

## Usage

```
ctmaPlotCtsemMod(
  ctStanFitObject = NULL,
  fitSummary = NULL,
  activeDirectory = NULL,
  TIpred.pos = 1,
  saveFilePrefix = "Moderator Plot ",
  scaleTime = 1,
  mod.sd.to.plot = -1:1,
  mod.raw.to.plot = NULL,
  digits = 4,
  timeUnit = "not specified",
  timeRange = NULL,
  mod.type = "cont",
  no.mod.cats = NULL,
  n.x.labels = NULL,
  x.Values.For.Mod.Values = NULL,
  plot = TRUE,
  plot.xMin = 0,
  plot.xMax = NULL,
  plot.yMin = NULL,
  plot.yMax = NULL,
  plot.type = "l",
  plot.lty = 1,
  plot.col = "grey",
  plot.lwd = 1.5,
  dot.plot = TRUE,
  dot.plot.type = "b",
  dot.plot.col = "black",
  dot.plot.lwd = 0.5,
  dot.plot.lty = 3,
  dot.plot.pch = 16,
  dot.plot.cex = 3
)
```

## Arguments

ctStanFitObject

The fit object with moderator (TIpred) effects to be plotted

|                         |                                                                                                                                                                       |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| fitSummary              | Mainl ofr debugging purpose. Saves computation time if provided in addition to the fit object                                                                         |
| activeDirectory         | defines the active directory (where to save plots)                                                                                                                    |
| TIpred.pos              | the TIpred that represents the moderator. Could be more than one in case of dummy variables made from categorical moderators (e.g., TIpred.pos = c(3,4))              |
| saveFilePrefix          | Prefix used for saving plots                                                                                                                                          |
| scaleTime               | Factor to increase or decrease the time scale (e.g., 1/12 if estimates were based on yearly intervals and figure should show monthly intervals)                       |
| mod.sd.to.plot          | The standard deviation values (default -1, 0, +1) for which the drift effects are plotted                                                                             |
| mod.raw.to.plot         | The raw values (default NULL) for which the drift effects are plotted. Overrides any mod.sd.to.plot values provided.                                                  |
| digits                  | number of digits used for rounding                                                                                                                                    |
| timeUnit                | Label for the x-axis                                                                                                                                                  |
| timeRange               | time range across which drift effects are plotted                                                                                                                     |
| mod.type                | Could be either "cont" or "cat"                                                                                                                                       |
| no.mod.cats             | Need to be specified if type = "cat". The number of categories should usually be equal the number of dummy variables used to represent the categorical moderator + 1. |
| n.x.labels              | How many values to be used for indicating time points on the x-axis (0 is automatically added and should not be counted)                                              |
| x.Values.For.Mod.Values | Positions where to plot the dots with moderator values. If set to 0, not moderator values will be plotted (default = NULL).                                           |
| plot                    | plots figures if TRUE (default) otherwise only return moderated drift matrices                                                                                        |
| plot.xMin               | default = 0                                                                                                                                                           |
| plot.xMax               | default = NULL                                                                                                                                                        |
| plot.yMin               | default = NULL. NULL sets the smallest y value to the smallest of all auto/cross effects plotted.                                                                     |
| plot.yMax               | default = NULL. NULL sets the largest y value to the largest of all auto/cross effects plotted.                                                                       |
| plot..type              | default = "l", # 2 dots .. are correct                                                                                                                                |
| plot.lty                | default = 1                                                                                                                                                           |
| plot.col                | default = "grey"                                                                                                                                                      |
| plot.lwd                | default = 1.5                                                                                                                                                         |
| dot.plot                | <- TRUE default = plot dots                                                                                                                                           |
| dot.plot.type           | default = "b" for the dots indicating the moderator values                                                                                                            |
| dot.plot.col            | default = "black" for the dots indicating the moderator values                                                                                                        |
| dot.plot.lwd            | default = .5 for the dots indicating the moderator values                                                                                                             |
| dot.plot.lty            | default = 3 for the dots indicating the moderator values                                                                                                              |
| dot.plot.pch            | default = 16 for the dots indicating the moderator values                                                                                                             |
| dot.plot.cex            | default = 3 for the dots indicating the moderator values                                                                                                              |

**Value**

writes png figures to disc using the path specified in the activeDirectory arguments.

**Examples**

```
#Plot a categorical moderator
## Not run:
ctmaPlotCtsemMod(ctStanFitObject = ctsemFit,
                  activeDirectory=NULL,
                  mod.sd.to.plot = NULL,
                  timeUnit = "Months",
                  timeRange = c(0, 12, .1),
                  mod.type = "cat",
                  no.mod.cats = NULL

## End(Not run)
```

---

ctmaPower

*ctmaPower*


---

**Description**

Fits a full invariant model to a list of primary studies and performs analyses of expected (post hoc) power and required sample sizes.

**Usage**

```
ctmaPower(
  ctmaInitFit = NULL,
  activeDirectory = NULL,
  statisticalPower = c(),
  failSafeN = NULL,
  failSafeP = NULL,
  timeRange = NULL,
  useMBESS = FALSE,
  coresToUse = 1,
  digits = 4,
  indVarying = FALSE,
  activateRPB = FALSE,
  silentOverwrite = FALSE,
  loadAllInvFit = c(),
  saveAllInvFit = c(),
  loadAllInvWOSingFit = c(),
  saveAllInvWOSingFit = c(),
  skipScaling = TRUE,
  useSampleFraction = NULL,
  optimize = TRUE,
```

```

    priors = FALSE,
    finishsamples = NULL,
    iter = NULL,
    chains = NULL,
    verbose = NULL,
    customPar = FALSE,
    scaleTime = NULL
  )

