Search on TAP User Evaluation & Demonstration

Rob McCool
Knowledge Systems Lab
Stanford University
robm@ksl.stanford.edu

Andrew J. Cowell
Rich Interaction Environments Group
Battelle, Pacific Northwest Division
andrew.cowell@pnl.gov

David A. Thurman
National Security Directorate
Battelle, Pacific Northwest Division
thurmand@battelle.org

Abstract

Stanford University's Knowledge Systems Laboratory (KSL) is working in partnership with Battelle Memorial Institute and IBM Watson Research Center to develop a suite of technologies for information extraction, knowledge representation & reasoning, and human-information interaction, in unison entitled "Knowledge Associates for Novel Intelligence" (KANI). We have developed an integrated analytic environment composed of a collection of *analyst associates*, software components that aid the user at different stages of the information analysis process. Here, we discuss our efforts to evaluate the 'Search on TAP' component that allows users to pose novel queries within a semantic context.

1 Introduction

Search on TAP is an end-user application that uses documents from the Semantic Web to enhance the search experience beyond the capabilities provided by typical Information Retrieval systems. Search on TAP builds on techniques previously described by Guha *et al*. [2004a] to aggregate information from multiple websites. The information from these websites is translated via scraping from HTML into RDF, and then merged together via a series of owl:sameAs assertions [Guha *et al.*, 2004b]. The end result is a coherent data set that can then be used to perform both entity-based search as well as traditional keyword search. Search on TAP covers 31 source sites in 12 topics, which results in 188,680 pages containing 1,089,389 entities.

1.1 User Experience

The use of structured information from the Semantic Web enables users to perform queries that are not possible with a simple keyword based search engine. The types of queries that the Search on Tap engine supports include:

- Entity queries about a single named entity. While such queries are allowed by keyword search engines, Search on TAP supports disambiguation of named entities. For example, in a query "Harrison Ford", the system can distinguish between Harrison Ford, the modern actor who played Han Solo, and Harrison Ford, the silent film star from the 1920's.
- Attribute queries allow the user to ask for specific attributes of an entity, such as Harrison Ford's birth date, or the population of China. The user may also ask for entities related to another entity, such as querying for "Chicago buildings" or "rail mobile nuclear missiles."
- Comparison queries allow the user to ask for entities that compare in a particular way to another entity. For example, buildings taller than the Sears Tower or roller coasters faster than the American Eagle.
- Group queries support searching for groups of entities, such as countries with a population greater than 250 million or movies starring both Meg Ryan and Tom Hanks.

Search on TAP can be accessed online at http://tap.stanford.edu.

1.2 User Interface

The user interface for the Search on TAP application is a basic browser-based search interface consisting of a single text entry box labeled "Query" and a submit button. This is familiar to users and is comparable to other search technologies. As the user types, suggestions are offered to aid the user in automatically completing their query. As shown in Figure 1, this auto-completion feature accelerates the search experience while also educating the user on the coverage of the Search on TAP knowledge bases.[1]

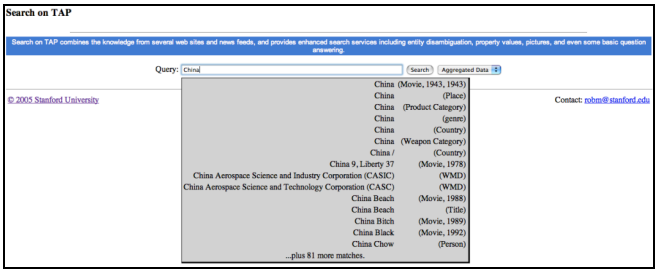

Figure 1: Entering a Query into Search on TAP

This functionality was included as a result of specific user feedback, discussed in section 2.2. Once a user submits a query (by typing a set of words into the query box) the system responds with two columns of results. On the left, Semantic Web-based entities matching the query are

[1] A full list of sources indexed by Search on TAP is available at http://sp11.stanford.edu/crawl-050210.html

displayed, while traditional keyword-search results are displayed on the right (see Figure 2).

