

Package ‘childsds’

September 30, 2020

Title Data and Methods Around Reference Values in Pediatrics

Version 0.7.6

Description Calculation of standard deviation scores and percentiles adduced from different growth standards (WHO, UK, Germany, Italy, China, etc). Therefore, the calculation of SDS-values for different measures like BMI, weight, height, head circumference, different ratios, etc. are easy to carry out. Also, references for laboratory values in children and adults are available, e.g., serum lipids, iron-related blood parameters, IGF, liver enzymes. In the new version, there are also functions combining the `lms()` function from package 'gamlss' with resampling methods for using with repeated measurements and family dependencies. A searchable list of items can be found here: <https://github.com/mvogel78/chilsds/wiki>.

Depends R (>= 3.5.0)

Imports gamlss, gamlss.dist, dplyr, magrittr, methods, tidyr, boot, class, tibble, reshape2, purrr, purrrlyr, utils, VGAM

Suggests ggplot2

BugReports <https://github.com/mvogel78/chilsds/issues>

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

NeedsCompilation no

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<i>aga_15.ref</i>	<i>Parameters from recommendations of the German Adiposity Association (2015, AGA)</i>
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Description

Parameters from recommendations of the German Adiposity Association (2015, AGA)

Usage

aga_15.ref

Source

"Kromeyer-Hauschild K, Moss A, Wabitsch M. Referenzwerte fuer den Body-Mass-Index fuer Kinder, Jugendliche und Erwachsene in Deutschland. *Adipositas - Ursachen, Folgeerkrankungen, Therapie*. 2015;09(3):123-7."

aggregate_lms *aggregate lms parameters*

Description

aggregate lms parameters

Usage

```
aggregate_lms(lms.list)
```

Arguments

lms.list list of parameter tables as returned by do_iterations()

Details

function takes the lms part of the result from the do_iterations() function and returns the mean parameters

Value

list of dataframes containing the aggregated parameters, each for every level of sex

Author(s)

Mandy Vogel

belgium.ref *Parameters derived from Flandern population*

Description

Parameters derived from Flandern population

Usage

```
belgium.ref
```

Source

Roelants M, Hauspie R, Hoppenbrouwers K. References for growth and pubertal development from birth to 21 years in Flanders, Belgium. *Annals of Human Biology*. 2009 Dezember;36(6):680-94.

bone.ref	<i>Parameters for different carotid artery intima-media thickness and distensibility</i>
----------	--

Description

Parameters for different carotid artery intima-media thickness and distensibility

Usage

bone.ref

Source

"Geserick M, Vogel M, Eckelt F, et al. Children and adolescents with obesity have reduced serum bone turnover markers and 25-hydroxyvitamin D but increased parathyroid hormone concentrations – Results derived from new pediatric reference ranges. *Bone* 2020;132:115124"

bp_wuehl_age.ref	<i>Parameters from Wuehl et al. blood pressure reference values Germany according to age, from version 0.7.3 unplausible values are replaced by interpolated ones. For the original values check out earlier versions</i>
------------------	---

Description

Parameters from Wuehl et al. blood pressure reference values Germany according to age, from version 0.7.3 unplausible values are replaced by interpolated ones. For the original values check out earlier versions

Usage

bp_wuehl_age.ref

Source

"Wuehl E, Witte K, Soergel M, Mehls O, Schaefer F, Hypertension for the GWG on P. Distribution of 24-h ambulatory blood pressure in children: normalized reference values and role of body dimensions. *Journal of Hypertension*. 2002 Oct;20(10):1995.", implausible values were replaced by interpolated ones from package version 0.7.4

bp_wuehl_height.ref *Parameters from Wuehl et al. blood pressure reference values Germany according to height from version 0.7.3 unplaussible values are replaced by interpolated ones. For the original values check out earlier versions*

Description

Parameters from Wuehl et al. blood pressure reference values Germany according to height from version 0.7.3 unplaussible values are replaced by interpolated ones. For the original values check out earlier versions

Usage

bp_wuehl_height.ref

Source

"Wuehl E, Witte K, Soergel M, Mehls O, Schaefer F, Hypertension for the GWG on P. Distribution of 24-h ambulatory blood pressure in children: normalized reference values and role of body dimensions. Journal of Hypertension. 2002 Oct;20(10):1995.", implausible values were replaced by interpolated ones from package version 0.7.4

calc_confints *Calculate confidence intervals*

Description

Calculate confidence intervals

Usage

```
calc_confints(
  lms.list,
  perc = c(2.5, 5, 50, 95, 97.5),
  level = 0.95,
  type = c("point")
)
```

Arguments

lms.list	lms part of the returned list of do_iterations
perc	percentiles for which the confidence bands are calculated
level	confidence level
type	for now only point is a valid value

Details

The function takes a lms list as returned by `do_iterations` and calculates the confidence bands for a given set of percentiles using `envelope` from the boot package

Value

list containing the respective confidence envelopes

Author(s)

mandy

cdc.ref	<i>LMS Parameters for the Centers for Disease Control and Prevention 2000 Growth Charts, contains bmi, height, head circumference, weight, weight for length,</i>
---------	---

Description

LMS Parameters for the Centers for Disease Control and Prevention 2000 Growth Charts, contains bmi, height, head circumference, weight, weight for length,

Usage

cdc.ref

Source

National health statistics reports 63.

