Package 'builtenvir'

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Description Functions for modeling the built environment

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R topics documented:

AIC.Dlm   *Akaike Information Criterion*

Description

Compute AIC statistic for fitted DLM

Usage

```
## S3 method for class 'Dlm'
AIC(object, ..., k = 2)
```

Value

A numeric scalar

BayesDlm   *Bayesian Distributed Lag Model*

Description

Parameters and summaries from a Bayesian DLM. Inherits from `"Dlm-class"`.

Slots

`fitted` fitted values; conditional expectation of observed y

`DIC` Deviance Information Criterion

`residuals` observed residuals

`sims` list of posterior simulation draws of model parameters

References

Baek J, et al. (2016) Epidemiology 27(1):116-24. (PubMed)

See Also

`dlm`, `Dlm-class`, `FreqDlm`

BIC.Dlm   *"Bayesian" Information Criterion*

Description

Compute BIC statistic for fitted DLM

Usage

```
## S3 method for class 'Dlm'
BIC(object, ...)
```

Value

A numeric scalar: BIC

coef.Dlm   *Extract Distributed Lag Model Coefficients*

Description

Return DLM coefficients

Usage

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

Details

Note that these are the basis-scaled coefficients. To extract coefficients on the scale of the original design (θ), see `theta`.

Value

A numeric vector of fitted coefficients.

coef.sims   *Extract Coefficient Simulations*

Description

Extract simulated coefficients from a model fitted with MCMC

Usage

```
coef.sims(object, ...)
```

Arguments

object   a fitted model object

Details

`coef.sims` is S4 generic.

Value

A numeric matrix

coef.sims,BayesDlm-method

Extract Distributed Lag Coefficient Simulation Draws

Description

`Dlm` objects fit by the Bayesian method store a matrix of simulated coefficients drawn via MCMC from their full conditional distribution. Extract the distributed lag-scaled simulated coefficient matrix.

Usage

```
## S4 method for signature 'BayesDlm'
coef.sims(object, ...)
```

Value

A numeric matrix containing the scaled simulated coefficient matrix

cr

Cubic Radial Basis

Description

Construct a natural cubic radial basis function for a given distance set vector and apply as a linear transformation of a covariate matrix.

Usage

```
cr(x, Z, ...)
```

Arguments

x	a vector of values to construct the basis from. Missing values are not allowed.
Z	a covariate matrix (or object that can be coerced to a matrix) to take the basis transformation of. length(x) should be the same as ncol(Z). Missing values are not allowed.
...	arguments to be passed to lag.basis

Details

At the time of writing, `cr` is little more than a convenient wrapper to lag.basis intended to simplify the task of specifying lag terms in a model `formula`. The longer term goal is for `cr` (and potentially other basis functions) to replace lag.basis entirely.

Value

An S4 object of class SmoothBasis.

---

dlm   *Distributed Lag Models*

Description

Fit distributed lag models to distance-profiled data. `frequentist` method relies on [lme](). `bayesian` method uses Gibbs to sample from full conditionals, with sampling parameters named in the `control` list.

Usage

```
dlm(formula, data, subset, na.action, method = c("frequentist", "bayesian",
    "Frequentist", "Bayesian"), control = list(), ...)
```

Arguments

formula	an object of class `"`[formula](`"`: a symbolic description of the model to be fitted. See Details.
data	an optional data frame, list, or environment containing the variables of the fitted model.
subset	optional vector specifying a subset of observations to be used in the fitting process.
na.action	optional function that indicates what should happen when the data contains NA's.
method	method used to fit the DLM. Partial matching and capitalization allowed.
control	a list of simulation control parameters. See Details.
...	Ignored for now.

Details

Models are specified using familiar R `formula` syntax with one set of lag terms returned by a given smoothing function (e.g. see [cr]()). The smoothing function can be any that returns a [SmoothLag]() basis object. Multiple lag terms or interactions with lag terms are not allowed, nor are NA and missing-value lag terms supported. See Examples for a basic call to `dlm` using the formula interface, and a cubic radial lag basis specified via `cr`.

