Package ‘VC2copula’

February 22, 2024

Title Extend the 'copula' Package with Families and Models from 'VineCopula'

Version 0.1.5

Description Provides new classes for (rotated) BB1, BB6, BB7, BB8, and Tawn copulas, extends the existing Gumbel and Clayton families with rotations, and allows to set up a vine copula model using the 'copula' API. Corresponding objects from the 'VineCopula' API can easily be converted.

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Encoding UTF-8

URL https://github.com/tnagler/VC2copula

BugReports https://github.com/tnagler/VC2copula/issues

Depends copula (>= 1.1-2)

Imports VineCopula (>= 2.3.0), methods

LinkingTo VineCopula

Suggests lattice, testthat (>= 2.1.0)

RoxygenNote 7.2.3

Language en-US

NeedsCompilation yes

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Repository CRAN

Date/Publication 2024-02-22 14:00:02 UTC

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Constructors for **BB1Copula**

Description

Constructs an object of the `BB1Copula` (survival sur, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

Usage

```r
BB1Copula(param = c(1, 1))
surBB1Copula(param = c(1, 1))
r90BB1Copula(param = c(-1, -1))
r270BB1Copula(param = c(-1, -1))
```

Arguments

- **param**: The parameter `param` defines the copula through `theta` and `delta`.

Value

One of the respective `BB1` copula classes (`BB1Copula`, `surBB1Copula`, `r90BB1Copula`, `r270BB1Copula`).
References


See Also

See also BB6Copula(), BB7Copula(), BB8Copula() and joeCopula() for further wrapper functions to the VineCopula-package().

Examples

library(copula)

persp(BB1Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(surBB1Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(r90BB1Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
persp(r270BB1Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
Constructors for BB6 copulas

Description

Constructs an object of the BB6Copula (survival sur, 90 degree rotated r90 and 270 degree rotated r270) family for given parameters.

Usage

BB6Copula(param = c(1, 1))

surBB6Copula(param = c(1, 1))

r90BB6Copula(param = c(-1, -1))

r270BB6Copula(param = c(-1, -1))

Arguments

param The parameter param defines the copula through theta and delta.

Value

One of the respective BB6 copula classes (BB6Copula, surBB6Copula, r90BB6Copula, r270BB6Copula).

References


See Also

See also BB6Copula(), BB7Copula(), BB8Copula() and joeCopula() for further wrapper functions to the VineCopula-package().

Examples

library(copula)
persp(BB6Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(surBB6Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(r90BB6Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
persp(r270BB6Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
BB6Copula-class  

**Description**

Wrapper classes representing the BB6, survival BB6, 90 degree and 270 degree rotated BB6 copula families (Joe 1997) from VineCopula-package().

**Objects from the Classes**

Objects can be created by calls of the form `new("BB6Copula", ...)`, `new("surBB6Copula", ...)`, `new("r90BB6Copula", ...)` and `new("r270BB6Copula", ...)` or by the functions `BB6Copula()`, `surBB6Copula()`, `r90BB6Copula()` and `r270BB6Copula()`.

**References**


**See Also**

See also `BB6Copula`, `BB7Copula`, `BB8Copula` and `joeCopula` for further wrapper classes to the VineCopula-package().

**Examples**

```r
showClass("BB6Copula")
```

### BB7Copula

**Constructors for BB7 copulas**

**Description**

Constructs an object of the BB7Copula (survival sur, 90 degree rotated r90 and 270 degree rotated r270) family for given parameters.

**Usage**

```r
BB7Copula(param = c(1, 1))
surBB7Copula(param = c(1, 1))
r90BB7Copula(param = c(-1, -1))
r270BB7Copula(param = c(-1, -1))
```
Arguments

`param`  
The parameter `param` defines the copula through theta and delta.

Value

One of the respective BB7 copula classes (BB7Copula, surBB7Copula, r90BB7Copula, r270BB7Copula).

References


See Also

See also BB6Copula(), BB7Copula(), BB8Copula() and joecopula() for further wrapper functions to the VineCopula-package().

