Package: Pomic (via r-universe)

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Type Package

Title Pattern Oriented Modelling Information Criterion

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Description Calculations of an information criterion are proposed to
check the quality of simulations results of Agent-based models
(ABM/IBM) or other non-linear rule-based models. The POMDEV
measure (Pattern Oriented Modelling DEViance) is based on the
Kullback-Leibler divergence and likelihood theory. It basically
indicates the deviance of simulation results from field
observations. Once POMDEV scores and metropolis-hasting
sampling on different model versions are effectuated, POMIC
scores (Pattern Oriented Modelling Information Criterion) can
be calculated. This method could be further developed to
incorporate multiple patterns assessment. Piou C, U Berger and
V Grimm (2009) <doi:10.1016/j.ecolmodel.2009.05.003>.

Depends stats

License GPL-2

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Contents

Pomic-package   *Pattern Oriented Modeling Information Criterion for ABM/IBM*

Description

Calculations of an information criterion are proposed to check the quality of simulations results of Agent-based models (ABM/IBM) or other non-linear rule-based models. The POMDEV measure (Pattern Oriented Modelling DEViance) is based on the Kullback-Leibler divergence and likelihood theory. It basically indicates the deviance of simulation results from field observations. Once POMDEV scores and metropolis-hasting sampling on different model versions are effectuated, POMIC scores (Pattern Oriented Modelling Information Criterion) can be calculated. This method could be further developed to incorporate multiple patterns assessment.

Details

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Date:	2018-02-09
License:	GPL-2

The pomdev function is for distribution patterns. It is computed as in Piou et al. (2009) It corresponds to twice the sum of the log of an approximated likelihood given by the approximating function of density from the simulation results applied on the field data.

The pomdev.extra function is to obtain POMDEV scores as well as other goodness of fit indicators.

The pomdev.corrected function is to obtain raw approximation of KL divergence.

The pomdev.ts function is for time series patterns. It is still under evaluation.

Type demo(demoPomic) for a demonstration of POMIC calculation as in appendix B of Piou et al. (2009).

And type demo{verification} for the verification of the first demonstration (as in appendix C of Piou et al. (2009)).

Author(s)

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References

Piou 2007, Patterns and individual-based modeling of spatial competition within two main components of Neotropical mangrove ecosystems. PhD thesis, University of Bremen. `http://elib.suub.uni-bremen.de/diss/docs/00010671.pdf`

Piou, C., U. Berger, and V. Grimm. 2009. Proposing an information criterion for individual-based models developed in a pattern-oriented modelling framework. Ecological Modelling 220:1957-1967. `http://dx.doi.org/10.1016/j.ecolmodel.2009.05.003`

See Also

pomdev pomdev.ts pomdev.extra pomdev.corrected

Examples

```
#example of field pattern distribution:
fieldpattern<-rnorm(100,10,5)
#model results:
model1runs<- rnorm(100*5,10.5,6)
model2runs<- rnorm(100*5,9.5,2)
#POMDEV measurements:
pomdev.extra(fieldpattern,model1runs,eps=10^-20,plotting=TRUE)
pomdev.extra(fieldpattern,model2runs,eps=10^-20,plotting=TRUE)
pomdev(fieldpattern,model2runs,eps=10^-20)
pomdev.corrected(fieldpattern,model1runs,eps=10^-20)
pomdev.corrected(fieldpattern,model2runs,eps=10^-20)

#other examples of POMDEV measures:
pomdev(x<-rnorm(100),y<-rnorm(100,0.1))
#POMDEV value for a model creating a normal distribution
#with identical variance as the field data but a mean 0.1
#away from the field data
par(mfrow=c(2,2))
hist(x,freq=FALSE) #plot the field data as histogram
lines(density(y))#check the simulation results distribution as line
pomdev(x<-rnorm(100),y<-rnorm(100,0.2)) #idem 0.2 away from the field data
hist(x,freq=FALSE); lines(density(y)) #plot
pomdev(x<-rnorm(100),y<-rnorm(100,1))   #idem 1 away from the field data
hist(x,freq=FALSE); lines(density(y)) #plot
pomdev(x<-rnorm(100),y<-rnorm(100,3))   #idem 3 away from the field data
hist(x,freq=FALSE); lines(density(y)) #plot

## Not run: demo(demoPomic)
## Not run: demo(verification)
```

pomdev	*POMDEV calculation for numerical patterns*

Description

This function calculate the POMDEV value of simulations results compared to a vector taken as a field pattern.

