



UNIVERSITY OF LEEDS

CENTRE FOR TRANSLATION STUDIES

SENTIML: FUNCTIONAL ANNOTATION FOR MULTILINGUAL SENTIMENT ANALYSIS

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Outline

- Sentiment analysis
- Appraisal framework
- SentiML schema
 - Categories, motivations, workflow
- Corpora
- Results
- Conclusions & future work



Sentiment analysis

Aim

Automatically detect in written texts whether a sentence/document is **positive**, **negative** or **neutral** (Liu, 2012).

Dual perspective:

- “When the usage of a word gives an impression of an attitudinal or pragmatic meaning, this is called a **semantic prosody**” (Sinclair, 1999)
- "**Polarity** identification focuses on whether a language unit has a positive or negative connotation (Su and Markert, 2008)

Applications

- *Products* (especially movies and books): is this review positive or negative?
- *Organisations/Politicians*: what do people think about them?
- *Services/Events*: how is consumer confidence?
- **News**: what are the author's opinions?
- **Politics**: what do people think about this issue?
- *Prediction*: predict election outcomes or market trends



Conventional approach

No word order = sum of single sentiments to get the overall one (Pang et al, 2002).

E.g.: “I will eliminate capital gains taxes for the small businesses”

Capital + businesses + I +  gains + will + small + the +  taxes + for +  eliminate = 



Issues

Polarity reversals

eliminate taxes

Negations

Our government should work for us, not against us

Different targets and sentiments

Hundreds of billions in tax breaks for big corporations, but not one penny of tax relief to Americans

Pronominal references

I don't believe that Senator McCain doesn't care. I just think he doesn't know.

False sentiment words

Well, it's time for them to own their failure

Opinions implied

Today, we import triple the amount of oil than we had on the day that Senator McCain took office

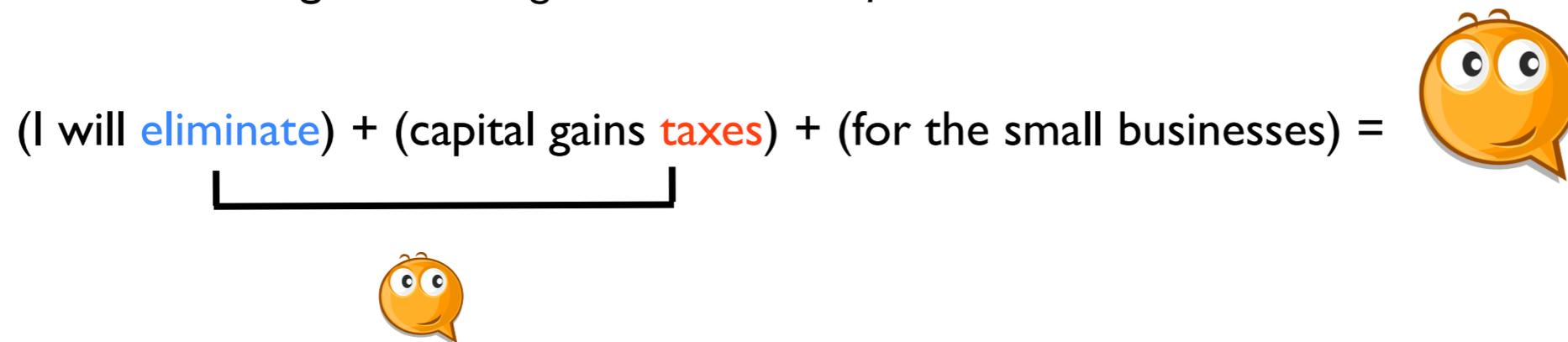
Idioms, Metaphors and Sarcasm

Pull yourself up by your own bootstraps, even if you don't have boots



Proposed approach

Pairs consisting of one *target* and one *modifier*



Word **meaning** and sentence **structure** important to calculate the overall sentiment.



