Package 'ggmr'

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Type Package

Title Generalized Gauss Markov Regression

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Description Implements the generalized Gauss Markov regression, this is useful when both predictor and response have uncertainty attached to them and also when covariance within the predictor, within the response and between the predictor and the response is present. Base on the results pub-
lished in guide ISO/TS 28037 (2010) <https://www.iso.org/standard/44473.html>.

Depends stats (>= 3.4.0), MASS (>= 7.3), R (>= 3.4.0)

License GPL (>= 2)

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NeedsCompilation no

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R topics documented:

`ggmr` *Solves the Generalized Gauss Markov Regression model*

Description

Fits the linear model using covariance matrices on the predictor, the response and covariance matrix between predictor and response, according to ISO/TS 28037 (2010).

Usage

```
ggmr(x, y, Ux = diag(0, length(x)),
Uy = diag(1, length(x)),
Uxy = diag(0, length(x)),
subset = rep(TRUE, length(x)),
tol = sqrt(.Machine$double.eps), max.iter = 100, alpha = 0.05,
coef.H0 = c(0, 1))
```

Arguments

x	numeric vector, the predictor values
y	numeric vector, the response values
Ux	numeric matrix, the variance matrix of the predictor
Uy	numeric matrix, the variance matrix of the response
Uxy	numeric matrix, the covariance matrix between predictor and the response
subset	a logical vector or a numeric vector with the position to be considered
tol	numeric, the maximum allowed error tolerance, tolerance is relative
max.iter	integer, the maximum number of allowed iterations
alpha	numeric, the significance level used on testing H0
coef.H0	the coeffients for hypothesis testing purposes

Value

a list with the following elements

coefficients	estimated coefficients
cov	covariance matrix of the estimated coefficients
xi	estimated latent unobservable variables
chisq.validation	chi-squared statistic for model validation
chisq.ht	chi-squared statistic of the observed values for the hypothesis testing
chisq.cri	chi-squared critical value
p.value	probability of observing a validation statistic equal or larger then the sampled just by chance
curr.iter	current number of iterations used
curr.tol	current relative tolerance

Author(s)

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References

ISO/TS 28037 (2010). *Determination and Use of straight-line calibration functions* https://www.iso.org/standard/44473.html

See Also

lm, dwlm

Examples

```
require(MASS)

# Example ISO 28037 (2010) Section 6. table 6
d<- data.frame(
 x=c(1.0, 2.0, 3.0, 4.0, 5.0, 6.0),
 y=c(3.2, 4.3, 7.6, 8.6, 11.7, 12.8),
 uy=c(0.5, 0.5, 0.5, 1.0, 1.0, 1.0)
)
# estimates
ggmr.res <- ggmr(d$x, d$y, Uy=diag(d$uy^2), coef.H0=c(0, 2), tol = 1e-10)
ggmr.res$coefficients
sqrt(diag(ggmr.res$cov))
ggmr.res$cov[1, 2]
ggmr.res$chisq.validation
ggmr.res$chisq.cri
# reference values
# coefficients = c(0.885, 2.057)
# se = c(0.530, 0.178)
# cov = -0.082
# validation.stat = 4.131
# critical.value = 9.488

# lm() estimates the coefficients correctly but
# fails to reproduce the standard errors
summary(lm(y~x, data=d, weights=1/d$uy^2))
# coefficients = c(0.8852, 2.0570)
# se = c(0.5383, 0.1808)

# Example ISO 28037 (2010) Section 7. table 10
d <- data.frame(
 x = c(1.2, 1.9, 2.9, 4.0, 4.7, 5.9),
 y = c(3.4, 4.4, 7.2, 8.5, 10.8, 13.5)
)
Ux = diag(c(0.2, 0.2, 0.2, 0.2, 0.2, 0.2))^2
Uy = diag(c(0.2, 0.2, 0.2, 0.4, 0.4, 0.4))^2

# estimates
ggmr.res <- ggmr(d$x, d$y, Ux, Uy, coef.H0=c(0, 2), tol = 1e-10)
ggmr.res$coefficients
sqrt(diag(ggmr.res$cov))
ggmr.res$cov[1, 2]
```

```
ggmr.res$chisq.validation
ggmr.res$chisq.cri
# reference values
# coefficients = c(0.5788, 2.1597)
# se = c(0.4764, 0.1355)
# cov = -0.0577
# validation.stat = 2.743
# critical.value = 9.488

# Example ISO 28037 (2010) Section 10. table 25
d<- data.frame(
 x=c(50.4, 99.0, 149.9, 200.4, 248.5, 299.7, 349.1),
 y=c(52.3, 97.8, 149.7, 200.1, 250.4, 300.9, 349.2)
)

Ux<- matrix(c(
 0.50, 0.00, 0.25, 0.00, 0.25, 0.00, 0.25,
 0.00, 1.25, 1.00, 0.00, 0.00, 1.00, 1.00,
 0.25, 1.00, 1.50, 0.00, 0.25, 1.00, 1.25,
 0.00, 0.00, 0.00, 1.25, 1.00, 1.00, 1.00,
 0.25, 0.00, 0.25, 1.00, 1.50, 1.00, 1.25,
 0.00, 1.00, 1.00, 1.00, 1.00, 2.25, 2.00,
 0.25, 1.00, 1.25, 1.00, 1.25, 2.00, 2.50
), 7, 7)

Uy<- matrix(1.00, 7, 7) + diag(4.00, 7)

Uxy<- matrix(0, 7, 7)

# estimates
ggmr.res<- ggmr(d$x, d$y, Ux, Uy, Uxy)
ggmr.res$coefficients
sqrt(diag(ggmr.res$cov))
ggmr.res$cov[1, 2]
ggmr.res$chisq.validation
ggmr.res$chisq.cri
# reference values
# coefficients = c(0.3424, 1.0012)
# se = c(2.0569, 0.0090)
# cov = -0.0129
# validation.stat = 1.772
# critical.value = 11.070
```

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