From tags to emotions:

Ontology-driven sentiment analysis in the social semantic web

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Outline

- Introduction
- Motive
- ArsEmotica
  - Overall architecture
  - Evaluation and user study
- Conclusion and future work

Introduction

- Huge data supplied by the Social Web users
  - is a precious information source about
    - perceptions, trends, and feelings
  - many research are extracting meaningful information from it

- the ArsEmotica
  - analyzes tagged artworks
  - captures user's emotions toward a specific resource

Motive

- the Emolex[1] (Version 0.92)
  - Plutchik's eight emotions + Polarity
  - 14,200 words

aback	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
abacus	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:1
abandon	positive:0	negative:1	anger:0	anticipation:0	disgust:0	fear:1	joy:0	sadness:1	surprise:0	trust:0
abandoned	positive:0	negative:1	anger:1	anticipation:0	disgust:0	fear:1	joy:0	sadness:1	surprise:0	trust:0
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abatement	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
abba	positive:1	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
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abbreviate	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
abbreviation	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
abdomen	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
abdominal	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
abduction	positive:0	negative:1	anger:0	anticipation:0	disgust:0	fear:1	joy:0	sadness:1	surprise:1	trust:0
aberrant	positive:0	negative:1	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
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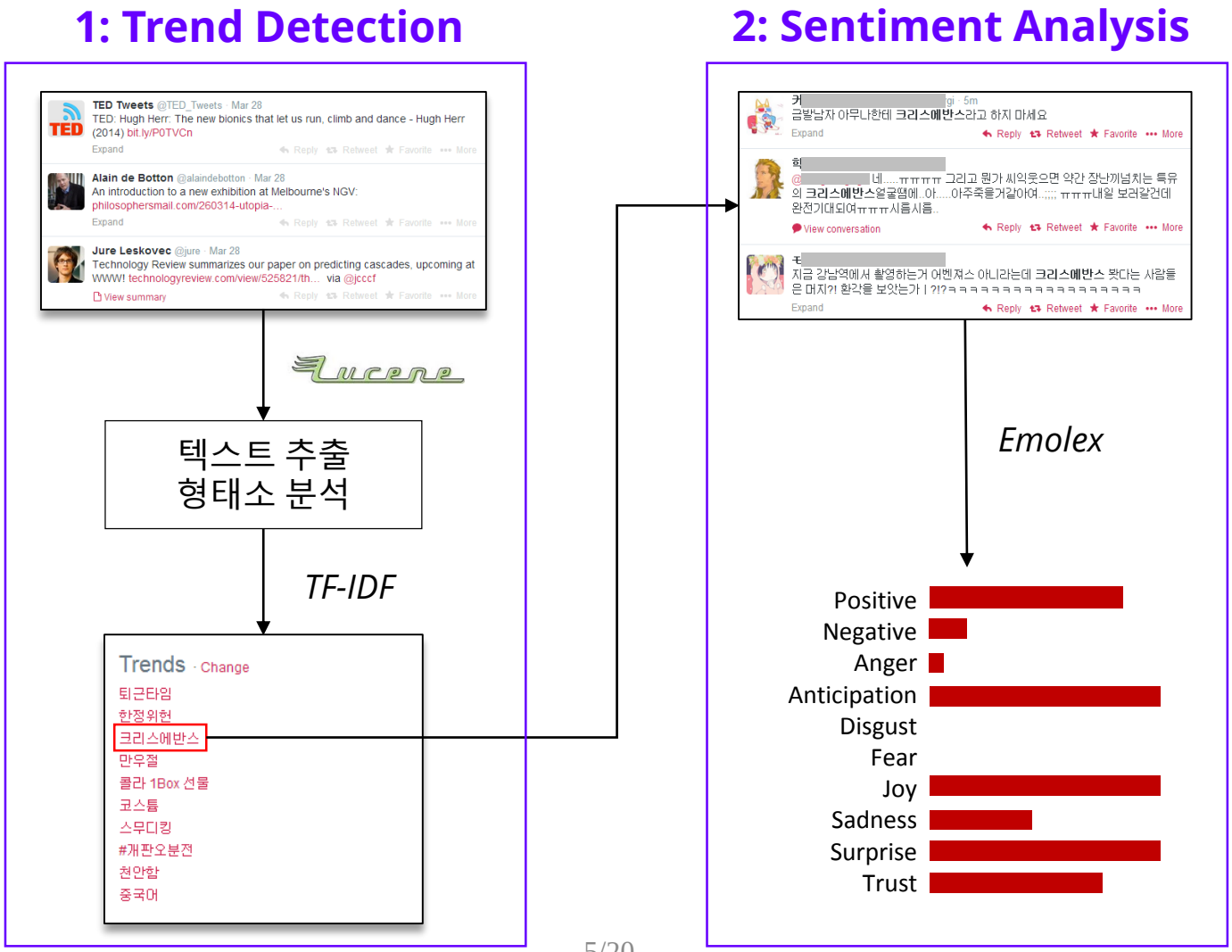
ablation	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
ablaze	positive:0	negative:0	anger:0	anticipation:0	disgust:0	fear:0	joy:0	sadness:0	surprise:0	trust:0
abnormal	positive:0	negative:1	anger:0	anticipation:0	disgust:1	fear:0	joy:0	sadness:0	surprise:0	trust:0

