

Package ‘distrEllipse’

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Title S4 classes for elliptically contoured distributions

Depends R(>= 2.8.0), methods, graphics, mvtnorm, setRNG(>= 2006.2-1),distr(>= 2.2), distrEx(>= 2.2), distrSim(>= 2.2), startupmsg

Suggests distrMod(>= 2.2), distrTEst(>= 2.2)

Author Peter Ruckdeschel

Description Distribution (S4-)classes for elliptically contoured distributions (based on package distr)

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LazyLoad yes

License LGPL-3

URL <http://distr.r-forge.r-project.org/>

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distrEllipse-package *distrEllipse – S4 classes for elliptically contoured distributions*

Description

distrEllipse provides infrastructure / (S4-)classes for elliptically contoured distributions (based on package `distr`).

Details

Package: distrEllipse
Version: 2.3
Date: 2010-12-03
Depends: R(>= 2.8.0), methods, graphics, mvtnorm, setRNG(>= 2006.2-1), distr(>= 2.2), distrEx(>= 2.2), distrSim(>= 2.2)
LazyLoad: yes
License: LGPL-3
URL: <http://distr.r-forge.r-project.org/>
SVNRevision: 699

Classes

```
#####
Distribution Classes
#####
[*]: there is a generating function with the same name

"Distribution" (from distr)
|>"MultivariateDistribution" (from distrEx)
|>|>"MultivarMixingDistribution" [*]
|>|>"SphericalDistribution" [*]
|>|>|>"EllipticalDistribution" [*]
|>|>|>"MVNormDistribution" [*]

"DistrList" (from distr)
|>"MultivarDistrList" [* / class union of "MVDistrList", "UnivarDistrList"]
|>|>"MVDistrList"
|>"UnivarDistrList" (from distr) [*]
```

Methods

plot-methods	Methods for Function plot (for SphericalDistribution)
show-methods	Methods for Function show (for Simulation/Contsimulation)

Functions

distrEllipseoptions	Functions to change the global variables of the package 'distrEllipse'
---------------------	---

Slot accessors / -replacement functions

All slots are inspected / modified by corresponding accessors / -replacement functions.

Start-up-Banner

You may suppress the start-up banner/message completely by setting `options("StartupBanner"="off")` somewhere before loading this package by `library` or `require` in your R-code / R-session.

If option "StartupBanner" is not defined (default) or setting `options("StartupBanner"=NULL)` or `options("StartupBanner"="complete")` the complete start-up banner is displayed.

For any other value of option "StartupBanner" (i.e., not in `c(NULL, "off", "complete")`) only the version information is displayed.

The same can be achieved by wrapping the `library` or `require` call into either `suppressStartupMessages()` or `onlytypeStartupMessages(., atypes="version")`.

Package versions

Note: The first two numbers of package versions do not necessarily reflect package-individual development, but rather are chosen for the distrXXX family as a whole in order to ease updating "depends" information.

Start-up-Banner

You may suppress the start-up banner/message completely by setting `options("StartupBanner"="off")` somewhere before loading this package by `library` or `require` in your R-code / R-session.

If option "StartupBanner" is not defined (default) or setting `options("StartupBanner"=NULL)` or `options("StartupBanner"="complete")` the complete start-up banner is displayed.

For any other value of option "StartupBanner" (i.e., not in `c(NULL, "off", "complete")`) only the version information is displayed.

As for general packageStartupMessage's, you may also suppress all the start-up banner by wrapping the `library` or `require` call into `suppressPackageStartupMessages()` from **startupmsg**-version 0.5 on.

Note

Global options controlling the plots and summaries of Dataclass and Simulation/Contsimulation objects may be inspected / set by `distrEllipseoptions()` and `getdistrEllipseOption()`.

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>,
Maintainer: Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

References

P. Ruckdeschel, M. Kohl, T. Stabla, F. Camphausen (2006): S4 Classes for Distributions, *R News*, 6(2), 2-6. http://CRAN.R-project.org/doc/Rnews/Rnews_2006-2.pdf

A vignette for packages **distr**, **distrSim**, **distrTEst**, **distrEx**, **distrTeach**, **distrMod**, and **distrEllipse** is included into the mere documentation package **distrDoc** and may be called by `require("distrDoc"); vignette("distrDoc")`.

