

TREC-7 Experiments at the University of Maryland

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Abstract

The University of Maryland participated in three TREC-7 tasks: ad hoc retrieval, cross-language retrieval, and spoken document retrieval. The principal focus of the work was evaluation of merging techniques for cross-language text retrieval from mixed language collections. The results show that biasing the merging strategy in favor of documents in the query language can be helpful. Ad hoc and spoken document retrieval results are also presented.

1 Introduction

The principal goal of the University of Maryland's participation in the Seventh Text REtrieval Conference (TREC-7) was to evaluate the performance of alternative merging strategies for Cross-Language Information Retrieval (CLIR) from mixed language collections. The Logos machine translation system¹ was used in a fully automatic mode for query translation, and PRISE from the National Institutes of Standards and Technology was used for all runs. We participated in the Ad Hoc task as well in order to gain experience with PRISE, and we also used PRISE for Spoken Document Retrieval (SDR) track runs. No manual processing was done, and all of our runs were submitted in the automatic category.

2 Cross-Language Information Retrieval

As typically formulated, interactive information retrieval involves at least three stages: query formulation, searching the document collection using the query to identify a set of possibly relevant documents, and selection of desirable documents by the user [1]. CLIR potentially adds complexity to each stage. The focus of our work in the CLIR track at TREC has been on fully automatic techniques that are appropriate for the middle stage, finding possibly relevant documents when the query and document may not be in the same language. At TREC-6 we compared query translation and document translation approaches, finding little difference in overall retrieval effectiveness [2]. Query translation is the more efficient of the two approaches, and that advantage is magnified when documents in several languages are present in the collection as is the case in the TREC-7 CLIR track. We have thus chosen query translation as the basis for our experiments this year.

In TREC-6 we learned that language-specific processing such as stemming can have a substantial effect on retrieval effectiveness, a lesson that others have learned before [3]. In those experiments we used Inquiry version 3.1, which was capable of stemming English but not German. With long queries, we observed that indexing English translations of German documents (with stemming) gave better results than indexing the documents in German (without stemming or compound splitting). We initially believed that this gave evidence favoring document translation. After seeing the same effect on English (AP) documents, however, we now believe that the differences resulted from a failure to perform stemming or compound splitting in German.

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The TREC-7 CLIR track requires that documents in German, French, Italian, and English be processed. Since we had reliable *a priori* knowledge of the language contained in each portion of the collection, we used that knowledge to select appropriate language-specific processing. Documents in the AP collection were treated as English, documents in the “French SDA” collection were treated as French, documents in the “Italian SDA” collection were treated as Italian, and documents in both the “German SDA” and the “NZZ” collections were treated as German.

The Logos machine translation system can translate from English to French, German, Italian and Spanish. Our queries were thus based on the English topics. We began by translating the queries from English into each other language, using the Logos system in a fully automatic mode with no application-specific additions to the lexicon or semantic rules. We then formed title queries from the words in the title field, and long queries from every topic word except SGML markup, the contents of the query number field, and the terms “Description:” and “Narrative:” that appear in every query.

PRISE includes the Porter stemmer for English, a German stemmer implemented by Martin Braschler, and a French stemmer implemented by Jacques Savoy. We did not have an Italian stemmer, and no compound splitting was performed in any language. The stopword list from Inquiry version 3.1 was used in English, and degenerate stopword lists were used in the other languages (“le” in French, “die” and “dir” in German, and “du” in Italian — PRISE choked if the stopword list was empty). No stop-structure removal was performed. Separate PRISE indexes were built for each language, with the German index covering both the “German SDA” and the “NZZ” collections. Index construction required between two and four hours on a dedicated Sparc 20, depending on the number of documents in each language, and retrieval results for all 25 queries were typically computed in a few minutes (varying slightly with query length and whether stopwords were used). In our official runs we inadvertently omitted the 1989 and 1990 AP documents from the English index, and this adversely affected our official results. That has been corrected in the results reported here.

Vector space text retrieval systems such as PRISE typically produce retrieval status values that lack comparability across collections, so rank-based merging generally outperforms strategies based on the retrieval status values. Voorhees demonstrated that giving more weight to collections that are historically more productive can yield better results than a uniform rank-based merging strategy [5]. In TREC-6 we observed that machine translation of German queries into English achieved 56% of the average precision that was observed when English queries were used for monolingual retrieval, and we expected that a strategy which selected more documents from the English collection than from the other three collections would perform well. We thus implemented a uniform weighted merge in which the top N (not yet selected) documents were selected from English every time the top (not yet selected) document was selected in each of the other languages.

