Findings of the WMT 2016 Bilingual Document Alignment Shared Task

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Abstract

This paper presents the results of the WMT16 Bilingual Document Alignment Shared Task. Given crawls of web sites, we asked participants to align documents that are translations of each other. 11 research groups submitted 19 systems, with a top performance of 95.0%.

1 Introduction

Parallel corpora are especially important for training statistical machine translation systems, but so far the collection of such data within the academic research community has been ad hoc and limited in scale. To promote this research problem we organized a shared task on one of the core processing steps in acquiring parallel corpora from the web: aligning bilingual documents from crawled web sites.

The task is to identify pairs of English and French documents from a given collection of documents such that one document is the translation of the other. As possible pairs we consider all pairs of documents from the same webdomain for which the source side has been identified as (mostly) English and the target side as (mostly) French.

Lack of data in some cases has held back research. To give an example, there are significant research efforts on various Indic languages (Post et al., 2012; Joshi et al., 2013; Singh, 2013), but this work has been severely hampered, since it uses very small amounts of data. But even for the language pairs tackled in high profile evaluation campaigns, such as the ones organized around WMT, IWSLT, and even NIST, we use magnitudes of data less than what has been reported to be used in the large-scale efforts of Google or Microsoft. This diminishes the value of research findings: reported improvements for methods may not hold up once more data is used. Work in reduced data settings may also distract from efforts to tackle problems that do not go away with more data, but are inherent limitations of current models.

2 Related Work

Although the idea of crawling the web indiscriminately for parallel data goes back to the 20th century (Resnik, 1999), work in the academic community on extraction of parallel corpora from the web has so far mostly focused on large stashes of multilingual content in homogeneous form, such as the Canadian Hansards, Europarl (Koehn, 2005), the United Nations (Rafalovitch and Dale, 2009; Ziemski et al., 2015), or European Patents (Täger, 2011). A nice collection of the products of these efforts is the OPUS web site1 (Skadiņš et al., 2014).

These efforts focused on individual web sites allow for writing specific rules for aligning documents as well as extracting and aligning content. Scaling these manual efforts to thousands or millions of web sites is not practical.

A typical processing pipeline breaks up parallel corpus extraction into five steps:

- Identifying web sites with bilingual content
- Crawling web sites
- Document alignment
- Sentence alignment
- Sentence pair filtering

For each of these steps, there has been varying amount of prior work and for some tools are readily available. Since there has been comparatively little work on document alignment, we picked this problem as the subject for the shared task this year, but other steps are valid candidates for future tasks.

1http://opus.lingfil.uu.se/
2.1 Web Crawling

Web crawling is a topic that has not received much attention from a specific natural language processing perspective. There are a number of challenges, such as identification of web sites with multilingual content, avoiding to crawl web pages with identical textual content, learning how often to re-crawl web sites based on frequency of newly appearing content, avoiding crawling of large sites that have content in different languages that is not parallel, and so on.

We used for the preparation of this shared task the tool Httrack\(^2\) which is a general web crawler that can be configured in various ways. Papavasiliou et al. (2013) present the focused crawler ILSP-FC\(^3\) that integrates crawling more closely with subsequent processing steps like text normalization and deduplication.

2.2 Document Alignment

Document alignment can be defined as a matching task that takes a pair of documents and computes a score that reflects the likelihood that they are translations of each other. Common choices include edit-distance between linearized documents (Resnik and Smith, 2003), cosine distance of idf-weighted bigram vectors (Uszkoreit et al., 2010), and probability of a probabilistic DOM-tree alignment model (Shi et al., 2006).

2.3 Sentence Alignment

The topic of sentence alignment has received a lot of attention, dating back to the early 1990s with the influential Church and Gale algorithm that is language-independent and easy to implement. It relies on relative sentence lengths for alignment decisions and hence is not tolerant to noisy input.

