
# LPS-BIGGER Project
# Sentiment Analysis

9th March 2017

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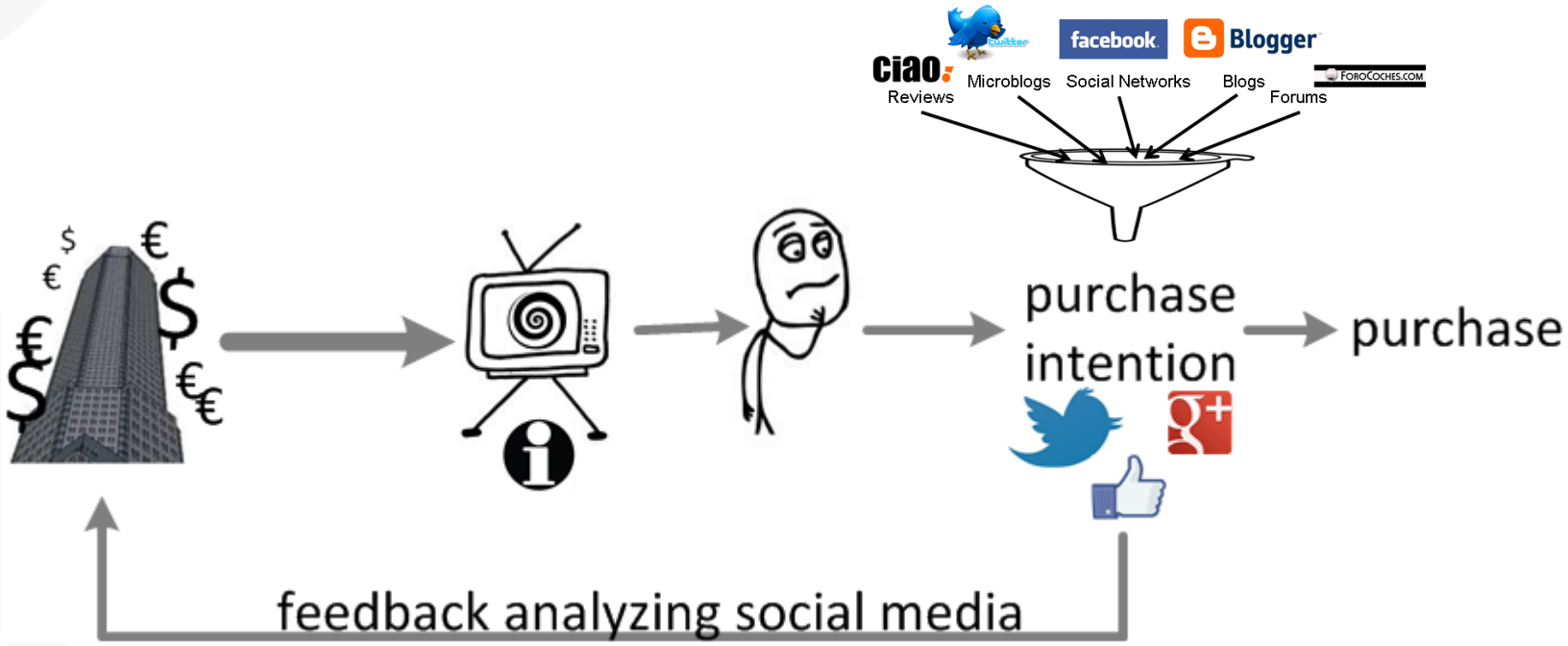
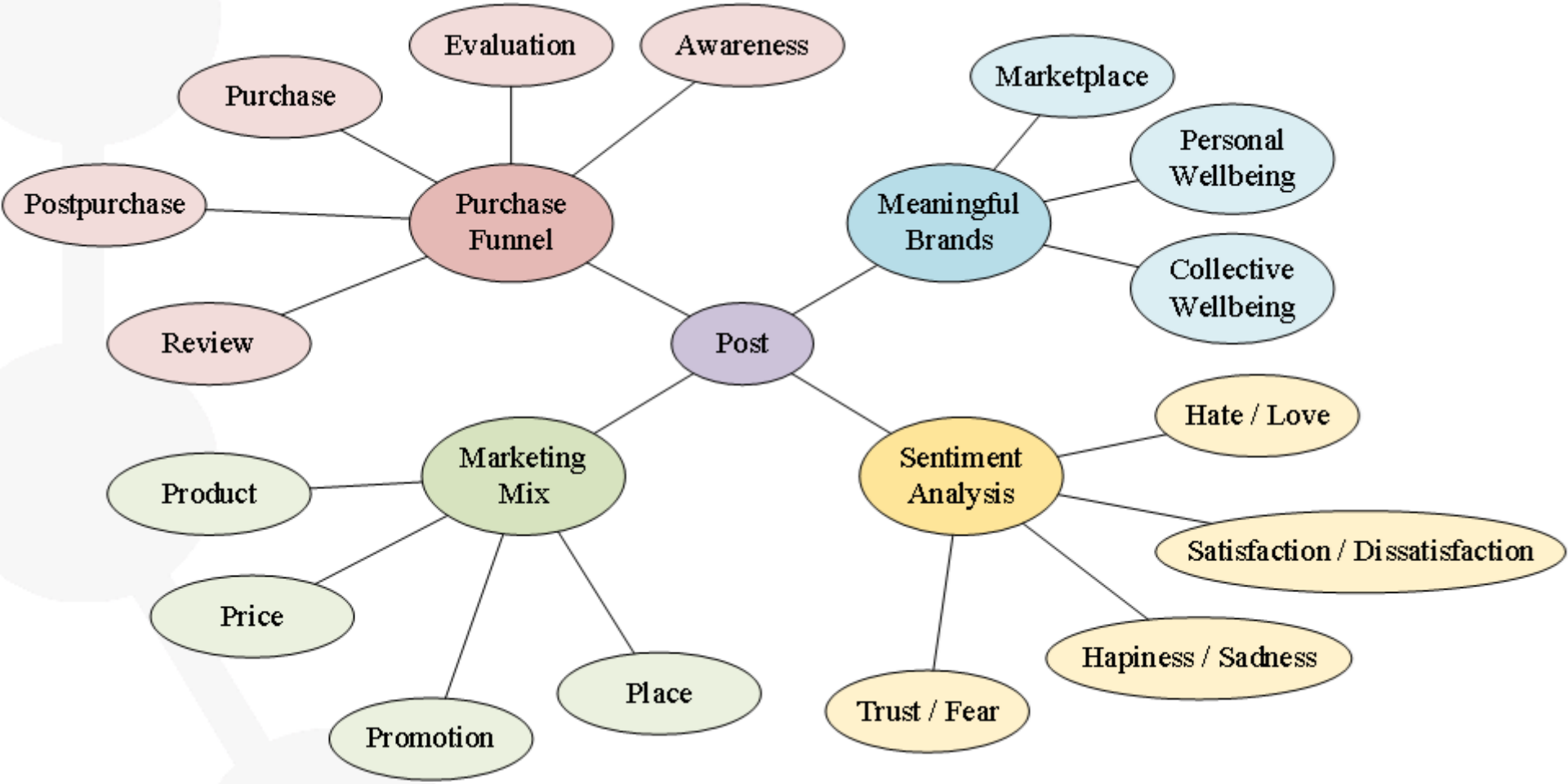
# Motivating case



