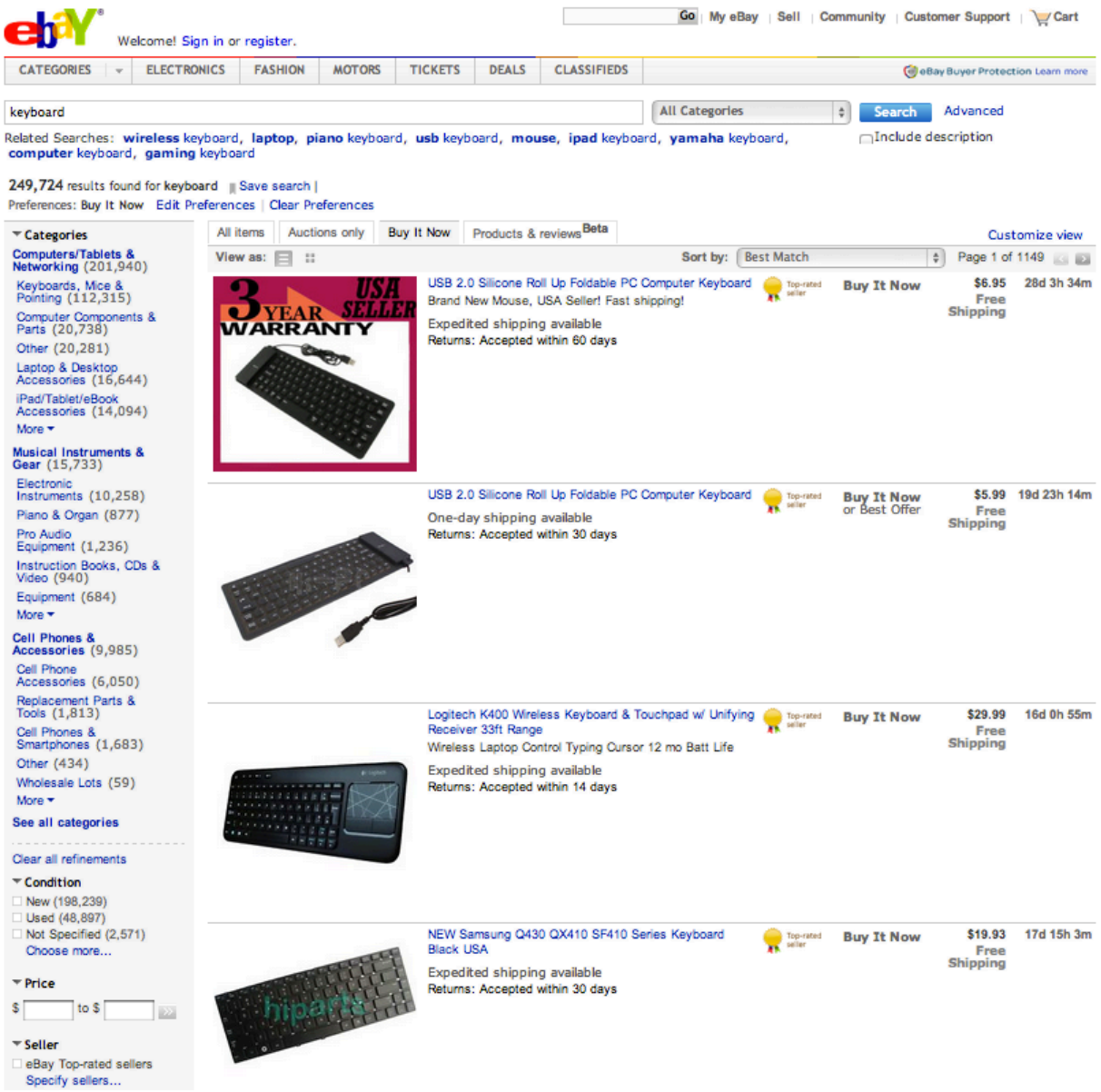
Latent Dirichlet Allocation based Diversified Retrieval for E-commerce Search

Jun Yu[1], Sunil Mohan[2], Duangmanee (Pew) Putthividhya[3] and Weng-Keen Wong[1]