A homepage to this package is available under
<http://distr.r-forge.r-project.org/>.

distrEllipseMASK

Masking off/by other functions in package "distrEllipse"

Description

Provides information on the (intended) masking of and (non-intended) masking by other other functions in package **distrEllipse**

Usage

```
distrEllipseMASK(library = NULL)
```

Arguments

`library` a character vector with path names of R libraries, or NULL. The default value of NULL corresponds to all libraries currently known. If the default is used, the loaded packages are searched before the libraries

Value

no value is returned

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

Examples

```
distrEllipseMASK()
```

distrEllipseoptions *functions to change the global variables of the package 'distrEllipse'*

Description

With `distrEllipseoptions` and `getdistrEllipseOption` you may inspect and change the global variables used by package **distrEllipse**.

Usage

```
distrEllipseoptions(...)  
getdistrEllipseOption(x)
```

Arguments

`...` any options can be defined, using `name = value` or by passing a list of such tagged values.

`x` a character string holding an option name.

Details

Invoking `distrEllipseoptions()` with no arguments returns a list with the current values of the options. To access the value of a single option, one should use `getdistrEllipseOption("WarningSim")`, e.g., rather than `distrEllipseoptions("WarningSim")` which is a *list* of length one.

Value

distrEllipseoptions() returns a list of the global options of **distrEllipse**.

distrEllipseoptions("Nsim") returns the global option Nsim as a list of length 1.

distrEllipseoptions("Nsim" = 3000) sets the value of the global option Nsim to 3000. getdistrEllipseOption("Nsim") returns the current value set for option Nsim.

Currently available options

Nsim for plotting: number of (simulated) points to be plotted.

withED for plotting: logical; shall principal axes of the contour ellipsoid be plot in (for each panel)?

lwd.Ed for plotting: line width of principal axes (for each panel).

col.Ed for plotting: color of principal axes (for each panel).

withMean for plotting: logical; shall mean be plot in (for each panel)?

cex.mean for plotting: size of the mean symbol (for each panel).

pch.mean for plotting: mean symbol (for each panel).

col.mean for plotting: color of the mean symbol (for each panel).

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[options](#), [getOption](#)

Examples

```
distrEllipseoptions("Nsim") # returns the value of Nsim, by default = 5
currentDistrOptions <- distrEllipseoptions()
distrEllipseoptions(Nsim = 6000)
distrEllipseoptions("Nsim")
getdistrEllipseOption("Nsim")
distrEllipseoptions(c("Nsim", "withED"))
```

EllipticalDistribution

Generating function for EllipticalDistribution-class

Description

Generates an object of class "EllipticalDistribution".

Usage

```
EllipticalDistribution(radDistr = sqrt(Chisq(df = length(loc))),
  loc = c(0,0), scale = diag(length(loc)), p = NULL, q = NULL)
```

Arguments

radDistr	an object of class <code>UnivariateDistribution</code> with positive support, i.e. $p(\text{radDistr})(0) == 0$; the radial distribution.
loc	real number: location / center of the elliptical distribution.
scale	a square matrix (with $nrow(\text{scale}) == ncol(\text{scale}) == \text{length}(\text{loc})$) of full rank: the / a scale matrix of the elliptical distribution — unique only upto $\text{scale} \% \% t(\text{scale})$, i.e. if $A1$ and $A2$ are two square matrices of full rank such that $A1 \% \% t(A1) == A2 \% \% t(A2)$, then we obtain the same elliptical distribution for $\text{scale} = A1$ and for $\text{scale} = A2$.
p	optional: p-slot of the corresponding distribution;
q	optional: q-slot of the corresponding distribution;

Value

Object of class "EllipticalDistribution"

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[EllipticalDistribution-class](#)

Examples

```
E0 <- EllipticalDistribution()
plot(E0)
E1 <- diag(1,2)%%E0+c(1,2)
plot(E1)
E(E1)
var(E1)
```

EllipticalDistribution-class

Elliptical distribution class

Description

Class `EllipticalDistribution` implements general elliptically symmetric distributions, i.e. starting from a spherically distribution realized as an object S of class `SphericalDistribution`, this is the distribution of an affine linear transformation $AS+b$.

Objects from the Class

Objects could in principle be created by calls to `new`, but more frequently you would create them via the generating function `EllipticalDistribution`.

