

# Introducing Argumentation in Opinion Analysis: Language and Reasoning Challenges

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## Abstract

This paper concentrates on pairing opinion analysis with argument extraction in order to identify why opinions about a certain feature are positive or negative. The objective is to have a better grasp at the underlying elements that support the analysis. In a second stage, given customer recommendations, the goal is to identify the preferences or priorities of customers, e.g. fares over welcome attitude. This induces customers value systems. Finally, we give elements of the implementation based on the <TextCoop> platform, dedicated to discourse analysis.

## 1 Introduction

Nowadays, there is an increasing need for an opinion analysis tool. While politicians may find it useful to analyze the popularity of new proposals or the overall public reaction to certain events, companies are definitely interested in consumer attitudes towards a product and the reasons and motivations of these attitudes. It is therefore essential to accurately and quickly analyze opinion intensity on a particular object. In addition to finding a quantitative and qualitative rating, it provides different information on the object like the most important features for people and the weaknesses of the object. The conjunction of efforts in language processing and artificial intelligence is a new promising way to address the problem. Argument analysis (Walton et al. 2008), (Reed, 1998) is a central challenge that has seldom been carried out in such a framework in particular paired with opinion analysis, where the semantics of evaluative expressions remains by large an open issue. The introduction of domain or common-sense knowledge (Breck et al. 2004) for the interpretation of these expressions is also an open issue.

In order to be able to analyze opinion, besides the language processing aspects and semantic interpretation challenges, we need to define efficient models for aggregating the different opinions reported on the web (Ashley et al. 2002), (Amgoud et al. 2005). We will take advantage of existing works in social choice theory, namely on judgment aggregation. The output would be a final rating of the object as well as a global rating of each feature and a list of key features. The main difficulty will be the choice of the aggregation function. Different kinds of simulations can also be made, in particular in order to know which feature(s) should be improved in order to alter the global rating of an object (Amgoud et al. 2001) (Keil, 2000) (Pollock 1974). Finally, we may help a user to get an opinion on an object. The idea is to ask the user to give her preferences on the set of features, then using an efficient multiple-criteria decision system, we could give an appropriate recommendation.

In this paper we first address the language point of view focusing on argument identification and extraction. Then, we introduce the main formal aspects of an aggregation system that allows to efficiently and accurately compute opinion values and their arguments, as found in various texts. The project is now in a development stage, implemented within the <TextCoop> platform and the Dislog language (under submission).

## 2 The global situation of opinion analysis

The current stage of opinion analysis is somewhat more oriented towards the analysis of short texts: blogs, in particular consumer blogs, news editorials or short news messages. This requires a more accurate linguistic analysis. A smaller amount of texts is then necessary, allowing opinions to be elaborated for a larger variety of topics. The assumption is to consider that the products or persons being evaluated can be qualified by means of a few salient predefined properties or attributes.

These properties may however be more or less independent from each other, salience is another important feature, which may depend on the text author. For example, for a political person: honesty, rigor, friendliness, capacity to listen to people, etc. For a hotel, welcome attitude, cleanliness, calm, fares, proximity of restaurants or attractions, quality of breakfast, etc. are salient properties from the consumer point of view. These properties may not correspond to the most salient ones from the product provider point of view: e.g., fares become profit.

In terms of argumentation, a statement in the hotel domain such as *very friendly welcome* can be interpreted as: *This hotel is good because the staff is very friendly*, or: *welcome is good because it is very friendly*. The argument is organized as follows: *this hotel is good* is the conclusion, while *because the staff is very friendly* is its support. The conclusion can also be attacked by other statements which are negatively oriented: ... *but it is really noisy because of heavy air traffic*. In fact, the conclusion summarizes the general feeling or recommendation of the customer, this conclusion being supported or attacked by various statements. The conclusion orientation w.r.t. its attacks and supports reveal the customer preferences and priorities: in our example, the hotel is good even if it is noisy: welcome has a higher priority over noise.

