

# Latent Aspect Rating Analysis

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# Online opinions cover all kinds of topics

## Topics:

People  
Events  
Products  
Services, ...



## Sources:

Blogs  
Microblogs  
Forums  
Reviews, ...

45M reviews ↑ 53M blogs ↑ 340M msgs/day ↑ 115M users ↑  
1307M posts 10M groups



Text Mining



# Reviews: helpful resource for decision making

The screenshot displays the Amazon.com product page for the **Asus VS248H-P 24-Inch Full-HD LED-lit LCD Monitor**. The page includes a navigation bar with the Amazon logo, search bar, and account options. The product title is prominently displayed, followed by a star rating of 4.5 stars based on 3,086 customer reviews. The current price is \$169.99, marked down from a list price of \$189.00. A 'Buy new' button is highlighted in yellow, with an 'Add to Cart' button below it. The product image shows the monitor with the ASUS logo on the screen. To the right, there are social sharing icons and a 'Write a Review' button. Below the product image, there are size selection buttons (21.5, 23, 23.6, 24, 27 inches) and a list of product features. The 'Other Sellers on Amazon' section shows two alternative sellers with their respective prices and shipping costs. The bottom right corner of the page features a 'Write a Review' section with a photo gallery and a 'See all 47 photos' link.

**Asus VS248H-P 24-Inch Full-HD LED-lit LCD Monitor**  
by Asus  
★★★★★ 3,086 customer reviews | 139 answered questions

List Price: \$189.00  
Price: **\$169.99** & FREE Shipping. Details  
You Save: \$19.01 (10%)  
Post-purchase rebate: \$20.00 Get forms ▾  
Price after rebate: \$149.99  
Rebate forms for recent purchases ▾

**In Stock.**  
Ships from and sold by Amazon.com. Gift-wrap available.

Want it Tuesday, July 29? Order within **24 hrs 40 mins** and choose **One-Day Shipping** at checkout. Details

Size: **24 Inch**

21.5 Inch 23 Inch 23.6 Inch **24 Inch** 27 Inch

- Slim Form Factor with Built-in Power Adapter and VESA mountable
- Corporate Stable Model and EPEAT Gold Certified
- 1920x1080 FullHD 1080p Resolution and LED Backlight with 50,000,000:1 ASCR
- Asus Splendid Video Intelligence Processor
- Quick response time of 2ms (GTG) eliminates ghosting and tracers for more fluid video playback.

76 new from \$169.99 14 used from \$120.00 1 refurbished from \$147.09

Is this a gift? This item ships in its own packaging. To keep the contents concealed, select **This will be a gift** during checkout.

**Product Alert:** IPS (In-Plane-Switching) is a new technology for LCD displays that offers users wider viewing angles and bolder colors by allowing more light to pass through the panel. As a result, IPS panels can exhibit a slight glow around the edges and corners (also known as light bleed), which is entirely normal.

**Buy new:** \$169.99  
Qty: 1 ▾  
 Yes, I want FREE Two-Day Shipping with Amazon Prime  
**Add to Cart**  
or  
 **Buy used:** \$149.68

**Other Sellers on Amazon**

**\$177.99** + \$11.99 shipping  
Sold by: The Nerds **Add to Cart**

**\$181.25** + \$11.99 shipping  
Sold by: Thewholesaler (Sorry, we cannot ship to PO Boxes, AK, HI, or APO, FFA, FPO Boxes and/or outside of the USA.) **Add to Cart**

**Write a Review** Add Photo Share Bookmark

asada torta by Sonny S. See all 47 photos

Today 11:00 am - 9:00 pm **Open now**  
Full menu  
Price range **Under \$10**

**Hours**  
Mon 11:00 am - 10:00 pm  
Tue 11:00 am - 10:00 pm  
Wed 11:00 am - 10:00 pm  
Thu 11:00 am - 10:00 pm

# However, it's not easy for users to make use of the online opinions

- Too much information!

tripadvisor Four Seasons Hotel Chicago

Chicago Hotels Flights Vacation Rentals Restaurants Things to Do Best of 2014 Trending Now More Write a Review

United States Illinois (IL) Chicago Chicago Hotels Search for a city, hotel, etc.

## Four Seasons Hotel Chicago

All 168 Chicago hotels

★★★★★ Hotel | 120 E. Delaware Pl., Chicago, IL 60611 (Gold Coast)  
Hotel website Hotel packages (312) 280-8800 Hotel amenities  
Special Offer Bed and Breakfast!

Enter dates for best prices

Check In [ ] Check Out [ ]

Show Prices

You must enter dates to see the best prices.

94% Ranked #2 of 168 hotels in Chicago  
★★★★ 1,199 Reviews  
Travelers' Choice® 2014 Winner Luxury

A recent review

"Amazing City Center Treasure"  
★★★★ reviewed yesterday  
Mike A Moraga, California

Professional photos  
477 traveler photos

Overview | Reviews (1,199) | Photos (497) | Amenities | Q&A (1) | Room tips (362) | Location

**1,199 people have reviewed this hotel** Write a Review

Traveler rating

Excellent	1,008
Very good	126
Average	38
Poor	16
Terrible	11

See reviews for

Families	321
Couples	336
Solo	53
Business	293

Rating summary

Location	★★★★
Sleep Quality	★★★★
Rooms	★★★★
Service	★★★★
Value	★★★★
Cleanliness	★★★★

Related hotels...

- The Langham, Chicago 520 Reviews Chicago, IL [Show Prices](#)
- The Talbott Hotel Great Value! 1,265 Reviews Chicago, IL [Show Prices](#)
- Thompson Chicago 403 Reviews Chicago, IL [Show Prices](#)

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Computers Brands Best Sellers Laptops & Tablets Desktops & Monitors Hard Drives & Storage Computer Accessories Tablet Accessories PC Components Printers & Ink Deals All Electronics

Electronics > Computers & Accessories > Monitors

## Asus VS248H-P 24-Inch Full-HD LED-lit LCD Monitor

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Price after rebate: \$149.99  
Rebate forms for recent purchases

In Stock.  
Ships from and sold by Amazon.com. Gift-wrap available.  
Want it Tuesday, July 29? Order within 24 hrs 40 mins and choose One-Day Shipping at checkout. Details  
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or  
Sign in to turn on 1-Click ordering.  
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# However, it's not easy for users to make use of the online opinions

- Inconsistent opinion!



V.S.



