A Hierarchical Aspect-Sentiment Model for Online Reviews

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Worth every penny!
I purchased the newest version (Early 2013) which had the upgrade to 16GB Ram and 512GB SSD.

The notebook is extremely fast. Computer seems solid, boots in 10-15 seconds from off, sleep to ready in 4-5 seconds. It opens programs in no time flat. It is not light as an air book, but still defiantly lighter than previous models. The screen is great, bright,...

Read the full review »
Published 4 months ago by Christopher Gustavus

I was sent a used Macbook pro
I ordered this computer on may 21st, received it on may 23rd. The shrink wrap on the box was intact, but when I opened it I found the charger missing. So I called customer support and they were willing to refund the amount for the charger so that I can I pick one up at the apples store, since I was leaving out of the country. I took the computer along with me to the apple...

Read the full review »
Published 1 month ago by kohlam rangeaswamy

Some peoples complaints are the new power adapter, I will agree with them, the new adapter sticks out further and gets knocked off a lot. Not having a dvd drive, not a big deal...I dont think i've used a dvd or cd in a computer in a few years! If I need to I will just have to purchase the external.
Reviews are not structurally organized

Consumers need to read through the reviews
Prior Work

- Flat-layer joint sentiment-aspect topic models
  - ASUM (Jo 2011)
  - JST (Lin 2009)
  - Reverse JST (Lin 2012)

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bright</td>
<td>Slow</td>
</tr>
<tr>
<td>Fast</td>
<td>Dim</td>
</tr>
<tr>
<td>Light</td>
<td>Heavy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Screen</th>
<th>Performance</th>
<th>Portability</th>
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Prior Work

- Flat-layer joint sentiment-aspect topic models
  - ASUM (Jo 2011)
  - JST (Lin 2009)
- Reverse JST (Lin 2012)

Different consumers are interested in different granularities of aspects and sentiments

“I want a laptop which has a great performance, especially for a graphics card. I don’t care about weight but screen should be visible quite well. And, of course, it should be rated positive overall!”
Our Solution

Aspect-Sentiment Hierarchy

Hierarchical structure of Aspect-Sentiment Nodes

- Aspect-sentiment nodes are tree structured
- Each aspect-sentiment node is a two-level tree: aspect and sentiments

Hierarchical structure of Aspect-Sentiment Nodes

- General
  - Laptops
    - Screen
      - Screen Size
    - Portability
      - Battery
    - Visibility
      - Glare / Fingerprint

- Specific
  - Aspect “Portability”
    - Sentiment 1 “Light”
    - ... Sentiment S “Heavy”
Our Solution

- Each aspect and sentiment is a multinomial distribution over words

A Bayesian nonparametric prior discovers tree structure
Our Solution

- Each aspect and sentiment is a multinominal distribution over words

**HASM:**
A new model to discover a hierarchical structure of aspect-based sentiments from unlabeled online reviews

A Bayesian nonparametric prior discovers tree structure
Hierarchical Aspect-Sentiment Model

- Automatically discovers a hierarchy of aspects and aspect-dependent sentiments

Sentiment Seed Words

<table>
<thead>
<tr>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>nice</td>
<td>nasty</td>
</tr>
<tr>
<td>perfect</td>
<td>nasty</td>
</tr>
<tr>
<td>amazing</td>
<td>wrong</td>
</tr>
</tbody>
</table>

Review Text

| Bright but heavy |

HasM

Aspect-Sentiment Hierarchy

Laptops
  - Screen
    - Screen Size
    - Visibility
      - Glare / Fingerprint
  - Portability
    - Battery

Bright but heavy
A Bayesian nonparametric topic model

A CRP Prior

Wednesday, July 24, 13
HASM: Example
HASM: Example

The screen is clear and the picture quality is outstanding.

Laptops

Screen

Screen Size

Visibility

Portability

Glare/
Fingerprint
The screen is clear and the picture quality is outstanding.
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The screen is clear and the picture quality is outstanding.
HASM: Example

Laptops

Screen
- The screen is clear and the picture quality is outstanding.

Screen Size

Visibility

Portability

Glare/Fingerprint

Wednesday, July 24, 13
HASM: Example

Laptops

Screen

The screen is clear and the picture quality is outstanding.