```

## Arguments

|                                  |                                                                                                                                          |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <code>ctmaInitFit</code>         | object to which all single 'ctsem' fits of primary studies has been assigned to (i.e., what has been returned by <code>ctmaInit</code> ) |
| <code>activeDirectory</code>     | defines another active directory than the one used in <code>ctmaInit</code>                                                              |
| <code>statisticalPower</code>    | vector of requested statistical power values                                                                                             |
| <code>failSafeN</code>           | sample size used to determine across which time intervals effects become non-significant                                                 |
| <code>failSafeP</code>           | p-value used to determine across which time intervals effects become non-significant                                                     |
| <code>timeRange</code>           | vector describing the time range for x-axis as sequence from/to/stepSize (e.g., <code>c(1, 144, 1)</code> )                              |
| <code>useMBESS</code>            | use 'MBESS' package to calculate statistical power (slower)                                                                              |
| <code>coresToUse</code>          | if negative, the value is subtracted from available cores, else value = cores to use                                                     |
| <code>digits</code>              | number of digits used for rounding (in outputs)                                                                                          |
| <code>indVarying</code>          | Allows continuous time intercepts to vary at the individual level (random effects model, accounts for unobserved heterogeneity)          |
| <code>activateRPB</code>         | set to TRUE to receive push messages with 'CoTiMA' notifications on your phone                                                           |
| <code>silentOverwrite</code>     | overwrite old files without asking                                                                                                       |
| <code>loadAllInvFit</code>       | load the fit of fully constrained 'CoTiMA' model                                                                                         |
| <code>saveAllInvFit</code>       | save the fit of fully constrained 'CoTiMA' model                                                                                         |
| <code>loadAllInvWOSingFit</code> | load series of fits of fully constrained 'CoTiMA' model with single cross effects excluded, respectively                                 |
| <code>saveAllInvWOSingFit</code> | save series of fits of fully constrained 'CoTiMA' model with single cross effects excluded, respectively                                 |
| <code>skipScaling</code>         | does not (re-)scale raw data (re-scaling of imported pseudo raw data achieves correlations = 1)                                          |
| <code>useSampleFraction</code>   | to speed up debugging. Provided as fraction (e.g., 1/10)                                                                                 |

|               |                                                                                                                                                                 |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| optimize      | if set to FALSE, Stan's Hamiltonian Monte Carlo sampler is used (default = TRUE = maximum a posteriori / importance sampling) .                                 |
| priors        | if FALSE, any priors are disabled – sometimes desirable for optimization                                                                                        |
| finishsamples | number of samples to draw (either from hessian based covariance or posterior distribution) for final results computation (default = 1000).                      |
| iter          | number of iterations (default = 1000). Sometimes larger values could be required from Bayesian estimation                                                       |
| chains        | number of chains to sample, during HMC or post-optimization importance sampling.                                                                                |
| verbose       | integer from 0 to 2. Higher values print more information during model fit – for debugging                                                                      |
| customPar     | logical. If set TRUE (default) leverages the first pass using priors and ensure that the drift diagonal cannot easily go too negative (helps since ctsem > 3.4) |
| scaleTime     | scale time (interval) - sometimes desirable to improve fitting                                                                                                  |

### Value

ctmaPower returns a list containing some arguments supplied, a fitted model with all (!) parameters invariant across primary studies, different elements summarizing the main results, model type, and the type of plot that could be performed with the returned object. The arguments in the returned object are activeDirectory, coresToUse, n.latent, n.manifest, and primaryStudyList. A further result returned is n.studies = 1 (required for proper plotting). Further arguments, which are just copied from the init-fit object supplied, are, n.latent, studyList, and the statisticsList. The fitted model is found in studyFitList, which is a large list with many elements (e.g., the ctsem model specified by CoTiMA, the rstan model created by ctsem, the fitted rstan model etc.). Further results returned are a list with modelResults (i.e., DRIFT=DRIFT, DIFFUSION=DIFFUSION, T0VAR=T0VAR, CINT=NULL) and the parameter names internally used. The summary list, which is printed if the summary function is applied to the returned object, contains "estimates", which is itself a list comprising "Estimates of Model with all Effects Invariant", "Requested Statistical Power" (which just returns the argument statisticalPower), "Power (post hoc) for Drift Effects", "Required Sample Sizes" "Effect Sizes (based on discrete-time calcs; used for power calcs.)", and "Range of significant effects" (across which intervals effects were significant). Plot type is plot.type=c("power") and model.type="ct" ("omx" was deprecated).

### Examples

```
## Not run:
CoTiMAInitFit_D_B0$activeDirectory <- "/Users/tmp/" # adapt!
CoTiMAPower_D_B0 <- ctmaPower(ctmaInitFit=CoTiMAInitFit_D_B0,
                             statisticalPower = c(.50, .80, .95),
                             finishsamples = 10000)

summary(CoTiMAPower_D_B0)

## End(Not run)
```

ctmaPRaw

*ctmaPRaw***Description**

Uses empirical correlation matrices to synthesise pseudo raw data (i.e. random data, that perfectly reproduce the correlations)

**Usage**

```
ctmaPRaw(
  empCovMat = NULL,
  empNMat = matrix(0, 0, 0),
  empN = NULL,
  studyNumber = NULL,
  empMeanVector = NULL,
  empVarVector = NULL,
  activateRPB = FALSE,
  experimental = FALSE
)
```

**Arguments**

|               |                                                                             |
|---------------|-----------------------------------------------------------------------------|
| empCovMat     | empirical primary study covariance matrix                                   |
| empNMat       | matrix of (possibly pairwise) N                                             |
| empN          | N (in case of listwise N)                                                   |
| studyNumber   | internal number                                                             |
| empMeanVector | vector of means for all variables, usually 0                                |
| empVarVector  | vector of variances for all variables, usually 1                            |
| activateRPB   | set TRUE to receive push messages with 'CoTiMA' notifications on your phone |
| experimental  | set TRUE to try new pairwise N function                                     |

ctmaPrep

*ctmaPrep***Description**

Combines information of primary studies into a list object and returns this list. This list is then used as input to fit 'ctsem' models. Primary study information is expected to be assigned to 'numbered' objects. Some of these objects are pre-defined (e.g., 'empcov', 'ageM'). Most of the pre-defined objects could be empty, or they could be dropped by entering their names in the excludedElements-object (e.g., excludedElements = c('ageM')), but dropping them is not really necessary. Additional elements could also be added, which could be useful to put together all information about primary studies at the convenience of the researcher.

