Automatic Enrichment of Terminological Resources: the IATE RDF Example

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Abstract
Terminological resources have proven necessary in many organizations and institutions to ensure communication between experts. However, the maintenance of these resources is a very time-consuming and expensive process. Therefore, the work described in this contribution aims to automate the maintenance process of such resources. As an example, we demonstrate enriching the RDF version of IATE with new terms in the languages for which no translation was available, as well as with domain-disambiguated sentences and information about usage frequency. This is achieved by relying on machine translation trained on parallel corpora that contains the terms in question and multilingual word sense disambiguation performed on the context provided by the sentences. Our results show that for most languages translating the terms within a disambiguated context significantly outperforms the approach with randomly selected sentences.

Keywords: knowledge bases, terminology, multilinguality, machine translation

1. Motivation
Terminological resources have proven necessary in many organizations and institutions to ensure the quality and consistency of the terms used across the documents that serve expert communication. In the translation field, these resources are usually integrated into Computer Aided Translation (CAT) tools to allow translators to store the terms that appear in the documents they are translating. Terms and their translations may be accompanied by additional information intended to represent the meaning and the translation decisions taken for the use of the terms. The collected information accounts for the domain of the document, the definition of source or target terms, a sentence in which the term appears or other terms with the same meaning, i.e., term variants.

One of the most representative terminological resources is the Inter-Active Terminology for Europe (IATE). It is a widely-used resource which incorporates all the terminology databases that had been independently built and maintained by the translation services of the different EU institutions. The public version of IATE contains approximately 1.4 million entries (8.6 million terms) in the 24 official EU languages. Due to the vast amount of domains covered in IATE (Table 1), the resource is a point of reference not only for EU translators and interpreters but also for translators and language service providers (LSPs) around the world. A simplified version of it is available in the TBX (Term Base eXchange) format for free download and has been converted to the Resource Description Framework (RDF) according to the linked data principles. As for any other language resource, the efforts that are required to maintain, update and clean the data are extensive. In addition to that, some languages or domains are extensively covered, whereas others have not received so much attention. Moreover, duplicate entries are common, since each institutional database was merged together into IATE in 2004. Furthermore, some terms are accompanied by definitions, contexts, and usage notes, and are supported by valid references and high reliability values, whereas others are not further described. Finally, due to the time pressure in the translation process, occasionally terminologists include terms or provide translations that are not properly checked, and thus not agreed or verified by experts.

Taking these issues into account, we claim that automatic processes should be put in place to support professionals in the enrichment, maintenance and cleaning of such a database, so that new terms in low covered languages could be added and enriched with contextual information, whereby duplicates, low quality or old terms could be removed. In order to contribute to the enrichment of IATE with terms that do not exist in some of the languages covered by the resource, we rely on Statistical Machine Translation (SMT) and leverage available translations in other languages, to identify relevant domain-specific sentences that contain those potential translations from a large set of parallel corpora. Furthermore, we use the identified relevant sentences to provide additional or missing contextual information to the terminological resource. Finally, we compare the usage of term variants in certain translations pairs, which can show a distinction between commonly used and less used terms in the IATE resource.

2. Related Work
Most of the previous work on the translation of knowledge resources, i.e., ontologies, taxonomies or terminological resources, tackled this problem by accessing multilingual lexical resources, e.g., EuroWordNet or IATE. Their work focuses on the identification of the lexical overlap between the terms stored in the resource to be translated and the multilingual resource. Since the replacement of source terms with their translations within the dictionaries guarantees a high pre-
determines the best translation for English WordNet synsets with SMT, but showed a machine learning approach which contrast, de Melo and Weikum (2012) did not match concepts using different translation directions within a loop. In contrast, de Melo and Weikum (2012) did not match concepts with SMT, but showed a machine learning approach which determines the best translation for English WordNet synsets by taking bilingual dictionaries, structural information of WordNet and corpus frequency information into account. Similarly, the multilingual disambiguation of ontology labels was performed by Espinoza et al. (2009) and McCrae et al. (2011), where the structure of the ontology along with existing multilingual ontologies was used to annotate the labels with their semantic senses and to link them across languages. Furthermore, McCrae et al. (2016) show positive effects of different domain adaptation techniques, i.e., using Web resources as additional bilingual knowledge, rescoring translations with Explicit Semantic Analysis (ESA) and language model adaptation for automatic knowledge base translation. To link knowledge graphs across languages, McCrae et al. (2017) propose a hybrid approach that combines dataset alignment and ontology translation techniques. The combination of these two techniques improves the translation of domain-specific expressions in comparison with approaches when used alone.