## Customer Reviews

[Samsung Galaxy S5 SM-G900H 16GB Factory Unlocked International Version - WHITE](#)



< Previous | **1** 2 ... 12 | Next >

[Most Helpful First](#) | [Newest First](#)

★★★★★ **suprissing**, July 27, 2014

By [osvaldo](#) - [See all my reviews](#)

**Verified Purchase** ([What's this?](#))

**This review is from:** [Samsung Galaxy S5 SM-G900H 16GB Factory Unlocked International Version - WHITE \(Wireless Phone Accessory\)](#)

I ordered not one but two and all thoe both came with different chargers i still was not dissapointed at all loving the phones got here earlier then expected and in great conditions

Help other customers find the most helpful reviews

[Report abuse](#) | [Permalink](#)

Was this review helpful to you?  Yes  No

[Comment](#)

1 of 1 people found the following review helpful

☆☆☆☆ **dissapointed**, July 26, 2014

By [Abdulaziz AL-Dossari](#) - [See all my reviews](#)

**Verified Purchase** ([What's this?](#))

**This review is from:** [Samsung Galaxy S5 SM-G900H 16GB Factory Unlocked International Version - WHITE \(Wireless Phone Accessory\)](#)

i bought this cell phone and it said its factory unlocked and when i gave this as a gift to a friend overseas he couldn't use it and i paid more money cause to ship it to him i'm very dissapointed. i bought 2 of them and same problem

Help other customers find the most helpful reviews

[Report abuse](#) | [Permalink](#)

Was this review helpful to you?  Yes  No

[Comment](#)

## Customer Reviews

[Apple iPhone 5s, Gold 16GB \(Unlocked\)](#)



< Previous | **1** 2 ... 38 | Next >

[Most Helpful First](#) | [Newest First](#)

★★★★★ **Five Stars**, July 26, 2014

By [Dmitriy](#) - [See all my reviews](#)

**Verified Purchase** ([What's this?](#))

**This review is from:** [Apple iPhone 5s 64GB \(Space Gray\) - Unlocked \(Wireless Phone Accessory\)](#)

Great phone!!!

Help other customers find the most helpful reviews

[Report abuse](#) | [Permalink](#)

Was this review helpful to you?  Yes  No

[Comment](#)

★★★★☆ **Four Stars**, July 25, 2014

By [Annitah Singh](#) - [See all my reviews](#)

**Verified Purchase** ([What's this?](#))

**This review is from:** [Apple iPhone 5s, Silver 16GB \(Unlocked\) \(Wireless Phone Accessory\)](#)

Another great phone by Apple...

Help other customers find the most helpful reviews

[Report abuse](#) | [Permalink](#)

Was this review helpful to you?  Yes  No

[Comment](#)

0 of 1 people found the following review helpful

★★★★★ **Four Stars**, July 24, 2014



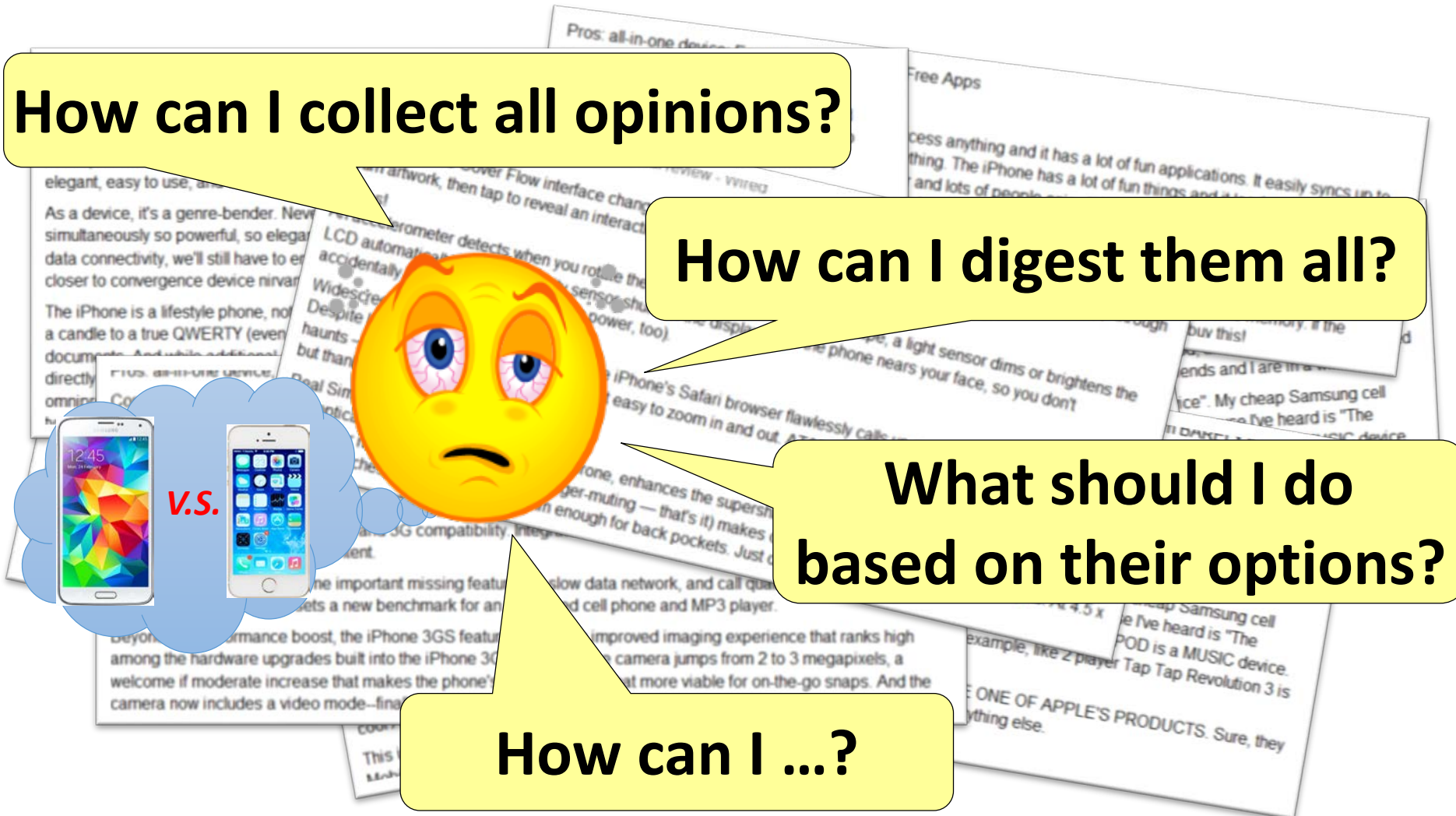
# Information overload

**How can I collect all opinions?**

**How can I digest them all?**

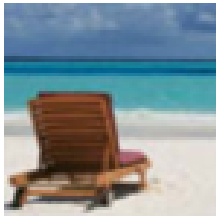
**What should I do based on their options?**

**How can I ...?**



# Opinion mining in review text data

- Sentiment orientation identification
  - E.g., Pang et.al 2002, Turney 2002
  - Solution
    - Supervised: classification/regression problem
    - Unsupervised: domain-specific sentiment lexicon



