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ItVENSES - A Symbolic System for Aspect-Based Sentiment Analysis

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Abstract

English. ItVENSES is a system for syntactic and semantic processing that is based on the parser for Italian called ItGetaruns to analyse each sentence. ItVenses receives the output of ItGetaruns and decides which terms may be used as keywords or features for aspect identification. This is done at first by a simple lookup in a list created on the basis of a quantitative analysis of the training corpus. The result is sifted by activating a set of syntactic and semantic SIEVES that act upon the output constituency structure, the lemmatized and classified list of words, the predicate-argument structure(s) of the sentence. After this step, the aspect(s) associated to each sentence are enriched by the sentiment and polarity components computed on the output of ItGetaruns. Finally negation, factuality and subjectivity are considered in relation to each aspect. Results have been at first fairly low – 61% F1-score –, but after a series of ablation experiments two components of the algorithm have been reduced and the evaluation has suddenly soared reaching 83% F1-score, a value close to the one obtained for training data.

Italiano. *ItVENSES è un sistema per analisi sintattico-semantico basato sul parser per l'italiano chiamato ItGetaruns per analizzare ogni frase. ItVenses riceve l'output di ItGetaruns e decide quali termini possono essere usati come feature o semi per identificare l'aspetto. Questo passo viene compiuto dapprima con una semplice operazione di lookup in una lista creata precedentemente sulla base di un'analisi quantitativa del corpus di*

training. Il risultato viene quindi vagliato attivando un insieme di filtri che agiscono sulla costituzione sintattica, la lista lemmatizzata e classificata delle parole e le strutture predicato-argomentali della frase. Dopo questo passaggio, l'aspetto associato a ciascuna frase viene arricchito dalle componenti di polarità e sentiment calcolate sull'output di ItGetaruns. Infine, vengono considerate negazione, fattualità e soggettività in relazione a ciascun aspetto. I risultati sono stati dapprima alquanto bassi – attorno al 61% di F1, ma successivamente, dopo aver eseguito una serie di esperimenti di sottrazione in cui sono stati ridotti due componenti dell'algoritmo, la valutazione ha improvvisamente avuto un'impennata raggiungendo l'83% di F1, valore simile a quello ottenuto per il training corpus.

1 Introduction

In this paper we present work carried out to analyze aspect and polarity in a corpus of Italian tweets collected and annotated at the University of Turin (Basile et al. (2018)). The final system produced is fully symbolic, is made up by different modules and takes advantage of previous work for similar challenges presented at Clic-It 2014 (Delmonte (2014b)). In particular, the underlying parser for the semantic analysis of each text provides a full processing pipeline including tokenization, multiwords creation, morpho-syntactic analysis, POS tagging, Named Entity Detection, chunking and finally, extraction of dependency relations such as subject, object and modifiers. It also provides for pronominal binding and coreference resolution, and propositional level semantics related to negation, factuality and subjectivity. In the sections below we present in detail the method

ESSERE and marked the first noun phrase as Subject to be able to compute propositional level semantics. At semantic and pragmatic level, specific words acquire a meaning determined by the context: consider the adjective “piccolo” which is only used to mark negative polarity when predicative and as a modifier when attributive, together with a number of downtoners like “poco”, as in the example below:

(3) 1240348699;1;1;0;1;0;1;0;0;0;0;0;0;0;0;
0;0;0;0;0;0;0;0;0;"Stanza piccola ma
pulita."

The problem in this case is represented by the implicit presence of "stanza" in the elliptical portion of the text preceded by the adversative marker "ma" which allows exclusive reference. Consider also example (4),

(4) 1240350017;0;0;0;0;0;0;1;0;1;1;1;0;0;0;0;0;0;0;0;0;0;0;0;0;"Qualche difficoltà col parcheggio nonostante la disponibilità del personale"

- where aspect feature terms are not the most relevant items, syntactically and semantically speaking, but are included as modifiers in a noun phrase ("del personale") or are treated as adjuncts prepositional phrases ("col parcheggio"). Inclusive semantic interpretation is associated to examples like (5) below,

(5) 1240347398;0;0;0;0;0;0;0;0;0;0;0;0;0;
0;0;0;1;1;1;0;0;"La posizione della
struttura è un po' fuori dal centro, ma
in compenso è vicina al capolinea degli
autobus"

- There are also idiomatic expressions which are taken into consideration and computed from PAS, as for instance "lasciare a desiderare", meaning "being insufficient" rather than its literal meaning "leave to desire"².

(6) 1240347831;1;0;1;0;0;0;0;0;0;0;0;0;0;0;
0;0;0;0;0;0;0;0;0;"La pulizia lascia a
desiderare per un hotel da 4 stelle."