1. S. M. Mohammad et al., "Emotions evoked by common words and phrases: using mechanical turk to create an emotion lexicon," CAAGET 2010

Motive

- Remind "Sentimental Analysis of Trends on Twitter"



Motive

- Remind “Sentimental Analysis of Trends on Twitter”
  - the Emolex has only 14,200 words

- How to extend the lexicon of Emolex?
  - SemanDic using page-rank?

ArsEmotica

- Overall architecture
  - Step1: Checking tags against the ontology of emotions

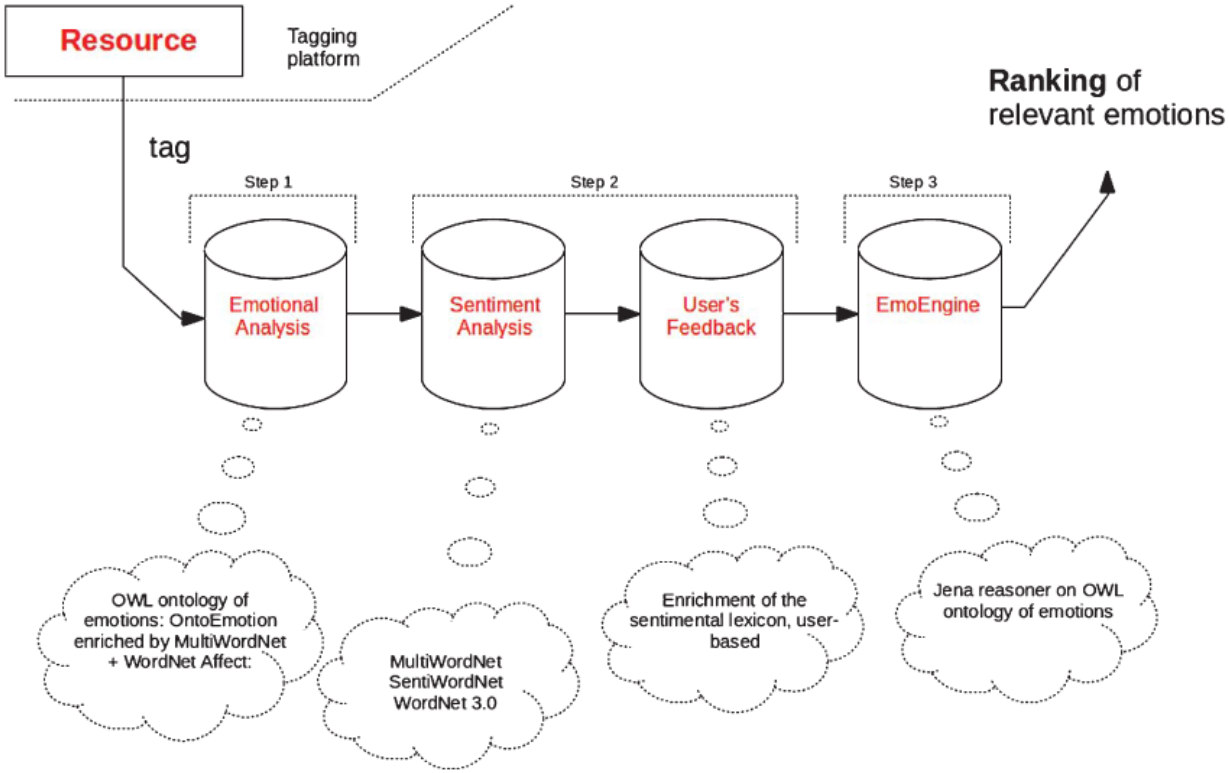


Fig. 1. ArsEmotica overall architecture.

