Compositional approach applied to analysis of attitudes expressed through written language

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Objectives

We set three-fold focus in our research:

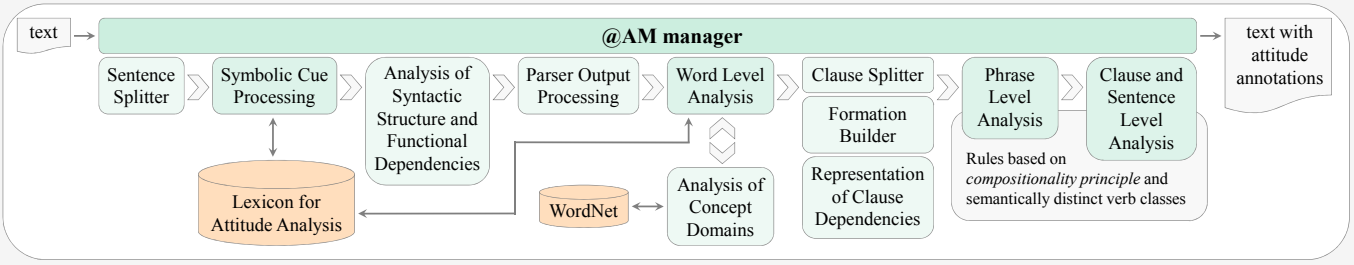
- **classification of sentences according to the fine-grained attitude labels**
- **analysis of the strength of the attitude**
- **determination of the level of confidence, with which the attitude is expressed.**

Approach

We developed @AM (ATtitude Analysis Model) system, which automatically recognizes affect, judgment, and appreciation in text.

The algorithm for attitude classification is designed based on the *compositionality principle* and a novel approach relying on the rules elaborated for semantically distinct verb classes.

Architecture and Principles of @AM (ATtitude Analysis Model)



Fine-grained attitude labels:

affect									judgment		appreciation		
'anger'	'disgust'	'fear'	'guilt'	'interest'	'joy'	'sadness'	'shame'	'surprise'	'POS jud'	'NEG jud'	'POS app'	'NEG app'	'neutral'

We built the **lexicon for attitude analysis** that includes:

(1) **affect-conveying symbolic cues** (emoticons and abbreviations)

(2) **attitude-conveying terms:**

POS	Word	Category: intensity
adjective	*honorable*	POS jud: 0.3
adjective	*unfriendly*	NEG aff (sadness): 0.5; NEG jud: 0.5; NEG app: 0.5
adverb	*gleefully*	POS aff (joy): 0.9
noun	*abnormality*	NEG app: 0.25
verb	*desire*	POS aff (interest): 1.0; POS aff (joy): 0.5

(3) **modifiers:**

- adverbs of degree ('*significantly*', '*slightly*') and adverbs of affirmation ('*absolutely*', '*seemingly*') that have an influence on the strength of attitude of the related words through coefficients (from 0.0 to 2.0)
- negation words ('*never*', '*nothing*'), adverbs of doubt ('*scarcely*', '*hardly*') and adverbs of falseness ('*wrongly*') that reverse the polarity of related statement
- prepositions ('*without*', '*despite*') and condition operators ('*if*', '*even though*') that neutralize the attitude of related words

(4) **"functional" words:**

- intensifying adjectives ('*rising*', '*rapidly-growing*'), nouns ('*increase*', '*up-tick*'), and verbs ('*to grow*', '*to rocket*'), which increase the strength of attitude of related words
- reversing adjectives ('*reduced*'), nouns ('*termination*', '*reduction*'), and verbs ('*to decrease*', '*to limit*', '*to diminish*'), which reverse the prior polarity of related words

(5) **modal operators**, which indicate a degree of person's belief in the truth of the proposition (*confidence level*):

- modal verbs (conf('*may*') = 0.27, conf('*would*') = 0.8)
- modal adverbs (conf('*vaguely*') = 0.17, conf('*arguably*') = 0.63, conf('*veritably*') = 1.0)

Compositionality Principle

The attitudinal meaning of a sentence is determined by composing the pieces that correspond to lexical units or other linguistic constituent types governed at various grammatical levels by the rules of

polarity reversal: '*never*' & POS('*succeed*') => NEG('*never succeed*')
'*scarcely*' & POS('*relax*') => NEG('*scarcely relax*')
'*reduced*' & POS('*enthusiasm*') => NEG('*reduced enthusiasm*'))

aggregation (fusion): POS('*beautiful*') & NEG('*fight*') => POS-neg('*beautiful fight*')
NEG('*shamelessly*') & POS('*celebrate*') => NEG-pos('*shamelessly celebrate*')

propagation: PROP-POS('*to admire*') & '*his behaviour*' => POS('*his behaviour*')
'*Mr. X*' & TRANS('*supports*') & NEG('*crime business*') => NEG('*Mr. X*'))

domination: NEG('*to deceive*') & POS('*hopes*') => NEG('*to deceive hopes*')
'NEG(*It was hard to climb a mountain all night long*), *but* POS(*a magnificent view rewarded the traveler at the morning*).' => POS(whole sentence)

neutralization: '*despite*' & NEG('*worries*') => NEUT('*despite worries*')

intensification: Pos_score('*extremely happy*') > Pos_score('*happy*'))
Neg_score('*sad*') < Neg_score('*sadder*') < Neg_score ('*saddest*')).

Consideration of the Sementics of Verbs

Based on the thorough analysis of 270 first-level classes of VerbNet and their members, 73 verb classes (1) were found useful for the task of attitude analysis, and (2) were further classified into **22 classes** differentiated by the role that members play in attitude analysis.

For each of our verb classes, we developed set of rules that are applied to attitude analysis on the phrase/clause-level.

EXAMPLES:

"*Object-centered (oriented) emotional state*" (subject is ignored)**:**
S & V+('*admires*') & O-('*mafia leader*') =>
interior: (verb valence dominance, V_score) =>'POS aff';
exterior: (verb valence reversal, *max*(V_score,O_score)) => 'NEG jud'.

"*Subject-driven change in emotional state (trans.)*" (object is ignored)**:**
S-('*Fatal consequences of GM food intake*') & V-('*frighten*') & O('*me*') =>
interior: 'NEG aff'; exterior: 'NEG app'.

"*Negative judgment*":
S('*He*') & V-('*blamed*') & O+('*innocent person*') => interior: 'NEG jud'; exterior: 'NEG jud'.

"*Adverse (unfavorable) attitude*":
S('*They*') & [V neg. reinforcement]('*prevented*') & O-('*the spread of disease*') => 'POS app'; O_score^.

"*Communication indicator/reinforcement of attitude*" and
"*Termination of activity*":
S('*Max*') & [V neg. reinforcement, confidence:0.2]('*doubt*') & PP-{'*that*' S+('*his good fortune*') & [V termination]('*will ever end*')} => 'POS app'; PP_score^; confidence:0.2.

@AM Interface and Evaluation Results

The evaluation of our method on 1000 sentences, which describe personal experiences (*Experience Project: www.experienceproject.com*), showed promising results: average accuracy on fine-grained level (14 categories) was 62%, on middle level (7 categories) – 71%, and on top level (3 categories) – 88%.

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