FLAME: A Probabilistic Model Combining Aspect Based Opinion Mining and Collaborative Filtering

Yao Wu and Martin Ester
Simon Fraser University, Canada
wuyaow@sfu.ca http://yaowu.co

Background

- Products on online E-commerce websites are accompanied by abundant user-generated reviews.
- Reviews can help users make better decision.

Challenges

- **Information Overload** – Impossible for users to read all the reviews.
- **Preferences Diversity** – People have different opinions on the same products.

Aspect Based Opinion Mining

- Aspect identification and Opinion prediction.
- Review-level Analysis, or Product-level Summarization.
- Can NOT handle user preference diversity well.

Collaborative Filtering

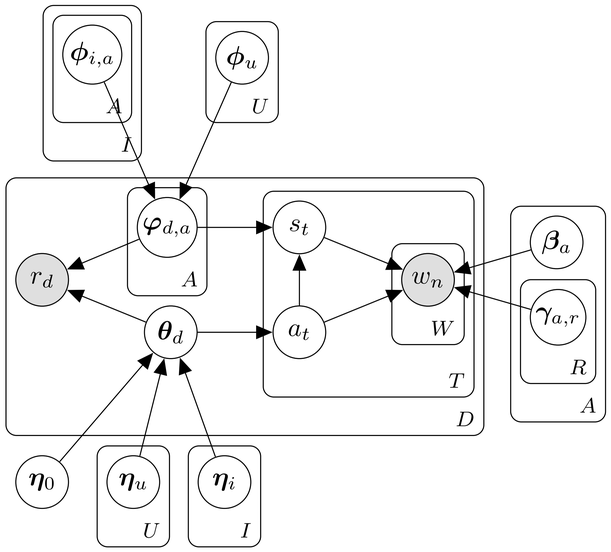
- Preferences prediction using collective intelligence.
- Assuming that users with the same ratings share the same tastes. But, two users who have assigned the same 4-stars to a restaurant might have significantly different reasoning.
- Mining fine-grained personalized preferences is important. Reviews provide richer information.

Problem Definition

Given a corpus of reviews on a list of items by a set of users

- Infer latent aspects and aspect ratings.
- Learn users' preferences on different aspects.
- Predict latent aspect ratings for users on new items.

Factorized Latent Aspect ModEl (FLAME)



Inference

We adopt a mixture of maximum a posteriori (MAP) point estimates and Bayesian inference.

Data

	TripAdvisor	Yelp
# Users	9,419	6,944
# Items	1,904	3,315
# Reviews	66,637	115,290
Density	0.37%	0.50%
# Sentences Per Review	12.60 ± 8.64	11.67 ± 7.80
# Words Per Sentence	7.50 ± 3.76	6.47 ± 4.64

Quantitative Evaluation

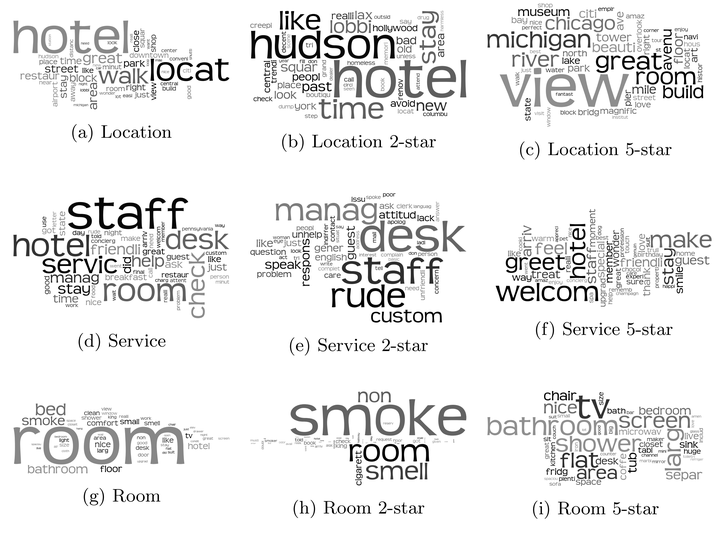
Perplexity on Held-out Reviews

	TripAdvisor	Yelp
LDA-A	1012.80	767.24
LDA-AR	918.07	728.00
D-LDA	771.05	621.24
FLAME	**733.12**	**590.46**

Aspect Rating Prediction on the TripAdvisor data

	PMF	LRR+PMF	FLAME
RMSE	**0.970**	1.000	0.980
ρ_A	N/A	0.110	**0.195**
ρ_I	0.304	0.177	**0.333**
$L_{0/1}$	0.210	0.238	**0.196**

Qualitative Evaluation

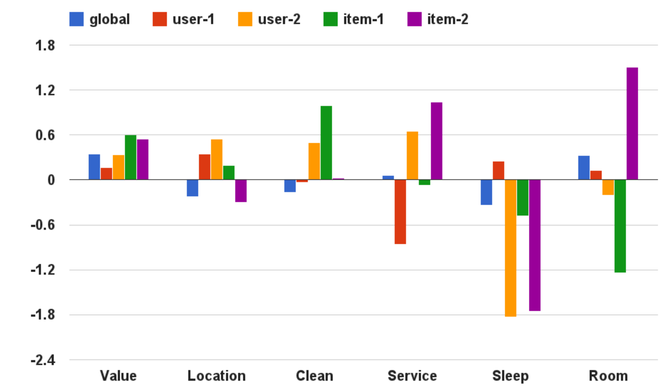


(a) Location (b) Location 2-star (c) Location 5-star

(d) Service (e) Service 2-star (f) Service 5-star

(g) Room (h) Room 2-star (i) Room 5-star

Review Behaviour Analysis



Other Applications

- **Personalized Review Recommendation** Pick the reviews by users with similar tastes.
- **Recommendation Explanation** Produce more persuasive recommendation explanations by the predicted aspect ratings and some selected reviews written by similar users.

The 8th International Conference on Web Search and Data Mining, Shanghai, China, Feb. 2015