Usage

```
pomdev(object1, object2, eps=10^-30, nrange=1000)
```

Arguments

object1	Numerical, vector of the field pattern
object2	Numerical, vector of simulations results
eps	Numerical, value to use when the likelihood = 0 for mathematical stability
nrange	Numerical, number of interval to consider for the probability density function creation and integration

Details

This function returns the POMDEV value as computed in Piou et al. It corresponds to twice the sum of the log of an approximated likelihood given by the approximating function of density from the simulation results applied on the field data.

Value

Return a value corresponding to the pomdev score of model results to reproduce the pattern.

Author(s)

Cyril Piou
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See Also

pomdev.extra pomdev.corrected

Examples

```
pomdev(rnorm(100,10,5),rnorm(100*5,10.5,6),eps=10^-20)
```

---

pomdev.corrected *POMDEV corrected calculation for numerical patterns*

Description

This function calculate the KL divergence of simulations results compared to a vector taken as a field pattern with identical techniques as POMDEV.

Usage

```
pomdev.corrected(object1, object2, eps=10^-30, nrange=1000)
```

Arguments

object1	Numerical, vector of the field pattern
object2	Numerical, vector of simulations results
eps	Numerical, value to use when the likelihood = 0 for mathematical stability
nrange	Numerical, number of interval to consider for the probability density function creation and integration

Details

This function returns 1/2 the POMDEV value + correction of the constant in KL equation corresponding to the entropy of the field pattern. Thus, this value should be close to the KL divergence using the same techniques of approximation than pomdev.

Value

Return a value corresponding to the KL divergence between the model results and the pattern

Author(s)

Cyril Piou
<cyril.piou@cirad.fr>

See Also

pomdev.extra pomdev

Examples

```
pomdev.corrected(rnorm(100,10,5),rnorm(100*5,10.5,6),eps=10^-20)
```

---

pomdev.extra	*POMDEV calculation for numerical patterns as well as other good-ness of fit indicators*

Description

This function calculate the POMDEV value of simulations results compared to a vector taken as a field pattern and compute also other goodness of fit indicators.

Usage

```
pomdev.extra(object1, object2, eps=10^-30, nrange=1000,
             fullmsd=FALSE,  plotting=FALSE,...)
```

Arguments

object1	Numerical, vector of the field pattern
object2	Numerical, vector of simulations results
eps	Numerical, value to use when the likelihood = 0 for mathematical stability
nrange	Numerical, number of interval to consider for the probability density function creation and integration
fullmsd	Boolean, should the full cross MSD be calculated as well
plotting	Boolean, should a plot illustrating the calculation be created
...	eventual information to give to the last plot (if plotting=T)...

Details

The KL divergence is only calculated comparing the simulations to the field vector, as if it is the truth (different from the **flexmix** KLdiv calculations)

Value

Return a list containing:

field_data	the field data
sim_data	the simulation data
kernel_estimator	
	information about the kernel estimator used
result	a table of 4 or 5 rows (depending if fullmsd=TRUE or not) with:
– POMDEV	pomdev score of model results to reproduce the pattern
– overlap	indicates if the model results overlap the range of the field data
– KLdiv	KL divergence of the model results from the field pattern
– MSD	$(\sum(field)/n_{field} - \sum(simulation)/n_{simulation})^2$
– CrossMSD	if fullmsd is true, calculate the mean square deviation among each pair of simulation and field data possible

Author(s)

Cyril Piou
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See Also

[pomdev](#) [pomdev.corrected](#)

Examples

```
pomdev.extra(rnorm(100,10,5),rnorm(100*5,10.5,6),eps=10^-20)
pomdev.extra(rnorm(100,10,5),rnorm(100*5,10.5,6),eps=10^-20,fullmsd=TRUE,plotting=TRUE)
```

---

pomdev.ts   *POMDEV calculation for numerical time series patterns*

Description

This function calculate the POMDEV value of time series simulations results compared to a vector taken as a field pattern.

Usage

```
pomdev.ts(object1, object2, eps=10^-30, nrange=1000)
```

Arguments

object1	Numerical, vector of the field pattern
object2	Numerical, matrix of simulations results with nrow = length(object1) and ncol > 2
eps	Numerical, value to use when the likelihood = 0 for mathematical stability
nrange	Numerical, number of interval to consider for the probability density function creation and integration

Details

This function is still under evaluation and should give a possibility of deviance measurement for temporal patterns. It corresponds to the sum of twice the log of approximated likelihoods given by approximating function of density from simulation results for each field data point.

Value

Return a value corresponding to the pomdev score of model results to reproduce the pattern.

Author(s)

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See Also

pomdev pomdev.extra pomdev.corrected

Examples

```
pomdev.ts(rnorm(100,10,5),matrix(rnorm(100*5,10.5,6),ncol=5),eps=10^-20)
```

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