**Usage**

```
ctmaPrep(
  selectedStudies = NULL,
  excludedElements = NULL,
  addElements = NULL,
  digits = 4,
  moderatorLabels = NULL,
  moderatorValues = NULL,
  newRawDataDirectory = NULL,
  n.latent = NULL,
  summary = TRUE,
  activeDirectory = NULL,
  ctmaPrepObject = NULL,
  excludedStudies = NULL
)
```

**Arguments**

- |                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>selectedStudies</code>  | Vector of primary study numbers (numeric values with no leading 0; e.g., '2' but not '02')                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <code>excludedElements</code> | Vector of predefined objects used to code primary study information. Some predefined objects are strongly defined; they have to be used in a special way because they are actually used in subsequent analyses. Some other objects could be used at the researcher's convenience (information is just collected). Strongly predefined objects are 'delta_t' (vector of time intervals; the only mandatory requirement; should be of the type <code>c(NA, NA)</code> in cases when raw data are provided), 'sampleSize' (single number), 'pairwiseN' (matrix of pairwise N; could be used if correlation matrix is based on pairwise N), 'empcov' (correlation matrix), 'moderator' (vector of numbers; could be continuous or categorical), 'startValues' (vector of start values), 'rawData' (information about file name and structure of raw data), 'empMeans' (means for variables; usually 0), and 'empVars' (variances for variables; usually 1). Weakly predefined objects are 'studyNumber' (intended as a special number used for the outputs of subsequently fitted CoTiMA models), 'source' (intended as vector of authors' names and publication year), 'ageM' (intended as value indicating the mean age of participants in a primary study), 'malePercent' (intended as value indicating the percentage of male participants in a primary study), 'occupation' (intended as vector of character strings representing the occupations of participants in a primary study), 'country' (intended as single character string representing the country in which a primary study was conducted), 'alphas' (intended as vector of Cronbach's alphas of the variables of a primary study; not yet functional), and 'targetVariables' (intended as vector of character strings representing information about the variables used).' |
| <code>addElements</code>      | User-added objects that are handled as the weakly predefined objects. The major purpose is to collect information a researcher regards as important.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <code>digits</code>           | Rounding used for summary function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                     |                                                                                                                                             |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| moderatorLabels     | character vector of names                                                                                                                   |
| moderatorValues     | list of character vectors                                                                                                                   |
| newRawDataDirectory | (NULL = default) Change paths for all raw data files.                                                                                       |
| n.latent            | (NULL = default) Only required for summary and if rawData are provided                                                                      |
| summary             | if TRUE (default) creates summary table and xlsx sheets. Could be set to FALSE in case of errors.                                           |
| activeDirectory     | Mandatory. If subsequent fitting is done using different folders or on different computers, it can be                                       |
| ctmaPrepObject      | previously created object with ctmaPrep, from which studies should be excluded. Only works in combination with the argument excludeStudies. |
| excludedStudies     | studies to be excluded from a previously created ctmaPrep-object changed so that raw data files can be loaded.                              |

### Value

List of primary studies and parameters for the following CoTiMA (plus StudyInformation which could be saved to Excel)

### Note

The following example shows information a researcher has about three studies, which have the numbers '2', '4' and '17'. All information about these studies are stored in objects ending with '2', '4', and '17', respectively. In most instances, one relevant piece of information is the empirical correlation (or covariance) matrix reported in this study, which is stored in the objects 'empcov2', 'empcov4', and 'empcov17'. Note that full and symmetric matrices are required for ctmaPrep. Usually, sample sizes ('sampleSize2', 'sampleSize4', & 'sampleSize17') and time lags ('delta\_t2', 'delta\_t4', & 'delta\_t17'), are required, too.

### Examples

```
# First Study
empcov2 <- matrix(c(1.00, 0.45, 0.57, 0.18,
                   0.45, 1.00, 0.31, 0.66,
                   0.57, 0.31, 1.00, 0.40,
                   0.18, 0.66, 0.40, 1.00), nrow=4, ncol=4)

delta_t2 <- 12
sampleSize2 <- 148
moderator2 <- c(1, 0.72)
source2 <- c("Houkes, I", "Janssen, P, P, M", "de Jonge, J",
            "& Bakker, A, B", "Study1", "2003")
addedByResearcher2 <- "something you want to add"

# Second Study
empcov3 <- matrix(c(1.00, 0.43, 0.71, 0.37,
```

```

0.43, 1.00, 0.34, 0.69,
0.71, 0.34, 1.00, 0.50,
0.37, 0.69, 0.50, 1.00), nrow=4, ncol=4)

delta_t3 <- 12
sampleSize3 <- 88
moderator3 <- c(1, 0.72)
source3 <- c("Houkes, I", "Janssen, P, P, M", "de Jonge, J",
"& Bakker, A, B", "Study2", "2003")
addedByResearcher3 <- ""

# Third Study
empcov313 <- matrix(c(1.00, 0.38, 0.54, 0.34, 0.60, 0.28,
0.38, 1.00, 0.34, 0.68, 0.28, 0.68,
0.54, 0.34, 1.00, 0.47, 0.66, 0.39,
0.34, 0.68, 0.47, 1.00, 0.38, 0.72,
0.60, 0.28, 0.66, 0.38, 1.00, 0.38,
0.28, 0.68, 0.39, 0.72, 0.38, 1.00), nrow=6, ncol=6)

delta_t313 <- c(1.5, 1.5)
sampleSize313 <- 335
moderator313 <- c(0.8, 2.47)
source313 <- c("Demerouti", "Bakker", "& Bulters", "2004")
addedByResearcher313 <- "check correlation matrix"

# Add Labels and Values for Moderators (just for optional excel tables)
moderatorLabels <- c("Control", "Social Support")
moderatorValues <- list("continuous", c("1 = very low", "2 = low",
"3 = medium", "4 = high", "5 = very high"))

CoTiMAstudyList_3 <- ctmaPrep(selectedStudies = c(2, 3, 313),
activeDirectory="/user/",
excludedElements = "ageM",
addElements = "addedByResearcher",
moderatorLabels=moderatorLabels,
moderatorValues=moderatorValues)

```

---

ctmaPub

---

ctmaPub

---

## Description

Compute publication and citation scores for studies based on the (team of) authors' publication scores .

## Usage

```

ctmaPub(
  getPubObj = NULL,
  primaryStudyList = NULL,
  yearsToExclude = 0,

```

```

    recency = 5,
    targetYear = NULL,
    indFUN = "sum",
    colFUN = "mean",
    addAsMod = FALSE
  )

```

## Arguments

|                  |                                                                                                                                  |
|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| getPubObj        | publication information compiled with <a href="#">ctmaGetPub</a>                                                                 |
| primaryStudyList | vector with numbers of studies (e.g., c(1,3); requires source1 and source3 to be available)                                      |
| yearsToExclude   | years to exclude from publications                                                                                               |
| recency          | years before targetYear that are considered for recency analysis                                                                 |
| targetYear       | year (default = last year) after which publications are ignored                                                                  |
| indFUN           | function (default = sum) how publications of each author within a collective (team) are summarized                               |
| colFUN           | function (default = mean) how publications all authors of collective (team) are summarized                                       |
| addAsMod         | currently disabled. Add to existing moderator objects (or create them) in primaryStudyList, which is part of the returned object |

## Value

returns NEPP (= the `\*number\*` of studies published by the authors of the primary studies supplied UNTIL the year when the primary study was published), NEPPRecency (like NEPP, but limited to the number of years before the publication as specified with the recency argument), "Meaning of NEPP" and "Meaning of NEPPRecency" which explain what `\*number\*` exactly means (e.g., could be the mean of the sum of each author's publication, or the sum of the maximum publications per year of the authors), and "primaryStudyList(full)", which just returns the primaryStudyList supplied).