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Appraisal framework

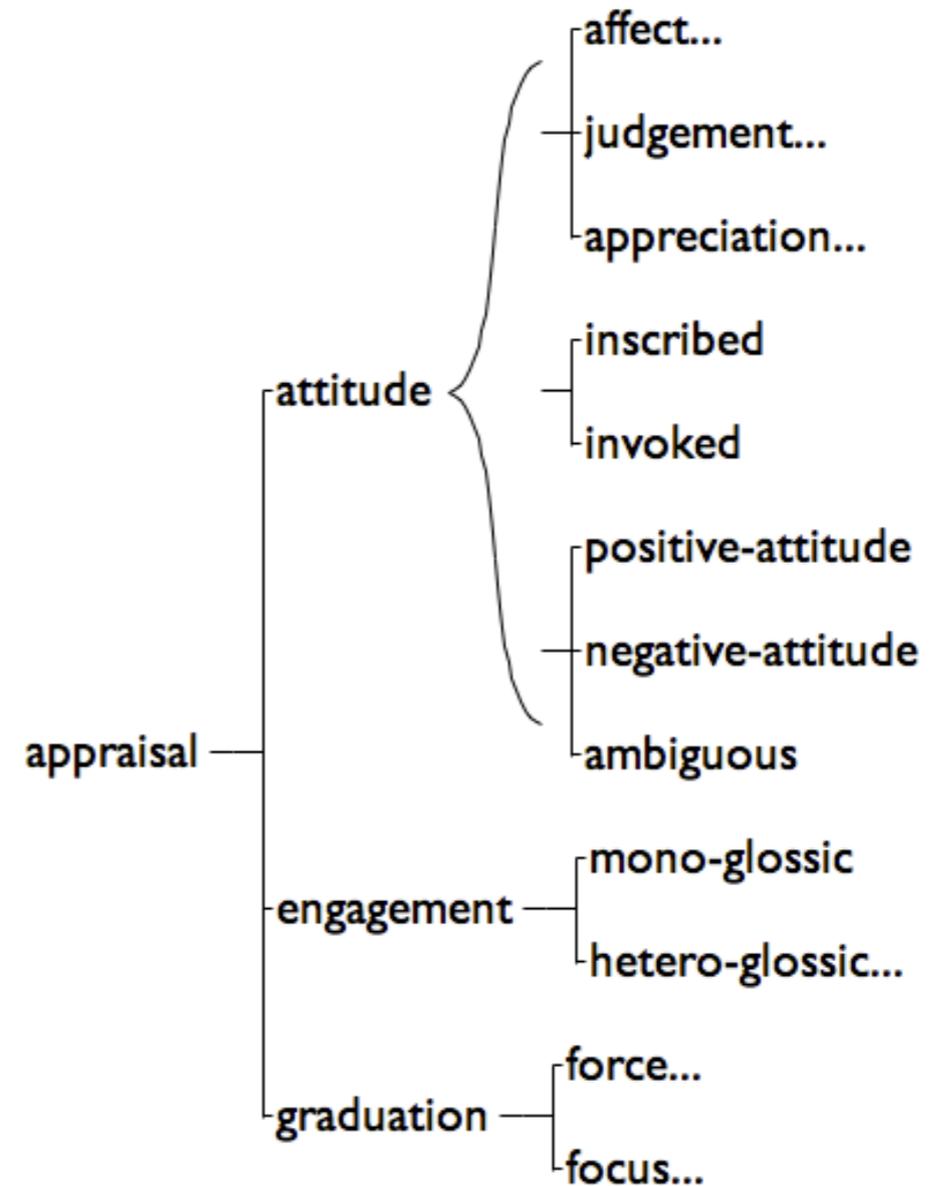
- Negotiation of social relationships by communicating **emotion, judgement**, and **appreciation** in written texts.
- Three systems and many subsystems:

Attitude:

- *affect*: personal emotions and opinions (e.g. *happy, sad*);
- *judgement*: attitude towards people's behaviour (e.g. *heroic, craven*);
- *appreciation*: evaluation of things (e.g. *ugly, useful*).

