Package ‘plot3logit’

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Description An implementation of the ternary plot for interpreting regression
coefficients of trinomial regression models, as proposed in Santi, Dickson
and Espa (2019) <doi:10.1080/00031305.2018.1442368>. Ternary plots can be
drawn using either 'ggtern' package (based on 'ggplot2') or 'Ternary'
package (based on standard graphics). The package and its features are
illustrated in Santi, Dickson, Espa and Giuliani (2022)
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- plot3logit-package .................................................. 2
- add_confregions ....................................................... 4
- autoplot.Hfield3logit ............................................. 6
- cross_1year .......................................................... 7
- extract3logit ......................................................... 8
- field3logit .......................................................... 10
- gg3logit ............................................................. 13
- labels ............................................................... 15
- multifield3logit ................................................... 15
- stat_3logit .......................................................... 18
- stat_conf3logit ..................................................... 19
- stat_field3logit .................................................... 20
- TernaryField ....................................................... 22
- USvote2016 .......................................................... 23

Index 24

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Ternary Plots for Trinomial Regression Models

Description

An implementation of the ternary plot for interpreting regression coefficients of trinomial regression models, as proposed in Santi et al. (2019). For details on the features of the package, see Santi et al. (2022).

Details

The package permits the covariate effects of trinomial regression models to be represented graphically by means of a ternary plot. The aim of the plots is helping the interpretation of regression coefficients in terms of the effects that a change in regressors’ values has on the probability distribution of the dependent variable. Such changes may involve either a single regressor, or a group of them (composite changes), and the package permits both cases to be represented in a user-friendly way. Methodological details are illustrated and discussed in Santi et al. (2019).

The package can read the results of both categorical and ordinal trinomial logit regression fitted by various functions (see extract3logit()) and creates a field3logit object which may be represented by means of functions autoplot() and plot().

The plot3logit package inherits graphical classes and methods from the package ggtern (Hamilton and Ferry 2018) which, in turn, is based on the ggplot2 package (Wickham 2016).
Graphical representation based on standard graphics is made available through the package Ternary (Smith 2017) by function TernaryField() and in particular by the method plot of field3logit class.

Since version 2.0.0, plot3logit can also compute and draw confidence regions associated to the covariate effects. See the vignette of the package (type vignette("plot3logit-overview")) and the help of function stat_conf3logit() for some examples.

Compatibility

Function field3logit() can read trinomial regression estimates from the output of the following functions:

- clm and clm2 of package ordinal (ordinal logit regression);
- mlogit of package mlogit (logit regression);
- multinom of package nnet (logit regression);
- polr of package MASS (ordinal logit regression);
- vgam and vglm of package VGAM (logit regression).

Moreover, explicit estimates can be passed to field3logit(). See examples and functions field3logit() and extract3logit() for further details.

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References


add_confregions

See Also

field3logit(), gg3logit(), TernaryField().

Examples

data(cross_1year)

# Read from "nnet::multinom" (categorical logit)
library(nnet)
mod0 <- multinom(employment_sit ~ gender + finalgrade, data = cross_1year)
field0 <- field3logit(mod0, 'genderFemale')
gg3logit(field0) + stat_field3logit()

# Read from "MASS::polr" (ordinal logit)
library(MASS)
mydata <- cross_1year
mydata$finalgrade <- factor(mydata$finalgrade,
  c('Low', 'Average', 'High'), ordered = TRUE)
mod1 <- polr(finalgrade ~ gender + irregularity, data = mydata)
field1 <- field3logit(mod1, 'genderFemale')
sg3logit(field1) + stat_field3logit()

# Read from list
mod2 <- list(
  B = matrix(
    data = c(-2.05, 0.46, -2.46, 0.37),
    nrow = 2,
    dimnames = list(c('(Intercept)', 'genderFemale'))
  ),
  levels = c('Employed', 'Unemployed', 'Trainee')
)
field2 <- field3logit(mod2, c(0, 1))
sg3logit(field2) + stat_field3logit()

add_confregions

Compute the confidence regions of covariate effects

Description

Given the confidence level, it computes the confidence regions of the effects for each arrow of the
field3logit or multifield3logit object given in input. If the field3logit or multifield3logit
object already contains the confidence regions, they will be updated if the value of conf is different.

Usage

add_confregions(x, conf = 0.95, npoints = 100)
Arguments

- `x`: an object of class `field3logit` or `multifield3logit`.
- `conf`: confidence level of the regions.
- `npoints`: number of points of the borders of the regions.