Figure 2: Traditional & Search on TAP Results

Displaying results together in this manner enables Search on TAP to add value to the potentially ambiguous keyword results by providing another mechanism to narrow down ones primary search aim. After selecting a specific result, Figure 3 shows the additional query-specific details, including associated sources that are presented to the user.

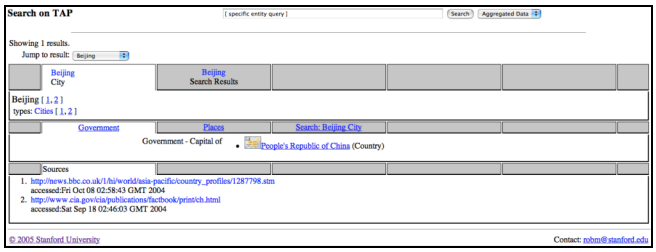

Figure 3: Detailed Information

2 Evaluation

A two-step process was used to evaluate the Search on TAP user experience. A heuristic evaluation of the component first allowed us to review the tool against common usability and consistency standards. The elements indicated by the review were re-designed, re-implemented, and reviewed in iterative fashion. After successful heuristic evaluation, the component was evaluated using a group of practicing analysts.

2.1 Heuristic Evaluation

Heuristic evaluation is a usability analysis method that utilizes history and experience to discover problems with a particular component. It involves performing some typical tasks using the component and then noting any disparities between of the component design and a checklist of user interface design principles. The heuristics used in this experiment follow Nielsen's [1994] checklist of design principles. These include ten general principles for user interface design including visibility of system status, consistency and standards, minimalist design, flexibility and efficiency of use, and help and documentation. A study conducted by two usability professionals at Battelle found 17 issues with the initial design. These included issues relating to speaking the users language (e.g., removal of overly technical prose within the user interface), error prevention (e.g., users could potentially enter a refinement query prior to entering the main query) and performance (e.g., a considerable amount of time passed without system status updates).

Solutions were identified for each issue and the component redesigned and re-implemented prior to a reevaluation. Once the component was deemed ready, the process proceeded to the user evaluation.

2.2 User Evaluation

Three Battelle analysts were recruited to help evaluate Search on TAP. They were recruited randomly from an available analyst pool and consisted of two females and one male, all aged within their 30s. The sessions highlighted a number of issues related to customizing such a tool for a specific domain. The participants had difficulty understanding the breadth of information behind Search on TAP. Being able to express that broadness while at the same time maintain expectations (that no tool will be able to answer everything) was a challenge. One solution to this problem was to provide an automatic completion capability (see Figure 1) that guided the user in selecting property names and values. Another highlight from the analyst sessions was the location of the Search on TAP results in relation to the traditional keyword results. Originally, Search on TAP results were shown on the right side of the screen. Due to familiarity with advertisements in popular search engine pages, users indicated they had "learned" to disregard anything on the right-hand side of such a page. The simple solution, shown in Figure 2, was to reverse the columns and provide Search on TAP results on the left side.

3 Summary

The evaluation of a semantic search application using heuristic and user-centered methods provided insight into users' preferences for interacting with semantic information. Subsequent design changes based on user feedback resulted in improvements to the application, leading to a more useful tool for a sample user population. The Search on Tap technology is currently undergoing more formal testing under a government-sponsored evaluation program.

Acknowledgments

The authors would like to thanks their respective teams at Stanford University and Battelle Pacific Northwest Division. This work is supported in part by the Advanced Research and Development Activity's Novel Intelligence from Massive Data (NIMD) program.

References

[Guha *et al.*, 2004a] R. Guha, R. McCool, and E. Miller. Semantic Search. In Proceedings of WWW 2004, Budapest, Hungary, 2003.