Popular tools are Hunalign\(^4\) (Varga et al., 2005), Gargantua\(^5\) (Braune and Fraser, 2010), Bilingual Sentence Aligner (Moore, 2002) Bleualign\(^6\) (Senrich and Volk, 2010), and Champollion\(^7\) (Ma, 2006). Shi and Zhou (2008) make use of the HTML structure to guide alignment. All of these use bilingual lexicons which may have to be provided upfront or are learned unsupervised.

It is not clear, which of these tools fares best with noisy parallel text that we can expect from web crawls, which may have spurious content and misleading boilerplate.

2.4 Filtering

A final stage of the processing pipeline filters out bad sentence pairs. These exist either because the original web site did not have any actual parallel data (garbage in, garbage out), or due to failures of earlier processing steps.

As Rarrick et al. (2011) point out, a key problem for parallel corpora extracted from the web is filtering out translations that have been created by machine translation. Venugopal et al. (2011) propose a method to watermark the output of machine translation systems to aid this distinction. Antonova and Misysurev (2011) report that rule-based machine translation output can be detected due to certain word choices, and machine translation output due to lack of reordering.

This year, a shared task on sentence pair filtering\(^8\) was organized, albeit in the context of cleaning translation memories which tend to be cleaner that the data at the end of a pipeline that starts with web crawls.

2.5 Comprehensive Tools

For a few language pairs, there have been individual efforts to cast a wider net, such as the billion word French–English corpus collected by Callison-Burch et al. (2009), or a 200 million word Czech–English corpus collected by Bojar et al. (2010). Smith et al. (2013) present a set of fairly basic tools to extract parallel data from the publicly available web crawl CommonCrawl\(^9\).

In all these cases, the corpus collection effort re-invented the wheel and wrote dedicated scripts to download web pages, extract text, and align sentences, with hardly any description of the methods used.

Our data preparation for the shared task builds partly on Bitextor\(^10\), which is a comprehensive pipeline from corpus crawling to sentence pair cleaning (Esplà-Gomis, 2009).

\(^2\)https://www.httrack.com/
\(^3\)http://nlp.ilsp.gr/redmine/projects/ilsp-fc
\(^4\)http://mokki.bme.hu/en/resources/hunalign/
\(^5\)https://sourceforge.net/projects/gargantua/
\(^6\)https://github.com/rsennrich/Bleualign
\(^7\)https://sourceforge.net/projects/champollion/
\(^8\)NLP4TM 2016: Shared task http://rgcl.wlv.ac.uk/nlp4tm2016/shared-task/
\(^9\)http://commoncrawl.org/
\(^10\)https://sourceforge.net/p/bitextor/wiki/Home/
3 Training and Test Data

We made available crawls of web sites (defined as pages under the same webdomain) that have translated content. We also annotated some document pairs to provide supervised training data to the participants of the shared task.

3.1 Terminology

A quick note on terminology: Unfortunately, the notion of domain is ambiguous in NLP applications, and we use an unusual meaning of the word in this report. To avoid confusion we will instead use the term webdomain to refer to content from a specific website, e.g., “This page is from the statmt.org webdomain.” We distinguish between webdomains using their Fully Qualified Domain Name (FQDN). Thus, www.example.com and example.com are considered to be different webdomains.

We will use source to denote English pages and target for French ones. This does not imply that translation was performed in that direction. In fact we cannot know if translation from one side to the other was performed at all, both sides could possibly be translations of a third language document.

The task was organized as part of the First Conference on Machine Translation (WMT), and all data can be downloaded from its web page.\footnote{http://www.statmt.org/wmt16/bilingual-task.html}

3.2 Data Preparation

We crawled full web sites with the web site copier HTTrack, from the homepage down, restricted to HTML content. Web sites differed significantly in their size, from a few hundred pages to almost 100,000.

