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# IR on Ecommerce Platforms

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# Application: Query augmentation

- For a user-specified query
    - Suggest modified / augmented queries
    - Auto-complete queries
  - Goal: increased user satisfaction
    - Help user to formulate good queries
    - Suggested queries will show better results to the user
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# Query augmentation in action


wooden dining table

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Home > Furniture > Dining Tables... > Dining Sets

Showing 1 – 40 of 525 results for "dinning table and chair" Show results for

Sort By Relevance Popularity Price -- Low to High Price -- High to Low



RoyalOak County Glass 4 Seater Dining Set  
Finish Color - Brown  
3.3 ★ (25)  
₹18,990 ₹30,000 36% off



FurnCulture Terrassa Solid Wood 8 Seater Dining Set  
Finish Color - Brown  
₹33,332 ₹50,250 33% off  
₹1140/month EMI

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# Query augmentation

- Examples taken from: Query Suggestion for E-Commerce Sites, Hasan et al., WSDM 2011
    - Published by Ebay
    - Observations are based on Ebay data, but should be generalizable to other Ecommerce sites as well
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# Need for query augmentation

- Mismatch between seller-buyer vocabulary
    - Item descriptions written by sellers usually more technical
    - “persian rug” vs. “carpet”
    - “gucci purse” vs. “designer handbag”
  - Lack of domain knowledge of buyers
    - “ipod nano 32gb” → “ipod nano 16gb”
  - Transient inventory – items may get sold and no longer be available, seasonal buzz items, ...
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# Flipkart results for “ipod nano 16gb”

ipod nano 16gb

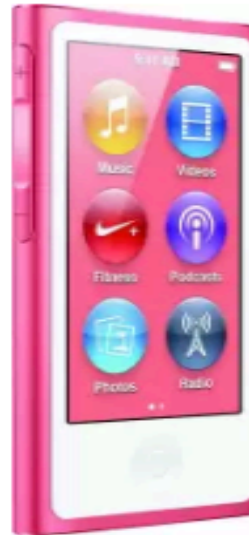
ELECTRONICS ▾ APPLIANCES ▾ MEN ▾ WOMEN ▾ BABY & KIDS ▾ HOME &

Showing 1 – 18 of 18 results for "ipod nano 16gb"

Sort By Relevance Popularity Price -- Low to High Price -- High to Low



Apple iPod Nano 16 GB  
Silver, 2.5 Display  
4.3 ★ (451)



Apple iPod nano 7th Generation  
7th Generation 16 G...  
Pink, 2.5 Display


# Flipkart results for “ipod nano 32gb”

ipod nano 32gb


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Showing 1 – 12 of 12 results for "ipod nano 32gb"

Sort By Relevance Popularity Price – Low to High Price – High to Low



Unique Collections Earbuds, Earphones, Headset and remo...  
White, In the Ear



iGreenPro White iGP Audio 3.5mm Male To x2 3.5mm Female...  
iOS

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# Types of query augmentation

- Query refinement
    - Specialization: "ipod nano" → "ipod nano 16 gb"
    - Generalization: "blue ipod nano" → "ipod nano"
  - Related query: suggestions that are neither specialization nor generalization
  - Which type of suggestions to give?
    - Depends on factors like type of buyer, category of item
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# Dependence on types of buyer

- Focused buyer
    - Intends to make a specific purchase
    - Better to give focused, specialized suggestions
    - Generalization or related queries might be distracting
  - Exploratory buyer
    - Exploring the inventory
    - Generalization or related queries helps to explore
  - Challenge to distinguish between the two types
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# Dependence on category of item

- Electronics category

- Usually buyers know what item they want to buy, might not know technical specifications
- Specializations or generalizations work better

- Antiques category

- Most users exploring without knowing what exactly to buy
  - Related suggestions might work better
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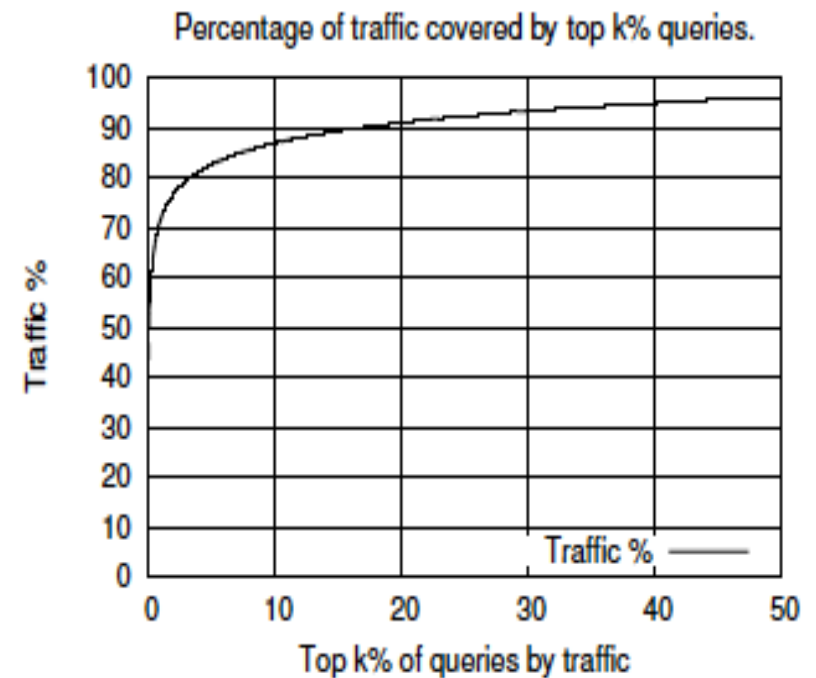
# Challenges

