

Analyse de sentiments : apport du discours et de la pragmatique

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Introduction

Study of evaluation: a multidisciplinary enterprise

- Evaluation aspects of language allow us to convey feelings, assessments of people, situations and objects, and to share and contrast those opinions with other speakers.
- The study of evaluation, affect and subjectivity is a multidisciplinary enterprise:
 - Sociology (Voas 2014).
 - Psychology (Ortony, Clore, and Collins 1988; Davidson, Scherer, and Goldsmith 2003).
 - Economics (Rick and Loewenstein 2008).
 - Linguistics (Hunston and Thompson 2000; Thompson and Alba-Juez 2014).
 - Computer science (Liu 2012; Liu 2015).

Introduction

Evaluation in linguistics: wide range of theories

Stance (Biber and Finegan 1989)

- Encompasses **evidentiality** (commitment towards the message) and **affect** (positive or negative attitudes, feelings and judgment).
 - Classification of stance markers (e.g., *of course*, *perhaps*) leads to an analysis of texts based on cluster analysis.
 - Genre classification according to how much the writer and speaker are involved: EXPOSITORY EXPRESSION OF DOUBT, EMPHATIC EXPRESSION OF AFFECT (personal letters, romance fiction), FACELESS (press reportage, radio broadcasts).

Introduction

Evaluation in linguistics: wide range of theories (cont'd)

Nonveridicality (Giannakidou 1995; Zwarts 1995)

- Contexts which are not veridical, i.e., which are not based on truth or existence.
- Class of nonveridical operators: negation, modal verbs, intensional verbs (*believe, think, want, suggest*), imperatives, etc.

Introduction

Evaluation in linguistics: wide range of theories (cont'd)

Evaluation (Hunston and Thompson 2000)

- **Modality** + **something else** (opinions about entities) called evaluation, appraisal or stance.
- Evaluation and pattern grammars: certain patterns contribute to evaluative meanings.
 - Performative patterns: *it* (*It is amazing that. . .*) and *there* patterns (*There is something admirable about...*).
 - Patterns that report evaluation: Verb + *that*.
 - Phrases that accompany evaluation: *to the point of*.

Introduction

Evaluation in linguistics: wide range of theories (cont'd)

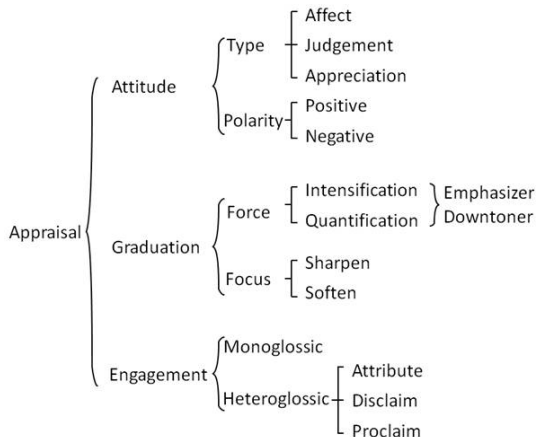
Appraisal (Martin and White 2005)

- The set of resources used to negotiate emotions, judgments, and valuations, alongside resources for amplifying and engaging with those evaluations.
 - **Attitude**: Models the ability to express emotional (e.g., *happiness, sadness, fear*), moral (*ethical, deceptive, brave*), and aesthetic opinions (*remarkable, elegant, innovative*).
 - **Graduation**: Speaker's ability to intensify or weaken the strength of the opinions that they express.
 - **Engagement**: Convey the degree of speaker's commitment to the opinion being presented.

Introduction

Evaluation in linguistics: wide range of theories (cont'd)

Appraisal (Martin and White 2005)



Introduction

Evaluation in computational linguistics

Extracting evaluation from NL data began in the 1990s:

- Determine if an author is in favor of, neutral, or opposed to some events in a document (Hearst 1992).
- Identify hostile messages (Spertus 1997).
- Classify narratives in subjective vs. objective (Wiebe 1994).
- Study subjective orientation of adjectives (Hatzivassiloglou and McKeown 1997).

Introduction

And then came social media



Introduction

.....and new needs

- Search for a movie
 - Results are returned in categories: positive and negative reviews.
- Consumer reviews
 - Products are ranked according to their reviews.
- Market intelligence
 - What are people saying about a new product? What do they think about a company?
- Politics
 - Opinions about a candidate, a policy, a new piece of legislation (maybe also over time).
- Business
 - Mapping of financial information (stock price, volume of sales) to what is being posted online.

