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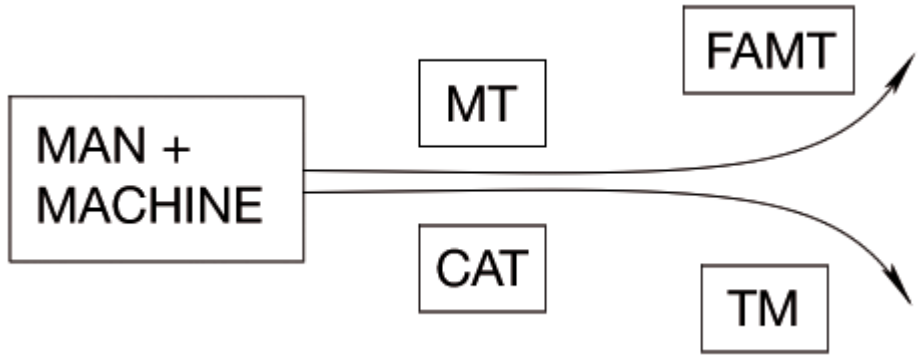
USING TRANSLATION MEMORIES IN A TRANSLATION SYSTEM

ABSTRACT

The paper discusses the idea of using Translation Memories (TM) in translation systems. Translation Memories are usually applied in Computer-Aided Translation (CAT) in the following way: for a given input sentence the system generates a prompt consisting of a TM unit (the sentence and its translation), where the source sentence is very similar (in terms of the word occurrence) to the input. It is the user's task to build the ultimate translation using the prompt. This paper presents a solution, in which the equivalent of the input sentence, based on a TM unit, is produced automatically. The idea may be used both in CAT system and Machine Translation (MT) systems. The algorithm takes advantage of regular expressions, which are used in: search for a match in the instance sentence, search for an appropriate example in the translation memory and transfer of the instance sentence into its equivalent.

"While the original aim of the MT pioneers was fully automatic MT systems, there has also been, at least since the 1966 ALPAC report and possibly even earlier, the view that computers could be used to help humans in their translation task rather than replace them". This citation comes from Harold Somers (Somers, 2003). The figure below may illustrate this view:

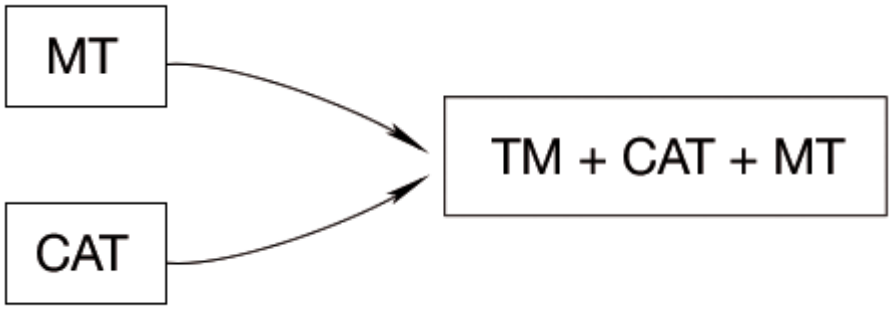


The idea of co-operation between man and machine goes in two directions: one direction is via Machine Translation (MT), possibly pre-edited or/and post-edited, towards Fully Automatic Machine Translation (FAMT) where there is nothing to do for a human. The other direction is via Computer-Aided Translation (CAT), where the user – human translator – is handily equipped with necessary glossaries and dictionaries and has the possibility to re-use his/her own translation, towards the use of large Translation Memories where there is almost nothing to do for a computer (except for just matching an instance text against an example that has once been translated).

It appears that the idea of Computer-Aided Translation is nowadays beating the idea of Machine Translation. The reason is mainly economical: The creation of a good-quality MT system is much more costly than that of a good-quality CAT system and the demand for the two types is comparable. It does not mean that there is no

future for MT. Firstly, modern approaches, based on large corpora, such as: Statistical Machine Translation (SMT) [Brown, 1990, Ney, 2005] and Example-Based Machine Translation (EBMT) [Nagao, 1984, Hutchins, 2005] aim at building MT systems at minimum cost. Secondly, once the quality of MT becomes reliable, the demand for it will rapidly grow.