## Examples

```

pubResults_6 <- ctmaPub(getPubObj=pubList_8,
                        primaryStudyList=CoTiMAstudyList_6)
summary(pubResults_6)

```

---

ctmaRedHet

*ctmaRedHet*


---

## Description

Computes the Reduction in Heterogeneity in drift effects after introducing study-level moderators

## Usage

```
ctmaRedHet(
  activateRPB = FALSE,
  activeDirectory = NULL,
  ctmaFitObject = NULL,
  ctmaFitObjectMod = NULL,
  digits = 4,
  dt = NULL,
  undoTimeScaling = TRUE
)
```

## Arguments

|                  |                                                                                                                                  |
|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| activateRPB      | if TRUE, messages (warning, finished) could be send to smart phone (default = FALSE)                                             |
| activeDirectory  | the directory where to save results (if not specified, it is taken from ctmaInitFit)                                             |
| ctmaFitObject    | ctmaFit Object WITHOUT Moderators (obtained from <a href="#">ctmaFit</a> with the arguments WEC='TRUE' and scaleTI=FALSE)        |
| ctmaFitObjectMod | ctmaFit Object WITH Moderators (obtained from <a href="#">ctmaFit</a> with the arguments WEC='TRUE' and scaleTI=FALSE)           |
| digits           | rounding (default = 4)                                                                                                           |
| dt               | A vector of scalars indicating a time interval across which discrete time effects should be estimated and then used for ctmaBiG. |
| undoTimeScaling  | if TRUE, the original time scale is used (timeScale argument possibly used in <a href="#">ctmaInit</a> is undone )               |

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|              |                     |
|--------------|---------------------|
| ctmaSaveFile | <i>ctmaSaveFile</i> |
|--------------|---------------------|

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## Description

Internal fcuntion to save files

## Usage

```
ctmaSaveFile(
  activateRPB,
  activeDirectory = activeDirectory,
  SaveObject,
  FileName,
  Directory,
  silentOverwrite = FALSE
)
```

## Arguments

|                 |                                                                             |
|-----------------|-----------------------------------------------------------------------------|
| activateRPB     | set TRUE to receive push messages with 'CoTiMA' notifications on your phone |
| activeDirectory | directory name                                                              |
| SaveObject      | object to save                                                              |
| FileName        | filename                                                                    |
| Directory       | directory to save file in                                                   |
| silentOverwrite | override old files without asking                                           |

## Value

No return value. Just saves files

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|                |                       |
|----------------|-----------------------|
| ctmaScaleInits | <i>ctmaScaleInits</i> |
|----------------|-----------------------|

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## Description

This function re-scales inits for drifts and sets all other inits to 0 (because it is too complicated to re-scale inits for diffusions). It uses the internal transformations of [ctStanFit](#) (i.e., tforms) to transform the raw estimates, then re-scale them, and finally use the inverse of tform to supply raw estimates as inits.

**Usage**

```
ctmaScaleInits(
  CoTiMAFit = NULL,
  ctsemFit = NULL,
  newTimeScale = NULL,
  autoRefit = FALSE
)
```

**Arguments**

|              |                                                                       |
|--------------|-----------------------------------------------------------------------|
| CoTiMAFit    | Fit object created with <a href="#">ctmaFit</a>                       |
| ctsemFit     | Fit object created with <a href="#">ctStanFit</a>                     |
| newTimeScale | New Time scale                                                        |
| autoRefit    | Whether to automatically refit the original model using the new inits |

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|                  |                         |
|------------------|-------------------------|
| ctmaShapeRawData | <i>ctmaShapeRawData</i> |
|------------------|-------------------------|

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**Description**

Raw data objects are re-shaped (dealing with missing time points, wrong time intervals etc)

**Usage**

```
ctmaShapeRawData(
  dataFrame = NULL,
  id = NULL,
  inputDataFrameFormat = NULL,
  inputTimeFormat = "time",
  missingValues = NA,
  n.manifest = NULL,
  manifest.per.latent = NULL,
  Tpoints = NULL,
  allInputVariablesNames = NULL,
  orderInputVariablesNames = NULL,
  targetInputVariablesNames = NULL,
  targetInputTDpredNames = NULL,
  targetInputTIpredNames = NULL,
  targetTimeVariablesNames = NULL,
  outputDataFrameFormat = "long",
  outputVariablesNames = "Y",
  outputTDpredNames = NULL,
  outputTIpredNames = NULL,
  outputTimeVariablesNames = "time",
  outputTimeFormat = "time",
  scaleTime = 1,
```

```

    minInterval = 1e-04,
    minToIDelta = NULL,
    maxToIDelta = NULL,
    negToIDelta = FALSE,
    min.val.n.Vars = 1,
    min.val.Tpoints = 1,
    standardization = "none"
  )

```

## Arguments

**dataFrame** an R object containing data

**id** the identifier of subjects if data are in long format

**inputDataFrameFormat** "wide" or "long"

**inputTimeFormat** "time" (default) or "delta"

**missingValues** Missing value indicator, e.g., -999 or NA (default)

**n.manifest** Number of process variables (e.g, 2 in a bivariate model)

**manifest.per.latent** n.manifest per latent factor. Frequently 1 manifest per latent, but e.g. c(2,3,1) also possible for 6 manifest loading on 3 latents

**Tpoints** Number of time points in the data frame

**allInputVariablesNames** vector of all process variable names, time dependent predictor names, time independent predictor names, and names of times/deltas. Only required if the dataFrame does not have column names.

**orderInputVariablesNames** = "names" vs "time" (e.g., names: X1, X2, X3, Y1, Y2, X3 vs time: X1, Y1, X2, Y2, ... ). For ctsem/CoTiMA, the output file will order by time.

**targetInputVariablesNames** = the process variables in the dataFrame that should be used (in "names" or in "times" order; e.g., c("X1", "X3", "Y1", "X3") ). This is used to delete variables from the data frame that are not required.