ArsEmotica

- Overall architecture
  - Step2: Sentiment analysis and user's feedback

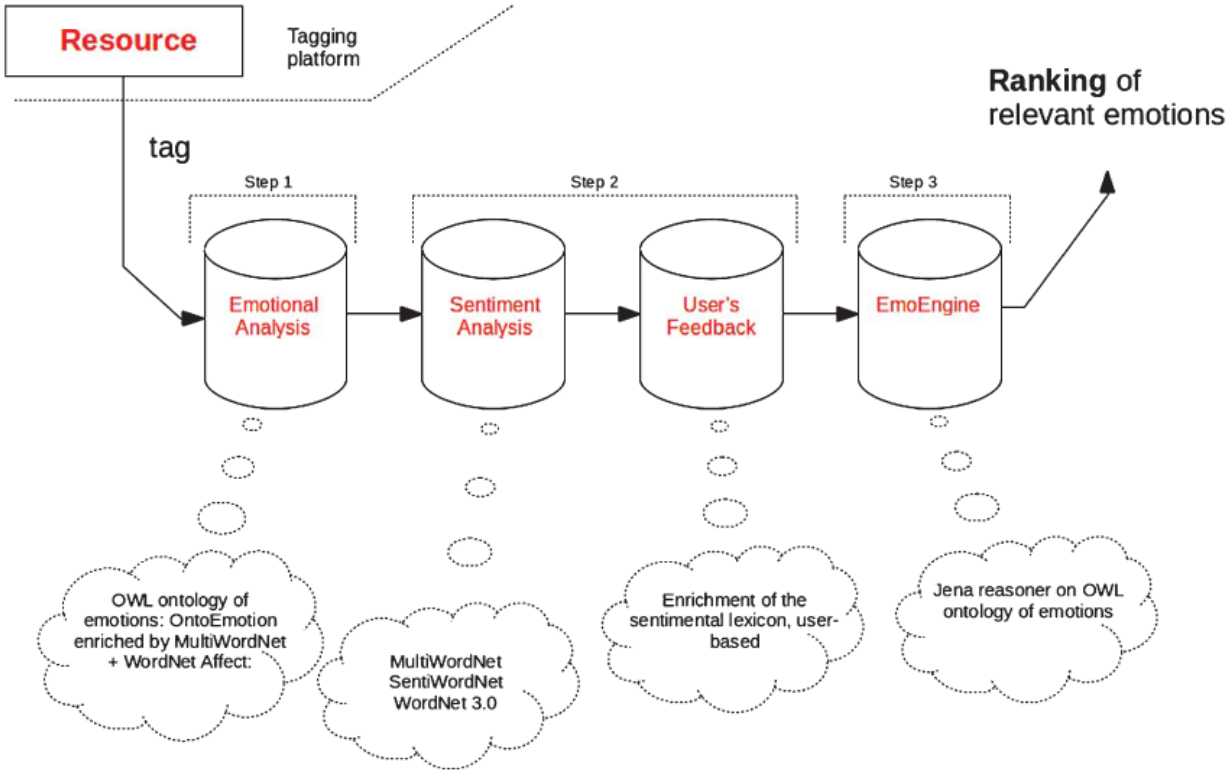


Fig. 1. ArsEmotica overall architecture.

