

A Language-independent Model for Introducing a New Semantic Relation Between Adjectives and Nouns in a WordNet

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Abstract

The aim of this paper is to show a language-independent process of creating a new semantic relation between adjectives and nouns in wordnets. The existence of such a relation is expected to improve the detection of figurative language and sentiment analysis (SA). The proposed method uses an annotated corpus to explore the semantic knowledge contained in linguistic constructs performing as the rhetorical figure Simile. Based on the frequency of occurrence of similes in an annotated corpus, we propose a new relation, which connects the noun synset with the synset of an adjective representing that noun's specific attribute. We elaborate on adding this new relation in the case of the Serbian WordNet (SWN). The proposed method is evaluated by human judgement in order to determine the relevance of automatically selected relation items. The evaluation has shown that 84% of the automatically selected and the most frequent linguistic constructs, whose frequency threshold was equal to 3, were also selected by humans.

1 Introduction

In this paper, we want to demonstrate that a WordNet (WN) can be expanded by a new semantic relation between adjectives and nouns in a way that could allow for its usage in detecting figurative language and in existing methods of sentiment analysis. WN is used successfully for analysis of literal meaning of texts using SA methods (Pease et al., 2012), (Reyes and Rosso, 2012), (Rademacher et al., 2014). Resources that came out of the

Princeton WordNet (PWN), such as SentiWordNet (Esuli and Sebastiani, 2006), (Baccianella et al., 2010), WordNetAffect (Strapparava and Valitutti, 2004) and others, which define the prior sentiment polarity (taken out of the context) of synsets are also being used. Still, the intensity of sentiment polarity of the lexical representation of synsets can be reduced, increased or completely changed in a given context with the usage of rhetorical figures from the group of Tropes — figures that change the meaning of words or phrases over which the figure itself is formed. These figures can be metaphor, metonymy, irony, sarcasm, oxymoron, simile, dysphemism, euphemism, hyperbole, litotes etc. (Mladenović and Mitrović, 2013). Analysing the usage of figurative language in the form of ironic similes, Hao and Veale (2010) noticed that they act similarly to valence shifters (Kennedy and Inkpen, 2006) “not”, “never” and “avoid” in text, because they change the polarity of sentiment words or phrases. In general, modifiers decrease, increase or change the sentiment polarity of words or phrases. Tropes work in a similar way. By definition, irony and sarcasm change the polarity, dysphemism and hyperbole increase the existing level of sentiment expressiveness, while litotes and euphemism decrease that expressiveness. Metaphor, metonymy, oxymoron and simile have a more complex mechanism of affecting both directions of change regarding the strength and polarity of sentiment.

Automatic detection of figurative language is a new area of interest in the field of SA that can improve the existing SA methods. Reyes and Rosso (2012) showed that the precision of classification in an SA task can be improved significantly (from 54% to 89.05% max.) when predictors detecting figurative speech are involved, com-

pared to a set of predictors that treat the text literally. Similarly, Rentoumi et al. (2010) improved the SA method of machine learning by integrating it with a rule-based method which detects the usage of figurative language, so the integrated methods achieved better precision than the baseline.

2 Related work

WordNet is a dynamic, flexible structure that can be expanded in different ways and for various purposes. In certain cases, introducing morpho-semantic relations results in solving the problems that stem from specificities of a language with rich morphology and derivation (Koeva et al., 2008). Otherwise, introducing new semantic relations can lead to the improvement of the representation of relations between synsets, e.g. Kuti et al. (2008) present a semantic relation *scalar middle* with which the antonymy relation of two descriptive adjective synsets is transformed into a triple gradable structure *lower-upper-middle*. Angioni et al. (2008) define a new relation *Commonsense* with which a literal in a synset is being connected with Wikipedia links in which it is described, while Maziarz et al. (2012) introduce a series of relations pertinent to adjectives, e.g. derivational relations *comparative* and *superlative* define gradable forms of descriptive adjectives. Derivational relation *similarity* defines a relation between an adjective and a noun such that, based on a given adjective, the structure or form of the object described by the noun can be discovered. Similarly, derivational relation *characteristic* defines a relation between an adjective and a noun where the contents or quality of an object described by the noun is known based on the adjective, e.g. based on the statement “*If someone is famous, then he is characterised by fame*” the relation *characteristic* will be set between the noun *fame* and the adjective *famous*.

