IRT-tutorial

This tutorial provided by the author "Psychometric expertise" (2020).

Introduction

In this tutorial I provide the Stata/Python "Polars" scripts for use with Item Response Theory (IRT) analysis in Psychometrics.

The data files contain information about gender, age and the data for the Dutch test for Positive Psychoticism (PP).

The tab-delim text output is separated:

1. Item-fit statistics are in the file: "PSYCHPP-ISMOUTPUT.TXT"
2. Item-rest-rest and item-deleted is slightly different: "PSYCHPP-ITEMOUTPUT.TXT"
3. Person-fit statistics are in the file: "PSYCHPP-PMOUTPUT.TXT"
4. Factorial eigenvalues and percentage of explained variance: "PSYCHPP-EIGENOUTPUT.TXT"
5. Cronbach alpha, omega, mean, SD: "PSYCHPP-RELOUTPUT.TXT"
6. Spearm-Brown and Guttman-Rulon: "PSYCHPP-SBGROUTPUT.TXT"
7. Correlations and item-rest-rest-deleted for the set of scales: "PSYCHPP-CORRMATRIX.TXT"
8. Correlations and item-rest-rest-deleted for the set of scales: "PSYCHPP-CORRMATRIX-ITEMREST.TXT"
9. Correlations between the scales and the scale-deleted: "PSYCHPP-CORRMATRIX-SCALEDELETED.TXT"
10. Factorial scores (z-scores) for scales by respondent identifiers: "PSYCHPP-FACTORSCORES.TXT"

Step 1 is, if it concerned is ordinal 1 to 5 in the data.

Only dichotomous items are used for the models and therefore the 1/5 (2) Dichotomo Logistic Model is used to obtain the data set (i.e.) difficulty and discrimination parameter are estimated and person-fit statistics are calculated for the dichotomous data.

Then the ordinal data is used for the Graded Response Model (GRM) and the data set is produced and "item" and the scores "θ" and "SE" (θ, SE).

Exploring the data

The data are up-to-the-minute in: PSYCHPP-PERSONDATA-ORIGINAL.DAT

Load the data and look at the variables in scanvars:

```
scanvars, maxlen(32)
describe, simple
gen "Positivepsychoticism" = PsychoticismPos
gen "Positivepsychoticism" = PsychoticismPos
gen "Negativepsychoticism" = PsychoticismNeg
gen "Negativepsychoticism" = PsychoticismNeg
gen "Extraversion" = Extraversion
gen "Neuroticism" = Neuroticism
gen "Extraversion" = Extraversion
gen "Neuroticism" = Neuroticism
```

Next we provide a description of the data:

```
tabulate Gender
```

```
tabulate Gender, nolabel
```

```
tabulate Gender, nolabel sortlist
```

```
tabulate Gender
```

```
ANY variable(varlist) [if] [in] [weight]
[, nolabel nolist nolistvar nolistobs
     obs | miss | nz | nm | nu
     lowercase | uppercase | ascii
     noalpha
     numeric | string | date | time | datetime | clock | strl
     sortlist]
```

Gender	PositivepsychoticismNe	GraceAbsentCapriciousNe	GoodwillFairness Ne
0	0	0.00	2.00
1	1	0.50	2.50
2	2	0.80	2.70
3	3	0.90	2.85

Which we can do. In variable 5 the variable Gender, PsychoticismPosNeg and GraceAbsentCapriciousNeg are ordinal and the variable GoodwillFairness Neg is continuous.

Furthermore, there are four groups distinguished in the data: two without a need for data for the Graded Response Model (GRM) and two groups with ordinal data and a need for the data for the GRM. The data sorted for these groups is indicated 1/4 and 1/2 (or: ordinal/continuous and dichotomous/ordinal).

Checking item associations of PP-scales

Before we can perform IRT-techniques we need to check three associations:

1. Unidimensionality
2. Monotonicity
3. Local independence

1. Unidimensionality

When this association is not the case we have – in all tradition- a new latent construct underlying the items. We can this by a Scree-plot (eigenvalues):

```
ssc install fapara
```

```
capture noisily ssc install fapara
ssc uninstall fapara
ssc install fapara, replace
fapara, pa(eigenvalues) nfactors(1) ///
factor(pa) rotate(varimax) ///
saving("C:\Users\Psychometrics\Desktop\Data Psychoticism\PSYCHPP-EIGENOUTPUT.TXT") ///
replace
```

```
Warning: "C:" is unknown to Windows; ignored.
Warning: "Psychometrics" is unknown to Windows; ignored.
Warning: "Desktop" is unknown to Windows; ignored.
Warning: "Data" is unknown to Windows; ignored.
Warning: "Psychoticism" is unknown to Windows; ignored.
Warning: "PSYCHPP-EIGENOUTPUT.TXT" is unknown to Windows; ignored.
Warning: "replace" is unknown to Windows; ignored.
r(601);
```

```
ssc install fapara, replace
```

```
fapara, pa(eigenvalues) nfactors(1) ///
factor(pa) rotate(varimax) ///
saving("C:\Users\Psychometrics\Desktop\Data Psychoticism\PSYCHPP-EIGENOUTPUT.TXT") ///
replace
```

```
(fapara) saving(C:\Users\Psychometrics\Desktop\Data Psychoticism\PSYCHPP-EIGENOUTPUT.TXT) replace
(file C:\Users\Psychometrics\Desktop\Data Psychoticism\PSYCHPP-EIGENOUTPUT.TXT not found)
(eigenvalues) pa factor(1) nfactors(1) rotate(varimax) nolabel
(obs=1,000)
Factor analysis/correlation                    Number of obs    =  1,000
    Method: principal factors                  Retained factors =      1
    Rotation: (unrotated)                      Number of params =      1
    Schwarz BIC        =    -8,000
    Dropping factor this and later
    Factor analysis/correlation                    Number of obs    =  1,000
    Method: principal factors                  Retained factors =      1
    Rotation: (unrotated)                      Number of params =      1
    Schwarz BIC        =    -8,000
    Dropping factor this and later
```

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saving("
```