Package 'diffeRenTES'

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Title Computation of TES-Based Cell Differentiation Trees

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Author Michele Braccini <braccini.michele@gmail.com>

Maintainer Michele Braccini <braccini.michele@gmail.com>

Description Computes the ATM (Attractor Transition Matrix) structure and
the tree-like structure describing the cell differentiation process
(based on the Threshold Ergodic Set concept introduced by Serra and
Villani), starting from the Boolean networks with synchronous updating
scheme of the 'BoolNet' R package. TESs (Threshold Ergodic Sets) are
the mathematical abstractions that represent the different cell types
arising during ontogenesis. TESs and the powerful model of biological
differentiation based on Boolean networks to which it belongs have
been firstly described in ``A Dynamical Model of Genetic Networks for
Cell Differentiation'' Villani M, Barbieri A, Serra R (2011) A
Dynamical Model of Genetic Networks for Cell Differentiation. PLOS ONE
6(3): e17703.

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Depends R (>= 3.3)

Imports BoolNet, DOT, igraph, tools

Suggests knitr, rmarkdown, testthat

VignetteBuilder knitr

Encoding UTF-8

RoxygenNote 7.1.2

NeedsCompilation no

Repository CRAN

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R topics documented:

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getATM   *Compute ATM*

Description

getATM returns the ATM (Attractor Transition Matrix) structure. The ATM computes the probability
of a transition between the attractors of the Boolean network upon the introduction of noise in the
form of a logic negation to each node of each state of each attractor, checking in which attractor the
dynamics relaxes. The diagonal of the ATM accounts for attractor robustness, as diagonal values
represent the probability of returning to the same attractor after a perturbation.

Usage

```
getATM(net, synchronous_attractors, MAX_STEPS_TO_FIND_ATTRACTORS = 1000)
```

Arguments

net   The Boolean network previously loaded with loadNetwork() of BoolNet pack-
                     age

synchronous_attractors
                     Synchronous attractors of the Boolean network

MAX_STEPS_TO_FIND_ATTRACTORS
                     Number of steps after that the dynamics after the perturbation gives up

Value

The output will be a named list containing the computed ATM structure, the number of the lost
flips (i.e., the number of perturbations that have not reach another attractor within the provided
MAX_STEPS_TO_FIND_ATTRACTORS), and lastly the attractors in two formats: the one re-
turned by the BoolNet package (called decimal) and their binary translation (called binary).

Examples

```
net <- BoolNet::generateRandomNKNetwork(10, 2)
attractors <- BoolNet::getAttractors(net)
getATM(net, attractors)
```

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getTESs   *Compute TES*

Description

Creates a structure for constructing the TES as described in "A Dynamical Model of Genetic Networks for Cell Differentiation Villani M, Barbieri A, Serra R (2011) A Dynamical Model of Genetic Networks for Cell Differentiation. PLOS ONE 6(3): e17703. https://doi.org/10.1371/journal.pone.0017703"

Usage

```
getTESs(ATM)
```

Arguments

ATM   ATM structure as returned from the getATM method.

Value

The output will be a named list that contains the list of computed TESs, the noise thresholds at which they emerged and lastly the ATM structure.

Examples

```
net <- BoolNet::generateRandomNKNetwork(10, 2)
attractors <- BoolNet::getAttractors(net)
ATM <- getATM(net, attractors)
getTESs(ATM)
```

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saveDifferentiationTreeToFile
                    Save the graphic representation of the differentiation tree.

Description

saveDifferentiationTreeToFile saves the image of the computed differentiation tree into a file.

Usage

```
saveDifferentiationTreeToFile(TESs, filename)
```

Arguments

`TESs`	TES structure computed with [getTESs]().
`filename`	Defines the filename for exporting the image of the differentiation tree. The only file extension accepted is "svg", filenames omitting the extensions and those with other extensions will be forced to SVG format.

Value

None

Examples

```
net <- BoolNet::generateRandomNKNetwork(10, 2)
attractors <- BoolNet::getAttractors(net)
ATM <- getATM(net, attractors)
TESs <- getTESs(ATM)
saveDifferentiationTreeToFile(TESs, tempfile(tmpdir = tempdir(), fileext = ".svg"))
```

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