Package 'varGuid'

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Type Package

Title Variance-Guided Regression for Heteroscedastic Linear Models

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Depends R (>= 3.5.0)

Imports glmnet, lmtest, sandwich

Description Fits variance-guided linear regression models for heteroscedastic data using an iteratively reweighted least squares estimator or an iteratively reweighted lasso estimator. This CRAN release focuses on the global linear mean-variance model in Section 2 of the accompanying preprint <doi:10.36227/techrxiv.177004877.75352102/v1>. The grouping-based nonlinear prediction extension from Section 3 is available in the development version on GitHub.

Encoding UTF-8

LazyData true

URL https://github.com/luminwin/varGuid

BugReports https://github.com/luminwin/varGuid/issues

NeedsCompilation no

Repository CRAN

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Contents

`cobra2d` *Data from the cobra2 Simulation*

Description

Data with non-linear and interaction relationship with 500 observations and 15 variables.

Usage

```
data(cobra2d)
```

Examples

```
# library(copula)
# cobra2 = function(n = 500, d = 15, sd = .1, corrv = 0) {
#   set.seed(1)
#   d <- max(10, d)
#   X <- matrix(runif(n * d, -1, 1), ncol = d)
#   paramlist <- lapply(1:d, function(j) {list(min=-1,max=1)})
#   myCop <- normalCopula(param=rep(corrv,dim(combn(d,2))[2]), dim = d, dispstr = "un")
#   myMvd <-  mvdc(copula=myCop, margins=rep("unif",d),paramMargins=paramlist)
#   X[, 1:d] <- rMvdc(n, myMvd)
#  dta <- data.frame(list(x = X, y = X[,1]*X[,2] + X[,3]^2 - X[,4]*X[,7] + X[,8]*X[,10] - X[,6]^2
#                         + rnorm(n, sd = sd)))
#   colnames(dta)[1:d] <- paste("x", 1:d, sep = "")
#   f <- "x1 * x2 + x3 ^ 2 - x4 * x7 + x8 * x10 - x6 ^ 2"
#   fs <- "I(x1 * x2) + I(x3 ^ 2) + I(-x4 * x7) + I(x8 * x10) - I(x6 ^ 2)"
#   list(f = f, fs = fs, dta = dta)
# }

data(cobra2d)
```

`lmv` *Fit Variance-Guided Linear Mean-Variance Models*

Description

Fits the stage-1 variance-guided linear model for heteroscedastic data using iteratively reweighted least squares (IRLS) when `lasso = FALSE` or an iteratively reweighted lasso procedure when `lasso = TRUE`. For `lasso = FALSE`, the returned object also includes weighted least squares and heteroscedasticity-consistent inference summaries based on the final fit.

Usage

```
lmv(X, Y, M = 10, step = 1, tol = exp(-10), lasso = FALSE)
```

Arguments

X	Input matrix with observations in rows and predictors in columns.
Y	Numeric response vector.
M	Maximum number of iterations.
step	Scale parameter for the data weights.
tol	Tolerance parameter for convergence.
lasso	Logical; if TRUE, uses the iteratively reweighted lasso algorithm. Otherwise, IRLS is used.

Value

A list with the following components:

beta	Coefficient estimates from the final variance-guided fit.
obj.OLS	Unweighted baseline lm fit used to initialize IRLS when lasso = FALSE.
obj.lasso	Unweighted baseline glmnet fit used to initialize the iteratively reweighted lasso when lasso = TRUE.
obj.varGuid	Final fitted model from either lm or glmnet, depending on lasso.
res	Object returned by the variance-model update in the last iteration.
obj.varGuid.coef	For lasso = FALSE, a list of weighted least squares and heteroscedasticity-consistent coefficient summaries computed from the final fit.
X	The input design matrix X.