# Dimensions


Evaluation
Awareness
Purchase
Postpurchase
Purchase Funnel
Review
Marketplace
Personal Wellbeing
Meaningful Brands
Collective Wellbeing
Post
Hate / Love
Marketing Mix
Sentiment Analysis
Product
Satisfaction / Dissatisfaction
Price
Hapiness / Sadness
Place
Trust / Fear
Promotion

# Corpus description

| | alimen | | automo | | banca | | bebida | | deport | | retail | | telco | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | es | en | es | en | es | en | es | en | es | en | es | en | es | en | tot |
| amor | 88 | 142 | 102 | 156 | 50 | 6 | 268 | 141 | 399 | 150 | 143 | 35 | 40 | 30 | 1750 |
| confian | 30 | 24 | 94 | 42 | 56 | 24 | 28 | 21 | 49 | 24 | 41 | 33 | 78 | 96 | 640 |
| felicid | 469 | 409 | 255 | 347 | 103 | 34 | 444 | 286 | 471 | 313 | 317 | 131 | 145 | 102 | 3826 |
| insatis | 198 | 240 | 441 | 258 | 711 | 694 | 419 | 315 | 368 | 242 | 464 | 148 | 750 | 772 | 6020 |
| odio | 77 | 84 | 116 | 134 | 421 | 424 | 165 | 173 | 161 | 125 | 148 | 76 | 415 | 560 | 3079 |
| satisfa | 919 | 709 | 674 | 515 | 113 | 88 | 675 | 486 | 566 | 626 | 602 | 321 | 303 | 242 | 6839 |
| temor | 9 | 19 | 40 | 18 | 101 | 54 | 36 | 11 | 13 | 3 | 38 | 11 | 37 | 24 | 414 |
| tristez | 12 | 35 | 42 | 26 | 41 | 55 | 32 | 13 | 31 | 37 | 32 | 26 | 27 | 53 | 462 |
| nc2 | 1521 | 1021 | 6236 | 1207 | 4468 | 1173 | 4467 | 1158 | 4671 | 1105 | 2065 | 1510 | 1437 | 971 | 33010 |
| col.well | 21 | 12 | 165 | 15 | 131 | 14 | 33 | 8 | 39 | 23 | 91 | 14 | 4 | 31 | 601 |
| marketpl | 14 | 161 | 1006 | 240 | 382 | 734 | 253 | 232 | 358 | 143 | 365 | 328 | 387 | 307 | 4910 |
| per.well | 44 | 1018 | 625 | 841 | 228 | 859 | 1579 | 718 | 1527 | 788 | 761 | 649 | 1130 | 45 | 10812 |

# Framework


# Architecture

# Technologies

- REST Services
- Command line
- Graphical User Interface

**We have tried/used these libraries**

IXAPipes 1.1.1 http://ixa2.si.ehu.es/ixa-pipes/
Freeling 3.0 http://nlp.lsi.upc.edu/freeling/
Stanford CoreNLP 3.7.0 http://stanfordnlp.github.io/CoreNLP/
OpenNLP 1.5.3 http://opennlp.apache.org
Weka 3.6 - http://www.cs.waikato.ac.nz/ml/weka/
Java API for WordNet Searching (JAWS) -http://lyle.smu.edu/~tspell/jaws/index.html
WordNet 3.0 - http://wordnet.princeton.edu/wordnet/license/
Mallet 2.0.7 http://mallet.cs.umass.edu/
Illinois POS 1.7.1 http://cogcomp.cs.illinois.edu/page/software