The new semantic relation between nouns and adjectives in the Portuguese WordNet is described in (Marrafa et al., 2006) and (Mendes, 2006). This relation is given in the form of a pair of inverse relations *a characteristic of / has as a characteristic*. According to the authors, although the purpose of the relation is to mark significant characteristics of a noun expressed by an adjective (e.g. ‘{carnivorous} is a characteristic of {shark}’), the status of this relation in the sense of lexical knowledge is not completely clear. Au-

thors also point out that introducing this new relation enriches a WordNet, that it can contribute to the process of determining the semantic domain of an adjective and that it can be included in reasoning applications. Veale and Hao also suggest specific enrichment of WordNet in their papers (Veale and Hao, 2008) and (Hao and Veale, 2010). As a source to be used in that enrichment, authors suggest semantic knowledge contained in language constructs of the form *as ADJ as a NOUN* which, in fact, are similes (e.g. “as free as a bird”, “as busy as a bee”). In order to obtain examples of simile, the authors first extracted all antonymous pairs of adjectives in PWN and made a list of candidate adjectives. For each adjective ADJ from that list, a query in the form *as ADJ as a ** was made and sent to the Google search engine. Out of the obtained results, the first 200 snippets were kept. A collection of *as ADJ as a NOUN* constructs was made and a task of disambiguation was performed over it. In this process, one noun (*peacock*) can semantically be connected to many adjectives based on different semantic grounds. The structure, named by the authors as *frame:slot:filler*, consists of a noun (*frame*), property of the noun (*slot*) and an adjective as a value of the property (*filler*). For one noun there can be a number of instances of such structure. Authors point out that an average number of *slot:filler* constructs per one noun obtained in this particular research was 8. For instance, the noun *peacock* contains the following set of *slot:filler* values: {*Has feather: brilliant; Has plumage: extravagant; Has strut: proud; Has tail: elegant; Has display: colorful; Has manner: stately; Has appearance: beautiful*}, therefore the suggested enrichment of WordNet only for the noun *peacock* leads to addition of 7 relations out of which the first one is of the form ‘{peacock} *Has feather* {brilliant}’.

3 Motivation

The research described in this paper is based on the previously mentioned research results by Marrafa et al. (2006) and Mendes (2006), because we are searching for specific relations between nouns and adjectives. However, unlike the relation *has as a characteristic* which connects a number of nouns {shark, cobra, orca, predator,...} to the same adjective {carnivorous}, we consider those descriptive adjectives that are specific to a small set

of nouns, or only to a single noun. In the process of generating of the new relation, we are proposing usage of the rhetorical figure simile which has a relatively high frequency of occurrence in texts written in a natural language. In that case, the relation ‘{peludo} is a characteristic of {abelha}’, meaning (‘{furry} is a characteristic of {bee}’), which exists in the Portuguese WordNet, would not be an adequate example, but the new relation would be created based on the common rhetorical figure simile “as busy as a bee” in which case the relation would be ‘{busy} specific of {bee}’.