The `control` list specifies additional optional `"bayes"` method arguments, and may include: `n.sims`, the total number of simulations to run (default = 5000); `n.save`, the total number of simulations to save (default = 1000); `burnin`, number of simulations to discard from the start of the chain (default = 2000); `alpha.tau.prior`, prior (shape) parameter α_{τ^2} (default = 0.1); `beta.tau.prior`, prior (rate) parameter β_{τ^2} (default = 1e-6); `alpha.sigma.prior`, prior (shape) parameter α_{σ^2} (default = 0.1); `beta.sigma.prior`, prior (rate) parameter β_{σ^2} (default = 1e-6).

The prior distribution heirarchy we assume in the Bayesian formulation of the DLM is as follows:

$$y \sim N(D\theta, \sigma^2 I_n)$$

$$\theta \sim N(\mu_\theta, \Sigma_\theta)$$

$$\theta_l \sim N(\mu_l, \tau^2)$$

$$\sigma^2 \sim Inv - Gamma(\alpha_{\sigma^2}, \frac{1}{\beta_{\sigma^2}})$$

$$\tau^2 \sim Inv - Gamma(\alpha_{\tau^2}, \frac{1}{\beta_{\tau^2}})$$

Where $l \in L$ indexes the set of lag coefficients.

Value

An S4 object that inherits from "`Dlm`" containing the results of the fitted model. If construction of this object fails, dlm will issue a warning, and as a last resort attempt to return a list with components of the fitted model.

References

Baek J, et al. (2016) Epidemiology 27(1):116-24. (PubMed)

See Also

`lme`, `cr`, `Dlm-class`, `FreqDlm`, `BayesDlm`

Examples

```
data (simdata)

## Setup distance count matrix and corresponding lag distances
X <- as.matrix(simdata[, -(1:3)])
lag <- seq(0.1, 10, length.out = ncol(X))

fit <- dlm(Y ~ Age + Gender + cr(lag, X), data = simdata)
summary (fit)
```

`Dlm-class`   *S4 Distributed Lag Models*

Description

Parent class for DLM object representation. Users will interact mainly with daughter classes, `FreqDlm` and `BayesDlm`.

Details

Coming soon!

Slots

`method` character identifier for method (frequentist vs. Bayesian) used to fit the DLM

`call` language object containing matching function call

`coefficients` DLM coefficients

`sigma` residual standard deviation

`tau` random effects standard deviation

`logLik` log likelihood

vcov fitted variance-covariance matrix

basis [LagBasis](#) object containing lag basis representation

N Number of data points the model was fit to

K list of coefficient type lengths. See 'Details.'

References

Baek J, et al. (2016) Epidemiology 27(1):116-24. ([PubMed](#))

See Also

[dlm](#), [LagBasis](#)

---

fitted.Dlm   *Extract DLM Model Fitted Values*

Description

Extract the predicted y values from a fitted by [dlm](#)

Usage

```
## S3 method for class 'Dlm'
fitted(object)
```

Arguments

object   a fitted ["Dlm"](#) object

Value

A numeric vector

---

fixef   *Extract Fixed Effects*

Description

Returns a vector of fixed effects coefficients from a fitted mixed effects model.

Usage

```
fixef(object, ...)

## S4 method for signature 'Dlm'
fixef(object)
```

Details

fixef is S4 generic.

Value

A numeric vector

Methods (by class)

- Dlm: S4 Method for *"Dlm"* Objects

FreqDlm *Classical Distributed Lag Model*

Description

Parameters and summaries from a classically fit DLM (freqentist; model fit using lme). Inherits from *"Dlm-class"*.

Slots

lme output of fitted lme object

References

Baek J, et al. (2016) Epidemiology 27(1):116-24. (PubMed)

See Also

dlm, lme, Dlm-class, BayesDlm

---

lag.basis *Cubic Radial Basis Functions for Distributed Lags*

Description

Compute cubic radial basis for a given lag set.

Usage

```
## S3 method for class 'basis'
lag(lag, center = TRUE, scale = FALSE)
```

Arguments

lag	Distributed lag to compute basis of
center	Either logical or numeric value to indicate if the lag should be mean centered before computing basis (center = TRUE), or else giving the value to center lag at.
scale	Either logical or numeric value to indicate if the lag should be standard deviation-scaled before computing basis (center = TRUE), or else giving the value to scale lag by.

