Online sellers revisited

Joachim Vandekerckhove and Michael Lee

Revisiting Online Sellers

- We now have five online sellers, each with different numbers of positive ratings from different numbers of total evaluations

Seller	Positive	Total	Percentage
One	10	10	100%
Two	48	50	96%
Three	186	200	93%
Four	75	100	75%
Five	1	2	50%

Revisiting Online Sellers

- We now have five online sellers, each with different numbers of positive ratings from different numbers of total evaluations
  - the additional sellers have 75 out of 100, and 1 out of 2 positive ratings

Seller	Positive	Total	Percentage
One	10	10	100%
Two	48	50	96%
Three	186	200	93%
Four	75	100	75%
Five	1	2	50%

Revisiting Online Sellers

- We now have five online sellers, each with different numbers of positive ratings from different numbers of total evaluations
  - the additional sellers have 75 out of 100, and 1 out of 2 positive ratings

Seller	Positive	Total	Percentage
One	10	10	100%
Two	48	50	96%
Three	186	200	93%
Four	75	100	75%
Five	1	2	50%

- The more general research question now is to model the rates with which the sellers generate positive reviews

Independent Rate Model

- The original rate model assumed that the k_i of positive ratings out of n_i total evaluations for the ith seller are generated by an underlying probability θ_i, so that

$$k_i \sim \text{binomial}(\theta_i, n_i)$$

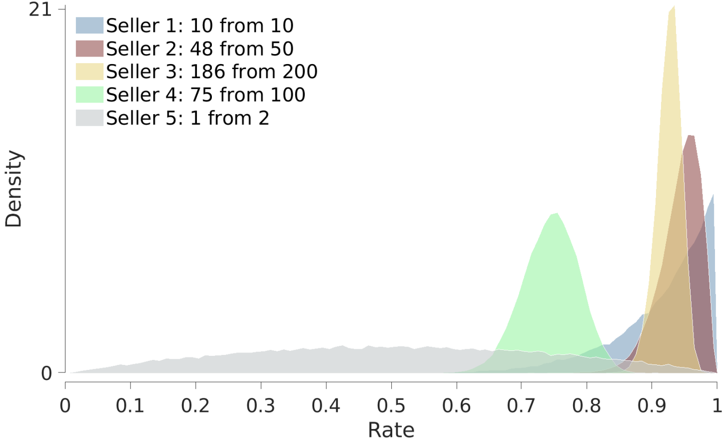
Independent Rate Model

- The original rate model assumed that the k_i of positive ratings out of n_i total evaluations for the ith seller are generated by an underlying probability θ_i, so that

$$k_i \sim \text{binomial}(\theta_i, n_i)$$

- The underlying rates are independent of each other, and given the uniform prior $\theta_i \sim \text{uniform}(0, 1)$

Independent Rate Model Inferences



Same Rate Model

- If we were willing to assume all the sellers had the same underlying rate, there would just be a single $\theta \sim \text{uniform}(0, 1)$, and the individual data would be generated as

$$k_i \sim \text{binomial}(\theta, n_i)$$

Same Rate Model

- If we were willing to assume all the sellers had the same underlying rate, there would just be a single $\theta \sim \mathrm{uniform}(0, 1)$, and the individual data would be generated as

$$k_i \sim \mathrm{binomial}(\theta, n_i)$$

- This assumption of the same parameter value for all sellers may seem unreasonable, but

Same Rate Model

- If we were willing to assume all the sellers had the same underlying rate, there would just be a single $\theta \sim \mathrm{uniform}(0, 1)$, and the individual data would be generated as

$$k_i \sim \mathrm{binomial}(\theta, n_i)$$

- This assumption of the same parameter value for all sellers may seem unreasonable, but
  - often cognitive modeling does assume there are no individual differences, at least for some parameters in some conditions or groups