On the other hand, significant research, that the work described in this paper leans on, is depicted in papers by Veale and Hao (2008) and (2010), regarding the development of automatic methods of extracting semantic knowledge out of examples of the simile figures usage. We suggest extraction of linguistic constructs of the form as ADJ as a NOUN from the corpus annotated with PoS and lemmas, which means that, in contrast to the results of Google search engine, the search would be faster and more precise, because in one step, we would obtain the set of those potential figures of simile that have only nouns positioned at the end of the observed linguistic structure. Furthermore, if we do not take into account all of the attributes that are characteristic for a certain noun, but only those that are used the most in everyday language (measured by the frequency of occurrence of the corresponding figure simile in the observed corpus) we would get the possibility to describe the set of “noun-adjective” candidates for expansion of the existing structure of WordNet with one unique relation (*specificOf/specifiedBy*). Introduction of a single relation would eliminate the risk pointed out in (Veale and Hao, 2008) that the introduction of a large number of relations expressed by the structure *slot:filler* would reduce the system’s ability to recognize similar properties. In a case of one relation, for example, {frame: *Has Strut*: proud} and {frame: *Has gait*: majestic} would be transformed into {frame: *specifiedBy*: proud} and {frame: *specifiedBy*: majestic}. Apart from that, taking into account only the most frequent ones, the described transformation would not involve all of the *slot:filler* structures of a certain noun, but only the most frequent one, which would, in the case of the noun *peacock* result in generating only one relation ‘{peacock} *specifiedBy* {proud}’, and not

all seven of them. If we introduce the frequency threshold as a parameter, its change can affect the number of *specificOf/specifiedBy* relations for the single noun synset, as well as for the total number of relations of that type.

With the suggested relation *specificOf/specifiedBy* we can determine the nature of the semantic connection between the concepts *arrow*, *light* and *rabbit*, which cannot be achieved with the existing PWN relations. Namely, the simile constructs *brz kao zec* “as fast as a rabbit”, *brz kao svetlost* “as fast as light”, *brz kao strela* “as fast as an arrow”, obtained by querying over the Corpus of Contemporary Serbian, we can confirm that ‘{strela, svetlost, zec} *specifiedBy* {brz}’ i.e. ‘{arrow, light, rabbit} *specifiedBy* {fast}’ holds true.

4 Language-independent model for WordNet Expansion

The procedure of expansion with the relation *specificOf/specifiedBy* that we are proposing, will be shown on the example of expansion of the Serbian WordNet (SWN) (Krstev, 2008), but it can also be used for other wordnets. The procedure consists of the following steps:

1) From the annotated corpus of a natural language K_l extract linguistic constructs of the form *pridev kao imenica* (in the case of English as ADJ as a NOUN) and create the set *Sims* such that:

$$Sims = \{ \text{“as ADJ as a NOUN”} \}, \text{ sims} \in Sims \subset K_l$$

In our case, from the Corpus of Contemporary Serbian Language¹ (Utvić, 2014) 5952 concordances of the form “<as ADJ as a NOUN>” were generated, such as the following:

ri više.-Kakva je?-<Bela kao mleko>. Ona traži isto crnog mrežastog šala, <lakog kao pero>, smele zelene dan od zatvorenika; lica <žuta kao limun>, radosno polete-<White as milk>.<light as a feather>,<yellow as a lemon>,

2) Eliminate all elements from the *Sims* set whose adjectives are not descriptive: $SimsRedycByAdj = \{ \text{sims} \in Sims \mid ADJ \text{ 'is descriptive'} \}$ like in the following examples where the adjectives are possessive:

¹<http://www.korpus.matf.bg.ac.rs/index.html/>

za taj dan. Jer reč je <ljudska kao glad>. Nema za Drugog? Ljubav <majčinska kao vernost>, ljubav muško-
 <human as hunger>.
 <motherly as loyalty>,

In our case, the result was
 $|SimsRedycByAdj| = 2030$ elements.

3) From the set *SimsRedycByAdj*, eliminate all elements whose nouns are proper names, or have been replaced by acronyms (3rd example)

$SimsRedycByNoun = \{sims \in SimsRedycByAdj$
 $|NOUN'is\ a\ common\ N'\}$

Like in the following examples:

Pljevlja bi bila bogata i <bleštava kao Las> Vegas
 da bude slavna i <bogata kao Monika> Seleš. Kako
 zatvoru u Beogradu, <opštepoznatom kao CZ>, naći u
 <glistening as Las> Vegas
 <rich as Monika>, Seleš.
 <generally known as CZ>,

In our case, the result was
 $|SimsRedycByNoun| = 1059$.

