A PropBank for Portuguese: the CINTIL-PropBank

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Abstract

With the CINTIL-International Corpus of Portuguese, an ongoing corpus annotated with fully fledged grammatical representation, sentences get not only a high level of lexical, morphological and syntactic annotation but also a semantic analysis that prepares the data to a manual specification step and thus opens the way for a number of tools and resources for which there is a great research focus at the present. This paper reports on the construction of a propbank that builds on CINTIL-DeepGramBank, with nearly 10 thousand sentences, on the basis of a deep linguistic grammar and on the process and the linguistic criteria guiding that construction, which makes possible to obtain a complete PropBank with both syntactic and semantic levels of linguistic annotation. Taking into account this and the promising scores presented in this study for inter-annotator agreement, CINTIL-PropBank presents itself as a great resource to train a semantic role labeller, one of our goals with this project.

Keywords: propbank, portuguese, annotated corpus

1. Introduction

Following the important methodological breakthrough that took place in Language Technology with the advent of statistical approaches, the development of annotated corpora has been deployed around adding increasingly more complex linguistic information, e.g. concerning phrase constituency (aka TreeBanks (Marcus et al., 1993)), syntactic functions (aka DependencyBanks (Bühmová et al., 2001)), and phrase-level semantic roles (aka PropBanks (Palmer et al., 2005)), just to mention a few salient examples.

To keep advancing along this trend and to develop corpora that are annotated with deep linguistic representations, the construction of annotated corpora faces a challenge that demands a new qualitative step: the fully fledged grammatical representation to be assigned to each sentence is so complex and so specific to that sentence that it cannot be reliably crafted manually piece by piece and the annotation cannot be performed without some supporting application, viz. a computational grammar.

This paper discusses the solutions we developed to construct a propbank on the basis of a deep linguistic grammar and its companion deep linguistic treebank (Branco et al., 2010), with a central goal: the construction of a high quality data set with semantic information that could support the development of automatic semantic role labelers (Baker et al., 2007; Carreras and Márquez, 2005) for Portuguese.

Section 2 reports on the construction of a propbank on the basis of a corpora annotated with a deep linguistic grammar. In Section 3, we describe the extraction of semi-annotated constituency trees with automatic semantic roles that assist the manual completion step of our dynamic propbank, presented in Section 4. In Section 5, we enumerate some applications of the PropBank, and Section 6 presents the concluding remarks.

2. A PropBank supported by a deep linguistic grammar

The deep linguistic grammar used for the initial semi-automatic propbanking was LXGram, a grammar for the computational processing of Portuguese (Branco and Costa, 2010; Branco and Costa, 2008a; Branco and Costa, 2008b), developed under the grammatical framework of HPSG (Pollard and Sag, 1994) which uses MRS (Copestake et al., 2005) for the representation of meaning and the Grammar Matrix (Bender et al., 2002) for the initial type system. In a first phase, the parses obtained with LXGram and manually selected by human annotators were gathered in the CINTIL-DeepGramBank, a corpus of deep grammatical representations, composed by sentences taken from the CINTIL-International Corpus of Portuguese with 1 million tokens of written and spoken linguistic materials (Branco et al., 2010).

The construction of the CINTIL-DeepGramBank was performed adopting the annotation procedure where independent annotators produce primary data and their decisions are validated in a subsequent adjudication phase by a third independent annotator. More specifically, each sentence was automatically processed by LX-Suite (Silva, 2007) and analysed by LXGram (Branco and Costa, 2010): once a set of grammatical analysis is obtained (parse forest), two independent annotators choose the analysis each one of them considers to be correct. In case of divergence between their decisions, a third independent adjudicator reviews their options and makes the final choice. The annotators and adjudicators are language experts with post-graduate degrees in Linguistics.

The workbench used to support this process of annotation was [incr tsdb()] (Oepen, 2001), which permits to parse, select and collect fully fledged deep grammatical represen-
tations for the respective sentences. Annotation speed is roughly 80 to 100 sentences per day. At the moment, last stable version 3 of the CINTIL-DeepGramBank is composed of 5422 sentences. For this version, the level of inter-annotator agreement (ITA) scores 0.86 in terms of the specific inter-annotator metric we developed for this kind of corpora and annotation (Castro, 2011). Since the CINTIL-DeepGramBank keeps being developed, we have an additional 4047 sentences in the ongoing version 4, with 0.80 of inter-annotator agreement.