In the test data we removed all duplicates from the crawl.\footnote{Because we provide the extracted texts of the training pages participants were able to do the same} Duplicates are defined as web pages, whose text content is identical. Duplicates may differ in markup and URL. To extract the text we used a Python implementation of the HTML5 parser to extract text as a browser would see it. As the text is free of formatting, determining whitespace is important. While generally following the standard, e.g. inserting line breaks after block level elements, we found that inserting spaces around <span> tags helps tokenization as these are often visually separated using CSS.

We restricted the task to the alignment of French and English documents, so we filtered out all web pages that are not in these two languages. However, we did not expect that participants would develop language-specific approaches. To detect the language of a document we feed the extracted text into an automatic language detector.\footnote{Compact Language Detector 2 (CLD2)} We note that language detection is a noisy process and many pages contain mixed language context, for example English boilerplate but French content. We take the overall majority language per page as the document language.

We decided to have a large collection of web sites, to encourage methods that can cope with various types of web sites, such as differing in size, balance in the number of French and English pages, and so on.

Given the large number of correct document pairs, we did not even attempt to annotate all of them, but instead randomly selected a subset of pages and identified their corresponding translated page. We augmented this effort with aligned document pairs that are indicated at the web site Linguee,\footnote{http://www.linguee.com/} a searchable collection of parallel corpora, in which each retrieved sentence is annotated with its source web page.

The task then is to find these document pairs. Since this is essentially a recall measure, which can be gamed by returning all possible document pairs, we enforce a 1-1 rule, so that participants may align each web page only once.

3.3 Training Data

As training data we provide a set of 1,624 EN-FR pairs from 49 webdomains. The number of annotated document pairs per webdomain varies between 4 and over 200. All pairs are from within a single webdomain, possible matches between two different webdomains, e.g. siemens.de and siemens.com, are not considered in this task.

The full list of webdomains in the training data is listed in Table 1. Webdomains range in size from $33 \times 29$ pages (schackportalen.nu) to $24,325 \times 43,045$ pages (www.nauticnews.com).