4) From the set *SimsRedycByNoun* generate a subset of the most frequent elements

$SimsMostFreq = \{sims \in SimsRedycByNoun$
 $|freq(sims) \geq k\}$

where *k* is the minimal frequency of occurrence as ADJ as a NOUN in the observed corpus *K_l*. In our case, for the value *k* = 1, the total number of ADJ-NOUN pairs, candidates for wordnet expansion is $|SimsMostFreq| = 1059$.

5) From the set *SimsMostFreq* create a text file *Adjective_As_Noun* with ADJ-NOUN pairs over which an algorithm for wordnet expansion is executed (see Algorithm).

The presented algorithm is used for sequential processing of input candidate ADJ-NOUN pairs. For each pair, it checks whether in a given wordnet there are synsets of adjectives and nouns which are lexicalized by literals of the observed *adjective* and *noun*. After that, the procedure of automatic creation of the relation *specificOf/specifiedBy* is implemented between synsets of an adjective and a noun using a restriction — both of them have to be lexicalized by only one literal whose sense is the first sense. The first

sense of a literal is considered to be the sense of a word in a certain language which is defined by a relevant dictionary or a corpus as the most commonly used one. Intuition on which this restriction is based is related to minimal pairing errors in the case when there are no synonyms in the observed synsets and the sense of the literals is the first sense. In that case, the possibility of error exists only if: at least one of the synsets is not correctly complemented with synonyms and there are no correctly assigned senses, or the desired sense is not the first one and it does not exist. In this regard, since the source of errors is known in advance, it is possible to check it before applying the algorithm. On the other hand, if at least one of the synsets has more than one synonym, or has one but its sense is not the first one, the new relation is not created and *adjective-noun* pair is separated into two independent files: the file containing adjectives and all their senses from a wordnet (named *adjective_senses*) and the file containing nouns and all their senses (named *noun_senses*). These resources are later used in a web application for manual pairing of adjectives and nouns and their connection through the desired relation. Finally, pairs for which it is determined at the very beginning of the process that they do not exist in the form of literals in a given wordnet, become candidates for later regular wordnet expansion – by adding new synsets.

Algorithm

Input: Adjective_As_Noun text file

Output: 1. a pair of WordNet mutually inverse semantic relations (specificOf/specifiedBy) for each input adjective-noun pair
 2. file containing adjectives and all their senses
 3. file containing nouns and all their senses

```
foreach adjective-noun pair in adjective-noun pairs
if ((adjective exists in Wordnet.adjective.literals)
and (noun exists in Wordnet.noun.literals)) {
  if ((Wordnet.senses(adjective).Count==1)
and (Wordnet.senses(noun).Count==1)
and (Wordnet.sense(adjective).FirstSense)
and (Wordnet.sense(noun).FirstSense)) {
    Create_Relation(specificOf,adjective,noun);
    Create_Relation(specifiedBy,noun,adjective);
  }
  else
  foreach (sense in Wordnet.senses(adjective)) {
    add_to_adjective_senses(adjective,sense,synsetId)}
  foreach (sense in Wordnet.senses(noun)) {
    add_to_noun_senses(noun,sense,synsetId)}
  }
}
```

Prior to the implementation of the given algo-

rithm, we examined the SWN in order to determine its structure in terms of the previously described restrictions. SWN has more than 22,000 synsets, contains 1660 synsets of adjectives with one literal, out of which in 1452 synsets the sense of that literal is the first sense, while the number of noun synsets with one literal, where the sense of that literal is the first sense is 15,035. By implementing the suggested algorithm, out of a total of 1059 ADJ-NOUN pairs, 69 pairs were found which are “pairs whose both members have one sense and that sense is the first sense”. In SWN there are 302 ADJ-NOUN pairs in which there is more than one sense or that sense is not the first sense. The 688 pairs that are left pertain to those cases when at least one member of the ADJ-NOUN pair does not exist as a literal in SWN. Therefore, using the proposed method produces 372 candidates that can be connected in SWN by the relation *specificOf/specifiedBy* after approval.