NomadNort...  
Canada

★ 24 reviews

🏆 21 helpful votes

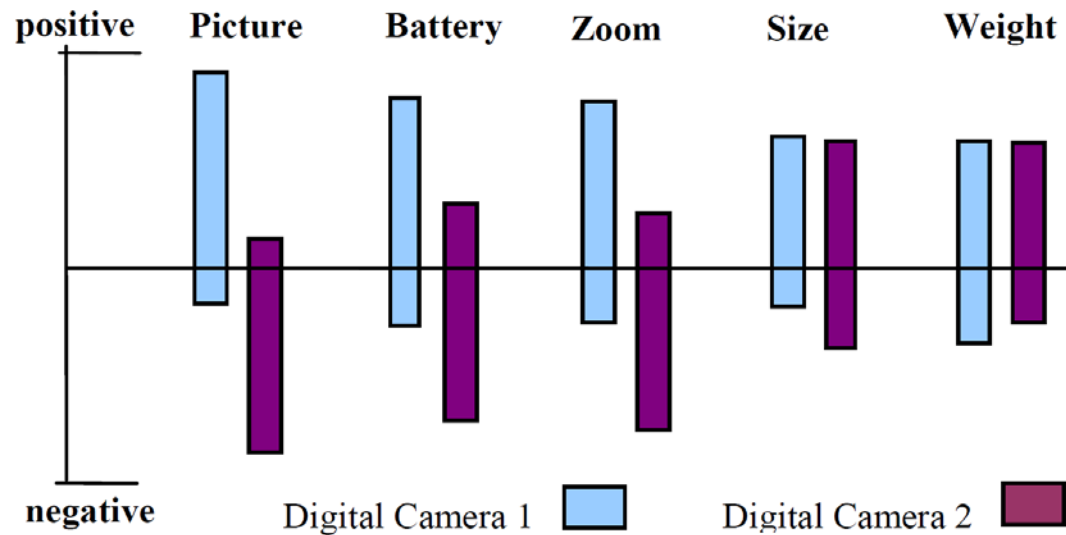
**“Location good, everything else bad - avoid”**

🟢🟢🟢🟢🟢 Reviewed May 24, 2011

Pros - About 2 blocks from Tien an men square & Forbidden city - Close to shopping including (near the square, across street into underground mall, or on pedestrian street next to hotel) Cons The lobby looks promising but it ends there. This is not a 4 or 5 star hotel by world standards. Closer to a 2 star -...

# Opinion mining in review text data

- Aspect-based sentiment analysis
  - E.g., *Hu and Liu KDD'04, Liu et al. WWW'05*
  - Solution
    - Frequent pattern mining based on syntax analysis for aspect identification
    - Sentiment lexicon for opinion orientation prediction





# How do we identify the latent aspects and decompose overall ratings into aspect ratings?

## Hotel Palomar Chicago: Traveler Reviews

“Great location+spacious room =happy traveler”



leos\_10 3 contributions  
Boston

Save Review

Jul 11, 2010 | Trip type: Couples **NEW**

Stayed for a weekend in July. Walked everywhere, enjoyed the comfy bed and quiet hallways. [more](#)

“terrific service and gorgeous facility”



ahickling 1 contribution  
Greensboro, North Carolina

Save Review

Jul 7, 2010 | Trip type: Family **NEW**

I stayed at the Palomar with my young daughter for three nights June 17-20, 2010 and absolutely loved the hotel. The room was one of the nicest I've ever stayed in (My daughter loved the Fuji jetted tub so much that she wanted to take 2 baths a day!) in terms of decor, design, and size. (It compared favorably to... [more](#))

~~Existing work:~~

~~Sentiment polarity identification [Pang et.al  
EMNLP'02, Pang et. al ACL'02, Turney ACL'02]~~



### My ratings for this hotel

○○○○○ Value  
○○○○○ Rooms  
○○○○○ Location  
○○○○○ Cleanliness

○○○○○ Service  
○○○○○ Sleep Quality

### My ratings for this hotel

○○○○○ Value  
○○○○○ Rooms  
○○○○○ Location  
○○○○○ Cleanliness

○○○○○ Service  
○○○○○ Sleep Quality

# How do we infer the preferences that the reviewers have put onto the aspects?

*No existing work*

“ Refreshing change of pace. ”

Hotel Palomar Chicago

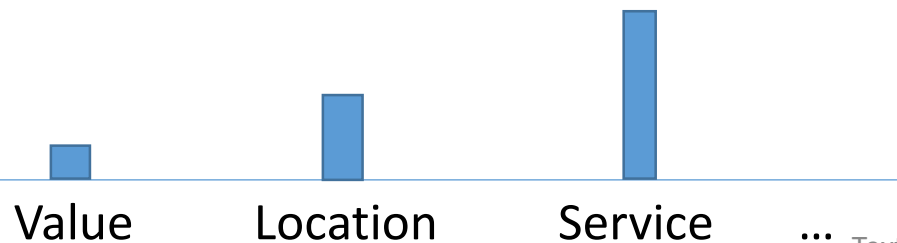


TShip 2 contributions  
Minneapolis

Apr 10, 2010 | Trip type: Business, Solo travel

I spent one night in Chicago at the end of a business trip, on my one dime. When in DC, I usually stay at either the Hotel Palomar (always great) or the Hotel Medera (Getting very tired), so I thought I'd check out the brand new Hotel Palomar in Chicago. The hotel just opened two week ago and is still in its soft opening. I grabbed a chance to stay for \$107! WOW what a deal! It was worth \$250!

My ratings for this hotel



“ Palomar Chicago exceeds all expectations ”

Hotel Palomar Chicago

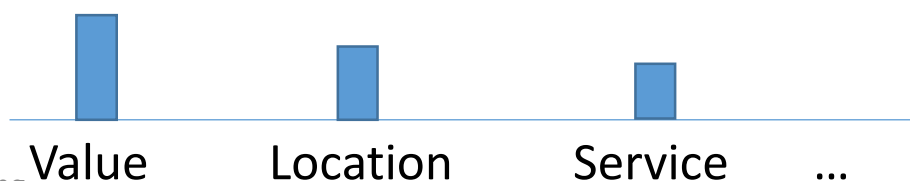


Ron97 1 contribution  
Minneapolis, Minnesota

Jul 5, 2010 | Trip type: Couples

mentioned to her that we were celebrating our 25th anniversary, and said we would appreciate any little special touch they could add to make our stay more enjoyable. Amanda assured me that we would not be disappointed. When we arrived, we were informed that we had been upgraded to a luxury suite. Wow! A lovely three-room suite, tastefully decorated, with the most comfortable bed I think I've ever slept in, and with a beautiful bathroom containing a huge glass-enclosed shower and a soaking tub designed to comfortably accommodate two. Staff was professional and accommodating at

My ratings for this hotel




# Latent Aspect Rating Analysis (LARA) [KDD'10/KDD'11]

**“A lot of history in this comfortable hotel”**

**Ambassador East Hotel**



Overall Rating: 

← Overall Rating

[candostill](#)  47 contributions

Western Michigan, USA


Dec 28, 2010



Text Content

The bathrooms are small with little counter space and the hotel is on the edge of needing some updating, but I have found each of my 3 trips to this hotel comfortable with a reasonable price. The Pump Room is a treat and breakfast has always been excellent. The hotel staff is friendly and helpful. The hotel is situated within walking distance to many restaurants and bars. I wouldn't recommend the hotel to families with small children but great for couples.

