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## **PolArt: a robust tool for sentiment analysis**

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# PolArt: A Robust Tool for Sentiment Analysis

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- Sentiment Detection across Multiple Languages  
→ English, German, French
- Engineering Approach to Sentiment Composition  
→ cascade of transducers
- Engineering Approach to Polarity Lexicon Design  
→ German lexicon manually specified (GermaNet)
- Evaluation on Different Text Types and Domains  
product reviews, novels, 'I battle depression' panel group

The screenshot shows the PolArt interface. On the left is a sidebar with a list of text targets and their evaluation status:

- + text11
  - + 1. targets
- + text12
  - + 1. targets
- + text13
  - + 1. targets
- + text14
  - + 1. targets
- + text15
  - + 1. targets
- + text16
  - 1. targets
  - positiv (8)
  - not evaluated (20)
- + text17
  - + 1. targets
- + text18
  - + 1. targets
- + text19
  - + 1. targets
- text2
  - 1. targets
  - positiv (11)
  - negativ (16)
  - not evaluated (17)
- + text20
  - + 1. targets
- + text21

On the right is a large text block with several phrases highlighted in orange:

You will feel great [1]  
I told them , my parents , and they really helped me [1] [2] [3]  
anybody who understands you [1]  
I wish you all a great life [1] [2]  
I felt at last free [1]  
that what I told you could help somebody [1] [2]  
what they said helped me [1]

I had social issues and there were 4 painful years that I had . In that period I could not talk or act freely . I was a loner and I was afraid of others judging me . I often cried because of social situations that were not very comfortable and nobody knew for four years . I kept this inside me and as much as I thought about myself that I'm a social disaster as much as I was unhappy . I have a loving family, wonderful parents and a cool sister , but I could not tell anyone about my pain ( that grew in time ) . Until this evening , I could not keep it in anymore . I had to let it go . I had to talk to someone . It was difficult , very difficult at first . I thought they would not understand me . I cried this evening as for four years that I kept silence . I told them , my parents , and they really helped me see things more clearly . They did not use psychological terms but with what they said helped me . It was a great relief . I felt at last free . My advice to anybody who has social anxiety is to talk about your problem once and for all . Talk to whom is closer to you . If you think you do not have anybody who understands you , talk anyway to someone . Decide once you are going to do it . And talk . Let out all your pain . It's better than letting it intensify inside of you . Just talk . You will feel great after . Talk honestly and tell the things exactly as they are . I hope somehow that what I told you could help somebody . I wish you all a great life , without fear .

# Word-level Polarity

Some words have a prior positive or negative polarity

→ perfect<sup>+</sup>, impertinent<sup>-</sup>, love<sup>+</sup>, hope<sup>+</sup>, enjoy<sup>+</sup>, detest<sup>-</sup>, ..

Most words do not have a prior polarity, i.e. they are neutral

→ tree, mouth, green, to read, to go, picture, building, ..

Some neutral words enforce a non-neutral polarity

→ long, old, strong, heavy, sweet, cold, burning, ...

POS	NEG	NEU
high resolution	high temperature (fever)	high building
burning candle	burning house	burning match
cold coke	cold French fries	cold winter
long life time	long waiting time	long line of cars

- English: subjectivity lexicon (Wiebe et al.) with 8,000 entries
- German: a lexicon manually curated from GermaNet with 8000 entries
  - only obvious classes (noun.emotion etc.)
  - we expect a final version with 10,000 - 12,000 entries
- French: automatic translation of the German lexicon with LEO
  - hypothesis: polarity is preserved by synonymous wordforms
  - we take them all: e.g. German 'Freude' = 'joie', 'plaisir', ..
  - not yet evaluated

# Polarity Composition: NP Level

ADJ	NOUN	→	NP	Example
NEG	POS	→	NEG	disappointed hope
NEG	NEG	→	NEG	a horrible liar
POS	POS	→	POS	a good friend
POS	NEG	→	NEG	a perfect misery
POS	NEU	→	POS	a perfect meal
NEG	NEU	→	NEG	a horrible meal
NEU	NEU	→	POS	old wine
NEU	NEU	→	NEG	old bread

