

The Insider's Guide to Knowledgebase Technology

Developments at the Cutting Edge of e-Service

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Executive Summary	3
Philosophical Approach	4
Current AI	5
Auto-Adjusting FAQs	6
Auto-Generated FAQ Relatedness	7
Natural Language Parsing	8
Future Directions for AI in RightNow Web	9
Research Partners	10
Relatedness	11
Visualization	12
Blue Sky	13

1. Executive Summary

RightNow Web is RightNow Technologies' flagship Internet Customer Service product: robust, easy to use and easy to administer. An article by PC Week recently stated, "Companies that do not want to save money on customer support should not buy RightNow Web" (Feb. 14, 2000, page 30). The article, entitled "RightNow Web: Support with Smarts," carried the tag line: "Updated Web e-mail response system makes good use of artificial intelligence at a great price." In this paper we'll examine the various forms of artificial intelligence (AI) contained in RightNow Web; the implications AI has in this area and how RightNow Technologies plans to use AI in its future products.

2. Philosophical Approach

Before considering the various AI methods implemented and proposed in RightNow Technologies products, we need to put our approach in a philosophical framework. Our goal is to create the industry's most usable and easily administered suite of tools for Internet Customer Service, which requires the development and adaptation of AI algorithms to the Internet Customer Service domain. To achieve this goal, we're trying to create a perfect self-maintaining system, which we call "organic." An organic Internet Customer Service system responds to the interests of the customer yet requires no administration to address the customer's needs. This sort of automation can only be achieved by using AI.

Because the organic approach means keeping the system running with minimal or no administration, we consider any task requiring administration a problem needing improvement. We believe administration should occur only when the underlying Internet Customer Service system is unable to adapt to or meet the end user's needs. Our use of AI relies heavily on organic adaptive methods while avoiding methods requiring extensive manual fine-tuning.

3. Current AI

All versions of RightNow Web have some embedded AI, and each new release has improved and expanded its use. The first version of RightNow Web had the list of frequently asked questions (FAQs) adjust automatically to the interests of the customers. The ordering of FAQs has improved, using several different techniques. Customers are now able to view FAQs related to the ones they have already read. Natural language parsing has also been introduced in several areas of the product. Keeping with the organic approach, none of these expanded customer features require administrative intervention.

4. Auto-adjusting FAQs

The original approach for auto-adjusting FAQs was basic but effective. Customers were explicitly asked for feedback on all FAQs they viewed. Those questions with the highest level of feedback moved to the top of the FAQ list.

Recent additions to RightNow Web include expanded AI applications in the ordering of the FAQ list. For those customers explicitly providing feedback on a FAQ, RightNow Web now offers a wider range of positive responses (those that move the FAQ upward), as well as allowing, for the first time, negative responses. Negative responses indicate the FAQ was not helpful and that solution will, over time, move down the list.

Implicit feedback is an entirely new concept, introduced in RightNow Web's latest version. Implicit feedback collects reactions from customers who don't provide explicit responses to FAQs. Analyzing the FAQs customers viewed and the order in which they viewed them generates the information.

Customer questions change over time and RightNow Web's FAQ orderings now reflect that. Every item containing any usage information has a time stamp indicating that item's last update. If the information becomes "stale;" not accessed for a given time period, then its importance is downgraded. Unused information then drops down the list while more recently used information rises to the top. We call this "information half-life" in reference to the decay of radioactive isotopes.

What AI technique describes FAQ auto-adjustments?

There are several standard AI techniques that come close to describing our approach, but still fail to grasp the essence of what we are doing. However, one rather new AI approach seems to closely match our auto-adjustment scheme. Under the domain of artificial life, our approach to FAQ auto-adjustment could be considered swarm intelligence. The only distinction between most applications of swarm intelligence and RightNow Web's implementation is that the customer's directed seeking behavior is used instead of relying on simple programmed agents.