# Latent Aspect Rating Analysis (LARA) [KDD'10/KDD'11]





**“A lot of history in this comfortable hotel”**  
**Ambassador East Hotel**



Overall Rating:  ← Overall Rating  
candostill  47 contributions  
Western Michigan, USA  
Dec 28, 2010

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**Aspect ratings and weights predicted for this hotel:**

	Value (0.41)		Location (0.11)
	Rooms (0.32)		Service (0.16)

Text Content

Aspect Identification

Aspect Rating Prediction

Aspect Weight Prediction

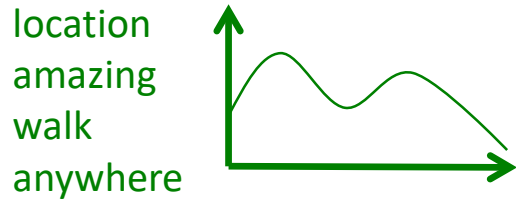
# A generative model for LARA

Entity

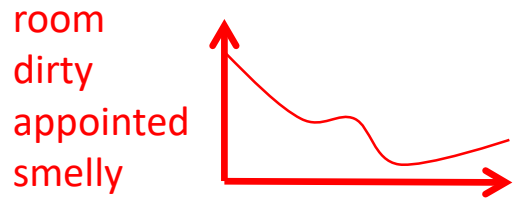


Aspects

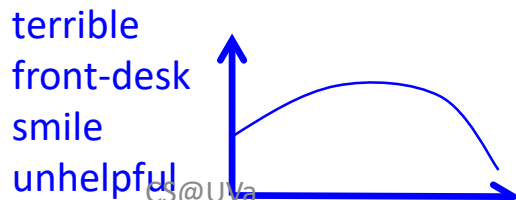
Location



Room



Service



Review

observable

**latent!**



**"Spend your money elsewhere"**

Reviewed September 19, 2010  
 Excellent location in walking distance to Tiananmen Square and shopping streets. That's the best part of this hotel! The rooms are getting really old. Bathroom was nasty. The fixtures were falling off, lots of cracks and everything looked dirty. I don't think it worth the price. Service was the most disappointing part, especially the door men. this is not how you treat guests, this is not hospitality.

Aspect Segments    Term Weight    Aspect Rating    Aspect Weight

excellent:1	2.1	⊗	⊗	0.10
walking:1	1.5	⊗	⊗	0.10
shopping:1	1.4	⊗	⊗	0.10
room:1	1.3	⊗	⊗	0.04
nasty:1	-0.8	⊗	⊗	0.04
dirty:1	-0.4	⊗	⊗	0.04
disappoint:1	-0.6	⊗	⊗	0.86
service:1	0.7	⊗	⊗	0.86
hospitality:1	1.9	⊗	⊗	0.86

# Latent Aspect Rating Analysis Model

- Unified framework

“Spend your money elsewhere”

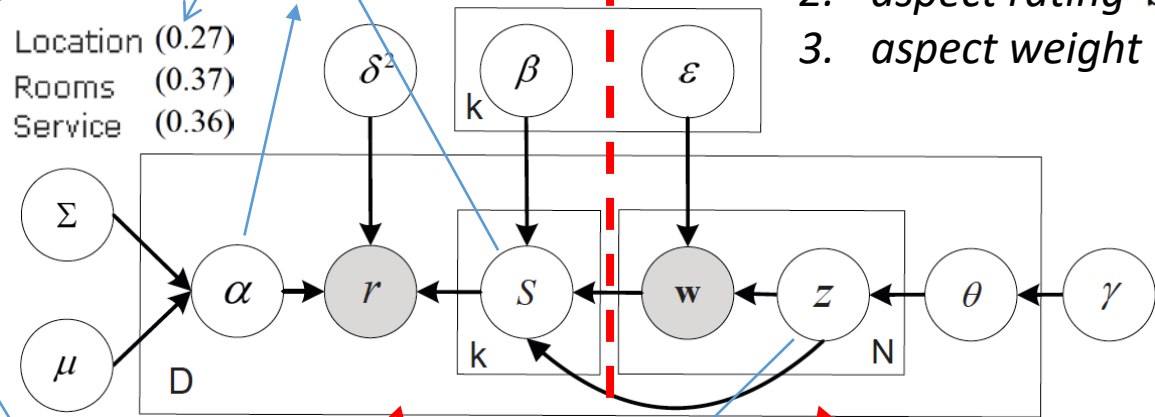
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⊙⊙⊙⊙⊙ Location (0.27)  
 ⊙⊙⊙⊙⊙ Rooms (0.37)  
 ⊙⊙⊙⊙⊙ Service (0.36)

$$s_i = \sum_{n=1}^{|d|} \beta_{ij} \Delta[w_n = v_j, z_n = i]$$

$$\alpha \sim N(\mu, \Sigma)$$



**Variables of interest**

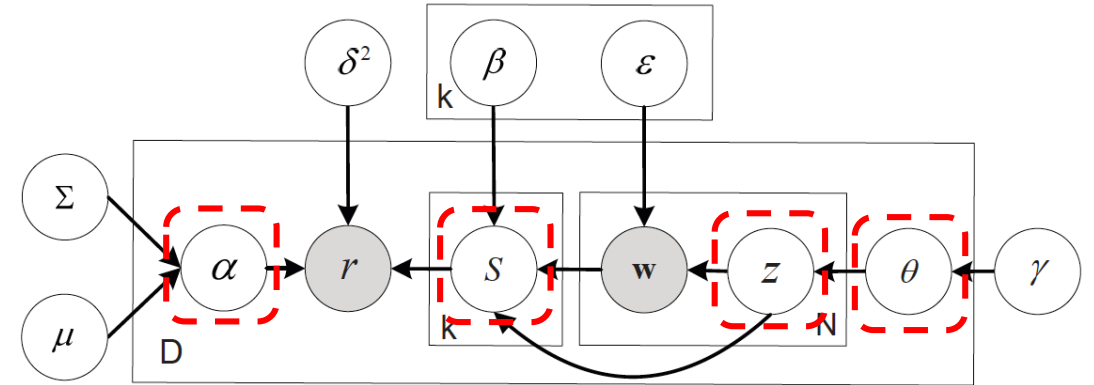
1. word-aspect assignment  $\mathbf{z}$
2. aspect rating  $s_i$
3. aspect weight  $\alpha$

$$p(\mathbf{W}, \mathbf{z}, \theta | \gamma, \epsilon) = p(\theta | \gamma) \prod_{n=1}^{|d|} p(w_n | z_n, \epsilon) p(z_n | \theta)$$

Rating prediction module    Aspect modeling module



# Posterior inference



- Variational inference

- Maximize lower bound of log-likelihood function

$$\begin{aligned}
 & \log p(r, \mathbf{W} | \epsilon, \gamma, \beta, \mu, \Sigma, \delta^2) \\
 &= \log p(\mathbf{W} | \epsilon, \gamma) + \log p(r | \mathbf{W}, \beta, \mu, \Sigma, \delta^2) \\
 &\geq E_q[\log p(\underline{z}, \underline{\theta}, \mathbf{W} | \epsilon, \gamma)] - E_q[\log q(\underline{z}, \underline{\theta} | \phi, \eta)] \\
 &+ E_q[\log p(\underline{r}, \underline{\alpha}, \underline{z} | \mathbf{W}, \beta, \mu, \Sigma, \delta^2)] - E_q[\log q(\underline{\alpha}, \underline{z} | \epsilon, \gamma, \phi, \eta)]
 \end{aligned}$$

