# A Hierarchical Aspect-Sentiment Model for Online Reviews

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### Motivation

- To help users quickly understand the major opinions from massive online reviews
- Potential consumers need information in different granularities of aspects and sentiments

### Contributions

- A first work to discover a hierarchical structure of aspect-based sentiments from unlabeled online reviews
- A Bayesian nonparametric model discovers flexible tree
- Quantitative analysis showed the effectiveness of HASM

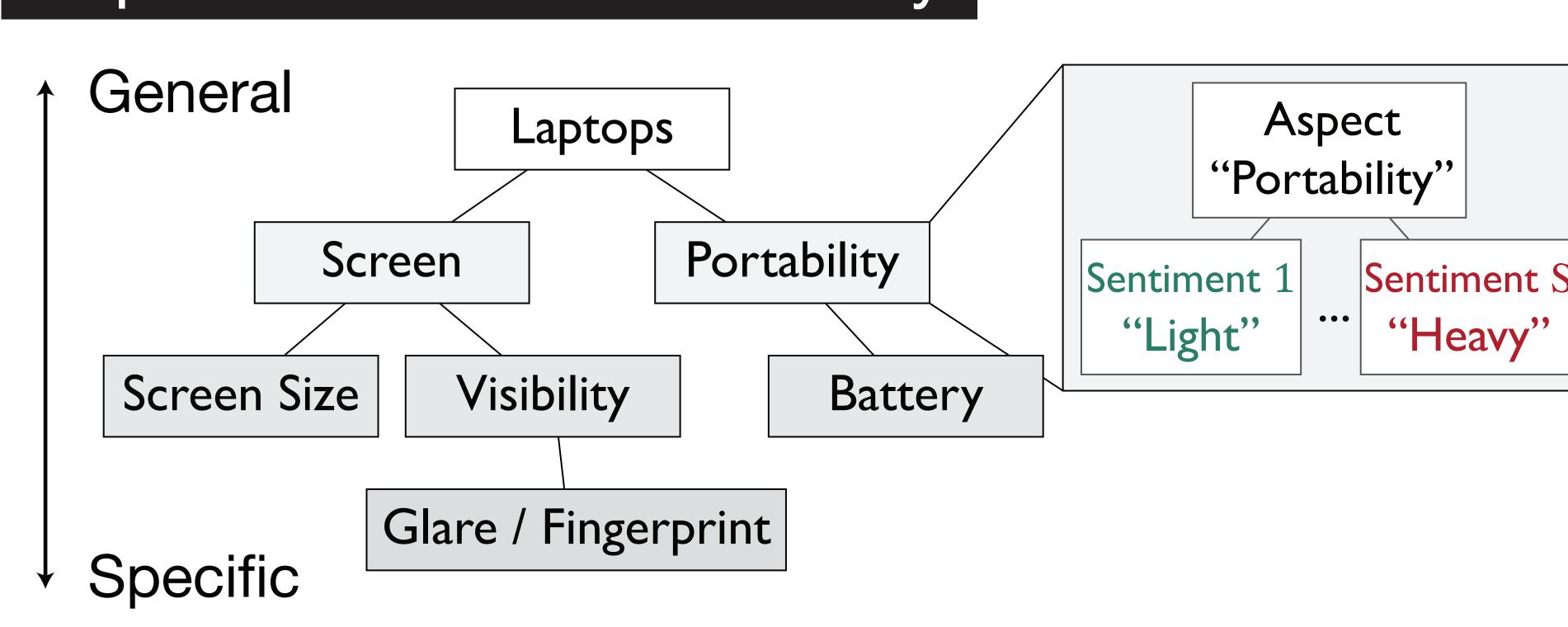
### HASM Framework

Sentiment Seed Words Review Corpus



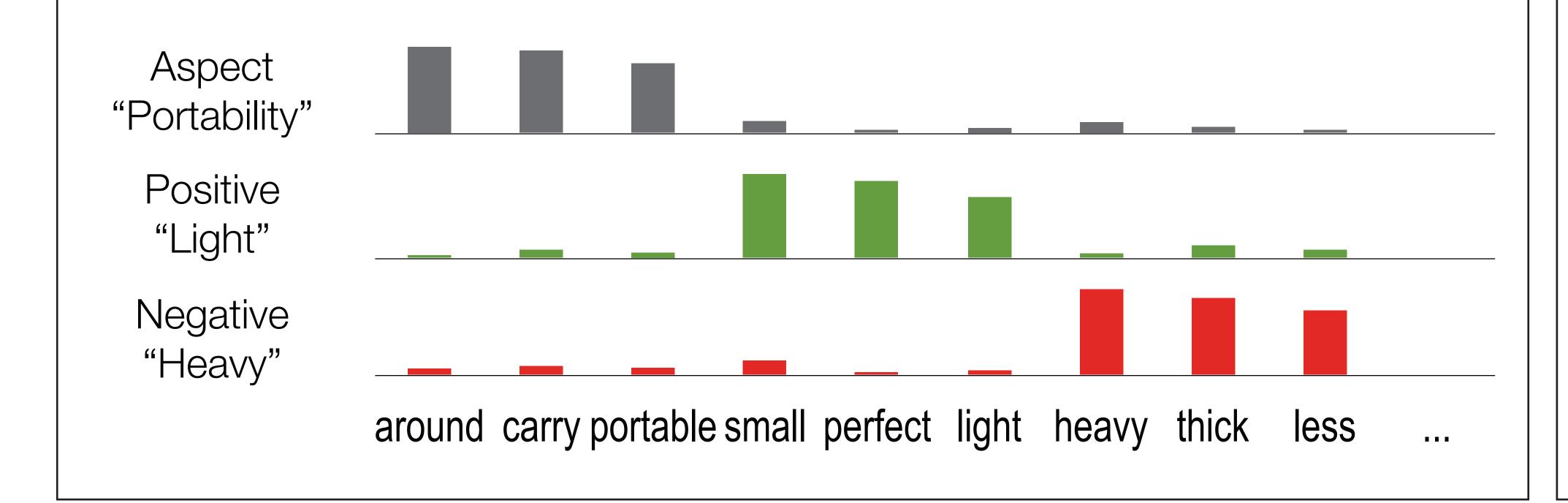
Aspect-Sentiment Hierarchy Tagged Reviews

# Aspect-Sentiment Hierarchy



### Definition

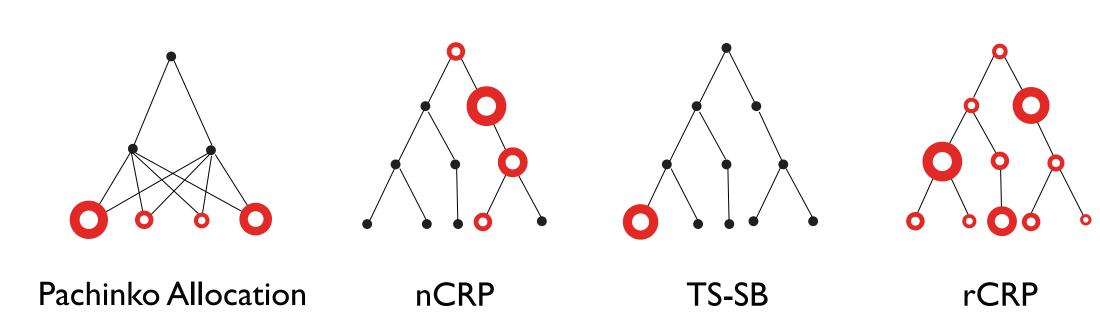