Details

Given a reference probability distribution $\pi_0$ over the simplex $S = \{(\pi^{(1)}, \pi^{(2)}, \pi^{(3)}) \in [0,1]^3 : \pi^{(1)} + \pi^{(2)} + \pi^{(3)} = 1\}$, and a change $\Delta \in \mathbb{R}^k$ of covariate values, the confidence region of the probability distribution resulting from the covariate change $\Delta$ is computed by means of the Wald statistics (Severini 2000), which should satisfy the following condition (Wooldridge 2010):

\[
(\delta - \hat{\delta})^T [I_2 \otimes \Delta]^T \hat{\Xi} (I_2 \otimes \Delta)]^{-1} (\delta - \hat{\delta}) \leq \chi^2_2 (1 - \alpha)
\]

where $\hat{\delta} = \hat{B}^T \Delta \in \mathbb{R}^2$ is the point estimate of change of natural parameters associated to $\Delta$, $\hat{B} = [\beta^{(2)}, \beta^{(3)}] \in \mathbb{R}^{k \times 2}$ is the matrix of point estimates of regression coefficients, $I_2$ is the identity matrix of order two, $\otimes$ is the Kronecker product, $\hat{\Xi} \in \mathbb{R}^{2k \times 2k}$ is the covariance matrix of $\text{vec}(\hat{B})$, and finally, $\chi^2_2 (1 - \alpha)$ is the $(1 - \alpha)$ quantile of $\chi^2_2$.

The set of points which satisfy the previous inequality with equal sign delimits the border of the confidence region for $\delta$.

If we denote with $R_\delta$ the set of points $\delta$ which satisfy the previous inequality, it is possible to obtain the confidence region of the effect of the covariate change $\Delta$ over the simplex $S$ as follows:

\[
R = \{g^{-1}(g(\pi_0) + \delta) : \delta \in R_\delta\} \subseteq S
\]

where $g : S \to \mathbb{R}^2$ and $g^{-1} : \mathbb{R}^2 \to S$ are respectively the link function of the trinomial logit model and its inverse. They are defined as follows:

\[
g(\pi) = g([\pi^{(1)}, \pi^{(2)}, \pi^{(3)}]^T) = \left[\frac{\ln \pi^{(2)}}{\pi^{(1)}}, \frac{\ln \pi^{(3)}}{\pi^{(1)}}\right]^T
\]

\[
g^{-1}(\eta) = g^{-1}([\eta_2, \eta_3]^T) = \left[\frac{1}{1 + e^{\eta_2} + e^{\eta_3}}, \frac{e^{\eta_2}}{1 + e^{\eta_2} + e^{\eta_3}}, \frac{e^{\eta_3}}{1 + e^{\eta_2} + e^{\eta_3}}\right]^T.
\]

For further details and notation see Santi et al. (2022) and Santi et al. (2019).

Value

Object of class `field3logit` or `multifield3logit` with updated confidence regions.

References


Examples

data(cross_1year)

mod0 <- nnet::multinom(employment_sit ~ gender + finalgrade,
data = cross_1year)
field0 <- field3logit(mod0, 'genderFemale')
field0
add_confregions(field0)

autoplot.Hfield3logit Create a gg3logit plot with field and confidence regions

Description

autoplot() creates a gg3logit plot and adds a field and its confidence regions. autoplot() is a
wrapper for gg3logit() and stat_3logit().

Usage

## S3 method for class 'Hfield3logit'
autoplot(
  object,
  ..., 
  mapping_field = aes(),
  mapping_conf = aes(),
  data = NULL,
  params_field = list(),
  params_conf = list(),
  show.legend = NA,
  conf = TRUE
)

Arguments

object an object of class field3logit or multifield3logit.
... other arguments passed to specific methods
mapping_field, mapping_conf aesthetic mappings passed to argument mapping of stat_field3logit() and
stat_conf3logit().
data a field3logit object, a multifield3logit object, or a data.frame structured like a fortified field3logit or a multifield3logit object.

params_field, params_conf graphical parameters passed to argument mapping of stat_field3logit() and stat_conf3logit().

show.legend logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes. It can also be a named logical vector to finely select the aesthetics to display.

conf if TRUE and if confidence regions are available, the layer of stat_conf3logit() is added, otherwise only a gg3logit() object with the layer of stat_field3logit() is returned.

Value
Object of class ggplot.

See Also
Other gg functions: gg3logit(), stat_3logit(), stat_conf3logit(), stat_field3logit()

Examples

data(cross_1year)
mod0 <- nnet::multinom(employment_sit ~ gender + finalgrade, data = cross_1year)
field0 <- field3logit(mod0, 'genderFemale', conf = 0.95)
autoplot(field0)

---

cross_1year Master's students' employment condition

Description
data.frame with 3282 cross-sectional observations of 7 variables about employment condition of master's students one year after graduation. Data are used in Santi et al. (2019) and refer to students graduated at the University of Trento (Italy) between 2009 and 2013.

