

Linguistic-based Patterns for Figurative Language Processing: The Case of Humor Recognition and Irony Detection*

*Patrones lingüísticos para el procesamiento del lenguaje figurado:
el caso de reconocimiento de humor y detección de ironía*

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Resumen: Tesis doctoral en Informática realizada por Antonio Reyes Pérez y dirigida por el doctor Paolo Rosso (Universitat Politècnica de València). La lectura de la tesis fue realizada en la ciudad de Valencia (España) el día 2 de julio de 2012 ante un tribunal compuesto por los doctores: Antónia Martí Antonín (Universitat de Barcelona), Walter Daelemans (University of Antwerp), Richard Anthony (Tony) Veale (University College Dublin), Carlo Strapparava (Fondazione Bruno Kessler FBK -IRST) y José Antonio Troyano Jiménez (Universidad de Sevilla). La calificación obtenida fue de *Apto* con la mención *Cum Laude*.

Palabras clave: Reconocimiento de humor, detección de ironía, lenguaje figurado.

Abstract: Ph. D. thesis in Computer Science written by Antonio Reyes Pérez under the supervision of Dr. Paolo Rosso (Universitat Politècnica de València). The thesis defense was done in Valencia (Spain) on July 2nd, 2012. The doctoral committee was integrated by the following doctors: Antónia Martí Antonín (University of Barcelona), Walter Daelemans (University of Antwerp), Richard Anthony (Tony) Veale (University College Dublin), Carlo Strapparava (Fondazione Bruno Kessler FBK -IRST), and José Antonio Troyano Jiménez (University of Sevilla). The obtained grade was *Cum Laude*.

Keywords: Humor recognition, irony detection, figurative language.

1. Introduction

This investigation aimed to show how two specific domains of figurative language: humor and irony, could be automatically handled by means of considering linguistic-based patterns. We were especially focused on discussing how underlying knowledge, which relies on shallow and deep linguistic layers, could represent relevant information to automatically identify figurative uses of language. In particular, and contrary to most researches on figurative language, we focused on identifying figurative uses of language in social media. This means that our findings do not rely on analyzing prototypical jokes or liter-

ary examples of irony; rather, we tried to find patterns in social media texts of informal register whose intrinsic characteristics are quite different to the characteristics described in the specialized literature. For instance, a joke which exploits phonetic devices to produce a funny effect, or a tweet in which irony is self-contained in the situation. In this context, we proposed a set of features which work together as a system: no single feature was particularly humorous or ironic, but all together provided a useful linguistic inventory for detecting humor and irony at textual level.

2. Objective

Figurative language is in some way inherent to discourse, whatever the type of text. In this respect, the problem of automatically detecting figurative language cuts through

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every aspect of language, from pronunciation to lexical choice, syntactic structure, semantics and conceptualization. As such, it is unrealistic to seek a computational silver bullet for figurative language, and a general solution will not be found in any single technique or algorithm. Rather, we tried to identify specific aspects and forms of figurative language that were susceptible to be computationally analyzed, and from these individual treatments attempt to synthesize a gradually broader solution. In this context, our objective was to deeply analyze two figurative devices: humor and irony, in order to detect textual patterns to be applied in their automatic processing, especially, in their automatic identification at textual level. In order to achieve such objective, several conceptual and practical issues were addressed throughout the thesis:

- I. Literal and figurative language are windows to cognitive processes that are linguistically verbalized: the meaning cannot be derived only from lexicon.
- II. Specialized literature defines humor and irony in fine-grained terms. Such granularity cannot be directly mapped from theory to praxis: need of representing the core of both devices the less abstract as possible in order to describe deeper and more general attributes of both phenomena; rather than only *ad hoc* cases.
- III. Overlapping is quite common in figurative language. Indeed, irony is a common mechanism to produce a humorous effect, and *vice versa*: there are not formal linguistic boundaries to accurately separate both figurative devices.
- IV. Humor and irony are typical devices in which both literal and non-literal meaning might be simultaneously active: there are not linguistic marks to denote where the figurative meaning is starting.
- V. There are no available data to assess hypothesis or models: need of building objective corpus.