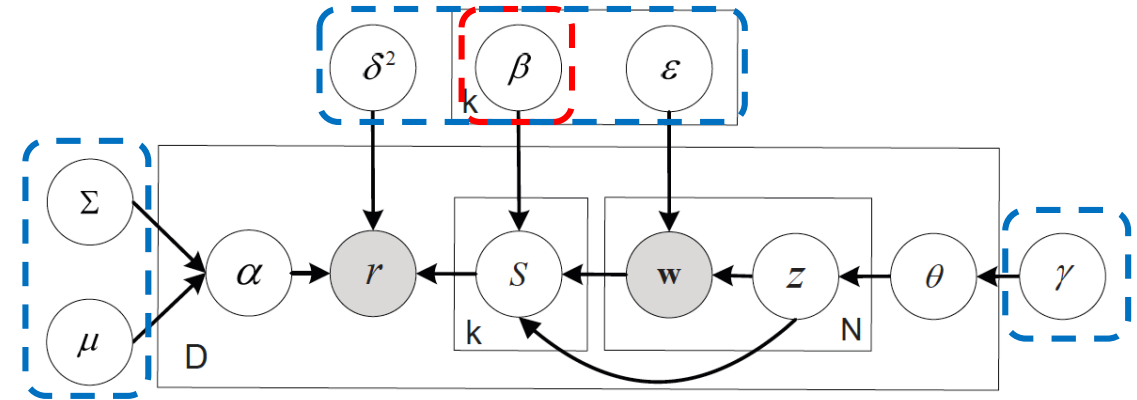
- Insight: bridge - aspect assignment  $\{z_n\}_{n=1}^{|d|}$

$$\hat{\phi}_n = \arg \max_{\phi_n} \underbrace{\sum_{i=1}^k w_n^j \phi_{ni} \left[ \psi(\eta_i) - \psi\left(\sum_{j=1}^k \eta_j\right) + w_n^j \log \epsilon_{ij} - \log \phi_{ni} \right]}_{\text{Aspect modeling part}}$$

$$- \underbrace{\frac{1}{2\delta^2} (\lambda^T \bar{\mathbf{s}} - r)^2 - \frac{1}{2\delta^2} \sum_{i=1}^k \left[ (\lambda_i^2 + \sigma_i^2) \text{Var}[\mathbf{s}_i] + \sigma_i^2 \bar{\mathbf{s}}_i^2 \right]}_{\text{Rating prediction part}}$$

# Model estimation

- Expectation Maximization
  - E-step: constrained posterior inference
  - M-step: maximizing log-likelihood of whole corpus
- Insight

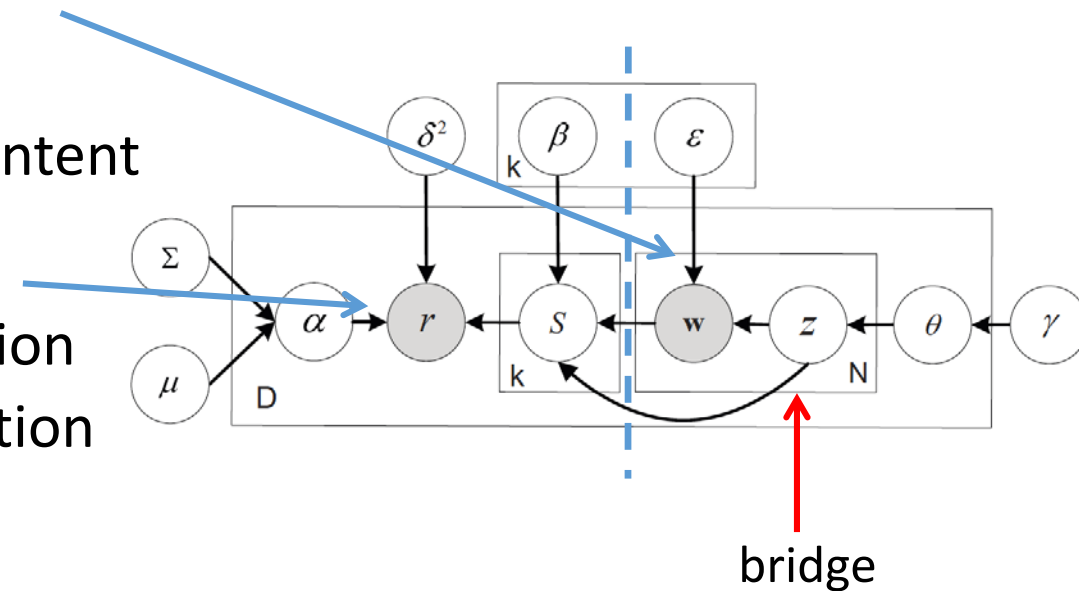


$$\begin{aligned}
 & \log p(r, \mathbf{W} | \epsilon, \gamma, \beta, \mu, \Sigma, \delta^2) \\
 \hat{\beta} = \arg \max_{\beta} & \left. \begin{aligned}
 & \log p(\mathbf{W} | \epsilon, \gamma) + \log p(r | \mathbf{W}, \beta, \mu, \Sigma, \delta^2) \\
 & \geq E_q[\log p(z, \theta, \mathbf{W} | \epsilon, \gamma)] - E_q[\log q(z, \theta | \phi, \eta)] \\
 & + E_q[\log p(r, \alpha, z | \mathbf{W}, \beta, \mu, \Sigma, \delta^2)] - E_q[\log q(\alpha, z | \epsilon, \gamma, \phi, \eta)]
 \end{aligned} \right\}
 \end{aligned}$$

*Alternative understanding of EM: coordinate ascent optimization*

# Model discussion

- Aspect modeling part
  - Identify word usage pattern
  - Leverage opinion ratings to analyze text content
- Rating analyzing part
  - Model uncertainty from aspect segmentation
  - Informative feedback for aspect segmentation



# Comparison with Bing Shopping



Apple iPhone 3GS 32GB - smartphone - WCDMA (UMTS) / GSM

**\$199** and up (2 stores)

★★★★★ user reviews (201)

★★★★★ expert reviews (1)

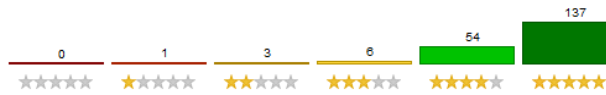
The first thing you'll notice about iPhone 3GS is how quickly you can launch applications. Web pages render in a fraction of the time, and you can view email attachments faster... [more...](#)

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## USER REVIEWS »



## The AMAZING Apple iPhone

**Pros:** apps, internet, fits in your pocket, Its awesome  
**Cons:** battery life is less than sub-par

Apple iPhone 3G S 32GB Cell Phone — I cannot say enough great things about my new Apple iphone 3Gs.?? My husband and I bought the...  
 ★★★★★ kellie626 · 9/28/2010  
[www.viewpoints.com](#)

## So much better than a blackberry

**Pros:** apps, internet, easy to use, customizable, small but...  
**Cons:** High price, battery life is less than sub-par

Apple iPhone 3G S 32GB Cell Phone — The iphone 3g 32GB is my favorite so far. Ive had just about all of them. They are wonderful...  
 ★★★★★ aliciarenee317 · 9/27/2010  
[www.viewpoints.com](#)

## The true Smart Phone

Apple iPhone 3G S 32GB Cell Phone — The i-phone 3G is an excellent device for anyone who is wanting the ability to multitask. It is simply an all in one device for anything you may need to accomplish. It also has the ability to shoot video. The video...

