Sentiment Detection: Polarity and Intensity

Sentiment polarity

- Classic Sentiment polarity task from Pang and Lee:
  - Is an IMDB movie review positive or negative?
  - Data: *Polarity Data 2.0: (people indicate polarity of own review)*
    - http://www.cs.cornell.edu/people/pabo/movie-review-data
- Treat as a document classification task
  - Positive, negative, and (possibly) neutral
- Similar but different from topic-based text classification.
  - In topic-based text classification, topic words are important.
  - In sentiment classification, sentiment words are more important, e.g., great, excellent, horrible, bad, worst, etc.

Bo Pang, Lillian Lee, and Shivakumar Vaithyanathan. 2002. Thumbs up? Sentiment Classification using Machine Learning Techniques. EMNLP-2002, 79—86.
Bo Pang and Lillian Lee. 2004. A Sentimental Education: Sentiment Analysis Using Subjectivity Summarization Based on Minimum Cuts. ACL, 271-278

IMDB data in the Pang and Lee database

✓

when _star wars_ came out some twenty years ago , the image of traveling throughout the stars has become a commonplace image . […]

when han solo goes light speed , the stars change to bright lines , going towards the viewer in lines that converge at an invisible point .

cool .

october sky offers a much simpler image– that of a single white dot , traveling horizontally across the night sky . [. . .]

✗

“ snake eyes ” is the most aggravating kind of movie : the kind that shows so much potential then becomes unbelievably disappointing .

it’s not just because this is a brian depalma film , and since he’s a great director and one who’s films are always greeted with at least some fanfare .

and it’s not even because this was a film starring nicolas cage and since he gives a brauvara performance , this film is hardly worth his talents .

Treat as a Classification Problem

- Tokenization
  - May be some differences, especially for text from social media
- Feature Extraction
  - The most important part!
- Classification using different classifiers
  - Naïve Bayes
  - MaxEnt
  - SVM
    - It turns out that MaxEnt and SVM are better than Naïve Bayes at some sentiment domains.

Sentiment Tokenization Issues

- For text from web, deal with HTML and XML markup
- Or Twitter mark-up (names, hash tags)
- Capitalization (preserve for words in all caps)
- Phone numbers, dates
- Emoticons

Potts emoticons

```
[<>]?                       # optional hat/brow
[:;=8]                      # eyes
[\-o\*\']?                  # optional nose
[\)\]\(\[dDpP/\:\}\{@\|\\]  # mouth
|                           #### reverse orientation
[\)\]\(\[dDpP/\:\}\{@\|\\]  # mouth
[\-o\*\']?                  # optional nose
[:;=8]                      # eyes
[<>]?                       # optional hat/brow
```

- Useful code:
  - Christopher Potts sentiment tokenizer
  - Brendan O'Connor twitter tokenizer

Extracting Features for Sentiment Classification

- Which words to use?
  - Only adjectives
  - All words
    - All words turns out to work better, at least on this data
- Syntax is not used as often
  - Constituent or dependency parses are occasionally used
  - Particularly at phrase level to find dependencies of opinion words
    - Also for finding the scope of negatiion
  - Can be used to shift the "valence"
    - For negation, intensification and diminution
      - Very good, deeply suspicious
      - Should have been good
      - He is a great actor, *however* this performance . . .
        - » However changes the valence of great to be negative

Handling negation is important!

- How to handle negation:
  - I **didn't** like this movie vs I really like this movie
  - Pang and Lee simple approximation to negation:
    - Add NOT_ to every word between negation and following punctuation:

```
didn't like this movie , but I
```

```
didn't NOT_like NOT_this NOT_movie but I
```

  - Negation has both scope and focus
    - These may be represented in more complex structures
    - Details in Wilson "Fine-grained sentiment analysis"

Sentiment Lexicons

- One of the early approaches to sentiment analysis was to just count the words in each document that had either a positive or negative polarity from a (hand-built) sentiment lexicon.
  - This approach usually not very accurate on individual documents, but it's easy because doesn't need training data.
  - May be useful over aggregate collections or to show trends over time.
- Now we use either presence or frequencies of sentiment words as features of the classifier

MPQA Subjectivity Cues Lexicon

Theresa Wilson, Janyce Wiebe, and Paul Hoffmann (2005). Recognizing Contextual Polarity in Phrase-Level Sentiment Analysis. Proc. of HLT-EMNLP-2005.