Engagement: positioning with respect to the opinions of others

Graduation: how the use of language amplifies or diminishes the meaning of words. In particular, intensity, quantity and temporality are under the sub-system *force*.

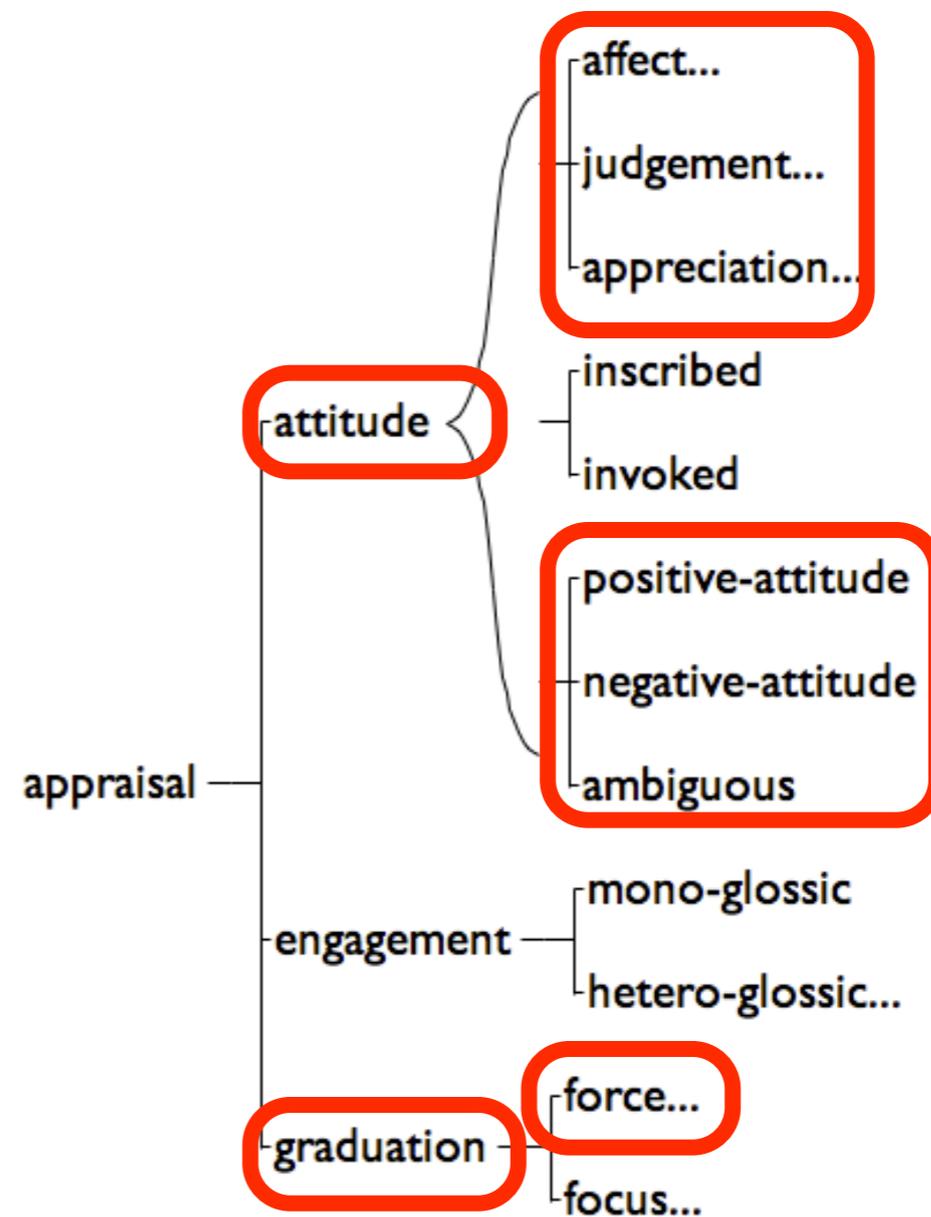


Development of *Systemic Functional Linguistics* (Halliday, 1994) by Martin & White (2005).



