Package 'ibelief'

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Type Package

Title An R Package for Implementing Belief Functions

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Description This package contains several basic functions to implement belief functions.

LazyData FALSE

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License GPL (>= 2)

NeedsCompilation no

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R topics documented:

ConflictTable *Computing the conflict table*

Description

Computing the table of conflict for $nbexperts$ masses and $natoms = round(\log 2(lm))$ classes. This function gives the conflict focal set combinations for the $nbexperts$ masses. The focal sets are labeled in natural order, e.g, number 2 denotes ω_1, and number 4 donoets $\{\omega_1, \omega_2\}$ if the discernment frame is $\{\omega_1, \omega_2, \ldots, \omega_n\}$. Note that only one case of conflict is given. For example, if expert 1 says 3, and expert 2 says 2 the function returns `matrix(c(2,3),,1)` and if expert 1 says 2, and expert 2 says 3 the function also returns `matrix(c(2,3),,1)`.

Usage

```
ConflictTable(lm, nbexperts)
```

Arguments

`lm`	The length of the power set of the discernment frame, i.e., 2^{natoms}
`nbexperts`	The number of experts (masses)

Value

Matrix with $nbexperts$ rows and number of conflict focal set combinations columns.

See Also

PCR6, decisionDST

Examples

```
## The conflict table for two experts in a discernment frame with three elements
 ConflictTable(2^3,2)
##The conflict table for three experts in a discernment frame with four elements
 ConflictTable(2^4,3)
```

decisionDST *Decision Rules*

Description

Different rules for making decisions in the framework of belief functions

Usage

```
decisionDST(mass, criterion, r = 0.5)
```

Arguments

mass	The matrix containing the masses. Each column represents a piece of mass.
criterion	The decison baseline: criterion=1 maximum of the plausibility criterion=2 maximum of the credibility criterion=3 maximum of the credibility with rejection criterion=4 maximum of the pignistic probability criterion=5 Appriou criterion (decision onto 2^{Θ})
r	The parameter in BayesianMass function. If criterion 5 is used, it should be given. Otherwise it will be set to the default value 0.5.

Value

The decision vector. E.g., in classification problem, class labels.

Examples

```
m1=c(0,0.4, 0.1, 0.2, 0.2, 0, 0, 0.1);
m2=c(0,0.2, 0.3, 0.1, 0.1, 0, 0.2, 0.1);
m3=c(0.1,0.2, 0, 0.1, 0.1, 0.1, 0, 0.3);

m3d=discounting(m3,0.95);

M_comb_Smets=DST(cbind(m1,m2,m3d),1);
M_comb_PCR6=DST(cbind(m1,m2),8);

class_fusion=decisionDST(M_comb_Smets,1)
class_fusion=decisionDST(M_comb_PCR6,1)
class_fusion=decisionDST(M_comb_Smets,5,0.5)
class_fusion=decisionDST(cbind(M_comb_Smets,M_comb_PCR6),1)
```

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discounting *Discounting masses*

Description

Discount masses using given factors

Usage

```
discounting(MassIn, alpha)
```

Arguments

MassIn	Matrix with 2^n rows and nb columns. Parameter n is the number of classes and nb is the number of experts.
alpha	Discounting factor. A number or a vector with length of ncol(MassIn)

Value

Mass matrix. The discounted masses, each column is a piece of mass

Examples

```
## The conflict table for two experts in a discernment frame with three elements
m1=c(0,0.4, 0.1, 0.2, 0.2, 0, 0, 0.1);
m2=c(0,0.2, 0.3, 0.1, 0.1, 0, 0.2, 0.1);
discounting(m1,0.95)
# if only one factor is given, all the masses are discounted using the same factor
discounting(cbind(m1,m2),0.95)
# if the factor vector is given, the masses are discounted using the corresponding factor
discounting(cbind(m1,m2),c(0.95,0.9))
```

DST *Combination rules*

Description

Different rules to combine masses

Usage

```
DST(MassIn, criterion)
```

Arguments

MassIn	The matrix containing the masses. Each column represents a piece of mass.
criterion	The combination criterion: criterion=1 Smets criterion criterion=2 Dempster-Shafer criterion (normalized) criterion=3 Yager criterion criterion=4 Disjunctive combination criterion criterion=5 Dubois criterion (normalized and disjunctive combination) criterion=6 Dubois and Prade criterion (mixt combination) criterion=7 Florea criterion criterion=8 PCR6 criterion=9 Cautious Denoeux Min for functions non-dogmatics criterion=10 Cautious Denoeux Max for separable functions criterion=11 Hard Denoeux for functions non-normales criterion=12 Mean of the bbas

Value

The combined mass vector. One column.