- Queries and items are heavily transient
    - Typically low overlap between distinct queries on a day and distinct queries on the next day (~30% on Ebay)
    - Buzz queries or seasonal queries (Halloween, Christmas) can come up during wrong time period
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# Challenges

- Long tail query distribution
  - ❑ Head queries: asked frequently
  - ❑ Tail queries: asked rarely
- Statistics from eBay:
  - ❑ 20% head queries cover 91% of search traffic
  - ❑ Query frequency distribution is usually power-law

Why care about the rest 80% queries in the long tail?



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# Importance of tail queries

- Tail queries have low recall
    - Low query frequency <--> low recall in inventory
    - Correlation between demand and supply
  - Low recall → shoppers need query suggestions more
    - Click Through Rate (CTR) on suggested queries much higher for queries which have low recall
  - For tail queries, not enough information in query logs
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# How to evaluate query suggestions?

- Most common measure: Click Through Rate (CTR)
    - A suggested query is helpful if users click on the results that it retrieves
  - Another intuitive measure: higher purchase
    - But, suggestions with higher CTR may not lead to higher purchase
    - Depends on the value of the suggested item, personal choice of the buyer, ...
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# Methods for Query Augmentation

- Use query logs → learn from past user behavior
  - A graph-based method
    - Inferring semantic query relations from collective user behavior, Parikh et al., CIKM 2008
  - Learning from how users recover from bad queries
    - User behavior in Zero-Recall eCommerce Queries, Singh, SIGIR 2011
    - A Study of Query Term Deletion using Large-scale Ecommerce Search Logs, Yang et al., ECIR 2014
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# Graph based augmentation

- ❑ Inferring semantic query relations from collective user behavior, Parikh et al., CIKM 2008
  - Each query: a bag of distinct words
  - Build a graph
    - ❑ Each node is a query
    - ❑ Edges between nodes (queries) added based on various estimates of similarity between queries
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# Query similarity: textual

- Connect a query  $q$  to
    - All queries that can be formed by adding one or more terms to  $q$  (specializations)
    - All queries that can be formed by removing one or more terms from  $q$  (generalizations)
  - Edges
    - Bidirectional: traversal in one direction implies specialization, traversal in reverse implies generalization
    - Can be weighted based on term overlap
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# Query similarity: textual

