

# Functions of Explicit Negation in German News Texts

Alexandra Klein<sup>1</sup>, Brigitte Krenn<sup>1</sup>, and Harald Trost<sup>2</sup>

<sup>1</sup> Austrian Research Institute for Artificial Intelligence (OFAI),  
Freyung 6/6, 1010 Vienna, Austria,

<sup>2</sup> Section for Artificial Intelligence,  
Center for Med. Statistics, Informatics, and Intelligent Systems,  
Medical University of Vienna,  
Freyung 6/2, 1010 Vienna, Austria

**Abstract.** Usually, humans have no problem interpreting negation in text. For NLP systems, there are so far no standard solutions for handling negations. Many NLP systems do not model negation phenomena and encounter difficulties whenever facts are taken as given even when the statement is negated. Besides from negating objective facts, negation may fulfill other functions in natural language, such as being part of a rhetorical relation. Thus, an adequate interpretation of negations requires a mechanism for distinguishing the different functions of negation as otherwise, the content of a text cannot be analysed properly. While negation has been extensively studied in linguistics, it seems that there is no classification of negation functions which can be used for NLP. Thus, a corpus-based study was carried out on German newspaper texts in order to derive a taxonomy of negation functions from the point of view of NLP. Four main categories have been identified: negations related to statements, discourse markers, speaker attitudes and idiomatic expressions. All categories may occur in the context of temporal markers which assign only a transient validity to the negated expression. The categorization serves as a base for a pattern-based negation-processing module which identifies and classifies negations.

## 1 Introduction

Negation fulfills various functions in text. In the following paper, we will argue that NLP systems need to handle negation, e.g. by means of a pre-processing module: some instances of negation may be vital to representing the underlying meaning of a text while negation in other contexts may not contribute to the propositional content of a core statement. No classification seems to be available which can be used to determine the contribution of negated expression to textual meaning from the point of view of NLP. Thus, we have carried out an empirical study on the use of negation in German newspaper texts as a base for a negation-processing module for the domain. The study is motivated by the needs of NLP applications such as Information Extraction, Sentiment/Subjectivity Analysis and Opinion Mining, and it analyzes the lexicalizations, contexts and functions

of the observed instances of negation in terms of their relevance for further automatic processing. While the study has been carried out on German newspaper texts and while the realization of negation is language-specific, we expect that the analysis of negation function may have many language-independent and domain-independent aspects.

For illustrative purposes, we will give some English examples from newspaper texts for what we consider the main functions of negation. An obvious function is the reversal of the truth value in a statement about an objective situation. In these cases, the statement is explicitly marked as false considering a specific situation and contrary to the assumed expectations on the reader's part [1,2]. In the example sentence

*Example 1. Nicklas Bendtner has not travelled to Malaysia for the first part of Arsenal's pre-season tour as he closes in on a move away from the club.*<sup>3</sup>

there is the underlying fact of Nicklas Bendtner's traveling to Malaysia with Arsenal. The statement marks this as false, given the current situation, and refutes the assumed prior expectation on the reader's part that the soccer player will join the pre-season tour. If negation is ignored in this sentence, e.g. by a bag-of-words approach, the extracted facts consist of Nicklas Bendtner's traveling to Malaysia, but they do not contain the vital information that actually, Nicklas Bendtner did not go on this journey with his teammates. Thus, Information Extraction applications need to include negations in a representation of the content of a text if the negations are part of statements.

Negation does not only occur in core statements regarding the propositional content of a sentence; it may also indicate a speaker attitude. In the sentence

*Example 2. Melanie Phillips is, as you might expect, not happy either at the idea of the likes of Coogan and Hugh Grant taking a moral stance.*<sup>4</sup>

the core statement is the fact that Coogan and Hugh Grant take a moral stance. But this is an embedded statement, and the negation is part of the introductory segment of the sentence containing the information that Melanie Phillips is *not happy* about this idea. Sentiment/Subjectivity Analysis or Opinion Mining systems would have to take into account this information as it refers to the opinion or attitude of a person with respect to a situation.