Value

LagBasis object containing the basis matrix.

Examples

```
l <- seq(0.1, 10, length.out = 100)
lb <- lag.basis(l)
```

LagBasis   *Create and Manipulate Lag Basis Functions*

Description

S4 class object to store and query components of lag basis functions. User interface for creating this class can be found in lag.basis.

Slots

x original lag data

x.center store the value the lag data was centered to. In theory this is useful for the non-yet-implemented `predict` method

x.scale store the value the lag data was scaled by. Again, should be useful primarily for the `predict` method in the future

C0 C_0 part of basis matrix

K1 K_1 part of basis matrix

References

Baek J, et al. (2016) Epidemiology 27(1):116-24. (PubMed)

---

logLik.Dlm   *Extract Log-Likelihood*

Description

Log likelihood of the observed data given the model

Usage

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

Value

An object of class `logLik` containing the log-likelihood of the data given the fitted DLM

---

omega *Extract Lag Basis Matrix*

Description

Extract lag basis matrix, Ω

Usage

```
omega(object, ...)

## S4 method for signature 'LagBasis'
omega(object, ...)
```

Details

omega is S4 generic.

Value

A square numeric matrix

Methods (by class)

- LagBasis: Method for "LagBasis" objects

---

plot.Dlm *Plot a Fitted Dlm*

Description

Plots point estimates and intervals for distributed lag terms from a fitted dlm. Default aesthetic relies on geom_pointrange from the ggplot2 package.

Usage

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

Arguments

x	a fitted "Dlm-class" object
...	additional arguments passed to summary.Dlm

Value

A ggplot2 graphic object

---

predict.Dlm   *Generate New Predictions from a Fitted DLM*

Description

Not yet implemented

Usage

```
## S3 method for class 'Dlm'
predict(object, ...)
```

---

predict.LagBasis   *Predict New Values for Fitted Lag Basis*

Description

Not yet implemented

Usage

```
## S3 method for class 'LagBasis'
predict(object, ...)
```

Arguments

object   A [LagBasis](#) object

---

ranef   *Extract Random Effects*

Description

Returns a vector of random effects coefficients from a fitted mixed effects model.

Usage

```
ranef(object, ...)

## S4 method for signature 'Dlm'
ranef(object)
```

Details

ranef is S4 generic.

Value

A numeric vector

Methods (by class)

- Dlm: S4 Method for ″`Dlm`″ Objects

---

residuals.Dlm *Extract DLM Model Residuals*

Description

Extract residuals from a model fitted by `dlm`

Usage

```
## S3 method for class 'Dlm'
residuals(object)
```

Arguments

object   a fitted ″`Dlm`″ object

Value

A numeric vector

---

scaleMat *Extract Distributed Lag Scale Matrix*

Description

Return lag coefficient scale matrix, S, such that the distributed lag coefficients fit by the model are obtained via the transformation $\beta = S\theta$. S should be invertable.

Usage

```
scaleMat(object, ...)

## S4 method for signature 'Dlm'
scaleMat(object, ...)
```

Arguments

object   a fitted model object

Details

`scaleMat` is S4 generic.

Value

A square numeric matrix

Methods (by class)

- Dlm: S4 Method for ″`Dlm`″ Objects

---

se.fixef   *Extract Standard Errors of Fixed Effects*

Description

Returns a vector of fixed effects standard errors from a fitted mixed effects model.

Usage

```
se.fixef(object)

## S4 method for signature 'Dlm'
se.fixef(object)
```

Details

`fixef` is S4 generic.

Value

A numeric vector

Methods (by class)

- `Dlm`: S4 Method for `"Dlm"` Objects

---

se.ranef   *Extract Standard Errors of Random Effects*

Description

Returns a vector of random effects standard errors from a fitted mixed effects model.

Usage

```
se.ranef(object)

## S4 method for signature 'Dlm'
se.ranef(object)
```

Details

`fixef` is S4 generic.