**targetInputTDpredNames** The actual time dependent (TD) predictor variable names, e.g, 3, or 6, or 9, ... names if Tpoints = 3. Internally, each of the 3, 6, etc represents one TDpred. One typically does NOT have TD predictors in a CoTiMA.

**targetInputTIpredNames** time independent (TI) predictor names in the dataFrame. One typically does NOT have TI predictors in CoTiMA except it uses raw data only, where TIpreds are available for individual cases.

**targetTimeVariablesNames** The time variables names in the dataFrame. They also define which Tpoints will be included in the output file , e.g., c("Time4", "Time9").

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| outputDataFrameFormat    | "long" (default) or "wide"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| outputVariablesNames     | "Y" (default; creates Y1_T0, Y2_T0, Y1_T1, Y2_T1, etc.), but can also be, e.g., c("X", "Y"; creates X_T0, Y_T0, X_T1, Y_T1, etc.).                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| outputTDpredNames        | Will become "TD" if not specified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| outputTIpredNames        | Will become "TI" if not specified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| outputTimeVariablesNames | "time" (default)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| outputTimeFormat         | "time" (default) or "delta"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| scaleTime                | A scalar that is used to multiply the time variable. Typical use is rescaling primary study time to the time scale use in other primary studies. For example, $scaleTime = 1/(60 \times 60 \times 24 \times 365.25)$ rescales time provided in seconds (frequent case when imported from SPSS) into years (60sec x 60min x 24hrs x 365.25days incl. leap years).                                                                                                                                                                                                               |
| minInterval              | A parameter (default = 0.0001) supplied to <code>ctIntervalise</code> . Set to smaller values than any possible observed measurement interval, but larger than 0.0001. The value is used for indicating unavailable time interval information (caused by missing values) because NA is technically not possible for time intervals.                                                                                                                                                                                                                                            |
| minTolDelta              | Set, e.g. to 1/24, to delete variables from time points that are too close (e.g., 1hr; or even before) after another time point. Could be useful to delete values generated by unreliable responding, e.g., in diary studies. Note that <code>minTolDelta</code> applies to the time intervals AFTER the <code>scaleTime</code> argument has applied (i.e., <code>scaleTime</code> may need adaptation for each primary study, but <code>minTolDelta</code> does not).                                                                                                         |
| maxTolDelta              | Set, e.g., to 7, to delete variables from time points that are too far after another time point (e.g., 7 days, if all participants should have responded within a week). Note that <code>maxTolDelta</code> applies to the time intervals AFTER the <code>scaleTime</code> argument has applied (i.e., <code>scaleTime</code> may need adaptation for each primary study, but <code>minTolDelta</code> does not).                                                                                                                                                              |
| negTolDelta              | FALSE (default) or TRUE. Delete entire cases that have at least one negative delta ('unreliable responding'; use <code>minTolDelta</code> to delete certain variables only)                                                                                                                                                                                                                                                                                                                                                                                                    |
| min.val.n.Vars           | <code>min.val.n.Vars</code> = Minimum no. of valid variables. Default = 1 (retains cases with only 1 valid variable), 0 would retain cases with all variables missing (not very useful). Retaining participants who provide a single valid variable is technically possible, but these participants contribute to the estimation of the variance/mean of this variable only. Since variance/mean are 1/0 in most CoTiMA applications, this is not very informative but at the cost of additional computational burden. Setting <code>min.val.n.Vars</code> = 2 is recommended. |
| min.val.Tpoints          | Minimum no. of valid Tpoints (i.e. Tpoints where <code>min.val.n.Vars</code> is met). Default = 1 retains participants with full set of valid variables at least at one single                                                                                                                                                                                                                                                                                                                                                                                                 |

Tpoint (which will become T0). Setting min.val.Tpoints = 2 or higher values retains participants which provide longitudinal information. Since T0 covariances are usually not too interesting, min.val.Tpoints = 2 may be more reasonable than the default = 1.

#### standardization

the way to standardize possible raw data ("none", "withinTimeA", "withinTimeB", "withinColumn", "withinPerson", or "overall"). Only applies if the list for specifying raw data information contains the list element 'standardize=TRUE'. 'WithinTimeA' standardizes within time points and deletes cases with missing T0 data. 'WithinTimeB' does not delete cases, and in subsequent ctsem or CoTiMA applications the user is advised to use the argument 'sameInitialTimes=TRUE'.

### Value

A reshaped raw data file

### Examples

```
## Not run:
tmpData <- data.frame(matrix(c(1, 2, 1, 2, 1, 2, 11, 26, 1,
                             NA, NA, 3, NA, 3, NA, 12, 27, 1,
                             1, 2, 1, 2, 1, 2, NA, 24, 0 ),
                             nrow=3, byrow=TRUE))
colnames(tmpData) <- c("first_T0", "second_T0", "first_T1", "second_T1",
                      "TD1_0", "TD1_1",
                      "time1", "time2", "sex")
shapedData <- ctmaShapeRawData(dataFrame=tmpData,
                              inputDataFrameFormat="wide",
                              inputTimeFormat="time",
                              n.manifest=2,
                              Tpoints=2,
                              orderInputVariablesNames="time",
                              targetInputVariablesNames=c("first_T0", "second_T0",
                                                            "first_T1", "second_T1"),
                              targetInputTDpredNames=c("TD1_0", "TD1_1"),
                              targetInputTIpredNames="sex",
                              targetTimeVariablesNames=c("time1", "time2"),
                              scaleTime=1/12,
                              maxTolDelta=1.2)

head(shapedData)

## End(Not run)
```

**Description**

re-sample from a fitted stanct model to achieve desired number of finishsamples (could be useful to prevent exhausted memory)

**Usage**

```
ctmaStanResample(ctmaFittedModel = NULL, nsamples = 25, overallSamples = 500)
```

**Arguments**

|                 |                                                                                      |
|-----------------|--------------------------------------------------------------------------------------|
| ctmaFittedModel | a 'CoTiMA' fit object, usually with few 'finishsamples' to prevent memory exhaustion |
| nsamples        | sample size per run                                                                  |
| overallSamples  | overall samples size to be achieved                                                  |

**Value**

returns a CoTiMA fit object with an increased number of finish samples

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|               |                      |
|---------------|----------------------|
| ctmaStdParams | <i>ctmaStdParams</i> |
|---------------|----------------------|

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**Description**

Computes standardized drift effects from a CoTiMA or ctsem fit object. Can only handle CLPM or RI-CLPM fit objects.