Introduction

Sentiment analysis: a hot topic in NLP

- Sentiment analysis or opinion mining: one of the most popular applications of NLP in academic research institutions and industry.
- A Google Scholar search for “sentiment analysis” yields about 28,000 publications.
 - The Pang and Lee survey (2012) alone has more than 3,800 citations.

Outline

- 1 Problem definition
- 2 Main approaches
- 3 From bag of words to discourse
- 4 From discourse to pragmatics
- 5 Conclusion

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Evaluation in NLP: problem definition

- Evaluation used as an umbrella term that covers a variety of phenomena including opinion, sentiment, attitude, appraisal, affect, point of view, subjectivity, desires and belief.
- An evaluation is:
 - A **subjective piece of language** expressed by a **holder** towards a topic or **target**.
 - Always associated with a **polarized scale** regarding social or moral norms.
 - *bad vs. good, love vs. hate, in favor of vs. against, prefer vs. dislike, better vs. worse, etc.*

Evaluation in NLP: problem definition

- This restaurant serves incredibly delicious food.
- I am jealous of the talent of the chef.
- I'm not going out for dinner tonight. I think it will rain.

Evaluation in NLP: problem definition

- This restaurant serves incredibly delicious food. ⇒ Evaluation
 - **Topic:** *restaurant.*
 - **SubTopic:** *food.*
 - **Holder:** *writer.*
 - **Subjective elements:** *incredibly delicious.*

Evaluation in NLP: problem definition

- This restaurant serves incredibly delicious food. \Rightarrow Evaluation.
- I am jealous of the talent of the chef. \Rightarrow Emotion
 - Emotion detection and classification (Khurshid 2013; Mohammad 2015)

Evaluation in NLP: problem definition

- This restaurant serves incredibly delicious food. \Rightarrow Evaluation.
- I am jealous of the talent of the chef. \Rightarrow Emotion
- I'm not going out for dinner tonight. I think it will rain. \Rightarrow
Nonveridicality+Evidentiality
 - Detecting negation and speculation, in particular in biomedical text (Morante and Sporleder 2012; Cruz, Taboada, and Mitkov in press).

Evaluation in NLP: standard definition (Liu 2012)

Evaluation as a structured model (e, a, s, h, t) :

- e : the topic or target of the opinion.
- a : the specific aspect or feature of that entity.
- h : the opinion holder or source.
- $s = (y, o, i)$: the sentiment or evaluation towards a
 - y : sentiment semantic category.
 - o : sentiment polarity or orientation (positive, negative, neutral).
 - i : sentiment valence, rate or strength, that indicates the degree of the evaluation on a given scale.
- t : the posting time of s .

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Evaluation in NLP: main tasks

- Automatic extraction of one or several elements of the quadruple (e, a, s, h)
- It involves roughly three main sub-tasks:
 - 1 Topic/aspect extraction
 - 2 Holder identification
 - 3 Sentiment determination
- These tasks are either performed independently from each other, or simultaneously.

Topic/aspect and holder extraction: overview

- Holder can be:
 - the author: *The movie is great*
 - the author reporting or stating someone else's evaluation: *My mother said that the movie is great*
- The holder evaluates on a topic or target:
 - a global entity e organized hierarchically into a set of attributes or aspects a (e.g., *engine*, *tires* are part of the entity *car*)
 - Aspects may be explicit or implicit.
 - *The characters are great.*
 - *We went to the new vegan restaurant yesterday. It was all too raw and chewy for me.*

Topic/aspect and holder extraction: what have been done

- Main assumptions:
 - One holder per sentence and one holder per document.
 - One topic per sentence and one topic per document.
 - One aspect per sentence: related to the main topic.
 - Aspects are explicit: feature-based opinion mining
- Information extraction task that exploits¹:
 - Semantic role labeling à la PropBank or FrameNet.
 - Noun or noun phrases,
 - Dependency relations or some syntactic patterns at the sentence level,
 - Knowledge representation paradigms (like hierarchies or domain ontologies) and external sources (e.g., Wikipedia).

¹For a survey on topic detection for aspect-based sentiment analysis, see (Liu:2015), Chapter 6.