Attributes borrowed from AF

- **Attitude:** affect, appreciation, or judgment.
- **Orientation:** positive, negative, neutral or ambiguous.
- **Force:** high, low, normal, reverse. Force is expressed via modifiers such as very (high force), or slightly (low force), but also lexically (e.g. greatest vs. great vs. good).
- **Polarity:** marked if there is a negation, or un-marked otherwise.
- **Target type:** person, thing, place, action or other.



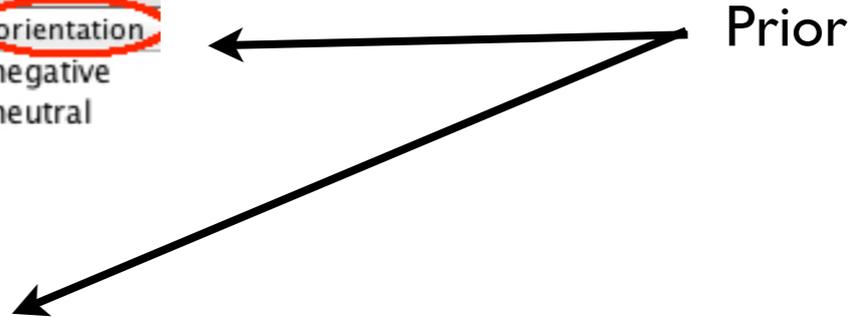
Development of *Systemic Functional Linguistics* (Halliday, 1994) by Martin & White (2005).



Annotation categories

- **Target:** either a subject or an object carrying sentiment with the modifier (e.g. in “we share beliefs” only belief is target in “share beliefs”)

| APPRaisalGROUP | | | | MODIFIER | TARGET |
|----------------|-------|-----|---------|----------|-------------|
| id | start | end | text | type | orientation |
| T0 | 656 | 663 | poverty | thing | negative |
| T1 | 687 | 691 | life | thing | neutral |



- **Modifier**

| APPRaisalGROUP | | | | MODIFIER | TARGET | | |
|----------------|-------|-----|---------|-----------|-------------|---------|----------|
| id | start | end | text | attitude | orientation | force | polarity |
| M0 | 629 | 636 | abolish | judgement | ambiguous | reverse | unmarked |

- **Appraisal group:**

1. Noun + Adjective (e.g. “good plan”) 2. Pronoun + Noun (e.g. “they cliches”) 3. Noun + Preposition + Noun (e.g. “stigmatization of people”) 4. Verb + Adverb (e.g. “strongly support”) 5. Noun + Verb (e.g. “children love”)

| APPRaisalGROUP | | | MODIFIER | TARGET | |
|----------------|--------|----------|----------|---------|-------------|
| id | fromID | fromText | toID | toText | orientation |
| A0 | M0 | abolish | T0 | poverty | positive |
| A1 | M0 | abolish | T1 | life | negative |





Motivations for annotation

To overcome previous research (Popescu et al 2005, Bloom et al 2010, Wilson 2008) limits:

1. **Multiple layers** of annotation:

- Prior (out-of-context) and contextual orientation
- Attitude
- Force of the appraisal

