Latent Class Analysis

——from manifest variables to latent variables

Reporter：黄颖诗

Contents

- **Related concepts**
- **What we have already knew**
- **What we want to know**
- **LatentGOLD**

Related concepts

:-D

Manifest?

↓

though direct measurement/observation

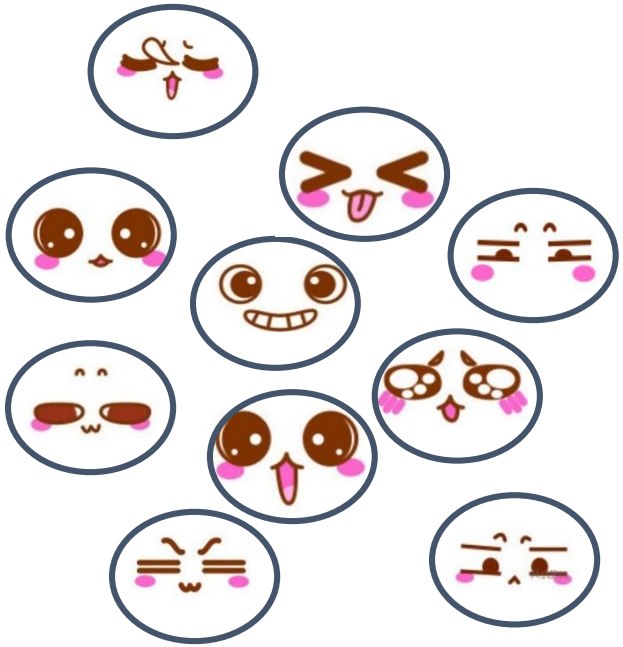
Latent?

↓

though indirect measurement

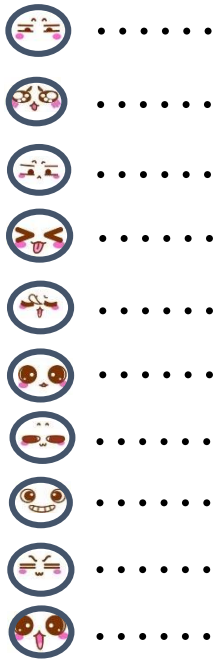
Already knew

As for continuous variable



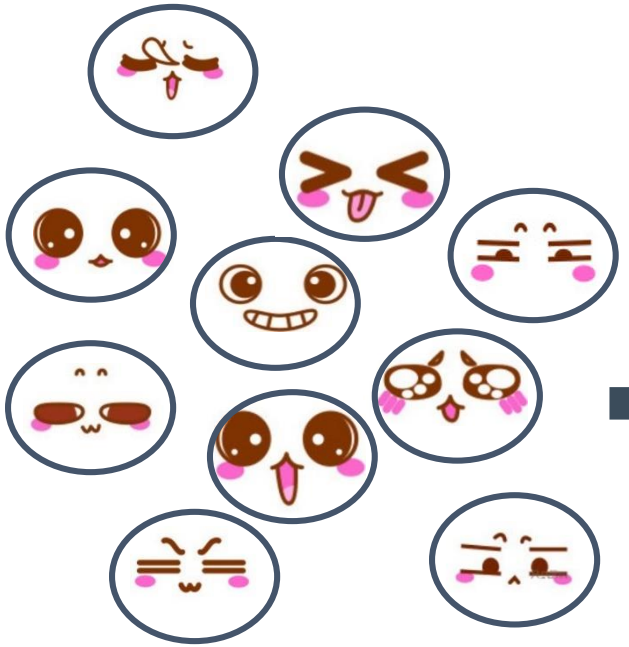
(10 items for math ability)

✓ Describe from 10 aspects



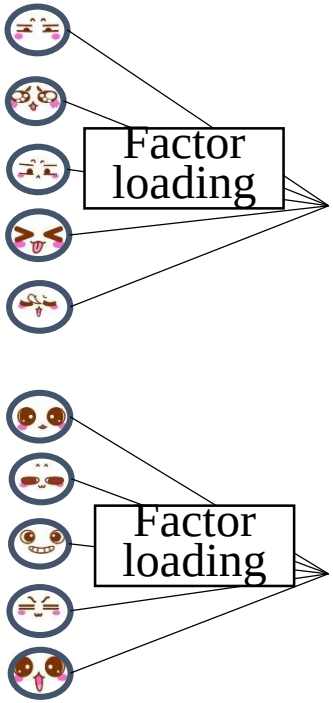
Already knew

As for continuous variable



(10 items for math ability)

✓ Common compound/linear transform (simple structure)



Want to know

As for categorical variable

How about the categorical variable?

&

How to have a cluster of the case?

↓

Latent class analysis(Lazarsfeld, 1950)

