

Generative Models for Mining Latent Aspects and Their Ratings from Short Reviews

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Outline

- Introduction
- Related Work
- Methods
- Experiments
- Conclusion

Introduction



★★★★☆ This is coooooooll by Georgia Veres

Sep 04, 2015 I like this app a lot!! When I grow up I'm going to be a secret agent with 5 of my friends. This app is awesome!

★★★★☆ GETTING SHARP

By [Francofilla](#) on November 1, 2015

Verified Purchase

Some games very challenging but with practice I definitely improve. Have to work hard not to feel I have a low IQ! Takes awhile when you haven't some these in many years. But good brain training.

"great family place!"

★★★★☆ Reviewed October 26, 2015

Great place to go with family! It is a small, quaint place but the staff are very friendly and the menu is laid out well. My girlfriend and i enjoyed lunch there...will definitely be back

★★★★★ 10/18/2015

Really good food, always fresh and tasty. The 1/4 chicken combo is what I usually get.

Try the sauces!!! Love love them, specially the yellow. Also the Sangria mix drink is really good too.

Introduction

"Very Nice Place"

Overall Rating



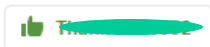
Reviewed October 3, 2015

It was near the hotel where I was staying in Charlotte for a convention, and had been to other restaurants and was looking for some place new to try. The staff was friendly and the food was very good. The pulled pork was some of the best I've had, and they had a nice selection of craft beer to order from. It is a short walk from Time Warner Arena and the hotels near there. A place to go for a nice relaxing meal and drink.

Visited September 2015

Less ▲

Helpful?



Report

See all 4 reviews by [blurred name]
Ask Phil [blurred name]

This review is the subjective opinion of a TripAdvisor member and not of TripAdvisor LLC.

Level 4 Contributor

30 reviews

19 restaurant reviews

12 helpful votes

Introduction

"Very Nice Place"

Overall Rating



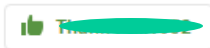
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1. What aspects is a review taking about?
2. How much does the user like each aspect?

Less ▲

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Related Work

- Aspect (topic) extraction
 - Summarization based technique (AAAI'04, SIGKDD'04 and HLT'05)
 - Latent dirichlet allocation (LDA) (*03'JMLR*)
 - Global topic and local topic (*WWW'08, ACL'08*)
 - Opinion phrase based models (*SIGIR'11, CIKM'12 and WWW'13*)
- Aspect rating prediction
 - Supervised regression based approach (*KDD'10*)
 - Unsupervised regression based approach (LARAM)(*KDD'11*)

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Methods : Task

Problem Definition:

Given a collection of review texts and their overall ratings, how to extract the aspects they talk about and predict ratings on each aspect.

“great family place!”

●●●●● Reviewed October 26, 2015

Great place to go with family! It is a small, quaint place but the staff are very friendly and the menu is laid out well. My girlfriend and i enjoyed lunch there...will definitely be back

“Love The Wings”

●●●●● Reviewed September 25, 2015

Stopped here after work one night just to have beers and appetizers. The wings were amazing and the beer menu was very good. Very comfortable place and service was great. Will definitely try more next time but I could live off the wings they were so good.

“Need to expand veggie and seafood options.”

●●○○○ Reviewed August 21, 2015

Very few healthy options - especially for those who don't like consuming large greasy hunks of dead mammal.



