Learning Attitudes and Attributes from Online Reviews

Julian McAuley, Jure Leskovec, Dan Jurafsky

Leland Stanford Junior University

November 16, 2012



‘Partridge in a Pear Tree’, brewed by ‘The Bruery’

Dark brown with a light tan head, minimal lace and low retention. Excellent aroma of dark fruit, plum, raisin and red grape with light vanilla, oak, caramel and toffee. Medium thick body with low carbonation. Flavor has strong brown sugar and molasses from the start over bready yeast and a dark fruit and plum finish. Minimal alcohol presence. Actually, this is a nice quad.

Feel: 4.5 Look: 4 Smell: 4.5 Taste: 4 Overall: 4

‘Partridge in a Pear Tree’, brewed by ‘The Bruery’

Dark brown with a light tan head, minimal lace and low retention. Excellent aroma of dark fruit, plum, raisin and red grape with light vanilla, oak, caramel and toffee. Medium thick body with low carbonation. Flavor has strong brown sugar and molasses from the start over bready yeast and a dark fruit and plum finish. Minimal alcohol presence. Actually, this is a nice quad.

Feel: 4.5 Look: 4 Smell: 4.5 Taste: 4 Overall: 4

Tasks

1. Learn language models for each aspect [RR09]
2. Summarize reviews and review corpora [BE10, GEM09, TM08]
3. Recover 'missing' ratings from users reviews [GDFH10, LOCT11]

DATASET	ASPECTS	#REVIEWS
Beer (beeradvocate)	feel, look, smell, taste, overall	1,586,259
Beer (ratebeer)	feel, look, smell, taste, overall	2,924,127
Pubs (beeradvocate)	food, price, quality, selection, service, vibe	18,350
Toys & Games (amazon)	durability, educational, fun, overall	373,974
Audio Books (audible)	author, narrator, overall	10,989
CitySearch [GEM09]	food, ambiance, price, staff	652

- 1,000 labeled sentences per dataset (labeled by me)
- 10,000 labeled beer sentences (labeled by oDesk)

Model

Preference and **A**ttribute **Le**arning from **La**beled **G**roundtruth and **E**xplicit **R**atings.

Model

Preference and **A**ttribute **Le**arning from **La**beled **G**roundtruth and **E**xplicit **R**atings.

Pale Lager

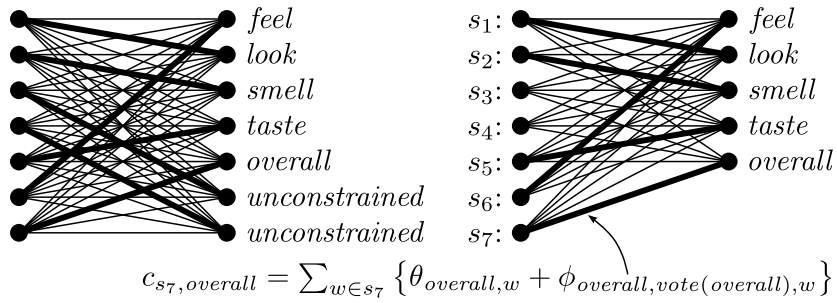
The Pale Lager Model

$$P(\text{aspect}(s) = k \mid \text{sentence } s, \text{rating } v) \propto$$
$$\exp \sum_{w \in s} \Big\{ \underbrace{\theta_{kw}}_{\text{aspect weights}} + \underbrace{\phi_{kv_k w}}_{\text{sentiment weights}} \Big\}$$