Want to know

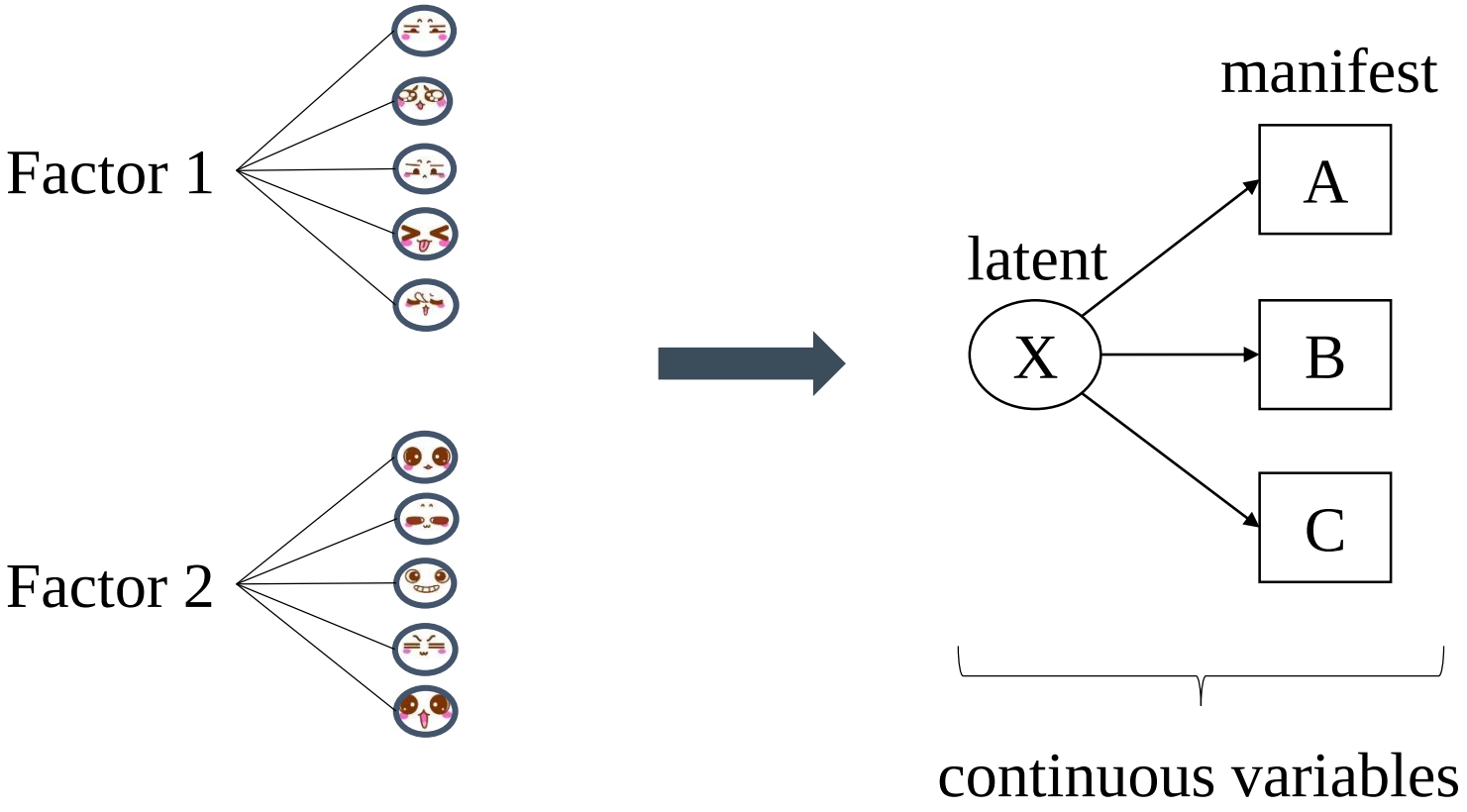
Latent class analysis(LCA)

Latent class analysis

- assumption
- parameters
- analysis process

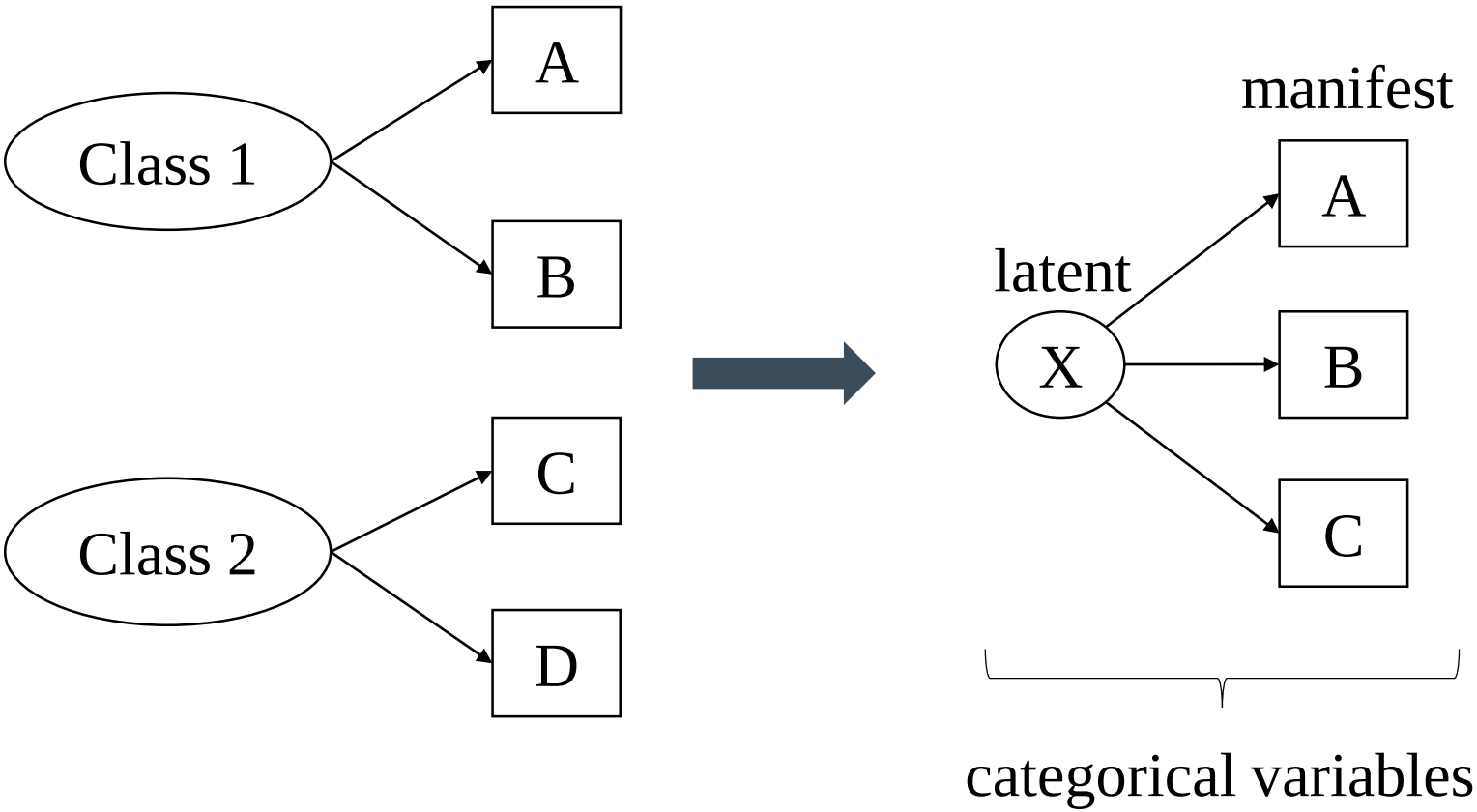
Want to know

Conceptualization & assumption



Want to know

Conceptualization & assumption



Want to know

Data table

Factor analysis

Person	**Item**				
	1	**2**	**3**	**…**	***i***
1	X_{11}	X_{12}	X_{13}	…	X_{1i}
2	X_{21}	X_{22}	X_{23}	…	X_{2i}
3	X_{31}	X_{32}	X_{33}	…	X_{3i}
…	…	…	…	…	…
p	X_{p1}	X_{p2}	X_{p3}	…	X_{pi}

Observed scores → individual difference

Want to know

Data table

Latent class analysis

Response	Gender	
	male	**female**
yes	89 (58.17%)	64 (41.83%)
no	56 (37.09%)	95 (62.91%)

Frequency/probability→ individual difference

Want to know

Assumption(Rolf Langeheine, 1988)

1 **Class size**

The population consists of *m* latent classes of unknown size W_j (j = 1, m).