- Extract Aspect
- Predict Aspect Rating

Methods : AIR – Observations

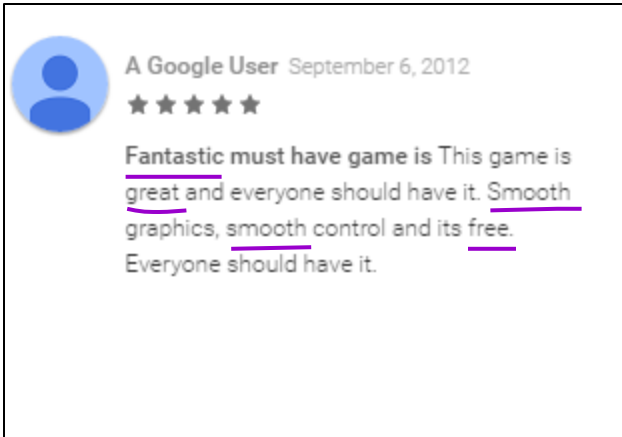
- **Intuition:**

When users have a latent high (or low) rating on one aspect of a product, they are more likely to comment on this aspect with positive (or negative) words.

Methods : AIR – Observations

- Intuition:

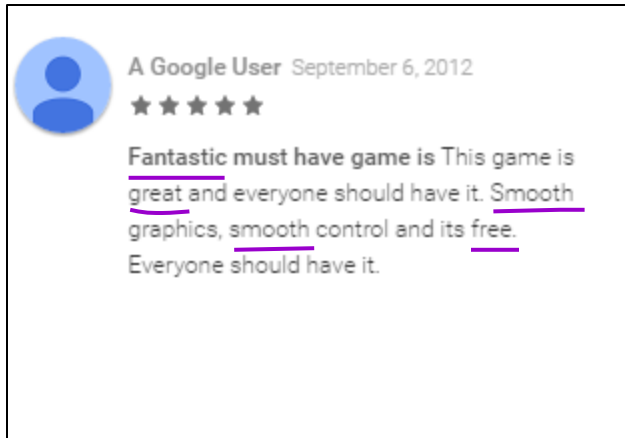
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Methods : AIR – Observations

- Intuition:

When users have a latent high (or low) rating on one aspect of a product, they are more likely to comment on this aspect with positive (or negative) words.



A Google User September 6, 2012
★★★★★
Fantastic must have game is This game is great and everyone should have it. Smooth graphics, smooth control and its free.
Everyone should have it.



Levi Wicks December 31, 2014
★★★★★
WORST GAME EVER!!!!!!!!!!!!!!!!!!!!!! This game is horrible!!!!!!!! It didn't work, and when you turn a corner, you didn't do anything wrong, and the monkeys are on your back, and then next time you turn a corner, you get eaten. I am uninstalling right now. HATE HATE HATE HATE HATE HATE it. DO NOT INSTALL THIS GAME!!!!!!!!!!!!!!!!!!!!!!

Methods : AIR – Observations

- Relationship between overall rating and aspect rating

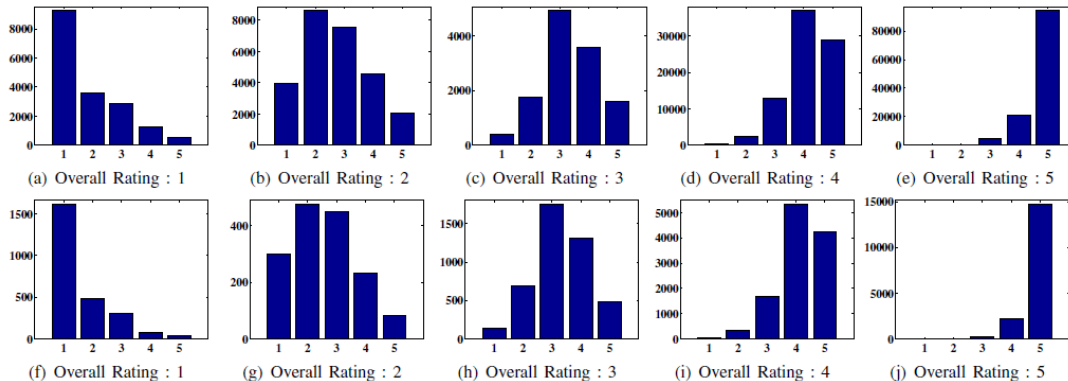


Figure 1: X-axis denotes different values of aspect rating and Y-axis is the frequency of them. (a)~(e) are the histograms with respect to different values of overall ratings. (f)~(j) are the histograms of ratings on Service aspect with respect to

Methods : AIR – Observations

- Relationship between overall rating and aspect rating
 - The histograms of aspect ratings are very close to the Beta distribution.
 - The value of aspect rating with maximum frequency is always equal to the value of overall rating.

