Retrieving Images
Using Cross-Language Text and Image Features

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Abstract. We present a report on our participation in the English-Indonesian image ad-hoc task of the 2005 Cross-Language Evaluation Forum (CLEF). We chose to translate an Indonesian query set into English using a commercial machine translation tool called *Transtool*. We used an approach that combines the retrieval results of the query on text and on image. We used query expansion in our effort to improve the retrieval effectiveness. However, worse retrieval effectiveness was resulted.

1 Introduction

This year we (the IR Group of the University of Indonesia) participated in the bilingual ad-hoc task of the CLEF cross-language image retrieval campaign (ImageCLEF) [5], e.g. Indonesian to English CLIR. We used a commercial machine translation software called *Transtool*[1] to translate an Indonesian query set into English. We learned from our previous work [1, 2] that freely-available dictionaries on the Internet failed to provide correct translations for many query terms, as their vocabulary was very limited. We hoped that we could improve the result using machine translation.

2 The Query Translation Process

As a first step, we translated the original query set from CLEF into Indonesian. Then this Indonesian version of the query set was translated back into English using *Transtool.* After deleting stopwords from the translated English queries, the words were then stemmed using a Porter stemmer. The resulting queries were then used to find relevant documents in the collections.

2.1 Query Expansion Technique

Expanding translation queries by adding relevant terms has been shown to improve CLIR effectiveness. Among the query expansion techniques is the *pseudo relevance*

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[1] See http://www.geocities.com/cdpenerjemah/

feedback [3, 5]. This technique is based on an assumption that the top few documents initially retrieved are indeed relevant to the query, and so they must contain other terms that are also relevant to the query. The query expansion technique adds such terms into the translated queries. We applied this technique to this work. To choose the good terms from the top ranked documents, we used the *tf*idf* term weighting formula [3, 5]. We added a certain number of noun terms with the highest weight values.

2.2   Combining the Scores of Text and Image

The short caption that attached to each image in the collections was indexed using *Lucene*[2], an open source indexing and retrieval engine, and the image collection was indexed using GIFT[3]. We combined the scores of text and image retrieval in order to get a better result. The text was given more weight because the image retrieval effectiveness that we obtained from using GIFT was poor. We used the two examples given by CLEF and ran them as query by example through GIFT to search through the collection. We combined the color histogram, texture histogram, the color block, and the texture block in order to get the images that are most similar to the two examples. The text score was given a weight of 0.8 and the image score was given 0.2. These weights were chosen after comparing a number of different weight configurations in our initial experiments.

3   Experiment

The image collection contains 28,133 images from the St. Andrews image collection that have short captions in English. We participated in the bilingual task using Indonesian query topics. We opted to use the query title and the narrative for all of the available 28 topics. The query translation process was performed fully automatic using the *Transtool* machine translation software.

   We then applied the pseudo relevance-feedback query-expansion technique to the translated queries. We used the top 20 documents from the *Glasgow Herald* collection to extract the expansion terms.

   In these experiments, we used the *Lucene* information retrieval system to index and retrieve image captions (text).

4   Results

Our work was focused on the bilingual task using Indonesian queries to retrieve images from the image collections. The machine translation tool failed to translate three words in the titles and eight words in the narratives. In particular, the machine translation failed to translate Indonesian names of places or locations such as *Skotlandia* (Scotland), *Swis* (Swiss), and *Irlandia* (Ireland) into English. The average number of words in the queries was largely the same as the resulting English version.

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[2] See http://lucene.apache.org/
[3] See http://savannah.gnu.org/projects/gift/

Table 1 shows the result of our experiments. The retrieval performance of the translation queries obtained using the machine translation-based technique falls below the equivalent monolingual query.

Table 1. Average retrieval precision of the monolingual runs using English queries

Query	Monolingual	Bilingual
Title	0.3538	0.2122 (-40.02%)
Narrative	0.3463	0.1781 (-48.57%)
Title + Narrative	0.3878	0.2082 (-46.31%)

The retrieval precision of the translated title queries was below that of the monolingual retrieval, i.e. by 40.02%. The retrieval effectiveness of translated narrative queries was 48.57% below that of the monolingual retrieval. The retrieval effectiveness of combined translated title and narrative queries was 46.31% below that of the monolingual retrieval.

Table 2. Average retrieval precision of the bilingual runs using Indonesian queries that were translated into English using machine translation

Task : Bilingual	P/R
Title	0.2122
Title + Expansion	0.1485
Title + Image	0.2290
Title + Narrative	0.2082
Title + Narrative + Expansion	0.1931
Title + Narrative + Image	0.2235
Narrative	0.1781
Narrative + Expansion	0.1586
Narrative + Image	0.1981

The retrieval performance of the translated queries using machine translation was best for title only (see Table 2). The effectiveness of narrative-only retrieval was 16.06% worse than that of the title only. By taking the image score into account, in addition to text, the results showed some improvement. For the title-based retrieval, the image score increased the average retrieval precision by 7.91%; for the narrative-based retrieval, the image score increased the average retrieval precision by 11.22%. However, the query expansion technique did not improve the retrieval performance. It decreased the retrieval performance of the title-only retrieval by 30.01% and narrative-only retrieval by 10.94%.

The retrieval effectiveness of combining title and narrative was 1.88% worse than that of the title only retrieval, but was 14.45% better than the narrative only retrieval. The query expansion also decreased the retrieval performance by 7.25% compared to the combined title and narrative queries. Adding the weight of the image to the combined title and narrative scores helped to increase the retrieval performance by 7.34%.

5   Summary

Our results demonstrate that combining the image with the text in the image collections result in better retrieval performance compared to using text only. However, query expansions using general newspaper collections hurt the retrieval performance of the queries. We hope to find a better approach to improve the retrieval effectiveness of combined text and image-based retrieval.

References

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