For 302 ADJ-NOUN pairs present in SWN, but with many senses or with one sense that is not the first sense, a web page is created in the SWNE² application (Mladenović et al., 2014) which allows users to input adjectives, thus generating a column with synsets lexicalized by the given adjective, while inputting nouns leads to generating of the second column, with synsets lexicalized by the noun at hand. New relations can be generated by looking for appropriate synsets and senses in *adjective_senses* and *noun_senses* files as well as by choosing the desired relation from the third column.

5 Evaluation

In order to assess whether the frequency of occurrence is a valid parameter for finding ADJ-NOUN pairs which are parts of similes that are used in everyday life, we used an online survey which was carried out through Google Forms. Comparing the list (marked here as *List1*) which was automatically generated using the Corpus and filtered using steps 1-4 explained in Section 4, and ordered in a decreasing order according to pair frequency, with the list which, in fact, represents a subset of the *List1* of those pairs that were marked positively in the anonymized survey (marked as *List2*), we wanted to assess which frequency threshold value entails the results obtained in the survey.

The survey itself was conducted over the time

²<http://resursi.mmiljana.com/>

period of 5 days, such that a total of 4 forms were published successively. Anonymous users of the social network Facebook were supposed to give an answer to each question generated on the basis of ADJ-NOUN pairs from the *List1* list with a goal of finding out whether “in everyday language we can say that someone/something is ADJ as NOUN?”. The answers were Yes or No and answering all questions in a form was mandatory. The Table 1 gives an overview of the distribution of questions in each form as well as the number of participants who were involved in answering the questions.

Google form	Number of questions per form	Participants per form
1	30	46
2	42	138
3	41	150
4	41	100
Total	154	434

Table 1: Distribution of questions and participants per form.

A Phd student at the Faculty of Philology, as a linguistic expert, manually selected 154 items from *List1* for which it could be presumed with some degree of certainty that they may be used in everyday language; namely, we retrieved a lot of noisy data from the Corpus, and some items stopped carrying meaning when taken out of the context. Linguistic constructs, chosen from the given *List1*, included *čist kao apoteka* “clean as a pharmacy”; *čist kao suza* “pure as a teardrop”; *hladan kao led* “cold as ice”; *lak kao pero*, “as light as a feather”; *veran kao pas* “as faithful as a dog” whereas constructs such as: *dobar kao oblik* “good as shape”; *dobar kao pisac* “good as a writer”; *poznat kao vodja* “famous as a leader” were not used as they represented occasional occurrences. As we could not predict how willing to help out the potential participants would be, we were aiming for at least 30 participants. Also, the first form had less constructs than the rest — 30 — as we wanted to test the method and to see what would be an optimal number of fields in the form. We obviously wanted to test as many constructs as possible, but had also to keep the forms interesting and easy to fill in. The rest of the forms were balanced unit-wise. The number of participants was not pre-chosen, it depended on the turnout on the particular day.

The problem with this kind of participant in-

volvement and with posts on Facebook in general is that the novelty wears off fast and if some post is very popular today, it might not be popular at all tomorrow. The call for participation in this project did receive a lot of attention in the first few hours after being posted on Facebook. The privacy for the post was set to Public, which meant that everyone could participate and share the link leading to the Google Forms. Due to the fact that people did share the link, and some of their friends did the same thing, we could see that the forms were being filled in quickly and that our research was getting a lot of attention. In the following three days, we posted another three forms on the same URL address (precisely because the post received a lot of attention and shares) and we were able to get enough responses in order to get valid results. On the fourth day, the novelty wore off and we were getting significantly fewer responses, which only proved our assumption that we had to move fast and to post new forms every day.

