Coarse and Fine Grained Sentiment Analysis of Online Text

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What is Sentiment?

“Sentiments are positive and negative emotions, evaluations, and stances.”
Wilson (2008)

They represent *private states* of individuals that are not directly observable, but are manifested in people’s written and spoken language.
There has been explosive growth in the adoption of social media
This provides a rich source of time tagged sentiment from millions of people
Natural Language Processing provides the tools for extracting and analyzing this data
Coarse and Fine Grained Sentiment Analysis of Online Text

- Coarse vs. Fine Grained Sentiment Analysis
- Blog Corpora
- Notional Workflow: From Raw Text to Sentiment
- Annotation of Blog Text For Sentiment Analysis
- Sentence Level Classification
- Identifying Sentiment Targets
Coarse Grained Sentiment Analysis

- Document Level Classification

Time and time again, the wily filmmakers sprinkle the overarching storyline of the fall and decline of Larry Gopnik's life (a masterful, wide-ranging and sensitive performance from Michael Stuhlbarg) with a fine combination of overt, discreet and subliminal set-ups whose payoffs give their film extra punch and an unstoppable pace. ...

A Serious Man is a truly despicable film, and I ordinarily count myself among the Coen brothers' fans and/or defenders. So I was astonished that with this film, in one fell stroke, they had me believing that everything their detractors say might just be right ...
Coarse Grained Sentiment Analysis

- Sentence Level Classification

  **Objective**
  McCain is projected to be the winner of the Missouri Republican primary.

  **Subjective/Sentiment**
  Trying to analyze the "birther" phenomenon would mean taking it seriously, and taking it seriously would be like arguing about the color of unicorns.

  **Subjective/No Sentiment**
  When we don't really have a mission, completing it is difficult indeed.
When Hillary's fans complained about the incredible amount of sexism on the Left, I took it with a grain of salt.

**Sentiment source** - **sentiment target (topic)**
From Raw Text to Sentiment

Blog Posts

Sentence Chunking

Subjective?

Contains Sentiment?

Other Processing and Analysis

Extract Fine Grained Sentiment Components
The FBI says the number of police officers slain in the line of duty fell sharply last year.
Annotating Sentiment in Blog Posts

They are very close to getting the votes needed for an over-ride.
Annotating Sentiment in Blog Posts

He just needs to not let up when the inevitable pushback comes from the GOP and their propaganda organ, FOX.
## Sentence Level Subjectivity/Sentiment Agreement Results

<table>
<thead>
<tr>
<th>Corpus</th>
<th>Krippendorff's Alpha (3 Annotators)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Politics</td>
<td>0.685</td>
</tr>
<tr>
<td>Knitting</td>
<td>0.779</td>
</tr>
<tr>
<td>Tango</td>
<td>0.852</td>
</tr>
</tbody>
</table>
### Sentiment Target Annotation Results

<table>
<thead>
<tr>
<th>Corpus</th>
<th>Avg % Pairwise Interannotator Agreement (3 Annotators)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
</tr>
<tr>
<td>U.S. Politics</td>
<td>61.53%</td>
</tr>
<tr>
<td>Knitting</td>
<td>74.67%</td>
</tr>
<tr>
<td>Tango</td>
<td>66.57%</td>
</tr>
</tbody>
</table>
Sentence Level Classification

- Sentence level subjectivity classification
- Used Pang/Lee movie review data, U.S. political blogs
- Features
  - Bag of words (not stemmed/stemmed)
  - Bigrams (not stemmed/stemmed)
  - Subjective words (MPQA)
  - Sentence level features (# adjectives, contains ‘!’ , contains quote, etc.)
## Sentence Level Classification

### Results: Subjective vs. Nonsubjective Sentences

<table>
<thead>
<tr>
<th>Classifier</th>
<th>Feature Set</th>
<th>Movies</th>
<th>U.S. Politics</th>
</tr>
</thead>
</table>
| **Baseline** | >=2 weak subjective words or >= 1 strong subjective words | Accuracy: 56.2%  
Precision: 54.2%  
Recall: 78.5% |                      |
| **Naive Bayes** | No Stemming | Accuracy: 89.6±.3%  
Precision: 89.1±.4%  
Recall: 90.3±.5% | Accuracy: 65.4±1.8%  
Precision: 68.5±1.2%  
Recall: 76.4±2.1% |
|             | Stemmed     | Accuracy: 88.7±.2%  
Precision: 88.5±.3%  
Recall: 89.0±.4% | Accuracy: 64.3±1.4%  
Precision: 67.0±1.4%  
Recall: 77.7±2.3% |
| **SVM**     | No Stemming | Accuracy: 83.4±.3%  
Precision: 83.8±.6%  
Recall: 82.7±.7% | Accuracy: 66.0±1.7%  
Precision: 74.6±2.2%  
Recall: 64.3±2.1% |
|             | Stemmed     | Accuracy: 81.2±.4%  
Precision: 82.0±.6%  
Recall: 81.2±.4% | Accuracy: 67.4±1.4%  
Precision: 74.0±1.4%  
Recall: 69.0±2.3% |
Tagging Sentiment Targets

Bill Moyers discussion on healthcare is essential watching for anyone who cares about this topic.

To have a pair of socks tailored specifically to my long feet is simply divine.

America doesn't trust you with our 21-year-old daughters, and we sure, Lord, don't trust you with our guns.
Tagging Sentiment Targets

- Related Work on Fine Grained Sentiment
  - Choi et al (2005) – Identifying the sources of sentiment using CRFs
  - Kim/Hovy (2006) – Identifying sentiment topics (targets) based on FrameNet roles
  - Wilson (2008) – Identifying subjective clauses and attitude (sentiment) attributions
  - Kessler/Nicolov (2009) – Identifying sentiment targets in online reviews
Tagging Sentiment Targets

- **Corpus**
  - We are using Wilson’s MPQA-2 attitude annotations which include sentiment target annotations.
Tagging Sentiment Targets

- What to classify?
  - Classify verb argument clauses as targets or not targets of sentiment
  - Use dependency parse to chunk verb argument clauses
  - Our work currently ignores the polarity of the clauses
The sale infuriated Beijing which regards Taiwan an integral part of its territory awaiting reunification, by force if necessary.
Tagging Sentiment Targets

- Features for clause “The sale:”
  - Neutral phrase (contains no subjective words)
  - Subjective governor word (“infuriated”)
  - Neutral root word (“sale”)
  - Verb subject
  - Subjective verb
  - Levin “amuse” verb class
### Results: Sentiment Target Classification

<table>
<thead>
<tr>
<th>Classifier</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naïve Bayes</td>
<td>Accuracy: 58.7 +/- 1.4%</td>
</tr>
<tr>
<td></td>
<td>Precision: 60.5 +/- 1.6%</td>
</tr>
<tr>
<td></td>
<td>Recall: 50.1 +/- 4.4%</td>
</tr>
<tr>
<td>SVM</td>
<td>Test Accuracy: 61.1 +/- 1.49 %</td>
</tr>
<tr>
<td></td>
<td>Precision: 62.1 +/- 1.2 %</td>
</tr>
<tr>
<td></td>
<td>Recall: 56.8 +/- 3.7 %</td>
</tr>
</tbody>
</table>
Further Work

- Additional exploration of features for sentiment target identification
  - Dependency paths
  - FrameNet info
  - Bag-of words/n-grams
Questions?

SOME QUESTIONS CAN'T BE ANSWERED BY GOOGLE
SUN WORSHIP 9AM