Topic/aspect and holder extraction: what have been done

Google products

Sony Cyber-shot DSC-W370 14.1 MP Digital Camera (Silver)

[Overview](#) - [Online stores](#) - [Nearby stores](#) - [Reviews](#) - [Technical specifications](#) - [Similar items](#) - [Accessories](#)



\$140 online, \$170 nearby

★★★★☆ 159 reviews +1 0

Reviews

Summary - Based on 159 reviews

1	2	3 stars	4 stars	5 stars
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What people are saying

pictures		"We use the product to take quickly photos."
features		"Impressive panoramic feature."
zoom/lens		"It also record better and focus better on sunny days."
design		"It has the slightest grip but it's sufficient."
video		"Video zoom is choppy."
battery life		"Even better, the battery lasts long."
screen		"I Love the Sony's 3" screen which I really wanted."

Topic/aspect and holder extraction: what needs to be done

- Extract evaluations in multi-topic and multi-holder documents:
 - News articles: Deal with discourse popping (Asher and Lascarides 2003).
 - Social media: Topics are dynamic over conversation threads, i.e., not necessary known in advance.
 - Social media: Investigate how related topics influence the holder's evaluation on this main topic.

- Implicit aspects extraction (upcoming)

Sentiment determination: overview

- **Subjectivity analysis:** objective vs. subjective
 - **Explicit** vs. **implicit** evaluation

*This movie is **poignant**, and the actors **excellent**.
It will remain in your DVD closet.*

- **Polarity analysis:** polarity (positive, negative, neutral) and/or scale rating
 - **Out of context** vs. contextual polarity

- *This restaurant is **not good** enough.*
- *What a **great** animated movie. I was **so scared** the whole time that I **didn't even move from my seat**.*

Sentiment determination: overview (cont'd)

Polarity analysis: polarity and/or orientation.

- Out of context vs. contextual polarity
- Polarity ambiguity
 - Domain dependency: A **horrible** movie may be positive if it is a thriller, but negative in a romantic comedy.
 - Some subjective expressions can have both positive and negative orientation: *This movie **surprised** me.*
 - Polarity vary according to a specific situation, group, or culture: **Yeah** and **right**,
 - Difference between the author and reader standpoint: a **small** restaurant

Sentiment determination: overview (cont'd)

Polarity analysis: polarity and/or orientation.

- Out of context vs. contextual polarity
- Polarity ambiguity
- Beyond positive vs. negative categorization
 - Comparatives: *The picture quality of camera X is better than that of Y.*
 - Agreement/disagreement on a given topic in a debate or discussion.
 - Other phenomena (upcoming).

Sentiment determination: what have been done

- Subjectivity and polarity analysis at the sentence, document and feature level:
 - Classification problem: categorize a text span as being positive, negative, or neutral towards a given topic.
 - Regression: assign a multi-scale rating (stars).
- Main assumptions:
 - Each sentence usually contains a single opinion.
 - Polarity is binary (+ neutral in some cases)
 - Focus almost exclusively on explicit evaluation.
 - Deal with a single corpus genre: product review, tweets, blogs.
 - Often monolingual systems.
 - Some approaches take into account valence shifters at the sentence level: effect of negation, intensifier and modality.

Sentiment determination: what have been done

The classification approach typically uses:

- Corpus-based techniques:
 - Train set of balanced examples (texts or sentences)
 - Build a classifier that learns the features that make those texts positive or negative
 - Features: Bag-of-words representation (BOW), POS, punctuation, emoticons, presence vs. frequency of features, dependency relations (adjective-noun, subject-verb, or verb-object relationships), subjective words (lexicons)
 - Accuracy can exceed 80%.

Sentiment determination: what have been done

The classification approach typically uses:

- Lexicon-based techniques
 - Dictionaries (created automatically or manually)
 - Process a new text:
 - Extract the opinion words from it
 - What to do with the words? Average the values
 - Find out more about the context in which the values appear: valence shifter, relate to aspect/topic, etc.

Sentiment determination: what have been done

A demo:

- Lexical-based approach: SentiStrenght
<http://text-processing.com/demo/sentiment/>
- Learning approach: Python NLTK Sentiment
<http://text-processing.com/demo/sentiment/>

Sentiment determination: major problems

- Bag-of-words approaches:
 - Difficult to generalize: Poor cross-domain performances.
 - Suffer from bias toward movie reviews.
 - Depends on the availability of labeled (sometimes unbalanced) data in one domain.
 - Ignore inter-sentential relations.
- Lexicon-based approaches:
 - Dictionaries are static.
 - New domain or new language involves creating new dictionaries.