Negation may also signal different rhetorical relations. In the sentence

*Example 3. Other incidents breached his privacy but not the law.*<sup>5</sup>

---

<sup>3</sup> guardian.co.uk, "Nicklas Bendtner misses Arsenal's Asian tour as transfer news", Sunday 10 July 2011, <http://www.guardian.co.uk/football/2011/jul/10/nicklas-bendtner-arsenal-transfer>

<sup>4</sup> guardian.co.uk, "News of the World phone-hacking scandal part one", Monday 11 July, <http://www.guardian.co.uk/news/blog/2011/jul/11/news-world-hacking-scandal-live>

<sup>5</sup> guardian.co.uk, "News International papers targeted Gordon Brown", Monday 11 July 2011, <http://www.guardian.co.uk/media/2011/jul/11/phone-hacking-news-international-gordon-brown>

the negation *not* is part of a contrast relation: the privacy was violated, but the mentioned incidents were not illegal. In this case, an Information Extraction system has to consider and resolve the negation as it is important to note that the sentence essentially contains two statements: 1) the incidents breached his privacy, 2) the incidents did not breach the law.

There is also a rhetorical relation which contains negation as a discourse marker which contributes less to the propositional content of the core statement:

*Example 4. According to the newspaper, the forces of Murdoch not only attempted to gain access to Brown's voicemail but also obtained private banking and medical information.*<sup>6</sup>

In this example, both statements are positive: 1) the forces of Murdoch attempted to gain access to Brown's voicemail, 2) the forces of Murdoch also obtained private banking and medical information. The two statements are connected by means of *not only... but also*. An Information Extraction system should not consider the negation if it does not extract rhetorical relations, but instead it should focus on the two positive statements.

Negations may also be modified by temporal markers:

*Example 5. News International has not yet responded to the claims.*<sup>7</sup>

Here, the negation refers to a situation at a certain point in time, which may be transitory. Temporal modifications may influence all types of negations. Information Extraction and Opinion Mining systems need to take into account temporal modifiers which may indicate transient situations.

As the examples have shown, it is important to analyse which parts of a statement or its context are negated and what the intended effects are. For the extraction of relations, it is essential to consider negated relations between terms or concepts as negative expressions are often much more than mere function words from the point of view of systems representing or annotating textual content.

## 2 Handling Negation in NLP

Most of research concerning NLP and negation has been carried out in the domain of biomedical texts. Negation is important in this domain as it may indicate the absence of certain relevant symptoms, pre-conditions, or adverse reactions. This is indispensable information for electronic patient records, quality control and billing purposes. In approaches for extracting information from biomedical text, negation is handled by defining or learning patterns for combinations of negation markers and medical concepts, cf. e.g. [3,4]. Corpora of biomedical texts

---

<sup>6</sup> American Journalism Review, "The Escalating Murdoch Scandal", Monday 11 July 2011, <http://www.ajr.org/Article.asp?id=5109>

<sup>7</sup> "The list goes on: Brown allegedly hacked by Sunday Times", Monday 11 July 2011, <http://citywire.co.uk>

which have been annotated with negation information have become available for English [5].

In contrast to NLP systems for biomedical texts, research on Information Extraction in other domains has just started to examine the functions and effects of negation. [6,7] represent recent approaches to incorporating negation in NLP beyond the medical domain. The application is the detection of conflicts and inconsistencies among pieces of information for automatic question answering.

Another field of research where negation has to be considered is Sentiment/Subjectivity Analysis and Opinion Mining; for an overview, cf. [8]. In order to represent negative contexts of opinion words, words or phrases are marked as negative, and they are added to the features which are used to determine the positive, negative or neutral polarity of an expression [9,10]. [11] distinguish between prior and contextual polarity of expression which may be reversed by negation. [12] describe a system for determining the scope of negation using Conditional Random Field (CRFs) models which are trained on the output of a dependency parser.

To our knowledge, no classifications of negation functions are available which can be adopted in NLP systems. [1] has carried out an empirical study on corpora of written and spoken English, and she has analysed the use of negation. She has derived a classification where she distinguishes between the two main functions REJECTION and DENIAL. REJECTION concerns suggestions while DENIAL concerns propositions. This classification comes from a corpus- or discourse-linguistics perspective; it lacks concern for the requirements of NLP applications. In particular, it does not differentiate between negated propositional content, negation in speaker attitudes, rhetorical relations and idiomatic expressions and the contribution of negation to textual meaning as analyzed by NLP systems.