[1] Oregon State University, [2] eBay Inc., [3] Google

Motivation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CATEGORIES | ELECTRONICS | FASHION | MOTORS | TICKETS | DEALS | CLASSIFIEDS
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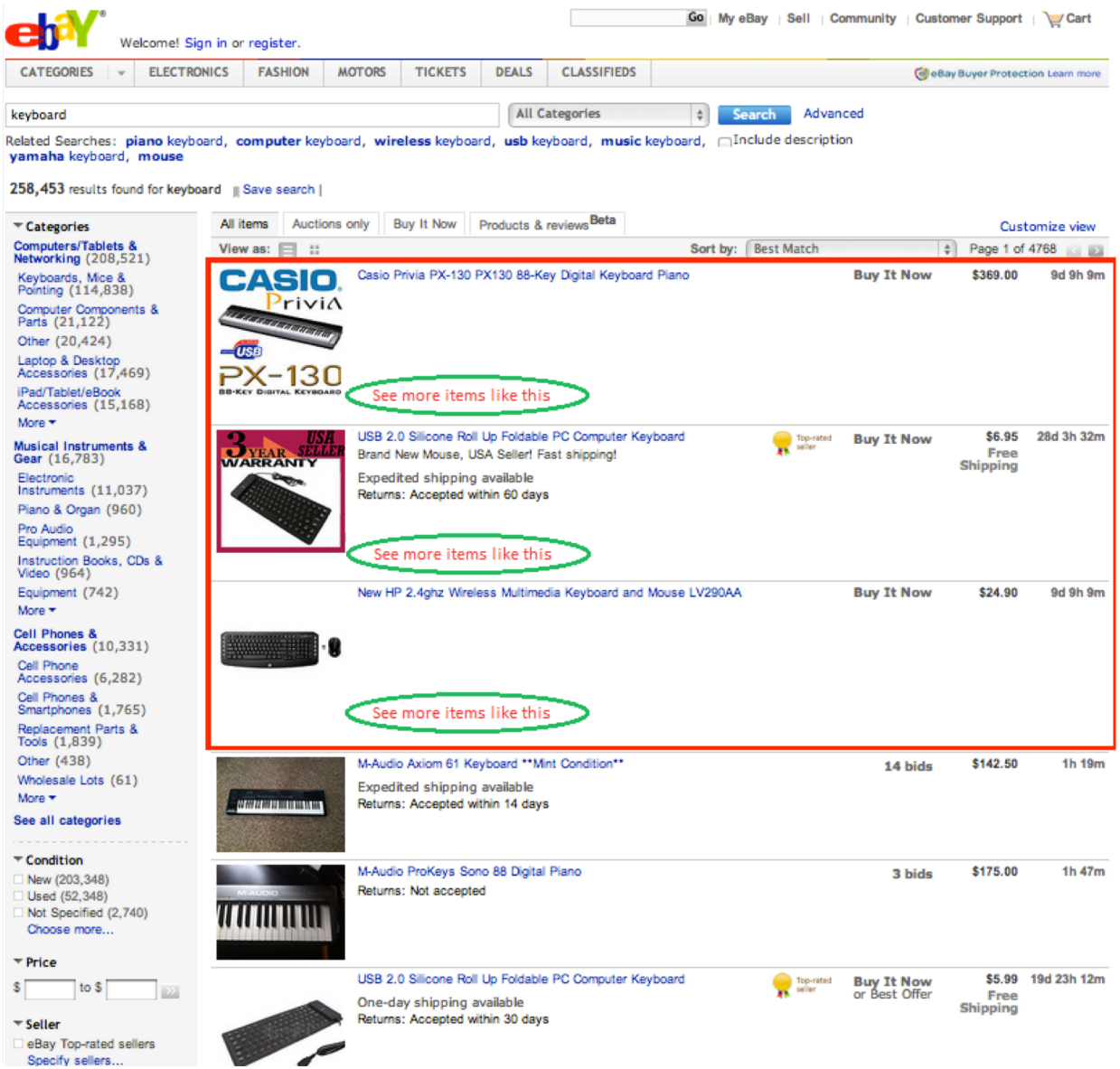
keyboard
All Categories
Search
Advanced
Include description
Related Searches: wireless keyboard, laptop, piano keyboard, usb keyboard, mouse, ipad keyboard, yamaha keyboard, computer keyboard, gaming keyboard
249,724 results found for keyboard | Save search |
Preferences: Buy It Now Edit Preferences | Clear Preferences
Categories
Computers/Tablets & Networking (201,940)
Keyboards, Mice & Pointing (112,315)
Computer Components & Parts (20,738)
Other (20,281)
Laptop & Desktop Accessories (16,644)
iPad/Tablet/eBook Accessories (14,094)
More
Musical Instruments & Gear (15,733)
Electronic Instruments (10,258)
Piano & Organ (877)
Pro Audio Equipment (1,236)
Instruction Books, CDs & Video (940)
Equipment (684)
More
Cell Phones & Accessories (9,985)
Cell Phone Accessories (6,050)
Replacement Parts & Tools (1,813)
Cell Phones & Smartphones (1,683)
Other (434)
Wholesale Lots (59)
More
See all categories
Clear all refinements
Condition
New (198,239)
Used (48,897)
Not Specified (2,571)
Choose more...
Price
$ to $
Seller
eBay Top-rated sellers
Specify sellers...
All items | Auctions only | Buy It Now | Products & reviews Beta
Customize view
View as:
Sort by: Best Match
Page 1 of 1149
USB 2.0 Silicone Roll Up Foldable PC Computer Keyboard
Brand New Mouse, USA Seller! Fast shipping!
Expedited shipping available
Returns: Accepted within 60 days
Buy It Now
$6.95 Free Shipping
28d 3h 34m
USB 2.0 Silicone Roll Up Foldable PC Computer Keyboard
One-day shipping available
Returns: Accepted within 30 days
Buy It Now or Best Offer
$5.99 Free Shipping
19d 23h 14m
Logitech K400 Wireless Keyboard & Touchpad w/ Unifying Receiver 33ft Range
Wireless Laptop Control Typing Cursor 12 mo Batt Life
Expedited shipping available
Returns: Accepted within 14 days
Buy It Now
$29.99 Free Shipping
16d 0h 55m
NEW Samsung Q430 QX410 SF410 Series Keyboard Black USA
Expedited shipping available
Returns: Accepted within 30 days
Buy It Now
$19.93 Free Shipping
17d 15h 3m