- Aspect-sentiment node is itself a two-level tree
- Aspect-sentiment node contains one aspect and S sentiment topics
- Each aspect and sentiment is a multinomial distribution over words
- A word is subjective if it expresses any sentiment



## Model

### Recursive CRP Prior

- Review contains multiple aspects and sentiments
- rCRP allows generation of document from whole tree



### Generative Process

- . Draw a tree  $T \sim rCRP(\gamma)$ .
- 2. Draw aspect/sentiment topics  $\varphi_k^{S} \sim \text{Dirichlet}(\beta_s).$

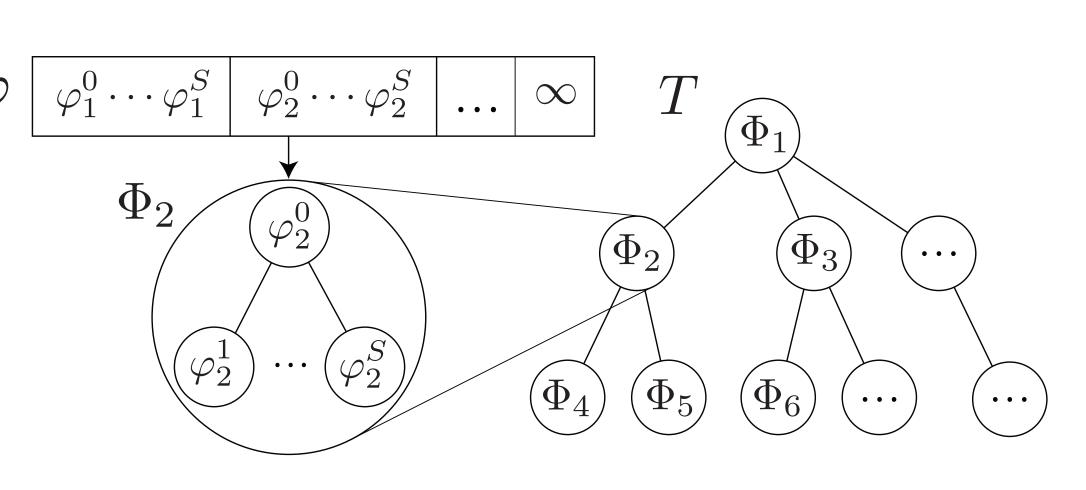
### For each sentence i, draw

- 1. Aspect-sentiment node  $c_i \sim T$ .
- 2. Sentiment  $s_i \sim \pi_d$ .
- 3. Subjectivity dist.  $\theta_i \sim \text{Beta}(\alpha)$ .
- 4. For each word j, draw
- 1. Subjectivity  $p_i \sim \theta_i$ .
- 2. Word  $w_i \sim \varphi_c^{s \times p}$ .

