DEAR SEARCH ENGINE: WHAT'S YOUR OPINION ABOUT...?

Sentiment Analysis for Semantic Enrichment of Web Search Results

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MOTIVATION

- As the Web grows, Search Engines are the main entry points
- The “visible” Web is: top search engine results
- Controversial topics are being discussed on the Web (news, blogs, ...)
- Search Engines can bias the way we see the Web!
- It is important to provide a good overview in top-N results
  - Topic
  - Sentiment
OUR CONTRIBUTION

- Approaches for computing sentiment of web pages
- Comparing sentiments for:
  - three search engines
  - top results vs lower ranked
OUTLINE

- Enhancing Search Results with Sentiments
- Related Work
- Extracting Sentiment from Web Pages
- Experimental Study
- Future Work
We are committed to the fundamental belief that the intentional killing of another person is wrong.

"There is no quality of life when the patient is dead."
THE IDEAL RESULT

Search engines might rank results according to sentiment
What is the “ideal ranking”?

Possible ideal results might be:

- Balanced Overview (both +1 and -1 docs)
- Neutral Overview (0 docs)
- Realistic Overview (80% negative docs)
- Personalized Overview (as the user likes)
RELATED WORK

- Bias in search engines
  - topical bias
  - on content/url level
- Search results diversification
  - relevance/diversity trade-off
- Opinion Mining
  - mainly on blogs (TREC)
  - approaches use Machine Learning techniques
- Enriching Search Results
EXTRACTING SENTIMENT FROM WEB PAGES

Sentiment Classification

- Lexicon-based: SentiWordNet
- Text Classification: Linear SVM trained with movie reviews

\[
\begin{align*}
pos(st) &= \frac{\sum_{a \in \text{Adjectives}(st)} pos(a)}{|\text{Adjectives}(st)|} \\
\neg(st) &= \frac{\sum_{a \in \text{Adjectives}(st)} \neg(a)}{|\text{Adjectives}(st)|} \\
\text{obj}(st) &= \frac{\sum_{a \in \text{Adjectives}(st)} \text{obj}(a)}{|\text{Adjectives}(st)|}
\end{align*}
\]
SENTIMENT ESTIMATION METHODS

Aggregation
- Given a web page
  - Full text
  - Relevant Sentences
- Assign to it
  - Class with highest score (2 or 3 classes)
  - Real classification score

Methods:
- SWN SEN BIN
- SWN SEN MAX
- SWN TXT BIN
- SWN TXT MAX
- SVM SEN BIN
- SVM SEN REA
- SVM TXT BIN
- SVM TXT REA
EXPERIMENTAL ANALYSIS

- 3 search engines: Bing, Google, Yahoo!
- 14 opinionated queries
- 50 search results

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METHOD COMPARISON
SEN more positive than TXT
SENTIMENT FOR DIFFERENT SE
SENTIMENT AT DIFFERENT RANKS

Top-1 is usually the “home page”
SENTIMENT ABOUT DIFFERENT TOPICS

Senti(Employment) > Senti(Marijuana)
FUTURE WORK

- Metadata Annotations: Explain what is the opinion in top results
- Measure effectiveness of different sentiment classification methods
- User Study to judge the usefulness of sentiment diversification

- Sentiment Diversification
  - Detect if top N results are a good sample of other results
  - Evaluate Search Engines
  - How topic/sentiment diversity interact
FUTURE WORK

Applications:

- Re-ranking techniques for producing a fair top-n result set (NP-hard)
- Fairness of Wikipedia (should be objective!)
- Lab experiments: fairness of BM25 on TREC ClueWeb corpus
- Search Results VS Public Opinion (Search engine VS blogosphere)