Linguistic-based Sentiment Analysis: Problems, Lexical Resources and Evaluation

Rodrigo Agerri
Outline

1. E-Drama
   - Emotion Detection

2. Implicit Expression of Affect: Stereotypes
   - Affect via Metaphor from E-Drama transcripts
   - Figurative Categorization for detection of emotion
   - Sentiment Analysis
   - Some Examples

3. Concluding Remarks
Disclaimer

The E-Drama section is provided in this presentation to contextualize section 2. For references to E-Drama described in section 1 of this presentation, please go to Zhang et al. (2007).

The tool E-Drama is property of Hi8tus: http://www.edrama.co.uk

(Part of) the content of section 2 onwards can be found in Wallington et al. (2009).

Any opinion (scientific or otherwise) expressed in this presentation can only be attributed to Rodrigo Agerri (not to every author of Wallington et al. (2009)).
To have a Real Life Drama on The Internet with someone else.

"shawn hasn't been online in 5 days now i think hes dating someone else!! or hes blocked me from msn, i think im going to rid myself from this horrible world, i HATE my life".

Frequently used during online gaming and MMORPG’s such as; World of Warcraft. E-Drama describes a moment in time when something is going on and a lot of drama and fuss is being caused.

-Erenion has left the guild-
Korfax: Dude, Erenion ninjaed the guild bank!
Rital: No way, dude we had 9000 gold in there!
Carion: WTF E-DRAMA

3 To be constantly getting into meaningless fights upon the Internet, and experiencing emotions from it: Fear, Regret, Sadness, Anger.

Random Dude: **OMG** man...I just got into a **fight** with my girlfriend....She was **mad** that she wasn't in my myspace! Y_Y

You: You have a girlfriend?
Random Dude: Yes, she lives in Florida. I've been talkin to her on Myspace for 6 months and im like, seriously **crying**...
You: E-drama...

WordNet: N(drama)

1. a dramatic work intended for performance by actors on a stage.
2. an episode that is turbulent or highly emotional
3. the literary genre of works intended for the theater
4. the quality of being arresting or highly emotional
E-drama: E-Drama
Background: E-Drama

- Virtual Improvised drama in education.
- Virtual characters (avatars) interact under human control.
- E-Drama helps students lose their usual inhibitions.
Background: E-Drama

Peter Williams

You were diagnosed with Crohn’s disease when you were 15. Crohn’s disease attacks the wall of the intestines and makes it very difficult to digest food properly. The main symptoms are incontinence, stomach cramps and weight loss. You have had a number of operations to
Background: E-Drama
Human Director

- Monitoring actors’ interactions.
- Intervention by sending messages to actors.
- Control a bit-part character.

Heavy burden on novice teachers-directors
Automate Director Functions

- Fully automated control of an optionally-included bit-part character
- Sending automated suggestions to the human director

Our work focused on point 1
Automated Actor

- Intelligent Conversational Agent (ICA) controls a character in the edrama (Dave Atkins).
- Dave makes (contentless) emotionally appropriate responses to keep the conversation flowing and stimulate improvisation.
- It saves work to human directors.
- Dave does not aim to extract full meaning of characters’ interventions, but to detect emotions that will allow it to generate appropriate responses.
- User-centred evaluation suggests that this is sufficient to stimulate improvisation and keep edrama on topic.
Dave’s Merits

Not just the positive first person case, but also

1. Affect that X implies it lacks
2. Affect that X implies that other characters have/lack
3. Questions, commands, injunction, implicit conveyance of affect (metaphor), etc.
4. Affect labels (Ortony et al., 1988; Ekman, 1992), P/N polarity (Watson and Tellegen, 1985), intensity (Ortony et al., 1988).

Emotions involved in edrama furthered by the themes (school bullying and Crohn’s disease).
Emotions Granularity

- **Fine-grained**: Emotion label + intensity if strong text clue detected.
- **Coarse-grained**: Polarity + intensity if weak text clue detected.