Examples

```
m1=c(0,0.4, 0.1, 0.2, 0.2, 0, 0, 0.1);
m2=c(0,0.2, 0.3, 0.1, 0.1, 0, 0.2, 0.1);
m3=c(0.1,0.2, 0, 0.1, 0.1, 0.1, 0, 0.3);

m3d=discounting(m3,0.95);

M_comb_Smets=DST(cbind(m1,m2,m3d),1);
M_comb_Smets
M_comb_PCR6=DST(cbind(m1,m2),8);
M_comb_PCR6
```

FMTfunctions *Fast Mobius Transform*

Description

Use the Fast Mobius Transformation to convert one measure to another one

Usage

```
beltob(InputVec)
beltom(InputVec)
beltopl(InputVec)
beltoq(InputVec)
btobel (InputVec)
btom(InputVec)
btopl (InputVec)
btoq (InputVec)
btov(InputVec)
mtob (InputVec)
mtobel(InputVec)
mtobetp(InputVec)
mtonm(InputVec)
mtopl(InputVec)
mtoq (InputVec)
mtov (InputVec)
mtow (InputVec)
pltob(InputVec)
pltobel(InputVec)
pltom(InputVec)
pltoq (InputVec)
qtom (InputVec)
qtow(InputVec)
vtob(InputVec)
vtom (InputVec)
wtom (InputVec)
wtoq(InputVec)
```

Arguments

InputVec	the measure to transform, e.g., mass, bel function, plausibility function, etc.

Value

The associated converted new measure

Examples

```
Mass=RandomMass(nbFocalElement=3, ThetaSize=3, nbMass=4, Type=1)
mass=mtobel(Mass)
qvec=mtoq(mass)
mass=qtom(qvec)
```

PCR6 *PCR6 rule*

Description

PCR6 combination rule

Usage

```
PCR6(MassIn, TabConflict)
```

Arguments

MassIn	Matrix with 2^n rows and nb columns. Parameter n is the number of classes (or the length of discernment frame) and nb is the number of experts.
TabConflict	The conflict table, which can be got using the function $ConflictTable$

Value

Two parts:

Mass	matrix with 2^n rows and one column, the combined mass
conf	a number, total conflict

See Also

ConflictTable, decisionDST

Examples

```
## The conflict table for two experts in a discernment frame with three elements
TabConflict=ConflictTable(2^3,2)
m1=c(0,0.4, 0.1, 0.2, 0.2, 0, 0, 0.1);
m2=c(0,0.2, 0.3, 0.1, 0.1, 0, 0.2, 0.1);
PCR6(cbind(m1,m2),TabConflict)
```

RandomMass *Generating masses*

Description

Different ways to generate masses

Usage

```
RandomMass(nbFocalElement, ThetaSize, nbMass, Type, singleton)
```

Arguments

nbFocalElement	The number of focal elements
ThetaSize	The length of the discernment frame Θ
nbMass	The number of masses to generate
Type	Which kind of mass to generate: Type=1 for focal elements can be evrywhere Type=2 for focal elements can not be on the emptyset Type=3 for no dogmatic mass : one focal element is on Θ (ignorance) Type=4 for no dogmatic mass : one focal element is on Θ (ignorance) and no focal elements are on the emptyset Type=5 for all the focal elements are the singletons Type=6 for all the focal elements are the singletons and on Θ (ignorance) Type=7 for all the focal elements are the singletons and on Θ (ignorance), but not on all the singletons Type=8 On only one defined singleton, on Θ (ignorance), and others Type=9 On one defined singleton, on other singletons and on Θ (ignorance) Type=10 On one focal element contain a defined singleton, on other focal elements and on Θ (ignorance) Type=11 On one focal element contain a defined singleton, on other focal elements (not emptyset) and on Θ (ignorance)
singleton	The singleton element (with only one element) in the focal sets. It should be given if Type is from 5 to 11

Value

The generated mass matrix. Each column represenets a piece of mass

Examples

```
RandomMass(nbFocalElement=3, ThetaSize=3, nbMass=4, Type=1)
RandomMass(nbFocalElement=3, ThetaSize=4, nbMass=4, Type=3)
RandomMass(nbFocalElement=4, ThetaSize=4, nbMass=4, Type=5,singleton=2)
RandomMass(nbFocalElement=4, ThetaSize=4, nbMass=4, Type=10,singleton=2)
```

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