Slots

img Object of class "Reals".

param Object of class "EllipticalParameter".

r function with argument n; random number generator

d optional function; in case it exists: the density of the distribution

p optional function; in case it is non-null: the cdf of the distribution evaluated on rectangles, i.e. if a random variable X is distributed according to an object of class "EllipticalDistribution", for q a matrix of dimension $d \times n$ $p(\text{object})(q)$ returns, for each of the n columns $P(X_i \leq q_i, i = 1, \dots, d)$.

q optional function; in case it is non-null: the quantile of the distribution evaluated on rectangles, i.e. if a random variable X is distributed according to an object of class "EllipticalDistribution", for p a vector of length n , returns, for each of the n components the infimal number q_j such that $P(X_i \leq q_j, i = 1, \dots, d) \geq p_j$.

radDistr an object of class UnivariateDistribution with positive support, i.e. $p(\text{radDistr})(0) == 0$; the radial distribution.

.withArith logical: used internally to issue warnings as to interpretation of arithmetics

.withSim logical: used internally to issue warnings as to accuracy

.logExact logical: used internally to flag the case where there are explicit formulae for the log version of density, cdf, and quantile function

.lowerExact logical: used internally to flag the case where there are explicit formulae for the lower tail version of cdf and quantile function

Symmetry object of class "EllipticalSymmetry" about center loc ; used internally to avoid unnecessary calculations.

Extends

Class "SphericalDistribution", directly.

Class "MultivariateDistribution", by class "SphericalDistribution". Class "Distribution", by class "MultivariateDistribution".

Methods

location signature(object = "EllipticalDistribution"): wrapped access method for slot location of slot param.

scale signature(x = "EllipticalDistribution"): wrapped access method for slot scale of slot param.

location<- signature(object = "EllipticalDistribution"): wrapped replace method for slot location of slot param.

scale<- signature(x = "EllipticalDistribution"): wrapped replace method for slot scale of slot param.

E signature(object = "EllipticalDistribution", fun = "missing", cond = "missing"): expectation of an elliptically symmetric distribution; exact.

var signature(x = "EllipticalDistribution"): expectation of an elliptically symmetric distribution; exact.

```

+ signature(e1 = "EllipticalDistribution", e2 = "numeric"): affine linear transformation; exact.
- signature(e1 = "EllipticalDistribution", e2 = "numeric"): affine linear transformation; exact.
* signature(e1 = "EllipticalDistribution", e2 = "numeric"): affine linear transformation; exact.
%% signature(e1 = "numeric", e2 = "EllipticalDistribution"): affine linear transformation; exact.
coerce signature(from = "EllipticalDistribution", to = "UnivariateDistribution"): create a UnivariateDistribution object from a (one-dimensional) elliptically symmetric distribution.
coerce signature(from = "UnivariateDistribution", to = "EllipticalDistribution"): create a EllipticalDistribution object from a (symmetric) univariate distribution.

```

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

Examples

```
new("EllipticalDistribution") ## better use EllipticalDistribution()
```

EllipticalParameter-class

Parameter of an Elliptical distributions

Description

The class of the parameter of Elliptical distributions.

Objects from the Class

Objects can be created by calls of the form `new("EllipticalParameter", ...)`.

Slots

`loc` numeric; center / location of the distribution.

`scale` matrix; the scale matrix; the number of rows of this matrix must be the same as the length of location.

`name` default name is "parameter of a Elliptical distribution".

Extends

Class "Parameter", directly.

Class "OptionalParameter", by class "Parameter".

Methods

location signature(object = "EllipticalParameter"): access method for slot location.

scale signature(x = "EllipticalParameter"): access method for slot scale.

location<- signature(object = "EllipticalParameter"): replace method for slot location.

scale<- signature(object = "EllipticalParameter"): replace method for slot scale.

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[EllipticalDistribution-class](#), [Parameter-class](#)

Examples

```
new("EllipticalParameter")
```

MultivarDistrList *Generating function for MultivarDistrList-class*

Description

Generates an object of class "MultivarDistrList".

Usage

```
MultivarDistrList(..., Dlist)
```

Arguments

...	Objects of class "MultivariateDistribution" (or subclasses)
Dlist	an optional list or object of class "MultivarDistrList"; if not missing it is appended to argument ...; this way MultivarMixingDistribution may also be called with a list (or "MultivarDistrList"-object) as argument as suggested in an e-mail by Krunoslav Sever (thank you!)

Value

Object of class "MVDistrList" or of class "UnivarDistrList", hence of class union "MultivarDistrList"

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[DistrList-class](#), [MultivarDistrList-class](#), [MultivarDistrList](#)

Examples

```
(DL1 <- MultivarDistrList(Norm(), Exp(), Pois()))
(DL2 <- MultivarDistrList(MVNorm(),
  EllipticalDistribution(radDistr=Exp(), loc=c(1,2),
    scale=diag(c(3,1))),MVt()))
```

MultivarDistrList-class

List of multivariate distributions

Description

Create a list of multivariate distributions

Objects from the Class

Objects can be created by calls of the form `new("MVDistrList", ...)`. More frequently they are created via the generating function [MultivarDistrList](#).