Other approaches (WordNet-Affect, SentiWordNet) also varied granularity in detecting and/or labelling emotions.
E-Drama

**Data Collections: What do they tell us?**

Transcripts automatically recorded during user-testing.

- Language is complex and idiosyncratic: Ungrammatical, abbreviations, mis-spellings, textese.

- Detecting affect and building representation of affective connotations more important than building an interpretation of text (for the application).
Overview
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## Emotion/Polarity Detection

### Polarity, Emotion, and Politeness.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pattern-Matching</strong></td>
<td>Keywords, Punctuation/Capitalisation, Specific expressions/idioms, Imperatives</td>
</tr>
<tr>
<td><strong>Linguistic Techniques</strong></td>
<td>Robust Parsing for sentence types, Lexical Resources: Synonyms, Implicit Expressions of Affect, Stereotypes and Figurative Language</td>
</tr>
</tbody>
</table>
Pre-processing: Non-trivial problems

- Slang: Brummie screwdriver (stupid).
- Abbreviation: C u l8r
- Ambiguity: I am 2 hungry 2 walk
- Upper case: SHUDUP!
- Special punctuation: Repeated exclamation/interrogation marks, etc. (Metaphone spelling-correction algorithm and dictionary).
- Open-ended interjective and onomatopoeic elements: Hm, ow, grrr, oh, errr, agghhh.
Emotional Brummy Slang

- Wench: Girl.
- Ar’l goo tClent: Expression of surprise.
- Bint: Slightly derogatory term for a young woman.
- Bloke: A gentleman.
- Gorra cobb on: in a bad mood.
- On a Loin: Annoyed, angry
Larkin around: being silly/stupid.
Getin on a line: On the verge of loosing your temper.
Shut yer gob, there’s a buzz comin’: Your mouth is too large.
He’s got a bob on hisself: He thinks a lot of himself.
Emotion Detection: Pattern Matching

- Explicitly deals with slang, idioms, punctuation.
- Simple explicit expressions.
- First person with future tense (threatening emotional state).
**Imperatives**

Useful pointer of affect.

- Repetitive forms: “Shut up” (shudup) or “mind your own business”.

- Rasp parser recognized many imperatives as declarative sentences (“please leave me alone”).

- Heuristic approach based on Rasp output: “you go away”, “dave get lost”, etc.

- Exception in pattern “name verb me” as in “Lisa hit me”, if verb is negative, then the sentence is declarative.

- “do not you + base form of a verb”: Rasp considers it to be interrogative.
Simple use of Robust Parsing

- Sentence type information with affective keywords: “I like the place when is quiet”.
- Imp+please (polite).
Simple use of WordNet

- I want my mum (fear), I hate you (dislike), I like you (liking).
- Pattern matching rules to obtain emotion state and Dave’s response.
- If not result, then WN is used to retrieve synonyms of the verb, replace the original verb and sent to the pattern matching module.
- Disambiguation of WN senses is done against Heise’s 1000 most frequently used words (labelled by polarity).
User-based Evaluation

- 2 day pilot user test, 39 students.
- Aim: Measuring the extent to which having Dave as opposed to a person changes users’ experience while using edrama.
- No statistical difference to measures of user engagement and enjoyment, or with respect to the contributions of Dave.
- Frequencies of Dave (program) and Dave (person) (and other characters in the edrama) being responded were roughly around 30%.
System-based Evaluation

- Human annotation of transcripts (gold-standard) by two annotators.
- Kappa = $P(A) - P(E)/1 - P(E)$ (Carletta, 1996).