Product description in newspapers or technical brochures abound in product descriptions based on e.g. charts of properties with yes/no indications or marks. Using these properties in opinion analysis results, in general, in an analysis of the opinion per attribute, based on an a priori classification of adjectives or closely related evaluative expressions identified as having a positive or a negative orientation. While this obviously constitutes a major progress w.r.t. the previous stage, the results remain quite limited. In particular:

- properties are not necessarily independent from each other; dependencies may be difficult to identify, and their impact on opinion cohesion difficult to establish (Redeker 1990) (Miltasaki et al. 2004),
- a number of texts abound in evaluative expressions with very rich forms, including metaphors, which need grammatical elaborations and an accurate semantic interpretation,
- some evaluative elements are very much domain and property dependent (Potts 2007), for example

*high* is either positive or negative depending on the objects it applies to and possibly the point of view: *high salary* versus *high taxes*. Accurate and contextually constrained lexical resources are necessary to avoid misinterpretations,

- we observed incorporation phenomena where the attribute and its evaluation are merged into a single term (*mal assis (uncomfortable seats), bon marché (cheap)*),

- we also observed a number of situations where the evaluation is given without any explicit mention of the evaluated property, because in general that property is easy to infer for a standard reader,

- finally, we noted that a number of discourse structures can be interpreted as evaluative forms. For example, giving a list of close-by touristic attractions for a hotel indicates that it is well-located for tourists, even though this is not explicitly said.

### 3 Identifying the motivations of an opinion

While the results produced by this second stage are of much interest and can produce accurate opinion analysis, e.g. taking into account temporal aspects for opinion evolution analysis, one of the main limitations is that there is no 'deep' analysis behind the satisfaction or dissatisfaction rates that would indicate *why* consumers are happy, unhappy with, approve or disapprove a certain political or economical decision. Such an analysis would also, in the long term, allow to induce some of the main priorities or preferences of consumers. This involves a deeper semantic interpretation of evaluative expressions and some discourse analysis following e.g. (Marcu 1997), (Saito et al. 2006).

A closer analysis of the expression of opinions, in e.g. consumer blogs, allow a deeper analysis of the pair property - value. The property is in general expressed by a short natural language expression (e.g. a noun or an event). This is the head of the structure: it 'subcategorizes' for an evaluative expression and, since it conveys the context, it gives the evaluative expression its interpretation in context. The evaluative expression, which can be very complex, contains itself its own head term, often an adjective, which may be modified by several types of constructions. In general, the formulation of the opinion has the following abstract form:

*property - evaluative expression.*

The evaluative expression is often a complex se-

semantic structure that integrates in one or a few words several aspects:

- a positive or negative orientation (Cheng et al. 2008) (Kim et al. 2007) (Takamura et al. 2005),
- the strength of that orientation, which may be elaborated via composition, from the various elements of the expression,
- an implicit qualification of the orientation, which is often very rich (for example *cheap fares* and *competitive fares* do not convey exactly the same meaning)
- various circumstances, realized e.g. by discourse structure(s), e.g. an illustration, which may also be interpreted as an argument,
- a number of arguments which are often incorporated into the main evaluative term.

We argue that interpreting arguments in opinion texts allows to identify why consumers like or dislike a product, a political decision, etc. and to determine, more generally, classes of values or preferences. Identifying arguments and value systems is therefore a major step in opinion analysis. For example, in a hotel, a result could be that fares and breakfast are more crucial than the room design.

In the remainder of this section, we develop a few prototypical cases of argument realization in consumer blogs. Our investigations have been conducted on French; English glosses are given for the sake of readability, however it must be noted that English structures may be quite different. Our corpora include opinions blogs on hotels, restaurants, hifi products and banking products.

If we consider consumer blogs from a global point of view, we note that they are in general short, well-written, with a direct style, and a clear aim of being explicit and accessible to a majority of readers. In most cases a few anecdotes illustrate the evaluation. A consumer blog ends (or begins) by a recommendation statement, that summarizes the overall feeling about the product or person at stake, in text form or by means of icons, e.g. a number of stars.

### 3.1 Adjectival incorporation of arguments

The theory of incorporation (Baker 1988) postulates a prelexical level, language independent, where the different 'facets' of a concept receive

a kind of conceptual realization, which is not yet lexical. Then, given a language, this concept receives one or more language (lexical) realizations where some of these facets are no longer linguistically realized for various reasons. By lexical realizations we mean a single word as well as an expression.