cn.ref	<i>Parameters for height of normal weight and obese children from the CrescNet database dependent on height</i>
--------	---

Description

Parameters for height of normal weight and obese children from the CrescNet database dependent on height

Usage

cn.ref

Source

"Kempf et al. In progress"

colombia_sf.ref

*Parameters of skinfold measures derived from Colombian population***Description**

Parameters of skinfold measures derived from Colombian population

Usage

colombia_sf.ref

Source

Ramirez-Velez, R. et al. Triceps and Subscapular Skinfold Thickness Percentiles and Cut-Offs for Overweight and Obesity in a Population-Based Sample of Schoolchildren and Adolescents in Bogota, Colombia. *Nutrients* 8, (2016).

doyon_age.ref

*Parameters for different carotid artery intima-media thickness and distensibility dependent on age***Description**

Parameters for different carotid artery intima-media thickness and distensibility dependent on age

Usage

doyon_age.ref

Source

"Doyon A, Kracht D, Bayazit AK, et al. Carotid artery intima-media thickness and distensibility in children and adolescents: reference values and role of body dimensions. *Hypertension* 2013;62(3):550-6"

doyon_height.ref	<i>Parameters for different carotid artery intima-media thickness and distensibility dependent on height</i>
------------------	--

Description

Parameters for different carotid artery intima-media thickness and distensibility dependent on height

Usage

doyon_height.ref

Source

"Doyon A, Kracht D, Bayazit AK, et al. Carotid artery intima-media thickness and distensibility in children and adolescents: reference values and role of body dimensions. Hypertension 2013;62(3):550-6"

do_iterations	<i>do lms iterations</i>
---------------	--------------------------

Description

Do lms iterations

Usage

```
do_iterations(
  data.list,
  n = 10,
  max.it = 1000,
  method = "gamlss",
  prop.fam = 0.75,
  prop.subject = 1,
  age.min = 0,
  age.max = 18,
  age.int = 1/12,
  keep.models = F,
  dist = "BCCGo",
  mu.df = 4,
  sigma.df = 3,
  nu.df = 2,
  tau.df = 2,
  verbose = F,
  formula = NULL,
```

```

sigma.formula = ~1,
nu.formula = ~1,
tau.formula = ~1,
method.pb = "ML",
trans.x = F,
lim.trans = c(0, 1.5)
)

```

Arguments

data.list	list of dataframes as returned by prepare_data
n	number of desired fits
max.it	maximum number of iterations that will be run
method	use vgam or gamlss
prop.fam	proportion of families to be sampled
prop.subject	proportion of subject to be sampled
age.min	lower bound of age
age.max	upper bound of age
age.int	stepwidth of the age variable
keep.models	indicator whether or not models in each iteration should be kept
dist	distribution used for the fitting process, has to be one of BCCGo, BCPEo, BCTo as they are accepted by lms()
mu.df	degree of freedom location parameter
sigma.df	degree of freedom spread parameter
nu.df	degree of freedom skewness parameter
tau.df	degree of freedom kurtosis parameter
verbose	whether or not information about sampling will be printed during while iterate
formula	formula for the location parameter
sigma.formula	formula for the sigma parameter
nu.formula	formula for the nu parameter
tau.formula	formula for the tau parameter
method.pb	GAIC or ML
trans.x	indicator wether age should be transformed or not
lim.trans	limits for the exponent of transformation of age

Details

function samples families, samples measurements (and subjects), fits the model for a given number of iterations

Value

list of lists for models and fitted parameters

Author(s)

Mandy Vogel

duran_bf.ref*Parameters for bodyfat (for Whites, Blacks, and Mexican-Americans)*

Description

Parameters for bodyfat (for Whites, Blacks, and Mexican-Americans)

Usage

duran_bf.ref

Source

"Duran I, Martakis K, Rehberg M, Stark C, Schafmeyer L, Schoenau E. Reference Centiles for the Evaluation of Nutritional Status in Children using Body Fat Percentage, Fat Mass and Lean Body Mass Index. Journal of Clinical Densitometry [Internet] 2019 [cited 2019 Mar 19];Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1094695018302622>"

ethiop.ref*Parameters derived Ethiopian children*

Description

Parameters derived Ethiopian children

Usage

ethiop.ref

Source

Amare, E. B. et al. Reference Ranges for Head Circumference in Ethiopian Children 0–2 Years of Age. World Neurosurgery 84, 1566–1571.e2 (2015).

 fit_gamlss

fit lms

Description

fit_gamlss

Usage

```
fit_gamlss(
  data,
  age.min = 0.25,
  age.max = 18,
  age.int = 1/12,
  keep.models = F,
  dist = "BCCGo",
  mu.df = 4,
  sigma.df = 3,
  nu.df = 2,
  tau.df = 2,
  trans.x = F,
  lim.trans = c(0, 1.5),
  value,
  tmpdata
)
```

Arguments

data	dataframe as return by select_meas()
age.min	lower bound of age
age.max	upper bound of age
age.int	stepwidth of the age variable
keep.models	indicator whether or not models in each iteration should be kept
dist	distribution used for the fitting process, has to be one of BCCGo, BCPEo, BCTo as they are accepted by lms()
mu.df	degree of freedom location parameter
sigma.df	degree of freedom spread parameter
nu.df	degree of freedom skewness parameter
tau.df	degree of freedom kurtosis parameter
trans.x	indicator whether age should be transformed or not
lim.trans	limits for the exponent of transformation of age
value	names of the value variable (character) if different from value, ignored
tmpdata	ignored

