Multilingual Sentiment Analysis in Social Media

Supervisors

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March 11, 2019
Multilingual Sentiment Analysis in Social Media

Definition

Sentiment Analysis (SA) studies people’s opinions, sentiments, and attitudes towards products, organizations, entities or topics.
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WHY?
• Organizations want to measure how the target consumers/social groups/audience react to their products/politics/proposals.
• Can we automatize the process?
Multilingual Sentiment Analysis in Social Media

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WHY?

- Organizations want to measure how the target consumers/social groups/audience react to their products/politics/proposals.

- Can we automatize the process? WWW + NLP
NLP challenges for SA

- Context dependent sentiment.

Example

“Gure salmentek behera egin dute”\(^a\) vs. “Langabeziak behera egin du”\(^b\)

\(^a\) English: Our sales are going down.
\(^b\) English: The unemployment rate is going down.

- Point of view

Example

“Osasunak 4-2 irabazi zuen Valladoliden aurka”.\(^a\)

\(^a\) English: Osasuna won 4-2 against Valladolid.
NLP challenges for SA

- Sentiment granularity: document vs. phrases vs. words

Example

“Family hotel. Age is showing. Great¹⁵ staff.” A value hotel for sure with rooms that are average⁻⁰·⁵, however some nice¹ touches like the coffee station downstairs and the free¹ brownies in the evening. Great¹⁵ staff, super friendly². Special thanks to Camilla who was very helpful and forgiving, When we returned our damaged⁻¹ umbrella.
• Primary Goal: Develop Basque Sentiment Analysis

• Is it enough to extract opinions exclusively in Basque?
  ○ Data is multilingual. Basque reality is multilingual (eu,es,fr).
• **Primary Goal:** Develop Basque Sentiment Analysis

• Is it enough to extract opinions exclusively in Basque?
  ○ Data is multilingual. Basque reality is multilingual (eu,es,fr).

• **Thesis Goal:** Develop Multilingual Sentiment Analysis including Basque
Basque opinions in the web:

- **Not supported**: TripAdvisor, Amazon, etc.
- **Few specialized websites**, e.g., Armiarma (literature) or zinea.eus (movies).
- Basque digital news media (Berria.eus, Sustatu.eus, Zuzeu.eus) do not have active comment sections.
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And **Social Media**?
- **33.6%** of the population (16-50 year range, up to 80% of Twitter users) has activity in Basque (EAS).
- **2.8 million tweets per year** in Basque (Umap)
Social Media: challenges

- Language identification

Example

“Kaixo, acabo de hacer la azterketa de gizarte. Fatal atera zait! 😞”

*aEnglish: Hi, I just finished the exam of Social Studies class. I dit it awfully! :(*

- Text normalization

Example

“Loo Exoo Maazooo dee Menooss Puuff :(" →
“Lo hecho mazo de menos Puff :("*

*aEnglish: I miss him so much :(*
Structure of this Thesis

Sentiment Lexicon Construction
- Subjectivity lexicons (Saralegi et al., 2013) (CICLING)
- Automatic Sentiment lexicons (San Vicente et al., 2014) (EACL)
- Method Comparison (San Vicente & Saralegi, 2016) (LREC)

Social Media Analysis
- Language Identification (Zubiaga et al., 2016) (JLRE)
- Microtext Normalization (Alegria et al., 2015; Saralegi & San Vicente, 2013) (JLRE)

Polarity Classification
- Spanish polarity Classification (San Vicente & Saralegi, 2014) (TASS)
- English polarity Classification (San Vicente et al., 2015) (SemEval)

Real World Application
- Social Media Monitor (San Vicente et al., 2019) (submitted to EAAI)
- Basque Polarity Classification

Conclusions
- Summary
- Future Work
Outline

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Subjectivity Lexicons for less resourced languages (Saralegi et al., 2013)

- **Compare methods for building sentiment lexicons:**
  - Projection/Translation (Mihalcea et al., 2007)
  - Corpus-based lexicon generation (Turney & Littman, 2003)

- **Less resourced scenario:**
  - No use of MT systems.
  - No parallel corpora available.
  - No polarity annotated data-sets.
Projection/Translation

Approach

*Translate an existing lexicon from other language by means of bilingual dictionaries.*

- OpinionFinder (Wilson et al., 2005) to Basque (en → eu)
- Only the first translation in $D_{en\rightarrow eu}$ (translations ordered by frequency of use).
Corpus-based Lexicon generation

Approach

Words that tend to appear in subjective (polar) texts with are good representatives of subjectivity (positive/negative polarity). → Word Association measures

- Log Likelihood Ratio (LLR) vs. Percentage Difference (%DIFF).

