Regression extension of latent class analysis

Description

This program is for doing the regression extension of latent class analysis. The program is based on the paper by Huang and Bandeen-Roche, Psychometrika 69: 5-32, 2004.

Usage

```
rlca(nlevels, nitem, nclass, nxcond=0, nxprev=0, y, xcond=c(0), xprev=c(0),alpha0init,
alphainit=c(0), beta0init, betainit=c(0),tol=0.0005,maxiter.em=500, maxiter.nr=1,
nfix=0, fix=c(0,0,0,0))
```

Arguments

nlevels	A (1 x nitem) vector with mth component being the number of levels of mth item.
nitem	the number of items.
nclass	the number of classes.
nxcond	the number of covariates for conditional probabilities.
nxprev	the number of covariates for latent calss prevalences.
y	y is a (npop x nitem) matrix with the (i,m)th element being the response of the ith individual on the mth item. Note: y's values must be in (1,2,3,...,nlevels(m)).
xcond	covariares for conditional probabilities. If nxcond!=0, xcond is a (npeop x nxcond x nitem) array. If nxcond=0, xcond=c(0) (default).
xprev	covariates for latent class prevalences. If nxprev!=0, xprev is a (npeop x nxprev) array. If nxprev=0, xprev=c(0) (default).
alpha0init	initial values for intercepts of conditional probabilities. alpha0init is a

(nclass x nitem x nlevels) array.

`alphainit` initial values for regression coefficients of conditional probabilities. If nxcond!=0, alphainit is a (nxcond x nitem x nlevels) array. If nxcond=0, alphainit=c(0) (default).

`beta0init` initial values for intercepts of latent class prevalences. beta0init is a ((nclass-1) x 1) vector.

`betainit` initial values for regression coefficients of latent class prevalences. If nxprev!=0, betainit is a (nxprev x (nclass-1)) array. If nxprev=0, betainit=c(0) (default).

`tol` convergence criteria. default tol=0.0005.

`maxiter.em` maximum iterations of the EM algorithm. default maxiter.em=500.

`maxiter.nr` maximum iterations of the NR procedure in each M step. For maxiter.nr=1, it is referred as EM gradient algorithm (Lange 1995) (default).

`nfix` the number of fixed alpha0's. For nfix=0, there is no fixed alpha0.

`fix` matrix of the index of fixed alpha0's. fix is a (4 x nfix) matrix with fix[c('j','k','m','sign'),1:(number of fixed alpha0s)],where 'j' represents jth class; 'k' represents kth level; 'm' represents mth item; sign=1 if alpha0 is fixed as 1.0e6; sign=-1 if alpha0 is fixed as -1.0e6. For example, nfix<-2 and fix<-matrix(0, ncol=nfix, nrow=4), fix[,1]<-c(3,1,1,1), fix[,2]<-c(3,2,2,-1) means that we have 2 fixed alpha0's, and for alpha0 of j=3, k=1, m=1, is fixed at the value 1.0e6, for alpha0 of j=3, k=2, m=2 is fixed at the value -1.0e6. Note:(1) the columns of fix are ordered from small to large based on the order('m','k','j'). (2) For nfix=0, fix=c(0,0,0,0)(default).

Details

This program is for doing the regression extension of latent class analysis (RLCA). RLCA models summarize shared features of the measured multiple indicators as an underlying categorical variable. RLCA also incorporates two sets of covariates: risk factors that are hypothesized to influence the underlying latent classes and covariates that may influence observed items directly, hence possibly causing misclassification of the class membership.

Value

`alpha0` estimates of intercepts of conditional probabilities.

`alpha` estimates of regression coefficients of conditional probabilities.

`beta0` estimates of intercepts of latent class prevalences.

`beta` estimates of regression coefficients of latent class prevalences.

`cov` the variance and covariance matrix of estimates of alpha0,alpha,beta0,beta.

`eta` the estimates of latent prevalences for each individual. It is a (npeop x nitem) matrix.

`pcond` the estimates of conditional probabilities for each individual. It is a (npop x nlevel x nclass x nitem) array.

`theta` the estimates of posterior latent prevalences for each individual. It is a (npop x nclass) matrix.

`niter` the number of iterations of the EM algorithm.

`logLmt` log likelihood of the final model.

Note

This program DOES NOT allow missing item measurements. Only individuals who have complete item measurements are included in the analysis.

Author(s)

Paper by Huang and Bandeen-Roche, R Package by Chin-Chieh Wu

References

Huang GH, Bandeen-Roche K. Building an Identifiable Latent Class Model with Covariate Effects on Underlying and Measured Variables, Psychometrika 69: 5-32, 2004.