# Fun, but…

- It’s multilabel! Not just one correct option.
- Subjectivity: polarity is not easy, emotion is other level…
- The emotion taxonomy is unrealistic (fear towards brands?)
- Unbalanced and bad corpus (not a clear criteria, the “same tweet” has several different classifications…)
- Time constraint (we can’t do everything we would want to, limited training, it has to be fast…)
- We have to deliver the code (it has to be easy, explained)
- Havas is very demanding (changes, requests, private corpus but also publications…)
- Twitter messages are not Shakespeare…

Previous efforts

# BASELINE

# Testing…

**Different Machine Learning Algorithms:**

- Naïve Bayes
- Linear Regresion…

**Different features:**

- Lemmas
- Tokens
- Chunks

**Resources and software:**

- Lexicons (new-built, existing ones)
- NLP tools (Ixa-pipes, Freeling, OpenNLP, CoreNLP)
- Other tools (Weka, SocialMedia, self-implemented)

**Other efforts:**

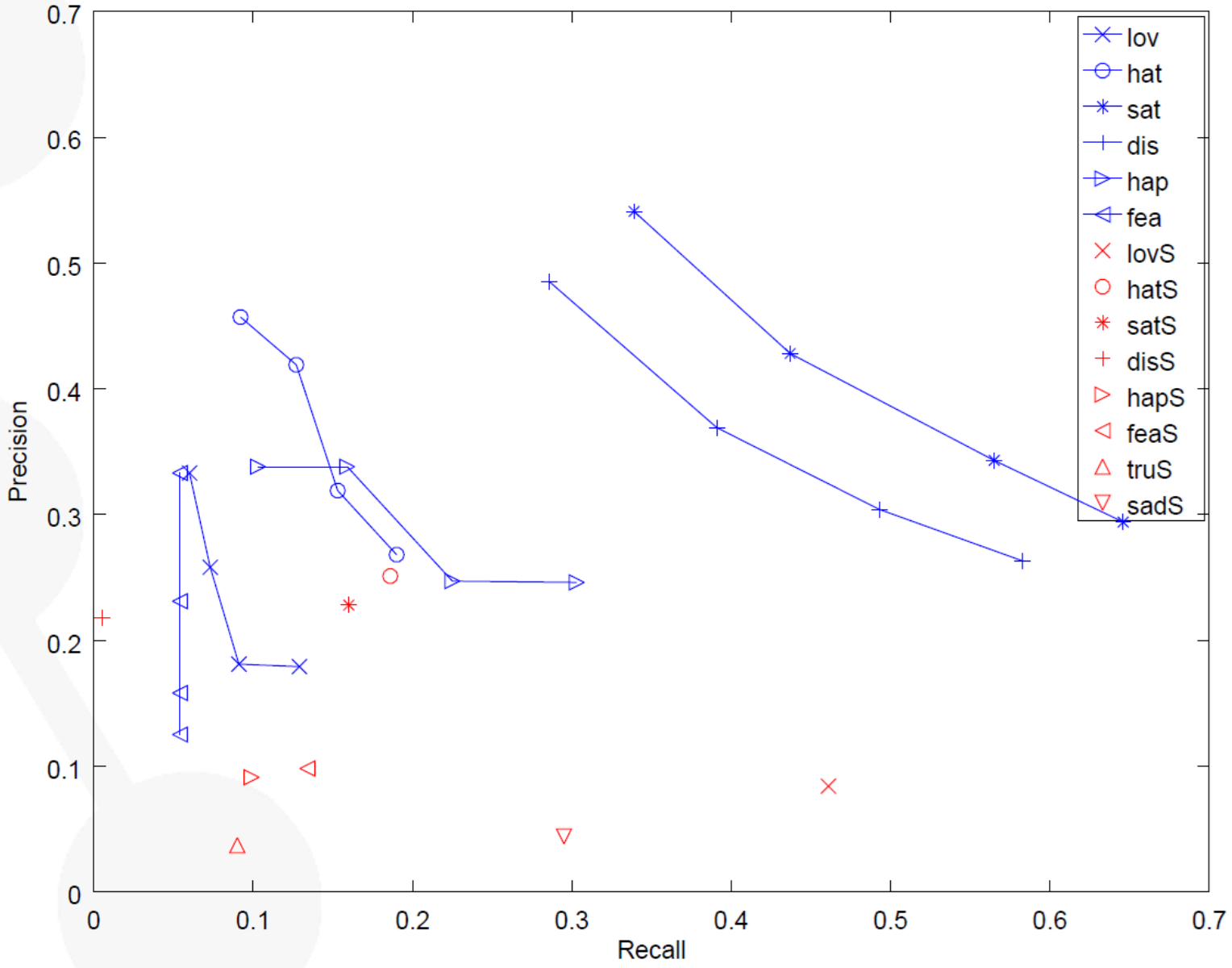
- Preprocessing: filters (normalizer, SentenceSplitter)
- POS
- Babelfy…

# Also…

- Optimal size if the corpus for training (5k~7,5k)
- Comparison to other corpora available (TASS, just for polarity)
- Creation of new sentilexicons:
  - Using TF-IDF for finding sector-dependent emotional words (*fresquita* for beverages).
  - Manual examination (for low-populated emotions)
  - Division in sectors/emotions
- Test of different thresholds.
- Cascade classification (the best of each classifier!). Problems:
  - Time restriction.
  - Several posible orders, different for each emotion.