- No corpus annotated with subjectivity! → Heuristic:
  - Subjective: Opinion articles.
  - Objective: Event news vs. Wikipedia.
Subjective word distribution (Saralegi et al., 2013)

**Figure** – Distribution of subjective words with various measures and corpus combinations wrt. ranking intervals. Higher intervals contain words scoring higher in the rankings.
Subjectivity lexicons: evaluation (Saralegi et al., 2013)

- Subjectivity classification task.
- **New datasets in Basque**: 5 domains (journalism, blogs, Twitter, reviews, subtitles).
- Classifier:
  \[
  \text{subjectivity}(tu) = \sum_{w \in tu} \text{sub}(w) / |tu|
  \]

- Takeaways:
  - No lexicon is best:
    - Corpus based lexicons better for "in domain" (News)
    - Projection more robust across domains.
  - News better as objective corpus than Wikipedia.
  - LLR better than %DIFF for detecting subjective words.
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Q-WordNet by Personalized Pageranking Vector (QWN-PPV) (San Vicente et al., 2014)

**Approach**

*Propagate the polarity of a few seeds through a Lexical Knowledge Base (LKB) projected over a graph*

1. **Seeds:**
   - Synsets (Agerri & García-Serrano, 2010).
   - Words (Turney & Littman, 2003).

2. **Propagation:**
   - Graph: MCR (Agirre et al., 2012).

   \[ Pr = c M Pr + (1 - c) v \]
QWN-PPV: Evaluation \textit{(San Vicente et al., 2014)}

- **Task based evaluation**: polarity classification.
  - 3 datasets: MPQA (en), (Bespalov et al., 2011) (en), HOpinion (es).
  - 7 sentiment lexicons:
    - Automatic={SWN, MSOL, QWN}
    - (semi-)Manual={Liu, GI, SO-CAL, OF}
  - Classifier:
    \[ polarity(d) = \frac{\sum_{w \in d} pol(w)}{|d|} \] (2)

- Takeaways:
  - No lexicon is best throughout all datasets $\rightarrow$ QWN-PPV produces task specific lexicons.
  - Outperforms automatic methods, competitive vs. manual lexicons.
  - Only needs a Wordnet like LKB.
QWN-PPV: Evaluation (San Vicente et al., 2014)

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  - **Outperforms** automatic methods, **competitive** vs. manual lexicons.
  - Only needs a Wordnet like LKB.
Comparing methods: Basque (San Vicente & Saralegi, 2016)

- Objectives:
  - compare the previous approaches.
  - Generate the polarity lexicons for Basque.

- When facing the task of creating such a resource for a new language:
  - Is it worth to make a great manual annotation effort?
Lexicons generated *(San Vicente & Saralegi, 2016)*

<table>
<thead>
<tr>
<th>Lexicon</th>
<th>#Lemmas</th>
<th>#+ lemmas</th>
<th>#- lemmas</th>
<th>Annotation speed</th>
<th>Annotation time (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Lex_{pr}$</td>
<td>5.335</td>
<td>1.892</td>
<td>3.303</td>
<td>5.3 w/min</td>
<td>36h</td>
</tr>
<tr>
<td>$Lex_C$</td>
<td>1.660</td>
<td>959</td>
<td>691</td>
<td>8.3 w/min</td>
<td>10h</td>
</tr>
<tr>
<td>$Lex_{Qwn−ppv}$</td>
<td>1.132</td>
<td>565</td>
<td>567</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Table* – Statistics for the lexicons generated.