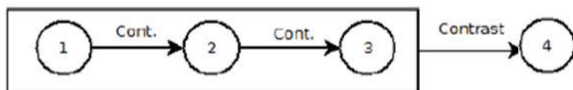
Sentiment determination: what needs to be done

Dealing with **context within** the document:

- Role of discourse connectives, discourse structure, rhetorical relations, topicality.

The whole is not necessarily the sum of the parts

The characters are unpleasant . The scenario is totally absurd .
The decoration seems to be made of cardboard . But, all these elements make the charm of this TV series.



Sentiment determination: what needs to be done

Dealing with **context outside** the document:

- Implicit evaluation
- Figurative language: irony and sarcasm
 - #Hollande est un très bon diplomate #Algérie #ironie
 - #Nabilla fille très classe, très belle, pas du tout refaite #ironie
- Other pragmatic phenomena: intent analysis (upcoming), demographic information and social network structure

Outline

- 1 Problem definition
- 2 Main approaches
- 3 Form bag of words to discourse**
- 4 From discourse to pragmatics
- 5 Conclusion

What is discourse?

- Texts and conversations are not just a juxtaposition of words and sentences.
- They are rather organized in a structure in which discourse units are related to each other so as to ensure:
 - **Coherence.** The logical structure of discourse where every part of a text has a role to play, with respect to other parts in the text.
 - **Cohesion.** The grammatical and lexical connections that link one element of a discourse to another

What is discourse?

- Studying the discourse structure of a document requires three main tasks:
 - 1 Discourse segmentation: what are the discourse units?
 - 2 Unit attachment: how do these units attach to other units?
 - 3 Labelling: how discourse units are linked?
- Two ways for building such a structure
 - Top-down approach
 - Bottom-up approach

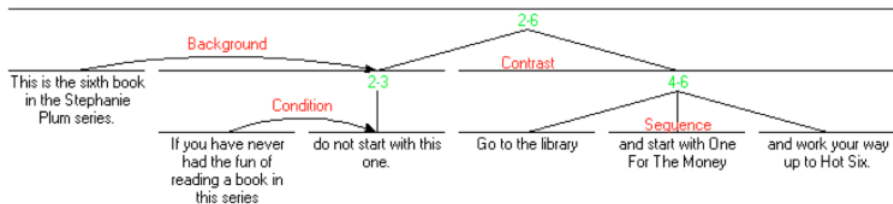
Top down approaches

- Capture the macro-organisation of a text or high-level textual patterns.
- Discourse segments: units higher than the sentence (e.g. the paragraph) or some larger entity such as topic unit.
- Link segments to build:
 - Topic-based structure (Hearst, 1994)(Purver, 2011).
 - Genre-induced structure (Agarwal and Yu, 2009).
 - Functional structure (Moor and Paris, 1993).

Bottom-up approaches

- Define hierarchical structures by constructing complex discourse units from Elementary Discourse Units (EDU) in recursive fashion.
- Identify the rhetorical relations holding between EDUs: EXPLANATION, NARRATION, CONTRAST, etc.
- Main approaches:
 - Lexically grounded: the Penn Discourse Treebank (Prasad et al. 2008)
 - Complete discourse coverage:
 - Intentionally driven: e.g., Rhetorical Structure Theory (RST) (Mann and Thompson 1988)
 - Semantically driven: e.g., Segmented Discourse Representation Theory (SDRT) (Asher and Lascarides 2003).

Bottom-up approaches: an RST tree



Sentiment analysis and discourse

- Discourse structure provides a crucial link between the local sentence level and the entire document.
- Discourse can help in three main tasks:
 - Identifying the subjectivity and polarity orientation of evaluative expressions;
 - Furnishing important clues for recognizing implicit opinions;
 - Assessing the overall stance of texts.

Top down approaches in sentiment analysis

In a subjective document only some parts of it are relevant to the overall sentiment.