# CURRENT RESULTS

# ROC


Precision
Recall
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
lov
hat
sat
dis
hap
fea
lovS
hatS
satS
disS
hapS
feaS
truS
sadS

Innovation

# NEW IDEAS

# Ideas

- **Where are the missclassified going?**

# Where are the missclassified going?

- Precision and recall are not enough…
- Remember it's multilabel…

Labeled as…

| | amor | felicidad | confianza | satisfaccion | insatisfaccion | tristeza | temor | odio | NC |
|---|---|---|---|---|---|---|---|---|---|
| amor | **3** | 0 | 0 | 0 | 12 | 1 | 0 | 6 | 22 |
| felicidad | 0 | **2** | 1 | 1 | 9 | 0 | 0 | 4 | 20 |
| confianza | 1 | 1 | **1** | 0 | 8 | 0 | 0 | 6 | 16 |
| satisfaccion | 3 | 1 | 7 | **212** | 273 | 11 | 9 | 160 | 659 |
| insatisfaccion | 3 | 18 | 10 | 39 | **282** | 2 | 9 | 0 | 201 |
| tristeza | 0 | 0 | 0 | 0 | 3 | **1** | 0 | 2 | 0 |
| temor | 0 | 0 | 0 | 0 | 2 | 0 | **3** | 1 | 5 |
| odio | 0 | 2 | 0 | 3 | 5 | 0 | 0 | **29** | 4 |

Classified as…

# Ideas

- Where are the missclassified going?
- **How to evaluate the results?**
  - It’s not the same to say LOVE instead of SATISFACTION than HATE instead of TRUST…
  - Also, it’s multilabel! Maybe you said just LOVE and it was SATISFACTION and LOVE… not a fail, but neither a hit…
  - Proposal (pending approval).

# Confussion matrix proposal

| es realmente… \ clasificado como… | AMOR | misma polaridad | distinta polaridad |
|---|---|---|---|
| AMOR | **A** tp 1 | **B** fn / tp 0.5 | **C** fn 0 |
| misma polaridad | **D** fp / tn 0.5 | **E** tn 1 | |
| distinta polaridad | **G** fp 0 | | |

We don't care in this case, so…

A: Si es Amor y lo clasifico como Amor→ 1, es un verdadero positivo

B: Si es Amor y lo clasifico como Felicidad → es 0,5 verdadero positivo y 0,5 falso negativo

C: Si es Amor y lo clasifico como Odio → 0, es un falso negativo

D: Si es Felicidad y lo clasifico como Amor → es 0,5 verdadero negativo y 0,5 falso positivo

E: Si es Felicidad y lo clasifico como algo distinto a Amor → es un verdadero negativo

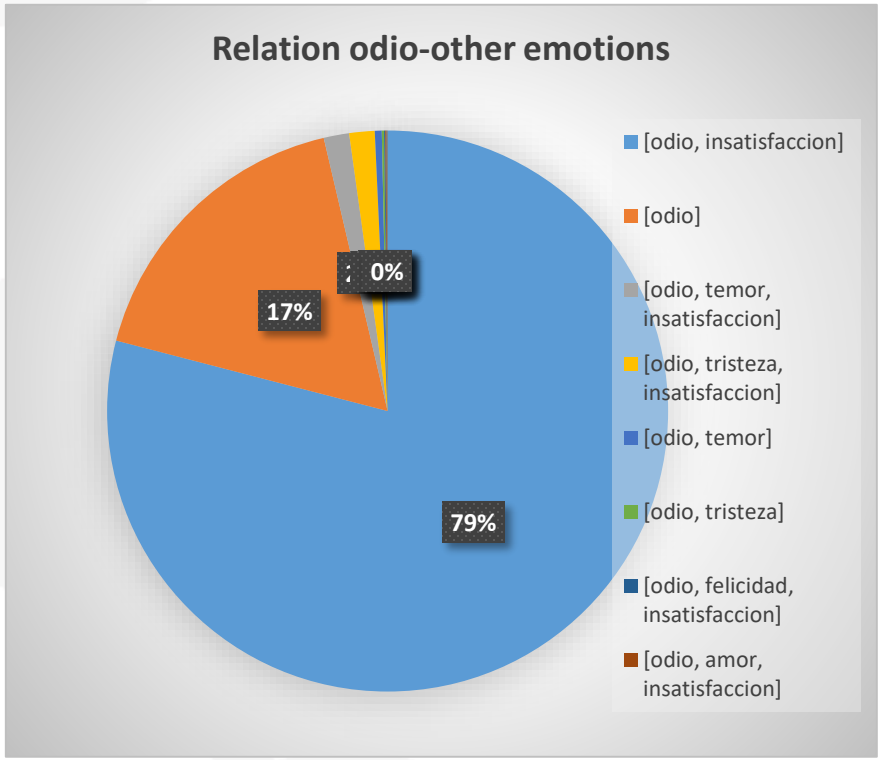
G: Si es Odio y lo clasifico como Amor → es un falso positivo

