Package 'IMEC'

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Title Ising Model of Explanatory Coherence

Version 0.2.0

Description Theories are one of the most important tools of science. Although psychologists discussed problems of theory in their discipline for a long time, weak theories are still widespread in most subfields.
One possible reason for this is that psychologists lack the tools to systematically assess the quality of their theories.
Previously a computational model for formal theory evaluation based on the concept of explanatory coherence was developed (Thagard, 1989, <doi:10.1017/S0140525X00057046>).
However, there are possible improvements to this model and it is not available in software that psychologists typically use.
Therefore, a new implementation of explanatory coherence based on the Ising model is available in this R-package.

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Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

Imports IsingSampler, igraph, qgraph

Suggests testthat

NeedsCompilation no

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R topics documented:

`computeIMEC` *Computes the Ising model of explanatory coherence.*

Description

Computes IMEC based on previously specified explanatory relations.

Usage

```
computeIMEC(
  matrix,
  evidence,
  phenomena,
  theory1,
  theory2 = character(),
  analytic = TRUE,
  analogy = numeric()
)
```

Arguments

`matrix`	matrix of explanatory relations.
`evidence`	vector of evidence for phenomena.
`phenomena`	vector of phenomena should be the same length as evidence.
`theory1`	vector of propositions in theory1.
`theory2`	vector of propositions in theory2.
`analytic`	whether the result should be calculated analytically or (for large networks) estimated using Metropolis-Hastings algorithm enhanced with Coupling from the past.
`analogy`	this argument is only for purposes of adding analogy in the future and should currently not be used.

Value

returns an IMEC object which contains the explanatory coherence of the propositions, the explanatory relations, the evidence, and the phenomena

Examples

```
# simple example comparing two hypotheses one of them with more explanatory breadth##
T1 <- c("H1", "H2")
Phenomena <- c("E1", "E2")
Thresholds <- c(2,2)
explanations <- initializeNetwork(Phenomena, T1)
explanations <- explain("H1", "E1", explanations)
explanations <- explain("H1", "E2", explanations)
explanations <- explain("H2", "E2", explanations)
explanations <- contradict("H1", "H2", explanations)
coherence <- computeIMEC(explanations, Thresholds, Phenomena, T1)
summary(coherence)
plot(coherence)
```

`contradict` *contradict*

Description

Sets a contradictory relation between a set of propositions and a phenomenon. If more than one proposition is used the edge weight will be reduced accordingly.

Usage

```
contradict(Explanation, Explanandum, matrix, weight = 4)
```

Arguments

`Explanation`	Vector of explanations that explain the explanadum
`Explanandum`	A proposition or phenomenon that is explained
`matrix`	Matrix of explanatory relations that is modified
`weight`	Strength of connection (i.e., strength of contradiction)
	#'@return returns the explanatory matrix with the edge weights modified according to the specified contradiction

Examples

```
# simple example comparing two hypotheses one of them with more explanatory breadth##
T1 <- c("H1", "H2")
Phenomena <- c("E1", "E2")
Thresholds <- c(2,2)
explanations <- initializeNetwork(Phenomena, T1)
explanations <- explain("H1", "E1", explanations)
explanations <- explain("H1", "E2", explanations)
explanations <- explain("H2", "E2", explanations)
explanations <- contradict("H1", "H2", explanations)
coherence <- computeIMEC(explanations, Thresholds, Phenomena, T1)
summary(coherence)
plot(coherence)
```

explain *explain*

Description

Sets an explanatory relation between a set of propositions and a phenomenon. If more than one proposition is used the edge weight will be reduced accordingly.