### 3. Methodology

We demonstrate an approach that uses the existing IATE terms to select the most relevant sentences in which those terms appear. By translating these sentences into languages for which no term is documented in the database, we obtain new translations for the available terms. Furthermore, we use these sentences to enrich IATE with additional information, i.e., how these terms appear in sentences of a representative domain as well as the usage of the translations in the parallel corpora.

| Language | Domain |
|----------|--------|
| Bulgarian | no domain (1,338), law (9,924), agriculture, forestry and fisheries (8,546), ... |
| Czech | natural and applied sciences (2,397), eu institutions and european civil service (2,320), chemistry (2,294), ... |
| Danish | health (66,777), agriculture, forestry and fisheries (42,195), natural and applied sciences (38,106), ... |
| German | law (50,139), land transport (29,801), executive power and public service (26,398), ... |
| Greek | no domain (7,735), communications (3,769), information technology and data processing (3,654), ... |
| English | health (28,543), information technology and data processing (28,063), ... |
| Spanish | law (957), no domain (927), politics (717), ... |
| Estonian | insurance (31), natural and applied sciences (29), agricultural activity (29), ... |
| Finnish | no domain (438), executive power and public service (306), agriculture, forestry and fisheries (280), ... |
| French | executive power and public service (11,685), natural environment (10,628), health (6,468), ... |
| Irish | natural and applied sciences (13), natural environment (7), agriculture, forestry and fisheries (2), ... |
| Croatian | fisheries (17), agriculture, forestry and fisheries (17), land transport (4), ... |
| Hungarian | executive power and public service (14), politics (4), political party (4), ... |
| Italian | no domain (1,262), natural environment (590), agriculture, forestry and fisheries (410), ... |
| Lithuanian | political party (7), culture and religion (6), agriculture, forestry and fisheries (5), ... |
| Latvian | politics (10), political party (9), regions of eu member states (5), ... |
| Maltese | health (4), finance (4), social protection (2), ... |
| Dutch | executive power and public service (1,955), humanities (992), education (951), ... |
| Polish | health (14), air and space transport (13), communications (11), ... |
| Portuguese | no domain (839), employment and working conditions (160), land transport (150), ... |
| Romanian | europe union law (11), finance (8), land transport (5), ... |
| Slovak | health (12), chemistry (10), industry (8), ... |
| Slovene | no domain (12), political party (2), politics (2), ... |
| Slovak | health (6), law (6), executive power and public service (4), ... |

Table 1: Statistics on most defined domains in IATE.
Table 2: Statistics on covered terms in IATE.

