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Applying business rules to search relevance

Relevance models determine the ordering of search results, but such models need not only be based on mathematical IR (information retrieval) methods - they can also incorporate the business logic at hand, to organize the answers in a way that is commercially or organizationally optimal.

A business white paper

by FAST Search Best Practices

5 things you should know about business rules

1. Well-constructed content is vital. Business rules should augment good content, not hide weaknesses
2. Understand the time it takes to formulate and apply business rules rather than relying on the standard relevancy model
3. Strive to eliminate futile queries, abandoned sessions, and multiple similar queries by the same user in the same session
4. Measure, measure, measure, and refine. Incorporate a closed-loop system of measurement, reporting, and refinement
5. Business rule management allows OEMs to better understand the impact of search on their applications

Organizations today are governed by business rules and workflow. The aim of the game is to tune the appropriate business rules to meet the needs of the business – and of its markets. But how do business rules apply to search technologies?

By definition, business rules are units of logic that govern how a system should behave or act. For example, a business rule might state that no credit check is to be performed on return customers who are applying for insurance policies. Another rule might flag a "Level 3 alert" if an abandoned car has been sitting in a "threat hot zone" for more than 2 weeks. The search application should be an open platform, allowing customers and search providers to deploy business rules at various stages of the search system - at ingestion, ranking, query transformation, or at alerting time.

Business rules should augment good content, not cover up its weaknesses.

Business rule configuration needn't be overly complicated. The most direct approach is to leverage the inbuilt management and monitoring tools of the search application. Here, business managers can adjust the relevancy and ranking models that are assigned to a particular subset of content, so, for example, a letter from the CEO pops to the top of each query, or a particular product leads the list of search results during a marketing campaign.

On the other hand, developers or IT managers can dig deeper, augmenting and analyzing the performance of the document and query processing stages to mine the query results themselves. That way, they can determine what queries and results do and don't work well in the search system, and then configure the system accordingly.

A deeper approach still is to construct a business rule environment, providing a syntactic or declarative model for creating, applying, and managing rules and the actions they trigger. In this scenario the rules are applied to new content as it appears, performing actions as directed by the rule.

Users can be more certain that they've got a flexible, best-in-class search solution when they understand the impact of business rules management and combine that understanding with the functionality of built-in search features such as document processing, index profile, relevancy/rank profiles, linguistics, and analytics tools.

This white paper will look closely at the impact of business rule management on search technologies and will review the options available to managers eager to leverage the capabilities available in today's search applications.

Enhancing search with business rules

Search application goals will vary significantly from one organization to another – hospitals will have different needs than an online careers Web site, a producer of consumer packaged goods, or a federal intelligence agency. The one common thread is the goal of displaying the right information to the right person at the right time – and in the right order without extraneous noise. Sometimes the information is simply the results of the search (as in investigating archival data); other times it is content set aside for further action or an alert to do something (as in monitoring streamed data).

It is important to note the "right person" aspect of this goal. Within a knowledge discovery environment, user-specific business rules should differentiate content from one role to another. This is where many standard web

search engines fall down; but the requirement is important because business rules always have scope, and that scope is generally defined by the activity of the person (or role).

Q: My CRM system features a search application and I need to modify the ranking for thousands of individual documents. Is there another way to do this, rather than using the management GUI?

A: It's possible to bulk-load rank tuning tasks. Similar functionality is provided but XML files are used as the input. The XML file will contain a specification of the rank modifications to be performed. This approach is preferable if you're able to extract the rank boost information from other data or applications.

Enterprise search engines do have this capability courtesy of the management tools shipped with the software. The tools have typically been designed to allow business and IT people to configure and improve the search experience so they can minimize time-to-relevant-information.

It's possible to configure for a particular user by monitoring that user's query behavior; the search system can be refined over time. Such management tools usually consist of three main elements: rank tuning, query reporting, and user management. Let's look at each in turn.

Rank tuning

Rank modifications based on business rules enable the search provider to influence or override the automatic ranking of documents – for example, by directing users to business-generating pages. There are several techniques to configure the ranking of documents:

Absolute query boosting: Suppose you want a document to be displayed consistently at a given position in the result set - for example, in the top position - when a user searches with a specific query. In this situation, you can specify a document-query combination that assigns a fixed absolute ranking position to a particular document. This ensures that the specified document surfaces within the result list whenever a user is searching with the specified (matching) query. Absolute query boosting also allows you to prevent individual documents from being displayed during such searches by giving it a ranking value of zero, for example.