Format
data.frame with 3282 observations of 7 variables:

employment_sit: employment situation, a factor with three levels: Employed, Unemployed, Trainee.
gender: gender, a factor with two levels: Male, Female.
finalgrade: final grade degree, a factor with three levels: Low, Average, High.
duration: duration of studies, a factor with three levels: Short, Average, Long.
social_class: social class, a factor with five levels: Working class, White-collar workers, Lower middle class, Upper middle class, Unclassified.
irregularity: irregularity indicator of student's studies, a factor with three levels: Low, Average, High.
hsscore: high school final score, a numeric between 60 and 100.

References

extract3logit

Description
extract3logit() extracts all information which is relevant for computing the vector field(s) from the object passed to argument x. See Details for information on how new S3 methods of generic extract3logit() should be implemented.

Usage

extract3logit(x, ...)

## Default S3 method:
extract3logit(x, ...)

## S3 method for class 'clm'
extract3logit(x, ...)

## S3 method for class 'clm2'
extract3logit(x, ...)

## S3 method for class 'mlogit'
extract3logit(x, ...)

## S3 method for class 'model3logit'
extract3logit(x, ...)

## S3 method for class 'multinom'
extract3logit(x, ...)

## S3 method for class 'polr'
extract3logit(x, ...)
## S3 method for class 'vgam'
extract3logit(x, ...)

## S3 method for class 'vglm'
extract3logit(x, ...)

### Arguments

- **x**: an object of any of the classes listed above. If instead, a list is passed, it should be structured as described in section **Details**.
- **...**: other arguments passed to other methods.

### Details

When a specific method is not available for a fitted model, it is possible to pass a list to argument `x`. In that case, the list should consists of the following components (the order is irrelevant):

- **levels**: vector of possible values of the dependent variable. It should be a character vector of length three, whose first element is interpreted as the reference level, whereas the second and the third elements are associated to the first and second columns of matrix `B` respectively.
- **B**: matrix of regression coefficients. It should be a numeric matrix (or any coercible object) with two columns if the model is cardinal, with only one column if the model is ordinal. The number of rows should be equal to the number of covariates and the names of covariates should be added as row names. The intercepts should be included only in case of categorical models, whereas column names, if provided, are ignored.
- **alpha**: intercepts of ordinal models. It should be a numerical vector of length two if the model is ordinal, otherwise this component should be either set to `NULL` or missing.
- **vcovB**: covariance matrix of regression coefficients. It should be a numeric matrix (or any coercible object) where the number of rows and columns equals the number of elements of `B`. Rows and columns should be ordered according to the labels of the dependent variable (slower index), and then to the covariates (faster index).

If a new S3 method for generic `extract3logit()` has to be implemented, the following components may be set:

- **readfrom**: character with information about the function that returned the estimates in the form `package::function` (for example `nnet::multinom`, `MASS::polr`, ...)

**In any case**, once the list has been created, the new method should invoke the default method `extract3logit.default()` and return its output. By so doing, automatic checks and initialisations are run before the `model3logit` object is returned.

### Value

An object of class `model3logit`.

### See Also

`plot3logit-package`, `field3logit()`.
Description

field3logit() computes the vector field associated to a change in regressor values (which may involve more than one regressor) of a trinomial logit model either fitted by some multinomial regression function or explicitly specified.

The method plot() draws the ternary plot using standard graphics methods provided by package Ternary. See functions gg3logit() and autoplot() for plotting through the package ggtern based on the grammar of graphics.

Methods as.data.frame(), as_tibble(), fortify() and tidy() permits the graphical information of a field3logit object to be exported in a standardised format (either a data.frame or a tibble).

See Santi et al. (2022) for details and examples.

Usage

field3logit(
  model,
  delta,
  label = "",
  p0 = NULL,
  nstreams = 8,
  narrow = Inf,
  edge = 0.01,
  conf = NA,
  npoints = 100,
  alpha = deprecated(),
  vcov = deprecated()
)

