Query Intelligence in E-Commerce Search

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01 Introduction

Aim

E-commerce search platforms have evolved from traditional keyword-based matching to actually understanding the user input and giving the results according to what they intend.

Our idea

- Apache Solr (for searching)
- Apache Spark (for preprocessing)

The project aims to refine search accuracy and user experience by implementing four key features such as query boosting based on user interaction, handling misspellings, searching with related keywords, and employing machine learning techniques (i.e., Learning To Rank algorithm) for building generalizable search systems.

02 Datasets

- Products.csv

  48195 rows,
  5 columns (upc, name,manufacturer, short Description, long Description)

- Signals.csv

  2M rows
  5 columns (session_id,user_id, type, target, signal_time)

  If the type is query, then the target is query text that user has entered.

  If the type is click, add-to-cart,purchase then target is upc of product.csv

TLDR:- Products.csv and Signals.csv are interlinked.

https://github.com/ai-powered-search/retrotech

Boosting products for a query

```
"885909457588"^966 "885909457595"^205 "885909471812"^202 "886111287055"^109 "843404073153"^73
"885909457601"^62 "635753493559"^62 "885909472376"^61 "610839379408"^29 "884962753071"^28
```

- Basic Intuition:-
  From User clicks data, for each query see what products have been clicked and how many times and try to store them in a separate collection.

- Next time, when user enters any query, search in that collection and identify the document and their frequency (boost) and form a list and search in original query

- So, basically we are recommending products with more clicks.

Finding Related Keywords

k1	k2	n_users1	n_users2	pmi2	comp_score
ipad	hp touchpad	7554	4829	1.2318940540272372	1.0
ipad 2	ipad	2842	7554	1.430517155037946	1.25
tablet	ipad	1818	7554	1.6685364924472557	1.6666666666666667
touchpad	ipad	2785	7554	1.2231908670315748	2.125
tablets	ipad	1627	7554	1.7493143317791537	2.6
ipad2	ipad	1254	7554	1.9027023623302282	3.0833333333333335
ipad	apple	7554	1814	1.4995901756327583	3.5714285714285716
touchpad	hp touchpad	2785	4829	1.3943192464710108	4.0625
ipad	hp tablet	7554	1421	1.5940745096856273	4.555555555555555
ipod touch	ipad	2931	7554	0.8634782989267505	5.05
ipad	i pad	7554	612	2.415162433949984	5.545454545454546
kindle	ipad	2833	7554	0.827835342752348	6.041666666666667
laptop	ipad	3554	7554	0.5933664189857986	6.538461538461538
ipad	apple ipad	7554	326	2.916383652644603	7.035714285714286
ipad 2	hp touchpad	2842	4829	1.1805849845414993	7.533333333333333
laptops	laptop	3369	3554	1.2902371152378296	8.03125
...					
ipad	i pad 2	7554	204	3.180197301966425	10.025