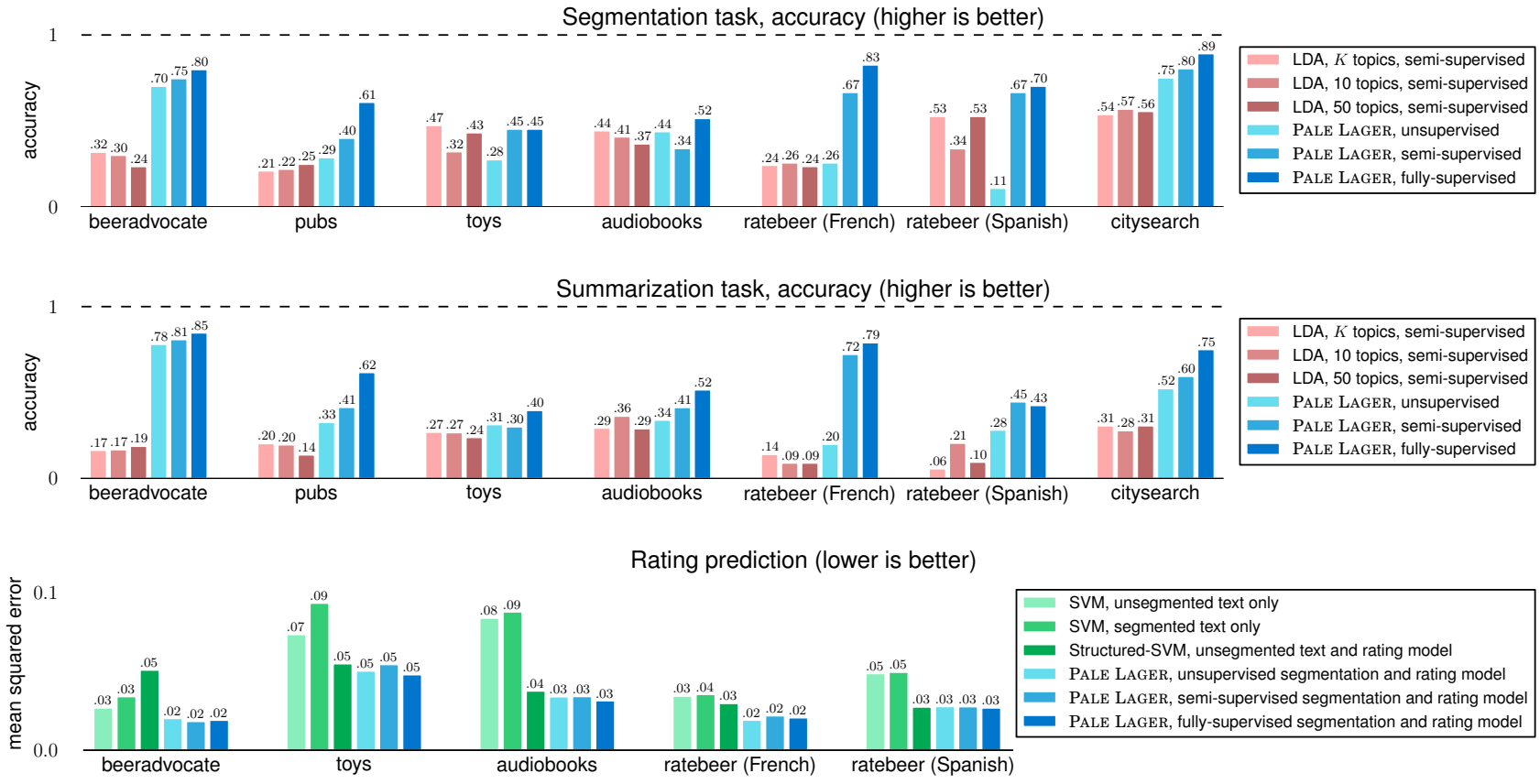
Learning proceeds by choosing the *aspect labels*, and the *model parameters* that maximize the likelihood of the corpus.