## S3 method for class 'field3logit'
print(x, ...)

## S3 method for class 'field3logit'
plot(x, ..., add = FALSE, length = 0.05)

## S3 method for class 'field3logit'
as_tibble(x, ..., wide = TRUE)

## S3 method for class 'field3logit'
as.data.frame(x, ..., wide = TRUE)

## S3 method for class 'field3logit'
fortify(model, data, ..., wide = TRUE)
## Arguments

- **model**: either a fitted trinomial model or a list properly structured. See section Details of \texttt{extract3logit()} and the last example of \texttt{plot3logit-package}.
- **delta**: the change in the values of covariates to be represented. This could be either a numeric vector, the name of a covariate (passed either as a character or an expression), or a mathematical expression involving one or more than one covariates (passed either as a character or an expression). If a list is passed to \texttt{delta}, multiple fields are computed according to parameters passed as components of a 2-level list. See details and examples.
- **label**: label to be used for identifying the field when multiple fields are plotted. See \texttt{multifield3logit()}.
- **p0**: list of starting points (ternary coordinates) of the curves of the field. If not specified, \texttt{field3logit} automatically compute \texttt{nstreams} candidate points so that arrows are evenly distributed over the ternary plot area. See Examples.
- **nstreams**: number of stream lines of the field to be computed. In case of ordinal models, this parameter is ineffective, as only one curve can be drawn. The parameter is ineffective also if argument \texttt{p0} is set.
- **narrows**: maximum number of arrows to be drawn per stream line.
- **edge**: minimum distance between each arrow (or point) and the edge of the ternary plot.
- **conf**: confidence level of confidence regions to be computed for each arrow of the vector field.
- **npoints**: number of points of the border to be computed for each confidence region.
- **alpha**: deprecated argument. It may be removed in a future version of the package.
- **vcov**: deprecated argument. It may be removed in a future version of the package.
- **x, object**: object of class \texttt{field3logit}.
- **...**: other arguments passed to or from other methods.
\textbf{add} \hspace{2em} \text{logical argument which specifies whether the field should be added to an existing plot (add = TRUE) or a new ternary plot should be drawn (add = FALSE).}

\textbf{length} \hspace{2em} \text{length of the edges of the arrow head (in inches).}

\textbf{wide} \hspace{2em} \text{it allows to choose whether as.data.frame, as_tibble, fortify and tidy should return a data.frame or a tibble in wide (default) or long form.}

\textbf{data} \hspace{2em} \text{not used. Argument included only for interface compatibility with the generic fortify.}

\textbf{value} \hspace{2em} \text{value to be assigned.}

\textbf{Details}

The content of this section is presented with plenty of details and examples in Sections 4.1 and 4.3 of Santi et al. (2022).

Argument \texttt{delta} could be passed in one of the following formats:

- explicitly, as a numeric vector corresponding to the change $\Delta x \in \mathbb{R}^k$ in regressors values $x \in \mathbb{R}^k$;
- implicitly, as a character of the name of the covariate to be considered. In this case, vector $\Delta x \in \mathbb{R}^k$ is computed for a unit change of the specified covariate;
- as a mathematical expression (passed as an expression or a character object) involving one or more than one covariates. This allows one to analyse the effects of composite covariate changes through an easy-to-write and easy-to-read code without having to cope with explicit numerical specification of vector $\Delta x \in \mathbb{R}^k$.

See examples for comparing all three methods.

\textbf{It is also possible to pass a list to argument} \texttt{delta}. In such a case, the function \texttt{field3logit} is run once for every component of \texttt{delta}, and the set of generated \texttt{field3logit} objects is combined into a single object of class \texttt{multifield3logit}. The components of the list passed to \texttt{delta} must be named lists whose elements are used as arguments of each call of function \texttt{field3logit}, whilst the arguments specified in the parent call of \texttt{field3logit} are used as default values. It follows that arguments shared by all fields can be specified once in the parent call of \texttt{field3logit}, and only arguments which changes from field to field (such as \texttt{delta} and \texttt{label}) should be set in the lists making up the list passed to \texttt{delta}. See the penultimate example in section Examples and the help of \texttt{multifield3logit()}.  

\textbf{Finally}, when argument \texttt{delta} is a character, it is possible to indicate the name of a factor covariate between delimiters $<<, >>$. In that case, \texttt{field3logit()} creates a multifield3logit object where each field corresponds to the effect of each dummy generated by the factor regressor. If more than one regressor is included between delimiters $<<, >>$, all combinations between dummies are generated. See the last example in section Examples.

\textbf{Value}

\texttt{S3} object of class \texttt{field3logit} structured as a named list or an object of class \texttt{multifield3logit} if \texttt{delta} is a list or syntax $<<\ldots, >>$ is used.

\textbf{See Also}

\texttt{multifield3logit()}, \texttt{gg3logit()}, \texttt{autoplot()}. 


# Fitting the model
mod0 <- nnet::multinom(employment_sit ~ finalgrade + irregularity + hsscore, cross_1year)

# Assessing the effect of "finalgradeHigh" (explicit notation)
field0 <- field3logit(mod0, c(0, 0, 1, 0, 0, 0))
gg3logit(field0) + stat_field3logit()

# Assessing the effect of "finalgradeHigh" (implicit notation)
field0 <- field3logit(mod0, 'finalgradeHigh')
gg3logit(field0) + stat_field3logit()

# Assessing the combined effect of "finalgradeHigh" and
# a decrease of "hsscore" by 10
field0 <- field3logit(mod0, 'finalgradeHigh - 10 * hsscore')
gg3logit(field0) + stat_field3logit()