2 **Class-specific item probabilities**

Within each class *j*, each item *i* has a specific probability of occurrence for each of its possible outcomes.

3 **Local independence**

Within each class *j* the manifest variables are postulated to be independent.

Want to know

Parameters(Rolf Langeheine, 1988)

Latent class probabilities → Cumulative contribution

The *w*'s, that is, unconditional probabilities of being in latent class *j*;

Conditional probabilities → Factor loading

The *p*'s, that is, conditional probabilities of making a particular response on an item *i*.

↓

Maximum Likelihood(ML)

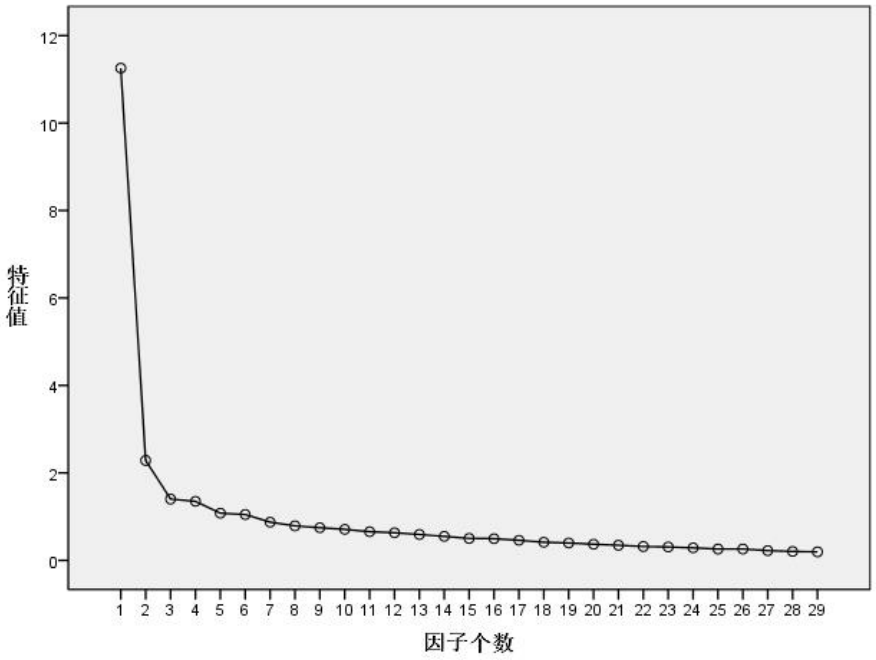
Want to know

Analysis process

model selection	AIC(Akaike's Information Criterion), BIC(Bayesian Information Criterion), Entropy
parameter estimation	Using the latent class probabilities & conditional probabilities
classification	Get the information about the class membership

Want to know

Model selection



FA

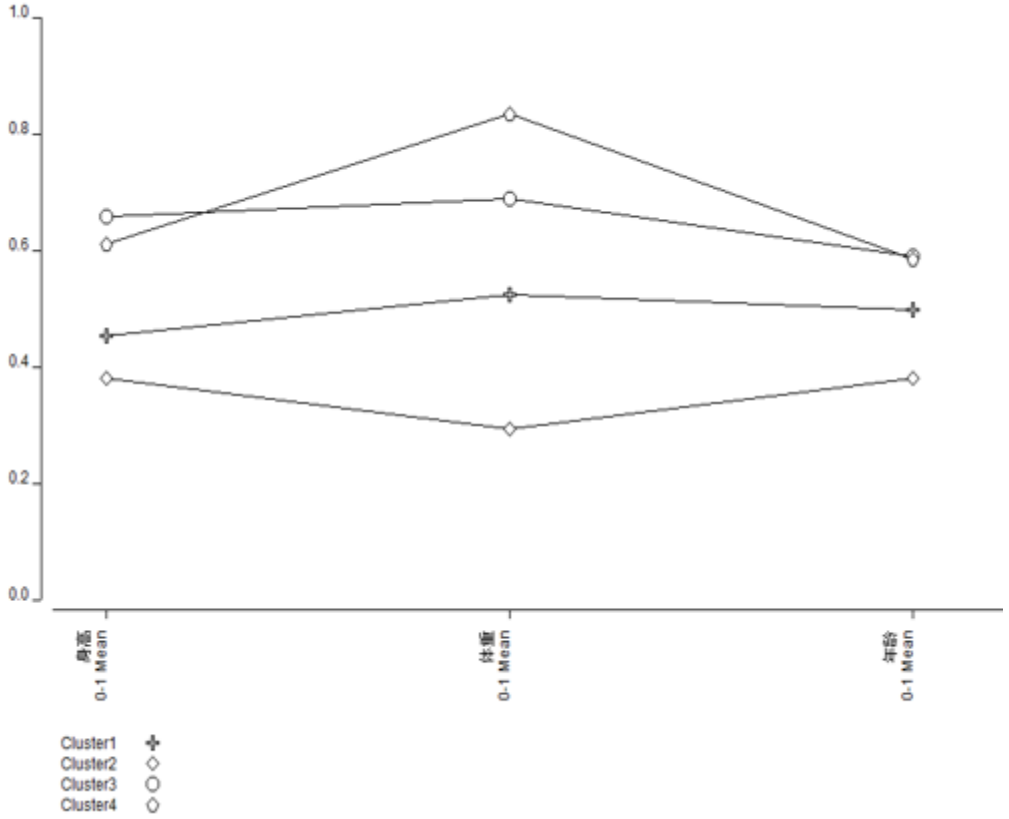
Model	AIC	BIC	Entropy
1	7063.259	7105.274	
2	6508.669	6596.201	0.928
3	6157.773	6290.821	0.942
4	6014.392	6192.956	0.934
5	5973.560	6197.641	0.888

LCA

→ Search for the inflection point & highest entropy

Want to know

Parameter estimation



- The higher value of the conditional probabilities indicates a greater tendency.