Motivation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CATEGORIES | ELECTRONICS | FASHION | MOTORS | TICKETS | DEALS | CLASSIFIEDS
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keyboard
All Categories
Search
Advanced
Related Searches: piano keyboard, computer keyboard, wireless keyboard, usb keyboard, music keyboard, yamaha keyboard, mouse
Include description
258,453 results found for keyboard | Save search |
Categories
Computers/Tablets & Networking (208,521)
Keyboards, Mice & Pointing (114,838)
Computer Components & Parts (21,122)
Other (20,424)
Laptop & Desktop Accessories (17,469)
iPad/Tablet/eBook Accessories (15,168)
More
Musical Instruments & Gear (16,783)
Electronic Instruments (11,037)
Piano & Organ (960)
Pro Audio Equipment (1,295)
Instruction Books, CDs & Video (964)
Equipment (742)
More
Cell Phones & Accessories (10,331)
Cell Phone Accessories (6,282)
Cell Phones & Smartphones (1,765)
Replacement Parts & Tools (1,839)
Other (438)
Wholesale Lots (61)
More
See all categories
Condition
New (203,348)
Used (52,348)
Not Specified (2,740)
Choose more...
Price
$ to $
Seller
eBay Top-rated sellers
Specify sellers...
All items | Auctions only | Buy It Now | Products & reviews Beta
Customize view
View as:
Sort by: Best Match
Page 1 of 4768
Casio Privia PX-130 PX130 88-Key Digital Keyboard Piano
Buy It Now $369.00 9d 9h 9m
See more items like this
USB 2.0 Silicone Roll Up Foldable PC Computer Keyboard
Brand New Mouse, USA Seller! Fast shipping!
Expedited shipping available
Returns: Accepted within 60 days
Buy It Now $6.95 Free Shipping 28d 3h 32m
See more items like this
New HP 2.4ghz Wireless Multimedia Keyboard and Mouse LV290AA
Buy It Now $24.90 9d 9h 9m
See more items like this
M-Audio Axiom 61 Keyboard **Mint Condition**
Expedited shipping available
Returns: Accepted within 14 days
14 bids $142.50 1h 19m
M-Audio ProKeys Sono 88 Digital Piano
Returns: Not accepted
3 bids $175.00 1h 47m
USB 2.0 Silicone Roll Up Foldable PC Computer Keyboard
One-day shipping available
Returns: Accepted within 30 days
Buy It Now or Best Offer $5.99 Free Shipping 19d 23h 12m

Goal & Challenges

Goal: minimize the risk of users with different purchase intents not seeing any relevant item.