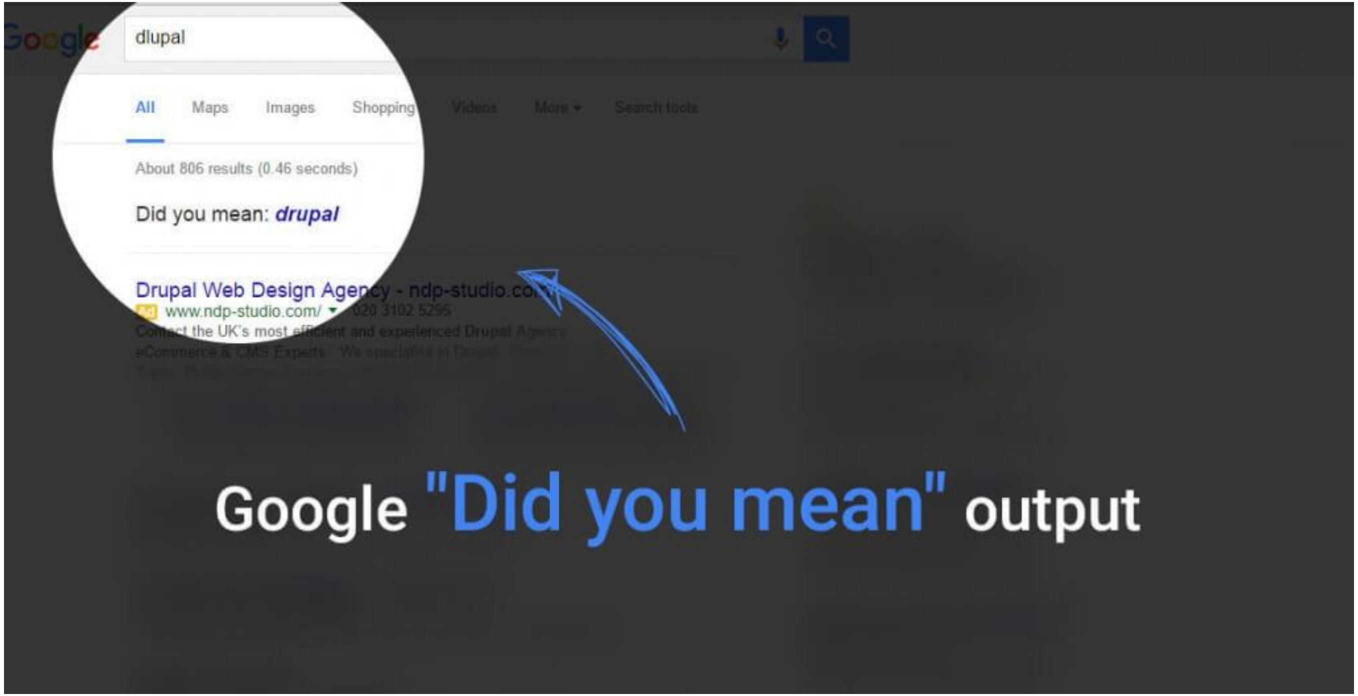
Basic Intuition:-

If user_1 types a query_1 and clicks on a product p

If user_2 types a query_2 and clicks on same product p

query_1 and query_2 are semantically similar

We use PMI and composite score statistics to balance n_users1 and n_users2


dlupal
All
Maps
Images
Shopping
About 806 results (0.46 seconds)
Did you mean: drupal
Drupal Web Design Agency - ndp-studio.com
www.ndp-studio.com/
020 3102 5295
Google "Did you mean" output

Finding Misspelled Words

	misspell	correction	misspell_counts	correction_counts	edit_dist
50	iphone3	iphone	6	16854	1
61	laptopa	laptop	6	14119	1
62	latop	laptop	5	14119	1
136	toucpad	touchpad	6	11550	1
137	touxhpad	touchpad	5	11550	1
148	wirless	wireless	6	10060	1
127	tableta	tablet	6	8260	1
10	cape	case	5	7541	1
8	cage	case	6	7541	1
30	gallaxy	galaxy	6	5839	1
64	loptops	laptops	5	5565	1
90	potable	portable	6	4477	1
5	bluetooh	bluetooth	5	4461	1
146	wats	wars	5	4179	1
56	kimdle	kindle	5	4129	1
99	rauter	router	5	4067	1
77	modum	modem	6	3590	1
76	moden	modem	5	3590	1
135	tosheba	toshiba	6	3432	1
34	gates	games	6	3239	1

Basic Intuition:-

Calculate the frequency for each query.

Quantile (0-20%) would likely be a misspelled word as less frequently used.

(80-100%) quantile would be a correct word as more frequently used.

Find the relation between (0-20%) and (80-100%) using edit distance.

Finding weights for name and longDescription field in products dataset

Addressing the bias in our data

Position Bias

- Detecting Position Bias? If the top positions have a significantly higher CTR
- Addressing Position Bias with SDBN:
  - **Mark the Last Click** - In each search session, identify the last result that was clicked.
  - **Consider Examinations** - Assume that all results above (and including) the last clicked result were actually seen or "examined" by the user.
  - **Calculate Relevance (Grade)**: No. of clicks/No. of examines.

Confidence bias

- Detecting Confidence bias? Document gets clicked every time it's examined, but it's only been examined a few times
- Addressing Position Bias with Beta Distribution
  - **Setting up the Beta Distribution -** Setting a prior belief about document relevance using a default grade and weight, which establish initial values for a (prior_a) and b (prior_b) i.e. (prior_grade = prior_a / (prior_a + prior_b))
  - **Updating with Click Data -** As clicks and examines are observed, "a" is incremented by the click count and "b" by the count of non-clicked examines
  - **Calculating the Updated Grade -** posterior_a / posterior_a + posterior_b

Evaluation

Thanks!