ID 392:TERSEO + T2T3 Transducer. A systems for recognizing and normalizing TIMEX3

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Abstract

The system described in this paper has participated in the Tempeval 2 competition, specifically in the Task A, which aim is to determine the extent of the time expressions in a text as defined by the TimeML TIMEX3 tag, and the value of the features type and val. For this purpose, a combination of TERSEO system and the T2T3 Transducer was used. TERSEO system is able to annotate text with TIDES TIMEX2 tags, and T2T3 transducer performs the translation from this TIMEX2 tags to TIMEX3 tags.

1 Introduction

Identification and extraction of explicit and implicit temporal information has become a very important field of research within the computational linguistics area since some years ago (Allen, 1983) (Allen, 1984). Moreover, a large number of NLP applications are exploiting this extracted information, such as question answering and summarization systems, allowing these applications to perform in a more complex level.

When dealing with temporal information identification and normalization, different approaches can be taken, depending on the available resources of the target language and the requirements of the system being developed. The most extended approaches to the problem are: a) rule-based approaches, such as Chronos (ITC-irst): recognizes and normalizes temporal expressions in English and Italian (Negri, 2007); TERSEO (University of Alicante, the system used for this work): a knowledge based system for Spanish that has been automatically extended to other languages, such as English, Italian and Catalan (Saquete et al., 2006), b) machine learning approaches, such as TimexTag (University of Amsterdam): applies data-driven methods for recognition and normalization tasks (Ahn et al., 2005) (Ahn, 2006); CU-TMP (University of Colorado): uses machine learning for automatic annotation (Bethard and Martin, 2007), and c) mixed combination of rules and ML approaches, such as, TempEx (MITRE Corporation): combines hand-coded patterns with machine learning rules to tag documents (TempEx, 2008) (Mani and Wilson, 2000); TARSQI (Brandeis University): currently uses GUTime (2008) for temporal expression annotation, which extends the capabilities of the TempEx tagger while generating `TIMEX3` annotations (Verhagen et al., 2005). However, whatever the approach, the output of these systems is a standardized annotation scheme.

The most popular annotation schemes are TIDES (Mani et al., 2001) and TimeML (Pustejovsky et al., 2003b). TIDES program followed the efforts started in the context of the Message Understanding Conference, MUC (1998), and defined the TIMEX2 tag, with the goal of interpreting temporal expressions within a normalized representation of the times they denote, adopting the ISO 8601 standard (Technical Committee ISO/TC 154, 2004). In 2004, within the ACE program, the Time Expression Recognition and Normalization (TERN, 2004) evaluation workshop was held, requiring by the participation systems to detect and normalize the temporal expressions mentioned in the source data, according to the TIDES annotation standard [1]. In spite of the widespread use of this annotation scheme within NLP researchers, it is necessary to identify other types of temporal information such as events or the relations between events and temporal expressions. Motivated by such considerations, the TimeML annotation scheme (Pustejovsky et al., 2003a) (Pustejovsky et al., 2005) (Lee et al., 2007) was developed, specifying four major data structures (elements) for an-

[1] http://fofoca.mitre.org/annotation_guidelines/2005_timex2_standard_v1.1.pdf

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notation: EVENT, TIMEX3, SIGNAL and LINK (Pustejovsky et al., 2005).

2 System Description

The system presented in this paper is a combination of two separated systems. First of all, TERSEO system, which is a knowledge-based system for Spanish automatically extended to English, performs an identification and normalization of all the temporal expressions in the text, annotating them with TIMEX2 tags. Once the text has been annotated with TIMEX2, the T2T3 transducer applies a set of translation rules to convert this TIMEX2 output to a TIMEX3 output.

2.1 Description of TERSEO system

TERSEO system first implementation used a hand-made knowledge database in Spanish. However, our main goal was the possibility of working with TERSEO on a multilingual level, but building the different knowledge databases for the new languages through the automatic acquisition of rules (Negri et al., 2006). Therefore, it is possible to create a multilingual system with no need of a previous knowledge of the other languages to which TERSEO system is going to be extended. For this purpose, an architecture similar to the one used by EuroWordNet (Vossen, 2000) was implemented, in order to obtain knowledge databases for the different languages, but all of them connected though a unit denominated TER-ILI or Temporal Expression Rules Interlingua Index. In doing that, TERSEO system have a new knowledge database for each new language and is able to solve any expression in this language. Besides, the system is easily extensible to other new languages. The output of TERSEO system is following the guidelines of TIDES annotation scheme.

This system participated in TERN2004 for English, obtaining the results shown in Table 1.

It is important to consider the results of the system annotating TIMEX2 tags, due to the fact that the final results after the translation depends on how correct the annotation was made by TERSEO.