5. Auto-generated FAQ relatedness

Presenting related information to Web users can take many forms. Amazon.com suggesting books based upon your stated preference is a good example. For Internet Customer Service, though, related information takes a slightly different route. Here, you want to present users with FAQs related to ones they have already viewed, in the hope that if the current FAQ does not solve their question, then the related FAQs will. Thanks to RightNow Web's organic, adaptive AI techniques, customers are now able to find their answers faster by viewing FAQs related to ones they have already viewed.

RightNow Web assumes each customer session is a new search for a single answer. Underlying technology automatically performs click stream analysis to track, record and leverage the paths users take through the knowledge base. The AI analysis is then conducted from an answer-based approach rather than customer-based. As a result, when building information relatedness, the question asked by a customer is not as important as the way in which the customer reached the answer.

How are FAQs organically related in RightNow Web?

In RightNow Web, information relatedness is a two-part process. The first part relies, again, on a type of swarm or agent approach. In this case it is assumed each customer session is a directed search for a single item existing in the knowledge base. Each step in the quest for this information builds on those steps already taken. The series of steps builds the second part of the process, an information map. The result of a large number (swarm) of customers (agents) is a detailed map of how each item in the knowledge base relates to other items in the knowledge base.

6. Natural Language Parsing

Natural language parsing (NLP) has been added to several areas in RightNow Web. NLP is a process allowing the computer to "read" a piece of text to gain information about its content. There are numerous NLP approaches, but most are distinguished from a basic keyword searching routine by analyzing the order and grouping of the words in the text. The result is a reasonable interpretation of questions asked in the customer's native language.

NLP had its introduction to RightNow Web through automated e-mail responses. When customers sent an email to their Internet Customer Service representative, the RightNow Web NLP algorithms "read" the email and attempted to find the answer to the question in the existing FAQ knowledge base. Once this NLP approach proved effective, it was added to Personal Assistance requests. The NLP algorithm was also found to be a useful search tool, and was added as the default means for customers searching the database.

What form of NLP is currently used in RightNow Web?

The NLP used by RightNow Web is a modified keyword based statistical method. The modified keyword based statistical approach works well for RightNow Web because of our highly organized FAQ knowledge base. Instead of attempting to find a general interpretation for the question by a statistical analysis, the result set is narrowed down into smaller and smaller areas within the list of FAQs. More than simple word frequency and keyword matching are used, and care has been taken to circumvent the pitfalls of standard statistical NLP methods.

7. Future Directions for AI in RightNow Web

As the capabilities of RightNow Web increase, the need for organic AI will also increase. Existing AI methods and features will be updated, and new AI methods and features added. Present AI methods include statistical, swarm and agent approaches, but future AI use won't be restricted to these.

Any AI method, which adequately solves a required task, will be seriously considered, but only those methods that function without human administrative setup, intervention, or steering will be used in RightNow Web and other RightNow products. RightNow plans to update existing features and include new features to address NLP, FAQ relatedness, user action prediction, information representation, and visualization.

8. Research Partners

In addition to our internal AI experts, RightNow funds applied research at a number of premier universities around the world. Some of the exciting possibilities realized from this work are described below.

NLP and Information Representation

One major university, with support from RightNow Technologies, discovered a new machine-learning approach specifically addressing the problems of NLP within the realm of FAQs and Internet Customer Service.

In general, the research builds off several standard machine-learning approaches for NLP to come up with a unique and enhanced learning method that outperforms other available approaches.

What standard machine-learning methods did the research team test against?

Our team of computer scientists based their comparisons against the standard model of tfidf, which is the basic term frequency keyword search model. This approach is commonly used as an NLP baseline since it is the most commonly used approach for searching. This was compared against several other standard machine-learning methods, starting with adaptive tfidf that adjusts keyword weights to optimize performance on training Q/A pairs.