Want to know

Class membership

Using the posterior probabilities of the participant in the latent class

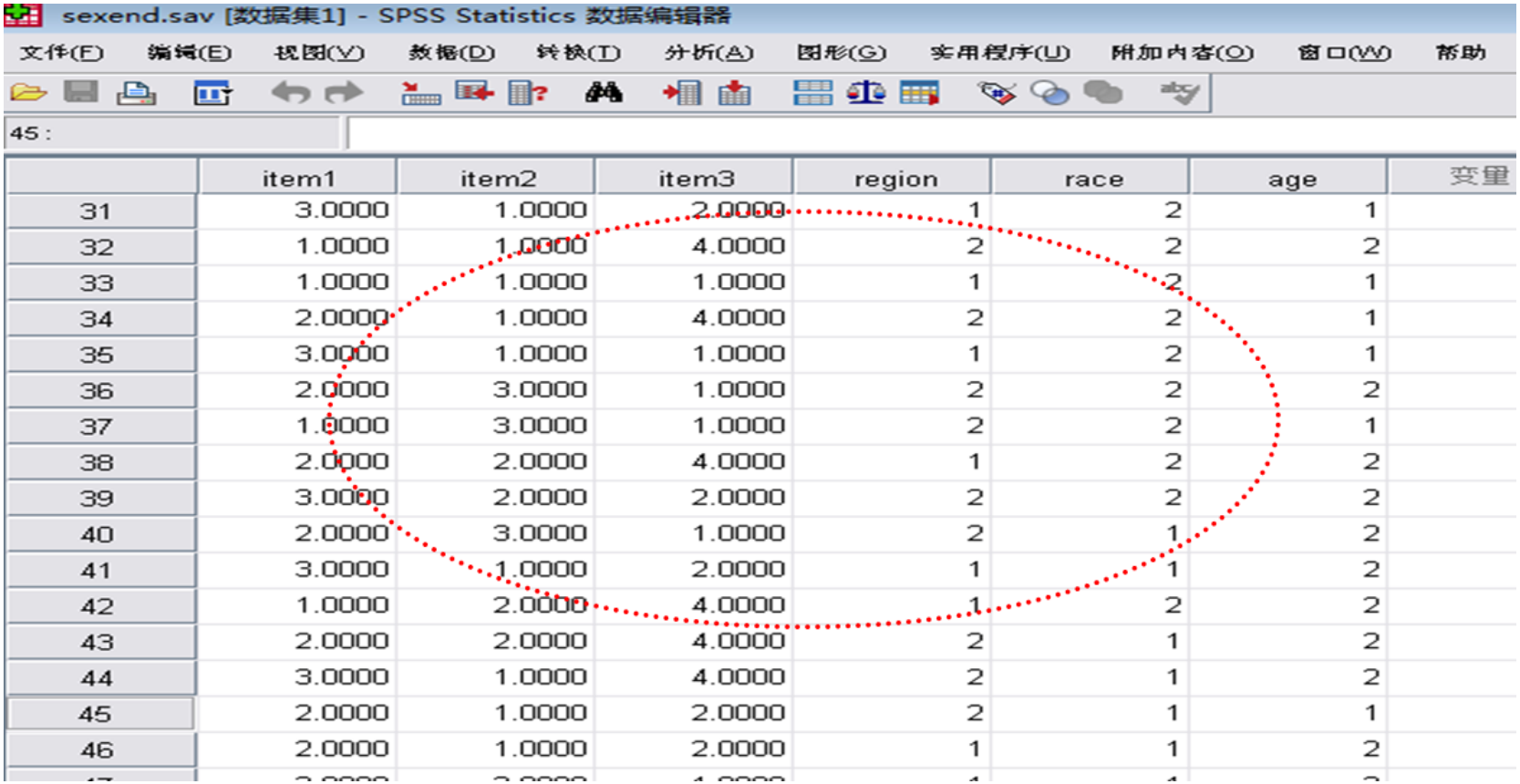
	Class 1	**Class 2**	**Class 3**
p_1	0.80	0.10	0.10
p_2	0.02	0.91	0.07

p_1 belongs to the class 1;

p_2 belongs to the class 2.

LatentGOLD

Create an SPSS data file


sexend.sav [数据集1] - SPSS Statistics 数据编辑器

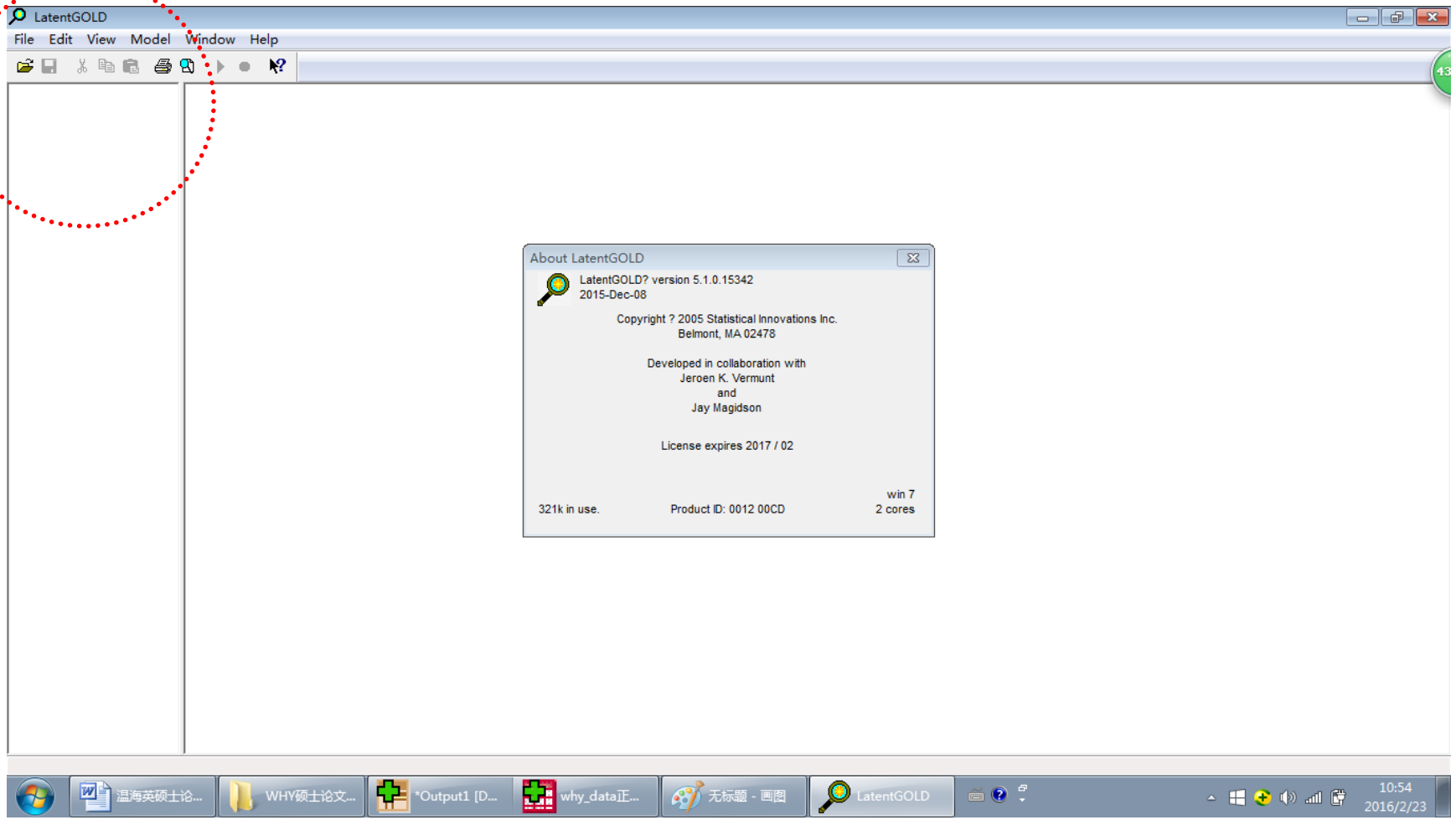
文件(F) 编辑(E) 视图(V) 数据(D) 转换(T) 分析(A) 图形(G) 实用程序(U) 附加内容(O) 窗口(W) 帮助