### **3 Empirical study: Negation in a corpus of German news texts**

Corpora of German newspaper texts serve as base for our analysis of negation. While there are many conventions regarding the style of newspaper articles, there is a large variety of expressions compared to other domains, and newspaper articles cover a wide range of topics, some describing temporal developments. Furthermore, large corpora are available – not only for English, but also for other languages. We therefore think that newspaper articles are a suitable base for a classification of negation function beyond more limited domains such as biomedical texts.

We consider only instances of explicit negation and only lexically realized negation. We did not take into account morphological negation, e.g. encoded in the prefix *un-*, as in approaches which are based on bag-of-words, a word with a negative prefix becomes a feature, while lexical negation has to be analysed in terms of its context. Thus, we define a negation element for our purposes as a lexeme which carries no meaning beyond its negative function, e.g. *no*, *not*, and

which belongs to a closed-class category. We do not take into account any other lexemes, e.g. *deny* which often signals negation in the biomedical domain:

*Example 6. The patient denies any chest pain.*

As a lexeme, *deny* carries a positive and a negative meaning. The act of stating something is positive, while the assertion that something is not true is negative. *deny* combines both aspects. The rationale for the exclusion of any lexemes which are not only negation 'function words' lies in the fact that, from the point of view of NLP, lexemes with positive/negative meaning tend to be domain-dependent, productive due to word formation processes, and fuzzy or non-binary in polarity assignment (e.g. *hardly*).

The NEGRA corpus [13] Version 2 is a syntactically annotated German corpus of newspaper texts. In order to derive a negation subcorpus, all sentences containing one or more negation elements were extracted from the first 4000 sentences of the NEGRA corpus. 626 (15.7%) of the 4000 sentences contain 705 negation elements, with *weder...noch*, the German equivalent to *neither...nor*, being counted as one negation element. Most sentences contain only one negation element, but there were sentences with up to four negation elements.

*nicht* ('not') is the most frequent negation element, which is not surprising, as it is the main negation lexeme for sentence negation in German, similar to the English *not*. Figure 1 shows a list of all negation elements which were found in the subcorpus with their frequency of occurrence.

Negation element	Count	%
<i>nicht</i> ('not')	468	66.7%
<i>kein</i> ('no')	103	14.7%
<i>ohne</i> ('without')	53	7.5%
<i>nichts</i> ('nothing')	23	3.3%
<i>nie</i> ('never')	21	3.0%
<i>weder...noch</i> ('neither...nor')	10	1.4%
<i>niemand</i> ('nobody')	8	1.1%
<i>keinerlei</i> ('no...at all/no...whatsoever')	3	0.4%
<i>niemandem</i> ('nobody', dat)	3	0.4%
<i>nirgendwo</i> ('nowhere')	2	0.3%
<i>keineswegs</i> ('by no means')	2	0.3%
<i>niemanden</i> ('nobody', acc)	2	0.3%
<i>keins</i> ('none')	1	0.1%
<i>nicht-</i> ('non-')	1	0.1%
<i>nirgends</i> ('nowhere')	1	0.1%
<i>niemals</i> ('never')	1	0.1%

**Fig. 1.** Negation elements

In most cases, the grammatical negation scope consists of a verb phrase, a noun phrase or an adjectival phrase. For our approach, we have examined

negation context instead of grammatical scope. On the one hand, we wanted our negation-processing module to be robust, which precludes relying on deep parsing. On the other hand, the whole negated statement which is important for relation extraction and ontology building may consist of more than the verb phrase. Therefore, we have focussed on negation context in terms of the core statements which contain negations as well as the statements which are part of a rhetorical relation modified by negation.

## 4 Classifying the Function of Negation

For a bottom-up classification of negation functions, we have started from the sentence structure. Analyzing the negation subcorpus, it becomes apparent that negation appears in four types of sentence structure: Statement, Rhetorical Relation, Speaker Attitude and Negative Polarity Item/Idiomatic Expression. Figure 2 shows how the 705 lexically realized negation elements appear as part of a statement, a rhetorical relation, a speaker attitude, and a NPI, based on the manual annotation.

