Package ‘UStatBookABSC’

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**Title**  A Companion Package to the Book “U-Statistics, M-Estimation and Resampling”

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**Description**  A set of functions leading to multivariate response L1 regression.

This includes functions on computing Euclidean inner products and norms, weighted least squares estimates on multivariate responses, function to compute fitted values and residuals. This package is a companion to the book “U-Statistics, M-estimation and Resampling”, by Arup Bose and Snigdhansu Chatterjee, to appear in 2017 as part of the “Texts and Readings in Mathematics” (TRIM) series of Hindustan Book Agency and Springer-Verlag.

**Depends**  R (>= 3.2.3)

**Suggests**  MASS

**License**  GPL-3

**Encoding**  UTF-8

**LazyData**  true

**RoxygenNote**  5.0.1.9000

**NeedsCompilation**  no

**Repository**  CRAN

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**R topics documented:**

- CCU12_Precip
- FitAndResiduals
- IdentityMatrix
- InnerProduct
- L1Regression
- Norm
- WLS

Index 7
CCU12_Precip | Precipitation for June-September 2012 recorded in Kolkata

Description
Precipitation for June-September 2012 recorded in Kolkata

Usage
data(CCU12_Precip)

Format
A data frame with columns
- **Date**: The data in Year-Month-Day format
- **Precip**: Precipitation in millimeters
- **TMax**: Maximum temperature, in Celsius
- **TMin**: Minimum temperature, in Celsius

Examples
```
Precip <- CCU12_Precip$Precip
TMax <- CCU12_Precip$TMax
plot(TMax, Precip)
```

FitAndResiduals | Computes a linear regression fit and residuals on possibly multivariate responses

Description
Computes a linear regression fit and residuals on possibly multivariate responses

Usage
```
FitAndResiduals(Y, X, BetaHat)
```

Arguments
- **Y**: a numeric matrix, to act as response
- **X**: a numeric matrix, to act as covariates
- **BetaHat**: a numeric matrix, to act as slope
**IdentityMatrix**

**Value**

a list consisting of two vectors, the fitted values and residuals

**Examples**

```r
## Not run:
DataY = cbind(CC12_Precip$Precip, CC12_Precip$TMax);
DataX = cbind(rep(1, length(CC12_Precip$Precip)), CC12_Precip$TMin)
BetaHat.New = WLS(DataY, DataX)
Results.New = FitAndResiduals(DataY, DataX, BetaHat.New);

## End(Not run)
```

---

**Description**

Obtains the identity matrix of dimension \( n \)

**Usage**

```r
IdentityMatrix(n)
```

**Arguments**

- **n**: an integer

**Value**

an identity matrix

**Examples**

```r
I.3 = IdentityMatrix(3)
print(I.3)
```
### InnerProduct

**Description**

Computes the Euclidean inner product

**Usage**

```
InnerProduct(a, b, na.rm)
```

**Arguments**

- `a`: a numeric vector
- `b`: another numeric vector
- `na.rm`: logical

**Value**

a real number

**Examples**

```
x <- c(1, 2, 3)
y <- c(3, 0, 1)
InnerProduct(x, y)
```

### L1Regression

**Description**

Computes a L1 multivariate regression. This is the equivalent of median regression when the response is possibly multivariate.

**Usage**

```
L1Regression(Data.Y, Data.X, Weights,
InitialValue = "WLS", MaxIteration, epsilon, lambda)
```
Norm

Arguments

Data.Y a numeric matrix, to act as response
Data.X a numeric matrix, to act as covariates
Weights a numeric matrix, to act as weights
InitialValue a character, to denote how the initial estimate will be computed currently the only available option is WLS
MaxIteration an integer, for the maximum number of iterations allowed
epsilon a positive real number, as tolerance value for convergence
lambda a real number between 0 and 1, to control the amount of update allowed in each iteration

Value

a list consisting of the iteration value at the last step, the difference in norms between the last two iterations, and the estimate of slope

Examples

## Not run:
DataY = cbind(CCU12_Precip$Precip, CCU12_Precip$TMax);
DataX = cbind(rep(1, length(CCU12_Precip$Precip)), CCU12_Precip$TMin)
A2 = L1Regression(DataY, DataX)

## End(Not run)

<table>
<thead>
<tr>
<th>Norm</th>
<th>Computes the Euclidean norm</th>
</tr>
</thead>
</table>

Description

Computes the Euclidean norm

Usage

Norm(a, na.rm)

Arguments

a a numeric vector
na.rm logical

Value

a real number
Examples

```r
x <- c(1, 2)
Norm(x)
```

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**WLS**

*Computes a weighted least squares linear regression on possibly multivariate responses*

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**Description**

Computes a weighted least squares linear regression on possibly multivariate responses

**Usage**

```r
WLS(Y, X, W)
```

**Arguments**

- `Y`: a numeric matrix, to act as response
- `X`: a numeric matrix, to act as covariates
- `W`: a numeric matrix, to act as weights

**Value**

a vector of regression coefficients

**Examples**

```r
## Not run:
DataY = cbind(CCUI2_Precip$Precip, CCUI2_Precip$TMax);
DataX = cbind(rep(1, length(CCUI2_Precip$Precip)), CCUI2_Precip$TMin)
BetaHat.New = WLS(DataY, DataX)

## End(Not run)
```
Index

*Topic datasets
  CCU12_Precip, 2

CCU12_Precip, 2
FitAndResiduals, 2
IdentityMatrix, 3
InnerProduct, 4
L1Regression, 4
Norm, 5
WLS, 6