Exploring the role of syntax in irony and stance detection tasks

Explorando el papel de la sintaxis en las tareas de detección de ironía y stance

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Resumen: Esta investigación tiene como objetivo estudiar el papel que puede desempeñar la sintaxis en las tareas de Análisis de Sentimiento, en particular, se centra en la detección de ironía y la postura asumida por un sujeto ante una afirmación ajena (conocido en inglés como *stance*). Aprovechando del principal formato de anotación morfosintáctica existente, *Universal Dependencies* (UD), exploramos la presencia y frecuencia de las estructuras sintácticas en los textos de las redes sociales. Dichos textos han sido analizados para extraer y modelar nuevas características sintácticas significativas útiles en los sistemas de Procesamiento de Lenguaje Natural (PNL). Para lograr este objetivo, nos centraremos en cómo se explota la ironía en los textos políticos que contienen una open stance hacia una entidad objetivo predeterminada y se ven afectados por una fuerte polarización. Además, gracias a la versatilidad multilingüe del formato de anotación UD para la sintaxis de dependencia, el enfoque se probará en dos idiomas diferentes: inglés y español.
Palabras clave: Ironía, Stance, Redes Sociales, Sintaxis, Universal Dependencies

Abstract: This research aims at investigating the role that syntax can play in Sentiment Analysis tasks, in particular focusing on irony and stance detection. Benefiting from the application on our data of the standard *de facto* morpho-syntactic annotation format *Universal Dependencies*, we observe the syntactic structures occurring in these parsed social media texts in order to extract and model novel syntactic features to be used in the implementation of Sentiment Analysis tools. For achieving this goal we will focus on how irony is exploited in texts about politics, which contain an open stance towards a predetermined target entity and are affected by a strong polarization. Furthermore, thanks to the multilingual versatility of the UD annotation format, the approach will be tested on two different case-studies, i.e. English and Spanish.
Keywords: Irony, Stance, Social Media, Syntax, Universal Dependencies

1 Introduction and motivation

In the last decade, the interest towards social networking sites has grown considerably, and the NLP community is relying more and more on data extracted from social media and micro-blogs. In particular, thanks to the the various APIs it provides and the great availability in the platform of expressions of people's sentiments and opinions, *Twitter* has become one of the most exploited sources for data retrieval, especially for Sentiment Analysis and Opinion Mining. Contents generated by users in Twitter, as some other forms of computer-mediated communication (CMC), are not revised by the authors for grammatical correctness before publication and therefore theymight contain non-standard forms such as: misspelled words, erroneous punctuation, dialectical forms, emojis, emoticons, and elongated words. Although humans understand each other when communicate with this kind of language, analyzing it automatically proves to be a very difficult challenge, especially for what concerns parsing and Part of Speech tagging.

In particular here we aim at studying the

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dependency syntax relations (*deprels*), represented through the standard format *Universal Dependencies*[1], and applied in two different case studies: irony detection and stance detection, within a multilingual framework, taking into account the English and Spanish language.

On the one hand, for what concerns irony detection, the aim of the task consists in investigating whether a short message (a tweet or a blog post) is ironic or not, with respect to a given context. The issue is therefore tackled as a binary classification task. On the other hand, stance detection consists in automatically determining whether the author of a text is in favour, against or neutral towards a given target (i.e. a statement, an event, a person or an organization) (Mohammad, Sobhani, and Kiritchenko, 2016) and it is addressed as a multi-class classification task.

The motivation of our research arises from the exponential growth of the interest towards analyses about a specific product or political actor, and the importance of creating automatic systems able to determine the attitude of a user within political elections or towards the product of a certain company. It has been studied how people (and therefore social media users) resort to irony in order to express also their negative opinions in a less aggressive way (Grice, 1975; Grice, 1978; Sperber and Wilson, 1981; Wilson and Sperber, 2007). Irony may also play the role of a polarity reverser, shifting the sentiment and the opinion from one end of the spectrum to its opposite. It is therefore crucial to identify an ironic expression when it occurs, to understand its real meaning and to correctly identify the stance the author wants to express using it.

2 Related work

2.1 Irony

The recognition of irony and the identification of pragmatic and linguistic devices triggering it are known as very challenging tasks to be performed by both humans or automatic tools (Mihalcea and Pulman, 2007; Reyes, Rosso, and Buscaldi, 2010; Kouloumpis, Wilson, and Moore, 2011; Maynard and Funk, 2011; Reyes, Rosso, and Buscaldi, 2012). Considering that the more promising tools for irony detection apply supervised approaches, it is becoming progressively crucial the development of more and larger linguistic resources on which these tools can be trained and tested.

Some of the first attempts on the automatic classification of irony in social media data have been made by (Karoui et al., 2015; Hernández Farías, Benedí, and Rosso, 2015; Reyes, Rosso, and Buscaldi, 2010), but we are still far from optimistic results and they all address this issue in English data only. A proposal, which goes instead towards a multilingual automatic classification comes from Karoui et al. (2017), where the authors developed a framework for a fine-grained annotation of irony in social media texts.