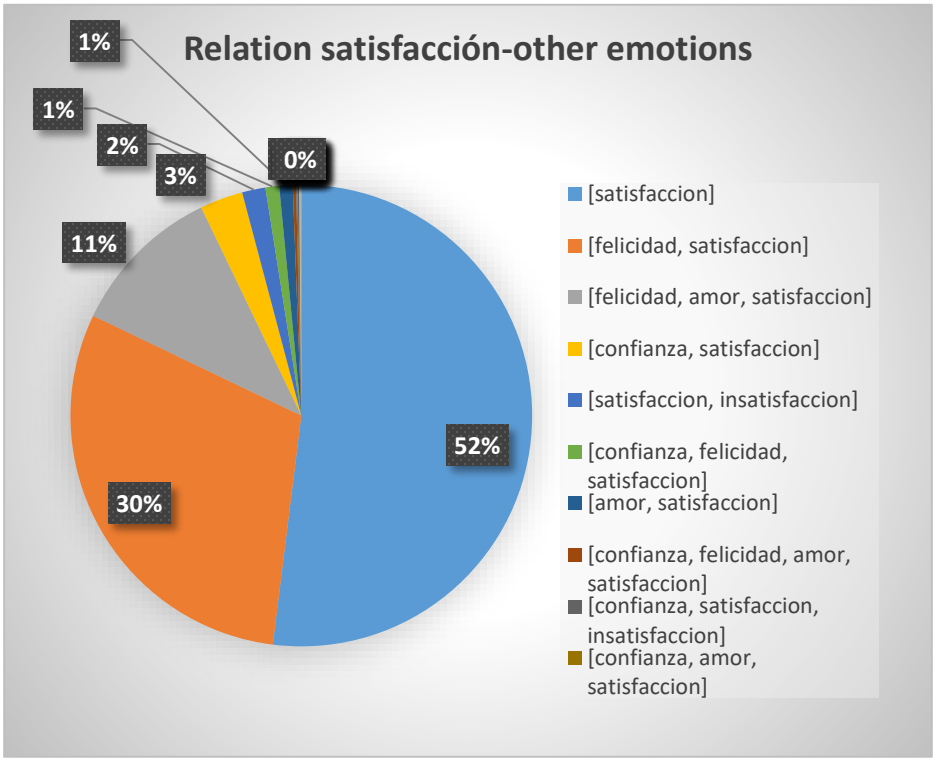
# Ideas

- Where are the missclassified going?
- How to evaluate the results?
  - It’s not the same to say LOVE in stead of SATISFACTION than HATE in stead of TRUST…
  - Also it’s multilabel! Maybe you said just LOVE and it was SATISFACTION and LOVE… not a fail, but neither a hit…
  - Proposal (pending of aproval).
- **Is there any correlation among emotions? Binary, but dependent?**

# Is there any correlation among emotions? (1)

## Graphic examples



# Is there any correlation amog emotions? (2)

- Strong correlation among a few emotions.
- A relevant list of probabilities:

$$P(Insatisfacción\,|Odio) = 0{,}821$$

$$P(Satisfacción|Felicidad) = 0{,}736$$

$$P(Felicidad|Amor) = 0{,}72$$

$$P(Amor|Felicidad) = 0{,}451$$
$$P(Insatisfacción|Tristeza) = 0{,}451$$
$$P(Satisfacción|Confianza) = 0{,}444$$
$$P(Satisfacción|Amor) = 0{,}425$$
$$P(Odio|Insatisfacción) = 0{,}368$$
$$P(Insatisfacción|Temor) = 0{,}346$$

- Possible orders for in-cascade classifiers:

**Amor → Felicidad → Satisfacción** **Odio → Insatisfacción**

→ Useful for ordering the tests!

→ Useful for deriving results from one clasifier to another!

# Ideas

- Where are the missclassified going?
- How to evaluate the results?
  - It's not the same to say LOVE in stead of SATISFACTION than HATE in stead of TRUST…
  - Also it's multilabel! Maybe you said just LOVE and it was SATISFACTION and LOVE… not a fail, but neither a hit…
  - Proposal (pending of aproval).
- Is there correlation among emotions? Binary, but dependent?
- **Pure emotions hypothesis.**

# Pure emotion hypothesis

- What makes the difference on fine-grained sentiment analysis?
- Where is the line between satisfaction and love?
- Where can we find discriminative leads?

- Let's take for training just "pure" emotions (this is, documents just tagged as one emotion). There must be *something* relevant…