Relative query boosting: This feature is valuable if you want to ensure that a particular document is always displayed among, say, the first 20 documents in the result list, provided a user searches with a specific query. For all other queries, the ranking position of the document will not be impacted by any boost. Here the business manager specifies a document-query combination and assigns a sum of ranking points (that is, enhancing the document's relevancy score) with which the document's overall ranking value is to be increased whenever a user is searching with the specified query.

Monitor user query behavior to refine the search system over time.

Relative document boosting: This feature is useful when it's necessary that a particular document is always displayed within the first 20 documents in the result list, no matter which query a user has submitted. At the same time, the user does not want to assign a fixed result list position to the document. Applying this feature, it's possible to specify that the overall ranking value of the particular document has to rank higher or must be increased by a certain number of points.

Use other features, e.g. navigation, to support and augment the effectiveness of business rules.

It is also possible to manipulate the relevancy score (rank) related to categorization using taxonomies present in the user's environment. This allows a rank boost to be applied to all documents within a category against all or specified queries. For example, the user may want to boost the medical category for queries specific to a particular area of medicine. Boosting for specified queries may be useful when tied to understanding and mining the query logs from the search system. Here, the most frequent queries on the site may be considered for boosting against specific categories.

In addition to applying the static rank tuning mechanisms discussed above, users can also adjust the dynamic relevancy of documents based on the rank profile concept, meaning that documents can be given higher ranking values based on freshness, completeness, authority, statistics, quality, or location. Using the freshness parameter (how recent is the document?), recent news articles or press releases can be boosted so that they appear at or

near the top of result sets, for example. This feature is discussed in depth in the SBP Relevancy white paper.

Q: I run an e-directory. How can I evolve my business model by leveraging business rule functionality?

A: Offer Gold, Silver and Bronze advertising packages on top of the paid inclusion model. For each package, you can apply different levels of ranking via the management interface and tie them to queries and keywords.

Query reporting

Query reporting or mining of the raw query logs is a task that is overlooked by many organizations when they're running search applications. They incorrectly assume that once the search application is up and running, it will look after itself. Although the search engine is designed to continually return 'relevant' results, the needs of the search user and the business environment are constantly evolving so it's crucial to understand the wider and more role-specific needs of the search base. This can be achieved by monitoring query trends, volumes, successes, zero hits, click streams, etc. and it provides the business owner the tools to adapt where necessary. We explore this area in more depth in our Benchmarking Search white paper.

For example, an e-directory provider may want to know the total volume of queries, or the top queries processed in a given time period. By doing so, the company can review its advertising revenue business model and potentially charge more for particular query terms in near real-time. Conversely, the directory provider could also analyze the top 'x' queries that yield no results and configure the system so that search users are at least given an alternative path to follow, such as 'find similar…?'.

Another example: mining the query logs of a mobile operator discovers that when their customers query for a song, they are most likely to then download its related ring tone. So, why not make that the follow-up question "automatically"?

Ideally the management interface should convey these results in a simple graphical manner to shorten the time-to-action. Analyzing query logs is a task that organizations should take seriously if they value the investment in search technology. The frequency of analysis depends on the business need – every day, once per week, per month, etc. – and on the resources available.

Q: We are a large organization and our most popular query is 'lunch menu'. How can I ensure that the searcher receives today's menu?

A: Within the search application, business rules can be configured to be time- and date-aware. For example, if a user searches for 'menu', he or she will be shown the menus relevant for that date. Also, rules can be implemented to promote breakfast, lunch, or dinner menus, depending on the time of day that the search is performed.

User management

Many of the elements discussed above work best when applied to specific search users or to groups of users with similar profiles. The administration tools inherent in search applications should enable simple and effective user management. Ideally, they should provide configuration (creation, deletion, modification, etc.) for users, groups, collections, or roles, so that results are targeted differently towards doctors, nurses, or medical researchers, for example. In an e-commerce environment, it can be difficult to manage users manually with the administration tools. So it's a good idea to integrate data from, for example, billing systems to automatically profile the user, not unlike the collaborative filtering functionality used by Amazon.com to suggest new products to the user based on his or her previous spending patterns and demographic profile.

In a typical deployment, organizations can enrich the document processing to control the static rank. They may also have a customized index with multiple rank profiles, based on the dynamic relevancy parameters discussed above, and would perform the standard query processing. The management functionality would likely be used for externally controlling the boosting of documents and for reporting tasks.