# Fitting the model
mod1 <- nnet::multinom(employment_sit ~ ., data = cross_1year)

# List passed to argument "delta" for generating "multifield3logit" objects
refpoint <- list(c(0.7, 0.15, 0.15))
depo <- list(
  list(delta = 'durationShort', label = 'Short duration'),
  list(delta = 'durationLong', label = 'Long duration'),
  list(delta = 'finalgradeHigh', label = 'High final grade'),
  list(delta = 'finalgradeLow', label = 'Low final grade')
)
mfields <- field3logit(mod1, delta = depo, p0 = refpoint, narrows = 1)
mfields

# Syntax "<<...>>" for categorical covariates
mfields <- field3logit(
  model = mod1, delta = '<<finalgrade>>', label = 'Final grade',
  p0 = refpoint, narrows = 1
)
mfields
Description

`gg3logit` initialises a `ggplot` object through `ggtern`. If a `field3logit` or a `multifield3logit` object is passed to argument `data`, the mandatory aesthetics of the ternary plot are automatically set. See Santi et al. (2022) for details and examples.

Usage

```r
gg3logit(data = NULL, mapping = aes(), ...)
```

Arguments

- **data**: a `field3logit` object, a `multifield3logit` object, or a `data.frame` structured like a fortified `field3logit` or a `multifield3logit` object.
- **mapping**: list of aesthetic mappings to be used for plot. If a `field3logit` or a `multifield3logit` is passed to `data`, none of the aesthetics mappings listed in section *Aesthetic mappings* below has to be specified (if specified, they will be overwritten).
- **...**: additional arguments passed through to `ggtern`.

Value

Object of class `ggplot`.

Aesthetic mappings

The following aesthetics are required by at least one of the available stats. None of them should be specified if a `field3logit` or a `multifield3logit` is passed to the argument `data` of `gg3logit()`, `stat_field3logit()` or `stat_conf3logit()`:

- `x`, `y`, `z`: required by:
  - `stat_field3logit()` as ternary coordinates of the starting points of the arrows;
  - `stat_conf3logit()` ternary coordinates of the points on the border of confidence regions;
- `xend`, `yend`, `zend`: required by `stat_field3logit()` as ternary coordinates of the ending points of the arrows;
- `group`: identifier of groups of graphical objects (arrows and their confidence regions);
- `type`: type of graphical object (arrows or confidence regions).

The following variables of a fortified `field3logit` or a `multifield3logit` object may be useful for defining other standard aesthetics (such as `fill`, `colour`, ...):

- `label` identifies a field through a label, thus it is useful for distinguishing the fields in a `multifield3logit` object.
- `idarrow` identifies each group of graphical objects (arrows and their confidence regions) *within* every field. Unlike variable `group`, `idarrow` is not a global identifier of graphical objects.

See Also

Other gg functions: `autoplot.Hfield3logit()`, `stat_3logit()`, `stat_conf3logit()`, `stat_field3logit()`
Examples

```r
data(cross_1year)
mod0 <- nnet::multinom(employment_sit ~ gender + finalgrade, data = cross_1year)
field0 <- field3logit(mod0, 'genderFemale')

gg3logit(field0) + stat_field3logit()
```

---

**labels**

*Set the labels of a field3logit or a multifield3logit object*

---

**Description**

It sets the labels of an existing field3logit or a multifield3logit object.

**Usage**

```r
labels(object) <- value
```

**Arguments**

- **object**: a field3logit or a multifield3logit object.
- **value**: a character with the new label (or labels in case of a multifield3logit object).

**Value**

Object of same class of argument object (either field3logit or multifield3logit).

---

**multifield3logit**

*Multiple trilogit fields*

---

**Description**

Methods of S3 class multifield3logit handle multiple fields3logit objects simultaneously and permit new multifield3logit objects to be easily created by means of the sum operator "+".

---
Usage

```r
multifield3logit(x, ...)  
```  
## S3 method for class 'Hfield3logit'  
`x + y`  

## S3 method for class 'multifield3logit'  
`print(x, maxitems = 10, ...)`  

## S3 method for class 'multifield3logit'  
`plot(x, y = NULL, add = FALSE, col = NA, legend = TRUE, ...)`  

## S3 method for class 'multifield3logit'  
`as_tibble(x, ..., wide = TRUE)`  

## S3 method for class 'multifield3logit'  
`as.data.frame(x, ..., wide = TRUE)`  

## S3 method for class 'multifield3logit'  
`fortify(model, data, ..., wide = TRUE)`  

## S3 method for class 'multifield3logit'  
`tidy(x, ..., wide = TRUE)`  

## S3 method for class 'multifield3logit'  
`labels(object, ...)`  

## S3 replacement method for class 'multifield3logit'  
`labels(object) <- value`  

## S3 method for class 'multifield3logit'  
`x[i, drop = TRUE]`  

## S3 replacement method for class 'multifield3logit'  
`x[i] <- value`

Arguments

- `x, y, model, object`  
  object of class `field3logit` or `multifield3logit`.  
- `...`  
  other arguments passed to or from other methods.  
- `maxitems`  
  maximum number of items to be enumerated when an object of class `multifield3logit` is printed.  
- `add`  
  logical argument which specifies whether the field should be added to an existing plot (add = TRUE) or a new ternary plot should be drawn (add = FALSE).  
- `col, legend`  
  graphical parameters if Ternary package is used.
multifield3logit