In the last few years, some shared task centered on irony detection have been proposed. In 2018 a shared task on irony detection in tweets has been organized (*SemEval-2018 Task 3: Irony detection in English tweets*)[2] (Van Hee, Lefever, and Hoste, 2018), and in the following months of the same year a twin shared task was also proposed in the Italian NLP community: IronITA[3] on *Irony and Sarcasm Detection in Italian Tweets* (Cignarella et al., 2018). Below we will also describe briefly the *IroSvA 2019* shared task, which focused on Irony Detection in Spanish Variants[4] (Ortega et al., 2019).

2.2 Stance

On the other hand, also detecting the stance expressed by people towards specific targets is a field of NLP research that is currently collecting a growing interest. Only recently stance detection has been acknowledged as an independent task having its own characteristics, peculiarities and importance. The first shared task on stance detection was indeed held for English at *SemEval2016 - Task6* (Mohammad, Sobhani, and Kiritchenko, 2016), but many others follwed it such as *Stance and Gender Detection in Tweets on Catalan Independence @ Ibereval 2017* for tweets in Spanish and Catalan (Taulé et al., 2017). A task strictly related to stance detection is also *SemEval2017 - Task 8* (Derczynski et al., 2017), which in-

[1] `https://universaldependencies.org/`

[2] `https://competitions.codalab.org/competitions/17468`

[3] `http://di.unito.it/ironita18`

[4] `http://www.autoritas.net/IroSvA2019//`

cludes two subtasks: (a) stance classification and (b) veracity classification of given rumors. In 2019 another experience followed this task: *SemEval2019 - Task 7* on Rumor Detection, which addressed an open stance classification task of rumors (Gorrell et al., 2019). Not surprisingly in all cases the stance detection task was based on data extracted from social media, such as Twitter or Reddit, whose topic was about politics and public life.

3 Research hypothesis

The main research hypothesis we want to investigate is that the inclusion of *ad-hoc* tailored syntactic features among those used by a sentiment analysis system may enhance its performance in processing texts. The first goal to be accomplished is therefore to observe the syntactic structures occurring in parsed texts from social media (namely Twitter and Reddit), to design some features encoding them and finally to investigate the impact of these features on two case studies: irony and stance detection.

Furthermore we would like to investigate these issues also in different languages, such as English, Spanish (and later Italian and French). Consequently, as main reference for syntax a format has been selected that has been drawn having the wider perspective on the variety of human languages in mind: the Universal Dependencies (Nivre et al., 2016) (UD), which is currently considered a standard *de facto* for dependency parsing also because of its portability on more than 70 different languages.

4 Methodology and preliminary experiments

Our approach has been inspired by some previous work which provided support to our hypothesis. We can cite in particular the study of Saif et al. (2016) in which the importance of the interface between syntax and semantic aspects is highlighted. Furthermore Sidorov et al. (2013) and Sidorov et al. (2014) proposed the idea of modeling shallow syntactic features for enhancing the performance of sentiment analysis systems.

We extended these ideas by referring to a particular syntactic framework, namely UD, and testing in some specific application scenarios the novel syntactic features that can be extracted from a UD parsed text. In both cases described below (see Sec. 4.1 and Sec. 4.2) during the pre-processing we applied indeed to the texts the morphological and syntactic analysis according to the UD framework. In Figure 1 an example of a Spanish tweet in UD format is provided[5].

In particular, we trained *UDPipe*[6], which includes tokenization, Part of Speech tagging and parsing, respectively on the *UD_Spanish-GSD corpus*[7] for Spanish, and on the *en_core_web_sm*[8] for English. This allowed us the extraction of the novel syntactic features on which our approach is centered.

We started by testing our hypothesis in the case of stance and participating in the *SemEval2019 - Task 7 on Rumor Detection* (RumorEval 2019[9]), which is focused on the identification of stance towards a set of given rumours in English texts from Twitter (see Sec. 4.1). As far as irony is concerned, we observed the relationships between UD syntactic structures and figurative language phenomena and we encoded our observations in the features we used in the system we proposed in the *Irony Detection in Spanish Variants* task: IroSvA 2019[10] (see Sec. 4.2).

In the following, we describe in more detail our participation in these shared tasks.

4.1 RumorEval 2019

The RumorEval task was articulated in the following sub-tasks: *Task A* (open stance classification – SDQC) which was a multiclass classification for determining whether a message is a "support", a "deny", a "query" or a "comment" with regard to the original post; *Task B* (verification) which was a binary classification for predicting the veracity of a given rumour into "true" or "false". We will focus here only on commenting the approach and results regarding Task A, that more related to stance detection.