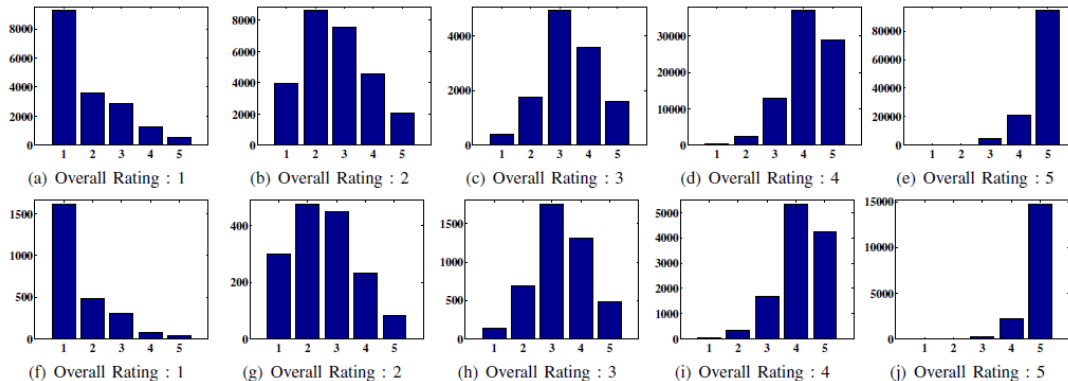


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$$\Omega_{ik} \sim Beta(\lambda R_i, \lambda(1 - R_i))$$

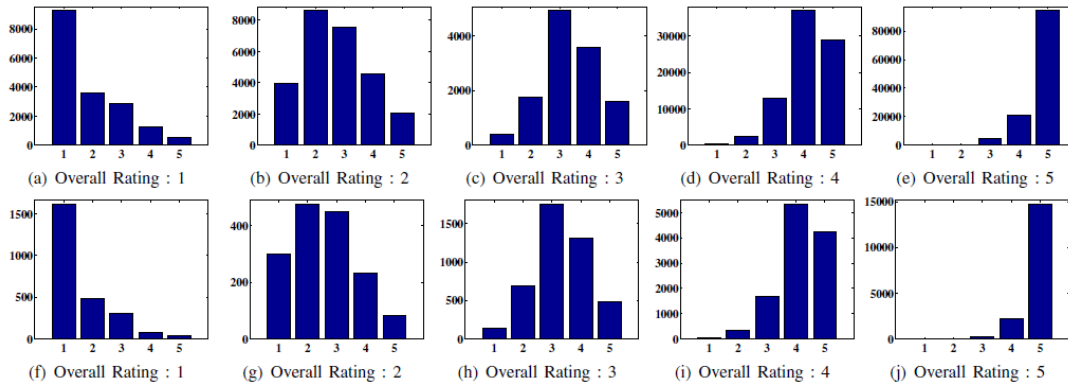
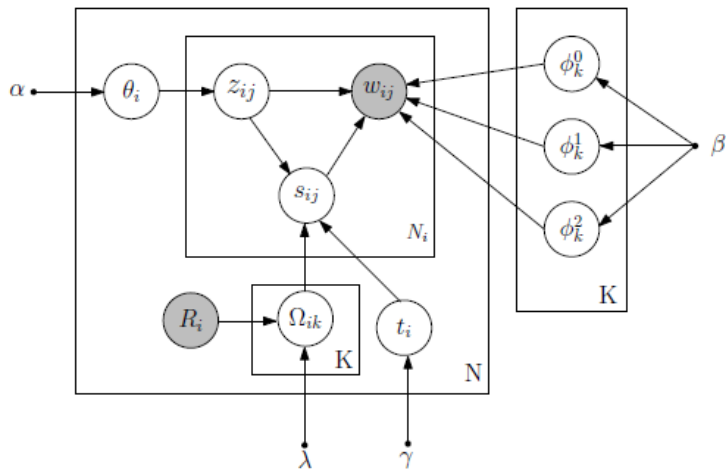


