

Search Engine Evaluation based on Relevancy



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Although, current evaluation models suggest a wide range of criteria for the success of a search platform, the importance of engine's relevancy and thereby its effectiveness gets ignored, and is not tested while selecting a search engine.

In this paper, simple and yet effective relevancy evaluation frameworks aimed at measuring the core-qualities - the system's usability and thereby user satisfaction - of the search results are researched upon. In addition, it discusses some aspects of relevancy influencing parameters such as user's site-actions and social-signals that play a critical role in defining search-relevancy.

We focus more on consumer-facing domains like the high-tech and retail industries, where consumers spend a lot more time online trying to find the right product or information.

Searching the Web and the How of it?

"The world is all over the Web" -the amount of transactions on the World Wide Web (WWW) seem to justify this statement. This century has brought the whole shopping experience from the physical stores to the wires. To cater to the needs of nearly 7 billion people worldwide, there are thousands and thousands of organizations that are working day-in and day-out. The initial age of online shopping was quite simple with countable number of online websites selling specific kind of products to users who were already exposed to these products in physical stores, making it easier for them to make buying decisions.

During the last decade we have encountered an extreme shift in the online shopping paradigm. Companies that provide the online shopping facilities have increased tremendously. The number of products available over these sites has increased many folds and the number of people having buying interests in these products is at an all-time high. With such a gigantic mesh of buyers and sellers, the whole system has become really complicated. The user's patience threshold

is lowering day by day and they want their demands (products) in a single-click while sellers also want to push the best of their products.

These days, one of the most challenging tasks is to provide the most relevant and meaningful search results to the customer. Normally, when a user searches for some product, most of them would just go through top 10 or 15 results. So, if the right product doesn't show up within this range of results, there is a high probability that the vendor would lose out to a competitor.

This view point discusses relevancy, its meaning, importance, underlying processes and methodologies to control and improve in an evolving environment.

Search Relevancy: Its Importance

With tremendous increase in the amount of data over the Web, it has become really tough to manage data in a way so as to present the user with the most accurate search results. This is an expensive affair, both in terms of time and money, and so, importance is laid upon the relevance of the information presented. Right

information means more business and better return on investments. In simple words, relevancy can be defined as simplicity and usefulness. If a specific bit of information is useful for the user and they can reach it without making a lot of effort, then that is what relevancy is.

Just the way a Web designer thinks of making a site that captures user's attention within seconds, the search results on the site decide whether a user will be interested in the site or not. The user's engagement with search-experience defines their site-behavior including the likelihood to purchase/complete certain transactions. This calls for the need to study and analyze behavior of site-users, their action-paths, decision-points, interest areas etc.

Relevancy means the relationship between things or events. In the context of this paper, the relationship that is being discussed is the relation between a user and searchable products. To strengthen it, the right product needs to reach the right people in quick time. We generally believe that relevancy is just a mathematical and statistical approximation of most meaningful results.

Major Factors Influencing Search Relevancy

There can be a majority of factors that influence relevancy. The major ones include -

Search Analytics

- Frequency of search terms
- Click Vs Buy Comparison
- Time Spent on Pages

Content Analytics

- Relevancy of the content tied with the search result title

Geographic Trends

- User's behavior on the basis of geographies
- Region based search result relevancy

Time-based Trends

- Time of day/year is a relevancy influencing parameter

Contextual Searches

- Context in which user is searching

Social Signals

- Promote/influence search results on the basis of recommendations and suggestions of the users on web

Personalized Search

- Users explicit (login) or implicit (cookies) to boost the search results

Major Factors

Major factors influencing relevancy can be of thought of as a combination of the following:

Search Analytics

This constitutes a major area, which includes searching habits of a user and capturing them for future analysis, using them for decision making while pushing results to the user. The search habits may comprise the following items.

- Frequency of search terms – It accounts for the number of times a particular search term is searched over the Web.
- Click Vs Buy Comparison – This explains the hit rate of the search result i.e. for a search term which is the most popular clicked result or the product bought.
- Time Spent on Pages - It identifies the time a user spends on a particular page.

Content Analysis

It is not only the search result titles that

we need to consider, we should be keen on the correlation between the search titles and the content tied with that title. It might happen that the search engine is pushing the right and most relevant title to the user but the underlying content is not adequately relevant to the user.

Geographic trends

The world in itself brings out so much diversity in users' behavior over the Web. Requirement is to keep a vigil on the users' behavior on the basis of geographies they belong to, and transform this study into the kind of result that user sitting in a region might expect.