Slots

`.Data`: Object of class "list". A list of multivariate distributions of the same dimension.

Extends

Class "DistrList", directly.
 Class "list", by class "DistrList".
 Class "vector", by class "DistrList".

Methods

coerce signature(from = "MultivariateDistribution", to = "MultivarDistrList"):
 create a MultivarDistrList object from a univariate distribution

dimension dim of the range space.

dim synonym to dimension.

Details

In fact, class "MultivarDistrList" is an inbetween class between class "DistrList" and class "UnivarDistrList", which is a case for [setIs](#), but we would have to modify the metadata information in package **distr** to realize this. So we introduce a new (sister) class "MVDistrList" which implements strictly lists of multivariate distributions, and which together with "UnivarDistrList" is a subclass of the common class union class "MultivarDistrList".

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[MultivarDistrList](#), [DistrList-class](#), [MultivariateDistribution-class](#)

Examples

```
(DL1 <- MultivarDistrList(Norm(), Exp(), Pois()))
(DL2 <- MultivarDistrList(MVNorm(),
  EllipticalDistribution(radDistr=Exp(), loc=c(1,2),
    scale=diag(c(3,1))),MVt()))
```

MultivarMixingDistribution

Generating function for Class "MultivarMixingDistribution"

Description

Generates an object of class "MultivarMixingDistribution".

Usage

```
MultivarMixingDistribution(..., Dlist, mixCoeff
  )
```

Arguments

...	Objects of class "MultivariateDistribution" (or subclasses)
Dlist	an optional list or object of class "MultivarDistrList"; if not missing it is appended to argument ...; this way MultivarMixingDistribution may also be called with a list (or "MultivarDistrList"-object) as argument as suggested in an e-mail by Krunoslav Sever (thank you!)
mixCoeff	Objects of class "numeric" : a vector of probabilities for the mixing components (must be of same length as arguments in ...).

Details

If mixCoeff is missing, all elements in ... are equally weighted.

Value

Object of class "MultivarMixingDistribution", or if argument withSimplify is TRUE and the resulting object would have one mixing component with probability (almost) 1, MultivarMixingDistribution will return this component.

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[MultivarMixingDistribution-class](#)

Examples

```
mylist <- MultivarMixingDistribution(Binom(3,.3), Dirac(2), Norm(),
  mixCoeff=c(1/4,1/5,11/20))
```

MultivarMixingDistribution-class

Class "MultivarMixingDistribution"

Description

MultivarMixingDistribution-class is a class to formalize multivariate mixing distributions; it is a subclass to class MultivariateDistribution.

Objects from the Class

Objects can be created by calls of the form `new("MultivarMixingDistribution", ...)`. More frequently they are created via the generating function [MultivarMixingDistribution](#).

Slots

`mixCoeff` Object of class "numeric": a vector of probabilities for the mixing components.

`mixDistr` Object of class "MultivarDistrList": a list of multivariate distributions containing the mixing components; must be of same length as `mixCoeff`.

`img` Object of class "Reals": the space of the image of this distribution which has dimension 1 and the name "Real Space"

`param` Object of class "Parameter": the parameter of this distribution, having only the slot name "Parameter of a discrete distribution"

`r` Object of class "function": generates random numbers

`d` fixed to NULL

`p` Object of class "OptionalFunction": if non-null cumulative distribution function

`q` Object of class "OptionalFunction": if non-null quantile function

`.withArith` logical: used internally to issue warnings as to interpretation of arithmetics

`.withSim` logical: used internally to issue warnings as to accuracy

`.logExact` logical: used internally to flag the case where there are explicit formulae for the log version of density, cdf, and quantile function

`.lowerExact` logical: used internally to flag the case where there are explicit formulae for the lower tail version of cdf and quantile function

`Symmetry` object of class "DistributionSymmetry"; used internally to avoid unnecessary calculations.

Extends

Class "MultivariateDistribution" class "Distribution" by class "MultivariateDistribution".