Type	Count	%
Statement	580	82.3
Rhetorical relation	90	12.8
Speaker attitude	29	4.1
NPI/Idiomatic expression	6	0.9

**Fig. 2.** Contexts and functions of negation

In the following, we will briefly describe the four types of functions and illustrate them with examples from the corpus. All negation functions may appear in the context of temporal information. Temporal modifiers were marked in the corpus.

### 4.1 Statement

For the purpose of identifying the scope and function of negation, we classify a statement as propositional content which may be represented in terms of a predicate-argument structure. A statement may be lexicalized as a clause or a noun phrase. Negation in single statements may negate the predicate (a verb in a verb phrase, a nominalization in a NP) or one or more of its attributes.

The following sentence from the corpus (sentence number 35 in the NEGRA corpus), which is taken from a review of a concert, gives an example of a negated statement:

*Example 7. Selbst die flotteren Passagen werden nie ausgelassen und fröhlich.*  
(35)

(‘Even the livelier passages never become jolly and cheerful.’)

## 4.2 Rhetorical relation

Negations may be part of rhetorical relations. Within rhetorical relations, negations may contribute to the propositional content of a statement, or they may mark the relation without negating a statement. Relations between statements establish textual coherence. Rhetorical Structure Theory (RST) [14] and Segmented Discourse Representation Theory (SDRT) [15] rely on varying inventories of discourse relations in text analysis and generation. In some cases, a subset of relations is selected which is most relevant in a specific application. Rhetorical relations connect sequences of statements; they may be implicit, or signaled by discourse markers.

For Information Extraction, it is important to distinguish the contribution (with respect to propositional content) and function of negation. All instances of explicit negation in the newspaper subcorpus were examined in order to determine if they occur as part of a rhetorical relation. The inventory of rhetorical relations was taken from the SDRT relations defined in [15]. [16] presents an approach for using linguistic cues to classify rhetorical relations from a subset of the SDRT relation inventory in [15]. In the newspaper negation subcorpus, three different types of rhetorical relations were associated with negations:

– **CONTRAST:**

*nicht...sondern* (*not...but*), *nicht...aber* (*not...however*) signal a CONTRAST relation. The first part of the sequence describes a statement (referring to an expectation) which is marked as false. In the second part, it is replaced by information which describes the actual situation. Both segments usually share some common features in form and content. In CONTRAST contexts, negation is important as it explicitly rejects an expectation.

Example from the corpus:

*nicht das Wort, sondern die Tat ist wichtig* (2978)  
(‘not words, but actions are important’)

– **CONTINUATION:**

Patterns of the type *nicht nur...sondern* (*not only...but also*), signal a CONTINUATION relation. The second part of the sequence, which may contain more unexpected information than the first part, is added by means of negating restrictive adverbs such as *nur* or *allein* (‘only’, ‘simply’). In CONTINUATION contexts, the negation only has a rhetorical function. Its contribution to the propositional content can be neglected. For the purposes of analysis in an NLP system, the negation and restriction can be removed, and both parts can be treated as related facts with equal contributions.

Example from the corpus:

*Nicht nur ein Tanz, sondern ein Gefühl* (3437)  
(‘not only a dance, but a feeling’)

– **CONDITION:**

*wenn nicht...* (*if not...*) or *wenn...nicht* (*if...not*) specify a CONDITION for

a specific situation. Negation explicitly contributes to the truth conditions which must be given for one statement in order for a second statement to be applicable.

Example from the corpus:

*Allerdings soll dies nur möglich sein, wenn sich Kunst nicht in den Dienst politischer Fortschrittskonzepte stellt.* (1810)

(‘however this should only be possible if art does not adhere to political concepts of progress’)

If negation is part of a rhetorical relation, negation marks a sequence of statements and establishes a relation between them in form and content.

### 4.3 Speaker attitude

Newspaper commentary is a genre which contains a complex mixture of facts and opinions [18,17]. In the subcorpus, speaker attitudes were expressed mostly by verbs and adjectives. If a negation occurred, it reversed the meaning of the verb or adjective, e.g.