3.4 Test Data

For testing, we provide 203 additional crawls of new webdomains, distinct from the ones in the training data in the same format. No aligned pairs...
| Website                      | Source Documents | Target Documents | Possible Pairs | Train Pairs |
|------------------------------|------------------|------------------|----------------|-------------|
| cineuropa.mobi               | 23 050           | 15 972           | 368 154 600    | 73          |
| forcesavenir.qc.ca           | 3 592            | 3 982            | 14 303 344     | 8           |
| galacticchannelings.com      | 4 231            | 1 283            | 5 428 373      | 9           |
| gollfrotter.com              | 377              | 361              | 136 097        | 8           |
| ironmaidencommentary.com    | 6 028            | 635              | 3 827 780      | 41          |
| kicktionary.de              | 2 752            | 888              | 2 443 776      | 29          |
| kustu.com                    | 1 544            | 1 511            | 2 322 984      | 13          |
| manchesterproducts.com       | 15 621           | 9 651            | 150 758 271    | 10          |
| minelinks.com                | 736              | 212              | 156 032        | 66          |
| pawpeds.com                  | 983              | 135              | 132 705        | 19          |
| rehazenter.lu                | 201              | 317              | 63 717         | 16          |
| tsb.gc.ca                    | 5 885            | 5 828            | 34 297 780     | 236         |
| virtualhospice.ca            | 43 500           | 22 327           | 971 224 500    | 46          |
| www.acted.org                | 3 333            | 2 431            | 8 102 523      | 21          |
| www.artsvivants.ca           | 5 487            | 1 368            | 7 056 216      | 6           |
| www.bonnke.net               | 414              | 129              | 53 406         | 27          |
| www.cyberspaceministry.org   | 1 534            | 958              | 1 469 572      | 29          |
| www.dfo-mpo.gc.ca            | 25 277           | 19 087           | 482 462 099    | 97          |
| www.ec.gc.ca                 | 12 266           | 15 404           | 188 945 464    | 26          |
| www.eu2005.lu                | 5 649            | 5 704            | 32 221 896     | 34          |
| www.inst.at                  | 3 203            | 543              | 1 739 229      | 62          |
| www.krn.org                  | 115              | 115              | 13 225         | 67          |
| www.lamecca.org              | 692              | 1 567            | 1 084 364      | 6           |
| www.pawpeds.com              | 1 011            | 136              | 137 496        | 43          |
| bugadacargnel.com            | 919              | 779              | 715 901        | 19          |
| cbsc.ca                      | 1 595            | 904              | 1 441 880      | 20          |
| creationwiki.org             | 8 417            | 203              | 1 708 651      | 22          |
| eu2007.de                    | 3 201            | 2 488            | 7 964 088      | 11          |
| eu.blizzard.com              | 10 493           | 6 640            | 69 673 320     | 10          |
| iiz-dvv.de                   | 1 160            | 894              | 1 037 040      | 67          |
| santabarbara-online.com      | 1 151            | 1 099            | 1 204 949      | 11          |
| schackportalen.nu            | 33               | 29               | 957            | 14          |
| www.antennas.biz             | 812              | 327              | 265 524        | 30          |
| www.bugadacargnel.com        | 919              | 779              | 715 901        | 7           |
| www.cgfmanet.org             | 9 241            | 6 260            | 57 848 660     | 25          |
| www.dakar.com                | 17 420           | 14 582           | 254 018 440    | 45          |
| www.eohu.ca                  | 2 277            | 2 136            | 4 803 672      | 4           |
| www.eu2007.de                | 3 249            | 2 535            | 8 236 215      | 11          |
| www.fao.org                  | 11 931           | 5 804            | 50 702 724     | 6           |
| www.luontopotti.com          | 3 645            | 1 796            | 6 546 420      | 30          |
| www.nato.int                 | 40 063           | 8 773            | 351 472 699    | 36          |
| www.nauticnews.com           | 24 325           | 43 045           | 1 047 069 625  | 21          |
| www.prohelvetia.ch           | 5 209            | 4 421            | 23 028 989     | 7           |
| www.socialwatch.org          | 13 803           | 2 419            | 33 389 457     | 21          |
| www.summerlea.ca             | 434              | 338              | 146 692        | 58          |
| www.the-great-adventure.fr   | 2 038            | 2 460            | 5 013 480      | 18          |
| www.ushmm.org                | 10 472           | 967              | 10 126 424     | 26          |
| www.usw.ca                   | 5 006            | 2 247            | 11 248 482     | 83          |
| www.vinci.com                | 3 564            | 3 374            | 12 024 936     | 24          |

Total 348 858 225 043 4 246 520 775 1 624

Table 1: Training data statistics.
are provided for the any of these domains. We re-
moved exact duplicates of pages, keeping only one
instance. Otherwise, we processed the data in the
same way as the training data.

3.5 Data Format

The training document pairs are specified as one
pair per line:

Source_URL<TAB>Target_URL

For the crawled data we provide one file per
webdomain in .lett format adapted from Bitex-
tor. This is a plain text format with one line per
page. Each line consists of 6 tab-separated values:

• Language ID (e.g. en)
• Mime type (always text/html)
• Encoding (always charset=utf-8)
• URL
• HTML in Base64 encoding
• Text in Base64 encoding

To facilitate use of the .lett files we provide a
simple reader class in Python. We make sure that
the language id is reliable, at least for the docu-
ments in the train and test pairs.

Text extraction was performed using an
HTML5 parser. As the original HTML pages are
available, participants are welcome to implement
their own text extraction, for example to remove
boilerplate.

Additionally, we have identified spans of
French text in French documents for which we
produced English translations using MT. We use
a basic Moses statistical machine translation en-
gine (Koehn et al., 2007) trained on Europarl and
News Commentary with decoding settings geared
towards speed (no lexicalized reordering model,
no additional language model, cube pruning with
pop limit 500).