2. Relative **short period of time** by annotating pairs, rather than more complex groups.

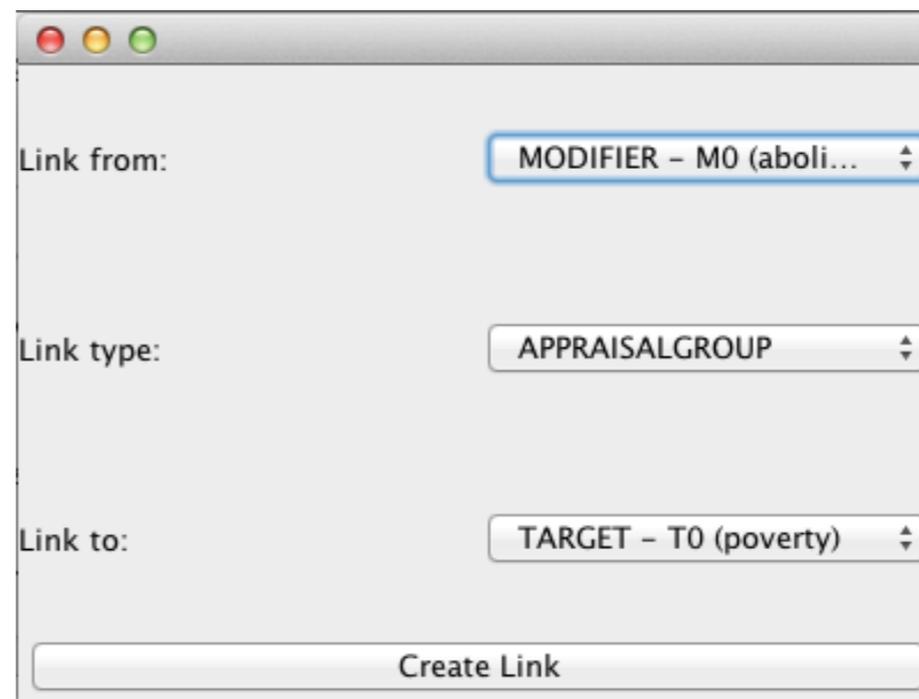
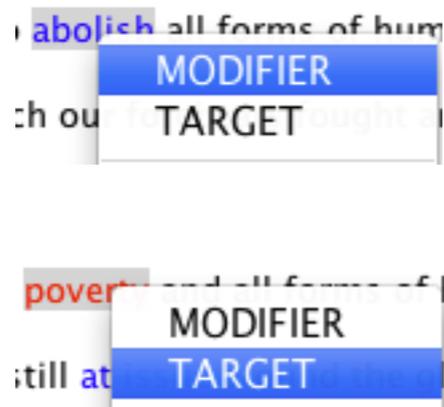
3. Pairs consisting not only of adjectives, but also nouns, verbs, adverbs.

4. Training of a **machine learning system**, i.e. a system which needs to learn from annotated data to execute the same tasks in non-annotated data, i.e. find pairs and classify them correctly.



Annotation workflow

1. One-time creation of a DTD (Document Type Definition)* for the tool MAE (Stubbs, 2011)
2. Loading of a document to annotate
3. Annotation of a target and its modifier first, and then of the appraisal group (e.g. “abolish poverty”)



4. Exporting of the annotations in XML format

*<http://corpus.leeds.ac.uk/marilena/SentiML/>



Output example

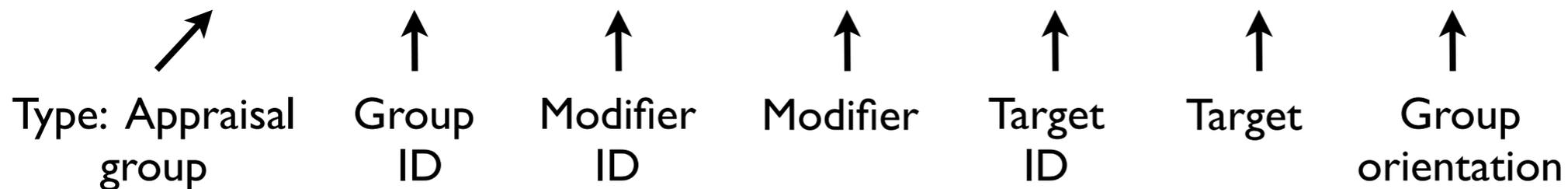
XML output respondent to the *Linguistic Annotation Framework* (LAF) developed by the *International Organization for Standardization* (ISO):

