

# A verb lexicon model for deep sentiment analysis and opinion mining applications

**Isa Maks**

VU University, Faculty of Arts  
De Boelelaan 1105, 1081 HV Amsterdam,  
The Netherlands  
e.maks@let.vu.nl

**Piek Vossen**

VU University, Faculty of Arts  
De Boelelaan 1105, 1081 HV Amsterdam,  
The Netherlands  
p.vossen@let.vu.nl

## Abstract

This paper presents a lexicon model for subjectivity description of Dutch verbs that offers a framework for the development of sentiment analysis and opinion mining applications based on a deep syntactic-semantic approach. The model aims to describe the detailed subjectivity relations that exist between the participants of the verbs, expressing multiple attitudes for each verb sense. Validation is provided by an annotation study that shows that these subtle subjectivity relations are reliably identifiable by human annotators.

## 1 Introduction

This paper presents a lexicon model for the description of verbs to be used in applications like sentiment analysis and opinion mining. Verbs are considered as the core of the sentence as they name events or states with participants expressed by the other elements in the sentence. We consider the detailed and subtle subjectivity relations that exist between the different participants as part of the meaning of a verb that can be modelled in a lexicon.

Consider the following example:

Ex. (1) ... Damilola's killers were boasting about his murder...

This sentence expresses a positive sentiment of the killers towards the fact they murdered Damilola

and it expresses the negative attitude on behalf of the speaker/writer who has negative opinion of the the murderers of Damilola. Both attitudes are part of the semantic profile of the verb and should be modelled in a subjectivity lexicon.

As opinion mining and sentiment analysis applications tend to utilize more and more the composition of sentences (Moilanen (2007), Choi and Cardie (2008), Jia et al. (2009)) and to use the value and properties of the verbs expressed by its dependency trees, there is a need for specialized lexicons where this information can be found. For the analysis of more complex opinionated text like news, political documents, and (online) debates the identification of the attitude holder and topic are of crucial importance. Applications that exploit the relations between the verb meaning and its arguments can better determine sentiment at sentence-level and trace emotions and opinions to their holders.

Our model seeks to combine the insights from a rather complex model like Framenet (Ruppenhofer et al. (2010)) with operational models like Sentiwordnet where simple polarity values (positive, negative, neutral) are applied to the entire lexicon. Subjectivity relations that exist between the different participants are labeled with information concerning both the identity of the attitude holder and the orientation (positive vs. negative) of the attitude. The model accounts for the fact that verbs may express multiple attitudes. It includes a categorisation into semantic categories relevant to opinion mining and sentiment analysis and provides means for the identification of the attitude holder and the polarity of the attitude and for the description of the emotions and sentiments of the different

participants involved in the event. Attention is paid to the role of the speaker/writer of the event whose perspective is expressed and whose views on what is happening are conveyed in the text.

As we wish to provide a model for a lexicon that is operational and can be exploited by tools for deeper sentiment analysis and rich opinion mining, the model is validated by an annotation study of 580 verb lexical units (cf. section 4).

## 2 Related Work

Polarity and subjectivity lexicons are valuable resources for sentiment analysis and opinion mining. For English, a couple of smaller and larger lexicons are available.

Widely used in sentiment analysis are automatically derived or manually built polarity lexicons. These lexicons are lists of words (for example, Hatzivassiloglou and McKeown (1997), Kamps et al. (2004), Kim and Hovy (2004) or word senses (for example, Esuli and Sebastiani (2006), Wiebe and Mihalcea (2006), Su and Markert, (2008)) annotated for negative or positive polarity. As they attribute single polarity values (positive, negative, neutral) to words they are not able to account for more complex cases like *boast* (cf. example 1) which carry both negative and positive polarity depending on who is the attitude holder.