First, we measured the contribution of participants and determined the set of those participants whose results were to be taken into account as relevant, on the basis that there was no substantial difference between arithmetic means of their answers. In order to measure the participants' contribution we generated 7 subsets of questions and answers where each set had less than 30 questions (units) using four spreadsheets containing participants' answers, as it is shown in Table 2 (each Google Form, except the first one, was divided into two parts). All 7 units were converted into matrices where each row represented answers of each participant and each column represented one question in the form <adjective>as<noun>. Content of each cell of the matrix had the value 1 if the participant marked a certain expression with "Yes" and the value 0 if the participant marked that expression with "No". Rows of the matrix were compared against each other with a paired t-test in order to determine that there was no substantial difference between arithmetic means of participants' answers. From each set we selected, among all participants belonging to that set, five participants whose difference in the paired t-test was the slightest.

After that, inter-annotator (participant) agreement was evaluated using the Krippendorff α coefficient (Kalpa). When the value of α is in the $[0, 1]$ interval, it represents the agreement level which

ranges from complete disagreement, when $\alpha = 0$, to complete agreement, when $\alpha = 1$. The α measure can also have a negative value, up to -1, when two mistakes are present: mistake in sampling and mistake in systemic disagreement. Considering an acceptable level of reliability, the works of (Hayes and Krippendorff, 2007), (Lombard et al., 2002) and (Maggetti, 2013) show that agreements whose values are $\alpha \geq 0.667$ are reliable, and that agreements whose values are $\alpha \geq 0.8$ can be considered very reliable. The results we obtained using the Kalpa test over the set of 5 annotators for each of the subsets of the forms is given in Table 2. Provided that for the first two forms and a

Form set	No of participants	No of questions	Kalpa value	No of quest. annot. with Yes
1	5	30	$\alpha = 0.757^*$	16
2a	5	21	$\alpha = 0.713^*$	17
2b	5	21	$\alpha = 0.698^*$	15
3a	5	21	$\alpha = 0.688^*$	5
3b	5	20	$\alpha = 0.484$	
4a	5	21	$\alpha = 0.434$	
4b	5	19	$\alpha = 0.375$	
Total		154		53

Table 2: Inter-annotator agreement over Google Forms and number of items which belong to reliable forms and were annotated with "Yes".

part of the third one, the value of Kalpa was such that the annotator agreement could be considered reliable, for all of the constructs in those forms, if a majority of annotators (3 or more than 3 out of 5) annotated a certain question with "Yes", that item was taken as an element of the *List2*'. Thus, we obtained 53 items in total and their distribution over form sets is given in the last column of Table 2. Furthermore, we want to draw attention to the phenomenon which we did not study in depth, which was described here in Table 2 and has to do with the decline of the Kalpa coefficient over the same questionnaire structure, related to the time period when the participants filled in the Google Forms.

Finally, we wanted to assess how much the change of the frequency threshold influenced the relevance of automatically selected ADJ-NOUN pairs, measured based on the results obtained through the surveys. The list *List1* has been reduced so that it contains forms 1, 2a, 2b and 3a which amounted to 93 elements, that is to say, all ADJ-NOUN pairs for which evaluation by

the participants was proved relevant. That list was named *List1'*. In contrast, the list named *List2'* contained only those ADJ-NOUN pairs from the *List1'* that were marked positively. First, we wanted to set the frequency threshold to $k = 4$, which meant that the algorithm was used to process only those pairs whose frequency of occurrence in the Corpus was $k \geq 4$. There were 23 such pairs in the list *List1'*. Out of those 23, 19 pairs were present in the list *List2'*, which meant that the participants in the survey did not recognize 4 pairs that were recognized by the algorithm. The entire statistics showing the percentage of pairs we obtained using the algorithm as well as human judgement is given in Table 3, and the graph showing the relation between human selection, as opposed to automatic selection, when the frequency threshold is being changed, is given in Figure 1.

Frequency threshold	by algorithm	by humans	humans / algorithm
$k = 1$	93	53	57%
$k = 2$	44	32	73%
$k = 3$	32	27	84%
$k = 4$	23	19	83%

Table 3: Relationship of manually and automatically selected pairs depending on the frequency threshold.