We postulate that most of the adjectives found in evaluative expressions, besides their polarity and strength, incorporate semantic features which can be interpreted as arguments in the opinion analysis domain because they explain the polarity and the strength. For example, an expression in the hotel domain such as:

*acceuil familial* (English gloss: you are welcome as a family member) has the following features:

- positive orientation, strength: high,
- incorporated argument, with the probable interpretation: 'because the owners behave as if you were from their family'.

Obviously, the term 'family' could then be interpreted in a number of ways, but we do not need at this stage to go much further.

The extraction of the incorporated meaning, interpreted as an argument, raises major challenges in lexical semantics and lexical inference. In conceptual semantics, the semantics of an adjective is defined by either a set of features, in attribute value form, or, more or less equivalently, by a formula. Both modes of representations can be combined. In general, the semantics of the adjective is largely underspecified or higher order. Indeed the semantic interpretation largely depends on the semantics of the modified term, generally a noun. The full meaning is induced by a subtle combination of the semantics of both the adjective and the modified term. This means complex lexical developments even if some generalizations are possible. For example, *high* has almost an infinite number of senses that depends on the noun it combines with. Its basic meaning is simply e.g. 'performs better than average' applied to one or more properties of the noun.

Concerning the above example, 'familial' is a higher-order adjective which has the following representations:

- (1) Communication domain: (*acceuil familial*, *conversation familiale*, etc.) globally means a communication act realized as if you were a family member. The modified nouns are predicative, e.g. *conversation(X, Y)*, the semantic represen-

tation of the adjective can then be:

$behave(X, in - family - of(Y, X))$

assuming that 'behave' and 'in-family-of' are defined as primitive terms.

(2) Concrete objects domain: *repas familial* (family-style meal) means a meal that has properties such as: casual, home-made, good and abundant, etc. Meal is not predicative:  $meal(X)$ , it has at least two facets: contents and atmosphere. Atmosphere being of communication type, it is represented as above. Besides a list of features, the contents feature can be represented by a formula as follows:

$meal(X) \wedge food(Y) - of(Y, X) \wedge good(Y) \wedge abundant(Y)$ .

These small formulae (or their language paraphrase) constitute the arguments which can be extracted. These arguments support the evaluation provided by the customer by adding precise information to the polarity and strength. The main problem of this approach are feasibility and scalability. For a given domain, the number of adjectives used is in general relatively large, between 50 and 300. For each property, we observed an average of 40 adjectives with maximums around 90, including metaphorical uses and a large number of quasi-synonyms. This is obviously large. However, about 70% of the adjectives in a given domain are stable over all properties and have a fixed polarity and strength. About 10% have a variable polarity depending on the term they are combined with.

The last stage of the process is to construct a synthesis: given an entity (e.g. a hotel) and a property, and given a set of blogs, the challenge is to construct a synthesis of all the evaluative expressions which have been found. This synthesis is a set of arguments positively or negatively evaluating the property at stake, in other terms either supporting or attacking the statement 'property is good' or supporting or attacking each other.

### 3.2 Discourse relations as arguments

While the previous section requires local language analysis, which can be handled by local grammars, opinion analysis abound in statements which must be processed at discourse level. Reformulations, illustrations, elaborations (Mann et al. 1988) (Grosz et al. 1986) of various types abound with a rich linguistic structure, including emphasis and irony, with different argumentative

purposes. Elaborations tend to reinforce an evaluation via a more detailed analysis of the reasons why the evaluation is positive or negative (e.g. ..., *in other words, free wifi*).

*insonorisation élevée qui permet de se reposer après une dure journée de travail*

(a high soundproofing that allows you to have a rest after a long working day).

The property 'soundproofing' of the hotel gets a positive value, associated with an elaboration which does not elaborate the soundproofing but one of its advantages in the present context, giving additional weight to that property. Considering our corpora on hotels and on banking products, it seems to us that the level of argumentation introduced by the elaboration relation is rather modest.

Illustrations, which also abound in opinion texts, are much more interesting. In general, the structure is the following:

*property - polarity - illustration.*

The polarity is optional: *location: 5 mns from Capitole and 10 mns from the station.*

The illustration gives the strength of the evaluation, possibly its orientation if there is no explicit polarity, and an argument that supports it:

*well located (2 mns from the Capitole, 5 mns from Saint Sernin, close to the station, close to fancy restaurants, ...)*. The illustration is here between brackets, under the form of an enumeration of elements of interest for tourists. Language elements that indicate distance (in minutes or 'close' obviously need to be interpreted to get a positive or negative orientation). The illustration therefore explains why the hotel is well located (or not).