<table>
<thead>
<tr>
<th></th>
<th>Inter-Annotator</th>
<th>Human1-Dave</th>
<th>Human2-Dave</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 Labels</td>
<td>0.32</td>
<td>0.32</td>
<td>0.23</td>
</tr>
<tr>
<td>3 Labels</td>
<td>0.65</td>
<td>0.55</td>
<td>0.42</td>
</tr>
</tbody>
</table>
A study was conducted in 2008 where people were asked to grade the intelligence of a person based on their accent and the Brummie accent was ranked as the least intelligent accent. It even scored lower than being silent, an example of the stereotype attached to the Brummie accent. [Wikipedia]
Expressing Emotion via Stereotypes

- Folk knowledge expressed via stereotypes.
- 36% of animal patterns on the Web describe a kind of Person, more than other kinds of Animal (32%).
- Implicit Expression of Emotion via Figurative Categorization.
- Note that polarity can be assigned to objective senses too, not only subjective (tuberculosis, etc.).
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Affect via Figurative Categorization

Detection and analysis of polarity via figurative categorization: e.g., when a human is cast as a non-human of various sorts:

- **As an animal**: Words with a conventional and non-conventional sense. Adults convey negative affect, young conveys positive (pig:piglet, dog:puppy, etc.).
- **Monster, mythical creature or supernatural being**: monster, dragon, angel, devil.
- **Artefact, substance or natural object**: Sewer, real diamond, rock.
- **Size adjectives** ‘adj X’ also convey affect: negative (little devils), positive (little angel), contempt (little rat), importance and/or intensity (big event, big bully).
- **X** can itself be figurative: big baby.
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http://www.cs.bham.ac.uk/jab/ATT-Meta/metaphoricity-signals.html

- Metaphoricity signals that often have metaphors as collocates.
- 3 syntactic structures: 'X is/are Y', 'You Y' and 'like [a] Y'.
- 3 lexical strings: 'a bit of a', 'such a', 'look[s] like'.

Similes are considered crucial to figurative categorization and a stereotypical way of expressing implicit opinion.
<table>
<thead>
<tr>
<th>Signal</th>
<th>Proportion of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>X is/are a Y</td>
<td>38%</td>
</tr>
<tr>
<td>You Y</td>
<td>61%</td>
</tr>
<tr>
<td>a bit of a/such a</td>
<td>40%</td>
</tr>
<tr>
<td>looks like/like</td>
<td>81%</td>
</tr>
</tbody>
</table>
Signals Detection

The Grammatical Relations (GRs) output of RASP (Briscoe et al., 2006) are used.

1. A list of signals.
2. The X and Y nouns from the syntactic signals.
3. A list of words modifying that noun.
Detection of X is a Y

|nccsubj| |be+_vbr| |you_ppy|
(the subject of ‘are’ is ‘you’)
|xcomp| |be+_vbr| |pig_nn1|
(the complement of ‘are’ is ‘pig’)
|det| |pig_nn1| |a_at1|
(the determiner of pig is a)

Output of vbr and ppy are specific to ‘are’ and ’you’ which also allows to detect tags for ‘is’, ‘she’, ‘he’, ‘it’ and for proper and common nouns too.
Detection of ‘You Y’

\[ | \text{ncmod}| | \text{you\_ppy}| | \text{idiot\_nn1}| \]

\[ Y = \text{'idiot'} \]

**Problem:** POS tagger favours tagging Y as a verb (as in ‘you cow’).

- Our system looks the word up in the list of tagged words of RASP tagger.
- If the verb can be tagged as a noun, the tag is changed, and the metaphoricity signal is detected.
- GRs between the verb and Y are the same regardless of the Y having adjectival modifiers.
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General Approach

X and Y: WordNet to analyze them.

1. **X**: Edrama proper names and WordNet.
2. **Y**: Analyzed using WordNet’s taxonomy looking for hyponyms of animals, supernatural beings, artifacts or natural objects.
Analyzing Y

1. Look for senses that are hyponyms of Person, as some metaphors are in the synsets already.
2. If a word contains different synsets that are hyponym of both Animal and Person, then we search for evaluative content about the metaphor.
3. It looks down the various hyponym chains of the term looking for instances with Person hypernym. All the terms are polarity-labelled and the polarity taking if ratio of 3 to 1.
4. If 4 fails, then the hypernym chain of the term is retrieved up to “Person, Animal, Artefact, etc.” and their polarities evaluated.
Intermediate synsets between the metaphorical sense of a term and Person contain glosses (description of semantic content of a synset).