Examples

```r
library(copula)
persp(BB7Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(surBB7Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(r90BB7Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
persp(r270BB7Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
```

---

**BB7Copula-class**

*BB7 copula models*

Description

Wrapper classes representing the BB7, survival BB7, 90 degree and 270 degree rotated BB7 copula families (Joe 1997) from VineCopula-package().

Objects from the Classes

Objects can be created by calls of the form `new("BB7Copula", ...), new("surBB7Copula", ...), new("r90BB7Copula", ...) and new("r270BB7Copula", ...)` or by the functions BB7Copula(), surBB7Copula(), r90BB7Copula() and r270BB7Copula().

References

BB8Copula

See Also

See also BB7Copula, BB7Copula, BB8Copula and joeCopula for further wrapper classes to the VineCopula-package().

Examples

showClass("BB7Copula")

---

### BB8Copula

*Constructors for BB8 copulas*

#### Description

Constructs an object of the BB8Copula (survival sur, 90 degree rotated r90 and 270 degree rotated r270) family for given parameters.

#### Usage

```r
BB8Copula(param = c(1, 1))
surBB8Copula(param = c(1, 1))
r90BB8Copula(param = c(-1, -1))
r270BB8Copula(param = c(-1, -1))
```

#### Arguments

- `param` The parameter `param` defines the copula through theta and delta.

#### Value

One of the respective BB8 copula classes (BB8Copula, surBB8Copula, r90BB8Copula, r270BB8Copula).

#### References


#### See Also

See also BB6Copula(), BB7Copula(), BB8Copula() and joeCopula() for further wrapper functions to the VineCopula-package().
Examples

```r
library(copula)

persp(BB8Copula(c(2, 0.9)), dCopula, zlim = c(0, 10))
persp(surBB8Copula(c(2, 0.9)), dCopula, zlim = c(0, 10))
persp(r90BB8Copula(c(-2, -0.9)), dCopula, zlim = c(0, 10))
persp(r270BB8Copula(c(-2, -0.9)), dCopula, zlim = c(0, 10))
```

BB8Copula-class  BB8 copula models

Description

Wrapper classes representing the BB8, survival BB8, 90 degree and 270 degree rotated BB8 copula families (Joe 1997) from VineCopula-package().

Objects from the Classes

Objects can be created by calls of the form `new("BB8Copula", ...)`, `new("surBB8Copula", ...)`, `new("r90BB8Copula", ...)`, `new("r270BB8Copula", ...)` or by the functions `BB8Copula()`, `surBB8Copula()`, `r90BB8Copula()` and `r270BB8Copula()`.

References


See Also

See also `BB8Copula`, `BB8Copula`, `BB8Copula` and `joeCopula` for further wrapper classes to the VineCopula-package().

Examples

```r
showClass("BB8Copula")
```
BiCop2copula

**Construction of a Copula Object from a VineCopula Family Index**

**Description**

A VineCopula family index along with its parameters is used to construct a corresponding copula object.

**Usage**

```
BiCop2copula(family, par, par2 = 0, obj = NULL)
copulaFromFamilyIndex(family, par, par2 = 0)
```

**Arguments**

- `family`: a family index as defined in VineCopula-package().
- `par`: first parameter.
- `par2`: second parameter.
- `obj`: BiCop() object containing the family and parameter specification.

**Details**

If the family and parameter specification is stored in a [BiCop()] object `obj`, the alternative version

```
BiCop2copula(u1, u2, obj)
```

can be used.

**Value**

An object inheriting copula corresponding to the specific family.

**Examples**

```
# normalCopula with parameter 0.5
BiCop2copula(1, 0.5)

# rotated Tawn T2 copula
BiCop2copula(224, -2, 0.5)
```
ddCopula

Partial Derivatives of Copulas

Description

Similar to \texttt{dCopula()} and \texttt{pCopula()} the function \texttt{dduCopula} evaluates the partial derivative \( \frac{\partial}{\partial u} C(u, v) \) and the function \texttt{ddvCopula} evaluates the partial derivative \( \frac{\partial}{\partial v} C(u, v) \) of the provided copula.