- **Projection $Lex_{pr}$**: $ElhPolar_{es}$ (Saralegi & San Vicente, 2013) → eu. 5 translations per entry.
- **Corpus-based $Lex_C$**: subjective/objective corpus (Saralegi *et al.*, 2013) + positive/negative manual annotation (5,000).
- **Automatic $Lex_{Qwn−ppv}$**: MCR synonym/antonym graphs. Setup from (San Vicente *et al.*, 2014) experiments.
Manual Effort: Projection vs. Corpus-based (San Vicente & Saralegi, 2016)

Figure – Correction speed and productivity data for $Lex_{pr}$ and $Lex_c$. 
## Results for Basque (San Vicente & Saralegi, 2016)

<table>
<thead>
<tr>
<th>Lexicon</th>
<th>News</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acc.</td>
<td>Fpos</td>
<td>Fneg</td>
<td>Acc.</td>
<td>Fpos</td>
<td>Fneg</td>
<td>Acc.</td>
<td>Fpos</td>
<td>Fneg</td>
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<td></td>
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<tr>
<td><strong>Projection</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lex_{pr}</td>
<td>0.86</td>
<td>0.68</td>
<td>0.91</td>
<td>0.70</td>
<td>0.75</td>
<td>0.62</td>
<td><strong>0.79</strong></td>
<td>0.72</td>
<td>0.84</td>
<td></td>
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</tr>
<tr>
<td><strong>Corpus-based</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Lex_{c}</td>
<td>0.78</td>
<td>0.56</td>
<td>0.86</td>
<td><strong>0.80</strong></td>
<td>0.86</td>
<td>0.67</td>
<td><strong>0.79</strong></td>
<td>0.75</td>
<td>0.82</td>
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<tr>
<td><strong>Automatic</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lex_{qwn−ppv}</td>
<td>0.67</td>
<td>0.21</td>
<td>0.79</td>
<td>0.55</td>
<td>0.68</td>
<td>0.20</td>
<td>0.63</td>
<td>0.53</td>
<td>0.69</td>
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<tr>
<td><strong>Combination</strong></td>
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</tr>
<tr>
<td>ConsensLex_{c+pr}</td>
<td><strong>0.88</strong></td>
<td>0.74</td>
<td>0.92</td>
<td><strong>0.83</strong></td>
<td>0.87</td>
<td>0.73</td>
<td><strong>0.86</strong></td>
<td>0.82</td>
<td>0.88</td>
<td></td>
<td></td>
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<tr>
<td><strong>External</strong></td>
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<tr>
<td>NRC_{eu}</td>
<td>0.62</td>
<td>0.29</td>
<td>0.74</td>
<td>0.47</td>
<td>0.51</td>
<td>0.41</td>
<td>0.56</td>
<td>0.41</td>
<td>0.65</td>
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<tr>
<td>MLSenticon</td>
<td>0.65</td>
<td>0.37</td>
<td>0.76</td>
<td>0.55</td>
<td>0.60</td>
<td>0.48</td>
<td>0.61</td>
<td>0.50</td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table – Projection > Corpus-based > LKB-based.
## Results for Basque (San Vicente & Saralegi, 2016)

<table>
<thead>
<tr>
<th>Lexicon</th>
<th>News</th>
<th></th>
<th>Music&amp;Films</th>
<th></th>
<th>Overall</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acc.</td>
<td>Fpos</td>
<td>Fneg</td>
<td>Acc.</td>
<td>Fpos</td>
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</tr>
<tr>
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<td></td>
<td></td>
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<td></td>
</tr>
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<td>$\text{Lex}_{pr}$</td>
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<tr>
<td>$\text{Lex}_{qwn-ppv}$</td>
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</tbody>
</table>

Table – QWN-PPV better than other external lexicons.
<table>
<thead>
<tr>
<th>Publication</th>
<th>Topic(s)</th>
<th>Langs</th>
<th>Datasets</th>
<th>Resources</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Saralegi et al., 2013)</td>
<td>Subjectivity Lexicons - Translation, Corpus based</td>
<td>Eu</td>
<td>News, blogs, tweets, Music/Film reviews</td>
<td>Lexicons (eu, corpus based and translated)</td>
<td>DSPL</td>
</tr>
<tr>
<td>(San Vicente et al., 2014)</td>
<td>Sentiment Lexicons - LKB based</td>
<td>En, Es</td>
<td>-(Bespalov et al., 2011)*</td>
<td>-Lexicons (es,en)</td>
<td>QWN-PPV</td>
</tr>
<tr>
<td>(San Vicente &amp; Saralegi, 2016)</td>
<td>Sentiment Lexicons - comparison</td>
<td>Eu</td>
<td>News, Music/Film reviews</td>
<td>-ElhPolar&lt;sub&gt;eu&lt;/sub&gt; lexicon -QWN-PPV lexicons for Basque</td>
<td>-</td>
</tr>
</tbody>
</table>

