

# Ordinal Deep Dive

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# Ordinal Logit

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- Use when data represents a rating scale that satisfies the proportional odds assumption
- For a rating scale of 1 to 5, the log of the odds of answering in a certain way are
  - $1 = \log\{p_1/[p_1+p_2+p_3+p_4+p_5]\}$
  - $2 = \log\{[p_1+p_2]/[p_1+p_2+p_3+p_4+p_5]\}$
  - $3 = \log\{[p_1+p_2+p_3]/[p_1+p_2+p_3+p_4+p_5]\}$

And so forth . . .

# Does This Occur Much?

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*“Ordinal data are the most frequently encountered type of data in the social sciences.” (Johnson and Albert, 1999, 126)*

## **Examples**

- Yes, maybe, no
- Likert scale (strongly agree – strongly disagree)
- Always, frequently, sometimes, rarely, never
- No hs diploma, hs diploma, some college, bachelor's degree, master's degree, doctoral degree
- Free school lunch, reduced school lunch, full price lunch
- 0–10K per year, 10–20K per year, 20–30K per year, 30–60K per year, > 60K per year
- Low, medium, high
- Basic math, regular math, pre-AP math, AP math

# Ordinal Logistic Regression: Results

Source	Value
Intercept 5	-1.738
Intercept 4	-0.166
Intercept 3	1.213
Intercept 2	2.435
Age	0.004
Action	-0.141
Adventure	0.129
Animation	0.601
Children's	-0.221
Comedy	-0.101
Crime	0.1
Documentary	0.12
Drama	0.383

← Cutoffs for each  
level of rating scale

$$\begin{aligned} Xb = & .004*Age - .141*Action \\ & + .129*Adventure + .601*Animation \\ & - .221*Children's - .101*Comedy \\ & + .1*Crime + .12*Documentary \\ & + .383*Drama \end{aligned}$$

# Rating Predictions

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- Probability of rating equals 5 =  $\text{logit}(\text{intercept } 5 - Xb)$
- Probability of rating equals 4 =
  - $\text{Logit}(\text{intercept } 4 - Xb) - \text{logit}(\text{intercept } 5 - Xb)$
- Probability of rating equals 3 =
  - $\text{Logit}(\text{intercept } 3 - Xb) - \text{logit}(\text{intercept } 4 - Xb)$
- Probability of rating equals 2 =
  - $\text{Logit}(\text{intercept } 3 - Xb) - \text{logit}(\text{intercept } 2 - Xb)$
- Probability of rating equals 1 =
  - $1 - \text{logit}(\text{intercept } 2 - Xb)$

$\text{Logit}(x) = \exp(x)/(1+\exp(x))$
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# Value of Collaborative Filtering

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**Value of Star Wars =**

**content budget \***

**(expected Star Wars viewing time/total viewing time)**

# Conclusion

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- Collaborative filtering is an essential tool in digital products.
- There are two main types of collaborative filtering:
  - Nonparametric—e.g., slope one
  - Model based—e.g., ordinal logit
- Ordinal logits are used in collaborative filtering because the levels in a rating scale have an inherent rank order.
- Advancements in collaborative filtering focus on
  - Using consumer viewing data to build proxies for missing ratings information
  - Grouping customers into similar segments and conducting collaborative filtering within each segment