- Positional features:
 - Keep the first and last quarter of a review, sentences towards the end of the text.
- Topic criteria:
 - Objectivity and subjectivity are usually consistent between adjacent sentences.
- Functional role played by some parts or zones in a text
 - Divide a document into its formal and functional (Comment + Description) constituents
 - Role of argumentation: viewing **what** are being expressed and **why** those particular views are held

Bottom-up approaches in sentiment analysis

Rely on local discourse relations at the inter-sentential or intra-sentential level

- Among the set of relations, only some of them are sentiment relevant

CONCESSION relation: positivity neutralized, downtoned at best

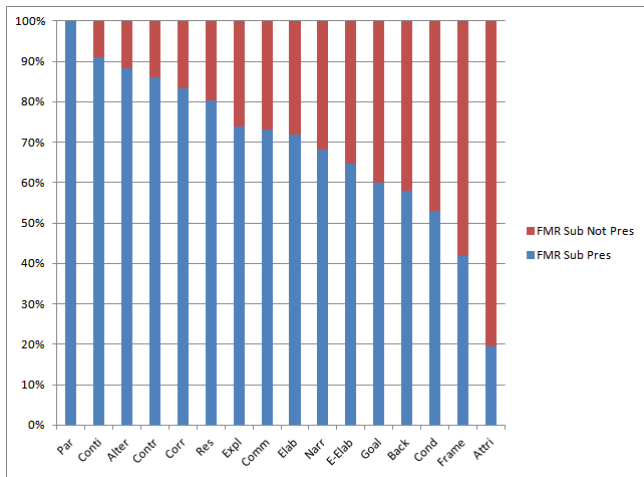
- **Although** Boris is **brilliant** at math, he is a **horrible** teacher

CONDITION relation: limits the extent of a positive evaluation

It is an **interesting** book **if** you can look at it without expecting the Grisham “law and order” style.

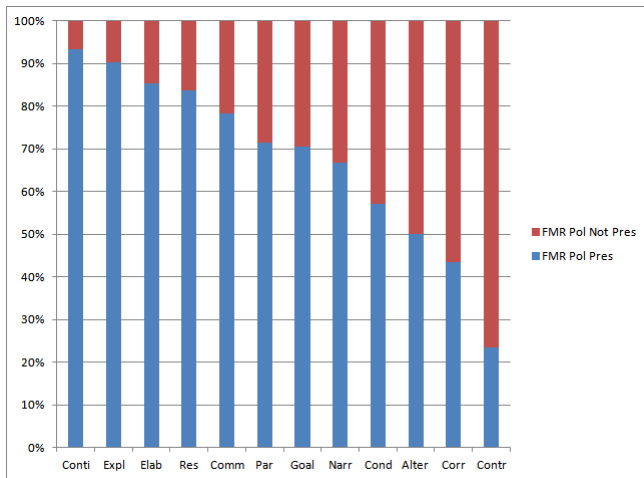
Bottom-up approaches in sentiment analysis

Impact of discourse relations on subjectivity analysis of movie reviews (Benamara et al, 2015)



Bottom-up approaches in sentiment analysis

Impact of discourse relations on polarity analysis of movie reviews (Benamara et al, 2015)



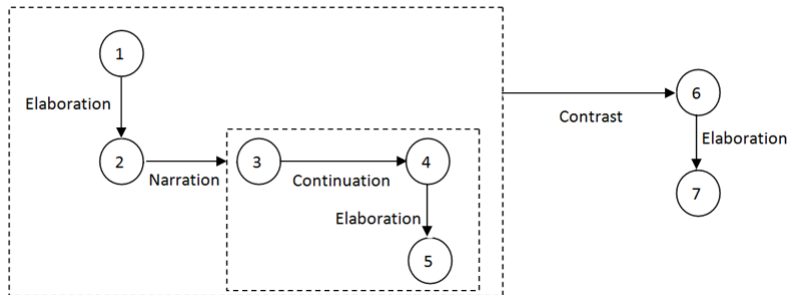
Bottom-up approaches in sentiment analysis

Leveraging overall discourse structure:

- Sentiment is a semantic scope phenomenon
- Long-distance dependency

Bottom-up approaches in sentiment analysis

- [I saw this movie on opening day.]₁ [Went in with mixed feelings.]₂
 [hoping it would be good.]₃ [expecting a big let down]₄ [(such
 as clash of the titans (2011), watchmen etc.)].₅ [This movie
 was shockingly unique however.]₆ [Visuals, and characters were
 excellent.]₇



Bottom-up approaches in sentiment analysis

The importance of discourse structure in sentiment analysis empirically validated in (Chardon et al. 2013).