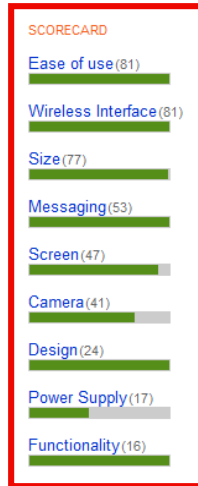
★★★★★ Steve75 · 9/27/2010  
[www.viewpoints.com](#)

## EXPERT REVIEWS »

### Apple 32GB iPhone 3GS Phone - by PCWorld.com

Performance enhancements distinguish the otherwise evolutionary step-up iPhone 3GS from its previous iterations. It would be easy to dismiss the Apple iPhone 3GS as an...

★★★★★ Melissa J. Perenson · 6/22/2009  
[www.pcworld.com](#)



## SCORECARD: SCREEN (See all)

23 positive reviews | 6 negative reviews

??I like how the keyboard is on the screen vs.

★★★★★ byufamily · 6/28/2010 · [www.viewpoints.com](#) [see all](#)

The touch screen is easier to use than we expected, and the multimedia performs well.

★★★★★ wwpauljd · 2/16/2010 · [www.viewpoints.com](#) [see all](#)

I love the touch-screen.

★★★★★ sal007 · 3/27/2010 · [www.viewpoints.com](#) [see all](#)

I like its heft, I like the brightness of the screen, and easy navigation.

★★★★★ auntieruth · 5/26/2009 · [www.epinions.com](#) [see all](#)

The touch screen is easy to use -- I find it much easier than the tiny buttons on the PalmPre for example.

★★★★★ lauren127 · 10/3/2009 · [www.viewpoints.com](#) [see all](#)

Criticisms aside, the iPhone display is remarkable for its multitouch technology, which allows you to move your finger in a variety of ways to manipulate what's on the screen.

★★★★★ debatablerug · 10/1/2009 · [www.viewpoints.com](#) [see all](#)

## SCORECARD: CAMERA (See all)

10 positive reviews | 18 negative reviews

**Cons:** no video camera, still no video camera

★★★★★ jasonmi · 9/10/2010 · [www.viewpoints.com](#) [see all](#)

**Cons:** Have to charge battery daily!!!!, must pay for data package, horrible battery life, battery life lacking, still no video camera, stuck with AT&T for now, average battery life, still no MMS

★★★★★ Whoozit · 11/23/2008 · [www.viewpoints.com](#) [see all](#)

**Cons:** no video camera, no flash, still no video camera

★★★★★ Ebony2988 · 8/2/2010 · [www.viewpoints.com](#) [see all](#)

**Cons:** Expensive, no flash, no video camera, still no video camera

★★★★★ knight2356 · 9/10/2010 · [www.viewpoints.com](#) [see all](#)

That is one of the things that I do not like about my iPhone 3G, is that it doesn't have a video camera on it.??

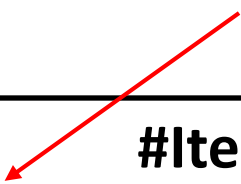
★★★★★ trlr2009 · 8/16/2010 · [www.viewpoints.com](#) [see all](#)

Text Mining

# Experiment results

- Data Set
  - Hotel reviews from TripAdvisor.com
  - MP3 player reviews from Amazon.com

*Aspect known*



	<b>#Item</b>	<b>#Review</b>	<b>#Reviewer</b>	<b>Avg. Len</b>	<b>Rating</b>
<b>Hotel</b>	2,232	37,181	34,187	96.5	3.92±1.23
<b>MP3</b>	686	16,680	15,004	87.3	3.76±1.41

# Identifying mostly commented aspects

- Amazon MP3 player reviews: no guidance

In Low Overall Rating Reviews			In High Overall Rating Reviews		
unit	jack	service	files	player	vision
usb	headphone	charge	format	music	video
battery	warranty	problem	included	download	player
charger	replacement	support	easy	headphones	quality
reset	problem	hours	convert	button	great
time	player	months	mp3	set	product
hours	back	weeks	videos	hours	sound
work	months	back	file	buds	radio
thing	buy	customer	wall	volume	accessory
wall	amazon	time	hours	ear	fm

battery life

accessory

service

file format

volume


video



# Quantitative evaluation of identified aspects

- KL divergency between the identified word-aspect distribution and “ground-truth” distribution in tripadvisor hotel reviews

classical topic models



	<b>LDA</b>	<b>sLDA</b>	<b>LARAM</b>
<b>7 topics</b>	<b>5.675</b>	14.878	5.827
<b>14 topics</b>	8.819	19.074	<b>8.356</b>
<b>21 topics</b>	12.745	22.411	<b>11.167</b>

# Opinion rating decomposition

- Hotels with the same overall rating but different aspect ratings

Hotel	Value	Room	Location	Cleanliness
Grand Mirage Resort	4.2(4.7)	3.8(3.1)	4.0(4.2)	4.1(4.2)
Gold Coast Hotel	<u>4.3(4.0)</u>	3.9(3.3)	3.7(3.1)	4.2(4.7)
Eurostars Grand Marina Hotel	3.7(3.8)	<u>4.4(3.8)</u>	4.1(4.9)	<u>4.5(4.8)</u>