[Guha *et al.*, 2004b] R.V. Guha, Rob McCool, Richard Fikes, Contexts for the Semantic Web. In *Proceedings of the Third International Semantic WebConference*, Hiroshima, Japan, 2004.

[Nielsen, J., 1994] Jacob Neilsen. Heuristic evaluation. In Nielsen, J., and Mack, R.L. (Eds.), *Usability Inspection Methods*, John Wiley & Sons, New York, NY.

Search on TAP: Demonstration Details

Rob McCool
Knowledge Systems Lab
Stanford University
robm@ksl.stanford.edu

Andrew J. Cowell
Rich Interaction Environments Group
Battelle, Pacific Northwest Division
andrew.cowell@pnl.gov

David A. Thurman
National Security Directorate
Battelle, Pacific Northwest Division
thurmand@battelle.org

1 Overview

The purpose of Search on TAP is to assist in creating context for information. When we read articles on the Internet, there is no direct connection between reader and author so putting information into its proper context is difficult. We can't simply ask if a country with 50 million people is relatively large, or if a 100-kiloton warhead is big, or if a $50 million movie is expensive. It can also be difficult to ask for facts such as the height of a building or the speed of a type of airplane. Often text lacks some visual accompaniment (e.g., a photograph of an item) and this is limiting because seeing a picture of the actual item creates a mental image that is an important part of being able to understand the context (something that TV news try hard to provide). Search on TAP tries to make locating this sort of information, as well as putting together comparison groups for information evaluation, very easy. We believe that such Semantic Web techniques will provide richer end-user experiences than approaches that use traditional techniques. Semantic Web techniques enable more types of queries and can integrate data from more providers than other approaches.

2 Demonstration Details

The Search on TAP poster shall be presented along with an interactive demonstration of this technology. This can be viewed online at http://tap.stanford.edu. The demonstration shall highlight the four major types of query that benefit from our approach. These are ambiguous queries, entities with multiple names (aliases), group queries and comparative queries.

2.1 Ambiguous Queries

The word "Georgia" can mean many things. Even if one considers only things that are named "Georgia" and not something like "Georgia O'Keefe", there are still at least two places that are named Georgia: it is a United States state, and a country in the former Soviet Union. If one is looking for information about one or the other, things can get tricky in a hurry with a keyword based search engine. When searching for Georgia, Search on TAP displays suggestions for which Georgia the user may be referring to, and allows the user to narrow down the results based on that. When the user narrows down to one in particular, Search on TAP tries to augment the queries sent to traditional search engines in order to get better results.

2.2 Queries with Multiple Names

Is the terrorist group named Aum Shinrikyo, or Aum Supreme Truth? Is it China, People's Republic of China, or PRC? Things in the real world have many names, and users of keyword-based engines can often miss information if they don't know every name of the thing they are searching for. Search on TAP combines the keyword search results for all names of what the user is searching for, and the result is more information.

2.3 Group Queries

When a user is looking for a set of things that are in a particular group, traditional search engines can fail. For instance, "skyscrapers located in Chicago" is a query for which keyword engines do reasonably well, but "skyscrapers taller than 500 meters" is not a query they do well with. They also can't convert between English and Metric units to answer a query. More complex groupings, such as "skyscrapers located in Europe taller than 300m" become impossible. Search on TAP enables complex queries such as this and allows the user to browse the results and examine search results for all matching entities.

2.4 Queries with Multiple Names

Similar to group queries, comparative queries are queries that try to find entities that compare to other entities. An example would be "countries population greater than Spain". Other examples would be queries such as "skyscrapers taller than sears tower". These sorts of comparative queries are nearly impossible with keyword-based search engines, unless someone has already taken the time to find the answer to the query and publish a page using the exact words that the user puts in their query. Search on TAP has a query recognition system that recognizes comparative queries, finds the results, and presents them to the user in a form they can easily browse and compare.

Search on Tap will be demonstrated across each of these main query types, using some of the many complex examples shown at http://sp11.stanford.edu/examples.html.