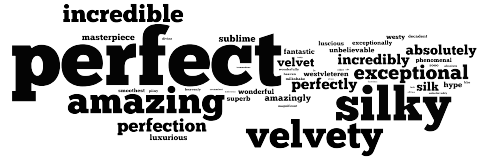
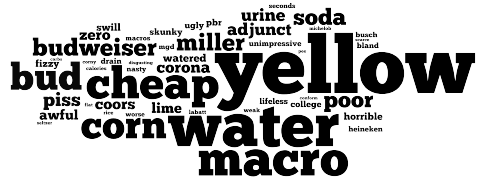
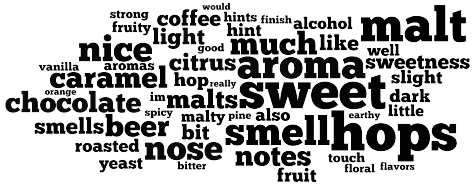
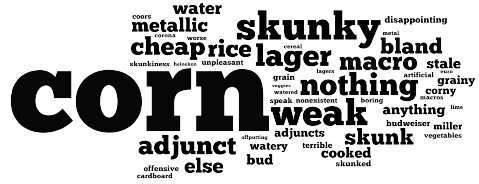
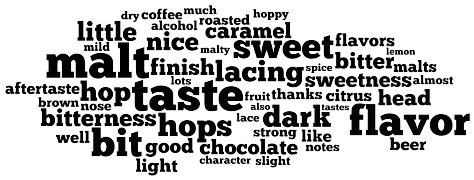
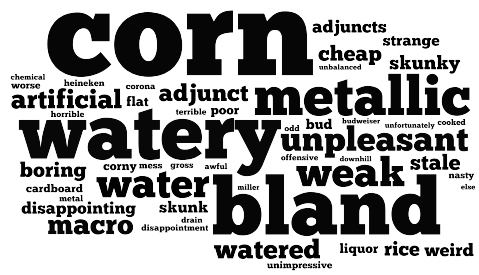
The Pale Lager Model

s_1: Clear copper colored brew, medium cream colored head.
s_2: Floral hop nose, caramel malt.
s_3: Caramel malt front dominated by a nice floral hop backround.
s_4: Grapefruit tones.
s_5: Very tasty hops run the show with this brew.
s_6: Thin to medium mouth.
s_7: Not a bad choice if you're looking for a nice hop treat.



Results


Segmentation task, accuracy (higher is better)
accuracy
1
0
beeradvocate
pubs
toys
audiobooks
ratebeer (French)
ratebeer (Spanish)
citysearch
LDA, K topics, semi-supervised
LDA, 10 topics, semi-supervised
LDA, 50 topics, semi-supervised
PALE LAGER, unsupervised
PALE LAGER, semi-supervised
PALE LAGER, fully-supervised
Summarization task, accuracy (higher is better)
accuracy
1
0
beeradvocate
pubs
toys
audiobooks
ratebeer (French)
ratebeer (Spanish)
citysearch
LDA, K topics, semi-supervised
LDA, 10 topics, semi-supervised
LDA, 50 topics, semi-supervised
PALE LAGER, unsupervised
PALE LAGER, semi-supervised
PALE LAGER, fully-supervised
Rating prediction (lower is better)
mean squared error
0.1
0.0
beeradvocate
toys
audiobooks
ratebeer (French)
ratebeer (Spanish)
SVM, unsegmented text only
SVM, segmented text only
Structured-SVM, unsegmented text and rating model
PALE LAGER, unsupervised segmentation and rating model
PALE LAGER, semi-supervised segmentation and rating model
PALE LAGER, fully-supervised segmentation and rating model

Aspect k	Aspect words θ_k	2-star sentiment words $\phi_{k,2}$	5-star sentiment words $\phi_{k,5}$
Feel			
Look			
Smell			
Taste			
Overall			

Bibliography


S. Brody and N. Elhadad.
An unsupervised aspect-sentiment model for online reviews.
In *ACL*, 2010.


N. Gupta, G. Di Fabbrizio, and P. Haffner.
Capturing the stars: predicting ratings for service and product reviews.
In *HLT Workshops*, 2010.


G. Ganu, N. Elhadad, and A. Marian.
Beyond the stars: Improving rating predictions using review text content.
In *WebDB*, 2009.


B. Lu, M. Ott, C. Cardie, and B. Tsou.
Multi-aspect sentiment analysis with topic models.
In *Workshop on SENTIRE*, 2011.


D. Rao and D. Ravichandran.
Semi-supervised polarity lexicon induction.
In *ACL*, 2009.


I. Titov and R. McDonald.
A joint model of text and aspect ratings for sentiment summarization.
In *ACL*, 2008.