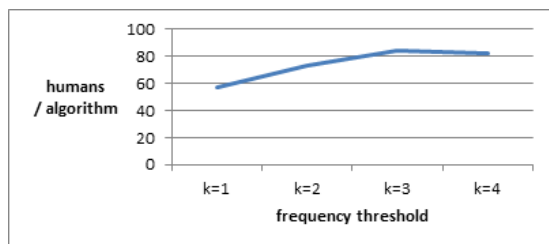


Figure 1: Relationship of selected pairs obtained with the survey method compared to the ones obtained with the method of the most frequent occurrence for different frequency thresholds.

Figure 1 shows the way in which, on a sample of 93 ADJ-NOUN pairs contained in the *List2'* list (Kalpha reliable), the percentage of participation of the manually selected pairs changes in the subset obtained by choosing only those pairs from the same list whose frequency was equal or higher than the set threshold, when the threshold changes. The achieved result of 84% gives us the manually measured accuracy of the Algorithm for automatic

WordNet expansion with the frequency threshold of $k=3$.

6 Conclusions

In this work, we presented a general way of automatic expansion of a WordNet with the semantic relation *specificOf/specifiedBy* which was produced after extraction of semantic knowledge contained in the relation of comparison from the annotated corpus. The results of the proposed method of selection of the most frequent ADJ-NOUN pairs extracted from the described linguistic constructs as ADJ as a NOUN for the frequency threshold $k \geq 3$ were matched in 84% of cases with the results obtained from anonymous evaluators, on identical sets of ADJ-NOUN pairs. The Algorithm for automatic WordNet expansion can be improved in step 5) by including the Word sense disambiguation (WSD) method. That would enable literals with more than one sense to be used in automatic adding of the new relation. In future work we plan to implement WSD and to use other linguistic constructs which indicate Simile.

Using the relation *specificOf/specifiedBy* between a noun and its specific adjective, the hidden meaning of another word or a phrase can be detected, e.g. in sentences such as “My sister is like a bee” or “My sister is a bee”, based on the relation *specificOf/specifiedBy* between the noun *bee* and its specific adjective *busy*, a sentiment neutral noun *sister* can have the same sentiment polarity as the adjective *busy*, i.e. positive polarity. If we say “My sister is like a lizard”, based on the same principle, the same noun changes its sentiment polarity into negative polarity, considering the fact that the noun *lizard* is connected with a relation *specifiedBy* with the adjective *lazy*. In the example “My sister is as fast as a turtle” the indirect connection of the antonymous pair *fast-slow* in the construct “as fast as a turtle” indicates the existence of the rhetorical figure irony, therefore, in a given context, the noun *sister* can have a negative sentiment polarity. In our future work, we plan on analysing whether the process of sentiment classification can be improved by changing the default sentiment polarity of n -gram predictors, depending on the figurative context detected in the previously described way.

Acknowledgments

This research was partly supported by the Serbian Ministry of Education and Science under the grant 47003.