**Usage**

```
ctmaStdParams(  
  fit = NULL,  
  times = 1,  
  digits = 4,  
  standardize = TRUE,  
  oneTailed = FALSE  
)
```

**Arguments**

|             |                                                                                                                               |
|-------------|-------------------------------------------------------------------------------------------------------------------------------|
| fit         | CoTiMA or ctsem fit object with or without random intercepts                                                                  |
| times       | scalar (1 by default) or vector of scalars defining the discrete time lags for which standardized drift effects are computed. |
| digits      | rounding (4 by default)                                                                                                       |
| standardize | logical. TRUE (default) or FALSE (does not standardize and just computes discrete time effects)                               |
| oneTailed   | logical. FALSE (default) or TRUE. If TRUE, one-tailed CIs will be reported                                                    |

Value

ctmaStdParams returns a list of standardized discrete time drift matrices for different time intervals.

Examples

```
## Not run:
ctmaStdParams(CoTiMAFullFit_3_orig, times=c(.1, 1, 2), digits=6, standardize=TRUE)

## End(Not run)
```

---

|        |               |
|--------|---------------|
| ctmaSV | <i>ctmaSV</i> |
|--------|---------------|

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Description

derives start values by average discrete time SEM effects, converting them to continuous time, and inversely apply transformations used by 'ctsem'

Usage

```
ctmaSV(
  ctmaInitFit = NULL,
  activeDirectory = NULL,
  primaryStudies = NULL,
  coresToUse = 1,
  replaceSV = TRUE
)
```

Arguments

- ctmaInitFit      object to which all single 'ctsem' fits of primary studies has been assigned to (i.e., what has been returned by [ctmaInit](#))
- activeDirectory      defines another active directory than the one used in [ctmaInit](#)
- primaryStudies      if ctmaInitFit does not contain the primaryStudies object created with [ctmaPrep](#) it could be added
- coresToUse      if negative, the value is subtracted from available cores, else value = cores to use
- replaceSV      if TRUE replaces startValues in primaryStudies, else it saves them as list element inits

Value

returns a modified list of primary studies with starting values added or replaced

**Examples**

```
## Not run:  
newPrimaryStudyList <- ctmaSV(ctmaInitFit=CoTiMAInitFit_6)  
  
## End(Not run)
```

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|          |                                |
|----------|--------------------------------|
| delta_t1 | <i>delta_t1 example vector</i> |
|----------|--------------------------------|

---

**Description**

delta\_t1 example vector

**Usage**

delta\_t1

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|            |                                  |
|------------|----------------------------------|
| delta_t128 | <i>delta_t128 example vector</i> |
|------------|----------------------------------|

---

**Description**

delta\_t128 example vector

**Usage**

delta\_t128

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|           |                                 |
|-----------|---------------------------------|
| delta_t18 | <i>delta_t18 example vector</i> |
|-----------|---------------------------------|

---

**Description**

delta\_t18 example vector

**Usage**

delta\_t18

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|            |                                  |
|------------|----------------------------------|
| delta_t201 | <i>delta_t201 example vector</i> |
|------------|----------------------------------|

---

**Description**

delta\_t201 example vector

**Usage**

delta\_t201

**Format**

An object of class `numeric` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|            |                                  |
|------------|----------------------------------|
| delta_t228 | <i>delta_t228 example vector</i> |
|------------|----------------------------------|

---

**Description**

delta\_t228 example vector

**Usage**

delta\_t228

**Format**

An object of class logical of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|            |                                  |
|------------|----------------------------------|
| delta_t313 | <i>delta_t313 example vector</i> |
|------------|----------------------------------|

---

**Description**

delta\_t313 example vector

**Usage**

delta\_t313

**Format**

An object of class numeric of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|           |                                 |
|-----------|---------------------------------|
| delta_t32 | <i>delta_t32 example vector</i> |
|-----------|---------------------------------|

---

**Description**

delta\_t32 example vector

**Usage**

delta\_t32

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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|          |                                |
|----------|--------------------------------|
| delta_t4 | <i>delta_t4 example vector</i> |
|----------|--------------------------------|

---

**Description**

delta\_t4 example vector

**Usage**

delta\_t4

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|          |                                |
|----------|--------------------------------|
| demands1 | <i>demands1 example vector</i> |
|----------|--------------------------------|

---

**Description**

demands1 example vector

**Usage**

demands1

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|            |                                  |
|------------|----------------------------------|
| demands128 | <i>demands128 example vector</i> |
|------------|----------------------------------|

---

**Description**

demands128 example vector

**Usage**

demands128

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|           |                                 |
|-----------|---------------------------------|
| demands18 | <i>demands18 example vector</i> |
|-----------|---------------------------------|

---

**Description**

demands18 example vector

**Usage**

demands18

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|            |                                  |
|------------|----------------------------------|
| demands201 | <i>demands201 example vector</i> |
|------------|----------------------------------|

---

**Description**

demands201 example vector

**Usage**

demands201

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

demands313

*demands313 example vector*

---

**Description**

demands313 example vector

**Usage**

demands313

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

demands32

*demands32 example vector*

---

**Description**

demands32 example vector

**Usage**

demands32

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|          |                                |
|----------|--------------------------------|
| demands4 | <i>demands4 example vector</i> |
|----------|--------------------------------|

---

**Description**

demands4 example vector

**Usage**

demands4

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|         |                             |
|---------|-----------------------------|
| dl_link | <i>dl_link example path</i> |
|---------|-----------------------------|

---

**Description**

dl\_link example path

**Usage**

dl\_link

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`empcov1`*empcov1 example matrix*

---

**Description**

`empcov1` example matrix

**Usage**

`empcov1`

**Format**

An object of class `matrix` (inherits from `array`) with 4 rows and 4 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`empcov128`*empcov128 example matrix*

---

**Description**

`empcov128` example matrix

**Usage**

`empcov128`

**Format**

An object of class `matrix` (inherits from `array`) with 4 rows and 4 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`empcov18`*empcov18 example matrix*

---

**Description**

empcov18 example matrix

**Usage**

`empcov18`

**Format**

An object of class `matrix` (inherits from `array`) with 4 rows and 4 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`empcov201`*empcov201 example matrix*

---

**Description**

empcov201 example matrix

**Usage**

`empcov201`

**Format**

An object of class `matrix` (inherits from `array`) with 6 rows and 6 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`empcov313`*empcov313 example matrix*

---

**Description**

empcov313 example matrix

**Usage**

`empcov313`

**Format**

An object of class `matrix` (inherits from `array`) with 6 rows and 6 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`empcov32`*empcov32 example matrix*