These translations are not part of the lett files
but provided separately. The format for the source
segments and target segments is

URL<TAB>Text

where the same URL might occur multiple
times if several lines/spans of French text were
found. The URLs can be used to identify the cor-
responding documents in the .lett files.

3.6 Baseline Method

We provide a baseline systems that relies on the
URL matching heuristic used by Smith et al.
(2013). Here two URLs are considered a pair
if both can be transformed into the same string
through stripping of language identifiers. Strings
indicating languages are found by splitting a large
number of randomly sampled URLs into compo-
ments and manually picking substrings that corre-
late with the detected language.

We further improve the approach by allow-
ing matches where only one URL contains a
strip-able language identifier, e.g. we match
x.com/index.htm and x.com/fr_index.htm.
If a URL has several matching candidates we pick
the one that requires the fewest rewrites, i.e. we
prefer the pair above over x.com/en/index.htm
x.com/fr_index.htm.

The baseline achieves roughly 60% recall, com-
pared to 95.0% of the best submission.

4 Evaluation

Our main evaluation metric is recall of the known
pairs, i.e. what percentage of the aligned pages in
the test set are found. We strictly enforce the rule
that every page may only be aligned once, so that
participants cannot just align everything. After a
URL has been seen as part of a submitted pair, all
later occurrences are ignored.

After we released the gold standard alignments,
a number of participants pointed out that some
predicted document pairs were unfairly counted as
wrong, even if their content differed only insignif-
ically from the gold standard.

To give an example, the web pages
www.taize.fr/fr_article10921.html?chooselang=1
and
www.taize.fr/fr_article10921.html
are almost identical, but the first offers a check-
box to select a language, while the second does
not. Since the text on the pages differs slightly,
these were not detected as (exact) duplicates.

To address this problem, we also included a soft
scoring metric which counts such near-matches
as correct. We chose that to be a close duplicate,
the edit distance between the text of two pages,
normalized by the maximum of their lengths (in
characters) must not exceed 5%.

If we observe a predicted pair (s, t) that is not
in the gold set, but (s, t′) is and dist(t, t′) \leq 5%,
then this pair is still counted as correct. The same
applies for a close duplicate s′ of s but not both as
we still follow the 1-1 rule.
5 Results

11 research groups participated in the shared task, some with multiple submissions. The list of participants is shown in Table 2, with a citation of their system descriptions, which are included in these conference proceedings.

Each participant submitted one or more collections of document pairs. We enforced the 1-1 rule on the collections, and scored them against the gold standard. Results are summarized in Table 3. Almost all systems outperformed the baseline by a wide margin. The best system is NOVA-LINCS-COVERAGE with 2,281 correct pairs, 95.0% of the total.

Note that the submissions varied in the number of document pairs, but after enforcing the 1-1 rule, most submissions comprise about 200,000-300,000 document pairs.

Table 4 displays the results with soft scoring. Essentially, every system improved, mostly by around 3%. The top two performers swapped places, with YODA now having the best showing with 96.0%. We also experimented with a tighter threshold of 1% which gave almost identical results.

6 System Descriptions

NOVA-LINCS (Gomes and Pereira Lopes, 2016) submitted 3 systems that use a phrase table from a phrase-based statistical machine translation system to compute coverage scores, based on the ratio of phrase pairs covered by a document pair. In addition to the purely coverage-based system, NOVA-LINCS-COVERAGE (88.6%), they also submit a system that uses coverage-based matching as a preference over URL matching NOVA-LINCS-COVERAGE-URL (85.8%) and the converse system that prefers URL matching over coverage-based matching NOVA-LINCS-URL-COVERAGE (95.0%).

YODA (Dara and Lin, 2016) submitted one system (93.9%) that uses the machine translation of the French document, and finds the English corresponding document based on bigram and 5-gram matches, assisted by a heuristics based on document length ratio.

UEDIN1 (Buck and Koehn, 2016) submitted one system (89.1%) that uses cosine similarity between tf/idf weighted vectors, extracted by collecting n-grams from the English and machine translated French text. They compare many hyper-parameters such as weighting schemes and two pair selection algorithms.