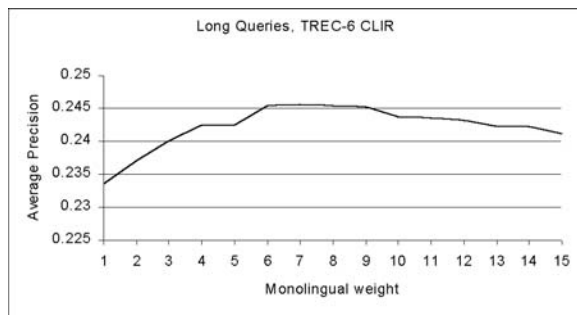


Figure 1: The effect of varying N on TREC-6 CLIR long queries.

In order to get some idea of a reasonable range for N , we tried our strategy on the TREC-6 CLIR collection. The TREC-6 document collection is a substantial subset of the TREC-7 document collection, lacking only the Italian SDA documents. A limited pool of participating systems may, however, have limited the completeness of the TREC-6 relevance judgments in some languages, and there were some differences in the way queries were formulated in the two evaluations. In our official runs we inadvertently omitted the 1990 or 1991 portions of the AP collection, artificially reducing the performance of the monolingual collection. Not surprisingly, $N = 1$ outperformed higher values of N under those conditions, so our two official TREC-7 CLIR submissions were produced with an even merging strategy ($N = 1$) on title (run umdxet) and long (run

umdxeof) queries. When we reran our experiments on the complete TREC-6 collection (after the deadline) we found that weighted merging outperformed even merging by about 5% on long queries (at $N = 6$), but that no more than a 0.3% advantage could be achieved on title queries (at $N = 1.4$). Figure 1 illustrates the long-query results. When the TREC-7 CLIR relevance judgments became available we observed a similar effect, achieving an 11% improvement on long queries (at $N = 9$) but only a 2% improvement on title queries (at $N = 5$). Figure 2 illustrates the long-query results. We have not determined whether any of these results are statistically significant.

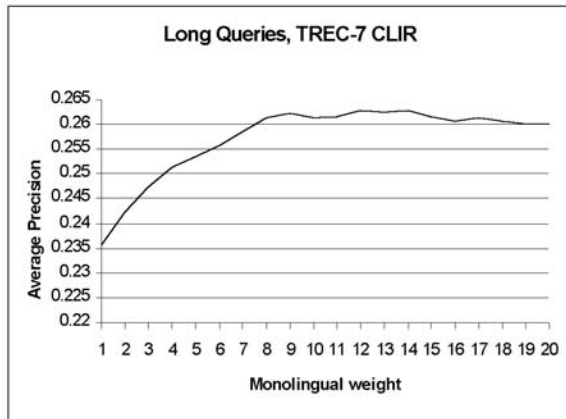


Figure 2: The effect of varying N on TREC-7 CLIR long queries.

3 Ad Hoc and Spoken Document Retrieval Tasks

We used our participation in the ad hoc retrieval task to become familiar with PRISE. The official run was submitted using the default term weighting strategy in PRISE, which does not do as well as the “okapi1” weights that we used for our CLIR and SDR experiments.

We are working on user interface design for information retrieval systems that provide access to large collections of recorded speech [4], and the SDR track offers an opportunity to gain additional experience with content-based retrieval using speech recognition output. Our speech recognition system was not ready in time for these runs, so we submitted results only for the baseline recognizer output. We used a modified version of PRISE for these experiments in which some changes had been made to the numerical details of retrieval status value computation, but a comparison with the original system revealed no significant differences in the ranked output. The Porter stemmer, okapi1 weights, and the Inquiry stopword list were the only deviations from the default settings in the indexer. Indexing took approximately 15 minutes for each of the three runs, and batch processing of the queries was completed in under a minute per collection. The queries used were identical for each of the three runs.

4 Conclusions

We have demonstrated one useful strategy for merging retrieval results from collections in different languages. As the richness of the TREC CLIR corpus grows, we hope to exploit it to investigate more sophisticated strategies. We are also interested in integrating automatic language identification in order to investigate a whether applications in which the document languages cannot be reliably determined from *a priori* information will pose substantially greater challenges. The TREC CLIR corpus also provides an excellent resource for evaluating other approaches to CLIR, and we hope to use it to explore both cognate matching and corpus-based techniques.

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