Identifying illustrations as arguments (and not just as mere enumerations) often requires domain knowledge. Touristic spots, food places and transportation facilities are identified as features of interest for tourists. The positive evaluation of the enumeration is induced e.g. from the spatial expressions that indicate proximity, which are, in our system, recognized by a local grammar. Proximity associated with touristic facilities is positively evaluated and constitutes an argument support. Besides the use of an ontology of the hotel domain and possibly touristic activity domain, inferential patterns that capture modes or strategies of evaluation are needed.

To further illustrate and generalize the above example, we developed a few, domain dependent, inferential schemas to identify illustrations which

behave as arguments. For example:

Room comfort (List of equipments in room): such a list indicates the level of comfort of the room: the evaluation is based on the level and amount of relevant room facilities.

Breakfast (List of food elements): such a list also indicates the quality of the breakfast. The evaluation is based on the proposed items, their originality, variety, etc. If the list is negative (e.g. no fruit juice, no pastries), then the polarity of the evaluation is inverted.

At the moment these remain quite basic. More corpus analysis should lead to the elaboration of higher level inferential patterns, but this is outside the scope of the present paper. The task is to investigate generalizations which would be domain independent that would capture generic uses of illustrations as an argument.

#### 4 The lexicon of opinion analysis

Besides domain specific terms, in particular nouns denoting properties, we have categorized the different lexical units that structure evaluative expressions from the point of view of their polarity and strength in the domain of news editorial analysis (Bal and Saint-Dizier, 2008). The case of opinion analysis is relatively similar, with features which are much less prominent such as propositional attitudes or report verb semantics and pragmatics.

First, a polarity and strength lexicon of evaluative expressions (adjectives and other expressions) has been designed. For each expression, the following features are mentioned: syntactic category, polarity: which may be general or attribute dependent, in this latter case, polarity is coded by a pair (attribute name, polarity), this level also captures metaphorical uses, and strength (or persuasion force): which seems to be rather stable over domains.

Next, our lexicon contains pre-modifier terms which are basically adverbs of intensity (*very, somewhat, quite, etc.*). About 55 such adverbs have been identified for French. Their orientation is described as a binary feature: increase or decrease. Then, we have identified three classes of intensifiers which have a kind of modal meaning: (1) emphasizeers, with the following subclasses: Really (truly, genuinely, actually), Simply (merely, just, only, plainly), For sure (surely, certainly, sure, for certain, sure enough, undoubt-

edly), Of course (naturally); (2) amplifiers, with the following subclasses: Completely (all, altogether, entirely, totally, whole, wholly), Absolutely (totally and definitely, without question, perfectly, utterly), Heartily (cordially, warmly, with gusto and without reservation); (3) downtoners: Kind of (sort of, kind a, rather, to some extent, almost, all but), Mildly (gently).

Finally, a modal verb lexicon of those verbs that occur to soften opinions or make them relative to a certain view, introduces notions such as possibility, advice or necessity: *can, could, may, might, should, etc.*. These various lexical structures are associated with several local grammars as described above which are designed to recognize the structure of evaluative expressions be they basic (single adjective) or more complex (conjunction of terms, use of adverbs, etc.). Strength and polarity are compositionally computed from the terms that constitute the evaluation.

#### 5 A formal framework for analyzing opinions

In this section, we propose a formal framework for modeling opinion analysis that can accommodate the previous observations. We consider a particular object (called target) on which some people have given their opinions. An opinion is generally given as a global rating on the object, and values associated with its attributes, and a set of arguments supporting this rating. Arguments highlight the positive (or the negative) features of the object on which the opinion is expressed. Let us consider the following opinion expressed on a digital camera: *It is a great digital camera for this century. The rotatable lens is great. It's very easy to use, and has fast response from the shutter. The LCD has increased from 1.5 to 1.8, which gives bigger view. But, it would be better if the model is designed for smaller size. I recommend this camera.*

The object here is the digital camera, the overall rating is “recommended”, while the features are: the size, rotatable lens, response from the shutter, size of LCD. For instance, “it’s easy to use” belongs to the arguments *pros* the digital camera while “it would be better if the model is designed for smaller size” is an argument against (or belongs to the *cons*) the camera.