Strapparava and Valitutti (2004) developed Wordnet-Affect, an affective extension of Wordnet. It describes ‘direct’ affective words, i.e. words which denote emotions. Synsets are classified into categories like emotion, cognitive state, trait, behaviour, attitude and feeling. The resource is further developed (Valitutti and Strapparava, 2010) by adding the descriptions of ‘indirect’ affective words according to a specific appraisal model of emotions (OCC). An indirect affective word indirectly refers to emotion categories and can refer to different possible emotions according to the subjects (actor, actee and observer) semantically connected to it. For example, the word *victory*, if localized in the past, can be used for expressing pride (related to the actor or “winner”), and disappointment (related to the actee or “loser”). If *victory* is a future event the expressed emotion is hope. Their model is similar to ours, as we both relate attitude to the participants of the event. However,

their model focuses on a rich description of different aspects and implications of emotions for each participant whereas we infer a single positive or negative attitude. Their model seems to focus on the cognitive aspects of emotion whereas we aim to also model the linguistic aspects by including specifically the attitude of the Speaker/Writer in our model. Moreover, our description is not at the level of the synset but at lexical unit level which enables us to differentiate gradations of the strength of emotions within the synsets. This enables us to relate the attitudes directly to the syntactic-semantic patterns of the lexical unit.

Also Framenet (Ruppenhofer et al. (2010)) is used as a resource in opinion mining and sentiment analysis (Kim and Hovy (2006)). Framenet (FN) is an online lexical resource for English that contains more than 11,600 lexical units. The aim is to classify words into categories (frames) which give for each lexical unit the range of semantic and syntactic combinatory possibilities. The semantic roles range from general ones like Agent, Patient and Theme to specific ones such as Speaker, Message and Addressee for Verbs of Communication. FN includes frames such as Communication, Judgment, Opinion, Emotion\_Directed and semantic roles such as Judge, Experiencer, Communicator which are highly relevant for opinion mining and sentiment analysis. However, subjectivity is not systematically and not (yet) exhaustively encoded in Framenet. For example, the verb *gobble* (*eat hurriedly and noisily*) belongs to the frame Ingestion (consumption of food, drink or smoke) and neither the frame nor the frame elements account for the negative connotation of *gobble*. Yet, we think that a resource like FN with rich and corpus based valency patterns is an ideal base/ starting point for subjectivity description.

None of these theories, models or resources is specifically tailored for the subjectivity description of verbs. Studies which focus on verbs for sentiment analysis, usually refer to smaller subclasses like, for example, emotion verbs (Mathieu, 2005, Mathieu and Fellbaum, 2010) or quotation verbs (Chen 2005, 2007).

## 3 Model

The proposed model is built as an extension of an already existing lexical database for Dutch, i.e.

Cornetto (Vossen et al. 2008). Cornetto combines two resources with different semantic organisations: the Dutch Wordnet (DWN) which has, like the Princeton Wordnet, a synset organization and the Dutch Reference Lexicon (RBN) which is organised in form-meaning composites or lexical units. The description of the lexical units includes definitions, usage constraints, selectional restrictions, syntactic behaviors, illustrative contexts, etc. DWN and RBN are linked to each other as each synonym in a synset is linked to a corresponding lexical unit. The subjectivity information is modelled as an extra layer related to the lexical units of Reference Lexicon thus providing a basis for the description of the verbs at word sense level.

### 3.1 Semantic Classes

For the identification of relevant semantic classes we adopt – and broaden – the definition of subjective language by Wiebe et al. (2006). Subjective expressions are defined as words and phrases that are used to express *private states* like opinions, emotions, evaluations, speculations.

Three main types are distinguished:

Type I:

Direct reference to private states (e.g. his alarm grew, he was boiling with anger). We include in this category emotion verbs (like *feel*, *love* and *hate*) and cognitive verbs (like *defend*, *dare*, *realize* etc.);

Type II:

Reference to speech or writing events that express private states (e.g. he condemns the president, they attack the speaker). According to our schema, this category includes all speech and writing events and the annotation schema points out if they are neutral (*say*, *ask*) or bear polarity (*condemn*, *praise*);

Type III:

Expressive subjective elements are expressions that indirectly express private states (e.g. superb, that doctor is a quack). According to our annotation schema this category is not a separate one, but verbs senses which fall in this category are always also member of one of the other categories. For example, *boast* (cf. ex. 1) is both a Type II (i.e.

speech act verb) verb and a Type III verb as it indirectly expresses the negative attitude of the speaker/writer towards the speech event. By considering this category as combinational, it enables to make a clear distinction between Speaker/Writer subjectivity and participant subjectivity.

