# Osaka Kyoiku University at NTCIR-10 CrossLink-2

## - Link Filtering by Title Tag of Corpus as a Dictionary -

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## [1] Introduction

- OKSAT submitted two types of runs named SMP and REF for every subtasks of NTCIR-10 Cross-lingual Link Discovery (CLLD).
- SMP corresponds to our submitted runs OKSAT-(CJK2E|E2CJK)-A2F-01-SMP.
- REF corresponds to OKSAT -(CJK2E|E2CJK)-A2F-01-REF.
- Using titles in Wikipedia pages (corpus) of source language as entries of a dictionary.

## [1] Introduction - Cnt'd

- SMP : aimed to discover cross-lingual links of actual Wikipedia, in other words it targets Wikipedia ground truth.
  — top performance : E2J-F2F-GT; E2K-F2F-GT; C2E-F2F-GT; J2E-F2F-GT; K2E-F2F-GT; J2E-F2F-MAN
- REF : aimed to discover as much meaningful cross-lingual links as possible automatically.

## [2] Our Approach

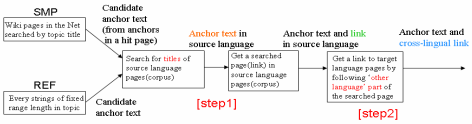


Figure 1. Process to get anchor texts and cross-lingual links.

## [2-1] Extracting Candidate Anchor Text

- SMP get the candidate anchor texts as anchor text of Wiki page (written in source language) in the Internet retrieved by title of each topic.
- REF makes the candidate anchor texts of every string (grams) in the fixed range length from each topic body.

topic body : ABCD
candidate anchor text :
A, AB, ABC, B, BC, BCD, C, CD, D

Figure 2. Example of topic body and candidate anchor texts generated. [range: 1-3]

## [2-2] Filtering Candidate Anchor Text

- For both type of runs, the candidate anchor texts are filtered by the following two steps.
- [step1] They should match a title of a pages in source language corpus.
  — REF : Sub-strings which are included in a longer string is abandoned, even if they match titles.
- [step2] Then there are links from the page of step1 to pages of target language corpus.

## [2-3] Getting Cross-lingual Link

- In step1, links in matched page are extracted.
- In step2, by following 'other language' part of the searched page we get links to the pages of target language corpus as cross-lingual links.

## [2-4] Ranking Link

- In order to rank anchor text (word) of links by probabilistic model, the indices to retrieve anchor text not only in topics but also in corpus quickly are inevitable.
- Indices for corpus of each language are made by 'variable length gram encoding in fixed byte' method.
- In preparation we examine distribution of UTF-8 characters in each corpus.
- Set of characters (alphabet) which appear more than 6 times (for CJK) or 11 times (for English) in each corpus is coded by Huffman coding.
  In other words, very rare characters are ignored because they do not seemed to be retrieved as anchor text of topics.
- Then we made grams in fixed 6 byte length from characters coded.

## [3] Experimental Results

- The programs for SMP and REF are constituted along with the flow shown in Figure 1.
- The parameter of fixed length range in REF is set between 6 to 60bytes, i.e. 2 to 20 characters of UTF-8 3byte code.
- We omit length one character strings from candidate anchor texts because many meaningless texts for anchors are extracted at present.

## [3] Experimental Results - Cnt'd

- Environment of experiment.

| | |
|---|---|
| CPU | Intel Corei5-3570@3.40GHz 4C/4T |
| Memory | DDR3-1600 4Gx2 |
| HDD | SATA300 500GB 7200rpm 16MBbuf |
| OS | FreeBSD 8.3 |
| Programming Language | C, Perl 5.12 |

## [3] Experimental Results - Cnt'd

- Execution time (sec) for 'extracting candidate anchor text', 'filtering candidate anchor text', and 'getting cross-lingual link' (2.1-2.3) about SMP and REF.

| subtask | SMP | REF |
|---|---|---|
| C2E | 0.22 | 2.9 |
| J2E | 0.38 | 5.6 |
| K2E | 0.13 | 1.6 |
| E2C | 0.38 | 8.8 |
| E2J | 0.40 | 8.8 |
| E2K | 0.38 | 8.8 |

## [3] Experimental Results - Cnt'd

- Indexing : alphabet size, index size, indexing time, and average/max gram length.
- English characters are expressed in 1 byte and most CJK characters are expressed in 3 byte in UTB-8, so the number of English characters is 3 times more than that of CJK per byte.

| language | alphabet size | index size (GB) | time (min.) | gram length average/max |
|---|---|---|---|---|
| Chinese | 18,065 | 2.13 | 98 | 3.58 / 12 |
| English | 11,845 | 24.81 | 1156 | 3.73 / 15 |
| Japanese | 12,116 | 5.66 | 250 | 3.17 / 11 |
| Korean | 12,105 | 1.10 | 58 | 3.61 / 11 |

## [4] Links and Anchors

- Submitted run REF (OKSAT-(CJK2E|E2CJK)-A2F-01-REF) is aimed to discover as much meaningful cross-lingual links as possible automatically.
- So, we are interested in the number of links and anchor texts.