Hence, we face a decision problem, namely, given an object  $O$  and information about  $O$  we should decide if this object should be recom-

mended or not. We propose the following definitions in order to be able to deal with this particular decision problem.

**Definition 1** (Recommendation domain). *A recommendation domain,  $RD$ , is a set that should contain at least two values representing the decision to recommend and not to recommend a given object.*

**Example 1.** *Recommendation domains can be either a boolean set  $\{YES, NO\}$ , or a set of qualitative decision values  $\{x_1, \dots, x_k\}$  or a continuous interval  $[0, 1]$ , where 0 represents “not recommended” and 1 represents “recommended”.*

We propose the following framework in order to aggregate opinions on a given subject:

**Definition 2** (General opinion aggregation framework (GOAF)). *Given a target  $O$ , a set of agents,  $Ag = a_1, \dots, a_n$ , a set of features,  $F = f_1, \dots, f_m$ , where each feature  $f_j$  is associated with a domain  $D_j$  (which is a set of possible values that can be assigned to the feature  $f_j$  of the object  $O$ ).*

*Let us denote the recommendation of agent  $a_i$  about object  $O$  by  $r_i(O)$ , the global recommendation about the object  $O$  by  $r(O)$ , and let  $v_{i,j}$  be the value attributed by agent  $a_i$  to the feature  $f_j$  of object  $O$ .*

*The data can be represented as follows:*

	$f_1$	...	$f_j$	...	$f_m$	Target
$Ag \setminus domains$	$D_1$	...	$D_j$	...	$D_m$	/
$a_1$	$v_{1,1}$	...	$v_{1,j}$	...	$v_{1,m}$	$r_1(O)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
$a_i$	$v_{i,1}$	...	$v_{i,j}$	...	$v_{i,m}$	$r_i(O)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
$a_n$	$v_{n,1}$	...	$v_{n,j}$	...	$v_{n,m}$	$r_n(O)$
Group	$v(f_1)$	...	$v(f_j)$	...	$v(f_m)$	$r(O)$

*where each  $v_{i,j} \in D_j$ .*

Some values of this table clearly depend from each other, namely, if the agent  $a_i$  is rational, then  $r_i(O)$  should depend from the  $v_{i,-}$ . Hence, we can assume that each rational agent  $a_i$  can be associated with an aggregation function  $agreg_i$  defined as follows:

**Definition 3** (MCA-function of an agent). *Let  $a_i$  be a rational agent and  $RD$  be a recommendation domain, a multi-criteria aggregation function for agent  $a_i$  is a function  $mca_i$  from  $D_1 \times \dots \times D_j \times \dots \times D_m$  to  $RD$  linking the values of the features to the recommendation:*

$$\forall i \in [1, n] \quad r_i(O) = mca_i(v_{i,1}, \dots, v_{i,m})$$

The same kind of aggregation can be done in order to summarize a group of opinions about a given feature, note that each feature may be associated with a distinct aggregation function (similarly, agents do not necessarily have the same MCA-function).

**Definition 4** (group aggregation). *Let  $f_j$  be a feature and  $D_j$  be its domain, a group aggregation function for the feature  $f_j$  is a function  $group_j$  from  $(D_j)^n$  to  $D_j$  linking the values given by agents to the feature  $f_j$  to only one value:*

$$\forall j \in [1, m] \quad v(f_j) = group_j(v_{1,j}, \dots, v_{n,j})$$

**Definition 5** (Group MCA recommendation). *A group multicriteria recommendation can be defined by:*

- either computing the MCA recommendation of each agent and then aggregates this result on the group of agent
- or computing the group values of the features and then making a multicriteria aggregation of these values.