Screen Size

Visibility

Glare/Fingerprint

Portability

+
HASM: Example

- Laptops
  - Screen
    - Screen Size: The screen is clear and the picture quality is outstanding.
  - Portability
  - Visibility
  - Glare/Fingerprint
The screen is clear and the picture quality is outstanding.
HASM: Example

- Laptops
  - Screen
    - Screen Size
      - Visibility
        - Positive: clear quality outstanding
        - Negative: glare/ fingerprint
  - Portability

the screen is and the picture
HASM: Example

- Laptops
  - Screen
    - Screen Size
    - Visibility
      - Glare/Fingerprint
  - Portability
A short battery life undermines portability.

Laptops

Screen

Screen Size

Visibility

Portability

Glare/Fingerprint
A short battery life undermines portability.
A short battery life undermines portability.
A short battery life undermines portability.
A short battery life undermines portability.

Laptops

Screen

Screen Size

Visibility

Glare/Fingerprint

Portability
A short battery life undermines portability.
A short battery life undermines portability.
HASM: Example

Laptops

Screen
  - Screen Size
  - Visibility
    - Glare/Fingerprint

Portability
  - A battery life portability
    - New Node
      - Positive
      - Negative
        - short undermines

Wednesday, July 24, 13
### Laptops

<table>
<thead>
<tr>
<th>Performance</th>
<th>Screen Size</th>
<th>Battery</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0) drive gb ram hard processor</td>
<td>(0) screen inch laptop new previous</td>
<td>(0) battery laptop life hour get</td>
<td>(0) service support customer laptop</td>
</tr>
<tr>
<td>(+) graphic intel core ram cpu fast</td>
<td>(+) like macbook display feel new</td>
<td>(+) battery good life size hour great</td>
<td>(+) warranty amazon service year</td>
</tr>
<tr>
<td>(-) gb video ram dedicate upgrade</td>
<td>(-) glossy black see review rest feel</td>
<td>(-) battery hour life time will less</td>
<td>(-) problem support customer call</td>
</tr>
</tbody>
</table>

### Graphics Card

| (+) gb ram perform game better fps | (-) gb video ram dedicate upgrade |

### CPU

| (+) core processor intel duo ghz | (-) intel amd old atom power lower |

### Screen

<table>
<thead>
<tr>
<th>Screen Size</th>
<th>Screen Quality &amp; Visibility</th>
<th>Portability</th>
<th>Support &amp; Warranty</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0) screen inch laptop new previous</td>
<td>(0) screen led backlight lcd bright</td>
<td>(0) laptop around carry portable</td>
<td>(0) support service tech call phone</td>
</tr>
<tr>
<td>(+) inch resolution solid like size</td>
<td>(+) led screen color bright really</td>
<td>(+) laptop size carry perfect small</td>
<td>(+) year warranty accident protect</td>
</tr>
<tr>
<td>(-) resolution inch small display</td>
<td>(-) screen glare issue glossy reflect</td>
<td>(-) battery life hour normal half</td>
<td>(-) support call tech hour took time</td>
</tr>
</tbody>
</table>

### Battery Life

<table>
<thead>
<tr>
<th>Battery Life</th>
<th>Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0) battery hour life get computer</td>
<td>(0) repair send back replace ship</td>
</tr>
<tr>
<td>(+) battery hour good last long</td>
<td>(+) send repair service back sent unit</td>
</tr>
<tr>
<td>(-) battery life power less even fast</td>
<td>(-) back ship day send week away</td>
</tr>
</tbody>
</table>

### Digital SLRs

<table>
<thead>
<tr>
<th>Image Quality</th>
<th>Lens</th>
<th>Operation</th>
<th>External Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0) camera image quality iso sensor</td>
<td>(0) lens mm camera kit zoom get</td>
<td>(0) camera set mode can focus auto</td>
<td>(0) camera card battery flash get</td>
</tr>
<tr>
<td>(+) quality like high better sensor</td>
<td>(+) lens mm kit good af zoom great</td>
<td>(+) set camera mode lcd view</td>
<td>(+) battery card raw software grip</td>
</tr>
<tr>
<td>(-) picture quality size sensor raw</td>
<td>(-) mm camera kit buy ef purchase</td>
<td>(-) camera set focus button mode</td>
<td>(-) card flash memory get battery</td>
</tr>
</tbody>
</table>