Details

wrapper around the `lms` function in the `gamlss` package returns the fitted `lms`-parameter at given age points the function is called inside `do_iterations` and may not called directly

Value

list containing a dataframe of the fitted `lms` parameter at the given age points and the fitted model

Author(s)

Mandy Vogel

<code>fit_gamlss1</code>	<i>fit_gamlss1</i>
--------------------------	--------------------

Description

`fit_gamlss`

Usage

```
fit_gamlss1(
  data,
  age.min = 0,
  age.max = 80,
  age.int = 1/12,
  keep.models = F,
  dist = "BCCGo",
  formula = NULL,
  sigma.formula = ~1,
  nu.formula = ~1,
  tau.formula = ~1,
  method.pb = "ML"
)
```

Arguments

<code>data</code>	dataframe as return by <code>select_meas()</code>
<code>age.min</code>	lower bound of age
<code>age.max</code>	upper bound of age
<code>age.int</code>	stepwidth of the age variable
<code>keep.models</code>	indicator whether or not models in each iteration should be kept
<code>dist</code>	distribution used for the fitting process, has to be one of <code>BCCGo</code> , <code>BCPEo</code> , <code>BCTo</code> as they are accepted by <code>lms()</code>
<code>formula</code>	formula for the location parameter

sigma.formula	formula for the sigma parameter
nu.formula	formula for the nu parameter
tau.formula	formula for the tau parameter
method.pb	GAIC or ML

Details

wrapper around the `gamlss` function from the `gamlss` package returns the fitted lms-parameter at given age points the function is called inside `do_iterations` and may not be called directly

Value

list containing a dataframe of the fitted lms parameter at the given age points and the fitted model

Author(s)

Mandy Vogel

fit_vgam	<i>fit lms parameters via VGAM</i>
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Description

fit `gamlss`

Usage

```
fit_vgam(
  data,
  age.min = 0.25,
  age.max = 18,
  age.int = 1/12,
  keep.models = F,
  dist = "BCN",
  mu.df = 4,
  sigma.df = 3,
  nu.df = 2,
  value
)
```

Arguments

data	dataframe as return by <code>select_meas()</code>
age.min	lower bound of age
age.max	upper bound of age
age.int	stepwidth of the age variable

keep.models	indicator whether or not models in each iteration should be kept
dist	distribution used for the fitting process, has to be one of BCCGo, BCPEo, BCTo as they are accepted by lms()
mu.df	degree of freedom location parameter
sigma.df	degree of freedom spread parameter
nu.df	degree of freedom skewness parameter
value	names of the value variable (character) if different from value, ignored

Details

wrapper around the `vgam` function in the VGAM package returns the fitted lms-parameter at given age points the function is called inside `do_iterations` and may not called directly

Value

list containing a dataframe of the fitted lms parameter at the given age points and the fitted model

Author(s)

mandy

fredriks05.ref

Parameters derived from Dutch children (additional to nl4.ref)

Description

Parameters derived from Dutch children (additional to nl4.ref)

Usage

fredriks05.ref

Source

Fredriks, A. M. et al. Nationwide age references for sitting height, leg length, and sitting height/height ratio, and their diagnostic value for disproportionate growth disorders. *Archives of Disease in Childhood* 90, 807–812 (2005)

international_lab.ref *International Laboratory Parameters Tables*

Description

International Laboratory Parameters Tables

Usage

international_lab.ref

Source

Bidlingmaier, M., Friedrich, N., Emeny, R.T., Spranger, J., Wolthers, O.D., Roswall, J., Koerner, A., Obermayer-Pietsch, B., Huebener, C., Dahlgren, J., others, 2014. Reference intervals for insulin-like growth factor-1 (IGF-I) from birth to senescence: results from a multicenter study using a new automated chemiluminescence IGF-I immunoassay conforming to recent international recommendations. *The Journal of Clinical Endocrinology & Metabolism* 99, 1712-1721.

Friedrich, N., Wolthers, O.D., Arafat, A.M., Emeny, R.T., Spranger, J., Roswall, J., Kratzsch, J., Grabe, H.J., Huebener, C., Pfeiffer, A.F.H., Doering, A., Bielohuby, M., Dahlgren, J., Frystyk, J., Wallaschofski, H., Bidlingmaier, M., 2014. Age- and Sex-Specific Reference Intervals Across Life Span for Insulin-Like Growth Factor Binding Protein 3 (IGFBP-3) and the IGF-I to IGFBP-3 Ratio Measured by New Automated Chemiluminescence Assays. *The Journal of Clinical Endocrinology & Metabolism* 99, 1675-1686. doi:10.1210/jc.2013-3060

iron.ref

Parameters for iron-related blood parameters in children

Description

Parameters for iron-related blood parameters in children

Usage

iron.ref

Source

Rieger, K. et al. Reference intervals for iron-related blood parameters: results from a population-based cohort study (LIFE Child). *LaboratoriumsMedizin* 40, (2016).

italian.ref

Parameters derived from Italian children

Description

Parameters derived from Italian children

Usage

italian.ref

Source

Cacciari E, Milani S, Balsamo A, Spada E, Bona G, Cavallo L, et al. Italian cross-sectional growth charts for height, weight and BMI (2 to 20 yr). *J Endocrinol Invest.* 2006 Jul 1;29(7):581–93.