1. **Shark** (hyponym of person): “a person who is ruthless and greedy and dishonest”.

2. **Fox**: “Shifty deceptive person”.

3. Search the glosses for words that indicate affective evaluation.

4. Crude method (not parsing of glosses so far).
Auto-PNWN vs SentiWordNet

- **SentiWordNet**: Numerical scores for positive, negative or objective.
- **However**, most of the terms were assigned an objective score.
- **Instead** we created a small list (over 100 words) from WordNet itself using the ‘quality’ synset which has attribute links to four other synsets (good, bad, positive and negative) and performing 4 iterations through the “see also” links.
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Implicit Expression of Affect: Stereotypes

Sentiment Analysis

Quality

WordNet Search - 3.0

Word to search for: quality

Display Options: (select option to change) ▼ Change

Key: S: — Show Synset (semantic) relations, W: — Show Word (lexical) relations

Noun

- S: (n) quality (an essential and distinguishing attribute of something or someone) "the quality of mercy is not strained"—Shakespeare
  - direct hyponym / full hyponym attribute
  - S: (adj) good (having desirable or positive qualities especially those suitable for a thing specified) "good news from the hospital"; "a good report card"; "when she was good she was very very good"; "a good knife is one good for cutting"; "this stump will make a good picnic table"; "a good check"; "a good joke"; "a good exterior paint"; "a good dress for the office"
  - S: (adj) bad (having undesirable or negative qualities) "a bad report card"; "his sloppy appearance made a bad impression"; "a bad little boy"; "clothes in bad shape"; "a bad cut"; "bad luck"; "the news was very bad"; "the reviews were bad"; "the pay is bad"; "it was a bad light for reading"; "the movie was a bad choice"
  - S: (adj) positive (characterized by or displaying affirmation or acceptance or certainty etc.) "a positive attitude"; "the reviews were all positive"; "a positive benefit"; "a positive demand"
  - S: (adj) negative (characterized by or displaying negation or denial or opposition or resistance; having no positive features) "a negative outlook on life"; "a colorless negative personality"; "a negative evaluation"; "a negative reaction to an advertising campaign"
  - direct hypernym / inherited hypernym / sister term
derivationally related form
- S: (n) quality, caliber, calibre (a degree or grade of excellence or worth) "the quality of students has risen"; "an executive of low caliber"
- S: (n) quality, character, lineament (a characteristic property that defines the apparent individual nature of something) "each town has a quality all its own"; "the radical character of our demands"
- S: (n) timbre, timber, quality, tone (musical the distinctive property of a complex sound (a voice or noise or musical sound)) "the timbre of her soprano was rich and lovely"; "the muffled tones of the broken bell summoned them to meet"
- S: (n) quality (high social status) "a man of quality"

Adjective

- S: (adj) choice, prime, prize, quality, select (of superior grade) "choice wines"; "prime beef"; "prize carnations"; "quality paper"; "select peaches"
- S: (adj) quality (of high social status) "people of quality"; "a quality family"