| Language  | # of Entries | All Entries | Tokens | Types | Avg. Length | # of Unigrams |
|-----------|--------------|-------------|--------|--------|-------------|---------------|
| French    | 932,078      | 1,102,995   | 3,876,429 | 181,344 | 3.51        | 182,977       |
| English   | 929,729      | 1,089,726   | 3,116,115 | 200,214 | 2.85        | 166,675       |
| German    | 673,851      | 846,925     | 1,631,472 | 520,999 | 1.92        | 514,634       |
| Italian   | 498,549      | 591,970     | 1,953,887 | 127,591 | 3.00        | 103,885       |
| Dutch     | 489,941      | 590,319     | 1,412,233 | 311,212 | 2.39        | 288,864       |
| Spanish   | 447,377      | 524,504     | 1,762,624 | 117,012 | 3.36        | 94,971        |
| Danish    | 445,939      | 533,541     | 1,114,400 | 308,581 | 2.08        | 284,811       |
| Greek     | 398,946      | 466,635     | 1,415,473 | 514,634 | 3.00        | 72,055        |
| Portuguese| 390,772      | 446,740     | 1,453,663 | 103,732 | 3.25        | 85,255        |
| Finnish   | 251,544      | 298,639     | 546,823  | 198,219 | 1.83        | 163,764       |
| Swedish   | 242,158      | 277,067     | 540,266  | 176,163 | 1.94        | 156,407       |
| Irish     | 57,415       | 63,331      | 210,477  | 36,321  | 3.22        | 10,825        |
| Polish    | 54,971       | 64,100      | 211,749  | 42,122  | 3.00        | 8,818         |
| Slovene   | 43,168       | 49,181      | 150,681  | 32,127  | 3.06        | 8,781         |
| Maltese   | 41,090       | 48,018      | 164,501  | 31,618  | 3.42        | 9,067         |
| Lithuanian| 38,281       | 43,799      | 134,902  | 28,426  | 3.08        | 6,046         |
| Romanian  | 38,126       | 43,822      | 159,205  | 26,281  | 3.63        | 7,145         |
| Estonian  | 34,957       | 43,735      | 100,196  | 37,303  | 2.92        | 17,406        |
| Slovak    | 34,453       | 39,647      | 131,726  | 30,920  | 3.32        | 6,643         |
| Hungarian | 32,369       | 38,939      | 109,510  | 31,595  | 2.81        | 10,460        |
| Bulgarian | 31,960       | 36,856      | 135,502  | 24,456  | 3.67        | 5,313         |
| Latvian   | 31,857       | 36,792      | 113,653  | 26,942  | 3.08        | 6,478         |
| Czech     | 27,866       | 33,562      | 116,364  | 23,842  | 3.46        | 4,876         |
| Croatian  | 14,635       | 16,440      | 55,139   | 15,003  | 3.35        | 2,317         |

Disambiguated Context Identification The main challenge involved in building multilingual knowledge bases, is, however, to bridge the gap between language-specific information and the language-independent semantic content (Gracia et al., 2012). Since manual multilingual translation and evaluation of knowledge bases is a very time-consuming and expensive process, we apply SMT to automatically translate domain-specific expressions and demonstrate its validity by translating the IATE entries. While an SMT system can only return the most frequent or dominant translation when given a term by itself, it has been showed that SMT provides strong word sense disambiguation when the word is given in the context of a sentence (Arcan et al., 2016a; Arcan et al., 2016b).

As a motivating example, we consider the word *vessel*, which appears several times in the IATE repository, whereby the most frequent translation into German is *Schiff*, with the meaning of ‘a craft designed for water transportation’, e.g., as given by Google Translate. To overcome the issue of obtaining translations for *vessel* in other languages, and also in different domains (in the sense of *blood vessel*, for instance), we aim to identify (several) parallel sentences, which hold the terminological entries in the targeted domain, and use their context to translate them into other languages for which a translation does not exist. This means that if we know that the word *vessel* also represents the meaning of ‘a tube in which a body fluid circulates’ and the German translation for this entry is *Gefäß*, we look in our approach for sentences in a parallel corpus where the words *vessel* and *Gefäß* both occur and obtain a context such as ‘blood vessel’ that allows the SMT system to translate this entry correctly. Although a translation into German is not necessary in this case, since it is already documented in the database, we can use the English sentence (appropriately disambiguated) to translate the term into other languages, where the translation does not exist. To maximize our chances of finding a well-disambiguated sentence, we use existing terms in as many languages as possible.

Enhancing IATE with New Translations and Contextual Information In addition to the extension of IATE with missing translations for less covered languages, we further provide information on how the domain-specific expressions appear in sentences. Since we identified the relevant sentences by using linked IATE entries in different languages, we believe that this additional information can further enrich the terminological resource.