DOCAL (Azpeitia and Etchegoyhen, 2016) submitted one system (88.6%) that used word translation lexicons to compute document similarity scores based on bag-of-word representations. They expand a basic translation lexicon by adding all capitalized tokens, numbers, and longest common prefixes of known vocabulary items.

UEDIN2 (Germann, 2016) submitted 2 systems based on word vector space representations of documents using latent semantic indexing and URL matching, UEDIN LSI (85.8%) and UEDIN LSI (87.6%). In addition to a global cosine similarity score, a local similarity score is computed by re-centering the vector around the mean vector for a webdomain.
| Name                      | Predicted pairs | Pairs after 1-1 rule | Found pairs | Recall % |
|---------------------------|-----------------|----------------------|-------------|---------|
| ADAPT                     | 61 094          | 61 094               | 644         | 26.8    |
| ADAPT-v2                  | 69 518          | 69 518               | 651         | 27.1    |
| BADLUC                    | 681 610         | 263 133              | 1 905       | 79.3    |
| DOCAL                     | 191 993         | 191 993              | 2 128       | 88.6    |
| ILSP-ARC-pv42             | 291 749         | 287 860              | 2 040       | 84.9    |
| JIS                       | 323 929         | 28 903               | 48          | 2.0     |
| MEDVED                    | 155 891         | 155 891              | 1 907       | 79.4    |
| NOVALINCS-COVERAGE-URL    | 207 022         | 207 022              | 2 060       | 85.8    |
| NOVALINCS-COVERAGE        | 235 763         | 235 763              | 2 129       | 88.6    |
| NOVALINCS-URL-COVERAGE    | 235 812         | 235 812              | 2 281       | 95.0    |
| UA PROMPSIT bitextor 4.1  | 95 760          | 95 760               | 748         | 31.1    |
| UA PROMPSIT bitextor 5.0  | 157 682         | 157 682              | 2 001       | 83.3    |
| UEdin1 cosine             | 368 260         | 368 260              | 2 140       | 89.1    |
| UEdin2 LSI                | 681 744         | 271 626              | 2 062       | 85.8    |
| UEdin2 LSI-v2             | 367 948         | 367 948              | 2 105       | 87.6    |
| UFAL-1                    | 592 337         | 360 260              | 2 140       | 89.1    |
| UFAL-2                    | 574 433         | 178 038              | 1 901       | 79.1    |
| UFAL-3                    | 574 434         | 207 358              | 1 938       | 80.7    |
| UFAL-4                    | 1 080 962       | 268 105              | 2 023       | 84.2    |
| YSDA                      | 277 896         | 277 896              | 2 021       | 84.1    |
| YODA                      | 318 568         | 318 568              | 2 256       | 93.9    |

Baseline
| 148 537 | 148 537 | 1 436 | 59.8 |

Table 3: Official Results of the WMT16 Bilingual Document Alignment Shared Task.

