# Package ‘dwlm’

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**Type** Package

**Title** Doubly Weighted Linear Model

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**Description** This linear model solution is useful when both predictor and response have associated uncertainty. The doubly weights linear model solution is invariant on which quantity is used as predictor or response. Based on the results by Reed(1989) <doi:10.1119/1.15963> and Ripley & Thompson(1987) <doi:10.1039/AN9871200377>.

**Depends** stats (>= 3.4.0), R (>= 3.4.0)

**License** GPL (>= 2)

**Encoding** UTF-8

**NeedsCompilation** no

**Repository** CRAN

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## Contents



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`dwlm` *Solves the doubly weighted simple linear model*

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### Description

Fits the simple linear model using weights on both the predictor and the response

## Usage

```
dwlm(x, y, weights.x = rep(1, length(x)),
weights.y = rep(1, length(y)), subset = rep(TRUE, length(x)),
sigma2.x = rep(0, length(x[subset])),
from = min((y[subset] - mean(y[subset]))/(x[subset] - mean(x[subset]))),
to = max((y[subset] - mean(y[subset]))/(x[subset] - mean(x[subset]))),
n = 1000, max.iter = 100, tol = .Machine$double.eps^0.25,
method = c("MLE", "SSE", "R"), trace = FALSE, coef.H0 = c(0,1), alpha = 0.05)
```

## Arguments

| | |
|---|---|
| `x` | the predictor values |
| `y` | the response values |
| `weights.x` | the weight attached to the predictor values |
| `weights.y` | the weight attached to the response values |
| `subset` | a logical vector or a numeric vector with the positions to be considered |
| `sigma2.x` | numeric, the variance due to heterogeneity in the predictor value |
| `from` | numeric, the lowest value of the slope to search for a solution |
| `to` | numeric, the highest value of the slope to search for a solution |
| `n` | integer, the number of slices the search interval (from, to) is divided in |
| `max.iter` | integer, the maximum number of allowed iterations |
| `tol` | numeric, the maximum allowed error tolerance |
| `method` | string, the selected method (MSE, SSE, R) as described in the references. |
| `trace` | logical, flag to keep track of the solution |
| `coef.H0` | numeric vector, the coeffients to test against to for significant difference |
| `alpha` | numeric, the significance level for estimating the Degrees of Equivalence (DoE) |

## Value

A list with the following elements:

| | |
|---|---|
| `x` | original pedictor values |
| `y` | original response values |
| `weights.x` | original predictor weigths |
| `weights.y` | original response weights |
| `subset` | original subset parameter |
| `coef.H0` | original parameter value for hypothesis testing against to |
| `coefficients` | estimated parameters for the linear model solution |
| `cov.mle` | Maximum Likelihood Estimafor for the covariance matrix |
| `cov.lse` | Least Squares Estiimator for the covariance matrix |
| `x.hat` | fitted true predictor value, this is a latent (unobserved) variable |

| | |
|---|---|
| `y.hat` | fitted true response value, this is a latent (unobserved) variable |
| `df.residuals` | degrees of freedom |
| `MSE` | mean square error of the solution |
| `DoE` | pointwise degrees of equivalente between the observed and the latent variables |
| `u.DoE.mle` | unceraintiy of the pointwise degrees of equivalence using maximum likelihood solution |
| `u.DoE.lse` | uncertainty of the pointwise degrees of equivalence using least squares solution |
| `dm.dXj` | partial gradient of the slope with respect to the jth predictor variable |
| `dm.dYj` | partial gradient of the slope with respect to the jth response variable |
| `dc.dXj` | partial gradient of the intercept with respect to the jth predictor variable |
| `dc.dYj` | partial gradient of the intercept with respect to the jth response variable |
| `curr.iter` | number of iterations |
| `curr.tol` | reached tolerance |

## Author(s)

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## References

Reed, B.C. (1989) "Linear least-squares fits with errors in both coordinates", American Journal of Physics, 57, 642. https://doi.org/10.1119/1.15963

Reed, B.C. (1992) "Linear least-squares fits with errors in both coordinates. II: Comments on parameter variances", American Journal of Physics, 60, 59. https://doi.org/10.1119/1.17044

Ripley and Thompson (1987) "Regression techniques for the detection of analytical bias", Analysts, 4. https://doi.org/10.1039/AN9871200377

## See Also

lm

## Examples

```
# Example ISO 28037 Section 7
X.i<- c(1.2, 1.9, 2.9, 4.0, 4.7, 5.9)
Y.i<- c(3.4, 4.4, 7.2, 8.5, 10.8, 13.5)
sd.X.i<- c(0.2, 0.2, 0.2, 0.2, 0.2, 0.2)
sd.Y.i<- c(0.2, 0.2, 0.2, 0.4, 0.4, 0.4)

# values obtained on sep-26, 2016
dwlm.res <- dwlm(X.i, Y.i, 1/sd.X.i^2, 1/sd.Y.i^2,
from = 0, to=3, coef.H0=c(0, 2), tol = 1e-10)
dwlm.res$coefficients
dwlm.res$cov.mle[1, 2]
dwlm.res$curr.tol
dwlm.res$curr.iter
```

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