Frequency and Reliability of Term Variants When accessing IATE from its online interface, it is common to find several translations for the same term in the same domain, the so-called term variants, and it is the user’s decision to choose one variant over the others. In the same way, for each term separately, additional information about its usage or the level of confidence assigned by the creators of the resource can only be obtained in a time-consuming fashion. To overcome these issues, we use the data we obtain from the parallel corpus that is believed to represent the real use of terms.
IATE Duplicates Due to the original merging of separately maintained databases, duplicates are common in IATE. To support the maintenance of the resource in a more efficient way, we evaluate how many IATE entries have identical terms in English and in other target languages.

4. Experimental Setting

In this section, we give an overview on the dataset and the translation toolkit used in our experiment and provide insights into the SMT evaluation techniques.

4.1. IATE - Inter-Active Terminology for Europe

IATE is the terminology database of the EU with its objective of supporting the EU translators and creating a terminology resource to ensure standardisation throughout all institutions. It incorporates the various terminology databases into one database containing approximately one million multilingual entries in English (Table 2). Recent domains that have been extensively covered include the financial crisis, environment, fisheries and migration.

4.2. Statistical Machine Translation

Our approach is based on phrase-based SMT (Koehn et al., 2003), where we wish to find the best translation of a string, given by a log-linear model combining a set of features. The translation that maximizes the score of the log-linear model is obtained by searching all possible translation candidates. The decoder, which is a search procedure, provides the most probable translation based on a statistical translation model learned from the training data.

For our task, we use the statistical translation toolkit Moses (Koehn et al., 2007), where word alignments, necessary for generating translation models, were built with the GIZA++ toolkit (Och and Ney, 2003). The KenLM toolkit (Heafield, 2011) was used to build a 5-gram language model.

4.3. Parallel Resources for SMT training and Multilingual Word Sense Disambiguation

To ensure a broad lexical and domain coverage of our SMT system, we merged the existing parallel corpora for each language pair from the OPUS web page6 into one parallel data set, i.e., Europarl (Koehn, 2005), DGT translation memories generated by the Directorate-General for Translation (Steinberger et al., 2014), MultiUN corpus (Eisele and Chen, 2010), EMEA, KDE4, OpenOffice (Tiedemann, 2009), OpenSubtitles2012 (Tiedemann, 2012). Similarly, we concatenated parallel corpora to identify relevant sentences containing IATE entries, which are then translated into the targeted languages. Table 3 shows the amount of parallel sentences used for the different language pairs.

4.4. Translation Evaluation Metrics

The automatic translation evaluation is based on the correspondence between the SMT output and reference translation (gold standard).

BLEU (Papineni et al., 2002) is calculated for individual translated segments (n-grams) by comparing them with a data set of reference translations. Considering the shortness of the entries in IATE, we report scores based on the unigram overlap (BLEU-1). Those scores, between 0 and 100 (perfect translation), are then averaged over the whole evaluation data set to reach an estimate of the translation’s overall quality.

METEOR (Denkowski and Lavie, 2014) is based on the harmonic mean of precision and recall, whereby recall is weighted higher than precision. Along with exact word (or phrase) matching it uses additional features, i.e., stemming, paraphrasing and synonymy matching.

chrF3 (Popović, 2015) is a character n-gram metric, which has shown very good correlations with human judgements, especially when translating from English into morphologically rich languages (Stanojević et al., 2015).

The approximate randomization approach (Clark et al., 2011) is used to test whether differences among system performances are statistically significant.

5. Results

In this section, we present the evaluation of the translated IATE entries into several languages not initially included in this resource, and how existing IATE terms have been exploited for our purposes in the parallel corpora used in this work. In addition to this, we illustrate the enhancing of IATE RDF resource with additional contextual information.

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1Based on IATE TBX file - IATE_export_16032017.tbx [http://opus.nlpl.eu/]

2We randomly selected 2,000 terms, although not all target terms are represented in each language for evaluation.

