Package 'causaleffect'

September 25, 2014

Version 1.0

Date 2014-09-17

Title Deriving Expressions of Joint Interventional Distributions in Causal Models

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Imports igraph, XML

Description An implementation of the complete identification algorithm constructed by Ilya Shpitser and Judea Pearl (2006) for deriving expressions of joint interventional distributions in causal models, which contain unobserved variables and induce directed acyclic graphs.

License GPL-2

NeedsCompilation no

Repository CRAN

Date/Publication 2014-09-25 22:42:50

R topics documented:

`causaleffect-package` *Deriving Expressions of Joint Interventional Distributions in Causal Models*

Description

Causal calculus is concerned with estimating the interventional distribution of some action from the observed joint probability distribution of the variables in a given causal structure. All identifiable causal effects can be derived using the rules of do-calculus, but the rules themselves do not give any direct indication whether the effect in question is identifiable or not. Ilya Shpitser and Judea Pearl (2006) constructed an algorithm for identifying joint interventional distributions in causal models, which contain unobserved variables and induce directed acyclic graphs. This algorithm can be seen as a repeated application of the rules of do-calculus and known properties of probabilities, that ultimately either derives an expression for the causal distribution, or fails to identify the effect, in which case the effect is non-identifiable. causaleffect provides an implementation of this algorithm.

Details

Package:	causaleffect
Type:	Package
Version:	1.0
Date:	2014-09-17
License:	GPL-2

The function `causal.effect` receives two character vectors describing the variables of interest and an `igraph` (package `igraph`) object as arguments and returns a string describing the interventional distribution in LaTeX syntax if the effect is identifiable.

Author(s)

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References

Pearl J. 2009 *Causality: Models, Reasoning and Inference*, New York: Cambridge University Press.

Shpitser I., Pearl J. 2006 Identification of Joint Interventional Distributions in Recursive semi-Markovian Causal Models. *Proceedings of the 21st National Conference on Artificial Intelligence*, **2**, 1219–1226.

`causal.effect` *Identify a causal effect*

Description

This function returns an expression for the joint distribution of the set of variables y given the intervention on the set of variables x if the effect is identifiable. Otherwise an error is thrown describing the graphical structure that witnesses non-identifiability.

Usage

```
causal.effect(y, x, G)
```

Arguments

y	A character vector of variables of interest given the intervention.
x	A character vector of the variables that are acted upon.
G	An igraph object created by the function parse.graphml that describes the directed acyclic graph induced by the causal model.

Value

A character string that describes the interventional distribution in LaTeX syntax.

Author(s)

Santtu Tikka

References

Shpitser I., Pearl J. 2006 Identification of Joint Interventional Distributions in Recursive semi-Markovian Causal Models. *Proceedings of the 21st National Conference on Artificial Intelligence*, **2**, 1219–1226.

See Also

parse.graphml

Examples

```
library(igraph)

# simplify = FALSE to allow multiple edges
g <- graph.formula(X -+ Y, Z -+ X, Z -+ Y , X -+ Z, Z -+ X, simplify = FALSE)

# Here the bidirected edge between X and Z is set to be unobserved in graph g
# This is denoted by giving them a description attribute with the value "U"
# The edges in question are the fourth and the fifth edge
g <- set.edge.attribute(graph = g, name = "description", index = c(4,5), value = "U")

res <- causal.effect("Y", "X", g)
```

`parse.graphml` *Prepare graphml files for internal use*

Description

This function reads graphml files created by the yEd graph editor, which describe directed acyclic graphs. The R-package XML is utilized to parse the contents of the files to suit the internal format used by `causal.effect`. Bidirected arcs are replaced by two unobserved unidirected arcs, and the resulting XML file is coerced into an igraph object. This function also serves as a wrapper for files that already correspond to the internal format. Names for the nodes of the graph can be supplied or read directly from the input file.

Usage

```
parse.graphml(file, format = c("standard", "internal"),
    nodes = c(), use.names = TRUE)
```

Arguments

`file`	The connection to read from.
`format`	A character constant describing how bidirected arcs are denoted in the graphml file. Option `standard` corresponds to bidirected arcs that are notated with a graphical parameter describing an arrow at each end of the arc or no arrows at all. Option `internal` matches the format that `standard` graphs are coerced into. This option should be used only if all bidirected arcs in the graph are denoted by two unidirected arcs which have a description parameter of a single character "U" (shorthand for "unobserved").
`nodes`	A character vector that describes the names of the nodes in the graph. This is ignored if `use.names` is `TRUE`.
`use.names`	A logical value indicating whether the names of the nodes should be read from the file or not.

Value

An object of class igraph that describes the causal diagram. The parsed graph can now be used by `causal.effect`.

Author(s)

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