- Multilayer
- Text above and annotations on the bottom

```

98  Finally, whether you are citizens of America or citizens of the world, ask of us the same high standards of strength
    and sacrifice which we ask of you. With a good conscience our only sure reward, with history the final judge of our
    deeds, let us go forth to lead the land we love, asking His blessing and His help, but knowing that here on earth
    God's work must truly be our own.
99  ]]></TEXT>
100 <TAGS>
101 <APPRAISALGROUP id="A0" fromID="M0" fromText="abolish" toID="T0" toText="poverty" orientation="positive" />
102 <APPRAISALGROUP id="A1" fromID="M0" fromText="abolish" toID="T1" toText="life" orientation="negative" />
103 <APPRAISALGROUP id="A2" fromID="M1" fromText="revolutionary" toID="T2" toText="beliefs" orientation="positive" />
104 <APPRAISALGROUP id="A3" fromID="M2" fromText="solemn" toID="T3" toText="oath" orientation="positive" />
105 <APPRAISALGROUP id="A4" fromID="M3" fromText="first" toID="T4" toText="revolution" orientation="positive" />
106 <APPRAISALGROUP id="A5" fromID="M4" fromText="Almighty" toID="T5" toText="God" orientation="positive" />
107 <APPRAISALGROUP id="A6" fromID="M5" fromText="reverend" toID="T6" toText="clergy" orientation="positive" />

```





Special cases

Adverb is too important to be implicit in the force of the modifier.

E.g.: “foolishly sought power”

2 annotations tried:

- Complete: a new group is created (“foolishly sought”), apart from the main one (“sought power”). In “foolishly sought”, *foolishly* has high force, whereas *sought* has normal force.
- Light: the verb in the main group (“sought power”) takes the force of the adverb (*foolishly*).

Because they almost take the same time and such cases are not very frequent, the complete has been chosen.



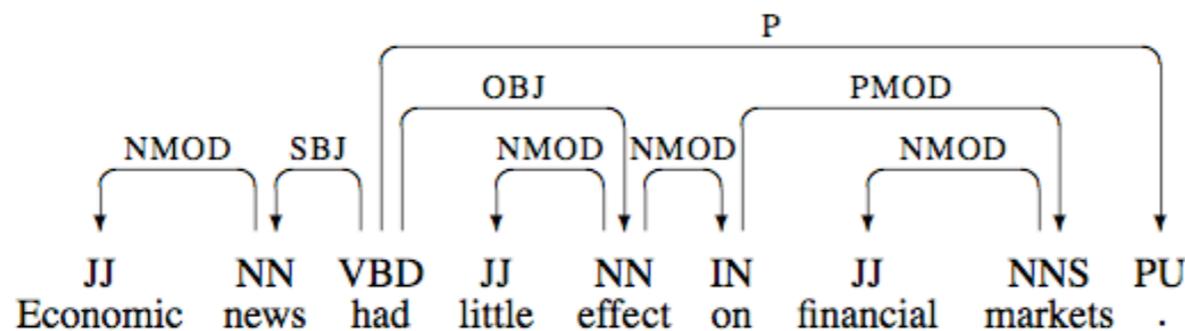
Special cases

- **Negation:** The polarity of the modifier is marked.
E.g. We do not **observe** a **victory** → observe = marked polarity
 - **More than one modifier for each target:** One group for each modifier.
E.g. Cultural and spiritual origins → **cultural origins**, **spiritual origins**
 - **Phrasal verbs and multi-word expressions:** Annotated as single tokens and put in a group.
E.g. **cast off**, **at issue**, **at odds** → **cast off worries**
- NB: Not annotated when words are not placed next to each other.
E.g. “**Never** seen our planet from this perspective **before**”
- **Co-reference:** The pronoun is annotated, instead of the logic subject.
E.g. Let’s begin with some images. They’re iconic, perhaps cliches → **they iconic**, **they cliches**
 - **Non-sentiment words:** No annotation.
E.g. Double standard, wordly possessions
 - **Nouns connected by a preposition:** Target and modifier
E.g. **victims** of **war**, **alliance** for **progress**