Usage

\begin{verbatim}
  dduCopula(u, copula)

  # S4 method for signature 'matrix,normalCopula'
  dduCopula(u, copula)

  # S4 method for signature 'numeric,normalCopula'
  dduCopula(u, copula, ...)

  # S4 method for signature 'matrix,normalCopula'
  ddvCopula(u, copula)

  # S4 method for signature 'numeric,normalCopula'
  ddvCopula(u, copula, ...)

  # S4 method for signature 'matrix,tCopula'
  dduCopula(u, copula)

  # S4 method for signature 'numeric,tCopula'
  dduCopula(u, copula, ...)

  # S4 method for signature 'matrix,tCopula'
  ddvCopula(u, copula)

  # S4 method for signature 'numeric,tCopula'
  ddvCopula(u, copula, ...)

  # S4 method for signature 'matrix,gumbelCopula'
  dduCopula(u, copula)

  # S4 method for signature 'numeric,gumbelCopula'
  dduCopula(u, copula, ...)

  # S4 method for signature 'matrix,gumbelCopula'
  ddvCopula(u, copula)

  # S4 method for signature 'numeric,gumbelCopula'
  ddvCopula(u, copula, ...)
\end{verbatim}
Arguments

- **u**: Pairs of values for which the partial derivative should be evaluated.
- **copula**: The copula object representing the family member of interest.
- **...**: Additional arguments can be passed on to the underlying functions.

Value

A vector of the evaluated partial derivatives of the same length as rows in u.
Examples

library(copula)

BB1Cop <- BB1Copula()
BB1CopSmpl <- rCopula(100, BB1Cop)

# conditional probabilities of a Gaussian copula given u
BB1GivenU <- dduCopula(BB1CopSmpl, BB1Cop)

# vs. conditional probabilities of a Gaussian copula given v
BB1GivenV <- ddvCopula(BB1CopSmpl[, c(2, 1)], BB1Cop)

plot(BB1GivenU, BB1GivenV)
abline(0, 1)

fitCopula

A dedicated method to use the estimation routines from the VineCopula package

Description

Bivariate copulas are estimated based on BiCopEst and vine copulas through RVineStructureSelect or RVineCopSelect depending on the method argument.

Usage

BCfitCopula(copula, data, method = "ml")

Arguments

copula an object of the desired copula class
data a matrix holding the U(0,1) distributed data columns
method for BIVARIATE copulas either "ml" or "itau" for maximum likelihood estimation or inverse tau estimation (for one parameter families) respectively. See BiCopEst for details. In case of a VINE copulas a list with names entries StructureSelect (default: FALSE), indeptest (default: FALSE), familyset (default: 'NA') and indeptest (default: FALSE). See RVineStructureSelect or RVineCopSelect for details.

Value

an object of class fitCopula as in the copula package.
Examples

\[ u \leftarrow \text{rCopula}(1000, \text{tawnT1Copula}(c(3, 0.5))) \]

\[ \text{fitCopula}(\text{tawnT1Copula}(), u) \]

---

### JoeBiCopula

#### Constructors for Joe copulas

**Description**

Constructs an object of the (survival surJoeBiCopula, 90 degree rotated r90JoeBiCopula and 270 degree rotated r270JoeBiCopula) family for a given parameter. Note that package `copula-package()` provides a class `joeCopula` as well.

**Usage**

```
joeBiCopula(param = 2)
surJoeBiCopula(param = 2)
r90JoeBiCopula(param = -2)
r270JoeBiCopula(param = -2)
```

**Arguments**

- `param` The parameter `param` defines the copula through theta.

**Value**

One of the respective Joe copula classes (`joeBiCopula`, `surJoeBiCopula`, `r90JoeBiCopula`, `r270JoeBiCopula`).