- Capture users' attentions so that they will stay on the eBay site.
- Improve users' buying experience by reducing their efforts in search.

Challenges:

- eBay product taxonomy is very noisy.
- Search requires real time scoring and ranking.
- Extremely large and dynamic inventory.

Methodology

1 Discovering user intents

Discover the hidden user intents of a query using the LDA model.

1 Ranking user intents

Rank discovered user intents by trading off their relevance and novelty.

1 Selecting items for user intents

Find the most representative item for each user intent to display.

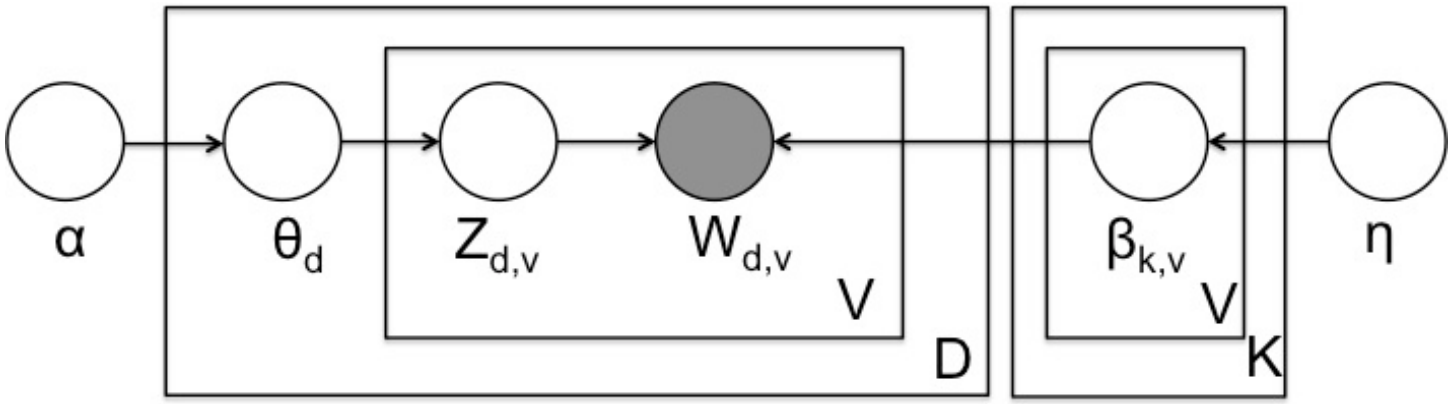
Discovering user intents

- Generate the “corpus” of a query by collecting the user clicked data resulted from the query.
  - User clicks carry the signal of a user’s purchase intent.
  - Each user click specifies a particular listing on eBay.
  - Use the item title of a listing since it is relatively noisy-free.

- Apply the LDA model to the query-specific “corpus”.
  - The topics correspond to the hidden user intents.

Multivariate Bernoulli LDA model

- No duplicated terms in an item title.
- Use Multivariate Bernoulli distribution rather than Multinomial distribution to characterize a user intent.



Discovered user intents

fossil		basketball		iPod	
Fossil bag and purse	"cat-Handbags and Purses" purse handbag bag leather tote shoulder key cross	*basketball*	"cat-Basketball" official size spalding ball 29.5 street	*iPod touch*	"cat-Portable Audio & Headphones" touch apple gb 8th generation
Fossil men watch	"cat-Wristwatches" watch men chronograph mens ch stainless steel fs	*basketball shoes*	"cat-Men's shoes" shoes nike size mens air black adidas	*iPod nano*	nano "cat-Portable Audio & Headphones" gb generation 8th model 4th
Fossil women watch	"cat-Wristwatches" watch es women stella relic gold dial by	*basketball card*	"cat-cards" card jordan lot michael auto rookie topps	*iPod case*	for case usb iPhone touch 4th new apple
Fossil wallet	wallet "cat-Wallets" leather clutch nwt brown new coin	*basketball shirt*	nike shirt shorts xl "cat-Men's Clothing" new jersey	*iPod charger*	for charger usb iPhone cable 4th mp 3rd
antique fossils	ammonite shark "cat-Shark Teeth" dinosaur "cat-Amphibian,Reptile and Dinosaur" "cat-Ammonites" tooth	*basketball hoop*	hoop "cat-Basketball" backboard rim nba portable in ground	*iPod classic*	"cat-Portable Audio & Headphones" classic apple 5th 30 gb black generation

- User intents line up to categories and associate semantically meaningful terms with the corresponding categories.
- Further explore existing product taxonomy.
- Combine similar categories according to user demand.