japanese.ref

Parameters derived from Japanese children

Description

Parameters derived from Japanese children

Usage

japanese.ref

Source

Inokuchi, M., Matsuo, N., Anzo, M., Takayama, J. I. & Hasegawa, T. Age-dependent percentile for waist circumference for Japanese children based on the 1992–1994 cross-sectional national survey data. *Eur J Pediatr* 166, 655–661 (2007)

japan_lab.ref

*Parameters of serum insulin-like growth factor-I (IGF-I)***Description**

Parameters of serum insulin-like growth factor-I (IGF-I)

Usage

japan_lab.ref

Source

Isojima, T., Shimatsu, A., Yokoya, S., Chihara, K., Tanaka, T., Hizuka, N., Teramoto, A., Tatsumi, K., Tachibana, K., Katsumata, N., Horikawa, R., 2012. Standardized centile curves and reference intervals of serum insulin-like growth factor-I (IGF-I) levels in a normal Japanese population using the LMS method. *Endocrine Journal* 59, 771-780. doi:10.1507/endocrj.EJ12-0110

kiggs.ref

LMS Parameters for German reference data (KiGGS, 2003-2006) for height, weight, bmi, hip, whr, whtr, bodyfat, skinfold sum, triceps skinfold, subscapular skinfold, and waist circumference

Description

LMS Parameters for German reference data (KiGGS, 2003-2006) for height, weight, bmi, hip, whr, whtr, bodyfat, skinfold sum, triceps skinfold, subscapular skinfold, and waist circumference

Usage

kiggs.ref

Source

Referenzperzentile fuer anthropometrische Masszahlen und Blutdruck aus KiGGS 2003-2006, Robert Koch Institut, Germany

kiggs_bp.ref

Parameters derived from the German KiGGS cohort

Description

Parameters derived from the German KiGGS cohort

Usage

kiggs_bp.ref

Details

contains 2-dimensional reference grid. Do not use with [sds](#) but [sds_2d](#)

Source

Neuhauser, H. K., Thamm, M., Ellert, U., Hense, H. W. & Rosario, A. S. Blood Pressure Percentiles by Age and Height from Nonoverweight Children and Adolescents in Germany. *Pediatrics* peds.2010-1290 (2011). doi:10.1542/peds.2010-1290.

kro.ref

LMS Parameters for German reference data (Kromeyer Hauschild, 2001) for height, weight, bmi, and waist circumference, including preterm correction (Voigt)

Description

LMS Parameters for German reference data (Kromeyer Hauschild, 2001) for height, weight, bmi, and waist circumference, including preterm correction (Voigt)

Usage

kro.ref

Source

Perzentile fuer den Body-mass-Index fuer das Kindes- und Jugendalter unter Heranziehung verschiedener deutscher Stichproben, *Monatsschrift Kinderheilkunde* August 2001, Volume 149, Issue 8, pp 807-818; Fruehgeborenenkorrektur nach Voigt

life_circ.ref	<i>Parameters for different circumferences and whr and whtr</i>
---------------	---

Description

Parameters for different circumferences and whr and whtr

Usage

life_circ.ref

Source

"Roennecke E, Vogel M, Bussler S, Grafe N, Jurkutat A, Schlingmann M, Koerner A, Kiess W. Age- and sex-related percentiles of skinfold thickness, waist and hip circumference, Waist-to- Hip Ratio and Waist-to-Height Ratio: Results from a population-based paediatric cohort in Germany (LIFE Child). Obesity Facts. 2019."

life_liver.ref	<i>Parameters for serum liver enzymes</i>
----------------	---

Description

Parameters for serum liver enzymes

Usage

life_liver.ref

Source

Bussler et al, New pediatric percentiles of liver enzyme serum levels (ALT, AST, GGT): effects of age, sex, BMI and pubertal stage, Hepatology 2017

life_skinfold.ref	<i>Parameters for different skinfolds</i>
-------------------	---

Description

Parameters for different skinfolds

Usage

life_skinfold.ref

Source

"Roennecke E, Vogel M, Bussler S, Grafe N, Jurkutat A, Schlingmann M, Koerner A, Kiess W. Age- and sex-related percentiles of skinfold thickness, waist and hip circumference, Waist-to- Hip Ratio and Waist-to-Height Ratio: Results from a population-based paediatric cohort in Germany (LIFE Child). Obesity Facts. 2019."

life_thyr.ref	<i>Parameters for TSH, FT3, FT4 from the LIFE Child cohort dependent on height</i>
---------------	--

Description

Parameters for TSH, FT3, FT4 from the LIFE Child cohort dependent on height

Usage

life_thyr.ref

Source

"Surup et al. In progress"

lipids.ref	<i>Parameters for serum lipids in children</i>
------------	--

Description

Parameters for serum lipids in children

Usage

lipids.ref

Source

Dathan-Stumpf, A. et al. Pediatric reference data of serum lipids and prevalence of dyslipidemia: Results from a population-based cohort in Germany. *Clinical Biochemistry* 49, 740–749 (2016).

make_percentile_tab	<i>calculate raw values</i>
---------------------	-----------------------------