wide  it allows to choose whether as.data.frame, as_tibble, fortify and tidy should return a data.frame or a tibble in wide (default) or long form.
data  not used. Argument included only for interface compatibility with the generic fortify.
value value to be assigned.
i  index of the field3logit object to be selected.
drop  if TRUE, a field3logit object is returned if the subsetted multifield3logit object has length one.

Value

S3 object of class multifield3logit structured as a named list.

See Also

field3logit().

Examples

data(cross_1year)
mod0 <- nnet::multinom(employment_sit ~ ., data = cross_1year)
mod0

field_Sdur <- field3logit(mod0, 'durationShort',
label = 'Short duration')
field_Hfgr <- field3logit(mod0, 'finalgradeHigh',
label = 'High final grade')

gg3logit(field_Sdur + field_Hfgr) +
stat_field3logit()
facet_wrap(~ label)

refpoint <- list(c(0.7, 0.15, 0.15))

field_Sdur <- field3logit(mod0, 'durationShort',
label = 'Short duration', p0 = refpoint, narrows = 1)
field_Ldur <- field3logit(mod0, 'durationLong',
label = 'Long duration', p0 = refpoint, narrows = 1)
field_Hfgr <- field3logit(mod0, 'finalgradeHigh',
label = 'High final grade', p0 = refpoint, narrows = 1)
field_Lfgr <- field3logit(mod0, 'finalgradeLow',
label = 'Low final grade', p0 = refpoint, narrows = 1)

mfields <- field_Sdur + field_Ldur + field_Lfgr + field_Hfgr
mfields

gg3logit(mfields) +
stat_field3logit(aes(colour = label)) +
theme_zoom_L(0.45)
stat_3logit | Add a field and confidence regions to a gg3logit plot

Description

`stat_3logit()` adds a field and confidence regions to a gg3logit plot. `stat_3logit()` is a wrapper for stats `stat_field3logit()` and `stat_conf3logit()` which are jointly applied.

Usage

```
stat_3logit(
  mapping_field = aes(),
  mapping_conf = aes(),
  data = NULL,
  params_field = list(),
  params_conf = list(),
  show.legend = NA,
  inherit.aes = TRUE,
  conf = TRUE
)
```

Arguments

- `mapping_field`, `mapping_conf`: aesthetic mappings passed to argument mapping of `stat_field3logit()` and `stat_conf3logit()`.
- `data`: a field3logit object, a multifield3logit object, or a data.frame structured like a fortified field3logit or a multifield3logit object.
- `params_field`, `params_conf`: graphical parameters passed to argument mapping of `stat_field3logit()` and `stat_conf3logit()`.
- `show.legend`: logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes. It can also be a named logical vector to finely select the aesthetics to display.
- `inherit.aes`: If FALSE, overrides the default aesthetics, rather than combining with them. This is most useful for helper functions that define both data and aesthetics and shouldn’t inherit behaviour from the default plot specification, e.g. `borders()`.
- `conf`: if TRUE and if confidence regions are available, the layer of `stat_conf3logit()` is added, otherwise only the layer of `stat_field3logit()` is returned.

Value

If conf is set to FALSE a layer of ggplot package is returned (object of class LayerInstance), otherwise, if conf is set to TRUE, stat_3logit returns a list of two ggplot2 layers (class LayerInstance).
See Also

Other gg functions: autoplot.Hfield3logit(), gg3logit(), stat_conf3logit(), stat_field3logit()

Examples

```r
data(cross_1year)

mod0 <- nnet::multinom(employment_sit ~ gender + finalgrade, data = cross_1year)
field0 <- field3logit(mod0, 'genderFemale', conf = 0.95)

gg3logit(field0) + stat_3logit()

gg3logit(field0) + stat_3logit(conf = TRUE)
```

---

**stat_conf3logit**

Add the confidence regions of a field to a gg3logit plot

Description

*stat_conf3logit()* adds a field to a gg3logit plot.