ArsEmotica

- Overall architecture
  - Step3: Ranking of emotions

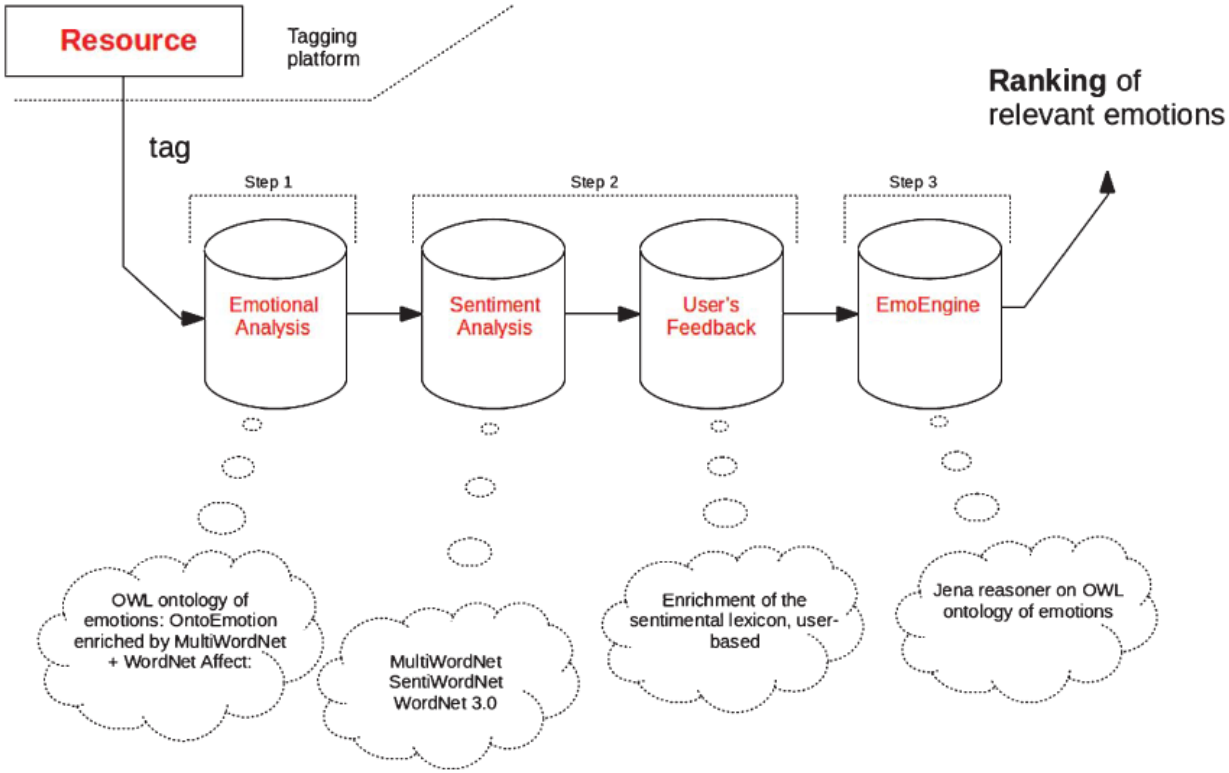
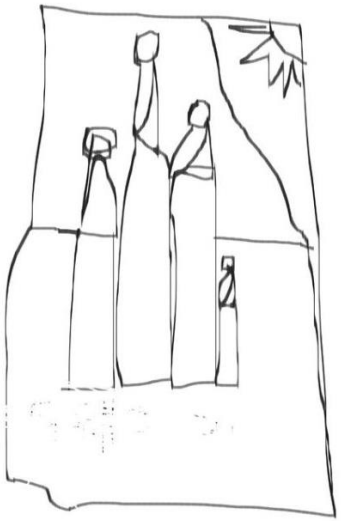


Fig. 1. ArsEmotica overall architecture.

ArsEmotica

- ArsMeteo (http://www.arsmeteo.org)
  - social platform
  - Italian art portal
  - have tagged artworks



Tag			
	disegno	famiglia	sole
	bellezza_della_semplicità	insieme	

ArsEmotica

- Architecture details
  - Step1: Checking tags against the ontology of emotions
    - if the tags are directly referring to some emotional categories
    - *OntoEmotion*
      A. emotional ontology, including 87 emotional concepts
      B. EnglishWord and SpanishWord
    - uses MultiWordNet, WordNet, and WordNet-Affect

Table 1
Emotional concepts organized by levels according to the OntoEmotion hierarchy [9]

Levels	Emotions
L1	Anger, Fear, Happiness, Sadness, Surprise
L2	Agitation, Annoyance, Arrogant, Displeasure, Envy, Fury, Hate, Hostility, Indignation, Rancour, Sulking, Alarm, Anxiety, Apprehension, Consternation, Courage, Distress, Dread, Fright, Horror, Panic, Paranoia, Phobia, Trepidation, Worry, Admiration, Affection, Ecstasy, Enthusiasm, Euphoria, Fascination, Glee, Gloating, Gratification, Hope, Jubilation, Pleasure, Relief, Satisfaction, Solidarity, Sympathy, Boredom, Contempt, Depression, Desolation, Disappointment, Discouragement, Gloom, Humiliation, Hurt, Indecisiveness, Nostalgia, Powerlessness, Regret, Rejection, Amazement, Intrigue
L3	Frustration, Grief, Terror, Care_for, Compassion, Liking, Excitement, Obsession, Pride, Apathy, Impatience, Despair, Confusion, Helplessness, Remorse, Disgust
L4	Attraction, Love, Lust, Shame
L5	Adoring, Passion, Arousal, Desire
L6	Infatuation