Still, the near future belongs to CAT. But we believe in the following scenario:



The producers of MT systems will incorporate more and more ideas and tools from CAT systems. On the other hand, CAT systems will include more and more machine work (some CAT systems can already be linked to MT procedures) .Eventually, there will be no distinction between CAT and MT systems. There will be no translator's workbench or machine translation system – just one translation tool.

This paper shows a step in this direction. Given a translation memory and a CAT system that uses the memory, can we enhance the process of matching a sentence under translation against a memory unit? The enhancement should be executed fully automatically.

The idea presented in the paper is to enhance the procedure of matching by means of regular expressions.

The idea of using regular expressions for natural language processing is widely known. Regular expressions (regexps) are most frequently applied to searching for regularly structured fragments, like numbers or dates. Kartunnen (1996) suggests applying finite automata and transducers that represent regular expressions, for natural language texts. Oflazer (2004) shows the use of regexps for tokenization, shallow parsing or morphology analysis. Hasan (2005) describes how regexps may be applied in SMT for sentence clustering.

Here, we present the use of regular expressions in a translation system based on the translation memory. Regular expressions are used in: search for a match in the instance sentence, search for an appropriate example in the translation memory and finally in the transfer of the instance sentence into its equivalent.

Below we present the formalism that describes search-and-transfer rules developed for a translation system, Translatica Server[1] , which applies Translation Memories to enhance the output of an MT system, Translatica.

Each rule consists of:
A) Regular expressions defining search patterns in: Instance, Source TM and Target TM

B) Transfer of the instance expression into an output expression.

Below, we show an example of a rule for translation from Polish into English. The rule converts one of the Polish date formats into its English equivalent.

Suppose the instance sentence is:

[1] See details at: www.translatica.pl, www.poleng.pl

Instance: *Egzamin jest zaplanowany na 18.02.2008.*

Suppose the translation memory contains the following example and its translation:

TM Source: *Egzamin jest zaplanowany na 15.01.2007.*

TM Target: *The exam is planned for 15/01/2007.*

We expect the algorithm to generate the following output sentence based on TM Target:

Output: *The exam is planned for 18/02/2008.*

The appropriate rule looks like this (for clarity, only selected tags are listed):

```
Rule 1:
1.      <instance>([0-9]{1,2})[\.]([0-9]{1,2})[\.]([0-9]{2,4})</instance>
2.      <source>([0-9]{1,2})[\.]([0-9]{1,2})[\.]([0-9]{2,4})</source>
3.      <target>([0-9]{1,2})[\/]([0-9]{1,2})[\/]([0-9]{2,4})</target>
4.      <orders>
5.              <order sourceGroup=”1” suffix=”/” />
6.              <order sourceGroup=”2” suffix=”/” />
7.              <order sourceGroup=”3” suffix=”” />
8.      </orders>
```

Line 1 defines the search pattern for an input sentence (here, the pattern matches one of Polish date notations). The Instance must contain a matching string to become applicable to the rule.

Line 2 defines the search pattern for the source part of an example. (Here, the pattern is identical to that for the Instance). The source part of an example must contain a matching string to be considered as the source for translation.

Line 3 defines the search pattern for the target part of an example. The target part of an example must contain a matching string to be considered as the target for translation

Lines 4. to 8. define the transfer of the regular expression:
Line 5 refers to the first group of the instance surrounded by braces, i.e. *[0-9]{1,2}*. It says that in the output sentence the matching string should be added a suffix “/”.

Lines 6 and 7 refer to the second and third group of the instance respectively.

The <orders> tag makes it possible to permute the order of the groups. The groups are listed inside the tag in the order expected in the target sentence (here, the order of the target is identical to that of the source).