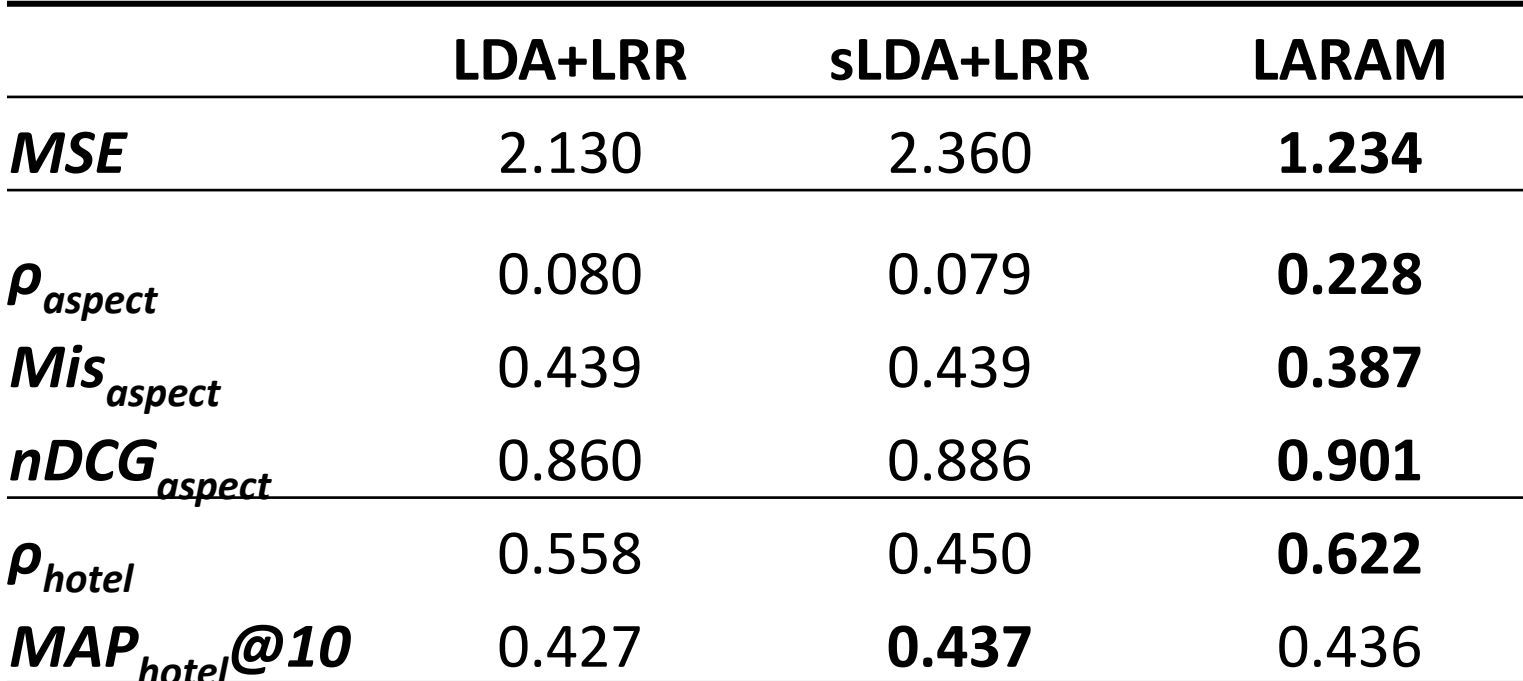
*(All 5 Stars hotels, ground-truth in parenthesis.)*

- Reveal detailed opinions at the aspect level

# Accuracy of aspect rating prediction

- Ground-truth aspect ratings in hotel reviews

two-step approach: topic model + aspect rating prediction



		LDA+LRR	sLDA+LRR	LARAM
aspect rating prediction accuracy	$MSE$	2.130	2.360	<b>1.234</b>
aspect-level correlation	$\rho_{aspect}$	0.080	0.079	<b>0.228</b>
	$Mis_{aspect}$	0.439	0.439	<b>0.387</b>
	$nDCG_{aspect}$	0.860	0.886	<b>0.901</b>
entity-level correlation	$\rho_{hotel}$	0.558	0.450	<b>0.622</b>
	$MAP_{hotel}@10$	0.427	<b>0.437</b>	0.436

# Corpus-specific word sentimental orientation

- Reveal sentimental information directly from the data

Value	Rooms	Location	Cleanliness
resort 22.80	<u>view 28.05</u>	<u>restaurant 24.47</u>	clean 55.35
value 19.64	comfortable 23.15	walk 18.89	smell 14.38
excellent 19.54	modern 15.82	bus 14.32	<u>linen 14.25</u>
worth 19.20	quiet 15.37	<u>beach 14.11</u>	maintain 13.51
bad -24.09	<u>carpet -9.88</u>	wall -11.70	smelly -0.53
<u>money -11.02</u>	smell -8.83	bad -5.40	<u>urine -0.43</u>
terrible -10.01	dirty -7.85	road -2.90	filthy -0.42
overprice -9.06	stain -5.85	website -1.67	dingy -0.38

# Reviewer rating behavior analysis

- Reviewers focus differently on 'expensive' and 'cheap' hotels

Aspect	Expensive Hotel		Cheap Hotel	
	5 Stars	3 Stars	5 Stars	1 Star
Value	0.134	0.148	<u>0.171</u>	0.093
Room	0.098	<u>0.162</u>	0.126	0.121
Location	0.171	0.074	0.161	0.082
Cleanliness	0.081	<u>0.163</u>	0.116	<u>0.294</u>
Service	<u>0.251</u>	0.101	0.101	0.049

# Inferring user aspect preferences

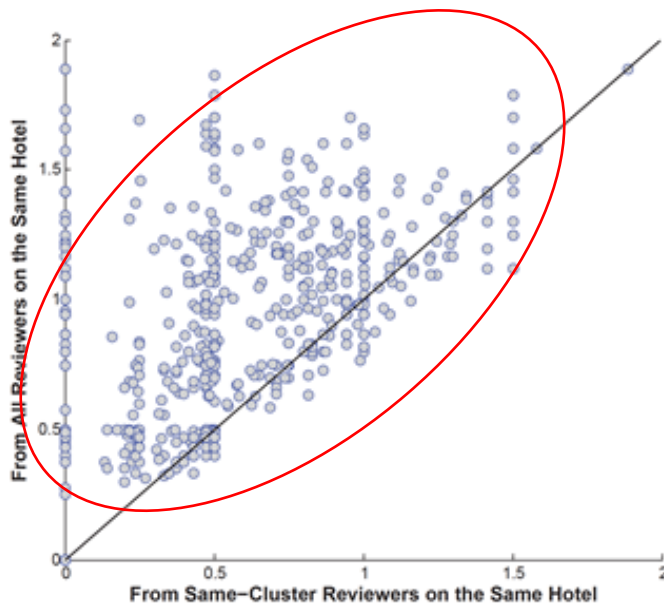
- Reviewers emphasize 'value' aspect would prefer 'cheap' hotels

City	AvgPrice	Group	Value/Location	Value/Room	Value/Service
Amsterdam	\$241	top-10	\$190	\$214	\$221
		bot-10	\$270	\$333	\$236
San Francisco	\$261	top-10	\$214	\$249	\$225
		bot-10	\$321	\$311	\$311
Florence	\$272	top-10	\$269	\$248	\$220
		bot-10	\$298	\$293	\$292

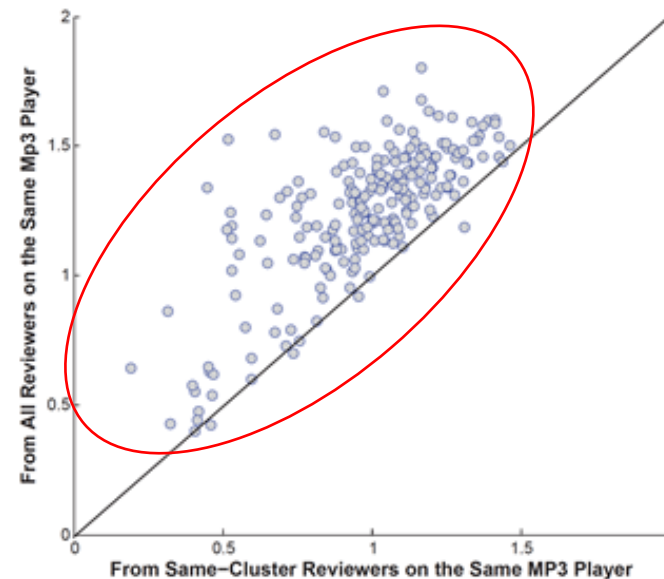


# User profiling

- Inferred aspect weight as user profile
  - Similar users give same entity similar overall rating
  - Cluster users by the inferred aspect weight