---

**Description**

empcov32 example matrix

**Usage**

`empcov32`

**Format**

An object of class `matrix` (inherits from `array`) with 4 rows and 4 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|         |                               |
|---------|-------------------------------|
| empcov4 | <i>empcov4 example matrix</i> |
|---------|-------------------------------|

---

**Description**

empcov4 example matrix

**Usage**

empcov4

**Format**

An object of class `matrix` (inherits from `array`) with 4 rows and 4 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| malePercent1 | <i>malePercent1 example vector</i> |
|--------------|------------------------------------|

---

**Description**

malePercent1 example vector

**Usage**

malePercent1

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                |                                      |
|----------------|--------------------------------------|
| malePercent128 | <i>malePercent128 example vector</i> |
|----------------|--------------------------------------|

---

**Description**

malePercent128 example vector

**Usage**

malePercent128

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|               |                                     |
|---------------|-------------------------------------|
| malePercent18 | <i>malePercent18 example vector</i> |
|---------------|-------------------------------------|

---

**Description**

malePercent18 example vector

**Usage**

malePercent18

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                |                                      |
|----------------|--------------------------------------|
| malePercent201 | <i>malePercent201 example vector</i> |
|----------------|--------------------------------------|

---

**Description**

malePercent201 example vector

**Usage**

malePercent201

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                |                                      |
|----------------|--------------------------------------|
| malePercent313 | <i>malePercent313 example vector</i> |
|----------------|--------------------------------------|

---

**Description**

malePercent313 example vector

**Usage**

malePercent313

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|               |                                     |
|---------------|-------------------------------------|
| malePercent32 | <i>malePercent32 example vector</i> |
|---------------|-------------------------------------|

---

**Description**

malePercent32 example vector

**Usage**

malePercent32

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| malePercent4 | <i>malePercent4 example vector</i> |
|--------------|------------------------------------|

---

**Description**

malePercent4 example vector

**Usage**

malePercent4

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|            |                                  |
|------------|----------------------------------|
| moderator1 | <i>moderator1 example vector</i> |
|------------|----------------------------------|

---

**Description**

moderator1 example vector

**Usage**

moderator1

**Format**

An object of class `numeric` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| moderator128 | <i>moderator128 example vector</i> |
|--------------|------------------------------------|

---

**Description**

moderator128 example vector

**Usage**

moderator128

**Format**

An object of class `numeric` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|             |                                   |
|-------------|-----------------------------------|
| moderator18 | <i>moderator18 example vector</i> |
|-------------|-----------------------------------|

---

**Description**

moderator18 example vector

**Usage**

moderator18

**Format**

An object of class `numeric` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| moderator201 | <i>moderator201 example vector</i> |
|--------------|------------------------------------|

---

**Description**

moderator201 example vector

**Usage**

moderator201

**Format**

An object of class `numeric` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| moderator313 | <i>moderator313 example vector</i> |
|--------------|------------------------------------|

---

**Description**

moderator313 example vector

**Usage**

moderator313

**Format**

An object of class `numeric` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|             |                                   |
|-------------|-----------------------------------|
| moderator32 | <i>moderator32 example vector</i> |
|-------------|-----------------------------------|

---

**Description**

moderator32 example vector

**Usage**

moderator32

**Format**

An object of class `numeric` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|            |                                  |
|------------|----------------------------------|
| moderator4 | <i>moderator4 example vector</i> |
|------------|----------------------------------|

---

**Description**

moderator4 example vector

**Usage**

moderator4

**Format**

An object of class `numeric` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                 |                                       |
|-----------------|---------------------------------------|
| moderatorLabels | <i>moderatorLabels example vector</i> |
|-----------------|---------------------------------------|

---

**Description**

moderatorLabels example vector

**Usage**

moderatorLabels

**Format**

An object of class `character` of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                 |                                       |
|-----------------|---------------------------------------|
| moderatorValues | <i>moderatorValues example vector</i> |
|-----------------|---------------------------------------|

---

**Description**

moderatorValues example vector

**Usage**

moderatorValues

**Format**

An object of class list of length 2.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|             |                                   |
|-------------|-----------------------------------|
| occupation1 | <i>occupation1 example vector</i> |
|-------------|-----------------------------------|

---

**Description**

occupation1 example vector

**Usage**

occupation1

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|               |                                     |
|---------------|-------------------------------------|
| occupation128 | <i>occupation128 example vector</i> |
|---------------|-------------------------------------|

---

**Description**

occupation128 example vector

**Usage**

occupation128

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| occupation18 | <i>occupation18 example vector</i> |
|--------------|------------------------------------|

---

**Description**

occupation18 example vector

**Usage**

occupation18

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|               |                                     |
|---------------|-------------------------------------|
| occupation201 | <i>occupation201 example vector</i> |
|---------------|-------------------------------------|

---

**Description**

occupation201 example vector

**Usage**

occupation201

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|               |                                     |
|---------------|-------------------------------------|
| occupation313 | <i>occupation313 example vector</i> |
|---------------|-------------------------------------|

---

**Description**

occupation313 example vector

**Usage**

occupation313

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| occupation32 | <i>occupation32 example vector</i> |
|--------------|------------------------------------|

---

**Description**

occupation32 example vector

**Usage**

occupation32

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|             |                                   |
|-------------|-----------------------------------|
| occupation4 | <i>occupation4 example vector</i> |
|-------------|-----------------------------------|

---

**Description**

occupation4 example vector

**Usage**

occupation4

**Format**

An object of class character of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| pairwiseN128 | <i>pairwiseN128 example vector</i> |
|--------------|------------------------------------|

---

**Description**

pairwiseN128 example vector

**Usage**

```
pairwiseN128
```

**Format**

An object of class `matrix` (inherits from `array`) with 9 rows and 9 columns.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                |                       |
|----------------|-----------------------|
| plot.CoTiMAFit | <i>plot.CoTiMAFit</i> |
|----------------|-----------------------|

---

**Description**

call `ctmaPlot` if a `CoTiMAFit` object is supplied to `plot()`

**Usage**

```
## S3 method for class 'CoTiMAFit'  
plot(x, ...)
```

**Arguments**

|     |                                                                  |
|-----|------------------------------------------------------------------|
| x   | list                                                             |
| ... | further arguments to be passed through to <code>summary()</code> |

**Value**

returns a call to `'ctmaPlot'`, which is used to plot CoTiMA fit objects

---

pubList\_8

*pubList\_8 example list*

---

**Description**

pubList\_8 example list

**Usage**

pubList\_8

**Format**

An object of class CoTiMAFit of length 9.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

rawData228

*rawData228 example list*

---

**Description**

rawData228 example list

**Usage**

rawData228

**Format**

An object of class list of length 7.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                    |                                          |
|--------------------|------------------------------------------|
| recodeVariables128 | <i>recodeVariables128 example vector</i> |
|--------------------|------------------------------------------|

---

### Description

recodeVariables128 example vector

### Usage

recodeVariables128

### Format

An object of class character of length 2.