- First subjectivity and sentiment lexicons for Basque.
- Task based (extrinsic) evaluations.
- Publicly available software.
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Conclusions
   Summary
   Future Work
TweetLID Shared task (Zubiaga et al., 2016)

- **Goal**: Identify language of tweets - (ca, es, eu, gl, pt) + English

**Example**

Qeeeee matadaaa<sup>a</sup> da Biyar laneaaaaa...<sup>b</sup> → es+eu

<sup>a</sup>English: that was exhausting (es)

<sup>b</sup>English: and gotta go to work tomorrow (eu)

- 7 participants, 21 systems
- Benchmark for LID focused on less-resourced languages
- **Role** as organizer: Annotation, coordination, evaluation.
TweetLID: Datasets

- 35k Tweets (Train 15K / Test 20K) fitting geographical criteria:
  - **Portugal**.
  - **Basque Country**, where Basque and Spanish are spoken → Gipuzkoa
  - **Catalonia**, where Catalan and Spanish are spoken → Girona
  - **Galicia**, where Galician and Spanish are spoken → Lugo

- Multi-label annotation:
  - Ambiguous tweets: e.g. *Acabo de publicar una foto* a → ca/es.
  - Multilingual tweets.

\[a^aEnglish: \text{I just published a photo}\]
TweetLID: Results per language

**Figure** – Distribution of precision scores by language for the 21 submitted systems, including results for both the constrained and the unconstrained tracks.
TweetLID: Takeaways

- Word and character ngrams used.
- **Normalization**: remove URL, @, #, uppercase, repeated characters.
- External resources **not** useful.
- Best **Microavg. Acc. 89.9%** (Macroavg Acc. 82.5%). State of the art (major languages): 92.4% (**Carter et al.**, 2013)
- Short tweets are difficult (<60 chars).
- **Multilingual tweets pending** (2/7 participants).
TweetNorm Shared Task (Alegria et al., 2015)

- Goal: Normalization of Tweets in Spanish

**Example**

cariiii k no te seguia en twitter!!! muy fuerte!!!... se te exa d menos en el bk.... sobreto en los cierres jajajajas

→

carino que no te seguia en twitter!!! muy fuerte!!!... se te echa de menos en el bk.... sobre todo en los cierres ja

---

*aEnglish: my dear i wasn’t following you on twitter!! no way!! we miss you in the bk.... especially when closing hahaha*

- 13 participants
- Benchmark for Microtext Normalization
- **Role** as organizer: coordination, evaluation.
TweetNorm: Elhuyar (Saralegi & San-Vicente, 2013)

- Two step algorithm:
  1. Generates all the possible candidates for the OOV words in a tweet.
     - Rules, LCSR: common abbreviations, colloquial expressions, repeated characters, onomatopoeia and orthographic errors.
     - Reference lexica of normalized forms were generated from various resources.
  2. Selects the combination of candidates that best fits a LM.
     - SRILM based on bigrams obtained from Wikipedia articles and a news corpus from EFE.

- ranked 4th.
- To improve: OOVs containing several errors.

Example
'cumpleee' → 'cumple' → 'cumpleaños'
## TweetNorm: Results

<table>
<thead>
<tr>
<th>Rank</th>
<th>System</th>
<th>Prec1</th>
<th>Prec2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RAE</td>
<td>0.781</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>Citius-Imaxin</td>
<td>0.663</td>
<td>0.662</td>
</tr>
<tr>
<td>3</td>
<td>UPC</td>
<td>0.653</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>Elhuyar</td>
<td>0.636</td>
<td>0.634</td>
</tr>
<tr>
<td>5</td>
<td>EHU</td>
<td>0.619</td>
<td>0.609</td>
</tr>
<tr>
<td></td>
<td>Baseline</td>
<td>0.198</td>
<td>—</td>
</tr>
</tbody>
</table>