ArsEmotica

- Architecture details
  - Step2: Sentiment analysis and user's feedback
    - from an Italian word
    - to Italian lemmas, to English Lemmas
    - to Synset of English Lemmas to (*t, e, s*)

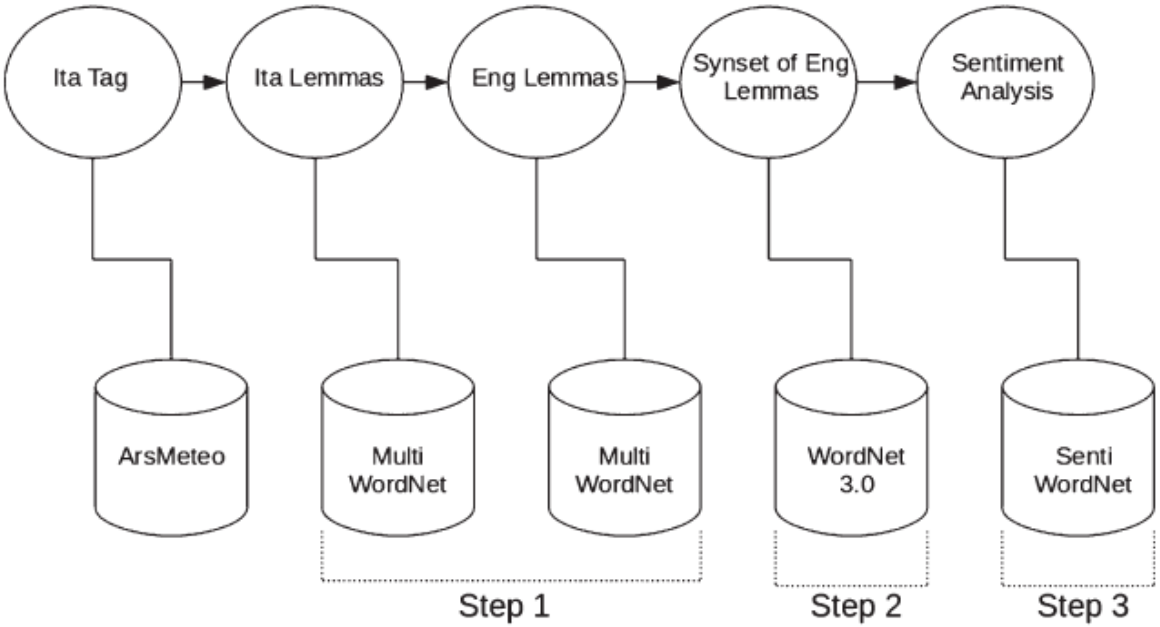
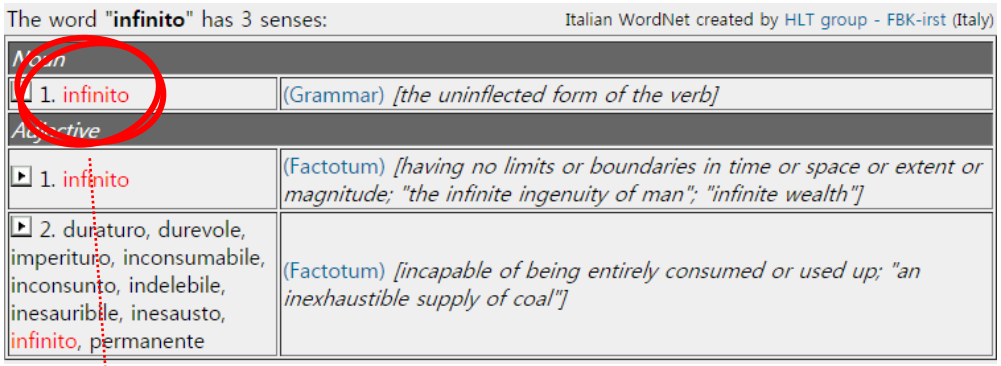


Fig. 2. Steps of the sentiment analysis on tags.