(a) Hotel



(b) MP3

# Analysis

- Limitation: bag-of-words assumption

hotel\_100587\_parsed\_TravelGirl222 5 4.32456

Value 5 : 4.23087 Room 5 : 4.62536 Location 5 : 4.78819 Cleanliness 5 : 4.21941  
Check-in 5 : 4.14636 Service 5 : 3.98103 Business Service 3 : 3.8463

Great **Boutique** Hotel - **Loved** It! I stayed at Hotel Max for a **week** during a **business trip** to **Seattle**. I really **enjoyed** my stay - the **service** was REALLY good and everyone was very **friendly**. **Whenever** I asked for anything, I got it in 15 **minutes** or less. The hotel is artsy and **fun**, a vast **improvement** over the generic mega-chains **available nearby** for 2x the **price**. My room was smaller but **perfectly adequate**, the **decor** was **contemporary** and I **LOVED** the **bed** - **excellent quality** on par with the **Westin 'heavenly'** bed. **Location** was also **excellent** - just around the **corner** from the retail core and **walking distance** to any of the **major tourist attractions** in **downtown** Seattle. Really a great **deal** for **downtown** Seattle.

# Review Miner system

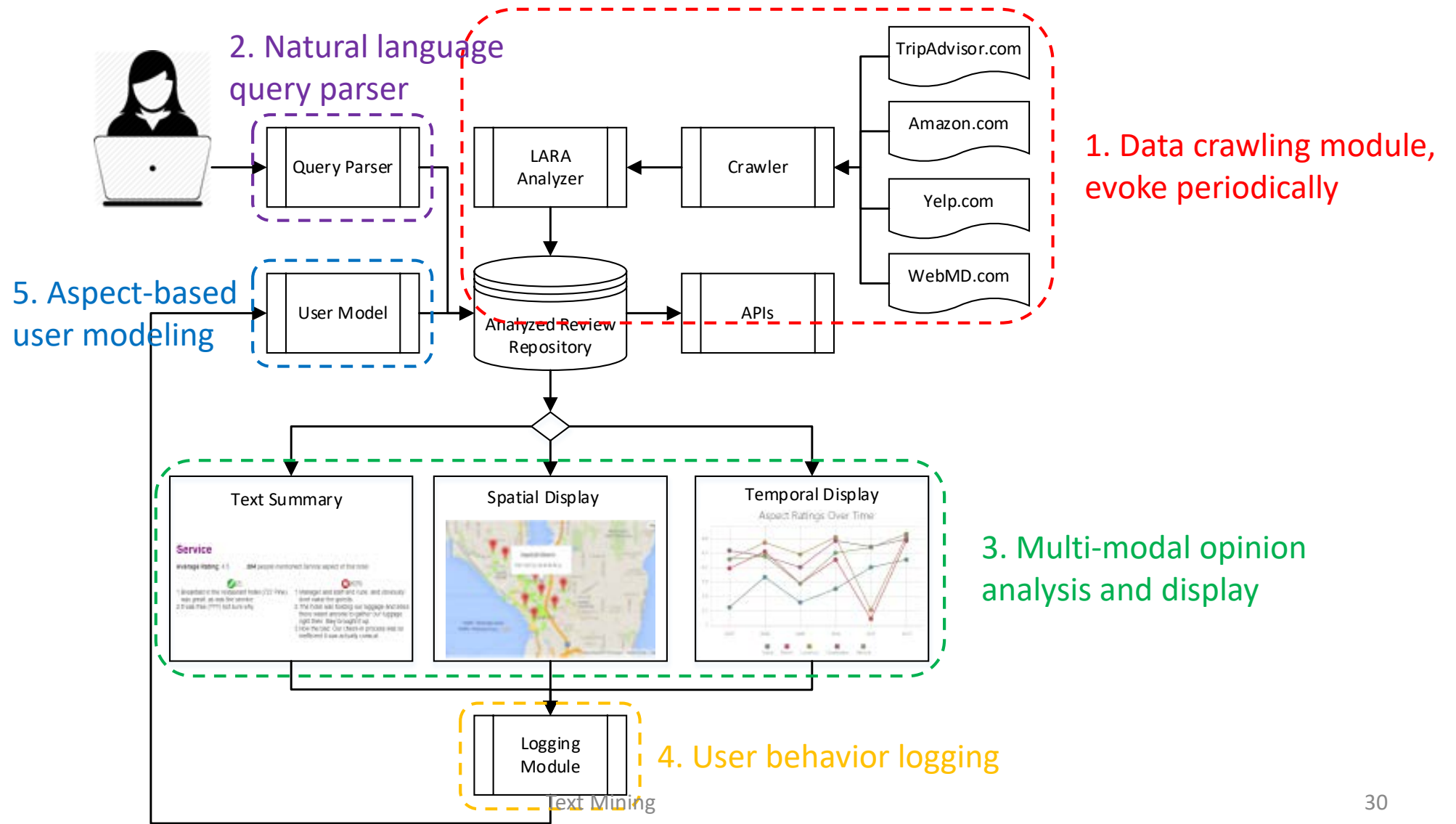
- 1) **27K hotels with 2M reviews**
- 2) **15K products with 472K reviews**
- 3) **12K restaurants with 230K reviews**
- 4) **129 medications with 15k reviews**

The screenshot shows the Review Miner web application interface. At the top left, the text "Review Miner" is displayed. At the top right, there are links for "Register", "Login", "Review Categories", and "Demo Slides". The main content area features a large "Review Miner" title. Below the title is a search bar containing the text "find hotels with cheap price and rating of 3 stars in Ct". To the right of the search bar is a "Search" button. A dropdown menu is open below the search bar, listing several suggestions:

- Find hotels with cheap price and rating of 3 stars in Chicago
- Find hotels with good location and non smoking room and clean bathrooms in New York
- Find hotels with price below \$200 and in city center and good service in Seattle
- Find hotels with good location in Chicago
- Find hotels with cheap price in Chicago
- Find hotels with good service in Chicago
- Find hotels with good location in New York
- Find hotels with good service in New York

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# System architecture



# Conclusions

- Latent Aspect Rating Analysis
  - Unified framework for exploring review text data with companion overall ratings
  - Simultaneously discover latent topical aspects, aspect ratings and weights
  - A multi-modal opinion analysis and decision support system
- Limitation
  - Bag-of-words assumption
- Future work
  - Incorporate sentence boundary/proximity information
  - Address aspect sparsity in review content

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# Thank you!

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