*Für nicht empfehlenswert hält er Fußball [...]* (2224)

(‘He does not recommend (playing) soccer’)

[1] notes in her empirical study that negation tends to occur often with mental verbs such as *think*.

### 4.4 NPIs/Idiomatic expressions

While the previously described categories for categorizing negations employ functional criteria, lexicalized expressions containing negation elements were assigned their own category since these expressions have to be represented as a whole in order to grasp textual meaning. These cases are important for Information Extraction systems as bag-of-words approaches may come up with distorted results if idiomatic expression are taken literally. Lexical items may prefer or establish negative contexts. In some cases, the resulting expressions are idiomatic expressions, e.g. *He didn't budge.* – *Er zuckte nicht mit der Wimper.* Other examples not being idiomatic expressions in the strict sense are lexemes which are likely to occur within negative constructions, e.g. *any* in English.

In the subcorpus, only six – different – instances of idiomatic expressions containing negation occurred, cf. Figure 3.

For German, a list of NPIs is available which has been extracted from large corpora using co-occurrence information [19,20]. This list is helpful for automatically detecting negation when it is part of an NPI. Since collocations are rigid structures with a lexicalized meaning, negation in NPIs should be marked so that it will not distort the result during relation extraction.



Expression	Translation	No.
<i>nicht Kinder von Traurigkeit sein</i>	'to know how to enjoy oneself'	(235)
<i>kein Geringerer als</i>	'none other than'	(1084)
<i>nicht hinter dem Berg halten</i>	'to be unhesitating'	(1678)
<i>nicht schlecht staunen</i>	'to be astonished'	(3528)
<i>nicht verhehlen</i>	'not to conceal'	(3616)
<i>über Geld nicht reden sondern es haben</i>	'not to talk about money but to have it'	(3744)

**Fig. 3.** NPIs/Idiomatic expressions

## 5 Automatic pattern-based analysis of negations

The analysis of negation in the NEGRA corpus, which was described in the previous sections, has resulted in a gold standard as well as patterns for negation recognition and classification. In order to examine whether the classification which was derived from the NEGRA corpus can be applied to other news texts, a second corpus was built which consists of articles from the Austrian daily newspaper *Der Standard*. 65 articles published on the same day in various sections of the newspaper were selected. The corpus was processed by a part-of-speech tagger [21], which also assigned sentence boundaries. In contrast to the situation in the NEGRA corpus, both part-of-speech tags and sentence boundaries in the *Standard* corpus were not corrected manually. The sentences were divided into segments according to rules. The aim was to create segments consisting of a one statement each. The patterns for negation identification and classification were formulated as regular expressions, and they were applied to the *Standard* corpus. The results of the negation identification and classification were then compared to a manual annotation.

According to the assignment of sentence boundaries, the corpus contains 1611 sentences; 169 sentences (i.e. 10.5 % of the 1611 sentences) contain at least one negation element. The 1611 sentences in the *Standard* corpus were automatically separated into segments, yielding 4952 segments. 171 segments (i.e. 3.45% of the segments) contain at least one negation element. In the 171 segments, 138 cases of negated statements, 15 cases of rhetorical relations (9 for the CONDITION relation, 4 for the CONTRAST relation and 1 for the CONTINUATION relation), 17 cases of speaker attitudes and only 1 case of an NPI were assigned. 14 temporal markers were identified by the system.

All negation elements were identified correctly, which comes as no surprise as we have concentrated on explicit lexical negation, with a closed class of lexical items. Of the 169 sentences containing at least one negation element, 112 (66.3 %) were segmented correctly, i.e. in a way that the negated statement was segmented. In the remaining 37 cases, a deeper syntactic analysis is needed. Since in contrast to the NEGRA corpus, the *Standard* corpus is raw and was not cleaned manually, many segmentations were assigned where punctuation was not disambiguated or where part-of-speech tags seem to suggest a segment boundary.

13 segmentation problems are due to coordination as it is often difficult to determine whether coordination connects different statements or whether it connects different elements within one statement, e.g.

