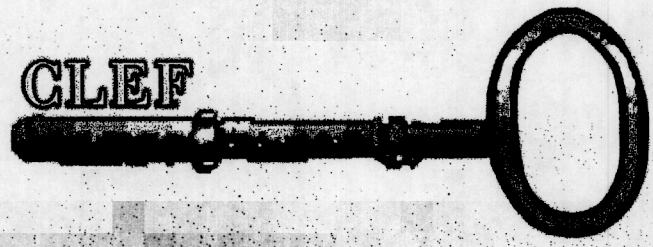
Cross Language Evaluation Forum



Results of the CLEF 2005 Cross-Language System Evaluation Campaign

EXTENDED ABSTRACTS

CLEF 2005 Workshop, 21-23 September, Vienna, Austria

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The Cross Language Evaluation Forum (CLEF) supports global digital library applications by (i) developing an infrastructure for the testing, tuning and evaluation of information retrieval systems operating on European languages in both monolingual and cross-language contexts, (ii) providing a forum for the discussion of results, and (iii) creating test-suites of reusable data which can be employed by system developers for benchmarking purposes.

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Information Society Technologies

SINAI at CLEF 2005: Multi-8 Two-Years-on and Multi-8 Merging-Only Tasks

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Abstract. This year, we participated in *multilingual two years on* and *Multi-8 merging-only* CLEF tasks. Our main interest has been to test several standard CLIR techniques and investigate how they affect the final performance of the multilingual system. Specifically, we have evaluated the information retrieval (IR) model used to obtain each monolingual result, the merging algorithm, the translation approach and the application of query expansion techniques. The obtained results show that by means of improving merging algorithms and translation resources we reach better results than improving other CLIR modules such as IR engines or the expansion of queries.

1 Introduction

In order to evaluate the relevance of several standard CLIR modules, we have made a combination between the collection fusion algorithm 2-step RSV and several IR systems. The 2-step RSV collection fusion algorithm is described in detail in [4,**?**]; we outline this algorithm below.

1.1 The Merging Algorithm

Briefly, the basic 2-step RSV idea is straightforward: given a query term and its translations into the other languages, its document frequencies are grouped together. Therefore, the method requires recalculating the document score by changing the document frequency of each query term. Given a query term, the new document frequency will be calculated by means of the sum of the monolingual retrieved document frequency of the term and their translations. In a first step the query is translated and searched on each monolingual collection. This phase produces a T_0 vocabulary made up by "concepts". A concept consists of each term together with its corresponding translations. Moreover, we obtain a single multilingual collection D_0 of preselected documents as a result of the union of the first 1000 retrieved documents for each language. The second step consists of creating a dynamic index by re-indexing the multilingual collection D_0, but considering solely the T_0 vocabulary. Finally, a new query formed by concepts in T_0 is generated and this query is carried out against this dynamic index.

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Thus, the first step of 2-step RSV consists of retrieving relevant documents for each language, and the alignment of the query and its translations.

This year we tested the performance of the algorithm using several information retrieval engines for each monolingual collection, and then applying the second step of the merging algorithm over the retrieved documents.

The relevant documents lists for the first step are retrieved by:

1. The ZPrise IR system with the OKAPI weighting function [6]
2. The IRn passage retrieval system [2]
3. Several relevant document lists available from the Multi-8 Merging-only task

2 Experimentation Framework

In the first step each monolingual collection is preprocessed as usual (token extraction, stopper, stemmer). In addition, compound words for German, Swedish, Finnish and Dutch are decompounded wheb possible. We use the decompounding algorithm depicted in [3]. The preprocessed collections were indexed by using the passage retrieval system IRn and ZPrise. The IRn system was modified in order to return a list of relevant documents, the documents that contain relevant passages. Then, given a query and its translations, all of them are searched in the corresponding monolingual collection.

Since we have used machine translation (MT) for several languages (MT translates the whole of the phrase better than word-by-word) and because 2-step RSV requires us to group together the document frequency for each term and its own translations, our merging algorithm is not directly feasible with MT (given a word of the original query, its translation to the rest of languages must be known). Thus, we propose in [3] a straightforward and effective algorithm in order to align the original query and its translations at term level. It aligns about 80-85% of non-empty words (Table 1).