Time Based Trends

The search engine is expected to take into consideration the time of day/year as one relevancy influencing parameter. For instance, search performed against local-listing sites like Yelp!, Yellow Pages for restaurants during afternoon hours bring back different results as compared to same query during evening hours.

Contextual Searches

The context in which user is searching for some information also provides an opportunity to lock the user preferences and utilize it in attracting them.

Social Signals

The Web has now become a prime platform for social interactions, where users share their experiences, provide recommendations, suggestions and opinions. All of this information can be harnessed by businesses to promote / influence search results.

Personalized Search

Most of the websites are 'user' aware. This could be explicit(login) or implicit(cookies etc). Based on privacy-settings of user, the information about their past purchase history, current browsing behaviors etc. can play a key-role in influencing search-relevancy. For example, Bing takes into consideration a user's Facebook activity to present the most 'relevant' results.

Let's consider a few use-cases of a typical e-Commerce/Product-catalog Store and understand how relevancy is influenced by these factors.

Use Case 1:

The most searched, most viewed and most bought product should influence the relevancy of the search result.

Influencing Factor: Search Analytics, Content Analytics

Use Case 2:

The relevancy of the search result should be influenced by the user's country, geography, segment, time zone, time of search and language.

Influencing Factor: Geographic trends, Time-based trends, Contextual Searches

Website-logs hold a wealth of information including top-search terms, most-visited pages and most-bought products. Some of this information is readily available through website analytics solutions/tools like Omniture, SiteCatalyst, Google Analytics etc. Rest of the information needs to be derived from the logs. Search engines often come packaged with logging and reporting frameworks to help in deciphering this information and identifying trends. This information can be used to feed and control the search-relevancy algorithm to ensure site-search features are driven by crowd-insights.

The need is to keep a vigil on the user's behavior on the basis of geographies they belong to and search from transforms the search-engine's response into the kind of result that the user might expect. The search-engine is expected to take into consideration the time of day/year as one relevancy influencing parameter. For instance, search performed against local-listing sites like Yelp!, Yellow Pages for restaurants, during afternoon hours bring back different results as compared to same query during evening hours. The context in which a user is searching for some information also provides an opportunity to lock the user preferences and utilize it in attracting them.

The Right Search Engine

In order to implement a user-centric and right kind of catalogue search solutions where user would prefer to search and get back relevant results, it is of utmost importance to choose a right search engine. The search engine capability and the ease of setting it up to push the most meaningful results to the user would drive the success of a search solution. Typically, there is an effort involved in studying, comparing and evaluating a search engine that would fit in the scope and requirements of an enterprise.

Shown below are the typical stages and influencing factors involved in the evaluation of a search solution.



This figure depicts how relevancy and others aspects related to it are considered during the stages of search solution implementation.

Factors influencing search engine selection:

While choosing a search engine, it has to be evaluated considering the technical factors that would reflect the product's capability to accomplish the technical and business goals of the enterprise and the business factors, which includes the profile of the product at a market level.

Technical factors

The following indicative features/technical capabilities play a crucial role in determining exhaustive capabilities of a search engine.

Relevancy & Tuning	How relevant the search result is for the end user.
Federation	Search Engine's capability to fetch results from discrete sources.
Administration	The easiness of control to tune and administer the search engine.
Stop-word	Feature for special deals and promotions.
Auto-complete	Engines' capability to suggest meaningful query terms to users.
Misspelling and suggestions	Automatic spelling correction feature.
Filtering	Capability to display selective set of results.
Extensibility	Content API, query-API, Admin API to ensure easier extension & custom features.
Reporting & Analytics Support	Captures logs and key metrics presented for easier administration.
Scalability & Performance	Increase in number of user base or queries per second.
Security	Support integration with standard authentication & authorization systems.

Business factors

From a business and product procurement - standpoint, every organization has different criteria. We observe that the following play an important role-

Market & geographical client footprint	Fortune 500 client base, worldwide deployment
Licensing model	Server-based, instance-based, query/document count, flat annual-fee
Product-roadmap	keyhole view into product features, components and integration plans
Revenues, R&D budget	Annual/Quarterly sales, revenues figures and budget for product's R&D
Company profile	Establishment, Public-private holding, Geographical presence(offices), number of employees
Professional services	Implementation and support services for systems integration
Support model	24/7, 12/5, onsite support, dedicated hotline option etc

Relevancy Evaluation

Aspart of search engine evaluation, a very important phase is to evaluate the relevancy of search results. There are many processes that can be followed to achieve this evaluation. We will be discussing a process that helps achieve specific goals in shorter span of time. This process involves comparing results from a search engine against the best-case scenario. The best-case scenario is a list of results in order of their relevancy for a given search-term as deemed by the end-user. This list is generally prepared by the business or some Web analytics based automated tools. The process can also be used to compare and evaluate multiple search engines at the same time.