In more advanced deployment scenarios, search providers would use the features described above and then apply document augmentation to enrich the query processing for tuning queries and to map them to the desired rank profiles and business rules. Boosting of documents (top

10, relative/absolute boosting) will occur where queries are tied to specific boosting models. Search providers can implement the ability to restrict or block out documents from particular queries in addition to using advanced alerting tools. Reporting and query mining and analysis would be pivotal to such deployments.

Finally, for scenarios where the content is streamed and the user model is centered on alerting rather than ask-and-answer querying, the role of the business rule changes from affecting results ranking to discovering patterns and initiating actions based on them. A wide corpus of content is compared against a control set and if a candidate for "success" is found, it is stored in a separate index for further investigation. The business rules determine what constitutes a possible success. Example scenarios are anti-money laundering, where business rules are used to find patterns in deposits and withdrawals; copyright infringement, where business rules determine whether or not something is a copy; and online black market trading, where business rules find patterns on sites that identify candidates.

Alert-based business rules are generally more independent of the search engine, being managed through a separate – and often custom from user to user – management portal. They may be as simple as a selection of choices, or a complete logical language with the capability to group together rules into composite rules complete with full Boolean logic.

Different industries, different solutions

Different business rules apply to different industry domains and need to be configured to suit each business environment.

Let's look at the example of an e-commerce site. It can use the business rules inherent in the search solution to control which products and services are delivered to the customer based on the particular query. By tuning the system in this manner, the e-commerce site can promote products that deliver higher margins, say, ahead of other products that also match the particular query term – in effect, boosting them to the top of the results list. The impact on the top line can be profound: for example, such capabilities can help offload end-of-season stock which in turn can reduce inventory, reduce warehousing costs, and also give the e-commerce retailer the capacity to stock new and 'hot' products.

From a knowledge discovery perspective – think of a pharmaceuticals manufacturer, for example – there is a real business need to run business rules, analyze query logs and offer reports in order to tailor and improve the search activities for operations such as R&D, clinical trials, sales and marketing, etc. Here, the analysis may pinpoint the need for custom dictionaries or linguistic capabilities (spell check, lemmatization, synonyms, etc.) to reduce the mean number of queries or 0 hits. In this scenario, business rules are effectively being used for 'fault detection'.

For monitoring and alerting environments, business rules are used to trigger activity, or isolate outliers or candidates for further investigation. Their value is in the dramatic reduction of investigative content. In other words, they act as a filter that removes all the unnecessary pieces and leaves only those that are candidates for deeper investigation.

Business rule management allows OEMs to better understand the impact of search on their applications, and to tweak as necessary to improve the value-add that search provides. This is particularly important for CMS applications where documents are published and are subsequently available in the search index. An alerting functionality can be applied here to notify users of new content so they don't have to search for it specifically. These types of tools eliminate the need for custom coding of search rules in an ad-hoc manner, and bypass the need to generate custom reports. If necessary, custom reporting can be achieved by exporting the reporting logs/data from the search application to a third-party reporting tool.

Understanding the impact of business rules

The search provider's foremost objective is to provide a flexible and configurable platform that displays what the business owners believe is the most relevant information for different contextual environments. The search experience needs to be altered easily – without needing to write custom modules – so that the search application reduces the time-to-information and helps users avoid having to mine for what they need. By monitoring the end-user query behavior to refine the search system over time, the search experience steadily improves, eliminating futile queries (0 hits) and enhancing user satisfaction rates.

By integrating management tools with the index and rank profiles, managers can ensure that the search framework aligns and supports the organization's strategic and tactical goals. That means that in the case of a marketing campaign, say, more important or more relevant information or products can be surfaced relative to a query. Managers can also quickly test (and deploy) different assumptions and models based on changes in business direction or environment.

From the IT support perspective, management and monitoring tools ideally reduce the burden of custom programming and integrations. They can also obviate the need to produce custom analysis and reports, returning more control of content to the business owners. However, experience indicates that business rules often end up being customized UI "hacks" rather than structured and well thought-out configurations. IT managers must be aware of the resulting maintenance issues.

It's also critical to balance the need for control with the trade-offs associated with management and monitoring tools. Managers first need to ask themselves whether the standard reporting functionality – the functionality embedded in the search application – is sufficient for their business requirements. If it is not sufficient, they need to understand that it takes time to formulate and apply business rules rather than relying on the standard quick-configuration relevancy model. It also helps if managers appreciate the differences between the static business rules model and the standard dynamic relevancy model with its multiple rank profiles. Ultimately, logic on the query side will have to be defined so that the right rank profiles are selected. This will take time.