The proposed alignment algorithm works fine, even though it does not obtain fully aligned queries. In order to improve the system performance when some terms of the query are not aligned, we make two subqueries. The first one is made up only by the aligned terms and the other is formed with the non-aligned terms.

Table 1. Percent of aligned non-empty words (CLEF2005 query set, Title+Description fields,)

Language	Translation resource	Alignment percent
Dutch	Prompt (MT)	85.4%
Finnish	FinnPlace (MDR)	100 %
French	Reverso (MT)	85.6%
German	Prompt (MT)	82.9 %
Italian	FreeTrans (MT)	83.8 %
Spanish	Reverso (MT)	81.5 %
Swedish	Babylon (MDR)	100 %

Thus, for each query every retrieved document obtains two scores. The first score is obtained with 2-step RSV merging algorithm over the first subquery. On the other hand, the second subquery is used in a traditional monolingual system with the respective monolingual list of documents.

Therefore, we have two scores for each query, the first one is calculated by using the dynamic and global index created by 2-step RSV for all languages, and the other one is calculated locally for each language. Thus, we have integrated both values. As a way to deal with partially aligned queries (i.e. queries with some terms not aligned), we implemented several ways to combine the aligned and non-aligned score in a single score for each query and retrieved document:

1. *Raw mixed 2-step RSV.* Combining the RSV value of the aligned words and non aligned words with the formula:

$$0.6 < RSVAlignedDoc > +0.4 < RSVNotAligned >$$

2. *Mixed 2-step RSV by using Logistic Regression.* The formula:

$$e^{\alpha \cdot < RSVAlignedDoc > + \beta \cdot < RSVNotAligned >}$$

3. *Mixed 2-step RSV by using Logistic Regression and local score.* The last one also uses Logistic Regression, but includes a new component the ranking of the document. It applies the formula:

$$e^{\alpha \cdot < RSVAlignedDoc > + \beta \cdot < RSVNotAligned > + \gamma \cdot < RankingDoc >}$$

4. *Mixed 2-step RSV by using Bayesian Logistic Regression and local score.* The last one is very similar to the previous approach, but is based on bayesian logistic regression instead of logistic regression.

Methods two, three and four required a training set (topics and their relevance assessments), which must be available for each monolingual collection.

We used the CLEF queries (140-160) and the relevance assessments available this year for training purposes. Therefore, twenty queries were used for training and the other forty were used for evaluation.

3 Expanding the Queries

Some experiments based on ZPrise used the pseudo-relevance feedback technique. We have adopted Robertson-Croft's approach [1], where the system expands the original query generally by 10-15 search keywords, extracted from the 10-best ranked documents. We chose this configuration because empirically it obtained better results than other configurations available with the ZPrise system.

The second step of the merging method does not make use of automatic query expansion techniques such as relevance feedback (RF) or pseudo-relevance feedback (PRF) applied to monolingual queries. Since RF and PRF extend every

Table 2. Percent of aligned non-empty words (CLEF2005 query set+PRF, Title+Description fields)

Language	Alignment percent
Dutch	45.02 %
Finnish	59.97 %
French	48.11 %
German	42.23 %
Italian	44.69 %
Spanish	45.11 %
Swedish	51.2 %

monolingual query with collection-dependent words, the reindexing process (second step of 2-step RSV) will not take into account of all these words.

Because such words are not the same for each monolingual collection, and the translation to the other languages is unknown, our merging method ignores these new terms for the second step.

However, overall the performance will improve since PRF and RF improve on monolingual experiments and usually some extended terms are similar with terms of the original query, and such terms will be aligned. The rest of the expanded terms are integrated as non-aligned terms, by using the approaches depicted in section 2 for mixed 2-step RSV. Of course, the percentage of non-aligned words increases because of the application of PRF. Table 2 shows the percentage of aligned words for expanded queries by using PRF and Machine Translation.