Ranking user intents

Rank all the user intents by trading off user intents' popularity and information novelty.

$$\lambda * \text{Popularity}(k) + (1 - \lambda) * \text{Novelty}(k)$$

- **Popularity(k)** indicates the relevance of the k*th* user intent to the query.
- **Novelty(k)** measures the extra information the k*th* user intent adds onto the user intents already selected.
- λ is the parameter trading off popularity and novelty.

Selecting items for user intents

- The multivariate Bernoulli distribution of a user intent specifies the weight of a term within that user intent.
- Score all the items in a user intent and select the item with the maximum score.

$$Score(I_i, T_k) = \frac{\sum_{j=1}^{|I_i|} \beta_{k,W_{i,j}}}{max(AvgTitleLength_Q, |I_i|)}$$

An example of query *fossil*

	eBay ranker	Cat	MB-LDA
1			
2			
3			

Evaluation metric

Averaged Satisfaction (AS): measures the user satisfaction averaged across all the users w.r.t. a list of N items.

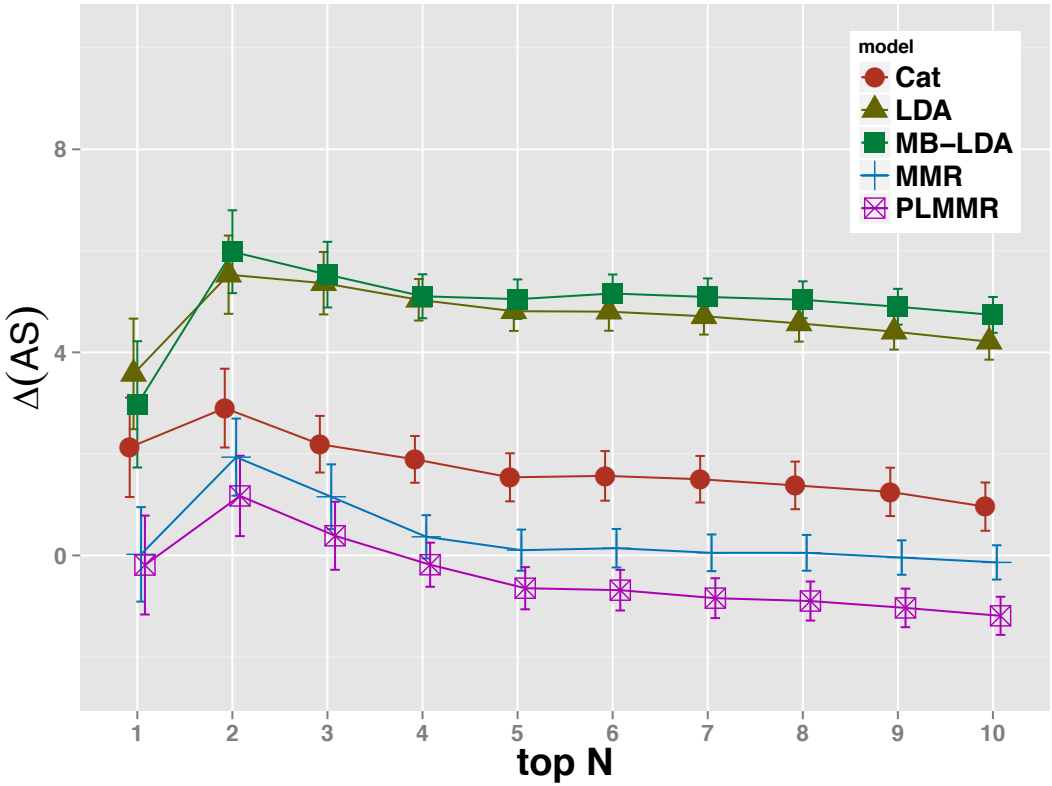
$$AS_N(R,Q) = \frac{1}{|\mathbf{U_Q}|} \sum_{U_j \in \mathbf{U_Q}} Satisfaction(U_j, R_N)$$