They also compared against a query expansion approach, which learns the pairings between questions and answers. Statistical translation, most commonly used for translation between different languages, was included as a novel comparison. The research team rounded out the evaluations by including some latent variable models, a form of soft clustering of questions and answers. Our research team's unique, groundbreaking approach produced the best performance of all methods tested.

Dynamic information systems, such as the RightNow Web knowledge base, require periodic maintenance to maintain optimal performance. This usually requires knowledge base administrators to periodically clean up the relationships and rankings to remove any useless information that has crept into the system. But this runs counter to the philosophy of an organic knowledge base, where manual administration is to be avoided whenever possible. Several AI maintenance functions are planned for RightNow Web, including auto-grouping (clustering) of FAQs, and auto-cleanup and noise reduction of FAQ and FAQ relatedness rankings.

Several techniques could be used for the maintenance features, including any of the standard machine-learning approaches for clustering related information. Maintenance features could also include various types of neural networks, which perform well on clustering. The auto-cleanup and noise reduction approaches under consideration include not only some statistical methods, but also genetic algorithms.

What is the status of the various maintenance approaches in RightNow Web?

Another university, under support from RightNow Technologies, is currently investigating numerous machine-learning techniques useful for parsing noise out of dynamic information systems such as the RightNow Web knowledge base. Their initial focus is on pursuing several statistical methods for noise reduction in an attempt to "refocus" the knowledge base and relatedness information as one would refocus a blurry image.

9. Relatedness

FAQ relatedness will expand in future versions of RightNow Web. The swarm and agent approaches will probably remain the driving forces behind the approach, but modifications and combinations of similar approaches will be used to increase the accuracy of the on-line recommendations.

One feature planned for RightNow Web is a module enhancing the collection of relatedness links. The module will be a set of machine-learning methods applied to the data for categorizing and clustering into logical groups. This automatic grouping of FAQs will be done apart from, and in addition to, the customer feedback and usage already existing within RightNow Web. New methods of categorizing and clustering unstructured data will be integrated into this module as they're formulated. The long-term intent is to form a highly effective method of automatically structuring customer data before it's presented to users. Instead of merely responding to customers, an Internet Customer Service application should, ideally, make intelligent guesses about customer problems. Conceptually this should be distinguished from the FAQ relatedness, already part of RightNow Web, to include more analysis of individual customer history and actions to make much more accurate guesses about their intent. RightNow Web plans to include this in future product versions, most likely using neural network or fuzzy logic methods.

10. Visualization

A key element of any Internet Customer Service application is its ease of use. Unfortunately, many of these AI approaches tend to deliver complex results to the customer. When the results are not exactly what the customer requested, it can be confusing. So, any suite of AI tools used to help untrained users must include visualization tools to support their understanding. RightNow Web is planning to include a map of the knowledge base information space to help these beginners find answers in large knowledge bases. These maps could take many forms, from the basic two-dimensional approach used by street map sites such as Mapquest, to representations that might organize the presentation along various information dimensions, to even more abstract representations using either Java or VRML.

11. Blue Sky

Ease of use is the goal for all products in the RightNow suite and with AI expanding and evolving, most techniques that fit the organic approach touted by RightNow Technologies will probably end up somewhere within the RightNow product line. These techniques range from various types of statistical methods for machine learning and fuzzy logic, to various neural and Bayesian networks, genetic algorithms and beyond. Research into AI continues at institutions around the world and ease of use will be enhanced as new methods and techniques are developed.

About RightNow Technologies

Founded in 1997, RightNow Technologies automates customer service and technical support operations for Internet-connected organizations. RightNow Technologies' customers include Ben & Jerry's Homemade Ice Cream, Nortel, PictureTel, Sprint, TDK, Vivitar, Xerox and more than 600 other organizations. RightNow Technologies is located at 77 Discovery Drive, PO Box 9300, Bozeman, MT 59718, and can be reached by phone at 888-322-3566, by fax at 406-522-4227, by e-mail at info@rightnowtech.com or on the Web at <http://www.rightnowtech.com>.