References

- Manuela Angioni, Roberto Demontis, Massimo Deriu, and Franco Tuveri. 2008. Semanticnet: a WordNet-based Tool for the Navigation of Semantic Information. *Proceedings of the 4th International Global Wordnet Conference (GWC2008)*, 21–34.
- Stefano Baccianella, Andrea Esuli and Fabrizio Sebastiani. 2010. SentiWordNet 3.0: An Enhanced Lexical Resource for Sentiment Analysis and Opinion Mining. *Proceedings of the 7th Language Resources and Evaluation Conference (LREC 2010)*, 2200–2204.
- Andrea Esuli and Fabrizio Sebastiani. 2006. Sentiwordnet: A Publicly Available Lexical Resource for Opinion Mining. *Proceedings of the 5th Conference on Language Resources and Evaluation (LREC 2006)*, 417–422.
- Yanfen Hao and Tony Veale. 2010. An Ironic Fist in a Velvet Glove: Creative Mis-Representation in the Construction of Ironic Similes. *Journal Minds and Machines*, 20(4):635–650.
- Andrew F. Hayes and Klaus Krippendorff. 2007. Answering the Call for a Standard Reliability Measure for Coding Data. *Communication Methods and Measures*, 1(1):77–89.
- Alistair Kennedy and Diana Inkpen. 2006. Sentiment Classification of Movie Reviews Using Contextual Valence Shifters. *Computational Intelligence*, 22(2):110–125.
- Svetla Koeva, Cvetana Krstev, and Duško Vitas. 2008. Morpho-semantic Relations in WordNet. A Case Study for two Slavic Languages. *Proceedings of the 4th International Global Wordnet Conference (GWC2008)*, 239–253.
- Cvetana Krstev. 2008. Processing of Serbian - Automata, Texts and Electronic dictionaries. *Faculty of Philology, University of Belgrade, Belgrade*.
- Judit Kuti, Károly Varasdi, Ágnes Gyarmati, and Péter Vajda. 2008. Language Independent and Language Dependent Innovations in the Hungarian WordNet. *Proceedings of the 4th International Global Wordnet Conference (GWC2008)*, 254–269.
- Matthew Lombard, Jennifer Snyder-Duch and Cheryl Campanella Bracken. 2002. Content analysis in mass communication: Assessment and reporting of intercoder reliability. *Human Communication Research*, 28(4):587–604.
- Martino Maggetti. 2013. Regulation in Practice: The de facto Independence of Regulatory. *Swiss Political Science Review*, 19(1):111–113.
- Palmira Marrafa, Raquel Amaro, Rui Pedro Chaves, Susana Lourosa, Catarina Martins, and Sara Mendes. 2006. WordNet.PT new directions. *Proceedings of the 3th International Global Wordnet Conference (GWC2006)*, 319–321.
- Marek Maziarz, Stanisław Szpakowicz, and Maciej Piasecki. 2012. Semantic Relations among Adjectives in Polish WordNet 2.0: A New Relation Set, Discussion and Evaluation. *Cognitive Studies / Études Cognitives*, 12:149–179.
- Sara Mendes. 2006. Adjectives in WordNet. *Proceedings of the 3th International Global Wordnet Conference (GWC2006)*, 225–230.
- Miljana Mladenović and Jelena Mitrović. 2013. Ontology of rhetorical figures for Serbian. *LNAI, Springer*, 8082:386–393.
- Miljana Mladenović, Jelena Mitrović and Cvetana Krstev. 2014. Developing and Maintaining a WordNet: Procedures and Tools. *Proceedings of the 7th International Global Wordnet Conference (GWC2014)*, 55–62.
- Adam Pease, John Li, and Karen Nomorosa. 2012. WordNet and SUMO for Sentiment Analysis. *Proceedings of the 6th International Global Wordnet Conference (GWC2012)*.
- Alexandre Rademaker, Valeria de Paiva, Gerard de Melo, Livy Maria Real Coelho, and Maira Gatti. 2014. OpenWordNet-PT: A Project Report. *Proceedings of the 7th Global WordNet Conference (GWC2014)*, 383–390.
- Vassiliki Rentoumi, Stefanos Petrakis, Manfred Klenner, George A. Vouros, and Vangelis Karkaletsis. 2010. United we stand - improving sentiment analysis by joining machine learning and rule based methods. *Proceedings of the 7th Language Resources and Evaluation Conference (LREC 2010)*.
- Antonio Reyes and Paolo Rosso. 2012. Making objective decisions from subjective data: Detecting irony in customer reviews. *Decision Support Systems*, 53(4):754–760.
- Carlo Strapparava and Alessandro Valitutti. 2004. Wordnet-affect: An Affective Extension of Wordnet. *Proceedings of the 4th International Conference on Language Resources and Evaluation (LREC 2004)*, 1083–1086.
- Miloš Utvić. 2014. Liste učestanosti Korpusa savremenog srpskog jezika [Corpus of Contemporary Serbian – Frequency Lists]. *Naučni sastanak slavista u Vukove dane*, 241–262. Faculty of Philology, University of Belgrade, Belgrade.

Tony Veale and Yanfen Hao. 2008. Enriching WordNet with folk knowledge and stereotypes. *Proceedings of the 4th International Global Wordnet Conference (GWC2008)*, 453–461.