Relevancy, being a subjective topic, is always tough to measure. As multiple dimensions like content models and retrieval algorithms come into play, it often demands non-standard methodologies to measure effectiveness by setting up custom metrics agreed by various stakeholders.

The relevancy evaluation process involves the following elements:

1. Analyze the current site-search trends: identify top searched-terms, user-actions, result-set context (position), etc.,
2. Based on the available data, identify short-head & long-tail cases (similar to power-law).
3. Identify sample data consisting of top 100 to 1000 search query terms (depending upon your site traffic and dynamics) along with sampling from long tail of search log.
4. For each search (query) terms in the list, identify the best result set for each of the search term.
5. Fire the search terms on all the different search engines that are being evaluated for relevancy.

This process can be automated by writing a simple utility (web app), which can be integrated to all the search engines that are under consideration. The application will fire the queries in parallel on each of the different search engine and collect the results in a presentable format.

6. Capture the response from each of the engines for each query-term side-by-side for comparative analysis.
7. Compare these results with a best result-set (defined in step-4)

Searchterm1	1	2	5	3
Searchterm2	2	4	1	5
Searchterm3	1	1	3	2

List of responses per search-term from each of the engines under evaluation (as defined in step-6 above)

8. From this, derive the result-set deviation of these different search engines against the best results.

The above steps could be repeated as you fine-tune each engine's relevancy configuration. Doing so, the test would serve two major purposes.

- a. It will identify which Search Engine is displaying results that are nearest to the best set of results.
- b. How much effort would be required to tune the Search Engines to come as close as possible to the best set of results?

Query-term	Ideal rank	Engine-A	Engine-B	Engine-C	Engine-A Deviation	Engine-B Deviation	Engine-C Deviation
Searchterm1	1	2	5	3	-1	-4	-2
Searchterm2	2	4	1	5	-2	+1	-3
Searchterm3	1	1	3	2	0	-2	-1

Taking this use-case scenario as an example, the first column has a list of query-terms. Next to it is ideal (best-case) rank. This rank is either defined manually and/or from prior search logs. Next, the responses from each of the search engine are listed. The value is rank of the desired result (document/product).

Once the result set is captured, a simple calculation to find comparative deviation from the ideal result set. Eg., For query term

'searchterm1', the best result is ProductABC. Engine A returns ProductABC at rank 2 while Engine B returned at rank 5 and EngineC at position 3. Continuing this process the ranks for all the search terms are captured. A relative differentiate score for rank position helps in understanding how much off are results from each of the engines.

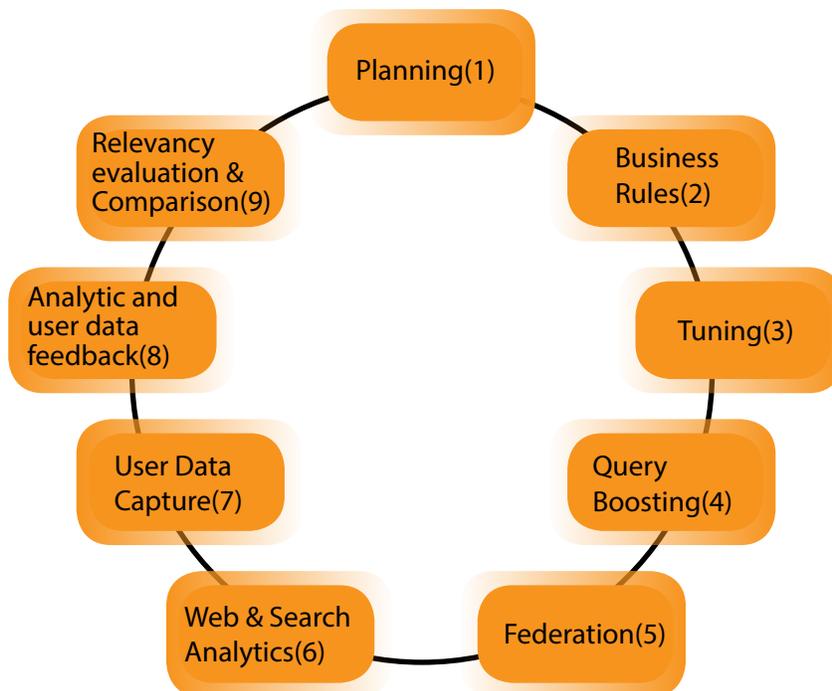
- If Deviation = 0, the rank of result from the search engine is same as that defined for ideal case.