In our system (Ghanem et al., 2019) we have modeled novel features taking advantage of the UD syntactic analysis made available after the application of the UDpipe to the dataset. The application of the syn-

[5]Translation: I have launched a reporter into the air and they do not fly... 😱

[6]https://pypi.org/project/ufal.udpipe/

[7]https://github.com/UniversalDependencies/UD_Spanish-GSD

[8]https://spacy.io/models/en

[9]https://competitions.codalab.org/competitions/19938

[10]http://www.autoritas.net/IroSvA2019//

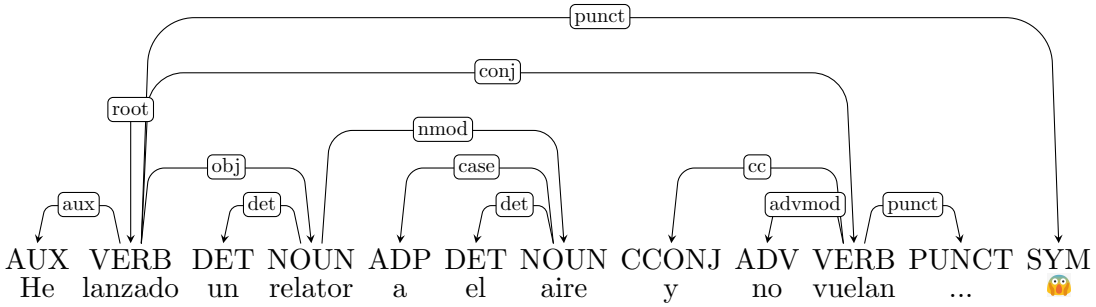

Figure 1: Example of a dependency tree for a Spanish tweet.

tactic "dependency relations" (*deprels*) allows us to extract from data: (a) the **ratio of negation** dependencies compared to all the other relations; (b) the Bag of Relations (BoR_all) considering all the *deprels* attached to **all the tokens**; (c) the Bag of Relations (BoR_list) considering all the *deprels* attached to the tokens belonging to a selected **list of words**[11]; and finally (d) Bag of Relations (BoR_verbs) considering all the *deprels* attached to all the **verbs**, thus fully exploiting morpho-syntactic knowledge.

We tested different machine learning classifiers performing 10-fold cross-validation. The results showed that Logistic Regression (LR) produces the highest scores. In general, the syntactic features we proposed here are really straightforward and simple, nonetheless they helped us to improve the overall performance of the system.

	MACRO-F1
Task A	48.95

Table 1: RumorEval 2019, final results.

In Table 1 we present the final scores achieved accordingly to the task organizers.

4.2 IroSvA 2019

The IroSvA 2019 shared task at IberLEF 2019 was focused on *Irony Detection in Spanish Variants*, to be addressed as a classical binary classification task. It allowed us to test the importance of morpho-syntactic information in the task of irony detection too. For this purpose, we exploited a straightforward methodology: we combined a Support Vector Classifier with a linear kernel (SVM), with shallow features based on morphology and dependency syntax. Beyond the morphological and syntactic analysis performed by the UDpipe, we applied another pre-processing step, which consists in stripping URLs from texts, all already normalized to lowercase letters.

In addition to the features already proposed in Ghanem et al. (2019) for the participation to RumorEval 2019 (see Sec. 4.1), we implemented here some novel features based on the ideas of Sidorov et al. (2014). In particular we created a Bag of Word Forms (tokens), considering the bi-grams that can be collected following the syntactic tree structure (rather than the bi-grams that can be collected reading the words of the sentence in the linear order). For instance, the bi-grams corresponding to the sentence in Figure 1 include: ['lanzado', 'He'], ['lanzado', 'relator'], ['relator', 'un'], ['relator', 'aire'], ['aire', 'a'], ['aire', 'el'], ['lanzado', 'vuelan'], ['vuelan', 'y'], ['vuelan', 'no'], ['vuelan', '...']. Then, the same approach was replicated in order to obtain bi-grams of *deprels*.

	F-AVG
LDSE	**0.6579**
W2V	0.6376
Word nGrams	0.6192
MAJORITY	0.4000
Our system	0.6302

Table 2: IroSvA 2019, final results.

Table 2 shows the official results we achieved in comparison with the four baselines proposed by the organizers. The results show that the addition of two particular features based on dependency relations, (i.e. the novelty of our work), produced a good contribution to the Irony Detection task in Spanish Variants. Considering that the results seem

[11] We manually created a list of words semantically significant and useful for discriminating the four sub-classes. For more details refer to Ghanem et al. (2019).

quite promising, and that the dependency-based features deserves a finer-grained study, in future work we will further investigate them observing their portability in other languages different than Spanish.

5 Objectives and future work

Our research aims at investigating the role that syntax can play in sentiment analysis tasks, in particular focusing on irony and stance detection. Up to now we have tailored some shallow morpho-syntactic features based on dependency syntax as they are represented according to the UD format.

In particular, we have explored until now the role of dependency relations within two contexts and across two languages: stance detection for English and irony detection for Spanish. We are currently working on the development of four different datasets extracted from Twitter for four different langauges (English, Spanish, French and Italian) and annotated for both stance and irony. The datasets thus built will help us in testing our hypothesis in a real multilingual setting. Considering the relevance of the syntactic annotation for the suitability of our approach, we are also working in the development and improvement of resources annotated in UD format.

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