4 Experiments and Results

Tables 3, 4, 5 show our official results. In order to evaluate the translation approach effect in the multilingual result, we recovered some old experiments from CLEF 2003 for 161-200 CLEF queries (experiment ujarsv2_2003). These experiments were based on Machine Dictionary Readable resources, and we compare them with the results of this year (experiment UJARSV2), based on Machine Translation. In order to evaluate the effect of query expansion we developed experiments ujaprfrsv2 and UJAPRFRSV2RR. Finally, experiments UJARSV2RR, UJAUARSV2RR, UJAMENEOKRR or UJAMENEDERR use several IR systems and models to obtain the lists of retrieved documents.

This table shows some interesting results:

- Note that the improvement for this year is considerable if compared to 2003, mainly because of a better translation strategy.
- In spite of the very different performance of the bilingual experiments (Table 6), final multilingual average precision is very similar independent of the selected documents for each IR system.
- Since the simultaneous application of PRF and Machine Translation dramatically decreases the percentage of aligned words, the application of PRF very slightly improves the final result.

Table 3. Multilingual experiments (I). Experiments with capital letters are official. The "main feature" is some particularity of each experiment in respect of the case base experiment. The name of the experiments: UJA[UA][PRF]RSV2[RR][_2003] means Univ. of Jaén[IRn system from Univ. of Alicante used][PRF used]2-step RSV merging algorithm[logistic regression used][CLEF 2003 results].

Experiment	Main feature	AvgP
UJARSV2	Case Base (OKAPI ZPrise IR, no PRF, MT, raw mixed 2-Step RSV)	28.78
ujaprfrsv2	UJARSV2+PRF	29.01
UJARSV2RR	different merging algorithm (see Table 4)	29.19
UJAPRFRSV2RR	UJARSV2RR+PRF	29.57
ujarsv2_2003	it uses MDR instead of MT	24.18
ujauarsv2	it uses IRn IR engine	28.81
UJAUARSV2RR	it uses IRn IR engine and a different merging algorithm	29.18

Table 4. Merging approaches. Experiments with capital letters are official.

Experiment	2-step RSV approach
UJARSV2	Raw mixed 2-step RSV
ujaprfrsv2	Raw mixed 2-step RSV
UJARSV2RR	Mixed 2-step RSV by using Logistic Regression and local score
UJAPRFRSV2RR	Mixed 2-step RSV by using Logistic Regression and local score
ujarsv2_2003	2-step RSV
ujauarsv2	Raw mixed 2-step RSV
UJAUARSV2RR	Mixed 2-step RSV by using Logistic Regression and local score

Table 5. Multi-8 merging-only experiments. Experiments with capital letters are official. "Documents" are several sets of relevant documents available for the task from Neuchatel Bilingual Runs from CLEF 2003 .

Experiment	Documents	Merging algorithm	AvgP
ujamenepr	Prosit	Raw mixed 2-step RSV	28.40
ujameprrr	Prosit	Mixed 2-step RSV by using Logistic Regression and local score	28.34
UJAMENEOK	Okapi	Raw mixed 2-step RSV	28.87
UJAMENEOKRR	Okapi	Mixed 2-step RSV by using Logistic Regression and local score	28.87
UJAMENEDF	DataFusion	Raw mixed 2-step RSV	29.42
UJAMENEDFRR	DataFusion	Mixed 2-step RSV by using Logistic Regression and local score	30.37

Table 6. Some bilingual results (except English which is a monolingual experiment)

Language	UJARSV2	ujaprfrsv2	UJAUARSV2RR	UJAMENEOKRR	UJAMENEDFRR
Dutch	30.94	38.71	34.03	35.15	44.94
English	52.06	50.73	50.96	50.29	55.71
Finnish	34.11	31.01	33.47	14.27	22.26
French	42.14	39.90	42.84	50.26	55.29
German	33.01	37.03	33.99	41.09	52.89
Italian	33.38	34.98	34.82	44.87	53.53
Spanish	37.35	40.63	39.68	43.73	51.07
Swedish	23.29	24.99	25.23	31.29	47.28

– Good performance of the raw-mixed 2-step RSV, obtaining a result very near to the result reached by means of logistic regression and neural networks. This result is counterintuitive since the method adds two values which are not directly comparable: the score obtained by both aligned and non-aligned terms. Some of the reasons for this good result are:
  - α parameter limits the weight of the unaligned factor.
  - Not all the terms to be added to the original query are new terms since some terms obtained by means of pseudo-relevance feedback are in the initial query. Thus, these terms are aligned terms. In the same way this explains the good performance of the original 2-step RSV method with expanded queries.
  - Only 20 queries were available for training.
  - The CLEF document collections are highly comparable (news stories from the same period). The results might be different if the collections have vastly different sizes and/or topics.