*Example 8. Man soll ja nicht überkritisch oder vorauseilend böse sein [...]*  
(‘one should not be overcritical and anticipatorily mean [...].’)

where the negation scope extends to both adjectives, but the segmentation separates them at the coordination *and* versus

*Example 9. Wenn nichts passiert und die Regierung auf das Erreichen des Nulldefizits wartet [...]*  
(‘if nothing happens and the government awaits reaching zero deficit [...].’)

where the coordination separates two statements.

The *Standard* negation corpus contains only one NPI, and it was not found by the system as it is not contained in the NPI list for German [20]. This may be due to the fact that it is an expression which is common in Austrian German, but less common in Standard German (*Schmied vs. Schmiedl* ‘expert vs. non expert’).

Of the 17 instances of speaker attitudes were assigned, none can be considered an actual speaker attitude. The patterns only apply to cases where the speaker attitude concerned an embedded sentence with the actual statement describing an objective situation. 12 of the classifications are due to errors of the part-of-speech tagger. Thus, it turned out that the assignment of speaker attitudes did not yield any correct assignments without taking into account the actual opinion words; the integration of lexical indicators for speaker attitudes seems necessary.

For rhetorical functions, however, all assignments in the *Standard* negation corpus are correct. In sum, all 15 instances of rhetorical functions were found, namely 9 for the CONDITION relation, 4 for the CONTRAST relation and 1 for the CONTINUATION relation.

Of the 14 temporal modifiers identified in the *Standard* negation corpus, 4 indicate ‘not yet’ and 10 indicate ‘not anymore’. 2 of these assignments turned out to be false positives. There are no false negatives. The errors are due to lexical ambiguities.

## 6 Conclusion

Unstructured texts are layered structures which convey information about facts, (e.g. causal or temporal) relationships and attitudes to readers. Each negation element occurring in a text plays a role in presenting this information by emphasizing that a certain assumed fact is not valid in a given situation. Human readers or listeners are usually able to interpret this information given the context. They develop a representation of the positive facts in a statement and reverse the polarity of the negated aspects of the statement. Apart from systems in the biomedical domain, where negation tends to be comparatively straightforward, and opinion mining approaches, where negation directly contributes to

assigned sentiment polarities, NLP systems mostly rely solely on the positive facts, without considering negated contexts. Since the contribution of negated information to the propositional content depends on the function of negation in a specific context, different types of negations need to be distinguished. In order to come up with a classification of negation function, an empirical study was carried out; German newspaper texts were selected as a sample domain.

A negation subcorpus was derived by selecting sentences which contain explicit lexical negation from a sample of the NEGRA corpus. A classification of the functions of the observed negations and their contexts was derived, based on the perspective of NLP applications such as Information Extraction and Opinion Mining. Negation elements, scopes and functions were annotated in the subcorpus.

As a next step, the negation phenomena which were encountered in the NEGRA subcorpus were transformed into regular expressions for a pattern-based negation-processing approach. A small raw corpus of texts from the Austrian newspaper *Der Standard* was part-of-speech tagged, and the patterns were applied to the test corpus. The results are encouraging: it turns out that even this simple approach performs reasonably well identifying factual negation, rhetorical relations and temporal modifiers. For the classification of negation in the context of speaker attitudes, more lexical resources are needed. The segmentation of negated statements still needs to be improved.

From the point of view of linguistic resources, the empirical study has resulted in an annotated negation subcorpus of German newspaper texts which may prove useful in various applications. Furthermore, a classification of negation functions was derived which describes the negation phenomena in the German newspaper corpus but which also can be applied to other languages and domains. From there, patterns describing functions of negations in German were created which will be extended and integrated into a negation-filtering module which can be used by NLP systems for German.

## Acknowledgment

The Austrian Research Institute for Artificial Intelligence is supported by the Austrian Federal Ministry for Transport, Innovation, and Technology.

## References

1. Tottie, G.: (1991). *Negation in English Speech and Writing: A Study in Variation*. San Diego: Academic Press, 1991.
2. Horn, L. R.: *A Natural History of Negation*. The David Hume Series: Philosophy and Cognitive Science Reissues. CSLI Publications, 2001.
3. Chapman, W. W., Bridewell, W., Hanbury, P., Cooper, G. F., Buchanan, B. G.: A Simple Algorithm for Identifying Negated Findings and Diseases in Discharge Summaries. *Journal of Biomedical Informatics*, **34**:301–310, 2001.
4. Morante, R.: Descriptive Analysis of Negation Cues in Biomedical Texts. *Proc. of LREC'10*. 2010.