Description

Calculate raw values for percentile curve

Usage

```
make_percentile_tab(
  ref,
  item,
  perc = c(2.5, 5, 50, 95, 97.5),
  stack = F,
  age = NULL,
  include.pars = T,
  digits = 4,
  sex
)
```

Arguments

ref	Refgroup object
item	name of the measurement item
perc	vector of percentiles to be calculated
stack	wether or not the data should be stacked, stacked data would most possibly be used in ggplot2
age	desired values of age

include.pars	indicator whether or not parameters should be included
digits	specification of number of decimal places
sex	name of the sex variable (character) if different from sex, not functional in this version and therefore ignored

Details

calculates quantile values for given RefGroup and given percentiles

Value

data frame either with the different percentiles as columns or, if stacked, as data frame with four columns: age, sex, variable, value

Author(s)

Mandy Vogel

Examples

```
ptab <- make_percentile_tab(ref = kro.ref,
                           item = "height",
                           perc = c(2.5,10,50,90,97.5),
                           stack = TRUE)

ggplot2::ggplot(ptab, ggplot2::aes(x = age, y = value, colour = variable)) +
  ggplot2::geom_line() +
  ggplot2::facet_wrap(~ sex, nrow = 2)
```

metabolom.ref	<i>Parameters for different metabolom parameters from the LIFE Child cohort dependent on height</i>
---------------	---

Description

Parameters for different metabolom parameters from the LIFE Child cohort dependent on height

Usage

```
metabolom.ref
```

Source

"Hirschel, J., Vogel, M., Baber, R., Garten, A., Beuchel, C., Dietz, Y., Dittrich, J., Körner, A., Kiess, W., & Ceglarek, U. (2020). Relation of Whole Blood Amino Acid and Acylcarnitine Metabolome to Age, Sex, BMI, Puberty, and Metabolic Markers in Children and Adolescents. *Metabolites*, 10(4), 149. <https://doi.org/10.3390/metabo10040149>"

mock_df	<i>Mock a data frame</i>
---------	--------------------------

Description

mock values for a given reference

Usage

```
mock_df(ref, item, n = 1000)
```

Arguments

ref	a valid RefGroup object
item	a valid imte present in ref
n	how many values should be created

Details

mock values for a given reference

Value

data frame containing a age, sex, and value column

Author(s)

mandy

mock_value	<i>Mock Value</i>
------------	-------------------

Description

mock a value for a given reference

Usage

```
mock_value(ref, item, sex = c("male", "female"), age)
```

Arguments

ref	a valid RefGroup object
item	a valid item present in ref
sex	character male or female
age	numeric age value

Details

the function creates a random value for a given age and sex value and a given reference

Value

a random value from the conditional distribution (conditionally on age and sex)

Author(s)

mandy

mock_values	<i>Mock Values</i>
-------------	--------------------

Description

mock values for a given reference, given age and given sex

Usage

```
mock_values(df, sex, age, ref, item)
```

Arguments

- df data frame containing the age and sex
- sex name of the sex variable
- age name of the age variable
- ref a valid RefGroup object
- item a valid imte present in ref

Details

the function creates random values for given age and sex values and a given reference

Value

data frame containing the additional column with random numbers

Author(s)

mandy

motor.ref

Parameters for 5 subtests of the KiGGS Motorik Module

Description

Parameters for 5 subtests of the KiGGS Motorik Module

Usage

motor.ref

Source

"Sobek et al. In progress"

nl3.ref

Parameters of skinfold measures derived from Colombian population

Description

Parameters of skinfold measures derived from Colombian population

Usage

nl3.ref

Source

Fredriks, A. M. et al. Continuing positive secular growth change in The Netherlands 1955-1997. *Pediatric research* 47, 316-323 (2000).

Fredriks, A.M., van Buuren, S., Wit, J.M., Verloove-Vanhorick, S.P., 2000. Body index measurements in 1996-7 compared with 1980. *Archives of disease in childhood* 82, 107-112.

<https://cran.r-project.org/package=AGD>

nl4.ref

*Parameters derived from the 4th Dutch growth study***Description**

Parameters derived from the 4th Dutch growth study

Usage

nl4.ref

Source

Fredriks, A. M. et al. Nationwide age references for sitting height, leg length, and sitting height/height ratio, and their diagnostic value for disproportionate growth disorders. *Archives of Disease in Childhood* 90, 807–812 (2005); Fredriks, A. M. et al. Height, weight, body mass index and pubertal development references for children of Moroccan origin in The Netherlands. *Acta Paediatr.* 93, 817–824 (2004); Fredriks, A. M. et al. Continuing positive secular growth change in The Netherlands 1955–1997. *Pediatric research* 47, 316–323 (2000); Fredriks, A. M. et al. Height, weight, body mass index and pubertal development reference values for children of Turkish origin in the Netherlands. *Eur. J. Pediatr.* 162, 788–793 (2003); Fredriks, A. M., van Buuren, S., Wit, J. M. & Verloove-Vanhorick, S. P. Body index measurements in 1996–7 compared with 1980. *Archives of disease in childhood* 82, 107–112 (2000); R package: AGD, Stef van Buuren, <http://www.stefvanbuuren.nl/>

one_iteration

*one iteration***Description**

one iteration

Usage

```
one_iteration(
  data.list,
  method,
  prop.fam = 0.75,
  prop.subject = 1,
  age.min = 0,
  age.max = 18,
  age.int = 1/12,
  keep.models = F,
  dist = "BCCGo",
  formula = NULL,
  sigma.df = 3,
```

```

nu.df = 2,
mu.df = 4,
tau.df = 2,
sigma.formula = ~1,
nu.formula = ~1,
tau.formula = ~1,
verbose = F,
trans.x = F,
lim.trans = c(0, 1.5),
method.pb = "ML"
)

