

Sentiment and Belief Extraction (Part 1)

Lecture #6
Continued

Introduction

- Isolate and compute sentiment conveyed in text
- We understand sentiment as the attitude toward a topic conveyed by writer
- Basic Affect Calculus that captures contributing elements of sentiment

Elements of Sentiment

- Example 1: ***Government regulations are crushing small businesses.***
- Example 2: ***It has spawned a gargantuan government bureaucracy at the Pentagon that is almost impossible to believe in its size, duplication and waste.***

Elements of Sentiment

- Example 1: ***Government regulations are crushing small businesses.***
- Example 2: ***It has spawned a gargantuan government bureaucracy...***
- Contributing elements are
 - Target: Government regulations, government bureaucracy
 - Relation: crushing, gargantuan
 - Argument X: small business, N/A

Semantic Roles of a Target

- Propertive : the way Target appears: looks, smells, sounds, feels, etc.
 - *heavy government regulations, labyrinthine bureaucracy*
- Agentive : the way Target acts or affects other things
 - *gouv. regulations are crushing, gouv. programs help*
- Patientive : the way to deal with it or to affect it
 - *navigate bureaucracy, fight government regulations*
- These are determined by the syntactic information obtained from dependency parse of sentence

Basic Affect Calculus

Relation type	Type 1 (proper- tive) <i>Rel(Target)</i>	Type 2 (agentive) <i>Rel (Target, X)</i>		Type 3 (patientive) <i>Rel(X, Target)</i>	
		$X \geq \text{neutral}$	$X < \text{neutral}$	$X \geq \text{neutral}$	$X < \text{neutral}$
<i>Positive</i>	POSITIVE	POSITIVE	\leq UNSYMP	POSITIVE	\leq SYMPAT
<i>Negative</i>	NEGATIVE	\leq UNSYMP	\geq SYMPAT	\leq SYMPAT	\geq SYMPAT
<i>Neutral</i>	NEUTRAL	NEUTRAL	\leq NEUTRAL	NEUTRAL	\leq NEUTRAL

Table 1. A simple affect calculus specifies affect polarity for linguistic metaphors using a 5-point polarity scale [negative < unsympathetic < neutral < sympathetic < positive]. X is the second argument.

Affect Lexicon

- Affective Norms of Words (ANEW)
 - c.f. Bradley and Lang, 1999
 - Also includes arousal and dominance values
- Scores on a 9 point scale
 - Lower scores \rightarrow negative valence ($[1, 4)$ negative)
 - Higher scores \rightarrow positive valence ($(5, 9]$ positive)
 - Neutral scores ($[4, 5]$)
- Expanded ANEW lexicon using WordNet
 - Modeled after Liu et al. 2014
 - Original contains scores for ~ 2500 words
 - Expanded contains 22755 words

Basic Affect Calculus

- Example 1: **Government regulations** are **crushing small businesses**.
- Semantic Role of Target: Agentive
- Valence of Relation *crushing*: 2.21
- Valence of Argument X (*small*) *business*: 5.48

Relation type	Type 1 (proper-tive) <i>Rel(Target)</i>	Type 2 (agentive) <i>Rel (Target, X)</i>		Type 3 (patientive) <i>Rel(X, Target)</i>	
		$X \geq \text{neutral}$	$X < \text{neutral}$	$X \geq \text{neutral}$	$X < \text{neutral}$
<i>Positive</i>	POSITIVE	POSITIVE	\leq UNSYMP	POSITIVE	\leq SYMPAT
<i>Negative</i>	NEGATIVE	\leq UNSYMP	\geq SYMPAT	\leq SYMPAT	\geq SYMPAT
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<i>Positive</i>	POSITIVE	POSITIVE	$\leq \text{UNSYMP}$	POSITIVE	$\leq \text{SYMPAT}$
<i>Negative</i>	NEGATIVE	$\leq \text{UNSYMP}$	$\geq \text{SYMPAT}$	$\leq \text{SYMPAT}$	$\geq \text{SYMPAT}$
<i>Neutral</i>	NEUTRAL	NEUTRAL	$\leq \text{NEUTRAL}$	NEUTRAL	$\leq \text{NEUTRAL}$

Basic Affect Calculus

- Example 2: *It has spawned a gargantuan government bureaucracy...*
- Semantic Role of Target: Propertive
- Valence of Relation *gargantuan*: 3.95
- Valence of Argument X: N/A