Thus, the 2-step RSV reaches the same precision in spite of using different IR systems. This is a drawback if the IR system used for the first step implements an IR model more sophisticated than the IR model implemented for the second step of the algorithm. In such a situation, the improvement is not fully exploited by the 2-step RSV merging algorithm because the 2-step RSV creates a dynamic index based on classic document retrieval models (more precisely the dynamic index is created by using a document-based OKAPI weighting scheme). So, what should we do to improve these results?. Since the second step is basically an OKAPI IR engine, we could improve such engine by using better IR models, and improving the translation and alignment processes.

5 Conclusions

In this work, we have tested the merging algorithm 2-step RSV in several ways. We have compared the CLEF 2003 and CLEF 2005 Multi-8 results, by using CLEF 160-200 queries. This year we obtained better results than in the 2003

edition. The main reason is a better translation approach and a more refined version of the merging algorithm.

The results obtained show that the improvement of merging algorithms and translation resources are higher than the improvement obtained by expanding the query by means of pseudo-relevance feedback.

In the same way, the improvement in the monolingual IR System used to retrieve each monolingual list of documents obtains very slightly better results in the final multilingual system. In order to evaluate the impact of the monolingual IR system, we have evaluated several lists of retrieved documents by using two IR systems and some of the retrieved documents available for the Multi-8 Merging-only task, but holding the same translation approach and merging algorithm. Results show that the precision is very similar independent of the monolingual IR engine. We conclude that improvements in the selection of documents by using some monolingual IR engine is not fully exploited by the 2-step RSV merging algorithm since this algorithm creates a dynamic index based on classic document retrieval models.

When pseudo-relevance feedback and machine translation is applied in the same experiment, the percentage of aligned words is too low to optimally apply some mixed variant of 2-step RSV. Thus, a more effective word alignment algorithm must be developed, especially for the new terms added to the query by means of PRF.

Finally, we think that the overall performance of the CLIR system will be improved if we develop better translation strategies and we improve the IR model used for the creation of the dynamic index for the second step of the algorithm.

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References

1. D. K. Harman: Relevance Feedback Revisited. In N. J. Belkin, P. Ingwersen, and A. M. Pejtersen, editors, *Proceedings of the 15th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR-92)*, pages 1–10. ACM, 1992.
2. F. LLopis: University of Alicante at CLEF 2002. In C. Peters, M. Braschler, J. Gonzalo, and M. Kluck, editors, *Advances in Cross-Language Information Retrieval, Third Workshop of the Cross-Language Evaluation Forum (CLEF 2002)*, Rome, pages 103–110, 2003.

3. F. Martínez-Santiago, M. García-Cumbreras and L. A. Ureña: SINAI at CLEF 2004: Using Machine Translation Resources with Mixed 2-Step RSV Merging Algorithm. *Multilingual Information Access for Text, Speech and Images: 5th Workshop of the Cross-Language Evaluation Forum*, Bath, page 156-164, 2005.
4. F. Martínez-Santiago, M. Martín, and L.A. Ureña: SINAI at CLEF 2002: Experiments with Merging Strategies. In C. Peters, M. Braschler, J. Gonzalo, and M. Kluck, editors, *Advances in Cross-Language Information Retrieval, Third Workshop of the Cross-Language Evaluation Forum (CLEF 2002)*, Rome, pages 103–110, 2003.
5. F. Martínez-Santiago, L. A. Ureña, and M. Martín: A Merging Strategy Proposal: Two Step Retrieval Status Value Method. *Information Retrieval*, 9(1):95–109, 2006.
6. S. E. Robertson and S. Walker. Okapi-Keenbow at TREC-8. In *Proceedings of the 8th Text Retrieval Conference TREC-8, NIST Special Publication 500-246*, pages 151–162, 1999.