Usage

```r
stat_conf3logit(
  mapping = aes(),
  data = NULL,
  geom = "polygon",
  position = "identity",
  show.legend = NA,
  inherit.aes = TRUE,
  ...
)
```

Arguments

- **mapping** list of aesthetic mappings to be used for plot. Mandatory aesthetics should not be specified if field3loglit or multifield3logit object is passed to data. See section Aesthetic mappings of gg3logit() for details.
- **data** a field3logit object, a multifield3logit object, or a data.frame structured like a fortified field3logit or a multifield3logit object.
- **geom** The geometric object to use to display the data, either as a ggproto Geom subclass or as a string naming the geom stripped of the geom_ prefix (e.g. “point” rather than “geom_point”)
stat_field3logit

Add a field to a gg3logit plot

Description

*stat_field3logit()* adds a field to a *gg3logit* plot.

Usage

```r
cross_1year = data.frame(employment_sit, gender, finalgrade)

mod0 <- nnet::multinom(employment_sit ~ gender + finalgrade, data = cross_1year)
field0 <- field3logit(mod0, 'genderFemale', conf = 0.95)

gg3logit(field0) + stat_field3logit()
```

Value

Layer of ggplot2 package, object of class `LayerInstance`.

See Also

Other *gg* functions: *autoplot.Hfield3logit()*, *gg3logit()*, *stat_3logit()*, *stat_field3logit()*. 

Examples

```r
data(cross_1year)

mod0 <- nnet::multinom(employment_sit ~ gender + finalgrade, data = cross_1year)
field0 <- field3logit(mod0, 'genderFemale', conf = 0.95)

gg3logit(field0) + stat_field3logit()
```

Position adjustment, either as a string naming the adjustment (e.g. "jitter" to use *position_jitter*), or the result of a call to a position adjustment function. Use the latter if you need to change the settings of the adjustment.

show.legend

logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes. It can also be a named logical vector to finely select the aesthetics to display.

inherit.aes

If FALSE, overrides the default aesthetics, rather than combining with them. This is most useful for helper functions that define both data and aesthetics and shouldn’t inherit behaviour from the default plot specification, e.g. *borders()*.

... additional arguments passed through to *ggtern*.
**stat_field3logit**

```r
  inherit.aes = TRUE,
  arrow. = arrow(length = unit(0.2, "cm")),
  ...
)
```

**Arguments**

- **mapping**
  - list of aesthetic mappings to be used for plot. Mandatory aesthetics should not be specified if `field3loglit` or `multifield3logit` object is passed to `data`. See section Aesthetic mappings of `gg3logit()` for details.

- **data**
  - a `field3logit` object, a `multifield3logit` object, or a `data.frame` structured like a fortified `field3logit` or a `multifield3logit` object.

- **geom**
  - The geometric object to use to display the data, either as a ggproto Geom subclass or as a string naming the geom stripped of the geom_ prefix (e.g. "point" rather than "geom_point")

- **position**
  - Position adjustment, either as a string naming the adjustment (e.g. "jitter" to use `position_jitter`), or the result of a call to a position adjustment function. Use the latter if you need to change the settings of the adjustment.

- **show.legend**
  - logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes. It can also be a named logical vector to finely select the aesthetics to display.

- **inherit.aes**
  - If FALSE, overrides the default aesthetics, rather than combining with them. This is most useful for helper functions that define both data and aesthetics and shouldn’t inherit behaviour from the default plot specification, e.g. `borders()`.

- **arrow.**
  - specification for arrow heads, as created by function `arrow` of package `grid`.

- **...**
  - additional arguments passed through to `ggtern`.

**Value**

Layer of ggplot2 package, object of class `LayerInstance`.

**See Also**

Other gg functions: `autoplot.Hfield3logit()`, `gg3logit()`, `stat_3logit()`, `stat_conf3logit()`

**Examples**

```r
  data(cross_1year)
  mod0 <- nnet::multinom(employment_sit ~ gender + finalgrade, data = cross_1year)
  field0 <- field3logit(mod0, 'genderFemale', conf = 0.95)
  gg3logit(field0) + stat_field3logit()
  gg3logit(field0) + stat_field3logit() + stat_conf3logit()
```
TernaryField

Draw a field on an existing ternary plot

Description

*TernaryField()* adds the vector field returned by *field3logit()* to an existing ternary plot generated by *Ternary::TernaryPlot()*.

Usage

```
TernaryField(
  field,
  ..., 
  length = 0.05,
  conf = FALSE,
  npoints = 100,
  conf.args = list()
)
```

Arguments

- **field**: object of class *field3logit* as returned by *field3logit()*.
- **...**: other arguments passed to or from other methods.
- **length**: length of the edges of the arrow head (in inches).
- **conf**: if FALSE confidence regions are not drawn, even if available; if TRUE confidence regions are drawn only if available; if a numeric value is passed, confidence regions at the specified confidence level are computed (if not already available) and drawn.
- **npoints**: number of points of the border to be computed for each confidence region.
- **conf.args**: graphical parameters of confidence regions to be passed to *Ternary::TernaryPolygon()*.

