Multilingual Entity-Centered Sentiment Analysis
Evaluated by Parallel Corpora

**Objective, for tens of languages**

- Develop tools to detect sentiment analysis (SA) towards entities without having access to parsers, POS-tagger, morphology.
- Create sentiment dictionaries via triangulated machine translation.
- Evaluate SA with minimal annotation by projecting sentiment annotations across languages. Q: Is sentiment always translated?

**Creating multilingual sentiment dictionaries**

- Sentiment resources are mostly available for English. Existing dictionaries in other languages are not comparable (purpose, size, …).
- We are developing highly multilingual and comparable sentiment dictionaries with similar size and a common specification.
- Simple translation does not work well, because of word ambiguity.
- Minimizing human effort through triangulation (J. Steinberger et al):
  - Produce gold standard dictionaries for English (2403 words) and Spanish (1737 words).
  - Machine translation of both word lists into 3rd language.
  - Take intersection of both target language term lists (triangulation).
  - Improve the resource in three steps:
    1. Filter the triangulation output; delete bad or ambiguous words.
    2. Extend lists (selected terms translated from only 1 language).
    3. Add morphological variants (e.g. be/are/ed).

**Evaluation of generated sentiment dictionaries (N° of words)**

<table>
<thead>
<tr>
<th>Target Language</th>
<th>Simple translation</th>
<th>Triangulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech</td>
<td>57.2% (2000)</td>
<td>89.1% (908)</td>
</tr>
<tr>
<td>French</td>
<td>68.1% (2311)</td>
<td>88.1% (1085)</td>
</tr>
<tr>
<td>German</td>
<td>68.5% (2235)</td>
<td>93.3% (1053)</td>
</tr>
<tr>
<td>Italian</td>
<td>71.4% (2101)</td>
<td>89.0% (1032)</td>
</tr>
<tr>
<td>Russian</td>
<td>66.3% (2092)</td>
<td>84.5% (966)</td>
</tr>
</tbody>
</table>

Ratio of correct terms for simple translation (EN) and for triangulation results.

- Currently, we have sentiment dictionaries for 15 languages.
- All steps performed (3 languages) – CZ, EN, RU
- Partly annotated (6 languages) – AR, DE, FR, IT, ES, TR
- Only triangulation output (6 languages) – BG, NL, HI, PL, PT, SK

**EMM approach to Sentiment Analysis (SA) (Balahur et al. 2010)**

- Add up sentiment term values inside 6-word windows around entities.
- 7 types of sentiment terms
  - Positive, very positive, negative, very negative;
  - Diminishers (less), intensifiers (very), inverters (not)
- Considered if found within two-words of sentiment term.
- A sentiment expression can be scored from -5 to +5:
  - absolutely the worst (-5) – worst (-4) – very bad (-3) – bad (-2) – less bad (-1) – maybe good (+1) – good (+2) – definitely good (+3) – great (+4) – great indeed (+5)
  - Inverter inverts the polarity, but max. in absolute value is 2.

**Inter-annotator agreement**

- How does one person annotate the same sentence in 2 languages?
- What is the agreement between two persons for the same sentence?

**Sentiment analysis evaluation using parallel corpora**

- Parallel corpus of up to 7065 parallel sentences in 7 languages (Data from Workshop on SMT, 2008, 2009, 2010)
- Evaluated on up to 1274 entity mentions per language.

<table>
<thead>
<tr>
<th>Language</th>
<th>English</th>
<th>Spanish</th>
<th>French</th>
<th>German</th>
<th>Czech</th>
<th>Italian</th>
<th>Hungarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEG</td>
<td>58%</td>
<td>57%</td>
<td>62%</td>
<td>70%</td>
<td>57%</td>
<td>56%</td>
<td>36%</td>
</tr>
<tr>
<td>NEUT</td>
<td>79%</td>
<td>73%</td>
<td>74%</td>
<td>72%</td>
<td>76%</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>POS</td>
<td>44%</td>
<td>31%</td>
<td>42%</td>
<td>32%</td>
<td>48%</td>
<td>34%</td>
<td>38%</td>
</tr>
<tr>
<td>ALL</td>
<td>74%</td>
<td>71%</td>
<td>72%</td>
<td>70%</td>
<td>74%</td>
<td>66%</td>
<td>68%</td>
</tr>
</tbody>
</table>

Precision. NEG=negative, NEUT=neutral, POS=positive, ALL = all mentions.

**Conclusions**

- Triangulation of translations works better than simple translation.
- Sentiment annotations can be projected across languages.
- Parallel corpora save annotation time and allow a fair comparison across languages.
- Determining the polarity of sentiment towards entities is difficult; even inter-annotator agreement is relatively now.
- First experiments on aggregating many SA results towards the same entity are very encouraging and will allow opinion trend analysis.

**Examples of news entity mentions** (Balahur-Dobrescu & R. Steinberger, 2009):

- Britain’s building societies could face a bill of more than 80m after the rescue of the Bradford & Bingley bank.
- According to Russian observers, the reasons for this are the welfare and stability in the country led by Alexander Lukashenko, while the Organization for Security and Co-operation in Europe (OSCE) explains it as vote counting frauds.
- It’s almost funny to see how Barack Obama, reputedly the wisest president, is trying so hard in the matter of the Afghan war to repeat the strategy of his predecessor, having himself considered him to be the most foolish.

**Sentiment annotations can be projected across languages.**

- “… the fluid and often ill-defined nature of sentiment expressions.”
- “… it is a potential problem in sentiment analysis.”
- “… we can check the inter-annotator agreement.”

**Selected publications**