Moreover, we add a fourth category which includes verbs which implicitly refer to private states. If we consider the following examples:

Ex. (2) the teacher used to beat the students

Ex. (3) C.A is arrested for public intoxication by the police

Neither *beat* nor *arrest* are included in one of the three mentioned categories as neither of them explicitly expresses a private state. However, in many contexts these verbs implicitly and indirectly refer to the private state of one of the participants. In ex. (2) the teacher and the students will have bad feelings towards each other and also in ex. (3) C.A. will have negative feelings about the situation. To be able to describe also these aspects of subjectivity we define the following additional category:

Type IV:

Indirect reference to a private state that is the source or the consequence of an event (action, state or process). The event is explicitly mentioned.

Verb senses which are categorized as Type I, II or III are considered as subjective; verb senses categorized as Type IV are only subjective if one of the annotation categories (see below for more details) has a non-zero value; otherwise they are considered as objective.

We assigned well-known semantic categories to each of the above mentioned Types (I, II and IV). Table 1 presents the resulting categories with examples for each category. The first column lists the potential subjectivity classes that can apply.

Type	Name	Description	Examples
I(+III)	EXPERIENCER	Verbs that denote emotions. Included are both experiencer subject and experiencer object verbs.	hate, love, enjoy, entertain, frighten, upset, frustrate
I(+III)	ATTITUDE	A cognitive action performed by one of the participants, in general the structural subject of the verb. The category is relevant as these cognitive actions may imply attitudes between participants.	defend, think, dare, ignore, avoid, feign, pretend, patronize, devote, dedicate
II(+III)	JUDGMENT	A judgment (mostly positive or negative) that someone may have towards something or somebody. The verbs directly refer to the thinking or speech act of judgment.	praise, admire, rebuke, criticize, scold, reproach, value, rate, estimate
II(+III)	COMM-S	A speech act that denotes the transfer of a spoken or written message from the perspective of the sender or speaker (S) of the message. The sender or speaker is the structural subject of the verb.	speak, say, write, grumble, stammer, talk, email, cable, chitchat, nag, inform
II(+III)	COMM-R	A speech act that denotes the transfer of a spoken or written message from the perspective of the receiver(R) of the message. The receiver is the structural subject of the verb	read, hear, observe, record, watch, comprehend
IV(+III)	ACTION	A physical action performed by one of the participants, in general the structural subject of the verb. The category is relevant as in some cases participants express an attitude by performing this action.	run, ride, disappear, hit, strike, stagger, stumble
IV(+III)	PROCESS_STATE	This is a broad and underspecified category of state and process verbs (non-action verbs) and may be considered as a rest category as it includes all verbs which are not included in other categories.	grow, disturb, drizzle, mizzle

Table 1 Semantic Categories

### 3.2 Attitude and roles

In our model, verb subjectivity is defined in terms of verb arguments carrying attitude towards each other, i.e. as experiencers holding attitudes towards targets or communicators expressing a judgment about an evaluatee. The various participants or attitude holders which are involved in the events expressed by the verbs all may have different attitudes towards the event and/or towards each other. We developed an annotation schema (see Table 2 below) which enables us to relate the attitude holders, the orientation of the attitude (positive, negative or neutral) and the syntactic valencies of the verb to each other.

To be able to attribute the attitudes to the relevant participants we identify for each form-meaning unit the semantic-syntactic distribution of the arguments, the associated Semantic Roles and some coarse grained selection restrictions.

We make a distinction between participants which are part of the described situation, the so-called event internal participants, and participants that are outside the described situation, the external participants.