## [4-1] Topic by Topic

- Figure 3(a), (b), and (c) show the number of links of SMP and REF in CJK2E subtask.
- In this figure, topic-id is in horizontal, and SL (the number of links of before 'Get links to target language pages' in Figure 1) and TL (that of after) are in vertical.
- It turns out that the number of links in REF is more than that of SMP in any topic.
- From SL (links in source language) to TL (links in target language), we know how these links are filtered.

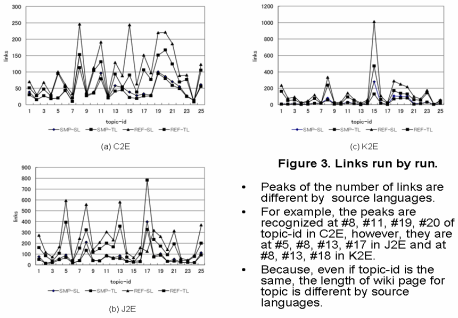


Figure 3. Links run by run.

- Peaks of the number of links are different by source languages.
- For example, the peaks are recognized at #8, #11, #19, #20 of topic-id in C2E, however, they are at #5, #8, #13, #17 in J2E and at #8, #13, #18 in K2E.
- Because, even if topic-id is the same, the length of wiki page for topic is different by source languages.

- Figure 4(a) and (b) show the number of links of SMP and REF in E2CJK subtask. Because SL is only for English, TLs of CJK are put in a same figure for SMP and REF.
- The differences of the number of cross-lingual links by target languages are not so large as the size of corpus of their languages.

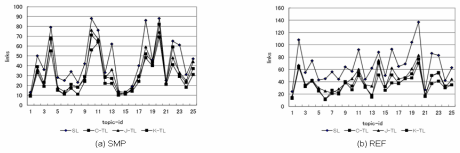


Figure 4. Links run by run for E2CJK.

## [4-2] Subtask by Subtask

- Figure 5 shows the total number of links of qrels assessed by organizer, that is A2BWikiManualResultSet-(CJK2E|E2CJK).xml (MAN in this figure) and REF over topics for each subtasks.

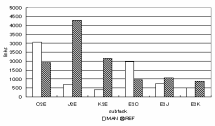


Figure 5. Links subtask by subtask.

•REF is about 6 times more than MAN in J2E subtask.

## [4-2] Subtask by Subtask - Cnt'd

- For ja-topic 9543.xml (title is 猪八戒), the anchor text of REF is following 74 words (with no duplication).
  文字,四大奇書,小説,西遊記,キャラクター,台湾,中国語,ブタ,イノシシ,意味,逸話,朝鮮,近似,発音,名字,皇帝,天の川,設定,摩利支天,将軍,刑罰,人間,妖怪,群れ,投し,妖怪,彼女,天竺,経典,観音菩薩,菩薩,慈悲,意志,精進料理,家畜,世間,玄奘三蔵,孫悟空,一行,三蔵,普通,沙悟浄,仏教,煩悩,殺生,飲む,シーン,義務,コミ,力ル,性格,太鼓,怪力,食欲,乗天,武器,熊手,農具,太上老君,速度,自由,性格,長寿,果実,理解,日本,ラム,イスラム教,存在,名前,天帝,繍養子,新聞,随筆家
- On the other hand, that of MAN is following 16 words.
  西遊記,フィクション,中,登場キャラ,ブ,イノ,天,天の川,摩利支天,黒,天竺,経,精進,化け物,玄奘,沙悟浄
- The number of links of MAN is more than that of REF in C2E and E2C subtask.
- The main difference we observed is that the number of links per anchor text is one in REF, however, it is one or more in MAN.
- We think that the notation and synonym expansion of anchor text are effective.

## [5] Conclusions

- Our group (OKSAT) submitted two types of runs named SMP and REF for every subtasks of NTCIR-10 Cross-lingual Link Discovery (CLLD).
- Our method uses titles in Wikipedia pages (corpus) of source language as a entries of a dictionary, so no external dictionary is required.
- For SMP, we aimed to discover cross-lingual links of actual Wikipedia, in other words it targets Wikipedia ground truth.
- For REF, on the other hand, we aimed to discover as much meaningful cross-lingual links as possible automatically.
- SMP work well although there is room for improvement.
- About REF, we recognized that continuous improvement is required.