	Movie reviews		News reactions	
	Accuracy	Pearson	Accuracy	Pearson
<i>Baseline</i>	0.89	0.81	0.88	0.52
<i>Bag of segments</i>	0.92	0.87	0.94	0.77
<i>Partial discourse</i>	<u>0.96</u> (Top1)	<u>0.94</u> (Top1)	<u>0.96</u> (Top2)	<u>0.82</u> (Top2)
<i>Full discourse</i>	0.90	0.86	0.94	<u>0.82</u>

Bottom-up approaches in sentiment analysis

Extracting evaluation in real scenarios requires automatic discourse representations

- Extract rhetorical structure from the texts: mainly RST discourse parsers.
- Assign parts of the text to nucleus or satellite status.
- Perform semantic orientation calculations:
 - Only on the nuclei, i.e., the most important parts.
 - Exploit sentence-level RST relation types.
 - Recursively propagating sentiment up through the tree.

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SA and pragmatic phenomena: implicit evaluation

Implicit evaluation: Polar-fact (Liu, 2015), Opinion implicature (Wilson and Wiebe, 2005), invoked evaluation (cf. Appraisal theory)

- Three ways to make an evaluation implicit or invoked:
 - Describe desirable or an undesirable situations
- Within a month, a valley formed in the middle of the mattress .
- The movie is not bad, although some persons left the auditorium.

SA and pragmatic phenomena: implicit evaluation (Cont'd)

Implicit evaluation:

- Three ways to make an evaluation implicit or invoked:
 - Describe desirable or an undesirable situations
 - Connotation

- Jim is a **vagrant** .
- Jim has **no fixed address** .
- Jim is **homeless** .

SA and pragmatic phenomena: implicit evaluation (Cont'd)

Implicit evaluation:

- Three ways to make an evaluation implicit or invoked:
 - Describe desirable or an undesirable situations
 - Connotation
 - Implicit features
- *The cell phone is heavy* ⇒ Weight –
- *My new phone lasted three days* ⇒ Durability –
- *The camera fits in my pocket* ⇒ Size +

SA and pragmatic phenomena: implicit evaluation (Cont'd)

(Benamara et al, 2011): Use discursive constraints to find the subjective orientation of desirable or an undesirable situations in movie reviews

	Accuracy
<i>Baseline (B1)</i>	68.79
<i>S classifier</i>	70.91
<i>Baseline (B2)</i>	73.33
<i>Op classifier</i>	75.45
<i>S+Op classifier: SE segments</i>	73.03 (non-iter. Op: 70.6)
<i>S+Op classifier: SN segments</i>	93.03 (non-iter. Op: 96.06)
<i>S+Op classifier: O segments</i>	74.54 (non-iter. Op: 75.75)
<i>S+Op classifier: SI segments</i>	70.9 (non-iter. Op: 66.06)

Table: Subjectivity analysis results in French reviews.

SA and pragmatic phenomena: figurative language (Cont'd)

- Non-literal meaning vs. conventional or intended meaning (Grice 1975; Sperber and Wilson 1981)
- The search for a non-literal meaning starts when the hearer realizes that the speaker's utterance is context-inappropriate
 - *Congratulation #lesbleus for a great match!*
- Irony overlaps with a variety of other figurative devices such as satire, parody, and sarcasm (Clark and Gerrig 1984).
 - Irony vs. sarcasm: sarcasm tends to be harsher, humiliating, degrading, and more aggressive (Lee and Katz 1998).

SA and pragmatic phenomena: figurative language (Cont'd)

- Most NLP research on Twitter.
- Users tend to employ specific hashtags: *#irony*, *#sarcasm*, *#sarcastic*.
- These hashtags are often used as gold labels to detect irony in a supervised learning setting.
- Features:
 - Mainly derived from the lexical cues internal to the utterance: Punctuation, emoticons, Sentiment, affect words, slang language, etc.
 - Can also come from pragmatic context internal to the utterance: Opposition in time, gap between rare and common words, etc.

SA and pragmatic phenomena: figurative language (Cont'd)

(Karoui et al, 2015): Explores other ways to go further by capturing the context outside of the utterance

- A model that detects irony in tweets containing an asserted fact of the form *Not(P)*.
- La #NSA a espioné un pays entier. Pas d'inquiétude pour la #Belgique: **ce n'est pas un pays entier**
- #Ayrault a admit qu'il était au courant pour les écoutes de #Sarkozy. Par contre, **il n'a pas dit si il savait qu'il était premier ministre**
- Such tweets are ironic if and only if one can prove the validity of *P* in reliable external sources, such as Wikipedia or online newspapers.