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The graphical model

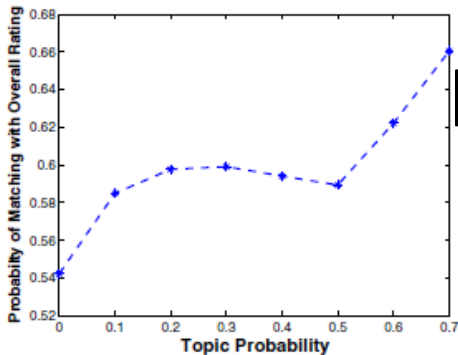
-
- For each review i ,
 - Draw the latent aspects $\theta_i \sim Dir(\alpha)$.
 - Draw the neutral ratio $t_i \sim Beta(\gamma)$.
 - For each aspect k , draw the predicted rating $\Omega_{ik} \sim Beta(\lambda R_i, \lambda(1 - R_i))$.
 - For each aspect k ,
 - Draw the word distribution $\phi_k^0 \sim Dir(\beta)$ under neutral sentiment.
 - Draw the word distribution $\phi_k^1 \sim Dir(\beta)$ under positive sentiment.
 - Draw the word distribution $\phi_k^2 \sim Dir(\beta)$ under negative sentiment.
 - For each word w_{ij} in review d_i ,
 - Draw a topic $z_{ij} \sim Multinomial(\theta_i)$.
 - Draw a sentiment index $s_{ij} \sim Multinomial(t_i, (1 - t_i)\Omega_{iz_{ij}}, (1 - t_i)(1 - \Omega_{iz_{ij}}))$.
 - Draw a word $w_{ij} \sim Multinomial(\phi_{z_{ij}}^{s_{ij}})$.
-

The generative process

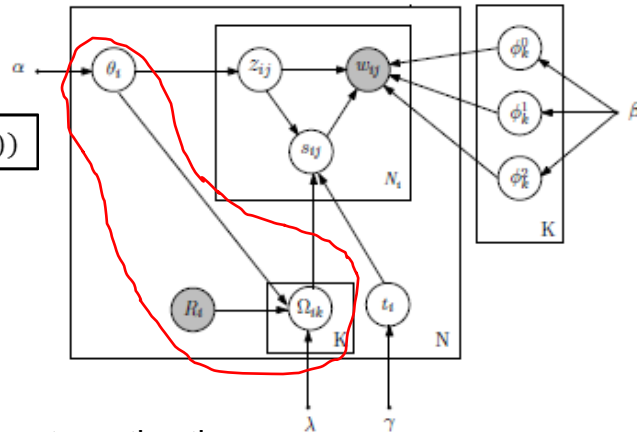
Gibbs Sampling is used for parameter estimation.

Methods : AIRS

- Characteristics of short reviews
 - The aspects mentioned in the review are quite imbalanced.
- Relationship between aspect probability and overall rating
 - If a reviewer talks more about a particular aspect, the rating on this aspect would be affected more by the overall rating.



$$\Omega_{ik} \sim \text{Beta}(\lambda \theta_{ik} R_i, \lambda \theta_{ik} (1 - R_i))$$



Maximum A Posterior is used for parameter estimation.

