

# 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>	
		<i>X ≥ neutral</i>	<i>X &lt; neutral</i>	<i>X ≥ neutral</i>	<i>X &lt; neutral</i>
<i>Positive</i>	POSITIVE	POSITIVE	≤ UNSYMP	POSITIVE	≤ SYMPAT
<i>Negative</i>	NEGATIVE	≤ UNSYMP	≥ SYMPAT	≤ SYMPAT	≥ SYMPAT
<i>Neutral</i>	NEUTRAL	NEUTRAL	≤ NEUTRAL	NEUTRAL	≤ 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  $\sim 2500$  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
<i>Neutral</i>	NEUTRAL	NEUTRAL	$\leq$ NEUTRAL	NEUTRAL	$\leq$ NEUTRAL

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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	$\leq \text{SYMPAT}$
<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 - 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>Negative</i>	NEGATIVE	$\leq UNSYMP$	$\geq SYMPAT$	$\leq SYMPAT$	$\geq SYMPAT$
<i>Neutral</i>	NEUTRAL	NEUTRAL	$\leq NEUTRAL$	NEUTRAL	$\leq NEUTRAL$

# 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: federal government regulations
- 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	$\leq UNSYMP$	$\geq SYMPAT$	$\leq SYMPAT$	$\geq SYMPAT$
<i>Neutral</i>	NEUTRAL	NEUTRAL	$\leq NEUTRAL$	NEUTRAL	$\leq NEUTRAL$

# 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