Relation type	Type 1 (propertive) <i>Rel(Target)</i>	Type 2 (agentive) <i>Rel (Target, X)</i>		Type 3 (patientive) <i>Rel(X, Target)</i>	
		$X \geq \text{neutral}$	$X < \text{neutral}$	$X \geq \text{neutral}$	$X < \text{neutral}$
<i>Positive</i>	POSITIVE	POSITIVE	$\leq \text{UNSYMP}$	POSITIVE	$\leq \text{SYMPAT}$
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<i>Neutral</i>	NEUTRAL	NEUTRAL	$\leq \text{NEUTRAL}$	NEUTRAL	$\leq \text{NEUTRAL}$

Some more examples - 1

- We cheered loudly more than a decade ago as Arizona moved to the forefront of empowering parents to take more control of the education of their children instead of being left to **the mercy of government bureaucracy.**
- Target: government bureaucracy
- Type of semantic role??
- Overall sentiment??

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<i>Relation/X</i>		$X \geq \text{neutral}$	$X < \text{neutral}$	$X \geq \text{neutral}$	$X < \text{neutral}$
<i>Positive</i>	POSITIVE	POSITIVE	$\leq \text{UNSYMP}$	POSITIVE	$\leq \text{SYMPAT}$
<i>Negative</i>	NEGATIVE	$\leq \text{UNSYMP}$	$\geq \text{SYMPAT}$	$\leq \text{SYMPAT}$	$\geq \text{SYMPAT}$
<i>Neutral</i>	NEUTRAL	NEUTRAL	$\leq \text{NEUTRAL}$	NEUTRAL	$\leq \text{NEUTRAL}$

Some more examples - 2

- Republicans, in particular, pointed to it as a prime example of how **federal government regulations** can **kill** jobs.
- Target: federal government regulations
- Argument X??
- Type of semantic role??
- Overall sentiment?

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		$X \geq neutral$	$X < neutral$	$X \geq neutral$	$X < neutral$
<i>Positive</i>	POSITIVE	POSITIVE	$\leq UNSYMP$	POSITIVE	$\leq SYMPAT$
<i>Negative</i>	NEGATIVE	$\leq UNSYMP$	$\geq SYMPAT$	$\leq SYMPAT$	$\geq SYMPAT$
<i>Neutral</i>	NEUTRAL	NEUTRAL	$\leq NEUTRAL$	NEUTRAL	$\leq NEUTRAL$

Some more examples - 3

- This committee will continue **digging into** the **government bureaucracy** that has so far only been good at wrapping us in red tape.
- **Target: government bureaucracy**
- **Argument X??**
- **Type of semantic role??**
- **Overall sentiment??**

Relation type	Type 1 (proper- tive) <i>Rel(Target)</i>	Type 2 (agentive) <i>Rel (Target, X)</i>		Type 3 (patientive) <i>Rel(X, Target)</i>	
		$X \geq neutral$	$X < neutral$	$X \geq neutral$	$X < neutral$
<i>Positive</i>	POSITIVE	POSITIVE	$\leq UNSYMP$	POSITIVE	$\leq SYMPAT$
<i>Negative</i>	NEGATIVE	$\leq UNSYMP$	$\geq SYMPAT$	$\leq SYMPAT$	$\geq SYMPAT$
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Extensions to Basic Affect Calculus

- Some words have strong, prior affect
 - *poverty, wealth*
- In sentiment text containing such word, the affect of sentiment target needs to be taken into account while calculating affect
- Develop an affect algebra
 - Combine affect computed from basic affect calculus with prior known affect of target

Measuring system performance

- Confusion matrix showing affect classification performance for a sample of 220 English sentences containing sentiment bearing metaphors

English Affect Sample size = 220		System identified as		
		Positive	Negative	Neutral
Answer Key	Positive	40	16	3
	Negative	12	109	1
	Neutral	10	14	15

- **Some material related to HW 2**

k-fold cross validation

- In machine learning, you have the
 - Training set
 - Test set
- Training set
 - Say 80% of data (for example)
- Test set
 - Remaining 20%

k-fold cross validation

- You measure performance of algorithm on the test set
- But what if it is a fluke??

k-fold cross validation

- Randomly partition set of data into k-partitions
- Test algorithm on each k partition, while training on the remaining k-1 partitions
- 5-fold, 10-fold and so on....

Homework 2/3

- HW2 main focus
 - Machine learning for sentiment analysis

Homework 3

- HW2 proposal for next part
 - Modeling complex socio-linguistic behaviors from conversational data
 - You are free to model any behaviors you are interested in
 - Present this proposal in class in a few slides
 - 5 minutes maximum per presentation
 - 3 minutes for questions/feedback/switchover
 - DO talk to us and let us know your thoughts
 - DON'T wait until last week