- Event internal attitude holders

The event internal attitude holders are participants which are lexicalized by the structural subject (A1), direct object (A2 or A3) or indirect/prepositional object (A2 or A3). A2 and A3 both can be syntactically realized as an NP, a PP, that-clause or infinitive clause. Each participant is associated with coarse-grained selection restrictions: SMB (somebody +human), SMT (something -human) or SMB/SMT (somebody/something + – human).

Attitude (positive, negative and neutral) is attributed to the relations between participants A1 vs. A2 (A1A2) and A1 vs. A3 (A1A3) and/or the relation between the participants (A1, A2 and A3) and the event itself (A1EV, A2EV and A3EV, respectively) as illustrated by the following examples.

verdedigen (defend: argue or speak in defense of)	
A1A2:	positive
A1A3:	negative

SMB (A1)	SMB/SMT (A2)	tegen SMB/SMT (A3)
He(A1) defends his decision(A2) against critique(A3)		

verliezen (lose: miss from one's possessions)	
A1EV: negative	
SMB(A1)	SMB/SMT(A2)
He (A1) loses his sunglasses (A2) like crazy	

- Event external attitude holders

Event external attitude holders are participants who are not part of the event itself but who are outside observers. We distinguish two kind of perspectives, i.e. that of the Speaker or Writer (SW) and a more general perspective (ALL) shared by a vast majority of people.

- Speaker /Writer (SW)

The Speaker/Writer (SW) expresses his attitude towards the described state of affairs by choosing words with overt affective connotation (cf. ex. 4) or by conveying his subjective interpretation of what happens (cf. ex. 5).

Ex. 4: He gobbles down three hamburgers a day

In (ex. 4) the SW not only describes the eating behavior of the ‘he’ but he also expresses his negative attitude towards this behavior by choosing the negative connotation word *gobble*.

(Ex. 5) B. S. misleads district A voters

In (ex. 5), the SW expresses his negative attitude towards the behavior of the subject of the sentence, by conceptualizing it in a negative way.

- ALL

Some concepts are considered as negative by a vast majority of people and therefore express a more general attitude shared by most people. For example, *to drown*, will be considered negative by everybody, i.e. observers, participants to the event and listener to the speech event. These concepts are labeled with a positive or negative attitude label for ALL. The annotation model is illustrated in table 2.

FORM	SUMMARY	SEMTYPE	COMPLEMENTATION	A1A2	A1A3	A1EV	A2EV	A3EV	SW	ALL
vreten (devour, gobble)	eat immoderately and hurriedly	ACTION	SMT (A2)	2	0	0	0	0	-4	0
afpakken (take away)	take without the owner's consent	ACTION	SMT(A2) van SMB (A3)	0	0	0	0	-3	0	0
verliezen (lose)	lose: fail to keep or to maintain	PROCESS	SMT (A2)	0	0	-3	0	0	0	0
dwingen (force)	urge a person to an action	ATTITUDE	SMB (A2) tot SMT (A3)	-3	2	0	0	0	0	0
opscheppen (boast)	to speak with exaggeration and excessive pride	COMM-S	over SMB/SMT (A2)	3	0	0	0	0	-4	0
helpen (help)	give help or assis- tance ; be of service	ACTION	SMB(A2) met SMT (A3)	2	1	0	0	0	0	0
bekritisieren(criticize)	express criticism of	COMM-S	SMB (A2)	-3	0	0	0	0	0	0
zwartmaken (slander)	charge falsely or with malicious intent	COMM-S	SMB (A2)	-3	0	0	0	0	-4	0
verwaarlozen (neglect)	fail to attend to	ATTITUDE	SMB (A2)	-3	0	0	0	0	-4	0
afleggen (lay out)	prepare a dead body	ACTION	SMB (A2)	0	0	0	0	0	0	-1
Explanation: A1A2        A1 has a positive (+) or negative(-) attitude towards A2 A1A3        A1 has a positive (+) or negative(-) attitude towards A3 A1EV        A1 has a positive or negative attitude towards the event A2EV        A2 has a positive or negative attitude towards the event A3EV        A3 has a positive or negative attitude towards the event SW         SW has a positive or negative attitude towards event or towards the structural subject of the event ALL        there is a general positive or negative attitude towards the event										

Table 2: Annotation Schema

#### 4 Intercoder Agreement Study

To explore our hypothesis that different attitudes associated with the different attitude holders can be modelled in an operational lexicon and to explore how far we can stretch the description of subtle subjectivity relations, we performed an inter-annotator agreement study to assess the reliability of the annotation schema.