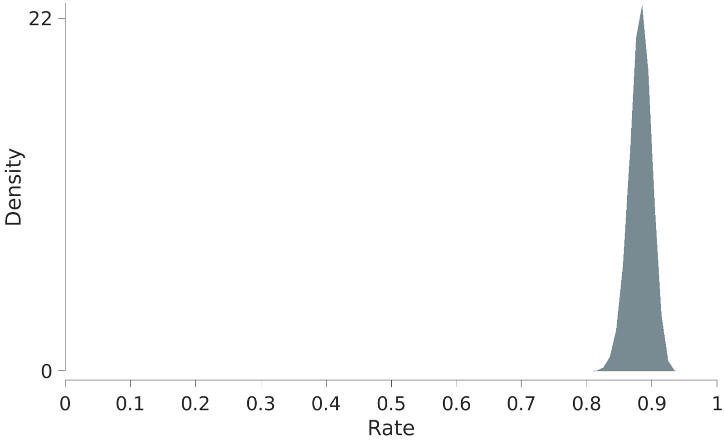
Same Rate Model

- If we were willing to assume all the sellers had the same underlying rate, there would just be a single $\theta \sim \text{uniform}(0, 1)$, and the individual data would be generated as

$$k_i \sim \text{binomial}(\theta, n_i)$$

- This assumption of the same parameter value for all sellers may seem unreasonable, but
  - often cognitive modeling does assume there are no individual differences, at least for some parameters in some conditions or groups
  - historically, cognitive modeling has often aggregated data before inferring parameters, which implicitly corresponds to assuming there are no individual differences

Same Rate Model Inferences



Hierarchical Rate Model

- The independent model is good at allowing for differences, while the same rate model tries to find commonalities

Hierarchical Rate Model

- The independent model is good at allowing for differences, while the same rate model tries to find commonalities
- In general, cognitive variables will have some mixture of sameness and difference, because both invariants and variation are involved in most cognitive phenomena

Hierarchical Rate Model

- Hierarchical models allow both sameness and difference to be modeled, by assuming individual-level parameters that are connected by all being drawn from an over-arching group distribution

$$\theta_i \sim \mathrm{Gaussian}(\mu, \sigma^2)\mathrm{T}(0, 1)$$

Hierarchical Rate Model

- This assumption of the same parameter value for all sellers may seem unreasonable, but

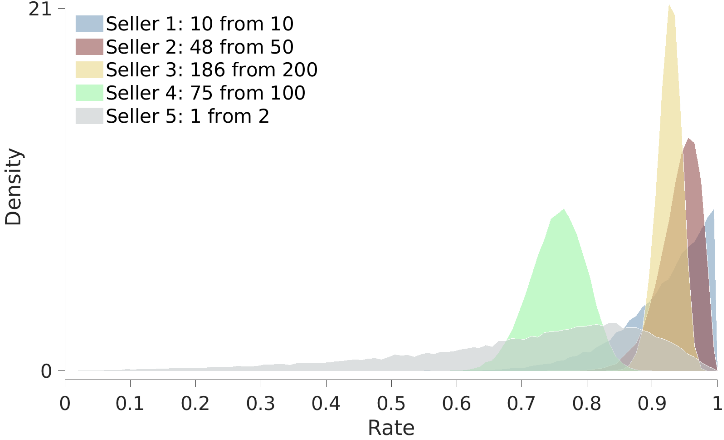
Hierarchical Rate Model

- This assumption of the same parameter value for all sellers may seem unreasonable, but
  - often cognitive modeling does assume there are no individual differences, at least for some parameters in some conditions or groups

Hierarchical Rate Model

- This assumption of the same parameter value for all sellers may seem unreasonable, but
    - often cognitive modeling does assume there are no individual differences, at least for some parameters in some conditions or groups
    - historically, cognitive modeling has often aggregated data before inferring parameters, which implicitly corresponds to assuming there are no individual differences

Hierarchical Rate Model Inferences



Exercise

Implement the hierarchical sellers model. Who is better?

$$\theta_i \sim \mathrm{Gaussian}(\mu, \sigma^2)\mathrm{T}(0,1)$$

$$k_i \sim \text{Bernoulli}(\theta_i, n_i)$$

Seller	Positive	Total	Percentage
One	10	10	100%
Two	48	50	96%
Three	186	200	93%
Four	75	100	75%
Five	1	2	50%