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Table 3: Statistics on parallel data for translation model training and word-sense disambiguation.

| Language Pair          | Sent. Tokens | Types |
|------------------------|--------------|-------|
| English-Spanish        | 37M          | 378M  |
| English-Greek          | 34M          | 330M  |
| English-Finnish        | 24M          | 293M  |
| English-French         | 53M          | 795M  |
| English-Irish          | 1M           | 15M   |
| English-Italian        | 22M          | 90M   |
| English-Lithuanian     | 6M           | 90M   |
| English-Latvian        | 5M           | 86M   |
| English-Slovak         | 11M          | 126M  |
| English-Slovene        | 13M          | 133M  |
| English-Portuguese     | 32M          | 354M  |
| English-Romanian       | 40M          | 353M  |
| English-Slovene        | 13M          | 133M  |
| English-Swedish        | 16M          | 163M  |
| English-Danish         | 17M          | 165M  |
| English-Croatian       | 16M          | 133M  |
| English-Greek          | 10M          | 135M  |
| English-Dutch          | 35M          | 363M  |
| English-Italian        | 22M          | 90M   |
| English-Irish          | 1M           | 14M   |
| English-Italian        | 22M          | 90M   |
| English-Lithuanian     | 6M           | 90M   |
| English-Latvian        | 5M           | 86M   |
| English-Slovak         | 11M          | 126M  |
| English-Slovene        | 13M          | 133M  |
| English-Swedish        | 16M          | 163M  |
| English-Polish         | 34M          | 295M  |
| English-Dutch          | 35M          | 363M  |
| English-Finnish        | 24M          | 293M  |
| English-French         | 53M          | 795M  |
| English-Irish          | 1M           | 14M   |
| English-Italian        | 22M          | 90M   |
| English-Lithuanian     | 6M           | 90M   |
| English-Latvian        | 5M           | 86M   |
| English-Slovak         | 11M          | 126M  |
| English-Slovene        | 13M          | 133M  |
| English-Swedish        | 16M          | 163M  |
| English-Danish         | 17M          | 165M  |
| English-Croatian       | 16M          | 133M  |
| English-Greek          | 10M          | 135M  |
| English-Dutch          | 35M          | 363M  |
| English-Italian        | 22M          | 90M   |
| English-Irish          | 1M           | 14M   |
| English-Italian        | 22M          | 90M   |
| English-Lithuanian     | 6M           | 90M   |
| English-Latvian        | 5M           | 86M   |
| English-Slovak         | 11M          | 126M  |
| English-Slovene        | 13M          | 133M  |
| English-Swedish        | 16M          | 163M  |
| English-Danish         | 17M          | 165M  |
| English-Croatian       | 16M          | 133M  |
| English-Greek          | 10M          | 135M  |
| English-Dutch          | 35M          | 363M  |
| English-Italian        | 22M          | 90M   |
| English-Irish          | 1M           | 14M   |
| English-Italian        | 22M          | 90M   |
| English-Lithuanian     | 6M           | 90M   |
| English-Latvian        | 5M           | 86M   |
| English-Slovak         | 11M          | 126M  |
| English-Slovene        | 13M          | 133M  |
| English-Swedish        | 16M          | 163M  |

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Table 4: Automatic translation evaluation of IATE entries with random and disambiguated context (* statistically significant compared to the random context translation approach).