We are aware of the fact that it is a rather complex annotation schema and that high agreement rates are not likely to be achieved. The main goal of the

annotation task is to determine what extent this kind of subjectivity information can be reliably identified, which parts of the annotation schema are more difficult than others and perhaps need to be redefined. This information is especially valuable when – in future- lexical acquisition tasks will be carried out to acquire automatically parts of the information specified by the annotation schema. . Annotation is performed by 2 linguists (i.e. both authors of this paper). We did a first annotation task for training and discussed the problems before the gold standard annotation task was carried out. The annotation is based upon the full description of

the lexical units including glosses and illustrative examples.

#### 4.1 Agreement results

All attitude holder categories were annotated as combined categories and will be evaluated together and as separate categories.

- Semantic category polarity

Overall percent agreement for all 7 attitude holder categories is 66% with a Cohen kappa ( $\kappa$ ) of 0.62 (cf. table 3, first row). Table 3 shows that not all semantic classes are of equal difficulty.

	Number of items	Kappa Agreement	Percent Agreement
All	581	0.62	0.66
Comm-s	57	0.75	0.77
Comm-r	16	0.55	0.81
Attitude	74	0.55	0.60
Action	304	0.60	0.66
StateProcess	83	0.47	0.55
Judgment	25	0.82	0.84
Experiencer	23	0.74	0.83

Table 3: Agreement for semantic categories

- Attitude Holder Polarity

Table 4 shows that agreement rates for each separate attitude holder differ. Although some categories are not reliable identifiable (cf. A1EV, A2EV, A3EV, ALL), the larger categories with many sentiment-laden items (cf. the third column which gives the coverage in percentage with regard to positive or negative annotations) are the ones with high agreement rates.

	Kappa	Percent agreement	PosOrNeg
A1-A2	0.73	0.89	25%
A1-A3	0.73	0.98	2%
A1EV	0.41	0.93	6%
A2EV	0.56	0.94	7%
A3EV	0.54	0.98	2%
SW	0.76	0.91	23%
ALL	0.37	0.87	10%

Table 4: Agreement rates for attitude holder categories

- Attitude Holder Polarity

Table 5 gives agreement figures for the most important attitude holder categories (A1A2 and SW) with respect to the different semantic categories. Low scores are found especially in categories (like

State\_Process) less relevant for Sentiment Analysis and opinion mining.

	A1A2( $\kappa$ )	SW( $\kappa$ )
Comm-s	0.83	0.93
Comm-r	1.00	1.00
Experiencer	0.82	0.84
Action	0.61	0.78
Judgment	0.92	0.63
State-process	0.33	0.64
Attitude	0.72	0.68

Table 5: Kappa agreement for SW and A1A2

- Single Polarity

One single polarity value for each item is derived by collapsing all attitude holder polarity values into one single value. If an item is tagged with different polarity values we apply them in the following order: SW, A1A2, A1A3, A1EV, A2EV, A3EV, ALL. As can be seen from table 6, observed agreement is 84% and kappa=0.75. Separate polarity computation (positive, negative and neutral) – with one polarity value of interest and the other values combined into one non-relevant category - shows that all polarity values are reliable identifiable.

	Kappa	Percent Agreement
Single polarity	0.75	0.84
Positive	0.70	0.91
Negative	0.82	0.92
Neutral	0.72	0.86

Table 6: agreement rates for polarity categories

#### 4.2 Disagreement Analysis

Overall agreement is 66% ( $K=0.62$ ) which is a reasonable score, in particular for such a complicated annotation schema. Moreover, scores are high for semantic categories such as Communication (0.75), Judgment (0.80), Experiencer (0.74) which are relevant for subjectivity analysis.