```

Arguments

data.list	list of dataframes as returned by prepare_data
method	use vgam or gamlss
prop.fam	proportion of families to be sampled
prop.subject	proportion of subject to be sampled
age.min	lower bound of age
age.max	upper bound of age
age.int	stepwidth of the age variable
keep.models	indicator whether or not models in each iteration should be kept
dist	distribution used for the fitting process, has to be one of BCCGo, BCPEo, BCTo as they are accepted by lms()
formula	formula for the location parameter
sigma.df	degree of freedom spread parameter
nu.df	degree of freedom skewness parameter
mu.df	degree of freedom location parameter
tau.df	degree of freedom kurtosis parameter
sigma.formula	formula for the sigma parameter
nu.formula	formula for the nu parameter
tau.formula	formula for the tau parameter
verbose	whether or not information about sampling will be printed during while iterate
trans.x	indicator wether age should be transformed or not
lim.trans	limits for the exponent of transformation of age
method.pb	GAIC or ML

Details

function samples families then measurements and fits the model the function is called inside [do_iterations](#) and may not called directly

Value

list of lists each containing a dataframe of the fitted lms parameter at the given age points and the fitted model

Author(s)

Mandy Vogel

ParTab-class	<i>Table of references</i>
--------------	----------------------------

Description

Reference tables

Slots

`item` identifier of the item

`dist` named list which contains the distribution which was used in fitting the references. One entry for male and one for female

portug.ref	<i>Parameters derived from Portuguese children</i>
------------	--

Description

Parameters derived from Portuguese children

Usage

`portug.ref`

Source

Chaves, R., Baxter-Jones, A., Souza, M., Santos, D. & Maia, J. Height, weight, body composition, and waist circumference references for 7-to 17-year-old children from rural Portugal. *HOMO- Journal of Comparative Human Biology* 66, 264–277 (2015).

prepare_data	<i>prepare data for iteration process</i>
--------------	---

Description

prepare data for repeated iteration process

Usage

```
prepare_data(
  data,
  group = NULL,
  subject = "SIC",
  sex = NULL,
  value = "value",
  age = "age",
  lb = -Inf,
  ub = Inf
)
```

Arguments

data	dataframe containing measurement values, age, sex, and subject identifier
group	optional variable indicating groups of subjects within the data frame in most cases (families)
subject	subject identifier
sex	column containing the sex (or any other stratum), ideally of type character, iteration process will run on each of the levels separately
value	numeric column containing the measurement values
age	numeric column containing the age
lb	optional - lower bound for age
ub	optional - upper bound for age

Details

given a dataframe, the column name of the subject identifier, sex, age, value and group columns, the function creates a dataframe containing only these five columns with the standard column names group, subject, sex, age, value. lines containing missing values are removed.

Value

list of dataframes containing the columns group, subject, sex, age, value; one dataframe for every level of sex

Author(s)

Mandy Vogel

```
preterm.ref      Parameters Preterm and Intrauterine
```

Description

Parameters Preterm and Intrauterine

Usage

```
preterm.ref
```

Source

Olsen, I.E., Lawson, M.L., Ferguson, A.N., Cantrell, R., Grabich, S.C., Zemel, B.S., Clark, R.H., 2015. BMI Curves for Preterm Infants. *PEDIATRICS* 135, e572-e581. doi:10.1542/peds.2014-2777

Olsen, I.E., Groveman, S.A., Lawson, M.L., Clark, R.H., Zemel, B.S., 2010. New intrauterine growth curves based on United States data. *Pediatrics* 125, e214-224. doi:10.1542/peds.2009-0913

```
RefGroup-class      Class of references
```

Description

Container for reference tables

Slots

name name of the reference group

refs List of references, each reference refers to one item and contains independent variable age, and the parameter values for both genders

citations information about the sources of the references

info additional infos regarding the references

Author(s)

Mandy Vogel

Examples

```
data(kiggs.ref)
print(kiggs.ref)
data(ukwho.ref)
print(ukwho.ref)
data(who.ref)
print(who.ref)
```

 saudi.ref

Parameters derived from Saudi children

Description

Parameters derived from Saudi children

Usage

saudi.ref

Source

Mouzan, M. I. E., Salloum, A. A. A., Alqurashi, M. M., Herbish, A. S. A. & Omar, A. A. The LMS and Z scale growth reference for Saudi school-age children and adolescents. Saudi Journal of Gastroenterology 22, 331 (2016)

Shaik, S.A., El Mouzan, M.I., AlSalloum, A.A., AlHerbish, A.S., 2016. Growth reference for Saudi preschool children: LMS parameters and percentiles. Ann Saudi Med 36, 2-6. doi:10.5144/0256-4947.2016.2

 sds

Calculate SDS Values

Description

Calculate SDS values

Usage

```
sds(value, age, sex, item, ref, type = "SDS", male = "male", female = "female")
```

Arguments

value	vector of measurement values
age	vector of age values
sex	vector of sex
item	name of the item e.g. "height"
ref	RefGroup object
type	"SDS" or "perc"
male	coding of sex for male
female	coding of sex for female

Details

The function takes a vector of measurement values, and of age and of sex and a RefGroup object as arguments. It calculates the sds or percentile values.