45 :

	item1	item2	item3	region	race	age	变量
31	3.0000	1.0000	2.0000	1	2	1	
32	1.0000	1.0000	4.0000	2	2	2	
33	1.0000	1.0000	1.0000	1	2	1	
34	2.0000	1.0000	4.0000	2	2	1	
35	3.0000	1.0000	1.0000	1	2	1	
36	2.0000	3.0000	1.0000	2	2	2	
37	1.0000	3.0000	1.0000	2	2	1	
38	2.0000	2.0000	4.0000	1	2	2	
39	3.0000	2.0000	2.0000	2	2	2	
40	2.0000	3.0000	1.0000	2	1	2	
41	3.0000	1.0000	2.0000	1	1	2	
42	1.0000	2.0000	4.0000	1	2	2	
43	2.0000	2.0000	4.0000	2	1	2	
44	3.0000	1.0000	4.0000	2	1	2	
45	2.0000	1.0000	2.0000	2	1	1	
46	2.0000	1.0000	2.0000	1	1	2	

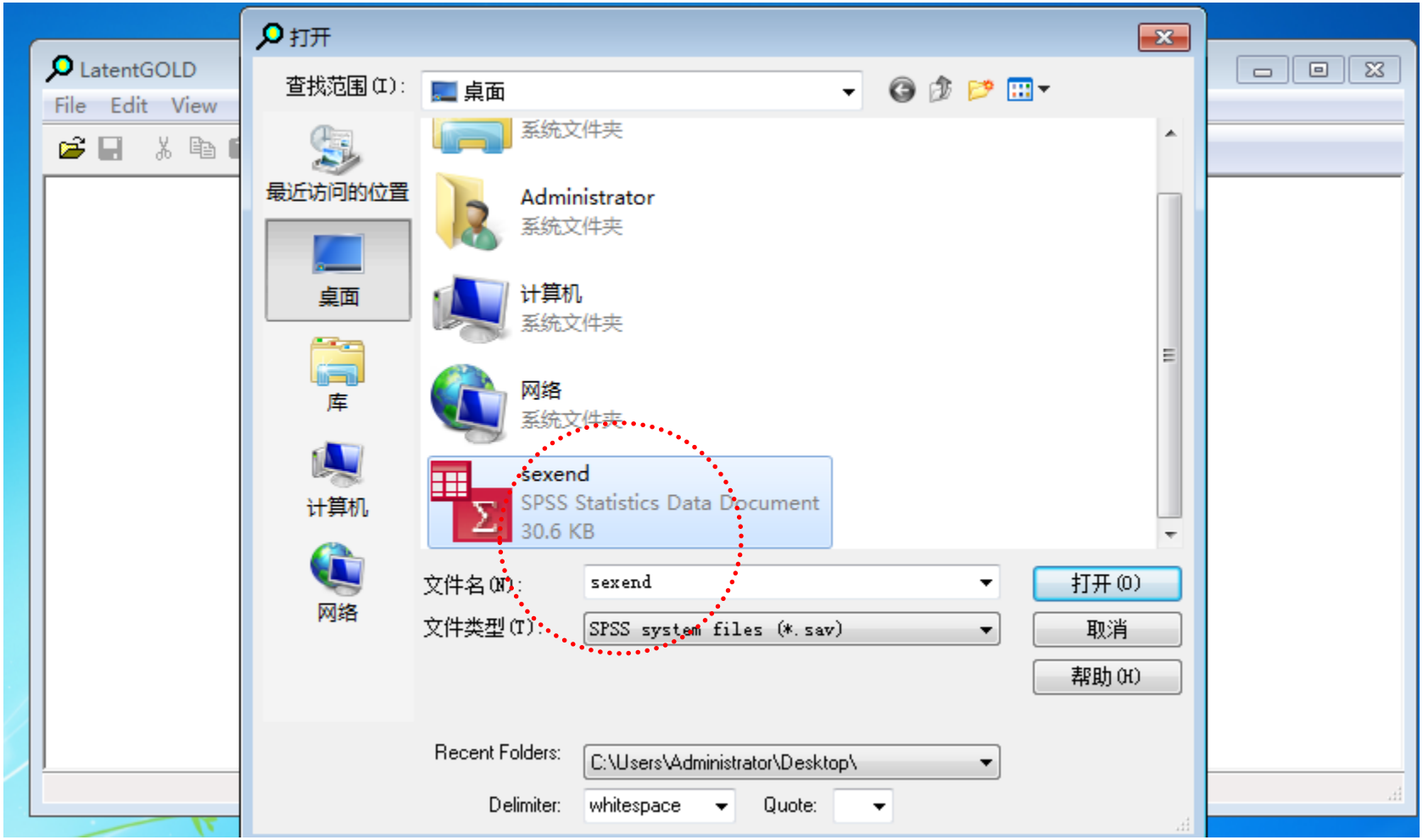
LatentGOLD

Open it in latentGOLD



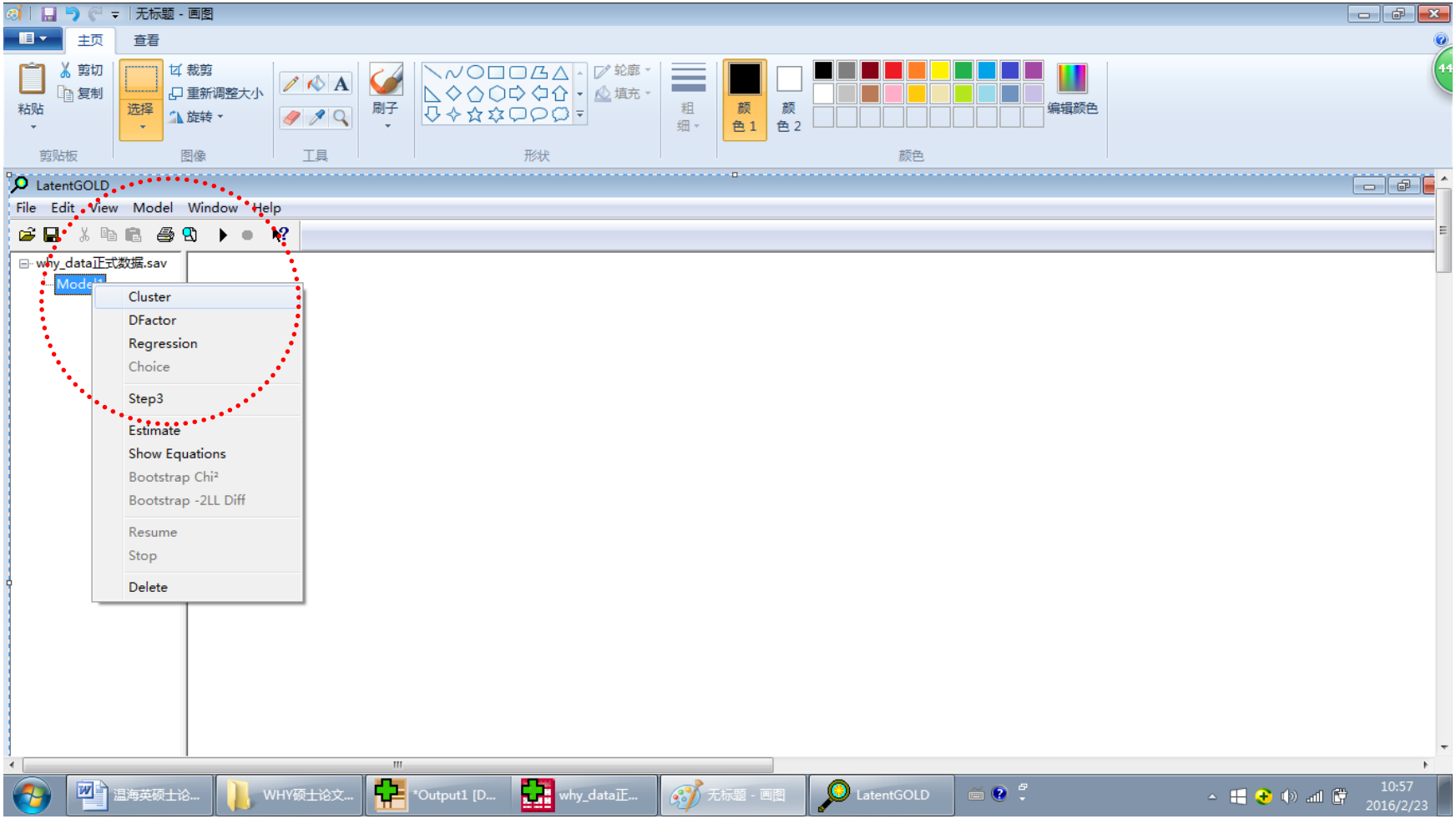
LatentGOLD

Open it in latentGOLD



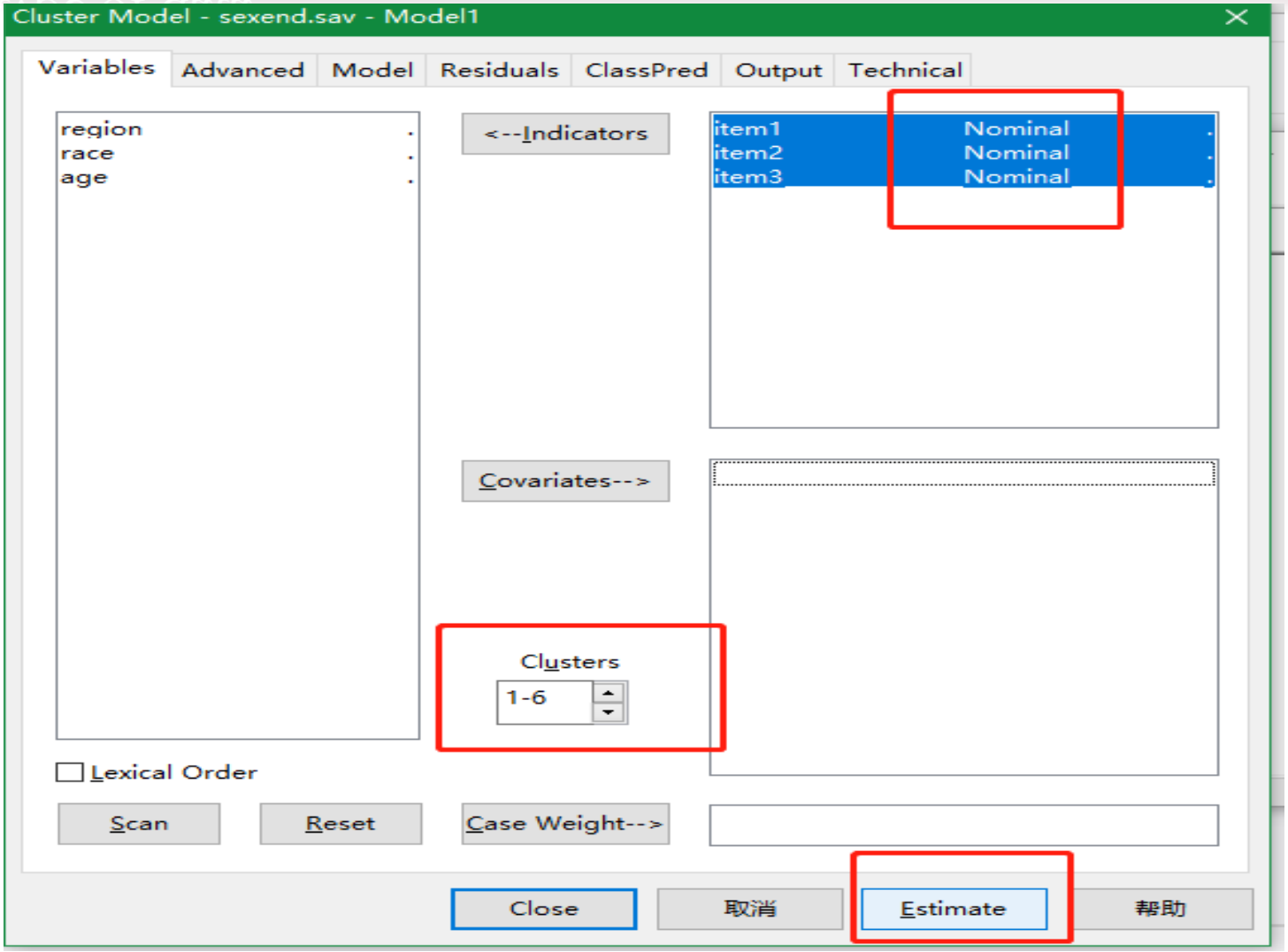
LatentGOLD

Choose cluster



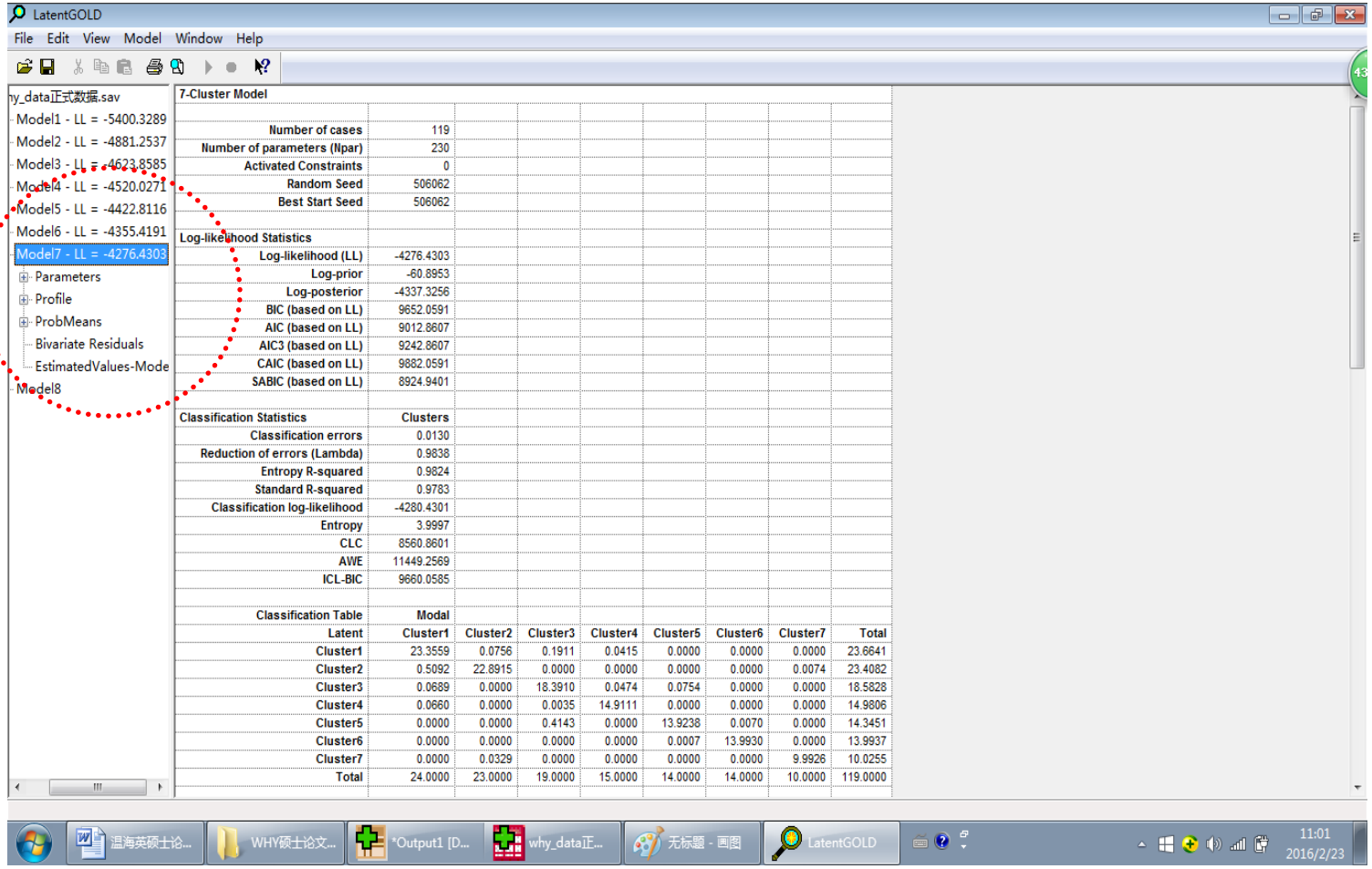