| Language | # of Terms | Random Context | Disambiguated Context |
|----------|------------|----------------|-----------------------|
|          | Evaluated  | New            | BLEU-1 | METEOR | ChrF | BLEU-1 | METEOR | ChrF |
| Bulgarian| 406        | 1,594          | 72.3   | 36.5   | 86.3 | 78.5*  | 39.3   | 86.9 |
| Danish   | 1,502      | 498            | 64.7   | 39.3   | 80.9 | 72.8*  | 43.5   | 84.4 |
| Greek    | 1,289      | 711            | 61.8   | 52.3   | 81.4 | 69.3*  | 55.1   | 84.9 |
| Spanish  | 1,504      | 496            | 77.7   | 37.4   | 77.3 | 84.2*  | 39.1   | 78.5 |
| Finnish  | 1,014      | 986            | 45.2   | 26.4   | 75.2 | 51.1*  | 29.7   | 77.2 |
| French   | 1,566      | 434            | 74.4   | 37.9   | 79.2 | 79.5*  | 39.2   | 79.6 |
| Croatian | 155        | 1,845          | 58.3   | 30.5   | 73.4 | 59.6   | 30.9   | 73.4 |
| Italian  | 1,524      | 476            | 72.6   | 35.5   | 75.1 | 81.7*  | 38.3   | 77.6 |
| Latvian  | 451        | 1,549          | 57.2   | 29.8   | 74.6 | 63.2*  | 33.6   | 79.5 |
| Dutch    | 1,505      | 495            | 69.8   | 42.1   | 82.0 | 77.8*  | 46.6   | 86.1 |
| Polish   | 566        | 1,434          | 53.8   | 25.1   | 70.2 | 63.4*  | 29.0   | 74.8 |
| Portuguese| 1,504     | 496            | 79.1   | 37.4   | 77.2 | 84.3*  | 38.9   | 78.4 |
| Romanian | 431        | 1,569          | 67.6   | 31.4   | 71.7 | 75.5*  | 35.5   | 74.7 |
| Slovak   | 459        | 1,541          | 59.5   | 30.4   | 76.2 | 67.0*  | 34.7   | 79.4 |
| Slovene  | 501        | 1,499          | 58.2   | 29.7   | 75.4 | 67.8*  | 34.3   | 79.2 |
| Swedish  | 1,071      | 929            | 66.8   | 40.6   | 83.3 | 75.0*  | 45.7   | 85.9 |

Table 5: Identified sentence for IATE entry *airworthiness*, and their translations in different languages.

certification of products pursuant to specific airworthiness specifications, the related modifications, repairs and their continuing *airworthiness*, shall be charged as defined in tables 1 to 6.

certificazione dei prodotti in conformità a determinate specifiche di aeronavigabilità, le relative modifiche, le riparazioni e la loro aeronavigabilità continua, sono contabilizzate come definito nelle tabelle da 1 a 6.
certificering van producten overeenkomstig specifieke luchtwaardigheidsspecificaties, de bijbehorende wijzigingen en reparaties en de permanente luchtwaardigheid daarvan, worden in rekening gebracht als omschreven in de tabellen 1 tot en met 6.
certificering af produkter i henhold til de specifikke lufthygighedsspecifikationer, de relaterede ændringer, reparationer og deres fortsatte lufthygighed faktureres i overensstemmelse med tabel 1 til 6.
certifikacija proizvodov v skladu s posebnimi plovnostnimi specifikacijami, povezane spremembe, popravila v njihova stalna plovnost se zaračunavajo, kot je določeno v tabelah 1 do 6.
a certificação de produtos em conformidade com especificações de aeronavegabilidade próprias, bem como as modificações e reparações associadas e respetiva aeronavegabilidade permanente, devem ser cobrados conforme definido nas tabelas 1 a 6.

5.1. Translation Evaluation

Table 4 illustrates the automatic translation evaluation for 16 languages. IATE entries are translated within a random and identified disambiguated context. Except for the Croatian language, translating IATE terminological expressions within a disambiguated context, statistically significantly (p-value < 0.01) outperforms the approach with randomly selected sentences. Due to this results, we believe that the newly added terms show similar translation quality.

5.2. Providing Disambiguated Contextual Information

To further enhance the IATE terminological resource, we believe that the identified disambiguated sentences can be beneficial for the users selecting a term due to the contextual information of the targeted domain. Therefore, we append the identified relevant sentences to the IATE RDF resource. Table 5 illustrates an example of the relevant sentence associated with the IATE term *airworthiness* (IATE-29309), with its translations in several languages.

5.3. Frequency and Reliability of Term Variants

With the aim of providing users with information about term variants and to help them choosing the best variant for their purposes, as well as to provide data to support the reliability score originally assigned by IATE terminologist, we perform an experiment on evaluating the appearance of terms in the parallel corpora used in this work. Table 6 illustrates examples of IATE terms in English that have more than one translation equivalent in the target languages, in this case, German, French and Slovene. These can be considered as term variants, and frequency numbers can give
Table 6: Examples of IATE term frequencies in the parallel corpora.