Value

vector containing SDS or percentile values

Author(s)

Mandy Vogel

Examples

```
anthro <- data.frame(age = c(11.61,12.49,9.5,10.42,8.42,10.75,9.57,10.48),
                    height = c(148.2,154.4,141.6,145.3,146,140.9,145.5,150),
                    sex = sample(c("male","female"), size = 8, replace = TRUE),
                    weight = c(69.5,72.65,47.3,51.6,45.6,48.9,53.5,58.5))
anthro$height_sds <- sds(anthro$height,
                        age = anthro$age,
                        sex = anthro$sex, male = "male", female = "female",
                        ref = kro.ref,
                        item = "height",
                        type = "SDS")

anthro$bmi <- anthro$weight/(anthro$height**2) * 10000
anthro$bmi_perc <- sds(anthro$bmi,
                      age = anthro$age,
                      sex = anthro$sex, male = "male", female = "female",
                      ref = kro.ref,
                      item = "bmi",
                      type = "perc")

data(who.ref)
x <- data.frame(height=c(50,100,60,54),
                sex=c("m","f","f","m"),
                age=c(0,2.9,0.6,0.2))
sds(value = x$height, age = x$age, sex = x$sex, male = "m", female = "f",
    ref = who.ref, item = "height")
```

sdsold

Calculate SDS Values

Description

Calculate SDS values - old version for comparison

Usage

```
sdsold(  
  value,  
  age,  
  sex,  
  item,  
  ref,  
  type = "SDS",  
  male = "male",  
  female = "female"  
)
```

Arguments

value	vector of measurement values
age	vector of age values
sex	vector of sex
item	name of the item e.g. "height"
ref	RefGroup object
type	"SDS" or "perc"
male	coding of sex for male
female	coding of sex for female

Details

The function takes a vector of measurement values, and of age and of sex and a RefGroup object as arguments. It calculates the sds or percentile values.

Value

vector containing SDS or percentile values

Author(s)

Mandy Vogel

Examples

```
anthro <- data.frame(age = c(11.61,12.49,9.5,10.42,8.42,10.75,9.57,10.48),  
  height = c(148.2,154.4,141.6,145.3,146,140.9,145.5,150),  
  sex = sample(c("male","female"), size = 8, replace = TRUE),  
  weight = c(69.5,72.65,47.3,51.6,45.6,48.9,53.5,58.5))  
anthro$height_sds <- sds(anthro$height,  
  age = anthro$age,  
  sex = anthro$sex, male = "male", female = "female",  
  ref = kro.ref,  
  item = "height",  
  type = "SDS")
```

```

anthro$bmi <- anthro$weight/(anthro$height**2) * 10000
anthro$bmi_perc <- sds(anthro$bmi,
                      age = anthro$age,
                      sex = anthro$sex, male = "male", female = "female",
                      ref = kro.ref,
                      item = "bmi",
                      type = "perc")

data(who.ref)
x <- data.frame(height=c(50,100,60,54),
                sex=c("m","f","f","m"),
                age=c(0,2.9,0.6,0.2))
sds(value = x$height, age = x$age, sex = x$sex, male = "m", female = "f",
    ref = who.ref, item = "height")

```

sds_2d

*Calculate SDS Values for 2-dimensional matrix of covariates***Description**

Calculate SDS values for 2-dimensional matrix of covariates

Usage

```

sds_2d(
  value,
  age,
  x2,
  sex,
  item,
  ref,
  type = "SDS",
  male = "male",
  female = "female"
)

```

Arguments

value	vector of measurement values
age	vector of age values
x2	second vector of covariates
sex	vector of sex
item	name of the item e.g. "height"
ref	RefGroup object
type	"SDS" or "perc"
male	coding of sex for male
female	coding of sex for male

Details

The function takes a vector of measurement values, and of age and a second covariate (like age and height for blood pressure) of sex and a RefGroup object as arguments. It calculates the sds or percentile values. This function is beta.

the function searches for the nearest given point in the reference grid. From there, the SDS/percentile value will be calculated. Different from [sds](#), no interpolation will be applied. The procedure is according to Neuhauser et al. Blood Pressure Percentiles by Age and Height from Nonoverweight Children and Adolescents in Germany. 2011.

Value

vector containing SDS or percentile values

Author(s)

Mandy Vogel

select_fams	<i>select families</i>
-------------	------------------------

Description

Select groups (families)

Usage

```
select_fams(data, prop = 0.75, group, verbose = F)
```

Arguments

data	dataframe as returned by prepare data
prop	proportion of families to be sampled
group	name of the group variable (character) if not "group", ignored
verbose	if TRUE information about sample size is printed out

Details

function selects a given proportion of groups/families from the data if no grouping variable is given the original data set is returned function is called inside [do_iterations](#) and may not called directly

Value

dataframe containing only prop.fam percent the families in data

Author(s)

Mandy Vogel

select_meas	<i>choose one measurement per subject</i>
-------------	---

Description

Choose one measurement per subject

Usage

```
select_meas(data, subject = "subject", prop = 1, verbose = F)
```

Arguments

data	dataframe as returned by prepare data
subject	name of the column containing the subject identifier
prop	optional - proportion of measurements to sample
verbose	if TRUE information about sample size is printed out