SA and pragmatic phenomena: figurative language (Cont'd)

(H1) the presence of negations, as an internal propriety of an utterance, can help to detect the disparity between the literal and the intended meaning of an utterance

	Ironic (IR)			Not ironic (NIR)		
	P	R	F	P	R	F
C_{Neg}	88.9	56.0	68.7	67.9	93.3	78.5
C_{NoNeg}	71.1	65.1	68.0	67.80	73.50	70.50
C_{All}	93.0	81.6	86.9	83.6	93.9	88.4

Overall Results	
	MAF
C_{Neg}	73.6
C_{NoNeg}	69.2
C_{All}	87.6

	A
C_{Neg}	74.5
C_{NoNeg}	69.3
C_{All}	87.7

SA and pragmatic phenomena: figurative language (Cont'd)

(H2) a tweet containing an asserted fact of the form $Not(P)$ is ironic if and only if one can prove P on the basis of some external common knowledge to the utterance shared by the author and the reader.

	Tweets with negation classified as NIR by the gold standard		Tweets with negation classified as NIR by the classifier		Non-personal tweets with negation classified as NIR by the classifier	
	All	Neg	All	Neg	All	Neg
<i>NIR tweets for which:</i>						
Query applied	37	207	327	644	40	18
Results on Google	25	102	166	331	17	12
Class changed into IR	5	35	69	178	7	4
Classifier Accuracy	87.7	74.46	87.7	74.46	87.7	74.46
Query-based Accuracy	88.51	78.19	78.15	62.98	86.57	74.89

SA and pragmatic phenomena: Intent analysis

- Discourse and different pragmatic context can enhance sentiment analysis systems.
- However, knowing what a holder likes and dislikes is only a first step in the decision making process.
 - Does the writer intend to stop using a service after a negative experience?
 - Do they desire to purchase a product or service?
 - Do they prefer buying one product over another?

SA and pragmatic phenomena: Intent analysis

- **Intent analysis:**

- The detection of **the future states of affairs** that a holder wants to achieve.
- It is thus orthogonal and supplementary to sentiment analysis which focuses on **past/present holder's states**.

- I don't like Apple's policy overall, and will never own any Mac products.
- How big is the screen on the Apple iPhone 4S?
- I will give birth in a month.

SA and pragmatic phenomena: Intent analysis

Intent= desires + preferences + intentions

- Desires: states of affairs that the agent, in an ideal world, would wish to be brought about
 - Desire and wish detection (Goldberg et al. 2009; Brun and Hagège 2013)
- Preferences: Desires may be ordered according to preferences. A preference is commonly defined as an asymmetric, transitive ordering by an agent over outcomes.
 - Preference extraction from dialogues (Thèse d'Anaïs Cadilhac 2010-2013)

π_1 . *Euan*: Anybody have any sheep for wheat?

π_2 . *Joel*: I can wheat for 1 clay or 1 wood.

π_3 . *Euan*: awesome.

SA and pragmatic phenomena: Intent analysis

Intent= desires + preferences + intentions

- Desires: states of affairs that the agent would wish to be brought about
- Preferences: Desires may be ordered according to preferences.
- Intentions: Among these desires, only some can be potentially satisfied. The chosen desires that the agent has committed to achieve are called intentions.
 - Intention detection: explicit vs. implicit (Sujay and Yalamanchi 2012; Ding et al. 2015)

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Conclusion

I hope to have established by now that evaluation is context-dependent at different discourse organization levels:

- **The sentence:** Interactions with linguistic operators like negation, modality and intensifiers, syntactic constraints such as altering the order of constituents in a clause or sentence.
- **The document:** Discourse connectives, discourse structure, rhetorical relations, topicality.
- **Beyond the document:** Effects of various pragmatic phenomena such as common sense knowledge, domain dependency, genre bias, cultural and social constraints, etc.

Conclusion

- The future developments in sentiment analysis need to be grounded on linguistic knowledge (and also extra-linguistic information).
- In particular, discourse and pragmatic phenomena play such an important role in the interpretation of evaluation that they need to be taken into account.
- The use of linguistic and statistic methods not as mutually exclusive, but as contributing to each other.
 - rather than general n-gram bag-of-words features, other features from discourse can be used to train classifiers for sentiment analysis.

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