Automatically identifying changes in the semantic orientation of words

Paul Cook and Suzanne Stevenson
University of Toronto
Amelioration and pejoration

- Changes in a word's meaning to have a more positive or negative evaluation

- Historical examples
  - Amelioration: Urbane
  - Pejoration: Hussy

- Contemporary examples
  - Amelioration: Pimp
  - Pejoration: Gay
Challenges

● Natural language processing
  – Many systems for sentiment analysis require appropriate and up-to-date polarity lexicons

● Lexicography
  – Identify new word senses and changes in established senses to keep dictionaries current
Inferring semantic orientation

- Semantic orientation from association with known positive and negative words
  - Turney and Littman's (2003) SO-PMI

\[
SO-PMI(t) = PMI(t, POS) - PMI(t, NEG)
\]

\[
PMI(t, S) \approx \log \left( \frac{N \sum_{s \in S} freq(t, s)}{freq(t) \sum_{s \in S} freq(s)} \right)
\]

- A difference in polarity between corpora of differing time periods indicates amelioration or pejoration
General Inquirer Dictionary

● Lexicon intended for text analysis
  – Some entries mark positive or negative outlook

● Seed words: All words labelled positive or negative (but not both)

● 1621 positive seeds, 1989 negative seeds
  – Turney and Littman: 7 positive seeds, 7 negative seeds
Corpora

- Three corpora of British English from differing time periods.

| Corpus       | Size (millions of words) | Time period       |
|--------------|--------------------------|-------------------|
| Lampeter     | 1                        | 1640-1740         |
| CLMETEV      | 15                       | 1710-1920         |
| BNC          | 100                      | Late 20\textsuperscript{th} c. |
Inferring polarity

● Verify that our method for inferring polarity works well on small corpora

● Leave-one-out experiment
  – Classify each seed word with frequency greater than 5 using all others as seeds
  – Performance metric: Accuracy over all words, and only words with calculated polarity in top 25%
## Inferring polarity: Results

| Corpus     | Accuracy: All | Accuracy: top-25% |
|------------|---------------|-------------------|
| Lampeter   | 75            | 88                |
| CLMETEV    | 80            | 92                |
| BNC        | 82            | 94                |

- Most frequent class baseline: 55%
Historical data

● Small dataset of ameliorations and pejorations
  - Taken from texts on semantic change, dictionaries, and Shakespearean plays
  - Underwent change in (roughly) 18\textsuperscript{th} c.
  - 6 ameliorations, 2 pejorations

● Compare calculated change in polarity (Lampeter to CLMETEV) to change indicated by resources
## Historical data: Results

| Expression | Change identified from resources | Calculated change in polarity |
|------------|----------------------------------|-----------------------------|
| ambition   | amelioration                     | 0.52                        |
| eager      | amelioration                     | 0.97                        |
| fond       | amelioration                     | 0.07                        |
| luxury     | amelioration                     | 1.49                        |
| nice       | amelioration                     | 2.84                        |
| succeed    | amelioration                     | -0.75                       |
| artful     | pejoration                       | -1.71                       |
| plainness  | pejoration                       | -0.61                       |
Artificial data

● Suppose *good* in one corpus and *bad* in another were in fact the same word
  – Similar to WSD evaluations using artificial words
  – Requires choosing pairs of words

● Instead compare average polarity of all positive words in one corpus to that of all negative words in another
Artificial data: Results

| Polarity in lexicon | Average polarity in corpus |
|---------------------|-----------------------------|
|                     | Lampeter | CLMETEV | BNC  |
| Positive            | 0.58     | 0.50    | 0.40 |
| Negative            | -0.74    | -0.67   | -0.76|
Hunting new senses

- **Hypothesis**: Words with largest change in polarity between two corpora have undergone amelioration or pejoration
- Identify candidate ameliorations and pejorations
  - 10 largest increases/decreases in polarity from CLMETEV to BNC
Usage extraction

● For each candidate extract 10 random usages (or as many as are available) from each corpus
  – Extract the sentence containing each usage

● Randomly pair each usage from CLMETEV with a usage from BNC
Usage annotation

- Use **Amazon Mechanical Turk** to obtain judgements
- Present **turkers** with pairs of usages
- Turkers judge which usage is more positive/negative (or if usages are equally positive)
- 10 independent judgements per pair
### Hunting new senses: Results

| Candidate type | Proportion of judgements for corpus of more positive usage |
|----------------|-----------------------------------------------------------|
|                | CLMETEV (earlier)                      | BNC (later)                       | Neither                  |
| Ameliorations  | 0.28                                      | 0.34                              | 0.37                     |
| Pejorations    | 0.36                                      | 0.27                              | 0.36                     |
Noisy seed words

・Seed words may undergo amelioration and pejoration!

・Randomly change polarity of n% of positive and negative seeds
  - E.g., *good* is negative, *bad* is positive

・Repeat experiment on inferring synchronic polarity
Noisy seed words: Results

![Graph showing accuracy percentage vs. noisy seed words percentage]

- BNC
- CLMETEV
- Lampeter
Conclusions

● First computational study focusing on amelioration and pejoration
  – Encouraging results identifying historical and artificial ameliorations and pejorations

● Future work:
  – More extensive evaluation
  – Methods for identifying semantic change and dialectal variation in word usage
Thank you

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