²or in the example below where, however, the annotated aspect has been wrongly marked as “other” in slot 8: as will be shown in a section below, “palazzo”, “struttura” and “hotel” have both been usually associated to location, slot 7. (7) 1240351211;0;1;0;1;“il palazzo dove è posta la struttura e l’accesso dalla via lascia un po’ a desiderare; tutto sembra ma non un hotel.”

ItVenses, the algorithm for aspect classification and sentiment analysis – we took part in SENTIPOOLC, (see Basile et al. (2014)) - takes as input the previous analysis and input files, including a list of all entities fully semantically classified and a list of all PAS with up to 4 arguments/adjuncts. Every PAS is preceded by one among three possible labels: a label NEG for negation (including negative sentiment of the lexical predicate), a label OPNSG for subjective propositions, and UNREAL for nonfactual ones; in addition to a label for speech act, STATEMENT, EXCLAMATIVE or QUESTION.

Seeds or features present in each text are searched both at word and lemma level. This is done at first by a simple look-up operation which matches each token and corresponding lemma in the text with the list of possible seeds created by a quantitative analysis of the training corpus. In fact, this list only includes most frequent terms found and collected – amounting to 300. To reinforce this match, synonyms are added when present again by matching with the synonyms lexicon available in ItGetaruns. This was done in view of the need to enlarge the number of features to make available for the test corpus, as well as to generalize the procedure. No such lists exist for polarity items which are searched for and matched with the lexica available in ItGetaruns³

³The list has been derived - checking and re-elaborating the data - from a number of previous lexica as for instance the one by Esuli and Sebastiani (2006).

(7) 1240344222;0;0;0;0;0;1;0;1;0;0;0;0;0;0;0;0;0;0;0;0;0;0;0;"In bagno 1 solo schampo e 1 solo bagno doccia per 2 persone."

(8) 1240347807;1;1;0;1;1;0;0;0;0;0;0;0;0;0;
0;0;0;0;0;0;0;0;"Pulita, spaziosa e soprattutto funzionale."

(9) 1240345322;0;0;0;0;0;1;0;1;0;0;0;0;0;0;0;0;0;0;0;1;0;1;"Molti gradini 93 Ascensore piccolo."

⁴But in (9) the annotation is not consistent: both "scala" and "ascensore" are mainly annotated with aspect 2, rather than aspect 3 present here. None of them apart for a small number of cases are annotated with 8, "Other".

(11) 1240344015;0;0;0;1;1;0;1;1;0;1;1;0;1;1;0;
0;0;0;0;0;0;0;0;"tutto molto bello e
professionale"

(12) 1240345792;0;0;0;0;0;0;0;0;0;0;0;0;
0;0;0;0;0;0;1;1;0;"Mi è piaciuto pratica-
mente tutto."

(13) 1240344497;1;1;0;1;1;0;1;1;0;1;1;0;1;1;0;1;1;0;1;1;0;1;1;0;"Mi è piaciuto tutto"

(14) 1240345153;0;0;0;0;0;0;0;0;0;0;0;0;
0;0;0;0;0;0;1;1;0;"Non c'è niente che
non mi è piaciuto."

(15) 1240344698;0;0;0;0;0;1;0;1;0;0;0;0;0;0;0;0;0;0;0;0;0;"Tuttavia sarebbe comodo un servizio navetta per il centro città soprattutto la sera."

Telling seeds or features from terms is the difficult part of the task of aspect identification which is done here on the basis of preferences. Preferences have been partly determined by the quantitative analysis of the training corpus. After tagging and lemmatizing each word or term contained in each review text, we associated the numerical value/s of the aspect/s present in the annotation for the

Aspect	2	3	4	7
Frequency	10623	8386	5488	5927

Multiple aspect annotation for the same text amounts to 8974 and they are mainly made by Doubles, then Triples, and finally Quadruples, and Quintuples. There are a few cases of empty evaluation⁵, and also a few cases of all slots

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filled up – see below. Going back now to the question of uniformity of annotation and/or consistency of aspect/feature association, organizers have computed the usual inter-annotator agreement per class and reported a lower boundary of 85% of agreed sentences. However, we note the following situation: if all unique aspect identifiers in texts were consistently assigned to the same term or seed, then there would be no ambiguity and the algorithm would be easily working. But even unique identifiers do not show such persistence.⁶ Most persistent seeds are the following ones in a graded scale order in list (1): WIFI, POSIZIONE, PERSONALE, STAZIONE, STAFF, CENTRO, PULIZIA; and in a lesser degree in list (2): METRO, PARCHEGGIO, DOC-CIA, PREZZO. All these seeds have a persistence ratio respectively over 90% - the first list - and over 80%, the second list. In Table 3 we report some of the remaining high frequency seeds, where percentages in column three register the ratio between total of occurrences of the seed with respect to majority class; and in column four, the ratio between majority class and unique aspect identifiers. These seeds have a much lower level of persistence – well below 80% -, "struttura" being the lowest. A low level of persistence indicates the fact that, for instance, the seed "struttura" has been associated to a great variety of aspect class markers of which two are however paramount, and are marked in column two, with aspect 8 (Other) the most frequent, and aspect 2 (comfort), the less frequent. In two cases, we have high val-