Methods

show signature(object = "MultivarMixingDistribution") prints the object

mixCoeff<- signature(object = "MultivarMixingDistribution") replaces the corresponding slot

mixCoeff signature(object = "MultivarMixingDistribution") returns the corresponding slot

mixDistr<- signature(object = "MultivarMixingDistribution") replaces the corresponding slot

mixDistr signature(object = "MultivarMixingDistribution") returns the corresponding slot

support signature(object = "MultivarMixingDistribution") returns the corresponding slot

gaps signature(object = "MultivarMixingDistribution") returns the corresponding slot

.logExact signature(object = "Distribution"): returns slot .logExact if existing; else tries to convert the object to a newer version of its class by [conv2NewVersion](#) and returns the corresponding slot of the converted object.

.lowerExact signature(object = "Distribution"): returns slot .lowerExact if existing; else tries to convert the object to a newer version of its class by [conv2NewVersion](#) and returns the corresponding slot of the converted object.

Symmetry returns slot Symmetry if existing; else tries to convert the object to a newer version of its class by [conv2NewVersion](#) and returns the corresponding slot of the converted object.

plot signature(x = "MultivarMixingDistribution", y = "missing"): plot for an spherically symmetric distribution; see [plot-methods](#).

E corresponding expectation — see [E](#).

dimension dim of the range space.

dim synonym to dimension.

show signature(object = "MultivarMixingDistribution"): show method for spherically symmetric distributions.

showobj signature(object = "MultivarMixingDistribution"): showobj method for spherically symmetric distributions.

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[Parameter-class](#), [MultivariateDistribution-class](#), [LatticeDistribution-class](#), [AbscontDistribution-class](#), [simplifyD-methods](#), [flat.mix](#)

Examples

```

mylist <- MultivarMixingDistribution(Binom(3,.3), Dirac(2), Norm(),
  mixCoeff=c(1/4,1/5,11/20))
mylist2 <- MultivarMixingDistribution(Binom(3,.3), mylist,
  mixCoeff=c(.3,.7))
mylist2
p(mylist)(0.3)
mixDistr(mylist2)

##multivariate
E1 <- diag(1,2)%*%EllipticalDistribution(radDistr=Gammad())+c(1,2)
mylistD <- MultivarMixingDistribution(MVNorm(), E1, MVt(),
  mixCoeff=c(1/4,1/5,11/20))
mylistD2 <- MultivarMixingDistribution(E1+c(-2,2), mylistD,
  mixCoeff=c(.3,.7))
mylistD2
p(mylistD)
mixDistr(mylistD2)

```

MVNormDistribution *Generating function for MVNormDistribution-class*

Description

Generates an object of class "MVNormDistribution".

Usage

```
MVNorm(loc=c(0,0), scale = diag(length(loc)))
```

Arguments

loc	real number: location / center of the elliptical distribution.
scale	a square matrix (with $nrow(scale) == ncol(scale) == length(loc)$) of full rank: the / a scale matrix of the elliptical distribution — unique only upto scale , i.e. if $A1$ and $A2$ are two square matrices of full rank such that $A1 \%*\% t(A1) == A2 \%*\% t(A2)$, then we obtain the same elliptical distribution for scale = $A1$ and for scale = $A2$.

Value

Object of class "MVNormDistribution"

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[MVNormDistribution-class](#)

Examples

```
E0 <- MVNorm()
plot(E0)
E1 <- diag(1,2)%*%E0+c(1,2)
plot(E1)
E(E1)
var(E1)
```

MVNormDistribution-class

MVNorm distribution class

Description

Class `MVNormDistribution` implements a general multivariate distribution using code from package `mvtnorm`. For details to this implementation confer to the references given in this package.

Objects from the Class

Objects could in principle be created by calls to `new`, but more frequently you would create them via the generating function `MVNormDistribution`.

Slots

`img`: Object of class "Reals".

`param`: Object of class "MvtParameter".

`r`: function with argument `n`; random number generator

`d`: the density of this distribution, `pmvnorm`

`p`: the (vectorized) function `pmvnorm`.

`q`: the (vectorized) function `qmvnorm`.

`radDistr`: the distribution `sqrt(Chisq(df=dim0))`

`.withArith`: FALSE

`.withSim`: FALSE

`.logExact`: TRUE

`.lowerExact`: TRUE

`Symmetry`: object of class "EllipticalSymmetry" about center `loc`; used internally to avoid unnecessary calculations.

Extends

Class "EllipticalDistribution", directly.
 Class "SphericalDistribution", by class "EllipticalDistribution".
 Class "MultivariateDistribution", by class "SphericalDistribution". Class "Distribution",
 by class "MultivariateDistribution".