Corpora

- 3 domains: news*, political speeches and TED (Technology, Entertainment, Design) talks**.
- 1. Availability of data 2. Long and well-formed sentences 3. No slang
- Languages: English (in the future Italian and Russian).
- Documents*** will be processed by the respective POS taggers (for grammatical function of each word) and dependency parsers (for sentence structure).



- **Why?** Because in a document in which sentence structures are shown it is easier to link targets with their modifiers.

* MPQA corpus (Wilson T., 2008)

** Wit³: Web inventory of transcribed and translated talks (Cettolo M., Girardi C., Federico M., 2012)

*** <http://corpus.leeds.ac.uk/marilena/SentiML>



Results

ANNOTATED WORDS

So far 307 English sentences (6987 tokens).

| Domain | % of annotated words | Appraisal groups | Targets | Modifiers |
|--------------------|-----------------------------|-------------------------|----------------|------------------|
| Political speeches | 27.54 | 601 | 515 | 577 |
| News | 19.33 | 237 | 207 | 231 |
| Talks | 19.39 | 98 | 87 | 93 |
| Total | - | 936 | 809 | 901 |

SPEED

12 sentences with 4 appraisal groups each per hour = 50 appraisal groups along with their targets and modifiers.



Results

ORIENTATION ANALYSIS

- 1872 words in the appraisal groups.
- For those present in the dictionary *NRC Word-Emotion Association Lexicon**, comparison between their **prior orientation** (taken from the dictionary) and the **contextual orientation** of their appraisal group (manually annotated).

| | | | | |
|-------------------------|--------|---|-------------------------|---|
| Words in dictionary | 38.51% | 1. Agreeing orientation | 70.60% | POSITIVE: almighty, friendly, reward NEGATIVE: abuse, crisis, failure, violence |
| | | 2. Disagreeing orientation | 28.57% | NO SENTIMENT: dark, rule, change OPPOSITE: real/crucial issue, republic and government REVERSE: infringement of liberty, lack of freedom |
| | | 3. Agreeing and disagreeing orientation | Intersection of 1 and 2 | OUT-OF-CONTEXT: innocent, useless, deserve REVERSALS: abolish, attack, oppose DEPENDING ON CONTEXT: abandoned, absolute, afford NOT A PRIORI: freedom, discrimination, peace |
| | | 4. Ambiguous orientation | 0.83% | Influence, intervention, retirement, revolution |
| Words not in dictionary | 61.49% | | | NOUNS: heritage, history, students ADJECTIVES: anti-terror, bitter, brave MULTI-WORD EXPRESSIONS: in dark, in doubt, in practise |

*NRC Lexicon (Mohammad S., 2011) containing 24200 word-sense pairs corresponding to 14200 word types.



Conclusions

- Annotation scheme aimed at a **comprehensive analysis** of groups carrying sentiment consisting of a modifier and target.
- As simple as possible without losing important linguistic features, such as both the prior and contextual orientation of words.

Future work

- Measure inter-annotator agreement for English data.
- Complete an **automatic extraction system** for appraisal groups.
- Start annotating Italian and Russian.



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Thank you.txt

File Display NC elements Help

Thank you

APPRAISALGROUP MODIFIER TARGET

| id | fromID | fromText | toID | toText | orientation |
|----|--------|----------|------|--------|-------------|
| A0 | M0 | Thank | T0 | you | positive |