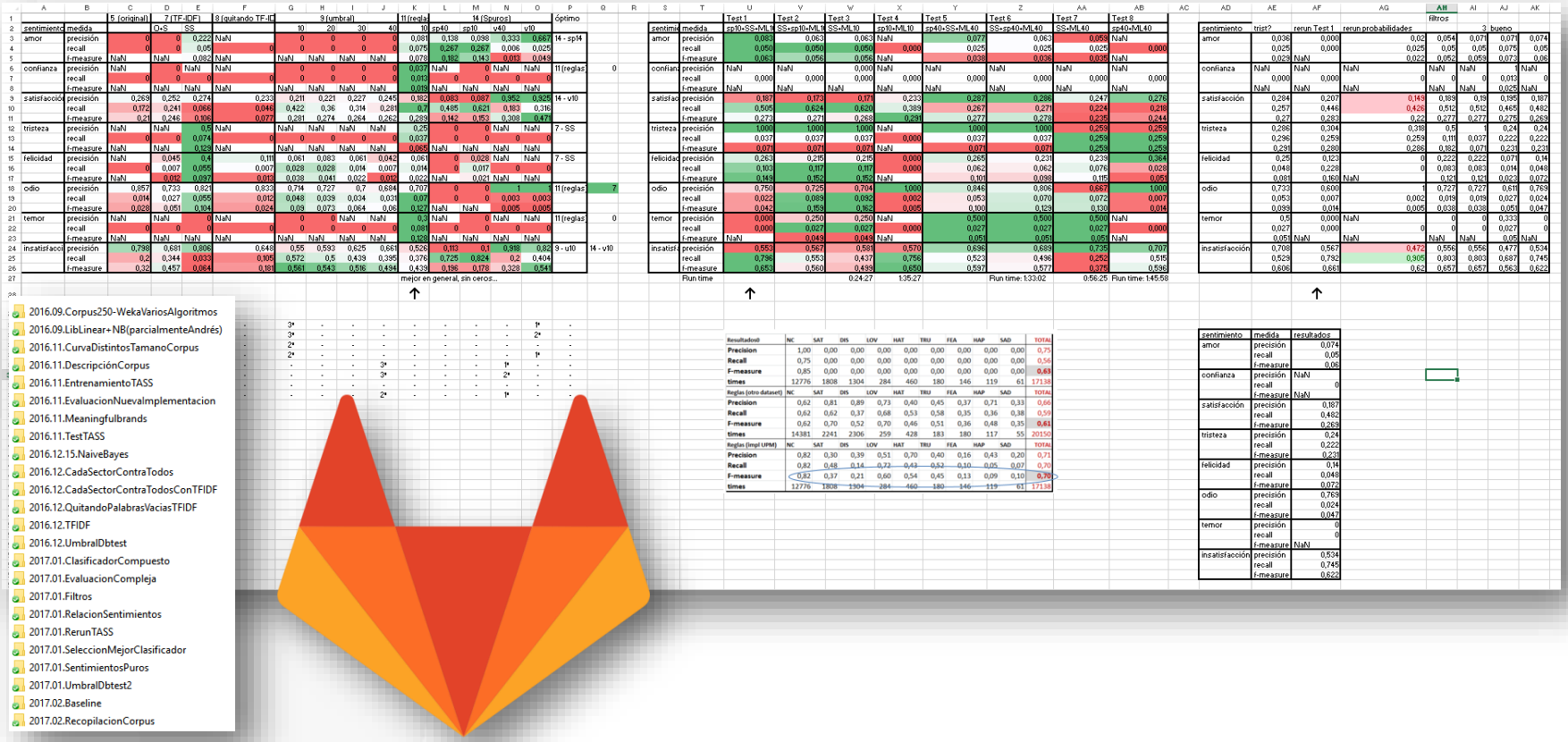
- So one of our classifiers follows this idea. On its own is obviously not good, but is useful in cascade!

# Ideas

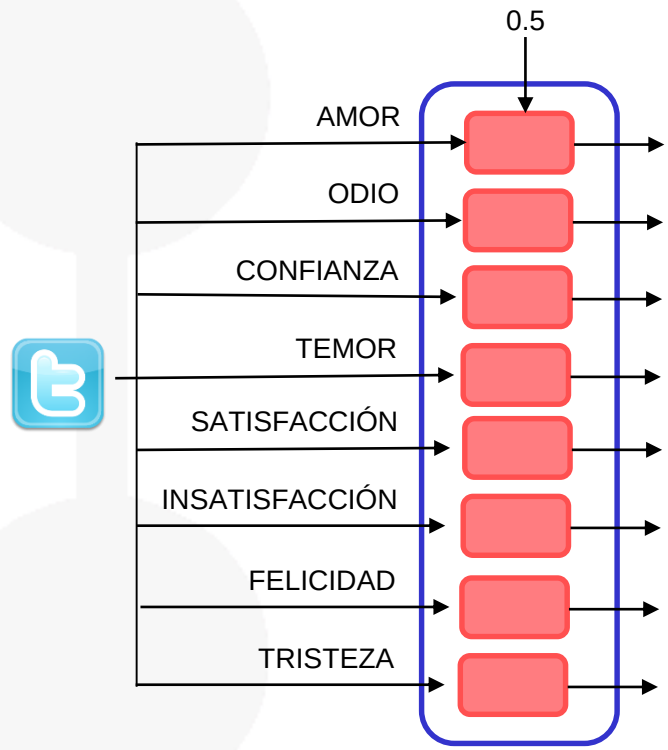
- Where are the missclassified going?
- How to evaluate the results?
  - It's not the same to say LOVE in stead of SATISFACTION than HATE in stead of TRUST…
  - Also it's multilabel! Maybe you said just LOVE and it was SATISFACTION and LOVE… not a fail, but neither a hit…
  - Proposal (pending of aproval).
- Is there correlation among emotions? Binary, but dependent?
- Pure emotions hypothesis.
- **It's multilabel!**
  - Different emotions, different results…
  - OK, multilabel classifiers are expensive… but why only binary?
  - **Different paths** for each emotion!

# Different paths for each emotion (1)

- Non trivial! Which one? (+dependence!)
  - One of the problems is how to track all the posible configurations and results, in constant change…)