Value

A numeric vector

Methods (by class)

- `Dlm`: S4 Method for `"Dlm"` Objects

---

sigma.Dlm   *Extract Residual Standard Deviation 'Sigma'*

Description

Return observed residual standard deviation

Usage

```
## S3 method for class 'Dlm'
sigma(object, ...)
```

Value

A positive numeric scalar: the residual standard deviation

---

simdata   *Simulated Built Environment Data*

Description

Simulated Built Environment Data

Usage

```
data(simdata)
```

Format

The first column (Y) is the outcome variable, covariates Gender and Age come next, and are followed by 100 location description variables. Each column of these 100 location count variables corresponds to a distance lag equal to the values in seq(0.1, 10, 0.1).

References

Baek J, et al. (2016) Epidemiology 27(1):116-24. (PubMed)

Examples

```
data(simdata)
simdata[1:10, 1:5]
```

SmoothLag   *Lag Matrix With Applied Smoothing*

Description

An S4 class object for representing a smoothed lag matrix in addition to containing details about the basis smoothing. Intended for use within [dlm] modeling framework to assist extraction of basis components treated as "fixed" and "random" effects. Inherits from matrix.

Slots

basis A [LagBasis] smoothing object containing details about the lag and the smoothing parameters used

.Data Contains the "fixed effects" components of the smoothed lag function. This scheme is intended to work conveniently with stats::model.matrix

random Contains the "random effects" components of the smoothed lag function

signature Character string contianing the deparsed call to whatever smoothing function generated the SmoothLag object

---

summary.Dlm   *Summarize a Fitted Dlm Object*

Description

Computes likelihood based statistics, t-statistic summaries, and correlations between fixed effects terms after the nlme package. Also computes rough distributional summaries for distributed lag terms (estimates and intervals, with confidence coefficient level determined by the level parameter).

Usage

```
## S3 method for class 'FreqDlm'
summary(object, level = 0.95, ...)

## S3 method for class 'BayesDlm'
summary(object, level = 0.95, ...)
```

Arguments

object	a fitted ["Dlm"] object
level	desired confidence coefficient (or credible interval) level for summarizing distributed lag terms
...	ignored

Value

An S4 object of class ["SummaryDlm"]

SummaryDlm   *Summarize a Distributed Lag Model*

Description

Compute and store various statistical summaries of a fitted distributed lag model object

Slots

method Character vector with details of the model fitting procedure

call Matching call from `dlm`

coefficients Numeric vector of distributed lag coefficients

likelihood.stats Named numeric vector of likelihood based statistical summaries

variances Named numeric vector with estimaed random effects and residual variance parameters

tTable t-statistic table summaries of fixed effects with (approximate) significance

lag.coefs A matrix with rough distributional summaries of the fitted lag coefficients, like estimates and confidence or posterior intervals.

cor.fixef Correlation matrix of fixed effects

residuals Numeric vector with the residuals from the fitted model

N Number of data points the model was fit to

K List of numbers of various covariate types

---

theta   *Extract Natural Scale Model Parameters 'Theta'*

Description

Extract θ coefficients from a fitted model

Usage

```
theta(object, ...)

## S4 method for signature 'Dlm'
theta(object, ...)
```

Arguments

object   a fitted model object

Details

Returns the natural scale coefficients $\theta = S^{-1}\beta$ given some invertable scale matrix, S.

`theta` is S4 generic.

Value

A numeric vector

Methods (by class)

- `Dlm`: S4 Method for `"Dlm"` Objects

---

vcov.Dlm	*Calculate the Distributed Lag Variance-Covariance Matrix for a Fitted Model Object*

Description

Returns the variance-covariance matrix of the fitted model coefficients (including the random effects terms).

Usage

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

Value

A numeric matrix: the coefficient variance-covariance matrix

---

vcovTheta	*Extract Natural Scale Coefficient Covariance Matrix*

Description

Extract $var\theta$ matrix from a fitted model

Usage

```
vcovTheta(object, ...)

## S4 method for signature 'Dlm'
vcovTheta(object, ...)
```

Arguments

object   a fitted model object

Details

Returns the covariance matrix for the natural scale coefficients, θ.

`vcovTheta` is S4 generic.

Value

A square numeric matrix

Methods (by class)

- `Dlm`: S4 Method for `"Dlm"` Objects

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