### Author(s)

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|            |                                |
|------------|--------------------------------|
| results128 | <i>results128 example list</i> |
|------------|--------------------------------|

---

### Description

results128 example list

### Usage

results128

### Format

An object of class list of length 3.

### Author(s)

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|             |                                   |
|-------------|-----------------------------------|
| sampleSize1 | <i>sampleSize1 example vector</i> |
|-------------|-----------------------------------|

---

**Description**

sampleSize1 example vector

**Usage**

sampleSize1

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|               |                                     |
|---------------|-------------------------------------|
| sampleSize128 | <i>sampleSize128 example vector</i> |
|---------------|-------------------------------------|

---

**Description**

sampleSize128 example vector

**Usage**

sampleSize128

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| sampleSize18 | <i>sampleSize18 example vector</i> |
|--------------|------------------------------------|

---

**Description**

sampleSize18 example vector

**Usage**

sampleSize18

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|               |                                     |
|---------------|-------------------------------------|
| sampleSize201 | <i>sampleSize201 example vector</i> |
|---------------|-------------------------------------|

---

**Description**

sampleSize201 example vector

**Usage**

sampleSize201

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|               |                                     |
|---------------|-------------------------------------|
| sampleSize313 | <i>sampleSize313 example vector</i> |
|---------------|-------------------------------------|

---

**Description**

sampleSize313 example vector

**Usage**

```
sampleSize313
```

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|              |                                    |
|--------------|------------------------------------|
| sampleSize32 | <i>sampleSize32 example vector</i> |
|--------------|------------------------------------|

---

**Description**

sampleSize32 example vector

**Usage**

```
sampleSize32
```

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|             |                                   |
|-------------|-----------------------------------|
| sampleSize4 | <i>sampleSize4 example vector</i> |
|-------------|-----------------------------------|

---

**Description**

sampleSize4 example vector

**Usage**

sampleSize4

**Format**

An object of class `numeric` of length 1.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|         |                               |
|---------|-------------------------------|
| source1 | <i>source1 example vector</i> |
|---------|-------------------------------|

---

**Description**

source1 example vector

**Usage**

source1

**Format**

An object of class `character` of length 6.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`source128`*source128 example vector*

---

**Description**

source128 example vector

**Usage**

`source128`

**Format**

An object of class character of length 4.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`source18`*source18 example vector*

---

**Description**

source18 example vector

**Usage**

`source18`

**Format**

An object of class character of length 4.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`source201`*source201 example vector*

---

**Description**

source201 example vector

**Usage**

`source201`

**Format**

An object of class character of length 6.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

`source313`*source313 example vector*

---

**Description**

source313 example vector

**Usage**

`source313`

**Format**

An object of class character of length 4.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|         |                               |
|---------|-------------------------------|
| source4 | <i>source4 example vector</i> |
|---------|-------------------------------|

---

**Description**

source4 example vector

**Usage**

source4

**Format**

An object of class character of length 6.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                   |                          |
|-------------------|--------------------------|
| summary.CoTiMAFit | <i>summary.CoTiMAFit</i> |
|-------------------|--------------------------|

---

**Description**

defines summary for 'CoTiMA' fit objects

**Usage**

```
## S3 method for class 'CoTiMAFit'
summary(object, ...)
```

**Arguments**

|        |                                                                    |
|--------|--------------------------------------------------------------------|
| object | one CoTiMAFit object or more as ctmaFitList(object1, object2, ...) |
| ...    | further arguments to be passed through to summary()                |

**Value**

returns a printed summary of a 'CoTiMA' fit object

---

|                  |                                        |
|------------------|----------------------------------------|
| targetVariables1 | <i>targetVariables1 example vector</i> |
|------------------|----------------------------------------|

---

**Description**

targetVariables1 example vector

**Usage**

targetVariables1

**Format**

An object of class character of length 4.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                    |                                          |
|--------------------|------------------------------------------|
| targetVariables128 | <i>targetVariables128 example vector</i> |
|--------------------|------------------------------------------|

---

**Description**

targetVariables128 example vector

**Usage**

targetVariables128

**Format**

An object of class character of length 7.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                    |                                          |
|--------------------|------------------------------------------|
| targetVariables313 | <i>targetVariables313 example vector</i> |
|--------------------|------------------------------------------|

---

**Description**

targetVariables313 example vector

**Usage**

targetVariables313

**Format**

An object of class character of length 6.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                  |                                        |
|------------------|----------------------------------------|
| targetVariables4 | <i>targetVariables4 example vector</i> |
|------------------|----------------------------------------|

---

**Description**

targetVariables4 example vector

**Usage**

targetVariables4

**Format**

An object of class character of length 4.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                  |                                        |
|------------------|----------------------------------------|
| variableNames128 | <i>variableNames128 example vector</i> |
|------------------|----------------------------------------|

---

**Description**

variableNames128 example vector

**Usage**

```
variableNames128
```

**Format**

An object of class character of length 9.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                 |                                       |
|-----------------|---------------------------------------|
| variableNames18 | <i>variableNames18 example vector</i> |
|-----------------|---------------------------------------|

---

**Description**

variableNames18 example vector

**Usage**

```
variableNames18
```

**Format**

An object of class character of length 4.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                               |                                        |
|-------------------------------|----------------------------------------|
| <code>variableNames201</code> | <i>variableNames201 example vector</i> |
|-------------------------------|----------------------------------------|

---

**Description**

`variableNames201` example vector

**Usage**

`variableNames201`

**Format**

An object of class character of length 6.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

---

|                              |                                       |
|------------------------------|---------------------------------------|
| <code>variableNames32</code> | <i>variableNames32 example vector</i> |
|------------------------------|---------------------------------------|

---

**Description**

`variableNames32` example vector

**Usage**

`variableNames32`

**Format**

An object of class character of length 4.

**Author(s)**

C. Dormann & M. Homburg <CoTiMA@uni-mainz.org>

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