| IATE ID   | English Term           | En. Term Freq | Target Term               | S&T Freq |
|-----------|------------------------|---------------|---------------------------|----------|
| IATE-913759 | south caucasus        | 277           | südkaukasus               | 229      |
|           |                        |               | transkaukasien            | 1        |
| IATE-1108878 | body mass index       | 282           | body-mass-index          | 126      |
|           |                        |               | körpermasse-index         | 4        |
| IATE-1126703 | outward investment    | 122           | investissement extérieur | 7        |
|           |                        |               | investissement réalisé à l’extérieur | 0 |
| IATE-46262 | electrical engineering | 137           | électrotechnique         | 36       |
|           |                        |               | gênie électrique         | 16       |
| IATE-1211765 | shovel                | 1,398         | pelle                     | 933      |
|           |                        |               | bèche                     | 10       |
|           |                        |               | bèche                     | 34       |
| IATE-770947 | state of the art      | 235           | stanje tehnike           | 16       |
|           |                        |               | najsodobnejša tehnologija | 0       |
| IATE-814939 | distortive effect    | 42            | izkrivljajoč učinek      | 7        |
|           |                        |               | učinek izkrivljanja      | 6        |
|           | distorting effect    | 28            | izkrivljajoč učinek      | 3        |
|           |                        |               | učinek izkrivljanja      | 3        |

Table 7: Statistics on duplicates between IATE terms in English and their translations.

| Language     | IATE Entries | Finnish | Lithuanian | Slovak | Slovak | Greek | Bulgarian |
|--------------|--------------|---------|------------|--------|--------|-------|-----------|
| French       | 57,216       | 9,677   | 372        |        |        | 373   |           |
| German       | 28,013       | 8,293   | 358        |        |        |       |           |
| Italian      | 27,941       | 1,163   | 352        |        |        |       |           |
| Spanish      | 23,533       | 683     | 314        |        |        |       |           |
| Dutch        | 23,009       | 519     | 296        |        |        |       |           |
| Danish       | 22,331       | 503     | 259        |        |        |       |           |
| Portuguese   | 20,185       | 489     | 148        |        |        |       |           |
| Greek        | 16,891       | 373     |            |        |        |       |           |

5.4. IATE Duplicates

Table 7 presents the amount of duplicate English entries and their translations. As seen, most of the duplicate entries appear between the English and French language pair. As an example, électronystagmography in French and électronystagmographie in French are represented in two IATE entries, i.e., IATE-1289555 and IATE-1517532, although both entries have the same IATE subjectField (2841, i.e., Medical science). Similarly, the very specific IATE terms international natural rubber council in English and internationaler Naturkautschukrat in German belong to two separate IATE entries, i.e., IATE-151353 and IATE-777553. Different to the previous example, these two entries belong to different, but similar domains, i.e., Industry and International trade. As in the case of frequency of use and reliability, such a statistical corpus analysis would allow us to identify those cases in which entries have been duplicated, most probably because of the merging of similar terminological resources.

5.5. Publication

In order to maximize the availability of this data, this data is available under an open license (CC-BY) and was contributed to the RDF version of IATE (Cimiano et al., 2015) so that it will be part of the linked open data cloud. In order to distinguish this automatically created data from the existing manually created data in IATE, we used the PROV-O.
6. Conclusion and Future Work

In this work, we showed automatic approaches for maintaining and increasing the lexical coverage of knowledge bases, e.g. IATE. By identifying disambiguated context, we demonstrate statistical significant translation improvement for several languages. With this approach, we identified relevant sentences, which can be beneficial for users when short terms cannot be disambiguated without any context surrounding them. To differentiate commonly used and less preferred terms, we evaluate the usage of the IATE terms and their translations in parallel corpora. At last, we identify duplicates in IATE, which can help to maintain and clean up the terminological resource. As ongoing work we are focusing on neural machine translation to cross the language barrier and how to incorporate the lexical information as well as the semantic structure of the resource into an embedded space for translating domain-specific expressions (Arcan and Buitelaar, 2017). Furthermore, our focus will lie on existing terminological variations within IATE as well as variations provided by machine translation.

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*for more information see https://nuig.insight-centre.org/unlp/research/resources/multilingual-iate-rdf/
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