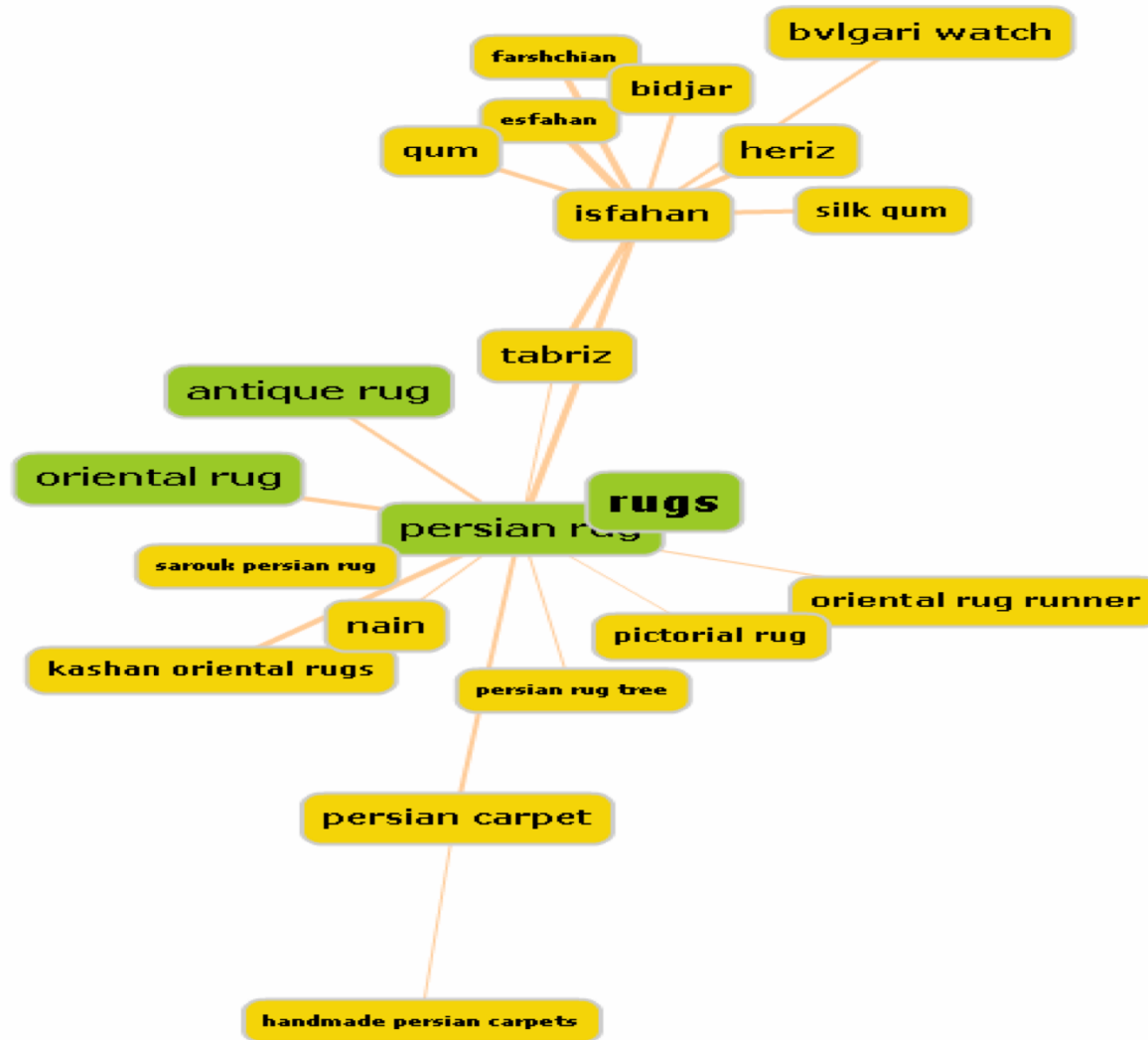


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# Query similarity: user session-based

- If a user issued a sequence of queries during a session  $Q1 \rightarrow Q2 \rightarrow Q3 \rightarrow Q4$ , connect  $Q1$  to  $Q2$ ,  $Q2$  to  $Q3$ ,  $Q3$  to  $Q4$
  - Intuition: user will issue semantically related queries in a session
  - Edges can be weighted based on number of sessions in which a transition appeared
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# Query similarity: user session-based



Can capture more semantics than purely text-based graph

E.g.,

- “rug” and “carpet”
- “isfahan”, “tabriz” are specific types of rugs

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# Query similarity: user session-based

- Concerns:

- Change in user-intent within a session
- Automated bot activity

- Remedies:

- Only consider user sessions where buying occurred
  - Only consider a transition (edge) if it appears in at least three sessions
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# Query similarity: semantic

- Queries mapped to a higher dimensional space where semantic similarity can be measured
  - Look at the item a user buys after issuing a query
    - Words found in Title / Description of item
    - Category, ISBN of item
  - Map the query to the features of the item bought
    - Query gets mapped to a vector in the high dim space
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# Query similarity: semantic

- Mapping of some queries (top features only shown)

Query	Features for the Query
apple ipod	gb(4061), gen(4051), mp3(3766), video(3539), player(3164), black(3101), nano(3004), silver(2959)
apple dishes	franciscan(8721), butter(4198), glass(3974), small(3045), logo(2887), mark(2887), vintage(2721), usa(2655)

j k rowling	potter(5412), harry(5395), 1st(5378), sorcerers(5069), stone(4521), signed(3254), chamber(2702)
1st sorcerer stone	sorcerers(11177), harry(6573), potter(6573), u(3402), american(3402), dj(3303), ed(3220), true(2981)

# Query similarity: semantic

- A query: a vector in a high-dimension space
- Semantic similarity between two queries: dot product of the corresponding vectors

jessica alba	rosario dawson	Film celebrities	0.728
zune	black zune	Generalization / Specialization	0.918
harry potter	j k rowling	Book character / Book author	0.631
ps2	playstation 2	Abbreviation / Full Name	0.891
apple player	apple dishes	None other than one common word	0.000
jessica simpson	shoes	Brand / Product	0.796



# Query similarity: semantic



Only those edges shown whose similarity value is at least 0.50

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# Query similarity: use which measure?

- Each similarity measure has pros and cons
    - Textual similarity does not capture semantic similarity
    - Textual similarity is the only usable method for new queries
    - Session based similarity might have noise due to user intent change
    - Session and semantic similarity useful only when a query has seen sufficient activity
  - eBay used linear combination of all three similarity measures to form a Semantic Query Network
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