LatentGOLD

Choose type of data



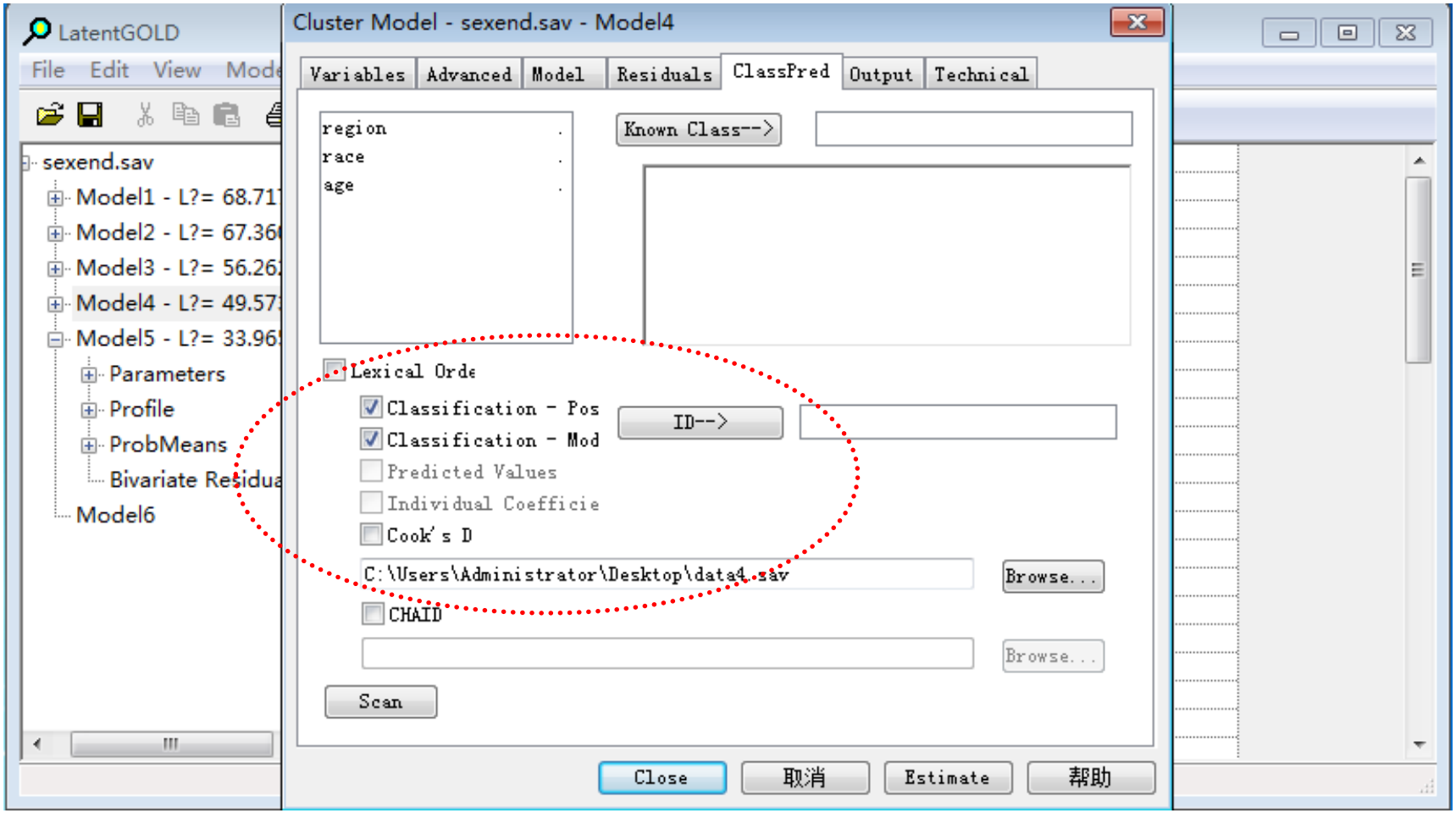
LatentGOLD

Sort out the goodness of fit index

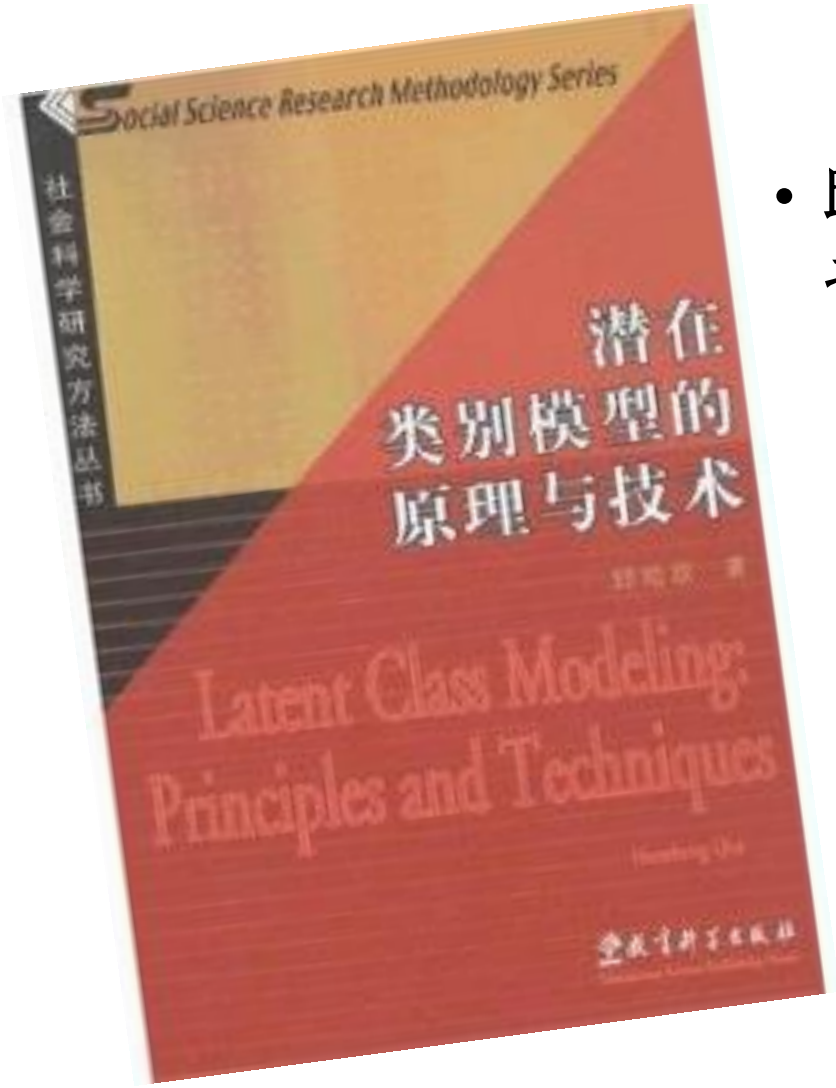


LatentGOLD

Produce an “SAV” file



Recommend



- 邱皓政. (2008). *潜在类别模型的原理与技术*. 北京：教育科学出版社.

Thanks!