Another area for consideration is which reporting tool to use to mine the query logs and which web tracking tool to use for monitoring click streams. Although it makes sense to keep the reporting of search within the application itself, this is not always appropriate for every organization. In this scenario, organizations should look for search solutions that allow outputs to be integrated into third-party soltions, or into homegrown tools. Typically the output from the reporting tool will be in a standard ASCII text/XML format.

Finally, there's value in appreciating the additional management and maintenance time and constraints of building and deploying business rules. This must be coupled with a thorough understanding of the business needs and a realistic view of what's achievable. It is advisable to continually analyze the usage trends long after deployment.

Mini case study

Global e-commerce provider streamlines its sales channels by using monitoring and management tools to know its customers better

Who
Worldwide IT e-commerce site

Challenge
To enhance the sales throughput of its e-commerce site by better understanding its user base and appropriately targeting highly relevant information.

Solution
Knowing that well-constructed content is vital, the company made sure that its business rules enhanced its existing content rather than hiding weaknesses. The project team put anchor text and links into clean content so that the site became self-organizing. Navigated search techniques were built in to support and enhance the effectiveness of the business rules.

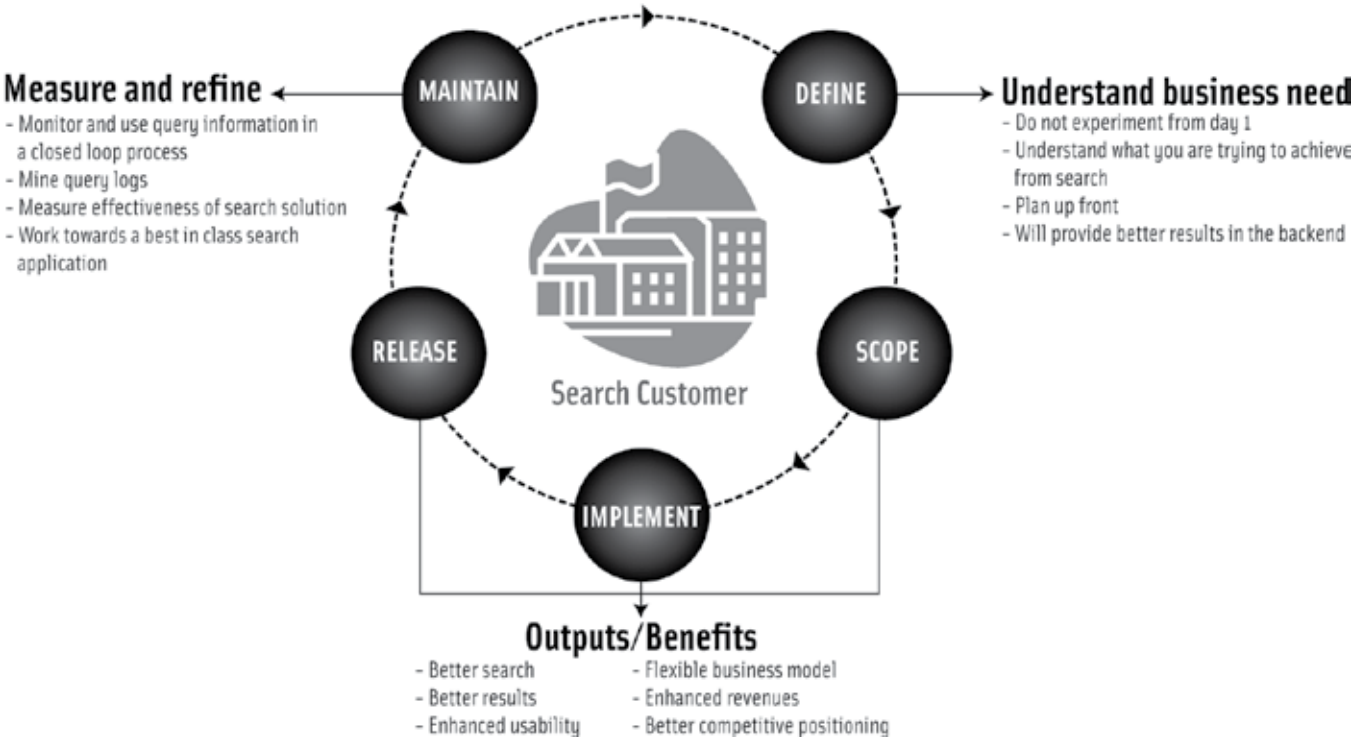
Technology
Advanced business management and monitoring tools, rank tuning (and bulk loading of rank models) and URL boosting.