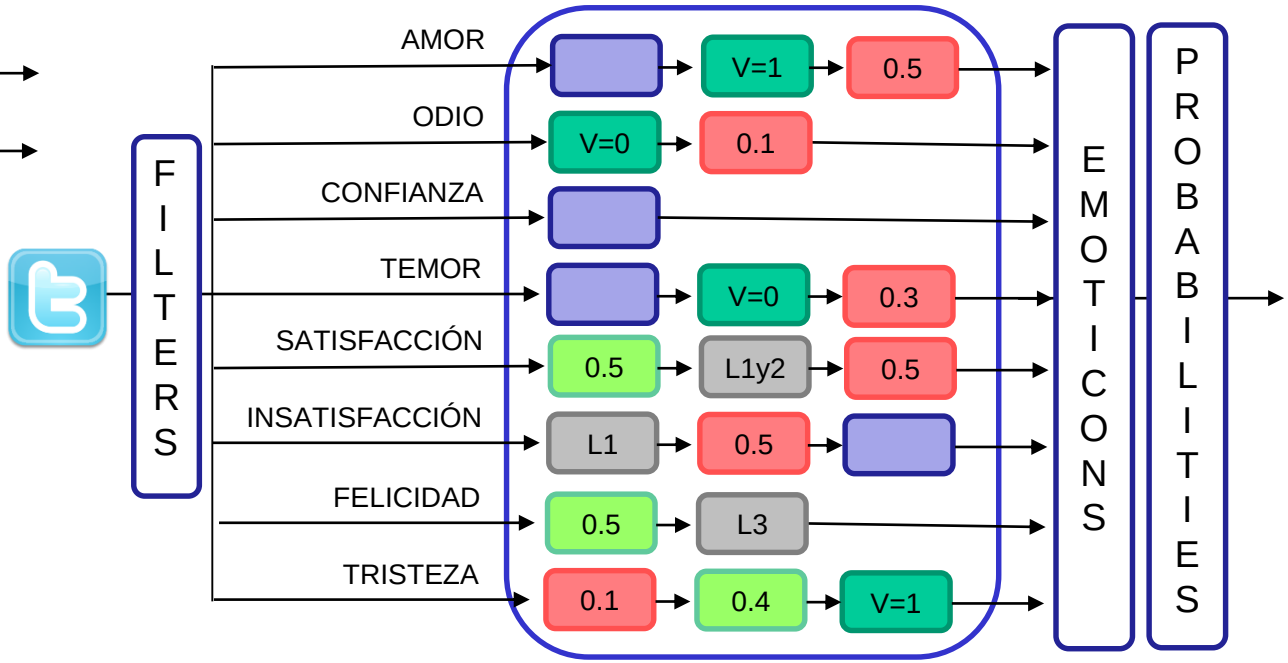


# Different paths for each emotion (2)

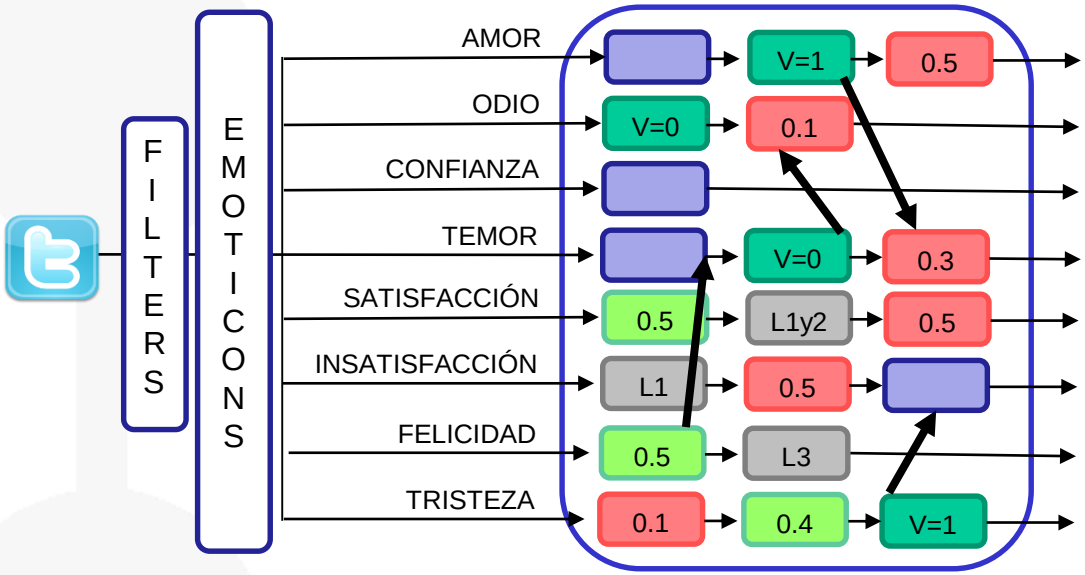



BASELINE

NOW



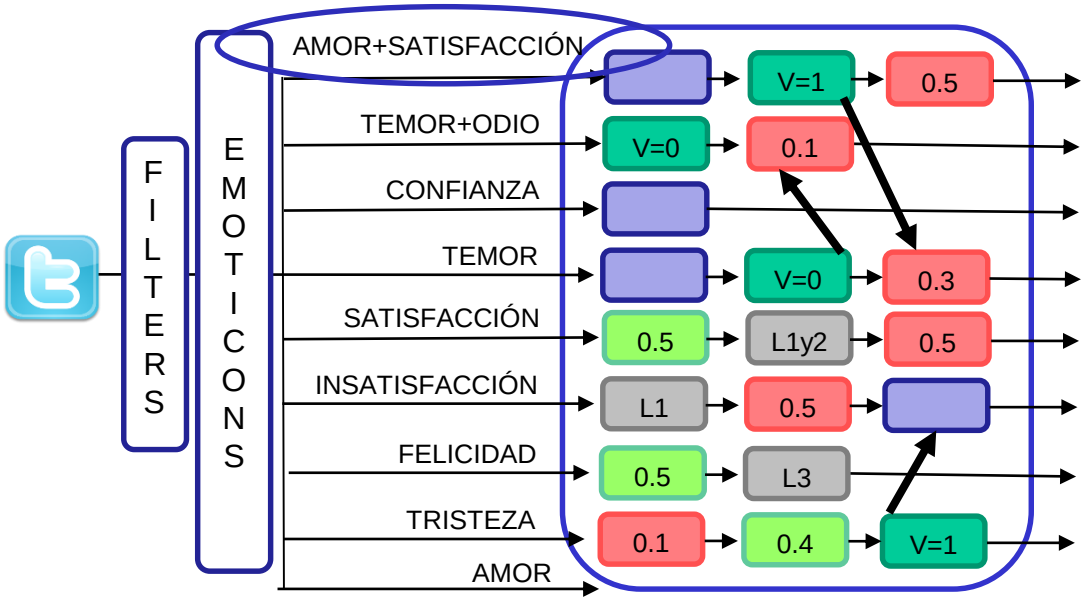
# Different paths for each emotion (3)




Future?