Value

An object of class *field3logit* with confidence regions included, if computed within *TernaryField()*.

See Also

*field3logit()*.

Examples

```
library(nnet)
data(cross_1year)

mod0 <- nnet::multinom(employment_sit ~ gender + finalgrade, data = cross_1year)
field0 <- field3logit(mod0, 'genderFemale')
```
USvote2016

TernaryPlot()
TernaryField(field0)

USvote2016  Self-reported votes from VOTER Survey in 2016

Description

Dataset based on self-reported votes from 2016 VOTER Survey by Democracy Fund Voter Study Group (2017), as used in the examples in Santi et al. (2022).

Format
tibble (data.frame) with 8000 observations of 7 variables:

idcode: voter identifier (integer).
vote: declared vote, a factor with three levels: Clinton, Trump, Other.
race: race, a factor with six levels: White, Black, Hispanic, Asian, Mixed, Other.
educ: level of education, a factor with six levels: No high school, High school grad., Some college, 2-year college, 4-year college, Post-grad.
gender: gender, a factor with four levels: Male, Female, Skipped, Not Asked.
famincome: income (in USD) of voter’s family, a factor with five levels: [0; 30,000), [30,000; 60,000), [60,000; 100,000), [100,000; 150,000), [150,000; Inf).

Details

Object USvote2016 includes only few variables based on the result of the survey, which are publicly available online. See file “data-raw/USvote2016_prepare.R” in the GitHub repository “f-santi/plot3logit” (https://github.com/f-santi/plot3logit), where it is documented how the dataset USvote2016 has been generated.

References


Index

* data
  cross_1year, 7
  USvote2016, 23
* gg functions
  autoplot.Hfield3logit, 6
  gg3logit, 13
  stat_3logit, 18
  stat_conf3logit, 19
  stat_field3logit, 20
  +.Hfield3logit (multifield3logit), 15
  [.multifield3logit (multifield3logit), 15
  <-.multifield3logit
    (multifield3logit), 15
  _PACKAGE (plot3logit-package), 2
  add_confregions, 4
  arrow, 21
  as.data.frame(), 10
  as.data.frame.field3logit
    (field3logit), 10
  as.data.frame.multifield3logit
    (multifield3logit), 15
  as_tibble(), 10
  as_tibble.field3logit (field3logit), 10
  as_tibble.multifield3logit
    (multifield3logit), 15
  autoplot(), 2, 6, 10, 12
  autoplot.Hfield3logit, 6, 14, 19–21
  borders(), 18, 20, 21
  clm, 3
  clm2, 3
  coef.field3logit (field3logit), 10
  cross_1year, 7
  extract3logit, 8
  extract3logit(), 2, 3, 8, 9, 11
  extract3logit.default(), 9
  field3logit, 10
  field3logit(), 3, 4, 9, 10, 12, 17, 22
  fortify(), 10
  fortify.field3logit (field3logit), 10
  fortify.multifield3logit
    (multifield3logit), 15
  gg3logit, 6, 7, 13, 18–21
  gg3logit(), 4, 6, 7, 10, 12, 14, 19, 21
  ggplot, 14
  ggplot2, 2
  ggtern, 2, 10, 14, 20, 21
  grid, 21
  labels, 15
  labels.field3logit (field3logit), 10
  labels.multifield3logit
    (multifield3logit), 15
  labels<- (labels), 15
  labels<- .field3logit (field3logit), 10
  labels<- .multifield3logit
    (multifield3logit), 15
  mlogit, 3
  multifield3logit, 15
  multifield3logit(), 11, 12
  multinom, 3
  plot, 3
  plot(), 2, 10
  plot.field3logit (field3logit), 10
  plot.multifield3logit
    (multifield3logit), 15
  plot3logit-package, 2
  polr, 3
  print.field3logit (field3logit), 10
  print.multifield3logit
    (multifield3logit), 15
  stat_3logit, 7, 14, 18, 20, 21
  stat_3logit(), 6, 18

24
stat_conf3logit, 7, 14, 19, 19, 21
stat_conf3logit(), 3, 6, 7, 14, 18, 19
stat_field3logit, 7, 14, 19, 20, 20
stat_field3logit(), 6, 7, 14, 18, 20

Ternary::TernaryPlot(), 22
Ternary::TernaryPolygon(), 22
TernaryField, 22
TernaryField(), 3, 4, 22
tidy(), 10
tidy.field3logit(field3logit), 10
tidy.multifield3logit (multifield3logit), 15

USvote2016, 23

vcov.field3logit(field3logit), 10
vgam, 3
vglm, 3