Methods

sigma signature(object = "MVNormDistribution"): wrapped access method for slot sigma
 of slot param.
mean signature(object = "MVNormDistribution"): wrapped access method for slot location
 of slot param.

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

Package **mvtnorm**

Examples

```
new("MVNormDistribution") ## better use generating function MVNormDistribution()
```

MVNormParameter-class *Parameter of a multivariate normal distribution*

Description

The class of the parameter of MVNorm distributions.

Objects from the Class

Objects can be created by calls of the form `new("MVNormParameter", ...)`.

Slots

loc: numeric; center / location of the distribution.
scale: matrix; the scale matrix; the number of rows of this matrix must be the same as the length
 of location.
name: default name is "parameter of a Elliptical distribution".

Extends

Class "EllipticalParameter", directly.
 Class "Parameter", by class "EllipticalParameter".
 Class "OptionalParameter", by class "Parameter".

Methods

mean signature(object = "MVNormParameter"): access method for slot location.

sigma signature(x = "MVNormParameter"): utility function; returns $S\%*\%t(S)$ for $S=scale(x)$.

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[MVNormDistribution-class](#), [Parameter-class](#)

Examples

```
new("MVNormParameter")
```

MvtDistribution

Generating function for MvtDistribution-class

Description

Generates an object of class "MvtDistribution".

Usage

```
Mvt(loc = c(0,0), scale = diag(length(loc)), df = 1, ncp = 0)
```

Arguments

loc real number: location / center of the elliptical distribution.

scale a square matrix (with $nrow(scale)==ncol(scale)==length(loc)$) of full rank: the / a scale matrix of the elliptical distribution — unique only upto $scale\%*\%t(scale)$, i.e. if $A1$ and $A2$ are two square matrices of full rank such that $A1\%*\%t(A1)==A2\%*\%t(A2)$, then we obtain the same elliptical distribution for $scale = A1$ and for $scale = A2$.

df integer; degrees of freedom

ncp positive real number; non-centrality parameter

Value

Object of class "MvtDistribution"

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also[MVtDistribution-class](#)**Examples**

```

E0 <- MVt()
plot(E0)
E1 <- diag(1,2)%*%E0+c(1,2)
plot(E1)
E(E1)
var(E1)

```

MVtDistribution-class *MVt distribution class*

Description

Class `MVtDistribution` implements multivariate t distributions using code from package **`mvt-norm`**. For details to this implementation confer to the references given in this package.

Objects from the Class

Objects could in principle be created by calls to `new`, but more frequently you would create them via the generating function [MVtDistribution](#).

Slots

img: Object of class "Reals".
param: Object of class "MVtParameter".
r: function with argument `n`; random number generator
d: the density of this distribution, [dmvt](#)
p: the (vectorized) function [pmvt](#).
q: the (vectorized) function [qmvt](#).
radDistr: an object of class `AbscontDistribution` with density

$$\frac{\Gamma\left(\frac{\dim + \text{df} - 1}{2}\right)}{\Gamma(\text{df}/2 - 1)} x^{\dim-1} \text{df}^{-\dim/2} / (1 + x^2/\text{df})^{(\dim+\text{df})/2}$$

.withArith: FALSE

.withSim: FALSE

.logExact: TRUE

.lowerExact: TRUE

Symmetry: object of class "EllipticalSymmetry" about center `loc`; used internally to avoid unnecessary calculations.

Extends

Class "EllipticalDistribution", directly.
 Class "SphericalDistribution", by class "EllipticalDistribution".
 Class "MultivariateDistribution", by class "SphericalDistribution". Class "Distribution",
 by class "MultivariateDistribution".

Methods

sigma signature(object = "MVtDistribution"): wrapped access method for slot sigma of slot param.
ncp signature(object = "MVtDistribution"): wrapped access method for slot ncp of slot param.
df signature(x = "MVtDistribution"): wrapped access method for slot scale of slot param.

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

Package **mvtnorm**

Examples

```
new("MVtDistribution") ## better use generating function MVtDistribution()
```

MVtParameter-class *Parameter of a multivariate t distribution*

Description

The class of the parameter of MVt distributions.

Objects from the Class

Objects can be created by calls of the form `new("MVtParameter", ...)`.

Slots

loc: numeric; center / location of the distribution.
scale: matrix; the scale matrix; the number of rows of this matrix must be the same as the length of location.
df: integer; the degrees of freedom.
ncp: positive real; the non-centrality parameter.
name: default name is "parameter of a Elliptical distribution".