Examples

```
## Not run:
```

```
y<-array(c(1,3,2,4,1,1,2,2,5,2,1,3,4,2,1,3,5,2,2,2,2,1,3,3,2,3,1,4,1,4,4,5,2,3,1,3,
1,1,1,2,2,3,4,1,2,3,2,3,2,5),dim=c(10,5))
  rlca(nlevels=c(2,3,2,2,2), nitem=5, nclass=2, nxcond=6, nxprev=6, y, xcond=c(0),
xprev=c(0),alpha0init=0, alphainit=c(0), beta0init=0,
betainit=c(0),tol=0.0005,maxiter.em=500, maxiter.nr=1, nfix=0, fix=c(0,0,0,0))
## End(Not run)
```

Initial values for RLCA

Description

This is for creating the initial values for RLCA. This function will return the initial parameter estimates - alpha0, alpha, beta0, beta.

Usage

```
initial.rlca(nlevels, nitem, nclass, nxcond=0, nxprev=0, y, xcond=c(0),
xprev=c(0),thetaLCA)
```

Arguments

nlevels	A (1 x nitem) vector with mth component being the number of levels of mth item.
nitem	the number of items.
nclass	the number of classes.
nxcond	the number of covariates for conditional probabilities.
nxprev	the number of covariates for latent calss prevalences.
y	y is a (npop x nitem) matrix with the (i,m)th element being the response of the ith individual on the mth item. Note: y's values must be in (1,2,3,...,nlevels(m)).
xcond	covariares for conditional probabilities. If nxcond!=0, xcond is a (npeop x nxcond x nitem) array. If nxcond=0, xcond=c(0) (default).
xprev	covariates for latent class prevalences. If nxprev!=0, xprev is a (npeop x nxprev) array. If nxprev=0, xprev=c(0) (default).
thetaLCA	estimated values for theta from LCA. It is a (npop x nclass) matrix.

Details

This is for creating the initial values for RLCA. This function will return the initial parameter estimates - alpha0, alpha, beta0, beta: alpha0[jth class, mth item, kth level], alpha[pth covariate, mth item, kth level], beta0[jth class], beta[pth covariate, jth class].

Value

`alpha0` estimates of intercepts for conditional probabilities.

`alpha` estimates of regression coefficients for conditional probabilities.

`beta0` estimates of intercepts for latent class prevalences.

`beta` estimates of regression coefficients for latent class prevalences.

Author(s)

Paper by Huang and Bandeen-Roche, R Package by Chin-Chieh Wu

References

Huang GH, Bandeen-Roche K. Building an Identifiable Latent Class Model with Covariate Effects on Underlying and Measured Variables, Psychometrika 69: 5-32, 2004.

Examples

```
 ## Not run:

y<-array(c(1,3,2,4,1,1,2,2,5,2,1,3,4,2,1,3,5,2,2,2,2,1,3,3,2,3,1,4,1,4,4,5,2,3,1,3,
1,1,1,2,2,3,4,1,2,3,2,3,2,5),dim=c(10,5))
  initial.rlca(nlevels=c(2,3,2,2,2), nitem=5, nclass=2, nxcond=6, nxprev=6, y,
xcond=c(0), xprev=c(0),thetaLCA=0)
## End(Not run)
```

Initial values for LCA

Description

This is for creating the initial values for LCA.

Usage

```
initial.LCA(y, nlevels, nitem, nclass, type.psclass=1, type.beta0=1, beta0sum=2)
```

Arguments

y	y is a (npop x nitem) matrix with the (i,m)th element being the response of the ith individual on the mth item. Note: y's values must be in (1,2,3,...,nlevels(m)).
nlevels	A (1 x nitem) vector with mth component being the number of levels of mth item.
nitem	the number of items.
nclass	the number of classes.
type.psclass	the method of generating pseudo-class: 1=based on eta, 2=based on pre-determined criterion.
type.beta0	the type of initial beta0 of LCA for type.psclass=1: 1=slowly decreasing, 2=random, 3=moderately decreasing, 4=rapidly decreasing, 5=self-specified.
beta0sum	the sum of initial beta0 of LCA for type.psclass=1.

Details

This is for creating the initial values for LCA.

Value

`alpha0` estimates of intercepts of conditional probabilities.

`beta0` estimates of intercepts of latent class prevalences.

Author(s)

Paper by Huang and Bandeen-Roche, R Package by Chin-Chieh Wu

References

Huang GH, Bandeen-Roche K. Building an Identifiable Latent Class Model with Covariate Effects on Underlying and Measured Variables, Psychometrika 69: 5-32, 2004.