WordNet home page
Extracting Bad-Attributed Terms

- **S**: (n) quality (an essential and distinguishing attribute of something or someone) "the quality of mercy is not strained"—Shakespeare
  - direct hyponym / full hyponym
  - attribute
    - **S**: (adj) good (having desirable or positive qualities especially those suitable for a thing specified) "good news from the hospital"; "a good report card"; "when she was good she was very very good"; "a good knife is one good for cutting"; "this stump will make a good picnic table"; "a good check"; "a good joke"; "a good exterior paint"; "a good secretary"; "a good dress for the office"
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  - see also
    - **S**: (adj) disobedient (not obeying or complying with commands of those in authority) "disobedient children"
    - **S**: (adj) evil (morally bad or wrong) "evil purposes"; "an evil influence"; "evil deeds"
    - **S**: (adj) unfavorable, unfavourable (not encouraging or approving or pleasing) "unfavorable conditions"; "an unfavorable comparison"; "unfavorable comments"; "unfavorable impression"
    - **S**: (adj) worse (comparative of "bad") inferior to another in quality or condition or desirability) "this road is worse than the first one we took"; "the road is in worse shape than it was"; "she was accused of worse things than cheating and lying"
    - **S**: (adj) worst (superlative of "bad") most wanting in quality or value or condition) "the worst player on the team"; "the worst weather of the year"
  - similar to
    - attribute
    - synonym
    - derivationally related form
      - **S**: (adj) positive (characterized by or displaying affirmation or acceptance or certainty etc.) "a positive attitude"; "the reviews were all positive"; "a positive benefit"; "a positive demand"
      - **S**: (adj) negative (characterized by or displaying negation or denial or opposition or resistance; having no positive features) "a negative outlook on life"; "a colorless negative personality"; "a negative evaluation"; "a negative reaction to an advertising campaign"
        - direct hypernym / inherited hypernym / sister term
        - derivationally related form
  - **S**: (n) quality, caliber, calibre (a degree or grade of excellence or worth) "the quality of students has risen"; "an executive of low caliber"
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  - **S**: (n) quality (high social status) "a man of quality"
Assigning Affective Evaluation

- Tallying positivity and negativity indicators.
- If the numbers are equal, term is labelled positive or negative (not possible to establish the affective quality).
- This method is also used in examples in which an animal does not have metaphorical sense as a kind of person (You elephant, You toad, etc.).
Negation

- **Problem**: Persona non grata: “A person who for some reason is not wanted or welcome”.
- “is not X”, we look for antonyms of “X”, and for antonyms of antonyms.
Modifiers

1. **Big**: More emphatic.
2. **Little**: If negative, then it expresses contempt. If positive, expresses affection.
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You piglet

1. ‘You Y’ signal and puts the noun ‘piglet’ on the blackboard.
2. ‘Piglet’ hyponym of ‘animal’.
3. ‘Person’ not a hypernym, so gloss is retrieved.
4. ‘Young pig’ found.
5. Words and glosses between in nodes between pig and person produces 5 negativity indicating words.
6. **Result:** Negative polarity with an affectionate sense.
Mayid is a rock

1. ‘X is a Y’ signal; ‘rock’ put on the blackboard.
2. ‘Mayid’ is a person in edrama.
3. ‘Rock’ hyponym of natural object.
4. Words and glosses of intermediate nodes between ‘rock’ and ‘person’ produce 1 negativity and 4 positivity indicating words.
5. Positive polarity of natural object.
Some Examples

- little rat: negative polarity with added contempt.
- cow: Negative polarity.
- monster: ‘positive or negative’ polarity.
- feather: ‘positive or negative’ polarity.
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Implicit Expression of Affect: Stereotypes

Some Examples

Evaluation

1. Gold-standard created by manually extracting 141 negative and 63 positive terms (two annotators, disagreements filtered out), from Animal, Artefact, Natural Object, Substance and Spiritual Being hyponym chains.

2. Using iteration over see-also from Quality attributes (previously described), evaluate the result against gold-standard.

3. Comparison to SentiWordNet.

<table>
<thead>
<tr>
<th></th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>SeeAlso-PNWN</td>
<td>Pos 65.1, Neg 42.0</td>
</tr>
<tr>
<td>SentiWordNet</td>
<td>Pos 22.2, Neg 42.0</td>
</tr>
</tbody>
</table>

SeeAlso-PNWN: 3832 Pos, 1128 Neg (out of 27053 synsets).
SentiWN: 0.79% Pos, 0.96% Neg (out of 115424 synsets).
Concluding Remarks

- Current Lexical resources do not contain enough relevant knowledge for sentiment analysis. Move to extracting knowledge from the Web, using specific signals.

- User-based vs system-based evaluations.

- System-based results for detection and analysis poor (as it shown in similar work: SemEval and SentiWN).

- Lack of resources related to Figurative Categorization.


Implicit Expression of Affect: Stereotypes

Some Examples