Author(s)

Sibei Liu and Min Lu

References

Liu, S. and Lu, M. (2026). *Variance-Guided Regression for Heteroscedastic Data*. TechRxiv. doi:10.36227/techrxiv.177004877.75352102/v1

Examples

```
data(cobra2d, package = "varGuid")
dat <- cobra2d
set.seed(1)
tid <- sample(seq_len(nrow(dat)), 200)
train <- dat[-tid, ]
yid <- which(colnames(dat) == "y")

o <- lmv(X = train[, -yid], Y = train[, yid], lasso = FALSE)
summary(o$obj.varGuid)
summary(o$obj.OLS)
head(prd(o, train[, -yid], model = "baseline"))
head(prd(o, train[, -yid], model = "varGuid"))
```

```
o2 <- lmv(X = train[, -yid], Y = train[, yid], lasso = TRUE)
o2$beta
o2$obj.lasso$beta
head(prd(o2, train[, -yid], model = "baseline"))
head(prd(o2, train[, -yid], model = "varGuid"))
```

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prd *Predict from Fitted Stage-1 varGuid Models*

Description

A lightweight prediction helper for objects returned by `lmv()`. For ordinary weighted least squares fits it dispatches to `stats::predict()`. For iteratively reweighted lasso fits it dispatches to `glmnet::predict.glmnet()` and returns a numeric vector.

Usage

```
prd(object, newdata, model = c("varGuid", "baseline"), ...)
```

Arguments

`object`	An object returned by `lmv()`.
`newdata`	A matrix or data frame of predictors for prediction.
`model`	Which fitted model to use. `"varGuid"` uses the final variance-guided fit. `"baseline"` uses the initial OLS fit when `lasso = FALSE` or the initial lasso fit when `lasso = TRUE`.
`...`	Additional arguments passed to `stats::predict()` or `glmnet::predict.glmnet()`.

Details

This CRAN release covers the global linear mean-variance model from Section 2 of Liu and Lu (2026). For the grouping-based nonlinear prediction extension from Section 3 of the paper, please use the development version available at `devtools::install_github("luminwin/varGuid")`.

Value

A numeric vector of predictions.

Author(s)

Sibei Liu and Min Lu

References

Liu, S. and Lu, M. (2026). *Variance-Guided Regression for Heteroscedastic Data*. TechRxiv. doi:10.36227/techrxiv.177004877.75352102/v1

Examples

```
data(cobra2d, package = "varGuid")
dat <- cobra2d
set.seed(1)
tid <- sample(seq_len(nrow(dat)), 200)
train <- dat[-tid, ]
yid <- which(colnames(dat) == "y")

o <- lmv(X = train[, -yid], Y = train[, yid], lasso = FALSE)
head(prd(o, train[, -yid], model = "baseline"))
head(prd(o, train[, -yid], model = "varGuid"))

o2 <- lmv(X = train[, -yid], Y = train[, yid], lasso = TRUE)
head(prd(o2, train[, -yid], model = "baseline"))
head(prd(o2, train[, -yid], model = "varGuid"))
```

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varGuid *Variance-Guided Regression for Heteroscedastic Linear Models*

Description

The **varGuid** package implements the global linear mean-variance model from Section 2 of Liu and Lu (2026) using iteratively reweighted least squares and iteratively reweighted lasso estimation. This CRAN release focuses on the heteroscedastic linear model and its prediction utilities for the fitted stage-1 models. For the grouping-based nonlinear prediction extension from Section 3 of the paper, please use the development version available at `devtools::install_github("luminwin/varGuid")`.

Author(s)

Sibei Liu and Min Lu

References

Liu, S. and Lu, M. (2026). *Variance-Guided Regression for Heteroscedastic Data*. TechRxiv. doi:10.36227/techrxiv.177004877.75352102/v1

Examples

```
data(cobra2d, package = "varGuid")
dat <- cobra2d
set.seed(1)
tid <- sample(seq_len(nrow(dat)), 200)
train <- dat[-tid, ]
yid <- which(colnames(dat) == "y")

o <- lmv(X = train[, -yid], Y = train[, yid], lasso = FALSE)
summary(o$obj.varGuid)
summary(o$obj.OLS)
```

```
head(prd(o, train[, -yid], model = "baseline"))
head(prd(o, train[, -yid], model = "varGuid"))

# Iteratively reweighted lasso:
o2 <- lmv(X = train[, -yid], Y = train[, yid], lasso = TRUE)
o2$beta
o2$obj.lasso$beta
head(prd(o2, train[, -yid], model = "baseline"))
head(prd(o2, train[, -yid], model = "varGuid"))
```

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