- If Deviation < 0, the rank of result from the search engine is less than the one defined for ideal case.

Finally the count of deviation score for each of the positions help in understanding 'nearness' (and thereby effectiveness) of engine's relevancy and effort in setting it up. This is a simple methodology to complete set of data would help in comparing the relevancy of different search engines.

Relevancy Improvement Model

Once the basic strength of a search engine in terms of relevancy is evaluated, need is to define a process that could increase the default relevancy capability of a search engine. The diagram below depicts the cyclic process that needs to be followed in order to achieve high level of search result relevancy.



Relevancy Improvement Model

The suggested relevancy improvement model consists of the following steps that need to be executed in a cyclical manner phase by phase in order to achieve a high degree of search result relevancy.

Planning & Business Rules

Before even attempting to set up a search engine, it is necessary to understand what we want to achieve as a part of search solution. The inputs from business users should be carefully examined and translated to search engine specific tuning parameters. Different enterprises have different strategies to display their products or information to the customer based on how and what they want to promote.

Tuning

Rank tuning is a process of controlling the knobs of search engine in order to increase relevancy of search results. It is about increasing the rank of a particular product over the other by applying the business rules, various techniques like synonyms, keywords stuffing etc. are used to achieve a high ranking for the search results.

Query Boosting

Boosting – relative and absolute

There can be two kinds of boosting. In absolute boosting, a particular product can be pushed for a particular rank irrespective of other results that are displayed along with it. Every time the rank of this product would be same. In relative boosting, the rank of a particular product is defined relative to some other results or set of results. For example, if product X needs to be part of top 5 results for a particular query term, then it is termed as relative boosting.

Federation

At times it is required to up sell, cross sell different products or display information from a different source to the end user, along with the actual search results. The process of fetching results from discrete sources and displaying them as one set of results is known as federation. Based on business requirements, the engine should be integrated with different information sources to provide the user with all required information at the same instance.

Data Capture & Analytics

Web & Search logging is an important feature as it lets the organizations

capture & analyze the user behavior while searching and surfing the website. This data is then used to identify user interests and user can be presented with the most relevant results. Organizations believe that once a good search system has been established, it will suffice the needs and fulfill the users' expectations always. The truth is, users behavior and trends change with time, so it is necessary to have proper reporting mechanism to capture all user-related actions and monitor them to analyze if the users' expectations are shifting. Search needs to be treated like a journey rather than a destination. Data mining is a process of looking deep into the analytics data that organizations collect. This data reveals information that can be loaded into our search systems to provide better results.

Relevancy Evaluation & Comparison

Before releasing a search solution to the market, the testing should be done with real users because it is their feedback that counts. Testing done by technical and business analysts might not cover the entire scope of the expected outcomes. The search result should be tested for their relevancy and compared against best set of expected results.

Some other important aspects for Relevancy Improvement

Natural language processing

Majority of the users worldwide are not technically astute; millions of people want to write query in a simple language, which varies based on geographies. The need is to understand these queries and convert them into meaningful queries that the search engine can understand, and return a logical and correct result set to the user.

AutoSuggest & Relevancy

AutoSuggest can be used as a tool to

promote relevancy. AutoSuggest is the capability of the site to suggest to the user the most searched terms and results, nearest to their query, as soon as the user starts typing the query. Providing the right kind of search ensures that the user reaches the right area of the search results. In many cases it becomes difficult for the user to express their needs in terms of a search query. In such scenarios, the autosuggest feature really helps in boosting the relevancy of the results shown to the user.

Search and Relevancy Administration

Relevancy and various mechanisms

required to achieve a high level has been discussed. The fact of the matter is that all these processes are complex in nature and the responsibility of achieving this rests with individuals, hence, the search solution should provide enough knobs, controls and switches required to incorporate necessary changes to keep the show running. The controls need to be simple so that even non-technical users are able to drive the system.

As an example, at a specific instance, a product X should be on the top of the charts whereas during other times a different product needs to take its place on the chart.





Conclusion

While the concept of relevancy as an approach is considered important, it also provides a novel interpretation of search engine effectiveness for the content provided. With the evolution of real-time web, social media and multichannel access mechanism, it is advisable to avoid over-fitting the concept of relevancy as an approach in information-discovery.

Search engine relevancy is a key feature, which often tends to get ignored resulting in losses in terms of time, money and effort to fix and tune the effectiveness of the engine. By giving adequate thought to various parameters, which can boost the relevancy, organizations can achieve a self-sustainable, intelligent and useful search system.

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