Use the correlations of emotions as classes

Crossed paths depending on results

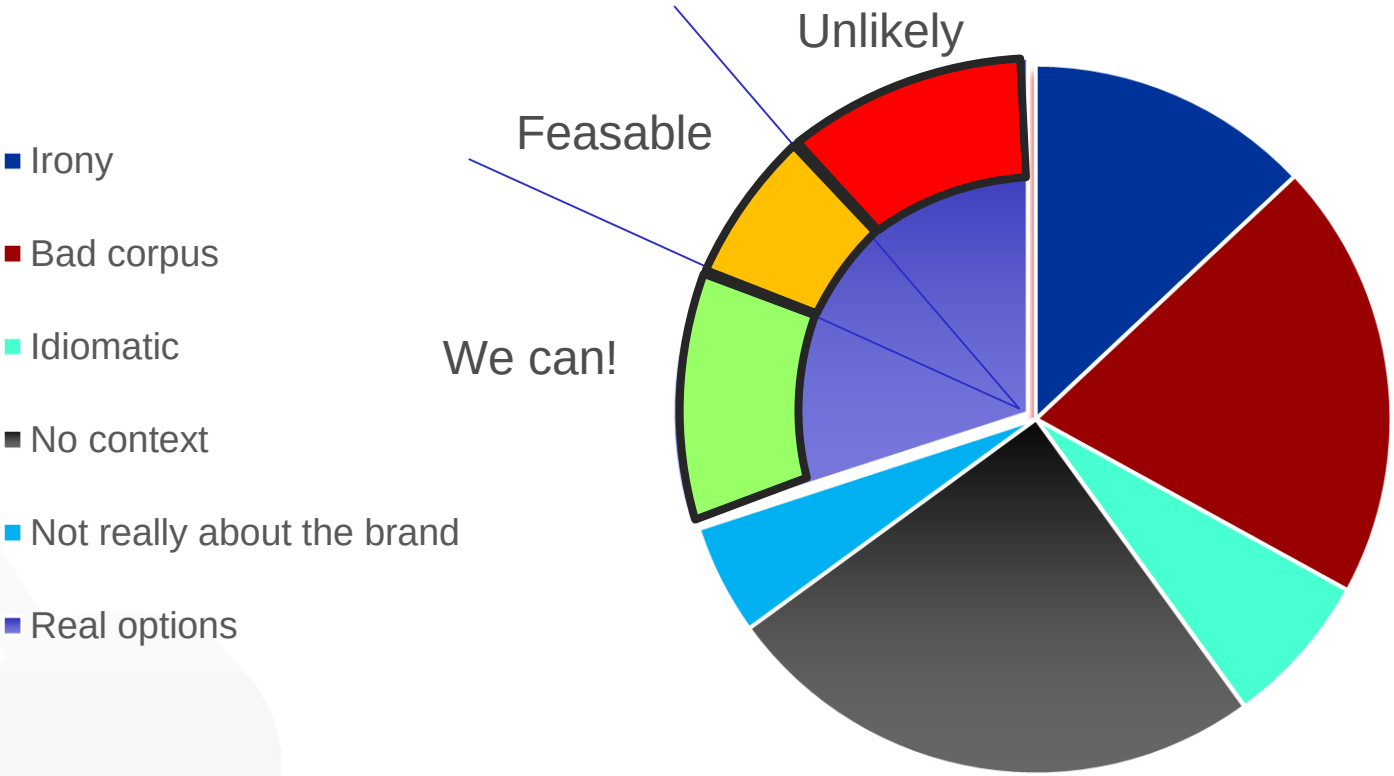


Conclusions

# FUTURE PATHS

# Conclusions

- Still to do (and just a few months remaining):
  - English
  - Meaningful Brands…
- Poor results



# Results and Future Papers

## Commercial results:

- OK for frequent emotions, but trust or sadness...
- Still applicable in an industrial setting?

## Academic results:

Already sent:

- Language, Data and Knowledge (LDK): we built our own corpus (Idafen, Víctor, María). http://sabcorpus.linkeddata.es/

Future:

- Natural Language Processing for Social Media Analysis at SPECOM 2017 (Special Session) (6th April)
- IberEVAL – COSET (8th May)
- ISWC (15th May) (probably, also workshops).
- TASS Workshop (September)

# Future paths

Ideas:

- Semantic paths
  - Use the semantic graph around brands/companies together with Named Entity Recognition
  - Use lexic-syntactic patterns
  - Topic modeling (Library)
- Machine learning paths
  - Hierarchy (first satisfaction/dissatisfaction, then other emotions)
  - Interaction emotions (not independent paths).
  - Better lexicons.
- For English, more resources (Senticnet…)

- Other options?