

Adebowale Olusola Adejumo

**Modelling
Generalized Linear
(Loglinear) Models
for Raters Agreement
Measure**

With Complete and Missing Values Cases



PETER LANG

Europäischer Verlag der Wissenschaften

Contents

1	General introduction	5
1.1	Why modelling in Raters Agreement measures?	5
1.2	Scales of measurements	8
1.3	Description of Data for Raters agreement	10
1.4	Association and agreement Measures	17
1.5	Scope of the study	17
2	Contingency tables	18
2.1	Introduction	18
2.2	Tabulation	18
2.2.1	One dimensional ($1 \times J$ contingency) tables	19
2.2.2	Two dimensional ($I \times J$ contingency) tables	19
2.2.3	Square tables ($I \times I$ contingency) tables	21
2.2.4	Multidimensional tables	22
2.3	Common sampling distributions for two-way classifications	23
2.3.1	Poisson sampling	23
2.3.2	Multinomial sampling	23
2.3.3	Product Multinomial sampling	24
2.3.4	Special sampling plans	24
2.4	Likelihood Functions and Maximum Likelihood estimates	25
2.5	Testing Goodness of fit	27
2.5.1	Pearson chi-squared statistic	27

2.5.2	Likelihood-Ratio statistic	28
-------	--------------------------------------	----

3 Generalized Linear and Loglinear Models 30

3.1	Introduction:	30
-----	-------------------------	----

3.2	Generalized Linear Models (GLMs)	31
-----	--	----

3.2.1	The components of Generalized Linear Models:	33
-------	--	----

3.2.2	Common distributions in the Exponential family used with GLMs:	34
-------	---	----

3.2.3	Maximum likelihood estimation for GLMs	38
-------	--	----

3.2.4	Analysis of Deviance	44
-------	--------------------------------	----

3.3	Loglinear models	45
-----	----------------------------	----

3.3.1	Sampling scheme for loglinear models	46
-------	--	----

3.3.2	Maximum likelihood estimation	55
-------	---	----

3.3.3	Assessing the goodness-of-fit of loglinear models	63
-------	---	----

4 Association and Agreement Measures 67

4.1	Introduction	67
-----	------------------------	----

4.2	Measures of association	68
-----	-----------------------------------	----

4.2.1	Basic measures of association	69
-------	---	----

4.3	Measures of Agreement	76
-----	---------------------------------	----

4.3.1	Basic measures of Agreement	78
-------	---------------------------------------	----

4.3.2	Modelling in Agreement measure	91
-------	--	----

5 Modelling and fitting of selected models 97

5.1	Introduction	97
-----	------------------------	----

5.2	Modelling baseline structures	98
-----	---	----

5.3	Some selected models	99
-----	--------------------------------	----

5.3.1	Symmetry models (SM).	99
-------	-------------------------------	----

5.3.2	Conditional symmetry models (CS).	100
-------	---	-----

5.3.3	Quasi-symmetry model (QS)	103
-------	-------------------------------------	-----

5.3.4	Uniform association model (UA).	105
-------	---	-----

5.3.5	Homogeneous agreement model (HA).	107
-------	---	-----

5.3.6	Uniform association model plus extra agreement (UAA).	108
5.3.7	Mover-Stayer model (MS).	109
5.3.8	Bradley-Terry model (BT)	111
5.4	Fitting of the selected models	113
5.5	Simulation work and results	119
5.5.1	Simulation work	119
5.5.2	Results	121
6	Modelling Quasi-independence and association for agreement	131
6.1	Introduction	131
6.2	Quasi independence Model (QID)	132
6.3	Quasi association (QA)	135
6.4	Fitting of the models	142
6.5	Simulation work and results	144
7	Modelling Negative binomial for agreement	157
7.1	Introduction	157
7.2	Why negative binomial model for agreement?	157
7.3	Model and its properties	159
7.4	Modelling and estimation of parameters	161
7.5	Applications to real life data and Results	168
7.5.1	Applications to real life data	168
7.5.2	Results	169
8	Missing ratings:Likelihood and Data based approaches	182
8.1	Introduction on missing values in general	182
8.1.1	Missing values pattern in general	184
8.1.2	Missing values mechanisms in general	186
8.2	Missing values in categorical data	187
8.2.1	Missing values in the ratings of raters	192
8.2.2	Missing ratings pattern	194
8.2.3	Missing ratings mechanisms	197

8.3	Maximum likelihood estimation in incomplete ratings case	198
8.3.1	Expectation Maximization (EM)	202
8.4	Data based approach in incomplete ratings case	204
8.4.1	Case-by-case formulations for missing structures with (PMAPS)	207
8.5	Simulation study and results	208
8.5.1	Simulation study	208
8.5.2	Results	214
9	Summary and Conclusion	219
9.1	Introduction	219
9.2	Summary	219
9.3	Conclusion	222
	References	224
A	Appendix for Chapter 4	239
A.1	Exponential logarithm notation $\{\exp - \log\}$	239
A.1.1	Gamma statistic	240
A.1.2	Somer's-d statistic	240
A.1.3	Kendall's tau-b	240
A.1.4	Pearson's correlation coefficient	241
A.1.5	Cohen's kappa	242
A.1.6	Response function F for various kappa indices	244