3. Extracting semi-annotated constituency trees

Propbanks are syntactic constituency treebanks whose trees have their constituents labeled with semantic role tags (Palmer et al., 2005). Propbanks are thus annotated corpora that result from the extension of the annotation associated to the sentences in treebanks by means of an extra layer of linguistic information for semantic roles.

After the manual selection of the correct analyses (described in the previous section), the CINTIL-DeepGramBank was processed in order to obtain only the syntactic constituency trees.1 To achieve this, the tool lkb2standard (Silva et al., 2010) was developed to extract these trees from the files exported by [incrisdb)]. These are trees that are then ready to be extended to form the CINTIL-PropBank, by means of their enrichment with appropriate semantic role tags.

Some of the semantic role labels in the tag set used in this PropBank can be obtained directly from the deep grammatical representations and through this extraction tool. This is done by resorting to the feature structures that describe the semantics of the sentence in the CINTIL-DeepGramBank, namely those used to represent the arguments of predicates, ARG1 to ARGn. Furthermore, the extraction tool lkb2standard was designed to play a role that goes beyond the mere extraction of the constituency tree annotated with these ARG1 to ARGn labels. By resorting to the details of the deep grammatical representation, it permits to label phrases with a number of further labels that account for phrases that, on the surface level, are associated with more than one argument (see Figure 1, for example):

- **ARG1** – Argument 1
e.g. *O João deu uma flor à Maria.* (“João gave Maria a flower.”)

- **ARG2** – Argument 2
e.g. *O João deu uma flor à Maria.* (idem)

- **ARG3** – Argument 3
e.g. *O João deu uma flor à Maria.* (idem)

- **ARG11** – Argument 1 of subordinating predicate and Argument 1 in the subordinate clause (semantic function of Subjects of so called Subject Control predicates)
e.g. *As crianças não querem dormir.* (“The children don’t want to go to sleep.”)

- **ARG21** – Argument 2 of subordinating predicate and Argument 1 in the subordinate clause (semantic function of Subjects of so called Direct Object Control predicates)
e.g. *Uma oferta obrigou o João a tomar medidas.* (“An offer made João take action.”)

- **ARGnec** – Argument n in complex predicate constructions
e.g. *O cliente podia estar mais confiante.* (“The client could have been more confident.”)

- **ARGnac** – Argument n of anticausative readings
e.g. *O doente acordou.* (“The patient woke up.”)

4. Manual PropBanking: completing the annotation

Building on the information made explicit by the deep linguistic grammar, the remaining phrases that are modifiers, associated with non argumental positions, are left with the semantic role tag M, as we can see in Figure 1.

There are two further tools supporting this manual phase of annotation described below aimed at specifying the semantic role of modifiers: one converts trees into an annotation format compatible with the annotation interface (see Figure 2); and a reverser tool for the inverse operation (transformed trees, such as the one shown in Figure 3).2

As the outcome of the operation of the first of them, the set of sentences to be annotated can be presented in a spreadsheet file, with each sentence in a different sheet. For each suite of treebanked sentences, a spreadsheet is created with as many sheets as there are sentences in that suite. If a given sentence happens not to have received a parse, its sheet only contains its identification number and that sentence.

As we can see in Figure 2, each line has cells automatically filled in, and others to be manually filled in by the annotator. Each line includes: in column (A), the syntactic category and grammatical function; in column (B), the semantic role assigned by the grammar; in (C), the cell to be filled in by the human annotator; in (D), the constituent being tagged, and in (E) the possible observations from the annotator.

A completion step followed that consists in the manual specification of the occurrences of this portmanteau tag M in terms of one of the semantic roles available for modifiers in our tag set:

- **LOC** – Location: to locate an action in place, whether physical or abstract (see Figure 4)

- **EXT** – Extension: to use with strings with an extension notion, mainly numerical. Includes measures, percentages, quantifiers, and comparative expressions (see Figure 4)

- **CAU** – Cause: to determine a cause, a reason of an action (see Figure 5)

- **TMP** – Temporal: to locate an action in time, including the frequency, duration, and repetition (see Figure 4)

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1For a detailed account of the linguistic options that are behind the syntactic constituency, see (Branco et al., 2011).