⁶This may be simply due to the fact that a given seed may be less "relevant" than another present in the same text. Some examples below:

(17) 1240343916;0;0;0;0;0;0;0;1;1;0;0;0;0;0;0;0;0;0;0;0;0;0;0;0;0;"La vasta camera ed il bagno confortevole, il servizio WIFI e la piacevole colazione"

ues associated with column 4, for "rapporto" and "materasso" indicating that these two seeds when found in unique aspect texts, have always or almost always persisted in the same annotated aspect marker.

Table 2: 19 less persistent majority class aspect seeds

5 Results and Discussion

synonym search for both aspect feature items and polarity items we discovered that a fully different result has been obtained and from the evaluation algorithm it was by far the best result – see Table 5 - in line with what we obtained in training data, which we report here below in Table 4.

Tasks/Results	ACD	ACP
Macro-Precis	0.8414	0.7705
Macro-Recall	0.8493	0.7916
Macro-F1score	0.8453	0.7809
Micro-Precis	0.8074	0.7076
Micro-Recall	0.8290	0.7766
Micro-F1score	0.8181	0.7405

Table 3: Results for Training Dataset

We discovered later on that that was due to a redundancy at a semantic level caused by polysemous synonyms present in our dictionary and used to enrich the list derived from training data. In developing the system with training data, we extracted synonym lists in order to adapt and contextualize them to the domain. Consider an important and frequent seed like POSIZIONE: it has a set of five different meanings in IWN (ItalianWordNet), (see Roventini et al. (2000)) which are then reflected in the extension of synonym lists covering all of them. So what we did was creating sublists adapted and limited to our domain. However, when we turned to analyse test data we decided to tune the seeds we regarded semantically unique, to the synonym lists without any previous adjustment. The result was a dramatic drop in performance when compared to training data.

Tasks/Results	ACD Run1	ACP Run1	ACD Run2	ACP Run2
Macro-P	0.5887	0.5277	0.5856	0.5241
Macro-R	0.6089	0.5661	0.6140	0.5699
Macro-F1	0.5986	0.5463	0.5994	0.5461
Micro-P	0.6232	0.5209	0.6164	0.5144
Micro-R	0.6093	0.5659	0.6134	0.5692
Micro-F1	0.6162	0.5425	0.6149	0.5404

Table 4: Published Results for Test Dataset

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Tasks/Results	ACD Run1	ACP Run1	ACD Run2	ACP Run2
Macro-P	0.8222	0.7590	0.8258	0.7603
Macro-R	0.8458	0.7932	0.8564	0.8009
Macro-F1	0.8339	0.7757	0.8408	0.7801
Micro-P	0.7975	0.7033	0.7951	0.6986
Micro-R	0.8348	0.7880	0.8430	0.7938
Micro-F1	0.8157	0.7432	0.8183	0.7431

Table 5: Results for Test Dataset after Ablation Experiments

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APPENDIX

English Translation of all Italian examples in the paper

- (1) cake/twisted, table, stop, plant, teaches/sign
- (2) luggage storage, bed room, socket, fiscal receipt, breakfast room, historical center
- (3) Small room but clean
- (4) Some difficulties with parking notwithstanding staff helpfulness
- (5) The position of the structure is a little out of the center, but in return it is close to the main bus stops
- (6) Cleaning has a lot to be desired for a 4 star hotel
- (7) In the bathroom only 1 schampoo and only 1 shower gel for 2 people
- (8) Clean, spacious and what's more functional
- (9) Many steps 93 lift small
- (10) nothing to complain; all perfect
- (11) all very nice and professional
- (12) I liked practically all
- (13) I liked all
- (14) There is nothing that I didn't like
- (15) However, a shuttle service for the city center would be convenient especially in the evening
- (16) Great position, hotel in remaking this is why there's care for modernizing, great breakfast, fabulous wifi internet I made a video call with no problems and I was in my room, room and bath very spacious, gentle staff
- (17) The large room and the comfortable bath, the WIFI service and the pleasant breakfast
 - (i) Definitely better the deluxe one that I have already taken other times and at lower costs
 - (ii) At 9 45 breakfast was rather scarce for the price of 15 Euros