Guidelines and recommendations

The true measures of any search application are its ability to return relevant results, and the time it takes for the user to find the information needed. It's no longer acceptable to return futile queries, so the search system must be able to provide an 'alternative path' to the right information – 'similar to…' or 'people like you also liked …'

By measuring the average and mean number of queries per session, you can understand how long it takes to locate the right information, or how many queries are needed. At the same time, monitoring the number of similar queries shows where there is room for improvement if the user has to rephrase the query several times. It is also important to measure and monitor session abandonment rates, where users may try two or more queries before giving up a search.

Iterative operational steps for good search applications



In all cases, business managers can tune the search interface or match queries with particular content to improve the search experience.

As noted earlier, many organizations fail to fully understand what they are trying to achieve before deploying search applications. Furthermore, they are likely to neglect the frequent monitoring and tuning aspects of search. Planning upfront will provide rewards later on, such as better search and results processing.

Other common oversights include the failure to fully understand boosting models and their application, and failure to mine the query logs for useful information. Unfortunately, organizations too often map queries and boosting of documents without fully considering why they are boosting particular content. Without mining the query logs, it is like the 'blind leading the blind' when it comes to refining the user experience. A crucial success factor is a familiarity with the usage patterns and the search intent.

Additionally, organizations must acknowledge the need for continuous and iterative measurement, reporting, and refinement. Advanced users of search applications usually assign this task to a particular employee or business owner. That way, it becomes that assignee's responsibility to continually monitor the search application, allowing for quick detection of trends and fast solutions to search trouble spots. Many e-commerce companies have reported increases in traffic and advertising-based revenue by using effective search tuning and configuration.

Five fundamental steps for improving search

In theory it is not difficult to put control back in the hands of the people who understand the dynamics of the business, but it can be tough to achieve in practice – especially from the standpoints of resources, experience, and company politics. That equation needs to be balanced carefully

There are five fundamental steps for improving search effectiveness. Here's a summary:

1. Understand your business rule needs – management and reporting tools enable flexible rank tuning, boosting, and blocking of documents with or without respect to a given query. These tools also produce reports to help business managers to track the efficacy of the system.

2. Determine the best method for rule deployment – depending on the scenario and an appreciation of the trade-offs discussed above, it's possible to apply other types of rules using the core of the search application – the document processing and query processing stages, the results processing stage, and configuration of the index itself.

3. Leverage the experience and knowledge of the search application – business rule tools have been configured to integrate and operate seamlessly with the search framework.

4. Measure, analyze and refine – use reporting tools to analyze query logs and measure the effectiveness of your search solution. Get close to the reports to continually refine the search experience; use boosting or hard-wired queries to draw out important information as quickly and cleanly as possible.

5. Develop a 'search analyst' role – this new position will be responsible for the closed-loop cycle of managing periodic updates and refinements, and will make sure that the results of the analysis are fed back into the search experience.

Frequently asked questions

Q: What is meant by boosting?

A: Boosting is the act of moving a document higher up the result set. It is achieved by adding points to a document's rank value. By default, documents with the highest rank values are received by the user sooner than documents of lower rank values.

Q: What is a boost point?

A: A boost point is a value that is added to a document to increase its relevancy relative to other documents returned in a set of search results. The create query boost, manage query boost, and create document boost help you to create and manage boost points in a search result set.

Q: What is a query log and how can I mine the data?

A: The search application will track the statistics of issued queries and information about them, e.g. volume, times, etc. This information is stored in ASCII text files called query logs. The search system's reporting tool will allow you to graphically mine the logs; otherwise you can push the data to an alternative preferred reporting tool.

Q: How can I delegate management/reporting tasks to multiple business owners?

A: The business reporting tool should permit multiple user 'roles' that align with admin (full control), rank tuning, reporting, and user management. Each role has its own respective rights.

Q: How can I alter the rank tuning in the management tool?

A: There are several methods of doing so, such as creating saved queries, managing saved queries, creating and editing document boosts, and/or direct input. Creating saved queries allows you to increase, decrease, or block the result set of a collection for the query that is being searched against. Managing saved queries allows you to delete or edit the rank of a saved query. Creating and editing document boosts allows a user to boost a document regardless of what query is entered. Direct input allows a user to create saved queries and add boost to documents that are not necessarily in the searchable index.

About FAST SBP™ (Search Best Practices)

SBP consulting is a highly focused transfer of search knowledge and experience from FAST to its prospects and customers. SBP workshops aim to help enterprises realize the full potential of search, by creating optimal strategic, functional and technical roadmaps, delivered in the form of business model, solution and architecture designs.

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