Extends

Class "Parameter", directly.
 Class "OptionalParameter", by class "Parameter".

Methods

mean signature(object = "MVnormParameter"): access method for slot location.
sigma signature(x = "MVnormParameter"): utility function; returns $S\%*t(S)$ for $S=scale(x)$.
ncp signature(object = "MVnormParameter"): access method for slot ncp.
df signature(x = "MVnormParameter"): access method for slot df.

Author(s)

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See Also

[MvtDistribution-class](#), [Parameter-class](#)

Examples

```
new("MvtParameter")
```

 plot-methods

Methods for Function plot in Package 'distrEllipse'

Description

plot-methods

Usage

```
plot(x, y, ...)
## S4 method for signature 'SphericalDistribution,missing'
plot(x, Nsim = getdistrEllipseOption("Nsim"), ...,
      withED = getdistrEllipseOption("withED"),
      lwd.Ed = getdistrEllipseOption("lwd.Ed"),
      col.Ed = getdistrEllipseOption("col.Ed"),
      withMean = getdistrEllipseOption("withMean"),
      cex.mean = getdistrEllipseOption("cex.mean"),
      pch.mean = getdistrEllipseOption("pch.mean"),
      col.mean = getdistrEllipseOption("col.mean"))
## S4 method for signature 'MultivarMixingDistribution,missing'
plot(x, Nsim = getdistrEllipseOption("Nsim"), ...,
      withED = getdistrEllipseOption("withED"),
      lwd.Ed = getdistrEllipseOption("lwd.Ed"),
```

```
col.Ed = getdistrEllipseOption("col.Ed"),
withMean = getdistrEllipseOption("withMean"),
cex.mean = getdistrEllipseOption("cex.mean"),
pch.mean = getdistrEllipseOption("pch.mean"),
col.mean = getdistrEllipseOption("col.mean"))
```

Arguments

x	object of class "SphericalDistribution" distribution to be plotted
y	missing
Nsim	number of (simulated) points to be plotted.
withED	logical; shall principal axes of the contour ellipsoid be plot in (for each panel)?
lwd.Ed	line width of principal axes (for each panel).
col.Ed	color of principal axes (for each panel).
withMean	logical; shall mean be plot in (for each panel)?
cex.mean	size of the mean symbol (for each panel).
pch.mean	mean symbol (for each panel).
col.mean	color of the mean symbol (for each panel).
...	additional arguments for plot — see plot , plot.default , plot.stepfun

Details

Using `pairs`, plots all pairs of coordinates of the object, using simulated values. Any parameters of [pairs](#) may be passed on to this particular plot method.

See Also

[pairs](#), [plot](#) [plot.default](#), [plot.stepfun](#), [par](#)

Examples

```
E0 <- matrix(c(2,1,1,4),2,2)%*%EllipticalDistribution()+c(2,1)
E1 <- matrix(c(3,2,2,4),2,2)%*%EllipticalDistribution(radDistr = exp(Binom(10,.8)))
plot(E0)
plot(E1, withED=FALSE, Nsim=5000)
mylist <- MultivarMixingDistribution(E0,E1, mixCoeff=c(1/4,3/4))
plot(mylist)
```

SphericalDistribution *Generating function for SphericalDistribution-class*

Description

Generates an object of class "SphericalDistribution".

Usage

```
SphericalDistribution(radDistr = sqrt(Chisq(df=dim)), dim = 2,  
                    p = NULL, q = NULL)
```

Arguments

radDistr	an object of class UnivariateDistribution with positive support, i.e. $p(\text{radDistr})(0)=0$; the radial distribution.
dim	positive integer: dimension of the distribution.
p	optional: p-slot of the corresponding distribution;
q	optional: q-slot of the corresponding distribution;

Value

Object of class "SphericalDistribution"

Author(s)

Peter Ruckdeschel <Peter.Ruckdeschel@itwm.fraunhofer.de>

See Also

[SphericalDistribution-class](#)

Examples

```
E0 <- SphericalDistribution()  
plot(E0)  
E1 <- diag(1,2)%*%E0+c(1,2)  
plot(E1)  
E(E1)  
var(E1)
```

SphericalDistribution-class

Spherical distribution class

Description

Class SphericalDistribution implements general spherically symmetric distributions, i.e. starting from a random variable L distributed according to a univariate distribution `radDistr` with positive support serving as radial distribution, and an independent random variable U distributed uniformly on the dim dimensional sphere, this is the distribution of LU .