### Image Sensor

<table>
<thead>
<tr>
<th>Image Sensor</th>
<th>Lens Performance</th>
<th>Menu Operation</th>
<th>Battery Grip</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0) sensor camera shake dust feature</td>
<td>(0) lens mm vr camera kit lens used</td>
<td>(0) set mode camera can auto manual</td>
<td>(0) battery camera grip hand around</td>
</tr>
<tr>
<td>(+) dust sensor camera shake clean</td>
<td>(+) lens kit mm good wide angle great</td>
<td>(+) mode set manual auto control</td>
<td>(+) battery grip life hand comfort time</td>
</tr>
<tr>
<td>(-) work camera stabilize not shake</td>
<td>(-) lens mm af dx nikon nikkor ed</td>
<td>(-) set mode manual menu change</td>
<td>(-) hand carry grip battery small bag</td>
</tr>
<tr>
<td>(-) lens mm af dx nikon nikkor ed</td>
<td></td>
<td>Live View Finder</td>
<td>Flash Memory</td>
</tr>
</tbody>
</table>

### Lens Features

<table>
<thead>
<tr>
<th>Lens Features</th>
<th>Live View Finder</th>
<th>Flash Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0) lens camera can use old system</td>
<td>(0) lcd button screen camera view set</td>
<td>(0) card raw camera gb memory sd</td>
</tr>
<tr>
<td>(+) lens stabilize body image range</td>
<td>(+) lcd screen view liveview find set</td>
<td>(+) raw card image file software photo</td>
</tr>
<tr>
<td>(-) len af focus old camera older</td>
<td>(-) button shutter can press change</td>
<td>(-) card memory gb sd cf flash speed</td>
</tr>
</tbody>
</table>
- Aspects become specific as depth increases
- Children of an aspect are close to their parent
- Word "fast," "small," "high" occur in both positive and negative topics
User Scenario

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 - even for high iso - is amazing
(+) helped me the most during the low light condition
(+) 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 LCD 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

Part of Aspect-Sentiment Hierarchy for a SLR camera

I’m looking for a camera with...
- Good picture quality (esp. under low lights)
- Good LCD screen
- High-end lenses available
Evaluation

• No prior work that discovers a hierarchy of aspect-sentiment nodes
  • A comprehensive comparison is difficult

• Divide the evaluation into two parts:
  • Hierarchy analysis
  • Sentiment analysis
Evaluation: Hierarchy Analysis

- Measures the quality of hierarchy

Hierarchical Affinity

- “My parent should be more similar to me than my parent and nephew”

Aspect-Sentiment Consistency

- “Sentiments in an aspect-sentiment node should be themselves more similar than other topics”
Evaluation: Hierarchy Analysis

- Measures the quality of hierarchy

- Hierarchical Affinity
  “My parent should be more similar to me than my parent and nephew”

- Aspect-Sentiment Consistency

  - Better HA than nCRP (Blei 2003)
  - Similar HA to rCRP (Kim 2012)
  - Better ASC than rJST (Lin 2012)
Evaluation: Classification Accuracy

Sentiment Classification Accuracy

- Sentiment classification using short (<100) reviews
- Small set contains positive reviews of 5 stars, negative reviews of 1 star
- Large set contains positive reviews of 4~5 stars, negative reviews of 1~2 stars
Sentiment classification using short (<100) reviews

Small set contains positive reviews of 5 stars, negative reviews of 1 star

Large set contains positive reviews of 4~5 stars, negative reviews of 1~2 stars

Classification Accuracy is comparable to other three models for both datasets
Conclusion

• The first model to discover hierarchical structure of aspect and aspect-dependent sentiments

• Bayesian nonparametric prior allows high flexibility

• Both hierarchical quality and sentiment classification accuracy are comparable to other models

• Framework can be further extended
Email me:
suin.kim@kaist.ac.kr

See you at the poster session!

Questions?
A review can have multiple aspects and sentiments
Nonparametric prior allows flexible tree
- unbounded width, unbounded depth
Model Assumption

- Each aspect-sentiment node consists of sentiment-polar topics
- Each aspect and sentiment is a probability distribution over words
Model Assumption

- Each sentence in a review is generated from a single aspect and sentiment
Model Assumption

- Each word in a sentence is either neutral or subjective

A short battery life undermines portability. The screen is crisp and outstanding.