Given a list of items, the user satisfaction is defined as the similarity between the clicked item and the most similar item of the list.

$$AS_N(R,Q) = \frac{1}{|C_Q|} \sum_{I_j \in C_Q} \max_{I_i \in R_N} Sim(I_j, I_i)$$

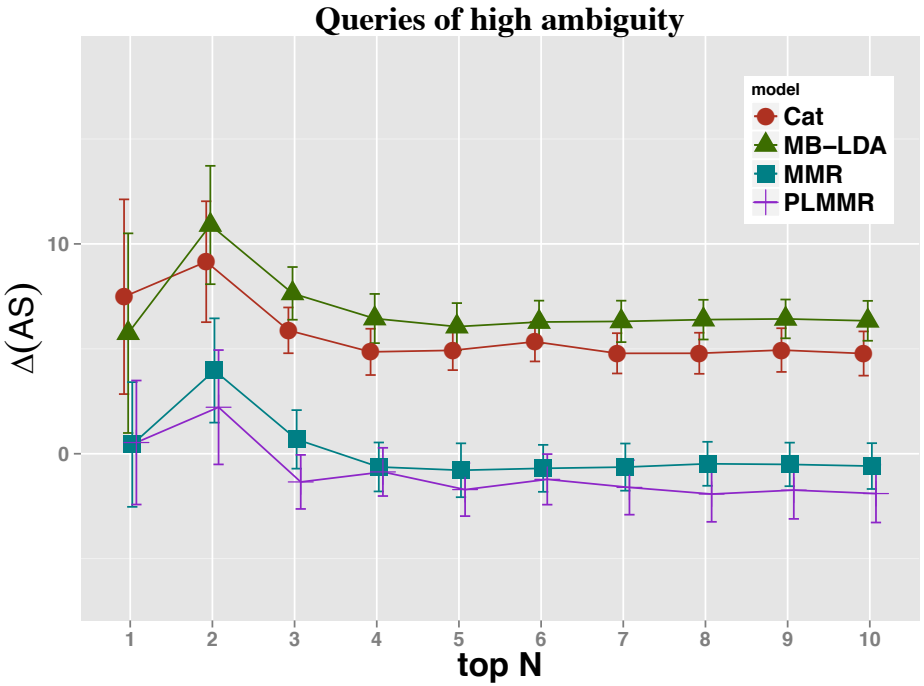
Results

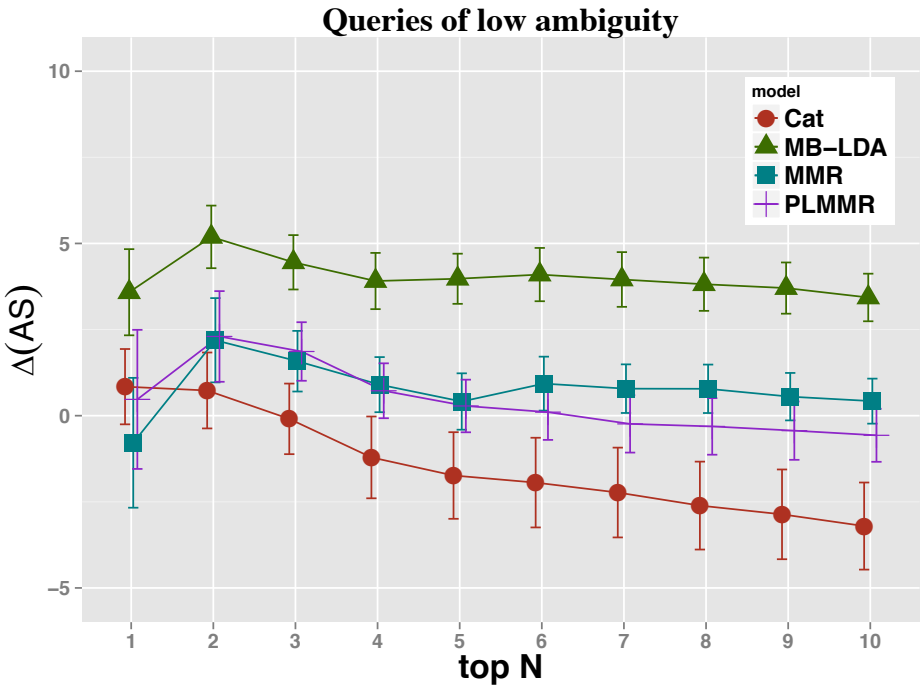
- 120 queries.
- Datasets:
  - Training: 10K user clicked.
  - Testing: 10K user clicked.
  - Ranking: eBay inventory.
- Baselines:
  - eBay production ranker
  - MMR
  - Category-based approach
  - PLMMR
  - LDA / MB-LDA with 10 user intents