Usage

```
explain(Explanation, Explanandum, matrix, weight = 1)
```

Arguments

Explanation	Vector of Explanations that explain the Explanadum
Explanandum	A proposition or phenomenon that is explained
matrix	Matrix of Explanatory relations that is modified
weight	Strength of connection (i.e., quality of explanation)

Value

Returns the explanatory matrix with the edge weights modified according to the specified explanation

Examples

```
# simple example comparing two hypotheses one of them with more explanatory breadth##
T1 <- c("H1", "H2")
Phenomena <- c("E1", "E2")
Thresholds <- c(2,2)
explanations <- initializeNetwork(Phenomena, T1)
explanations <- explain("H1", "E1", explanations)
explanations <- explain("H1", "E2", explanations)
explanations <- explain("H2", "E2", explanations)
explanations <- contradict("H1", "H2", explanations)
coherence <- computeIMEC(explanations, Thresholds, Phenomena, T1)
summary(coherence)
plot(coherence)
```

IMEC *IMEC*

Description

This package computes the Ising Model of Explanatory Coherence for theory comparison and theory appraisal.

Construct Explanary Network

intializeNetwork constructs an initial empty explanatoy network *Explain* and *Contradict* specify explanatory relations.

Calculate IMEC

computeIMEC computes the Ising model of explanatory coherence and returns an object of class IMEC. Use summary to summarize the result and plot to plot the explanatory relations.

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initializeNetwork *Initialize the explanatory network*

Description

This function initializes the network in which explanatory relations can be stored later.

Usage

```
initializeNetwork(phenomena, theory1, theory2 = character())
```

Arguments

phenomena	Vector of phenomena that are explained
theory1	Vector of propositions included in theory 1
theory2	Vector of propositions included in theory 2 (only set manually if theory comparison is intended)

Value

An empty edge matrix (all edges 0)

Examples

```
# simple example comparing two hypotheses one of them with more explanatory breadth##
T1 <- c("H1", "H2")
Phenomena <- c("E1", "E2")
Thresholds <- c(2,2)
explanations <- initializeNetwork(Phenomena, T1)
explanations <- explain("H1", "E1", explanations)
explanations <- explain("H1", "E2", explanations)
explanations <- explain("H2", "E2", explanations)
explanations <- contradict("H1", "H2", explanations)
coherence <- computeIMEC(explanations, Thresholds, Phenomena, T1)
summary(coherence)
plot(coherence)
```

---

plot.IMEC *Plots the explanatory relations*

Description

Plot the explanatory relations between data and phenomena. A window will open where you can drag the nodes in the intended position. Then press enter to plot the network.

Usage

```
## S3 method for class 'IMEC'
plot(x, nodesize = 10, ...)
```

Arguments

x	Object of the class IMEC as returned by computeIMEC
nodesize	size of vertices in the plotted network
...	other parameters passed on to S3 method.

Examples

```
# simple example comparing two hypotheses one of them with more explanatory breadth##
T1 <- c("H1", "H2")
Phenomena <- c("E1", "E2")
Thresholds <- c(2,2)
explanations <- initializeNetwork(Phenomena, T1)
explanations <- explain("H1", "E1", explanations)
explanations <- explain("H1", "E2", explanations)
explanations <- explain("H2", "E2", explanations)
explanations <- contradict("H1", "H2", explanations)
coherence <- computeIMEC(explanations, Thresholds, Phenomena, T1)
summary(coherence)
plot(coherence)
```

summary.IMEC *Summary of an IMEC object.*

Description

Summary of an IMEC object.

Usage

```
## S3 method for class 'IMEC'
summary(object, ...)
```

Arguments

object	IMEC object.
...	other parameters passed on from S3 method.

Examples

```
# simple example comparing two hypotheses one of them with more explanatory breadth##
T1 <- c("H1", "H2")
Phenomena <- c("E1", "E2")
Thresholds <- c(2,2)
explanations <- initializeNetwork(Phenomena, T1)
explanations <- explain("H1", "E1", explanations)
explanations <- explain("H1", "E2", explanations)
explanations <- explain("H2", "E2", explanations)
explanations <- contradict("H1", "H2", explanations)
coherence <- computeIMEC(explanations, Thresholds, Phenomena, T1)
summary(coherence)
plot(coherence)
```

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