Objects from the Class

Objects could in principle be created by calls to `new`, but more frequently you would create them via the generating function `SphericalDistribution`.

Slots

`img` Object of class "Reals".

`param` Object of class "SphericalParameter".

`r` function with argument n ; random number generator

`d` optional function; in case it exists: the density of the distribution

`p` optional function; in case it is non-null: the cdf of the distribution evaluated on rectangles, i.e. if a random variable X is distributed according to an object of class "SphericalDistribution", for q a matrix of dimension $d \times n$ `p(object)(q)` returns, for each of the n columns $P(X_i \leq q_i, i = 1, \dots, d)$.

`q` optional function; in case it is non-null: the quantile of the distribution evaluated on rectangles, i.e. if a random variable X is distributed according to an object of class "SphericalDistribution", for p a vector of length n , returns, for each of the n components the infimal number q_j such that $P(X_i \leq q_j, i = 1, \dots, d) \geq p_j$.

`radDistr` an object of class UnivariateDistribution with positive support, i.e. `p(radDistr)(0)==0`; the radial distribution.

`.withArith` logical: used internally to issue warnings as to interpretation of arithmetics

`.withSim` logical: used internally to issue warnings as to accuracy

`.logExact` logical: used internally to flag the case where there are explicit formulae for the log version of density, cdf, and quantile function

`.lowerExact` logical: used internally to flag the case where there are explicit formulae for the lower tail version of cdf and quantile function

`Symmetry` object of class "SphericalSymmetry" about center `loc`; used internally to avoid unnecessary calculations.

Extends

Class "MultivariateDistribution", directly.

Class "Distribution", by class "MultivariateDistribution".

Methods

- dimension** signature(object = "SphericalDistribution"): returns the dimension of the distribution.
- dim** signature(object = "SphericalDistribution"): synonym to dimension.
- location** signature(object = "SphericalDistribution"): helper function to have the same interface as class "EllipticalDistribution"; always returns 0 (in the respective dimension).
- scale** signature(object = "SphericalDistribution"): helper function to have the same interface as class "EllipticalDistribution"; always returns the unit matrix (in the respective dimension).
- radDistr** signature(object = "SphericalDistribution"): access method for slot radDistr.
- r.rd** signature(object = "SphericalDistribution"): wrapped access method for slot r of slot radDistr.
- d.rd** signature(object = "SphericalDistribution"): wrapped access method for slot d of slot radDistr.
- p.rd** signature(object = "SphericalDistribution"): wrapped access method for slot p of slot radDistr.
- q.rd** signature(object = "SphericalDistribution"): wrapped access method for slot q of slot radDistr.
- plot.rd** signature(x = "SphericalDistribution"): utility; calls plot for slot radDistr.
- plot** signature(x = "SphericalDistribution", y = "missing"): plot for an spherically symmetric distribution; see [plot-methods](#).
- show** signature(object = "SphericalDistribution"): show method for spherically symmetric distributions.
- showobj** signature(object = "SphericalDistribution"): showobj method for spherically symmetric distributions.
- E** signature(object = "SphericalDistribution", fun = "missing", cond = "missing"): expectation of an elliptically symmetric distribution; exact.
- var** signature(x = "SphericalDistribution"): expectation of an elliptically symmetric distribution; exact.
- coerce** signature(from = "SphericalDistribution", to = "EllipticalDistribution"): create a EllipticalDistribution object from a spherically symmetric distribution.
- + signature(e1 = "SphericalDistribution", e2 = "numeric"): affine linear transformation; exact.
- signature(e1 = "SphericalDistribution", e2 = "numeric"): affine linear transformation; exact.
- signature(e1 = "SphericalDistribution", e2 = "missing"): affine linear transformation; exact.
- * signature(e1 = "SphericalDistribution", e2 = "numeric"): affine linear transformation; exact.
- + signature(e1 = "numeric", e2 = "SphericalDistribution"): affine linear transformation; exact.

```
- signature(e1 = "numeric", e2 = "SphericalDistribution"): affine linear transformation;  
  exact.  
* signature(e1 = "numeric", e2 = "SphericalDistribution"): affine linear transformation;  
  exact.  
%% signature(e1 = "numeric", e2 = "SphericalDistribution"): affine linear transforma-  
  tion; exact.
```

Author(s)

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Examples

```
new("SphericalDistribution") ## better use SphericalDistribution()
```

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