3. Thesis Overview

The thesis is conceptually organized as follows: In Chapter 2 we described the linguistic background as well as the theoretical issues regarding literal language and fig-

urative language. We emphasized the importance of considering language as a dynamic system, rather than a static one. Both humor and irony were conceptually described and discussed in detail. In Chapter 3 we introduced the related work concerning figurative language processing. First, the framework in which the thesis is developed was described. Then, the challenges that any computational treatment of figurative language faces was outlined.

In Chapter 4 we described, both conceptually and pragmatically, our humor recognition model. Hypotheses, patterns, experiments, and results were presented. Moreover, evaluation data sets were introduced. Finally, we discussed model's implications. In Chapter 5, in turn, we presented our irony detection model. First, operational bases, as well as aims, were outlined. Then, experiments and results were explained. Like in the previous chapter, all the evaluation data sets were introduced. Lastly, results and further implications were discussed.

In Chapter 6 we described how both models were assessed in terms of their applicability in tasks related to information retrieval, sentiment analysis, and trend discovery. Such evaluations were intended to represent real scenarios concerning figurative language processing beyond the data sets employed in Chapters 4 and 5. Finally, in Chapter 7 we outlined the main conclusions of the thesis, as well as its contributions and lines for future work.

4. Contributions

In this thesis we approached two tasks in which the automatic processing of figurative language has been involved: humor recognition and irony detection. Each task was undertaken independently by means of a linguistic pattern representation. In this respect, two models of figurative language were proposed:

- HRM (Humor Recognition Model);
- IDM (Irony Detection Model).

Both models go beyond surface elements to extract different types of patterns from a text: from lexicon to pragmatics. Since our target was focused on representing figurative language concerning social media texts, each

model was evaluated by considering non-prototypical texts that are laden with social meaning. Such texts were automatically collected by chiefly taking advantage of user-generated tags. The data sets are freely available for research purposes.

Two goals were highlighted while evaluating the models: representativeness and relevance. The former was intended to consider the appropriateness or representativeness of different patterns to humor recognition and irony detection, respectively; whereas the latter was focused on considering the empirical performance of each model on a text classification task.

Below are summarized our major findings:

- I. By representing humor and irony in terms of their conceptual use rather than only of their theoretical description, our models seem to efficiently capture the core of the most salient attributes of each figurative device.
- II. Our figurative language representation is given by analyzing the linguistic system as an integral structure which depends on grammatical rules as well as on cognitive, experiential, and social contexts, which altogether, represent the meaning of what is communicated.
- III. We provided a methodology to automatically identify figurative uses of language in order to foster figurative language processing beyond the tasks described in the document.
- IV. By analyzing non prototypical examples of humor and irony, we provided a pair of models which were supported by general patterns used by people to effectively communicate figurative intents.
- V. With our approach (that is focused on taking advantage of user-generated tags), we have reduced the constraints

facing corpus-based research. For instance, the subjectivity of determining figurativity at textual level is reduced by collecting examples that are intentionally labeled with a descriptor (user-generated tag) whose goal is to focus people's posts on particular topics.

- VI. By making freely available our data sets we are collaborating to the spread of researches related to figurative language, as well as palliating the lack of resources for figurative language processing.
- VII. Figurative language is a widespread phenomenon in web content. In this respect, the empirical insights described in the document showed how our models provide fine-grained knowledge concerning their applicability in tasks as diverse as information retrieval, sentiment analysis, trend discovery, or online reputation.

5. Publications (Impact Factor)

Reyes A., P. Rosso, D. Buscaldi. 2012. From Humor Recognition to Irony Detection: The Figurative Language of Social Media. *Data & Knowledge Engineering*, 74:1–12. DOI: 10.1016/j.datak.2012.02.005.

Reyes A., P. Rosso. 2012. Making Objective Decisions from Subjective Data: Detecting Irony in Customers Reviews. *Journal on Decision Support Systems*, 53(4):754–760. DOI: 10.1016/j.dss.2012.05.027.

Reyes A., P. Rosso, T. Veale. 2012. A Multidimensional Approach For Detecting Irony in Twitter. *Language Resources and Evaluation*, 47(1). DOI: 10.1007/s10579-012-9196-x.

Reyes A., P. Rosso. Forthcoming. On the Difficulty of Automatically Detecting Irony: Beyond a Simple Case of Negation *Knowledge and Information Systems*.