Table 4 shows that low performance is largely due to the attitude holder categories A1EV, A2EV, A3EV and ALL which have scores ranging from 0.37 to 0.56 whereas the categories A1A2, A1A3 and SW are reliably identifiable. As the last 3 categories are the largest ones with respect to senti-

ment bearing items, overall scores do not degrade much.

The low scores of A1EV, A2EV, A3EV and ALL are probably due to the fact that they are easily confused with each other. For example, *jagen* (hunt), *vallen* (fall), *klemmen* (stick, jam) and *flauwvallen* (faint) all have negative polarity but the annotators do not agree about who is the attitude holder: ALL (i.e. ALL have a negative attitude towards hunting, falling, being jammed, and fainting) or A1/2-RES (i.e. the person who falls, is jammed, is fainted or is hunted is the one who has the negative attitude). Confusion is found also between A2EV and A1A2. For example, with respect to *misleiden* (mislead), annotators agree about a negative attitude from A1 vs. A2, but one annotator marks additionally a negative attitude on behalf of A2 (A2EV: negative) whereas the other does not.

Especially the category ALL seems not to be defined well as many items are marked positive or negative by one annotator and neutral by the other. Examples of disagreements of this kind are *ploegen* (plough), *ontwateren* (drain), *omvertrekken* (pull over) and *achternalopen* (follow, pursue). Both annotators regard these items as objective expressions but they do not agree about whether some general positive or negative feelings are associated to them or not.

Disagreement occurs also where collocational information may lead one annotator to see subjectivity in a sense and the other not. For example, *houden* (keep - conform one's action or practice to) associated with collocations like *to keep appointments* and *to keep one's promises* is considered positive (A1A2) by one annotator and neutral by the other. This seems to apply to all frequent light verbs with little semantic content like *make*, *do* and *take*.

With respect to the category SW disagreements do not arise from confusions with other categories but from judgments which differ between neutral vs. non-neutral. Consider for example, *tevredens-tellen* (mollify) as in *I mollified her (A2) by cleaning my room*. Both annotators agree about the positive attitude between A1 and A2, but they disagree (SW:positive vs. SW:neutral) about whether the SW conveys a positive attitude towards 'I' by describing her behavior or not. Other examples of this type are *ignoreren* (ignore), *zich verzoenen*

(*make up*), *redden* (deal with), and *dwingen* (force).

Overall agreement for one polarity is rather high with  $\kappa=0.75$ . (cf. table 6). The scores are comparable to agreement rates of other studies where verbs are marked for single polarity. For example, inter-annotator agreement between 2 annotators who annotated 265 verb senses of the Micro-WNop corpus (Cerini et al. (2007)) is 0.75 ( $\kappa$ ) as well. It shows that a complicated and layered annotation does not hamper overall agreement and may also produce lexicons which are appropriate to use within applications that use single polarity only.

Summarizing, we conclude that overall agreement is good, especially with regard to most semantic categories relevant for subjectivity analysis and with respect to the most important attitude holder categories, SW and A1A2. When defining an operational model the small and low scoring categories, i.e. A1/A2/A3EV and ALL, will be collapsed into one underspecified attitude holder category.

## 5 Conclusions

In this paper we presented a lexicon model for the description of verbs to be used in applications like deeper sentiment analysis and opinion mining, describing the detailed and subtle subjectivity relations that exist between the different participants of a verb. The relations can be labeled with subjectivity information concerning the identity of the attitude holder, the orientation (positive vs. negative) of the attitude and its target. Special attention is paid to the role of the speaker/writer of the event whose perspective is expressed and whose views on what is happening are conveyed in the text.

We measured the reliability of the annotation. The results show that when using all 7 attitude holder categories, 3 categories, SW, A1A2 and A1A3 are reliable and the other 4 are not. As these not reliable categories are also small, we think that the annotation schema is sufficiently validated.

An additional outcome to our study is that we created a gold standard of 580 verb senses. In the future we will use this gold standard to test methods for the automatic detection of subjectivity and polarity properties of word senses in order to build a rich subjectivity lexicon for Dutch verbs.