## 6 Applications and perspectives

The applications under development concern basic services : hotels, restaurants and e-commerce consumer opinions. A question-answering interface is being developed so that users can query the system only on one or a few properties, i.e. *is hotel X well located ?*. Besides these useful experimentations and developments, we are now investigating the e-reputation framework, of much importance for companies and public persons (we are having major elections in 2012), in particular using data from social networks, wikis and some rapidly evolving blogs. Then, given criteria and thresholds, alert signals can be sent to these companies or persons with an analysis of the reasons of opinion evolution, via arguments.

Finally, given that we can propose an analysis based on arguments, we can then model a network for opinion sharing via argumentation, analyzing support and attack situations, as developed in argumentation. The language part of this project has been implemented with the <TextCoop> platform (Saint-Dizier 2011, forthcoming). This platform is dedicated to discourse analysis and integrates lexical semantics and reasoning capabilities.

## References

- Ashley, K.,D., Desai, R., Levine, J.M., Teaching case-based argumentation concepts using dialectic arguments vs. didactic explanations, ITS 2002, Lecture notes in computer science, 2002.
- Amgoud, L., Bonnefon, J.F., Prade, H., An Argumentation-based Approach to Multiple Criteria Decision, in 8th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty, ECSQARU'2005, Barcelona, 2005.
- Amgoud, L., Parsons, S., Maudet, N., Arguments, Dialogue, and Negotiation, in: 14th European Conference on Artificial Intelligence, Berlin, 2001.
- Bal, K.B., Saint-Dizier, P. Towards Building Annotated Resources for Analyzing Opinions and Argumentation in News Editorials, LREC, Malta, 2008.
- Baker, Mark C. Incorporation: A theory of grammatical function changing. Chicago, University of Chicago Press, 1988.
- Bethard S., Yu H., Thornton A., Hatzivassiloglou V., Rafsky D., Automatic extraction of opinion propositions and their holders, Proceedings AAAI04, 2004.
- Breck E., Choi Y., Cardie C., Identifying expressions of opinion in context. Twentieth International Joint Conference on Artificial Intelligence (IJCAI), 2007.
- Cheng X., Xu F., Fine-grained opinion topic and polarity identification, Proceedings of LREC'08, marakech, morocco, 2008.
- Grosz, B., Sidner, C., Attention, intention and the structure of discourse, Computational Linguistics 12(3), 1986.
- Keil, F.C., Wilson, R.A., Explanation and Cognition, Bradford Book, 2000.
- Kim, s.m. and Hovy, E., Crystal: analyzing predictive opinions on the web. EMNLP 2007
- Mann, W., Thompson, S., Rhetorical Structure Theory: Towards a Functional Theory of Text Organisation, TEXT 8 (3) pp. 243-281, 1988.
- Mann, W., Thompson, S.A. (eds), Discourse Description: diverse linguistic analyses of a fund raising text, John Benjamins, 1992.
- Marcu, D., The Rhetorical Parsing of Natural Language Texts, ACL 1997.
- Marcu, D., Au unsupervised approach to recognizing Discourse relations, ACL 2002.
- Miltasaki, E., Prasad, R., Joshi, A., Webber, B., Annotating Discourse Connectives and Their Arguments, new frontiers in NLP, 2004.
- Pollock, J.L., Knowledge and Justification, Princeton university Press, 1974.
- Potts, C., The expressive dimension. Theoretical linguistics 33(2):165-197, 2007
- Redeker, G. (1990). Ideational and Pragmatic Markers of Discourse Structure, Journal of Pragmatics, vol. 14.
- Reed, C., Generating Arguments in Natural Language, PhD dissertation, University College, London, 1998.
- Saito, M., Yamamoto, K., Sekine, S., Using Phrasal Patterns to Identify Discourse Relations, ACL, 2006.
- Takamura h., Inui,T., Okumura M., Extracting semantic orientations of words using spin model, Proceedings of the 43rd annual meeting on ACL, 2005.
- Takechi, M., Tokunaga, T., Matsumoto, Y., Tanaka, H., *Feature Selection in Categorizing Procedural Expressions*, The Sixth International Workshop on Information Retrieval with Asian Languages (IRAL2003), pp.49-56, 2003.
- Walton, D., Reed, C., Macagno, F., Argumentation Schemes, Cambridge University Press, 2008.
- Wierzbicka, A., English Speech Act Verbs, Academic Press, 1987.
- Wright, von G.H., Explanation and understanding, Cornell university Press, 2004.