**References**


**See Also**

See also `BB1Copula()`, `BB6Copula()`, `BB7Copula()` and `BB8Copula()` for further wrapper functions to the `VineCopula-package()`.
**joeBiCopula-class**

**Examples**

```r
library(copula)

persp(surJoeBiCopula(1.5), dCopula, zlim = c(0, 10))
persp(r90JoeBiCopula(-1.5), dCopula, zlim = c(0, 10))
persp(r270JoeBiCopula(-1.5), dCopula, zlim = c(0, 10))
```

---

**Description**

Wrapper classes representing the bivariate Joe, survival Joe, 90 degree and 270 degree rotated Joe copula families (Joe 1997) from `VineCopula-package()`. Note that package `copula-package()` provides a class `joeCopula` as well.

**Objects from the Classes**

Objects can be created by calls of the form `new("joeBiCopula", ...), new("surJoeBiCopula", ...), new("r90JoeBiCopula", ...) and new("r270JoeBiCopula", ...)` or by the functions `joeBiCopula(), surJoeBiCopula(), r90JoeBiCopula()` and `r270JoeBiCopula()`.

**References**


**See Also**

See also `BB1Copula`, `BB6Copula`, `BB7Copula` and `BB8Copula` for further wrapper classes to the `VineCopula-package()`.

**Examples**

```r
showClass("surJoeBiCopula")
```
surClaytonCopula

Constructors for survival and rotated Clayton Copulas

Description
These are wrappers to functions from VineCopula-package()

Usage
surClaytonCopula(param = 1)
r90ClaytonCopula(param = -1)
r270ClaytonCopula(param = -1)

Arguments
param A single parameter defining the Copula.

Value
An object of class surClaytonCopula, r90ClaytonCopula or r270ClaytonCopula respectively.

Examples

library(copula)
persp(surClaytonCopula(1.5), dCopula, zlim = c(0, 10))
persp(r90ClaytonCopula(-1.5), dCopula, zlim = c(0, 10))
persp(r270ClaytonCopula(-1.5), dCopula, zlim = c(0, 10))

surClaytonCopula-class
Survival and rotated Clayton copula models

Description
A class representing rotated versions of the Clayton copula family (survival, 90 and 270 degree rotated).

Objects from the Class
Objects can be created by calls of the form new("surClaytonCopula", ...), new("r90ClaytonCopula", ...) and new("r270ClaytonCopula", ...) or by the function surClaytonCopula(), r90ClaytonCopula() and r270ClaytonCopula() respectively.
surGumbelCopula

Constructors for survival and rotated Gumbel Copulas

Description

These are wrappers to functions from `VineCopula-package()`

Usage

```r
surGumbelCopula(param = 1)
r90GumbelCopula(param = -1)
r270GumbelCopula(param = -1)
```

Arguments

- `param`: A single parameter defining the Copula.

Value

An object of class `surGumbelCopula`, `r90GumbelCopula` or `r270GumbelCopula` respectively.

Examples

```r
library(copula)
persp(surGumbelCopula(1.5), dCopula, zlim = c(0, 10))
persp(r90GumbelCopula(-1.5), dCopula, zlim = c(0, 10))
persp(r270GumbelCopula(-1.5), dCopula, zlim = c(0, 10))
```
surGumbelCopula-class

Surfival and rotated Gumbel copula models

Description

A class representing rotated versions of the Gumbel copula family (survival, 90 and 270 degree rotated).

Objects from the Class

Objects can be created by calls of the form new("surGumbelCopula", ...), new("r90GumbelCopula", ...) and new("r270GumbelCopula", ...) or by the function surGumbelCopula(), r90GumbelCopula() and r270GumbelCopula() respectively.

See Also

VineCopula-package()

Examples

library(copula)

persp(surGumbelCopula(5), dCopula, zlim = c(0, 10))
persp(r90GumbelCopula(-5), dCopula, zlim = c(0, 10))
persp(r270GumbelCopula(-5), dCopula, zlim = c(0, 10))

tawnT1Copula

Constructor for Tawn copulas (type 1)

Description

Constructs an object of the tawnT1Copula (survival sur, 90 degree rotated r90 and 270 degree rotated r270) family for given parameters.

Usage

tawnT1Copula(param = c(2, 0.5))

surTawnT1Copula(param = c(2, 0.5))

r90TawnT1Copula(param = c(-2, 0.5))

r270TawnT1Copula(param = c(-2, 0.5))
**Arguments**

param  The parameter param defines the copula through param1 and param2.

