

# Translation approaches for Cross-Language Information Retrieval (CLIR)

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**Abstract**—This research paper presents and evaluates the issue of providing systems for CLIR. Different translation approaches are first elaborated and then compared. The two studied issues elaborate what and how to translate.

## I. INTRODUCTION

PEOPLE may write a query in one language and understand answers given in another. This is for instance when regarding very short text in Question and Answer format or just factual information for travel. Many documents contain non-textual information such as images, videos and statistics that can be understood regardless of the language involved and do not need translation.

Next to the two most common working languages in the European Union English and French there are 22 other official languages. While the EU encourages all its citizens to be able to speak two languages in addition to their mother tongue many are not bilingual. [1] Others can read documents written in another language but cannot formulate a query to search it, or at least cannot provide reliable search terms in a form comparable to those found in the documents being searched. The challenge is "given a query in any medium and any language, select relevant items from a multilingual multimedia collection which can be in any medium and any language, and present them in the style or order most likely to be useful to the querier, with identical or near identical objects in different media or languages appropriately identified." [2]

For the within-language retrieval the implementation is essentially separated into two phases, namely an indexing and a matching phase. Such a system first indexes the documents offline in advance and then in the second step reacts online to the users query. To retrieve documents across languages, that is written in languages different from the language used for query formulation, the classic information retrieval mechanisms have to be extended by Cross-Language Information Retrieval systems. There is a difference between what they translate (such as the query or document only or a combination of both) and how they translate (either using machine-readable dictionaries, with machine translation or applying a statistical approach). This system manages a language mismatch between query and parts of the document collection where either:

- the document collection is monolingual, but the users can formulate queries in a different language.
- the document collection contains documents in multiple languages and users can query the entire collection in any language.

- the document collection contains documents with mixed-language content and users can query the entire collection in any language.

A Multilingual Information Retrieval (MLIR) system covers all the above cases plus the basic within-language retrieval. There are four choices for crossing the language gap between query and documents. We can either:

- 1) translate the query into the language of the documents
- 2) translate the documents into the language of the query
- 3) translate both the query and the documents into an intermediary language
- 4) translate nothing

There are direct advantages and disadvantages to all options. With the second choice the whole corpus has to be translated which uses more storage space with each covered language and is a time-consuming process. With improving translation systems the whole document collection has to be periodically re-translated to take advantage of these improvements. However the whole translation process can be shifted to the offline portion and avoids any speed penalty at retrieval time. Also the context of terms is available and helps disambiguate words with multiple meanings. On the contrary in the first choice only the words in the query (which is usually short) are translated and avoids these problems. However, since user queries tend to be short and thus offer little context to handle ambiguous terms. The third choice can be used if there is no direct translation available or the quality is poor and the extra translation results in a better retrieval. For similar languages such as in the Nordic languages Danish, Swedish and Norwegian the query might not need to be translated based on the similar vocabulary and with a spelling correction algorithm one language can be seen as a mis-spelled form of another.

Before applying any translation method the text in question has to be preprocessed. In general the text is transformed to lowercase to improve matching regardless of the capitalization (for instance when the word is at the beginning of a sentence). Compound words that don't exist in the target language have to be segmented and on the other hand tokens have to be compounded to represent a meaningful word. The German word "Bundesbankpräsident" should be decompounded to "Bund" + "es" + "Bank" + "Präsident" which is then translated to "federal bank CEO". Conversely when translating the Chinese word 中国人 to the English language the three logograms when segmented mean "middle" "kingdom" and "people" which should be compounded and translated to "Chinese".[3] Additionally the text is modified

using a stemmer which conflates different token of the same word type. For instance the singular and plural form (like "horse" and "horses") or different grammatical cases (such as the English noun "Prague" in the Czech language where the dative form is "Praze" and the genitive form is "Prahy" are merged with the nominative form "Prah" <sup>1</sup>). Sometimes a stopword list is applied to remove frequent and insignificant terms with the goal to reduce the size of the inverted file. Such a list may contain only one term ("the") as in the WIN system (Thomson Reuters), nine terms ("an", "and", "by", "for", "from", "of", "the", "to", "with") as suggested by the DIALOG system or may like the SMART system include 571 words (e.g. "a", "all", "are", "is", "it", "just", "while", "who", "with", ...).

There are some problems that come with the translation. One of the most prominent problem is the insufficient lexical coverage where some words have no translation such as for abbreviations or names. This can be countered by using a specialized thesauri with names of persons ("Gorbachev" in English and "Gorbatschow" in German), arts ("Mona Lisa" in English is "La Gioconda" in Italian) and cities ("Lisbon" in English is "Lisboa" in Portuguese) and a dictionary for codes ("WHO" in English is "OMS" in French). Depending on the previously applied stopword list there might have been new problems introduced. The query "vitamin A" is transformed to "vitamin" when using the SMART system. In this case any document referring to any vitamin is retrieved even if it is about the vitamin C that is of no use for the querier. The same problems appear for the queries "IT engineer" and "WHO goals". Assuming the systems applies a stopword list that preserves the word "who" but uses a dictionary of codes. In this case the query "Who won the Tour de France in 1995" could be translated to "OMS gagné le tour de France en 1995".

## REFERENCES

- [1] TNS Opinion and European Commission. Europeans and their Languages. *Special Eurobarometer 386*, 2012.
- [2] Doug Oard and David Hull. AAAI Symposium on Cross-Language IR. Stanford, Spring 1997.
- [3] Jacques Savoy. Information Retrieval and the Internet: Beyond just English - CLIR. University of Neuchâtel, Spring 2013.
- [4] Tim Gollins and Mark Sanderson. Improving Cross Language Information Retrieval with Triangulated Translation. In *SIGIR*, pages 90–95, 2001.
- [5] Carol Peters, Martin Braschler, and Paul Clough. *Multilingual Information Retrieval - From Research To Practice*. Springer, 2012.
- [6] Jacques Savoy and Ljiljana Dolamic. How effective is Google's translation service in search? *Commun. ACM*, 52(10):139–143, 2009.
- [7] Kun Yu and Junichi Tsujii. Bilingual Dictionary Extraction from Wikipedia. *Proc. Of Machine translation Summit XII*, 2009.

## II. STATE OF THE ART

Most important previous work  
Summarize them  
limit of current practices

## III. FORMALISM

Notation used  
Example

## IV. EVALUATION

Benchmarks  
Interpretation

## V. CONCLUSION

Recap main idea  
Main results found  
Improvements/applications  
[4] [5] [6] [7]

<sup>1</sup>People sometimes use "Prah" in English instead of Prague but mostly forget to decline it. It would obviously be "to be in Praze" and "go to Prahy".