# $(S + 1) \times \infty$

### Aspect-Sentiment Hierarchy

- A tree T has unbounded width and unbounded depth
- Each aspect-sentiment node is two-level topic tree
- $\Phi$  has aspect topic and Ssentiment polar topics



# Experimental Setup

### Corpus

Review text from Amazon.com electronics section

| Ī | Corpus      | Reviews | Products | Avg. R/P | Avg. Length |
|---|-------------|---------|----------|----------|-------------|
| · | Laptops     | 10,014  | 825      | 12.14    | 1,160.1     |
|   | DigitalSLRs | 20.862  | 260      | 80.24    | 1,029.6     |

### Sentiment Seed Words

Positive and Negative sentiments, 27 words each

good nice excel excellent posit fortun correct superior amaz... bad nasti poor neg unfortun wrong inferior annoi complain...

### Tagged Reviews

- For each sentence s, HASM reports
  - Which aspect-sentiment node s belongs?
  - Which sentiment s expresses?
- For each sentence w, HASM reports
  - Is w subjective?

# Experimental Results

### Aspect-Sentiment Hierarchy

### Laptops

(0) laptop used computer get will screen just work (+) like windows screen great work new macbook look (-) battery screen hour problem time windows hp drive

| creen                                                                                                   | Battery                                                                                                                                       |  |  |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| O) screen laptop look display pro H) like macbook display feel new H) glossy black see review rest feel | <ul><li>(0) battery laptop life hour get</li><li>(+) battery good life size hour great</li><li>(-) battery hour life time will less</li></ul> |  |  |
|                                                                                                         |                                                                                                                                               |  |  |
| creen Size                                                                                              | Portability                                                                                                                                   |  |  |
| )) screen inch laptop new previous  +) inch resolution solid like size                                  | <ul><li>(0) laptop around carry portable</li><li>(+) laptop size carry perfect small</li></ul>                                                |  |  |

### (+) inch resolution solid like size (-) resolution inch small display Screen Quality & Visibility

(0) screen led backlight lcd bright (+) led screen color bright really (-) screen glare issue glossy reflect

### **Performance**

(0) drive gb ram hard processor +) graphic intel core ram cpu fast -) drive gb hard ram external need

### **Graphics Card**

(0) ram card graphic video memory (+) gb ram perform game better fps (-) gb video ram dedicate upgrade CPU

(0) core processor intel duo ghz +) core intel dual fast duo cpu ghz -) intel amd old atom power lower

### (-) support call tech hour took time Repair

(0) repair send back replace ship +) send repair serice back sent unit -) back ship day send week away

Support & Warranty

(-) battery life hour normal half

(0) battery hour life get computer

(-) battery life power less even fast

(0) service support customer laptop

(-) problem support customer call

(+) warranty amazon service year

(0) support service tech call phone

+) year warranty accident protect

(+) battery hour good last long

**Battery Life** 

Service

### User Scenario

### I'm looking for a camera with...

- Good picture quality, esp. under low light condition
- Good LCD screen
- High-end lenses available

# **Overall Evaluation** (+) highly recommend if you have a crop sensor camera (+) This camera is best for stills if hand held

(-) It doesn't compare to a dedicated video camera

### Picture Quality

(+) full-framed sensor camera continues to impress me (+) as with 21 megapixels I can crop with no problem (-) the photos always have lots of grainy red dots

### Low light condition

- (+) The image quality for high iso is amazing (+) helped me the most during the low light
- (+) focus is better in low light for sure

### **LCD Screen**

(+) the true VGA screen is a very welcome change (+) good exposure on the rear LCD screen

(+) no need to adjust Icd brightness from time to time

### **Lens Related**

(+) For high quality you need only new mark II lenses (-) Canon please make us a wide angle lens with this (-) disappointing for a lens that costs over \$1K

### Aspect-Sentiment Consistency

- How in-node topics are coherent in compared to topics outside?
- Better ASC than rJST

# Hierarchical Affinity

- How a node is more similar to its children than nephews?
- Similar HA to rCRP
- Better HA than nCRP

### Classification Accuracy

- Single-sentence reviews having <100</li> characters
- Small set: 1, 5 stars
- Large set: 1, 2, 4, 5 stars
- Classification accuracy of HASM is comparable to other sentiment topic models