- Generate/Filter strategy: 10 out of 13 systems.
- Generate: Rules, RE, transducers, edit distance, gazetteers.
- Filter: LM (1-5grams), scoring.
<table>
<thead>
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</tr>
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<tbody>
<tr>
<td>(Zubiaga et al., 2016)</td>
<td>Language identification in Twitter</td>
<td>Ca, Gi, En, Es, Eu, Pt</td>
<td>TweetLID</td>
<td>TweetLID corpus</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Alegria et al., 2015)</td>
<td>Microtext Normalization</td>
<td>Es</td>
<td>TweetNorm</td>
<td>TweetNorm corpus</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Saralegi &amp; San Vicente, 2013)</td>
<td>Microtext Normalization</td>
<td>Es</td>
<td>TweetNorm</td>
<td>TweetNorm corpus*</td>
<td>OOV normalization dictionary (es)</td>
<td>Normalization module</td>
</tr>
</tbody>
</table>

- Organizer of TweeLID and TweetNorm shared tasks.
- Generated benchmarking datasets.
- TweetNorm participation → Normalization module.
Outline

Sentiment Lexicon Construction
  Subjectivity lexicons (Saralegi et al., 2013) (CICLING)
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Spanish Polarity Classification

- 3 participations in TASS (2012, 2013, 2014)

- (Saralegi & San Vicente, 2012) (rank: 1st)
  - ngrams vs. Polarity lexicon lemmas.
  - Twitter normalization: Emoticons, interjections, urls.

- (Saralegi & San Vicente, 2013) (rank: 1st)
  - $ElhPolar_{es}$ v2.
  - TweetNorm normalization (Saralegi & San Vicente, 2013)
  - Polarity scores based on $ElhPolar_{es}$ include modifiers.

- (San Vicente & Saralegi, 2014) (rank: 2nd)
  - Syntax based ngrams. E.g. perro faldero [Noun+Adj]
  - Negation treatment features: $w$ and $NOT\_w$
  - Lexicon Combination.
TASS Takeaways

👍:
- $ElhPolar_{es}$ key to success.
- Polarity scores.
- Normalization helps.

👎:
- Additional training examples.
- performance of NEU.
- Train/test corpora distribution.
English Polarity Classification (San Vicente et al., 2015)

- Semeval 2015 ABSA shared task.
  - Domains: Restaurant, Laptops, Hotels (no training data)
- Features different wrt. the Spanish system:
  - Domain specific sentiment lexicons (Yelp, Amazon).
  - Word Clusters (word2vec + K-means) from Yelp, Amazon.
  - Category information (present in the datasets).
### SemEval Results (EN) (*San Vicente et al., 2015*)

<table>
<thead>
<tr>
<th>System</th>
<th>Rest.</th>
<th>Lapt.</th>
<th>Hotel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>63.55</td>
<td>69.97</td>
<td>71.68 (majority)</td>
</tr>
<tr>
<td>Sentiue</td>
<td>78.70 (1)</td>
<td>79.35 (1)</td>
<td>71.68 (4)</td>
</tr>
<tr>
<td>Isislif</td>
<td>75.50 (3)</td>
<td>77.87 (3)</td>
<td>85.84 (1)</td>
</tr>
<tr>
<td>EliXa (u)</td>
<td>70.06 (10)</td>
<td>72.92 (7)</td>
<td>79.65 (3)</td>
</tr>
<tr>
<td>EliXa (c)</td>
<td>67.34 (14)</td>
<td>71.55 (9)</td>
<td>74.93 (5)</td>
</tr>
</tbody>
</table>

**Table** – Results obtained on the slot3 evaluation on restaurant data; ranking in brackets.

- **takeaways:**
  - **ngrams** vs. polarity lexicon ngrams.
  - Domain polarity lexicons.
  - Clusters need lots of data.
EliXa

- [http://github.com/Elhuyar/Elixa](http://github.com/Elhuyar/Elixa)

**SVM + linguistic features:**
- word form/ lemma n-grams.
- PoS tags.
- Sentiment lexicon lemmas/ polarity scores.
- Polarity modifiers (good ≠ not good ≠ very good).
- Interjections, onomatopoeia.
- Typographic polarity clues: punctuation, uppercase.
- Cluster features.