5. Vincze, V., Szarvas, G., Farkas, R., Móra, G., Csirik, J.: The BioScope Corpus: Annotation for Negation, Uncertainty and their Scope in Biomedical Yexts. *BMC Bioinformatics*, 9(Suppl 11):S9, 2008.
6. Harabagiu, S., Hickl, A., Lacatusu, F.: Negation, Contrast and Contradiction in Text Processing. *Proc. of AAAI06*, 2006.
7. de Marneffe, M.-C., Rafferty, A., Manning, C. D.: Finding Contradictions in Text. *Proc. of ACL/HTL*, 2008.
8. Wiegand, M. , Balahur, A., Roth, B., Klakow, D., Montoyo, A.: A Survey on the Role of Negation in Sentiment Analysis. *Proc. of the Workshop on Negation and Speculation in Natural Language Processing*, Uppsala, Sweden, 60–68, 2010.
9. Das, S. R., Chon, M. Y.: Yahoo! for Amazon: Sentiment Extraction from Small Talk on the Web. *Management Science*, 53:1375–1388, 2007.
10. Na, J.-Ch., Sui, H., Khoo, Ch., Chan, S., Zhou, Y.: Effectiveness of Simple Linguistic Processing in Automatic Sentiment Classification of Product Reviews. In *Conference of the International Society for Knowledge Organisation (ISKO)*, pp. 49–54, 2004.
11. Wilson, Th., Wiebe, J., Hoffmann, P.: Recognizing Contextual Polarity in Phrase-level Sentiment Analysis. In *Proceedings of the Human Language Technology Conference and the Conference on Empirical Methods in Natural Language Processing (HLT/EMNLP)*, pp. 347–354, 2005.
12. Councill, I., McDonald, R., Velikovich, L.: What's great and what's not: Learning to Classify the Scope of Negation for Improved Sentiment Analysis. In *Proceedings of the Workshop on Negation and Speculation in Natural Language Processing*, pp. 51–59, Uppsala, Sweden, July 2010. University of Antwerp.
13. Skut, W., Krenn, B., Brants, T., Uszkoreit, H.: An Annotation Scheme for Free Word Order Languages. *Proc. of ANLP-97*, Washington, DC., 1997.
14. Mann, W. C., Thompson S.: Rhetorical Structure Theory: Toward a functional theory of text organisation. *Text*, 8(3):243–281, 1988.
15. Asher, N. and Lascarides, A.: *Logics of Conversation*, Cambridge University Press, 2003.
16. Sporleder, C., Lascarides, A.: Exploiting Linguistic Cues to Classify Rhetorical Relations. In *Proceedings of RANLP-05*, pages 532–539, Borovets, Bulgaria, 2005.
17. Asher, N., Benamara, F., Mathieu, Y. Y.: Distilling Opinion in Discourse: A Preliminary Study. In *Proceedings of COLING*, volume Companion Volume: Posters, pages 7–10, Manchester, UK, 2008.
18. Stede, M.: Surfaces and Depths in Text Understanding: The Case of Newspaper Commentary. In *Proc. of the HLT/NAACL Workshop on Text Meaning*, Edmonton/AL, 2003.
19. Lichte, T. and Soehn, J.-Ph.: The Retrieval and Classification of Negative Polarity Items using Statistical Profiles. In *Roots: Linguistics in Search of its Evidential Base*. Mouton de Gruyter, 2007.
20. Soehn, J.-Ph., Liu, M., Trawinski, B., Iordachioaia, G.: Positive und Negative Polaritätselemente als lexikalische Einheiten mit Distributionsidiosynkrasien. In *Proceedings of the Europhras*, 2008.
21. Schmid, H.: Probabilistic Part-of-Speech Tagging Using Decision Trees. In *Proceedings of the International Conference on New Methods in Language Processing*, September, 1994.