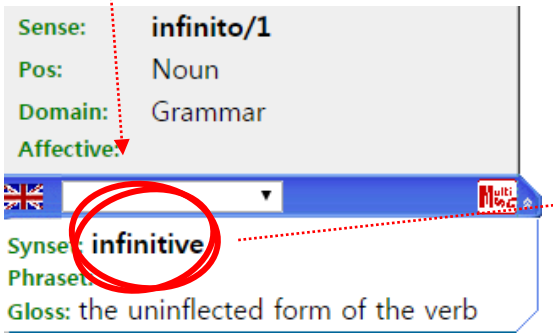
ArsEmotica

- Architecture details
  - Step2: Sentiment analysis and user's feedback
  - Potentially affective tags
    - Example of *infinito*



The word "**infinito**" has 3 senses: Italian WordNet created by HLT group - FBK-irst (Italy)

Noun	
1. infinito	(Grammar) *[the uninflected form of the verb]*
Adjective	
1. infinito	(Factotum) *[having no limits or boundaries in time or space or extent or magnitude; "the infinite ingenuity of man"; "infinite wealth"]*
2. duraturo, durevole, imperituro, inconsumabile, inconsunto, indelebile, inesauribile, inesausto, infinito, permanente	(Factotum) *[incapable of being entirely consumed or used up; "an inexhaustible supply of coal"]*



- (*infinite: 00028651*), Pos(s): 0, Neg(s): 0;
- (*infinite: 01007354*), Pos(s): 0.125, Neg(s): 0.5;
- (*infinite: 01008745*), Pos(s): 0, Neg(s): 0;
- (*infinitive: 00301951*), Pos(s): 0, Neg(s): 0;
- (*inexhaustible: 00005718*), Pos(s): 0.25, Neg(s): 0.375;
- (*inexhaustible: 01008289*), Pos(s): 0.375, Neg(s): 0.25;

ArsEmotica

- Architecture details
  - Step2: Sentiment analysis and user's feedback
    - Users choose one or more emotions and specify strength value

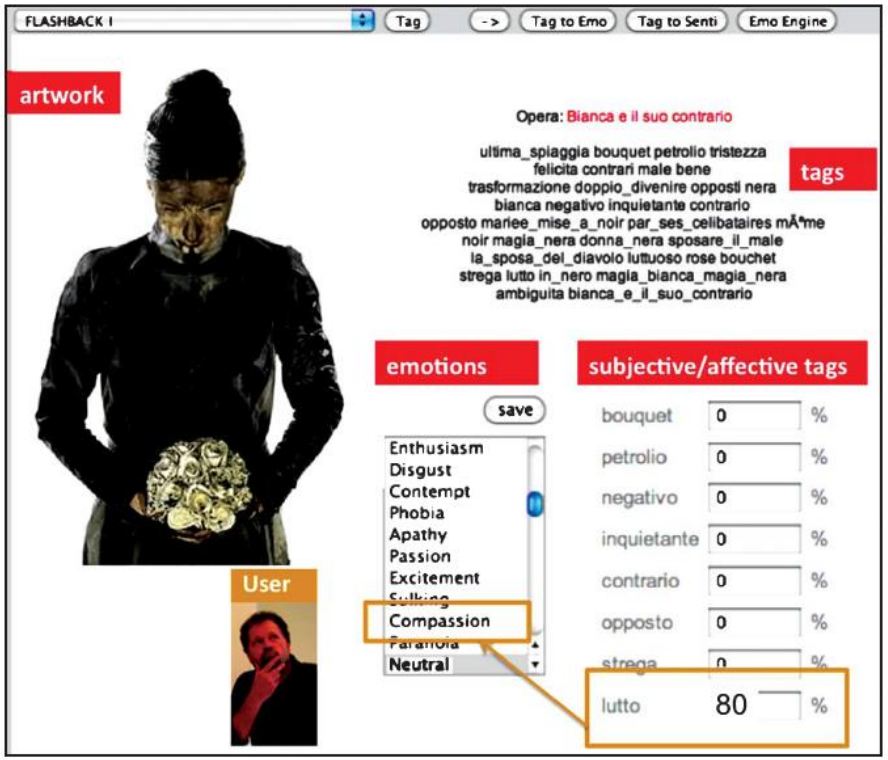


Fig. 4. User's feedback.