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Experiments : Datasets

- TripAdvisor hotel review (observed aspect rating available)
 - Hotel (Users provide ratings on all predefined 7 aspects.)
 - Incomplete Hotel (Users provide ratings on several aspects.)
- RateBeer review
- Applause app review
 - Applause 1 (Reviews on similar apps.)
 - Applause 2 (Reviews on Temple Run and Temple Run II.)

Table III: Statistics of Data Sets

Data Set	Review Number	Average Length
Hotel	39,586	113.04
Incomplete Hotel	9,339	31.50
RateBeer	94,963	23.40
Applause 1	77,465	14.91
Applause 2	15,606	17.55

Experiments : Performance Comparison

Table IV: Performances of Aspect Rating

	LARAM	AIR	AIRS
Hotel Data			
<i>MSE</i>	1.087	0.782	0.782
ρ_{aspect}	0.457	0.737	0.738
<i>Mis_{aspect}</i>	0.214	0.180	0.178
<i>nDCG</i>	0.956	0.956	0.956
Incomplete Hotel Data			
<i>MSE</i>	1.313	0.774	0.765
ρ_{aspect}	0.259	0.736	0.737
<i>Mis_{aspect}</i>	0.167	0.144	0.130
<i>nDCG</i>	0.966	0.967	0.969

Table V: KL Divergence Performance

Hotel Data				
	LDA	LARAM	AIR	AIRS
7 topics	9.634	10.683	8.735	8.800
Incomplete Hotel Data				
7 topics	12.337	24.433	8.912	11.678

Experiments : Aspect Sentiment Words

Table VI: Top Sentiment Words Mined with AIR Model.

	Fighting	Usability	Sound & Graphic	Story	Platform	Control
Positive	god king awesome best beat epic defeat avenge father armor weapon beat bloodline die	best amazing amazing graphic buy awesome best play great graphic cannot wait addicting worth money	amazing graphic excellent addicting beautiful perfect control graphic incredible gorgeous fantastic beautiful graphic	great awesome great graphic amazing play love wish more fun play excellent addicting	amazing best ios best incredible fantastic best play cannot wait amazing graphic epic impressive	awesome love cool enjoy feel hand action addicting sword fighting fight
Negative	fix save data bug fix bug lost progress lost play hour save frustrating delete save	crash fix fix crash cannot play crash start screen title crash play fix bug crash open crash update	sound effect no sound lack no sound music sound frame rate decent missing unfortunately	not boring fight same not worth repetitive same disappointed epic citadel no don't	disappointed gameloft not crap no terrible horrible sad arena garbage	dodge button fix frustrating control problem annoying bad issue unresponsive dodge attack

Experiments : User Behaviors

Table VII: Rating Behavior Comparisons with Different Apps.

User Name	App	Overall Rating	Aspect Rating			Review Content
			Sound& Graphic	Story	Usability	
Robert Rinehart	Infinity Balde	5	4.978	2.277	5.093	Graphics are very good. Fun to play but it can get tedious. Same monsters same places. But overall as an app and not a Xbox game it's super.
	Infinity Balde II	5	5.01	5.054	5.336	Such a great game. Amazing graphics. Challenging but not impossible. It never gets old. Keep em coming.
Wingbirdx	Infinity Balde	5	5.004	5.178	5.182	Great graphics and fun game play can't wait for more.
	Infinity Balde II	2	0.763	1.992	1.836	The lack of sounds when swords clash and random bits of dialogue are very upsetting in an otherwise very polished game.
Someguy127	Infinity Baldex	5	5.058	5.051	5.085	The game is awesome! Infinty blade 2 better be as good! Simply the most impressive and breathtaking game in the app store!
	Infinity Balde II	4	3.909	4.043	2.046	Crashes at title screen still after entering a new rebirth. Still has bugs.

AIR model on Applause 2 dataset

Conclusion

- Propose AIR model to extract aspects and predict their ratings for the general reviews
- Propose AIRS model to address the imbalance issue of aspects on short review
- Evaluate the proposed models in real-world data with various metrics

Thank you! Any Questions?