2For a more detailed account of this annotation environment and process, see (Branco et al., 2009).
Figure 1: CINTIL-DeepGramBank constituency tree with semantic M tags highlighted for: *Decidimos trabalhar em conjunto e cooperar nas questões delicadas* (“We decided to work together and cooperate on the delicate issues”).

Figure 2: Spreadsheet annotation interface for specifying semantic roles of the M tags for: *Decidimos trabalhar em conjunto e cooperar nas questões delicadas* (“We decided to work together and cooperate on the delicate issues”).

Figure 3: CINTIL-PropBank tree with manual MNR and ADV tags and automatic PRED tag highlighted for: *Decidimos trabalhar em conjunto e cooperar nas questões delicadas* (“We decided to work together and cooperate on the delicate issues”).
Figure 4: CINTIL-PropBank tree with the semantic roles EXT, TMP, LOC, and DIR highlighted for: Só quando sentiu uma mão no ombro levantou os olhos do chão (“Only when he felt a hand on his shoulder did he raise his eyes from the floor”).

Figure 5: CINTIL-PropBank tree with the semantic role CAU highlighted for: Eles falharam por várias razões conjunturais (“They failed for many conjunctural reasons”).

- **PNC** – Purpose, goal: to all strings that describe a goal or a proposal of a given action (see Figure 6)
- **MNR** – Manner: to all strings that specifies the way, manner how an action is realized or due (see Figure 3)
- **DIR** – Direction: to reference directions, covering both the source/origin and destination (see Figure 4)
- **POV** – Point of View: to strings that expresses an author position about a given event (see Figure 7)
- **PRED** – Secondary predication: to all cases of predicative structures, mainly past participles and resultative constructions
- **ADV** – Adverbial: to strings that do not fall into any of the other categories (see Figure 3)

This manual phase of the construction of the PropBank is always done by two independent annotators, who choose the tags each one of them consider to be correct. In case of divergence between annotators, a third independent adjudicator reviews their decisions and makes the final choice.

The annotators are experts with post-graduations in Linguistics. The annotation speed is around 200 sentences per day. According to our latest data, from stable version 3 (5422 sentences), the level of inter-annotator agreement is over 0.75 in terms of the $k$-coefficient. For the ongoing version 4 (with an extra 4047 sentences), the level of inter-annotator agreement is 0.76.

At this point, it is important to note that, in the case of attributes and relative clauses with A-M, AP-M and CP-M tags at the constituency level, the tag M (at the third level, the semantic role) is automatically replaced by PRED at this step of conversion (see and compare Figures 1 and 3 for the phrase “nas questões delicadas”).
5. Some applications of the PropBank

It is important to note that with the automatic PropBanking phase it was already possible to extract treebanks and dependencybanks since CINTIL-DeepGramBank already contains the constituency structure with syntactic information, which is enough to extract a treebank, and syntactic functions tags, which can be used to build a dependencybank. With the second PropBanking step — manual specification of semantic role tags — we now have an opportunity to get an added value, a resource to train a semantic role labeller.\(^3\) A semantic role labeller allows to correctly identify the various semantic roles in a sentence enabling the recognition of relations between their elements, such as who did what, what happened to whom, etc. With these semantic values, we have a world of new possibilities to improve or create tools and resources for areas such as question answering, information extraction, summarization, machine learning, and information retrieval on the web which opens the possibility for semantic web searching.

6. Concluding remarks

In this paper, we reported on the solutions we followed to develop a propbank with almost 10 thousand sentences. This propbank was built with the help of a deep linguistic grammar which permitted to construct a high quality and reliable data set with semantic information that will support the training of semantic role labellers for Portuguese. This resource has also the potential to benefit many other natural language processing applications, such as information extraction, question-answering, summarization, machine translation, information retrieval, among others.

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\(^3\)This application is currently under development and testing with the current version of the CINTIL-PropBank.
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