| Name                      | Pairs found | ∆   | Recall | ∆   | Rank | ∆ |
|---------------------------|-------------|-----|--------|-----|------|---|
| ADAPT                     | 726         | +82 | 30.2   | +3.4| 20   | 0 |
| ADAPT-v2                  | 733         | +82 | 30.5   | +3.4| 19   | 0 |
| BADLUC                    | 2 062       | +157| 85.9   | +6.5| 13   | +3|
| DOCAL                     | 2 235       | +107| 93.1   | +4.5| 4    | +1|
| ILSP-ARC-pv42             | 2 185       | +145| 91.0   | +6.0| 7    | +2|
| JIS                       | 48          | 0   | 2.0    | 0   | 21   | 0 |
| MEDVED                    | 1 986       | +79 | 82.7   | +3.3| 15   | 0 |
| NOVALINCS-COVERAGE-URL    | 2 130       | +70 | 88.7   | +2.9| 9    | -1|
| NOVALINCS-COVERAGE        | 2 192       | +63 | 91.3   | +2.6| 6    | -2|
| NOVALINCS-URL-COVERAGE    | 2 303       | +22 | 95.9   | +0.9| 2    | -1|
| UA PROMPSIT bitextor 4.1  | 775         | +27 | 32.3   | +1.1| 18   | 0 |
| UA PROMPSIT bitextor 5.0  | 2 117       | +116| 88.1   | +4.8| 10   | +2|
| UEdin1 cosine             | 2 227       | +87 | 92.7   | +3.6| 5    | -2|
| UEdin2 LSI                | 2 146       | +84 | 89.3   | +3.5| 8    | -1|
| UEdin2 LSI-v2             | 2 281       | +176| 95.0   | +7.3| 3    | +3|
| UFAL-1                    | 2 060       | +107| 85.8   | +4.5| 14   | -1|
| UFAL-2                    | 1 954       | +53 | 81.4   | +2.2| 17   | 0 |
| UFAL-3                    | 1 980       | +42 | 82.4   | +1.8| 16   | -2|
| UFAL-4                    | 2 078       | +55 | 86.5   | +2.3| 12   | -2|
| YSDA                      | 2 102       | +81 | 87.5   | +3.4| 11   | 0 |
| YODA                      | 2 307       | +51 | 96.0   | +2.1| 1    | +1|

Table 4: Soft Scoring Results of the WMT16 Bilingual Document Alignment Shared Task, allowing 5% edits between predicted and expected pairing.
ILSP/ARC (Papavassiliou et al., 2016) submitted one system (84.9%), which uses boilerplate removal, and carries out document alignment based on features such as links to documents in the same webdomain, URLs, digits, image filenames and HTML structure. Their paper also describes in detail the open source ILSP Focused Crawler.

YSDA (Shchukin et al., 2016) submitted one system (84.1%) that uses n-gram matches between the machine translation of the French document and the English document. They cluster French and English words into bilingual clusters of up to 90 words, starting with word pairs with high translation probability in both directions, and then adding words that translated well into existing words in a cluster.

UA PROMPSIT (Esplà-Gomis et al., 2016) submitted 2 systems based on Bitextor and describe improvements to the Bitextor toolkit. Their submissions contrast the old version of the tool, UA PROMPSIT BITEXTOR 4.1 (31.1%), with the recent release, UA PROMPSIT BITEXTOR 5.0 (83.3%). Improved document alignment quality is based on various new features: ratio of shared links, similarity of link URLs, ratio of shared images, binary feature indicating if the documents are linked, and similarity of URLs, in addition to the old features bag of words similarity using a translation dictionary and DOM structure similarity.

UFAL (Le et al., 2016) submitted 4 systems, each using a different method. UFAL-1 (81.3%) uses identical word matches by also considering their position in the text. UFAL-2 (79.1%) matches translations of French documents with English documents based on word occurrence probabilities. UFAL-3 (80.7%) adds Levenshtein distance on URLs to this method. UFAL-4 (84.2%) combines UFAL-1 and UFAL-3.

MEDVED (Medved et al., 2016) submitted one system (79.4%), which determines the top 100 keywords based on tf/idf scores for each document and uses word translation dictionaries to match them.

BADLUC (Jakubina and Langlais, 2016) submitted one system (79.3%) that uses the information retrieval tool Apache Lucene to create two indexes, on URLs and text content, and retrieves the most similar documents based on variants of td/idf scores. Both monolingual queries and bilingual queries based on a word translation dictionary are performed.

ADAPT (Lohar et al., 2016) submitted one system (and a revision) that combines similarity metrics computed on ratio of number of sentences in documents, ratio of number of words in the documents, and matched named entities.

JIS (Mahata et al., 2016) submitted one system (2.0%), which uses text matching based on sentence alignment and word dictionaries. Their paper also described improvements over the original submission.

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