- Gives a list of words that have been judged to be weakly or strongly positive, negative or neutral in subjectivity
- Home page: http://www.cs.pitt.edu/mpqa/subj_lexicon.html
- 6885 words from 8221 lemmas
  - 2718 positive, 4912 negative
  - GNU GPL license
  - Examples:

type=weaksubj len=1 word1=abandoned pos1=adj stemmed1=n priorpolarity=negative
type=weaksubj len=1 word1=abandonment pos1=noun stemmed1=n priorpolarity=negative
type=weaksubj len=1 word1=abandon pos1=verb stemmed1=y priorpolarity=negative
type=strongsubj len=1 word1=abase pos1=verb stemmed1=y priorpolarity=negative
type=strongsubj len=1 word1=abasement pos1=anypos stemmed1=y priorpolarity=negative
type=strongsubj len=1 word1=abash pos1=verb stemmed1=y priorpolarity=negative
type=weaksubj len=1 word1=abate pos1=verb stemmed1=y priorpolarity=negative
type=strongsubj len=1 word1=absolve pos1=verb stemmed1=y priorpolarity=positive
type=strongsubj len=1 word1=absolute pos1=adj stemmed1=n priorpolarity=neutral

LIWC (Linguistic Inquiry and Word Count)

- Linguistic Inquiry and Word Count
  - Text analysis software based on dictionaries of word dimensions
  - Dimensions can be syntactic
    - Pronouns, past-tense verbs
  - Dimensions can be semantic
    - Social words, affect, cognitive mechanisms
  - Other categories
    - See http://www.liwc.net/comparedicts.php
- James Pennebaker, Univ. of Texas at Austin
  - http://www.liwc.net/
    - $30 - $90 fee for software (make sure to get dictionaries)
- Often used for positive and negative emotion words in opinion mining

ANEW (Affective Norms for English Words)

- Provides a set of emotional ratings for a large number of words in the English language
- Participants gave graded reactions from 1-9 on three dimensions
  - Good/bad, psychological valence
  - Active/passive, arousal valence
  - Strong/weak, dominance valence
- From the NIMH Center for the Study of Emotion and Attention at the University of Florida
  - http://csea.phhp.ufl.edu/Media.html
  - See also the paper by Dodds and Danforth on Happiness of Large-Scale Written Expressions
  - Free for research use

The General Inquirer

Philip J. Stone, Dexter C Dunphy, Marshall S. Smith, Daniel M. Ogilvie. 1966. The General Inquirer: A Computer Approach to Content Analysis. MIT Press

- Home page: http://www.wjh.harvard.edu/~inquirer
- List of Categories: http://www.wjh.harvard.edu/~inquirer/homecat.htm
- Spreadsheet: http://www.wjh.harvard.edu/~inquirer/inquirerbasic.xls
- Categories:
  - Positiv (1915 words) and Negativ (2291 words)
  - Strong vs Weak, Active vs Passive, Overstated versus Understated
  - Pleasure, Pain, Virtue, Vice, Motivation, Cognitive Orientation, etc
- Free for Research Use

Bing Liu Opinion Lexicon

Minqing Hu and Bing Liu. Mining and Summarizing Customer Reviews. ACM SIGKDD-2004.

- Bing Liu's Page on Opinion Mining
- http://www.cs.uic.edu/~liub/FBS/opinion-lexicon-English.rar

- 6786 words
  - 2006 positive
  - 4783 negative

SentiWordNet

Stefano Baccianella, Andrea Esuli, and Fabrizio Sebastiani. 2010 SENTIWORDNET 3.0: An Enhanced Lexical Resource for Sentiment Analysis and Opinion Mining. LREC-2010

- Home page: http://sentiwordnet.isti.cnr.it/
- All WordNet synsets automatically annotated for degrees of positivity, negativity, and neutrality/objectiveness
- [estimable(J,3)] "may be computed or estimated"

  `Pos 0 Neg 0 Obj 1`
- [estimable(J,1)] "deserving of respect or high regard"

  `Pos .75 Neg 0 Obj .25`

Which Sentiment Lexicon to use?

- An area of active research in the sentiment analysis community
- It is now recognized that the amount of overlap between the lexicons is small!
  - But in general, where there is overlap, the sentiment polarity of the words is in agreement, 2% or less disagreement.
    - Except for SentiWordNet, which disagrees up to 25%
      - Chris Potts, Sentiment Symposium Tutorial
- How to represent features from sentiment words still under research:
  - Frequency of all positive and all negative words
  - Presence of positive or negative words (particularly for twitter)
  - Sum of the positive or negative intensity scores

Build a sentiment lexicon

- For some domains, it has been shown that the best lexicon is one built for that domain
- Automatic lexicon building from unlabeled data
  - bootstrapping
    - Identify a number of seed words of positive and negative polarity
    - Search for text involving those words that also have connecting words, such as “and”
    - Other words that occur with the connecting word are added to the lexicon with the appropriate polarity
  - Trained from annotated text by associating words with the sentiment labels that they occur with
    - Using Mutual Information scores or other measures

Building a sentiment lexicon

- Automatic lexicon building from labeled data
  - In some cases, the domain has lots of text that has been labeled with sentiment
  - Twitter
    - Use tweets labeled with sentiment hashtags: #good, #happy, #bad, #sad
    - Use tweets labeled with happy or sad emoticons
  - Collect words from the positive and negative labeled texts and keep the frequent ones as part of a lexicon

How to deal with 7 stars?

Bo Pang and Lillian Lee. 2005. Seeing stars: Exploiting class relationships for sentiment categorization with respect to rating scales. ACL, 115–124

- The second level of sentiment analysis deals is a similar classification task, but needs to find levels of strength

    1. Map to binary, or
    2. Use linear or ordinal regression
        - Or specialized models like metric labeling