Details

function samples one measurement per subject, if prop < 1 additional a prop*100 percent will be sampled from the measurements the function is called inside [do_iterations](#) and may not called directly

Value

dataframe containing the sampled rows

Author(s)

Mandy Vogel

show, ParTab-method	<i>class ParTab</i>
---------------------	---------------------

Description

show method for ParTab

Usage

```
## S4 method for signature 'ParTab'  
show(object)
```

Arguments

object object of class ParTab

Details

show method for ParTab

Value

print information about the respective reference table

Author(s)

Mandy Vogel

show,RefGroup-method *class RefGroup*

Description

show method for RefGroup

Usage

```
## S4 method for signature 'RefGroup'  
show(object)
```

Arguments

object object of class RefGroup

Details

show method for RefGroup

Value

prints information about age range, citations, etc.

Author(s)

Mandy Vogel

turkish.ref

Parameters derived from Turkish children

Description

Parameters derived from Turkish children

Usage

turkish.ref

Source

Hatipoglu, N. et al. Waist circumference percentiles for 7- to 17-year-old Turkish children and adolescents. *Eur J Pediatr* 167, 383–389 (2008); Bundak, R. et al. Body mass index references for Turkish children. *Acta Paediatrica* 95, 194–198 (2006).

Neyzi, O., Furman, A., Bundak, R., Gunoz, H., Darendeliler, F., Bas, F., 2006. Growth references for Turkish children aged 6 to 18 years. *Acta Paediatrica* 95, 1635-1641. doi:10.1080/08035250600652013

Bundak, R. et al. Body mass index references for Turkish children. *Acta Paediatrica* 95, 194-198 (2006).

uk1990.ref

Parameters from the 1990 UK growth study

Description

Parameters from the 1990 UK growth study

Usage

uk1990.ref

Source

Cole, T.J., Freeman, J.V., Preece, M.A., 1998. British 1990 growth reference centiles for weight, height, body mass index and head circumference fitted by maximum penalized likelihood. *Statistics in medicine* 17, 407-429.

Cole, T.J., Freeman, J.V., Preece, M.A., 1995. Body mass index reference curves for the UK, 1990. *Archives of disease in childhood* 73, 25-29.

ukwho.ref	<i>LMS Parameters for UK-WHO growth charts for height, weight, bmi, head circumference</i>
-----------	--

Description

LMS Parameters for UK-WHO growth charts for height, weight, bmi, head circumference

Usage

ukwho.ref

Source

Wright, Charlotte M., et al, Practice pointer: Using the new UK-WHO growth charts. *British Medical Journal* 340.c1140 (2010): 647-650. Preterm British 1990, 0-4 WHO2006, 4-18 British1990

us.ref	<i>Parameters derived from US children (additional to the cdc.ref)</i>
--------	--

Description

Parameters derived from US children (additional to the cdc.ref)

Usage

us.ref

Source

Sharma, A. K., Metzger, D. L., Daymont, C., Hadjiyannakis, S. & Rodd, C. J. LMS tables for waist-circumference and waist-height ratio Z-scores in children aged 5-19 y in NHANES III: association with cardio-metabolic risks. *Pediatric research* (2015)

who.ref	<i>LMS Parameters for UK-WHO growth charts for height, weight, bmi, head circumference, arm mid upper arm circumference, subscapular and triceps skinfold, weight for height</i>
---------	--

Description

LMS Parameters for UK-WHO growth charts for height, weight, bmi, head circumference, arm mid upper arm circumference, subscapular and triceps skinfold, weight for height

Usage

who.ref

Source

de Onis, M., Onyango, A., Borghi, E., Siyam, A., Blossner, M., & Lutter, C. (2012). Worldwide implementation of the WHO child growth standards. *Public Health Nutr*, 12, 1-8.

who2007.ref	<i>Parameters of skinfold measures derived from Colombian population</i>
-------------	--

Description

Parameters of skinfold measures derived from Colombian population

Usage

who2007.ref

Source

Onis, M. de, Onyango, A.W., Borghi, E., Siyam, A., Nishida, C., Siekmann, J., 2007. Development of a WHO growth reference for school-aged children and adolescents. *Bulletin of the World Health Organization* 85, 660-667.

`wormplot_gg`*Worm Plot ggplot version*

Description

Worm plot ggplot version

Usage

```
wormplot_gg(  
  m = NULL,  
  residuals = NULL,  
  age = NA,  
  n.inter = 1,  
  y.limits = c(-1, 1)  
)
```

Arguments

<code>m</code>	a gamlss model
<code>residuals</code>	normalized quantile residuals
<code>age</code>	numeric vector of ages
<code>n.inter</code>	number of age intervals or cut points
<code>y.limits</code>	limits of the y-axis

Details

creates a wormplot for a gamlss model or a given vector of normalized quantile residuals, either for all residuals or grouped by age intervals

Value

ggplot object

`zong13.ref`*Parameters derived from Chinese children (additional to nl4.ref)*

Description

Parameters derived from Chinese children (additional to nl4.ref)

Usage

```
zong13.ref
```

Source

Zong, X.-N., Li, H. Construction of a New Growth References for China Based on Urban Chinese Children: Comparison with the WHO Growth Standards. PLOS ONE 8, e59569 (2013).

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