2.2 Description of T2T3 Transducer

The T2T3 Transducer, developed by University of Alicante and Brandeis University, implements an automatic mapping between TIDES annotation scheme and TimeML, only in English in a first step. This mapping is performed applying a set of rules in two steps:

- **Step 1: Rules for the adaptation of the extent**: the temporal expression extent is adapted from TIMEX2 to TIMEX3. The extension of the expression is related to recognition of the expression. Most expressions which are considered as markable in TIDES are also considered as markable in TimeML. However, TimeML differs from TIDES with respect to the tag span in some cases. Therefore, following the outline of both TIDES 2005 guidelines[2] and TimeML 1.2.1 guidelines[3], a mapping is performed in order to properly adapt the TIMEX2 extent to the TIMEX3 extent. Besides, all the possible adaptations from one scheme to the other are clustered in a set of transformation rules.

- **Step 2: Rules for the transformation of the attributes**: TIMEX2 attributes are transformed to TIMEX3 attributes. The attributes are related to normalization of the expression. The transducer has one rule for each TimeML TIMEX3 attribute, extracting and combining the information provided by the TIMEX2 attributes of each temporal expression. In Tempeval 2 competition only type and val attributes are considered. Therefore, only these two transformation rules are presented here:

  – Attribute type: The **Type Assignment** rule defines the following steps:
    1. If the <TIMEX2> tag has a SET attribute which value is ”YES”, then type="SET" must be added to the TIMEX3 tag.
    2. If the VAL attribute of the <TIMEX2> tag starts with ”P”, then type="DURATION" must be added to the TIMEX3 tag.
    3. If the VAL attribute of the <TIMEX2> tag contains a ”T”, then type="TIME" must be added to the TIMEX3 tag.
    4. In any other case, type="DATE" must be added to the TIMEX3 tag.

  – Attribute value: The attribute value is equivalent to the VAL attribute in

[2]Section 5 in TIDES guidelines http://fofoca.mitre.org

[3]Section 2.2.1.2 in TimeML guidelines http://www.timeml.org

Tag	Precision	Recall	F-Measure
TIMEX2	0.954	0.786	0.862
TIMEX2:ANCHOR_DIR	0.818	0.566	0.669
TIMEX2:ANCHOR_VAL	0.703	0.487	0.575
TIMEX2:MOD	0.444	0.111	0.178
TIMEX2:SET	0.882	0.455	0.600
TIMEX2:TEXT	0.687	0.567	0.621
TIMEX2:VAL	0.686	0.709	0.698

Table 1: Results obtained by TERSEO in TERN2004 competition for TIMEX2

TIMEX2 in most cases. Therefore, in general, the translation is direct. However, there is an exception to this rule in the case of time-anchored expressions. Whereas in TimeML, the value of the head expression is always a period, according to TIDES, there are two different types of time-anchored expressions: a) Anchored point expressions and b) Anchored duration expressions. Therefore, when the T2T3 transducer detects one of these anchored point expressions, a special treatment with the TIMEX2 attributes is performed in order to obtain the proper period value. Moreover, the ”DURATION” type is established for the expression.

3 Evaluation results

In this section all the evaluation results for Task A in English are presented. Table 2 shows the results of the system using the trial corpus provided by the organization, the results of the system using the first delivered training corpus and the whole training data, and finally, the score of the system with the test corpus. Accuracy value is not given in the test results and it can not be calculated from the results data provided.

As shown in the results of the different evaluations, test results are very similar to training results, what means that the system is performing steadily. Besides, in the test evaluation, the type attribute result is the best one obtained, being close to 100%. It would be interesting to have the corpus annotated also with TIMEX2 in order to determine which errors derive from TERSEO and which errors derive from the Transducer.

4 Conclusions

Our participation in Tempeval 2 competition was only in Task A, due to the fact that the system presented is a extension of TERSEO system, which only performs identification and normalization of temporal expressions generating TIMEX2 annotation output. Events and links are out of the scope of this system currently.

However, our motivation for participating in Tempeval 2 competition was the possibility to determine the performance of the extension applied to TERSEO, by means of a transducer that is able to convert TIMEX2 annotation to TIMEX3, only using the information of the TIMEX2 tags as input. The transducer applies a set of rules, in order to transform the extent of the temporal expression according to TimeML annotation guidelines, and a set of rules to translate the TIMEX2 attributes to the attributes established by TimeML also. It is important to consider that TERSEO system is a knowledge-based system, with hand-made rules for Spanish. These rules were automatically extended to other languages (English is one of them) using only automatic resources and without manual revision. This automatic extension is very interesting since it is possible to create a new knowledge for the system very fast and with satisfactory results.

The results of the evaluation of this combination (TERSEO + T2T3 Transducer) are 76% precision, 66% recall and 71% F1-Measure. For the case of the attributes, it obtained 98% for type and 65% for value.

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Measure	Trial	Training 1	Training 2	Test
PRECISION	0.83	0.78	0.83	0.76
RECALL	0.72	0.66	0.55	0.66
F1-MEASURE	0.77	0.72	0.66	0.71
ACCURACY	0.99	0.98	0.98	-
ATT. TYPE	0.86	0.87	0.87	0.98
ATT. VAL	0.64	0.58	0.63	0.65

Table 2: Results obtained by TERSEO+T2T3 Transducer with trial corpus for English

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