Figure: NP composition

## Polarity Composition: 'NP PP' Combination

NP	Prep	NP	→	'NP PP'
POS	to	NEG	→	POS      solution to my problem
POS	for	POS	→	POS      hope for relief
NEG	of	NEG	→	NEG      pain of disappointment
NEG	of	POS	→	NEG      lost of hope

Figure: 'NP PP' composition



# Shifting and Intensifying Polarities

## Polarity Shifters

→ fail (to destroy), not (allowed), without (fear), hardly (convincing)

## Intensifiers

→ e.g. very, really

→ e.g. very good, very convincing

# Polarity Composition: Sentence Level

'She (doesn't\* (fail\* (to verify<sup>+</sup> (her excellent<sup>+</sup> idea)<sup>+</sup>)<sup>+</sup>)<sup>-</sup>)<sup>+</sup>

excellent<sup>+</sup> idea → POS<sub>1</sub>

verify<sup>+</sup> POS<sub>1</sub> → POS<sub>2</sub>

fail\* POS<sub>2</sub> → NEG<sub>3</sub>

not\* NEG<sub>3</sub> → POS<sub>4</sub>

\* indicates a polarity shifter

# Problems: NEG + POS = {POS,NEG}?

'perfect spy': POS  $\vee$  NEG

- subjective perspective: POS
- objective perspective: NEG

'perfect murder': NEG with admiration

- admiration, but a positive evaluation?

'perfect misery': purely NEG

- negative, not even admiration, might be sarcasm, irony
- NEG + POS: indicator of sarcasm or irony?

## Tree-Tagger Chunker (Schmid, 1994)

- available for English, German, French
- composition rules operate on chunker output

## Rules: domain-independent

- German: 65
- English: 88
- French: 21 (experimental)

# Rule Application (schematic example)

## Cascade of rewrite operations

e.g. 'there is <nc no\* disappointed<sup>-</sup> hope<sup>+</sup> nc> or longing'

matching part	rule composition	result
disappointed <sup>-</sup> hope <sup>+</sup>	NEG+POS=NEG	is <nc no* NEG nc>
no* NEG	SHIFT+NEG=POS	is <nc POS nc> ..

## Rules: English, Examples

'disappointed hope'

nc\_jj:NEG,nn:POS;→ NEG

'without fear'

pc\_pol=SHIFT;nc\_pol=NEG;pc\_end;→ POS

'lack of luck'

nc\_pol=SHIFT;pc\_l=of;nc\_pol=POS;pc\_end;→ NEG

'hardly amused'

advc\_pol=SHIFT;xc\_pol=POS;→ NEG

product reviews (Ding & Liu, 2007):

1511 sentences, 3859 phrases

baseline	sentence-level	68.03%
PolArt	sentence-level	72.46 %

## Empirical Evaluation II

Language	Texts	Phrases	POS	NEG
English	depression	248	80.5%	90.2%
German	E.v. Keyserling novels	1209	90.38%	80.48%
French	not yet	-	-	-



## Resources: polarity lexicons

SentiWordNet, General Inquirer, WordNetAffect

→ noisy or too small

## Sentiment analysis is compositional

Moilanen & Pulman (2007)

→ normative grammar, not robust

## Composition of sentiment can be learned

Choi & Cardie (2008)

→ machine learning approach to sentiment composition

→ also simple pattern matching as a baseline (thus rather simple)

## coming up soon?

- more rules: what are the limitations of a cascaded approach
- comparison to work of Choi & Cardie
- measure for polarity strength
- polarity at the document level
- more fine-grained classification: appraisal theory (e.g. Whitelaw et al., 2005)

# Love, actually?

'I love my family'

POS

'I love you so badly'

POS, idiomatic use of 'badly'?

'I love your impertinent answers'

POS + NEG = NEG (nobody loves such answers), hence: sarcasm

'I love violent films'

POS + NEG = {POS, NEG}

again: subjective versus objective evaluation

# What about Ambiguity?

- e.g. 'cheap'
  - 'cheap food' (good price)
  - 'cheapfodd' (low quality)