Examples

```
 ## Not run:

y<-array(c(1,3,2,4,1,1,2,2,5,2,1,3,4,2,1,3,5,2,2,2,2,1,3,3,2,3,1,4,1,4,4,5,2,3,1,3,
1,1,1,2,2,3,4,1,2,3,2,3,2,5),dim=c(10,5))
  initial.LCA(y, nlevels=c(2,3,2,2,2), nitem=5, nclass=2, type.psclass=1,
type.beta0=1, beta0sum=2)
## End(Not run)
```

An example for running RLCA models

Description

An example for running the program of doing the regression extension of latent class analysis.

Usage

```
rlcaf(nlevels, nitem, nxcond, nxprev, type.psclass = 1, type.beta0 = 1, beta0sum = 2)
```

Arguments

nlevels	A (1 x nitem) vector with mth component being the number of levels of mth item.
nitem	the number of items.
nxcond	the number of covariates for conditional probabilities.
nxprev	the number of covariates for latent calss prevalences.
type.psclass	the method of generating pseudo-class: 1=based on eta, 2=based on pre-determined criterion.
type.beta0	the type of initial beta0 of LCA for type.psclass=1: 1=slowly decreasing, 2=random, 3=moderately decreasing, 4=rapidly decreasing, 5=self-specified.
beta0sum	the sum of initial beta0 of LCA for type.psclass=1.

Details

This is a program for running the example in the paper: Huang GH, Bandeen-Roche K. Building an Identifiable Latent Class Model with Covariate Effects on Underlying and Measured Variables, Psychometrika 69: 5-32, 2004. The data is from the Salisbury Eye Evaluation project,a population-based,prospective study(N=1641)of how vision affects older adults' functioning ability(West et al. 1997).

Value

`nclass`	the number of classes.
`est.lca`	the returned list of LCA model.
`est.rlca.cond`	the returned list of RLCA model with covariate effects on conditional probabilities only.
`est.rlca.prev`	the returned list of RLCA model with covariate effects on latent prevalences only.
`est.rlca.condprev`	the returned list of RLCA model with covariate effects on both conditional probabilities and latent prevalences.

Note

This program DOES NOT allow missing item measurements. Only individuals who have complete item measurements are included in the analysis.

Author(s)

Paper by Huang and Bandeen-Roche, R Package by Chin-Chieh Wu

References

Huang GH, Bandeen-Roche K. Building an Identifiable Latent Class Model with Covariate Effects on Underlying and Measured Variables, Psychometrika 69: 5-32, 2004.

Examples

```
## Not run:
```

```
 rlcaf(nlevels=c(2,3,2,2,2), nitem=5, nxcond=6, nxprev=6, type.psclass = 1, type.beta0
= 1, beta0sum = 2)
## End(Not run)
```

nclass {RLCA} R Documentation

Estimate the number of classes

Description

This program is for selecting the number of classes to fit for regression extension of latent class analysis models.

Usage

```
 nclass(y, xcond, xprev, nlevels, nitem, nxcond, nxprev)
```

Arguments

y	y is a (npop x nitem) matrix with the (i,m)th element being the response of the ith individual on the mth item. Note: y's values must be in (1,2,3,...,nlevels(m)).
xcond	covariares for conditional probabilities: If nxcond!=0, xcond is a (npeop x nxcond x nitem) array. If nxcond=0, xcond=c(0) (default).
xprev	covariates for latent class prevalences: If nxprev!=0, xprev is a (npeop x nxprev) array. If nxprev=0, xprev=c(0) (default).
nlevels	A (1 x nitem) vector with mth component being the number of levels of mth item.
nitem	the number of items.
nxcond	the number of covariates for conditional probabilities.
nxprev	the number of covariates for latent calss prevalences.

Details

This program is for selecting the number of classes to fit for regression extension of latent class analysis models.

Value

J estimated number of classes.

Author(s)

Paper by Huang, R Package by Chin-Chieh Wu

References

Huang GH. Selecting the number of classes under latent class regression: a factor analytic analogue. Psychometrika 70: 325-345, 2005.

Examples

```
 ## Not run:

y<-array(c(1,3,2,4,1,1,2,2,5,2,1,3,4,2,1,3,5,2,2,2,2,1,3,3,2,3,1,4,1,4,4,5,2,3,1,3,
1,1,1,2,2,3,4,1,2,3,2,3,2,5),dim=c(10,5))
  nclass(y, xcond=c(0), xprev=c(0), nlevels=c(2,3,2,2,2), nitem=5, nxcond=6, nxprev=6)
## End(Not run)
```