The below rules are listed in order to clarify the translation algorithm. Rule 2 converts another date format. Rule 3 is used for the time format conversion.

```
Rule 2:
<instance>([0-9]{1,2})[\.]([0-9]{1,2})[\.]([0-9]{2,4})</instance>
<source>([0-9]{1,2})[\.]([0-9]{1,2})[\.]([0-9]{2,4})</source>
<target>[0-9{1,2})(st|nd|rd|th)?\s ((January)|(February)|(March)|(April)|(May)|(June)|(July)|(August)|
(September)|(October)|(November)|(December))\s([0-9]{2,4})</target>
<orders>
        <order sourceGroup="1" sufix=" " />
        <order sourceGroup="2" sufix=" " />
```

```
        <order sourceGroup="3" sufix="" />
</orders>
<rules className="ToEnglishDateRules" />
```

```
Rule 3:
<instance>([0-2]?[0-9])(?:\:([0-5]?[0-9])(?:[\:\.]([0-5]?[0-9]))?)?</instance>
<source>([0-2]?[0-9])(\:([0-5]?[0-9])([\:\.]([0-5]?[0-9]))?)?</source>
<target>((([0-1]?[0-9])([\:\.]([0-5]?[0-9])([\:\.]([0-5]?[0-9]))?)?\s?[AaPp]\.?[Mm]\.?)|(([0-2]?[0-9])(\:([0-5]?[0-9])
([\:\.]([0-5]?[0-9]))?)))</target>
<orders>
        <order sourceGroup="1" sufix=":" />
        <order sourceGroup="2" sufix=":" />
        <order sourceGroup="3" sufix="" />
</orders>
<rules className="ToEnglishTimeRules" />
```

ALGORITHM

Instance: Egzamin jest zaplanowany na 12.05.2008, na godzinę 15:15.

TM Source: Egzamin jest zaplanowany na 02.03.2007, na godzinę 13:00.

TM Target: The exam is planned for 2 March 2007, at 1 PM.

Expected Output: The exam is planned for 12 May 2008, at 3:15 p.m.

For each rule in turn
if regexp described in <instance> tag matches a fragment of Instance
extract the fragment, and name it **RegExpInstance**
//Here, Rule 2 extracts the RegExpInstance: 12.05.2008

For each TM Unit in turn //TM Unit is a pair <TMSource; TM Target>
    If regexp described in <target> matches a fragment of TM Target
    extract the fragment, and name it **RegExpTarget**
    *//Here, the above TM Target is found and **2 March 2007** is extracted*

Separate RegExpInstance into groups according to positions of braces in the <instance> pattern
*//Here the **12.05.2008** is divided into 3 groups: **12**, **05**, **2008**.*
    For each group use the conversion declared in <rules className>
    *//Here, the rule named ToEnglishDateRules is invoked. The rule converts the 3 groups into **12, May, 2008** respectively*

Merge the converted groups according to the <orders> element.
//Here, the merged expression is: 12 May 2008, as the order of the groups is preserved.

Place the merged expression into the TM Target surrounded by the tag **antra-changed**
//The following is obtained:
The exam is planned on <antra-changed>12 May 2008</antra-changed>, at 1 PM.
Still, the hour needs adjustment

Go back to the beginning. In the next loop do not touch texts surrounded by the **antra-changed** tag.
//Another loop yields:
The exam is planned on ***<antra-changed>12 May 2008</antra-changed>,*** *at* ***<antra-changed>****3:15 p.m****</antra-changed>.***

Clear up all <antra-changed> tags

So far, transfer rules have been developed for:

- various formats of date
- various formats of time
- currency expressions
- metric expressions
- numbers
- e-mail addresses.

FUTURE WORK

One direction of the development is to expand the set of rules. The sample ideas for the Polish language are: zip-codes, telephone numbers and URL addresses.

Another aspect is the transfer of formatting tags. The most obvious fields of interest seem to be XML and HTML formatting languages. The structure of tags is strictly defined, which allows for using the mechanism of regular expressions to recognize and transfer tags between texts in different languages.

Another possible direction is to expand the formalism beyond regular expressions. The idea is to replace regular expressions in the rules by lexical expressions based on bilingual dictionaries prepared beforehand.

SUMMARY

The transfer approach in Machine Translation has been widely criticized for high cost of rule preparation. The idea of using Translation Memories in a MT system, presented here, overcomes this problem: On the one hand a rule is not required to cover the whole sentence – only a part of it must match the pattern – which expands the application of a rule. On the other, thanks to using a general formalism of regular expressions, one rule may be matched to many text fragments.

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