**Value**

One of the Tawn type 1 copula classes (tawnT1Copula, surTawnT1Copula, r90TawnT1Copula, r270TawnT1Copula).

**See Also**

tawnT1Copula() and the package VineCopula-package() for implementation details.

**Examples**

```r
library(copula)
persp(tawnT1Copula(), dCopula, zlim = c(0, 10))
persp(surTawnT1Copula(), dCopula, zlim = c(0, 10))
persp(r90TawnT1Copula(), dCopula, zlim = c(0, 10))
persp(r270TawnT1Copula(), dCopula, zlim = c(0, 10))
```

---

tawnT1Copula-class  Tawn copula models (type 1)

**Description**

S4-class representation of the Tawn Copula family of type 1 and rotated versions thereof.

**Objects from the Class**

Objects can be created by calls of the form new("tawnT1Copula", ...), or through the explicit constructors tawnT1Copula(), surTawnT1Copula(), r90TawnT1Copula() and r270TawnT1Copula() respectively.

**See Also**

tawnT1Copula and the package VineCopula-package() for implementation details.

**Examples**

```r
showClass("tawnT1Copula")
```
**tawnT2Copula**

**Constructor for Tawn copulas (type 2)**

**Description**

Constructs an object of the `tawnT2Copula` (survival sur, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

**Usage**

```r
tawnT2Copula(param = c(2, 0.5))
surTawnT2Copula(param = c(2, 0.5))
r90TawnT2Copula(param = c(-2, 0.5))
r270TawnT2Copula(param = c(-2, 0.5))
```

**Arguments**

`param`  
The parameter `param` defines the copula through `param1` and `param2`.

**Value**

One of the Tawn type 2 copula classes (`tawnT2Copula`, `surTawnT2Copula`, `r90TawnT2Copula`, `r270TawnT2Copula`).

**See Also**

`tawnT2Copula()` and the package `VineCopula-package()` for implementation details.

**Examples**

```r
library/copula
persp(tawnT2Copula(), dCopula, zlim = c(0, 10))
persp(surTawnT2Copula(), dCopula, zlim = c(0, 10))
persp(r90TawnT2Copula(), dCopula, zlim = c(0, 10))
persp(r270TawnT2Copula(), dCopula, zlim = c(0, 10))
```
Description

S4-class representation of the Tawn Copula family of type 2 and rotated versions there of.

Objects from the Class

Objects can be created by calls of the form `new("tawnT2Copula", ...)`, or through the explicit constructors `tawnT2Copula()`, `surTawnT2Copula()`, `r90TawnT2Copula()` and `r270TawnT2Copula()` respectively.

See Also

tawnT2Copula and the package `VineCopula-package()` for implementation details.

Examples

```r
showClass("tawnT2Copula")
```

vineCopula

Constructor of the Class vineCopula.

Description

Constructs an instance of the `vineCopula` class.

Usage

```r
vineCopula(RVM, type = "CVine")
```

Arguments

- **RVM**
  
  An object of class `RVineMatrix` generated from `RVineMatrix` in the package `VineCopula-package` or an integer (e.g. `4L`) defining the dimension (an independent Gaussian C-vine of this dimension will be constructed).

- **type**
  
  A predefined type if only the dimension is provided and ignored otherwise, the default is a canonical vine.

Value

An instance of the `vineCopula` class.
vineCopula-class

Author(s)
Benedikt Graeler

References

Examples

# a C-vine of independent copulas
vine <- vineCopula(4L, "CVine")

library(copula)
library(lattice)

cloud(V1 ~ V2 + V3, as.data.frame(rCopula(500, vine)))

vineCopula-class

Class "vineCopula"

Description
A class representing vine copulas in a object oriented implementations. Many functions go back to the package VineCopula-package

Objects from the Class
Objects can be created by calls of the form new("vineCopula", ...) or through the function vineCopula.

Author(s)
Benedikt Graeler

References

See Also
RVineMatrix from package VineCopula-package

Examples

showClass("vineCopula")
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