Package 'IsingFitBO'

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Type Package

Title Ising Model Estimation with Bayesian Optimization

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Description An extension of the IsingFit package (van Borkulo et al., 2014) that implements Bayesian Optimization for lambda hyperparameter tuning. This adaptation retains the original network estimation logic while adding automated hyperparameter selection. Licensed under GPL-2 as a derivative work.

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Depends R (>= 3.5.0)

Imports glmnet,
qgraph,
GauPro

URL https://https://github.com/renatoUFG/IsingFitBO

BugReports https://github.com/yourusername/IsingFitBO/issues

RoxygenNote 7.3.2

Encoding UTF-8

Contents

`IsingFitBO` *Network Estimation Using eLasso Method with Bayesian Optimization*

Description

An extension of the IsingFit package that implements Bayesian Optimization for lambda hyperparameter tuning. This adaptation retains the original network estimation logic while adding automated hyperparameter selection. Licensed under GPL-2 as a derivative work.

Usage

```
IsingFitBO(
  x,
  method = "BayesOpt",
  family = "binomial",
  AND = TRUE,
  niter = 20,
  plot = TRUE,
  gamma_hyp = 0.25,
  ...
)
```

Arguments

x	Input matrix (nobs x nvars) where each row represents an observation of the variables. Must be cross-sectional data.
method	Either "BayesOpt" (default) for Bayesian Optimization or "Grid" for predefined grid search with nine lambda values.
family	Currently only "binomial" is supported (for binary data).
AND	Logical indicating whether to use AND-rule (TRUE) or OR-rule (FALSE) to define network edges. Defaults to TRUE.
niter	Number of iterations for Bayesian Optimization. Default is 20.
plot	Logical indicating whether to plot the resulting network. Default is TRUE.
...	Additional arguments passed to qgraph.
gamma	Hyperparameter gamma value for extended BIC (between 0 and 1). Default is 0.25.

Value

An object of class 'IsingFit' containing:

weiadj	Weighted adjacency matrix
thresholds	Variable thresholds
q	qgraph object (class 'qgraph')
gamma	Used gamma hyperparameter value
AND	Logical indicating AND-rule usage
time	Computation time
asymm.weights	Asymmetrical weighted adjacency matrix before AND/OR rule
lambda.values	Optimal tuning parameter values per node

Note

This function extends the original IsingFit package (van Borkulo et al., 2014). The Bayesian Optimization feature was added in 2025.

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References

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van Borkulo, C. D., Borsboom, D., Epskamp, S., Blanken, T. F., Boschloo, L., Schoevers, R. A., & Waldorp, L. J. (2014). A new method for constructing networks from binary data. Scientific Reports 4, 5918. DOI:10.1038/srep05918.

Examples

```
library(IsingSampler)

# Simulate dataset
N <- 6  # Number of nodes
nSample <- 1000  # Number of samples

# Generate random graph structure
Graph <- matrix(sample(0:1, N^2, TRUE, prob = c(0.8, 0.2)) * runif(N^2, 0.5, 2)
Graph <- pmax(Graph, t(Graph))  # Symmetrize
diag(Graph) <- 0  # No self-loops
Thresh <- -rowSums(Graph)/2  # Thresholds

# Simulate data
Data <- IsingSampler(nSample, Graph, Thresh)

# Fit model with Bayesian Optimization
Res <- IsingFitBO(Data, method = "BayesOpt", niter = 20, gamma = 0.25)

# Plot results
if (require("qgraph")) {
  layout(t(1:2))
  qgraph(Res$weiadj, fade = FALSE, title = "Estimated Network")
  qgraph(Graph, fade = FALSE, title = "True Network")
}
```

---

plot.IsingFitBO *Plot Method for IsingFitBO Objects*

Description

Visualizes the results of an Ising model estimation with Bayesian optimization.

Usage

```
## S3 method for class 'IsingFitBO'
plot(x, ...)
```

Arguments

x	An object of class ‘IsingFitBO‘
...	Additional arguments passed to plot functions
type	Plot type: "network" (default), "convergence", or "parameters"
main	Plot title (optional)

Value

Invisibly returns the plot object. For "network" type, returns a ‘qgraph‘ object.

See Also

qgraph for network visualization options

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print.IsingFitBO *Print Method for IsingFitBO Objects*

Description

Displays concise output of Ising model estimation results.

Usage

```
## S3 method for class 'IsingFitBO'
print(x, ...)
```

Arguments

x	An object of class ‘IsingFitBO‘
...	Additional arguments

Value

Invisibly returns the input object.

---

summary.IsingFitBO *Summary Method for IsingFitBO Objects*

Description

Provides comprehensive summary statistics for Ising model estimation results.

Usage

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

Arguments

`object`	An object of class 'IsingFitBO'
`...`	Additional arguments
`digits`	Number of significant digits (default=3)

Value

An object of class 'summary.IsingFitBO' containing network properties and optimization details.

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