- 4 languages: EU, EN, ES, FR

**Ixa-pipes integrated**

**Inherent problems of social media addressed → Microtext normalization**
- Non standard language, emojis (Saralegi & San Vicente, 2013) → SA oriented.
## Contributions in polarity classification

<table>
<thead>
<tr>
<th>Publication</th>
<th>Topic(s)</th>
<th>Langs</th>
<th>Task</th>
<th>Resources</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>(San Vicente &amp; Saralegi, 2014)</td>
<td>Polarity classification</td>
<td>Es</td>
<td>TASS</td>
<td>ElhPolar&lt;sub&gt;es&lt;/sub&gt; lexicon</td>
<td>SVM classifier</td>
</tr>
<tr>
<td>(San Vicente et al., 2015)</td>
<td>Polarity classification, Aspect Based SA</td>
<td>En</td>
<td>SemEval ABSA</td>
<td>Sentiment Lexicons (en, domain specific)</td>
<td>EliXa</td>
</tr>
</tbody>
</table>

- Sentence and document level polarity classification.
- 3 participations in TASS (es): 1<sup>st</sup> (2012), 1<sup>st</sup> (2013), 2<sup>nd</sup> (2014)
- SemEval ABSA 2015. 3<sup>rd</sup> in hidden domain task.
- First release of EliXa SA software, open source.
Outline

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What is Talaia?

Automatic analysis of the impact in social media and digital press of topics specified by the user, based on Natural Language Processing.
Talaia: Success cases: Behagunea

- Real time opinion monitor - Donostia 2016 cultural capital
  - Basque, English, French, Spanish.
  - Developed by Elhuyar and IXA. Competitive tendering.
  - Low latency: **166K mentions in a year (max 6.6K mentions/day)**.
  - Real time: 15 minutes.

- [http://behagune.elhuyar.eus](http://behagune.elhuyar.eus)
Talaia: Success cases: Basque elections 2016

- Real time opinion monitor - Basque regional election campaign 2016.
  - Basque, Spanish.
  - Limited geographical area.
  - Collaboration with Berria.
  - Data volume: 4.25M mentions (avg. 125K mentions/day, max. 433K mentions/day).

Talaia: Datasets

- No datasets for training supervised systems. **Two new multilingual datasets** created:

<table>
<thead>
<tr>
<th>Language</th>
<th>Total size</th>
<th>#pos</th>
<th>#neg</th>
<th>#neu</th>
</tr>
</thead>
<tbody>
<tr>
<td>eu</td>
<td>2,937</td>
<td>931</td>
<td>408</td>
<td>1,598</td>
</tr>
<tr>
<td>es</td>
<td>4,754</td>
<td>1,487</td>
<td>1,303</td>
<td>1,964</td>
</tr>
<tr>
<td>en</td>
<td>12,273</td>
<td>4,654</td>
<td>1,837</td>
<td>5,782</td>
</tr>
<tr>
<td>fr</td>
<td>11,071</td>
<td>3,459</td>
<td>2,618</td>
<td>4,994</td>
</tr>
</tbody>
</table>

*Table* – Cultural domain dataset in Basque.

<table>
<thead>
<tr>
<th>Language</th>
<th>#Tweets</th>
<th>#Annotations</th>
<th>#pos</th>
<th>#neg</th>
<th>#neu</th>
</tr>
</thead>
<tbody>
<tr>
<td>eu</td>
<td>9,418</td>
<td>11,692</td>
<td>3,974</td>
<td>3,185</td>
<td>4,533</td>
</tr>
<tr>
<td>es</td>
<td>15,550</td>
<td>20,278</td>
<td>3,788</td>
<td>7,601</td>
<td>8,889</td>
</tr>
</tbody>
</table>

*Table* – Political domain dataset in Basque, entity level annotations.
Talaia: Results

<table>
<thead>
<tr>
<th>Language</th>
<th>#features</th>
<th>acc</th>
<th>fpos</th>
<th>fneg</th>
<th>fneu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cultural Domain</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eu</td>
<td>4,777</td>
<td>74.02</td>
<td>0.658</td>
<td>0.635</td>
<td>0.803</td>
</tr>
<tr>
<td>es</td>
<td>10,037</td>
<td>73.03</td>
<td>0.683</td>
<td>0.756</td>
<td>0.744</td>
</tr>
<tr>
<td>en</td>
<td>24,183</td>
<td>70.43</td>
<td>0.715</td>
<td>0.530</td>
<td>0.743</td>
</tr>
<tr>
<td>fr</td>
<td>23,779</td>
<td>66.17</td>
<td>0.600</td>
<td>0.617</td>
<td>0.721</td>
</tr>
<tr>
<td><strong>Political Domain</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eu</td>
<td>9,394</td>
<td>69.88</td>
<td>0.714</td>
<td>0.702</td>
<td>0.683</td>
</tr>
<tr>
<td>es</td>
<td>15,751</td>
<td>67.05</td>
<td>0.545</td>
<td>0.693</td>
<td>0.700</td>
</tr>
</tbody>
</table>