ArsEmotica

- Architecture details
  - Step1-2
    - in OntoEmotion
      A. 450 Italian emotional words referring to 87 emotional concepts
      B. these words' scores are 100
    - by users' feedback
      A. scores can be less than 100
    - both scores are saved in a set of triples (*t*,*e*,*s*)

Table 2
Tabular representation of (t, e, s)

	Emo_1	Emo_2	...	Emo_n
Tag_1	s_{11}	s_{12}	...	s_{1n}
Tag_2	s_{21}	s_{22}	...	s_{2n}
...	...	...	...	...
Tag_n	s_{n1}	s_{n2}	...	s_{nn}

ArsEmotica

- Architecture details
  - Step3: Ranking of emotions

Analisi completa.
tristezza, [Sadness]
felicita, [Happiness]
male, [Hurt, Distress]
bene, [Affection, Love]

(*felicita'*, *Happiness*, 100)
(*tristezza*, *Sadness*, 100)
(*male*, *Hurt*, 50)
(*male*, *Distress*, 50)
(*bene*, *Love*, 50)
(*bene*, *Affection*, 50)

ArsEmotica

- Architecture details
  - Step3: Ranking of emotions

(*felicita'*, *Happiness*, 100)
(*tristezza*, *Sadness*, 100)
(*male*, *Hurt*, 50)
(*male*, *Distress*, 50)
(*bene*, *Love*, 50)
\+ (*bene*, *Affection*, 50)

sum : 400

Table 3
Emotions extracted from "Bianca e il suo contrario" divided in layers

Layer 1	Happiness (25%)	Sadness (25%)
Layer 2	Affection (12.50%)	Distress (12.50%)
	Hurt (12.50%)	
Layer 4	Love (12.50%)	

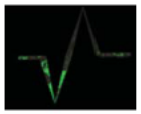
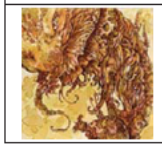
Table 4
Final table that allows identifying the prevalent emotions

Layer 1	*Happiness (50%)*	Sadness (37.50%)
Layer 2	Affection (25%)	Distress (12.50%)
	Hurt (12.50%)	
Layer 4	Love (12.50%)	

ArsEmotica

- Evaluation
  - on step 1
    - 285 users and randomly selected 38 artworks
    - corpus generated 44 different emotions
    - two questions
      A. artwork to emotions
      B. emotion to artworks

Table 5
Some examples of artworks and the emotions they raise, identified by the tag analysis

Artwork	Title and artist	tag [Emotions]
	*Bianca e il suo contrario* by *M. Migliora*	"tristezza" [Sadness (L1, 50%)] "felicità" [Happiness (L1, 37.50%)] "male" [Distress (L2, 12.50%), Hurt (L2, 12.50%)] "bene" [Love (L4, 12.50%), Affection (L2, 25%)]
	*Forse un giorno arriveranno al mare* by *C. Guasti*	"desiderio" [Desire (L5, 33.33%)] "stupore" [Amazement (L2, 33.33%)] "paura" [Fear (L1, 33.33%)]
	*Da lontano il suono* by *S. Minniti*	"ossessione" [Obsession (L3, 33.33%)] "angoscia" [Apprehension (L2, 8.25%), Trepidation (L2, 8.25%), Anxiety (L2, 8.25%), Worry (L2, 8.25%)] "nostalgia" [Nostalgia (L2, 33.33%)]
	*Angry Germ* by *A. Caligaris Cappio*	"ira" [Anger (L1, 50%)] "furioso" [Fury (L2, 50%)]

ArsEmotica

- Evaluation
  - on step 1
    - 35% of the users answered
    - results show a clear correlation[1]

	Overall Replies		
	#concordant	#total	%concordant
*Q*1	352	495	71.11%
*Q*2	347	495	70.10%

Table 1 The table reports the total number of concordant replies, the total number of answers (both without dividing them per artwork) and the percentages of the former w.r.t. the latter.

1. M. Baldoni, C. Baroglio, V. Patti, and C. Schifanella. Sentiment Analysis in the Planet Art: a Case Study in the Social Semantic Web. Technical Report RT 141/2012, Dipartimento di Informatica, Università degli Studi di Torino, 2012.

Conclusion and Future Work

- Conclusion
  - extracts prevalent emotions from tags
    - by combining lexicons and libraries (already available)
  - set of tuples collected are interesting corpus
    - emotions on twin towers (before/after “September, 11”)

- Future work
  - applying word-similarity algorithms
  - processing composite tags
  - varying output depending on context
  - emotion-aware search engine
  - emotional tag clouds