## 6 Acknowledgments

This research has been carried out within the project From Text To Political Positions (<http://www2.let.vu.nl/oz/ctl/t2pp/>). It is funded by the VUA Interfaculty Research Institute CAMeRA.

## 7 References

- Andreevskaia, A. and S. Bergler (2006) Mining WordNet for Fuzzy Sentiment: Sentiment Tag Extraction from WordNet Glosses. In: EACL-2006, Trento, Italy.
- Chen, L. (2005) Transitivity in Media Texts: negative verbal process sub-functions and narrator bias. In International Review of Applied Linguistics in Teaching, (IRAL-vol. 43) Mouton De Gruyter, The Hague, The Netherlands.
- Cerini, S., Compagnoni, V., Demontis, A., Formentelli, M., and Gandini, G. (2007). Language resources and linguistic theory: Typology, second language acquisition, English linguistics (Forthcoming), chapter Micro-WNOp: A gold standard for the evaluation of automatically compiled lexical resources for opinion mining. Milano, Italy.
- Choi Y. and C. Cardie (2008). Learning with Compositional Semantics as Structural Inference for sub-sentential Sentiment Analysis. Proceedings of Recent Advances in Natural Language Processing (RANLP), Hawaii.
- Esuli, Andrea and Fabrizio Sebastiani. (2006). SentiWordNet: A Publicly Available Lexical Resource for Opinion Mining. In: Proceedings of LREC-2006, Genova, Italy.
- Hatzivassiloglou, V., McKeown, K.B. (1997) Predicting the semantic orientation of adjectives. In Proceedings of ACL-97, Madrid, Spain.
- Jia, L., Yu, C.T., Meng, W. (2009) The effect of negation on sentiment analysis and retrieval effectiveness. In CIKM-2009, China.
- Kamps, J., R. J. Mokken, M. Marx, and M. de Rijke (2004). Using WordNet to measure semantic orientation of adjectives. In Proceedings LREC-2004, Paris.
- Kim, S. and E. Hovy (2004) Determining the sentiment of opinions. In Proceedings of COLING, Geneva, Switzerland.
- Kim, S. and E. Hovy (2006) Extracting Opinions Expressed in Online News Media Text with Opinion Holders and Topics. In: Proceedings of the Workshop on Sentiment and Subjectivity in Text (SST-06). Sydney, Australia.
- Maks, I. and P. Vossen (2010) Modeling Attitude, Polarity and Subjectivity in Wordnet. In Proceedings of Fifth Global Wordnet Conference, Mumbai, India.
- Mathieu, Y. Y. (2005). A Computational Semantic Lexicon of French Verbs of Emotion. In: Computing Attitude and Affect in Text: Theory and Applications J. Shanahan, Yan Qu, J. Wiebe (Eds.). Springer, Dordrecht, The Netherlands.
- Mathieu, Y. Y. and C. Felbaum (2010). Verbs of emotion in French and English. In: Proceedings of GWC-2010, Mumbai, India.
- Moilanen K. and S. Pulman. (2007). Sentiment Composition. In Proceedings of Recent Advances in Natural Language Processing (RANLP), Bulgaria.
- Ruppenhofer, J., M. Ellsworth, M. Petrucci, C. Johnson, and J. Scheffczyk (2010) Framenet II: Theory and Practice (e-book) <http://framenet.icsi.berkeley.edu/book/book.pdf>.
- C. Strapparava and A. Valitutti (2004). WordNet-Affect: an affective extension of WordNet. In Proceedings LREC 2004, Lisbon, Portugal
- Su, F. and K. Markert (2008). Eliciting Subjectivity and Polarity Judgements on Word Senses. In Proceedings of Coling-2008, Manchester, UK.
- Valitutti, A. and C. Strapparava (2010). Interfacing Wordnet-Affect withj OCC model of emotions. In Proceedings of EMOTION-2010, Valletta, Malta.
- Wiebe, Janyce and Rada Micalcea. (2006) . Word Sense and Subjectivity. In Proceedings of ACL'06, Sydney, Australia.