- SVM Features:
  - 1-gram word forms (frequency $\geq 2$; document frequency (df) $\geq 2$).
  - POS tag 1-gram features.
  - Polarity lemmas in $ElhPolar_{eu}$ (San Vicente & Saralegi, 2016).
  - Sentence length.
  - Upper case ratio: % of capital letters wrt. sentence length in characters.
## Contribution table

<table>
<thead>
<tr>
<th>Publication</th>
<th>Topic(s)</th>
<th>Langs</th>
<th>Datasets</th>
<th>Resources</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>(San Vicente et al., 2019)</td>
<td>Social Media monitor, normalization, Polarity classification</td>
<td>En, Es, Eu, Fr</td>
<td>-DSS2016 Behagunea -BEC2016 (politics)</td>
<td>Social media normalization resources</td>
<td>-Behagunea UI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-MSM crawler</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-EliXa</td>
</tr>
</tbody>
</table>

- Integration of previous research.
- First full SA system including Basque.
- First polarity annotated datasets for Basque.
- System in production.
- Open source software.
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Summary

• Multilingual Sentiment Analysis in order to develop a social media monitor on specific topics, including Basque.
  ○ Methods applicable across languages.
  ○ Methods applicable to less-resourced languages.
Summary: Sentiment Lexicons

- Pioneering work for Basque:
  - First sentiment lexicons (subjectivity/polarity).


- Evaluation of Sentiment lexicons must be **task-based**.

- For Basque manual effort pays off vs. fully automatic methods ([San Vicente & Saralegi, 2016](#)).
Summary: Social Media

- Part of the organizing committee in two shared tasks:
  - TweetLID: Annotation, coordination, evaluation.
  - TweetNorm: coordination, evaluation.
- Participant in TweetNorm (ranked 4th).
- Multi Source Monitor (MSM): Publicly available software to harvest data from social Media (Twitter) (San Vicente et al., 2019).
  https://github.com/elhuyar/MSM
- Pending issues:
  - Identification of multilingual tweets and short messages (<60 chars).
  - Task dependent normalization.
Summary: Polarity Classification

- Pioneering work for Basque:
  - The first polarity annotated datasets.
    https://hizkuntzateknologiak.elhuyar.eus/eu/baliabideak
  - We generated the first resources for Basque microtext normalization
    https://hizkuntzateknologiak.elhuyar.eus/assets/files/elixa-resources-10.tgz
  - EliXa, the first multilingual SA system including Basque
    https://github.com/elhuyar/elixa

- Participation in international shared tasks:

- Pending: aspect extraction
Summary: Real World application

- **Talaia** [https://talaia.elhuyar.eus](https://talaia.elhuyar.eus)
  - Culmination of the journey → **Final product**
  - System in production.
  - **Open source** software.
Summary: Thesis in Numbers

- 14 publications.
- 2 shared tasks organized.
- 5 participations in shared tasks.
- 5 software packages publicly available.
- 1 final product.
- Previously non-existing SA resources for Basque:
  - Polarity lexicons for Basque (2+).
  - 2 Polarity annotated datasets.
Future Work

- Polarity classification:
  - Deep EliXa:
    - Robust cross domain performance
    - Cost of training and hyper-parameter tuning vs. improvement obtained over other approaches.
    - Domain adaptation: measure the cost of creating datasets for new domains.

- Aspect Based Sentiment Analysis

- Data crawling
  - Keyword based crawling suffers from coverage, keywords change over time.
Acknowledgements

Projects

ber2tek

OpeNER

ElkarOla

TUNER

Tacardi

Knowtour (IE11-305)

skater

Organizations

elhuyar

Universidad del País Vasco

Euskal Herriko Unibertsitatea

ixa
Eskerrik asko!

Moltes gràcies!

Thank you!

¡Muchas gracias!