Results

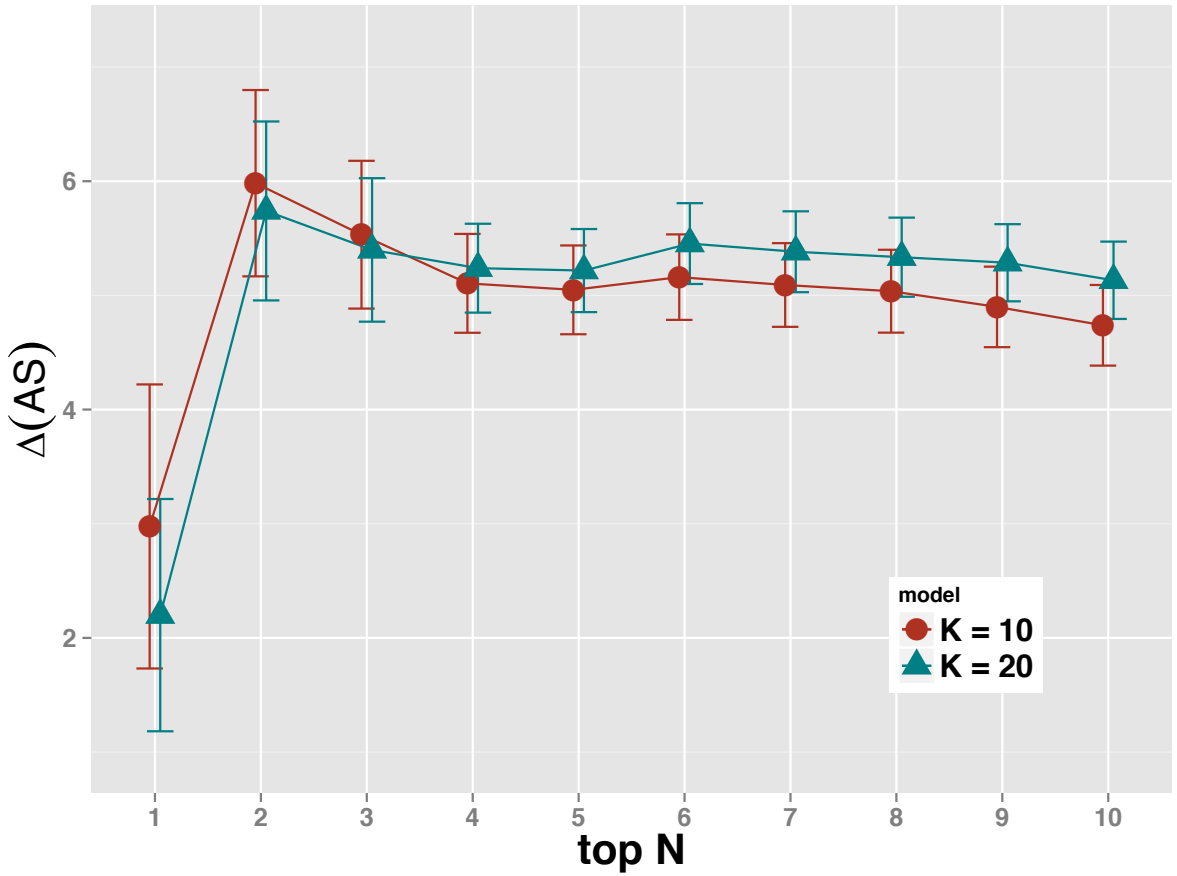
Queries of high and low ambiguity.





Results

The MB-LDA model with 10 user intents vs. 20 user intents.



Acknowledgements

We would like to thank Daniel Miranda and Nadia (Ghamrawi) Vase for their helps on the eBay title relevance models.

Questions