Automatic computing of global emotional polarity in French health forum messages

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Abstract. Social media provide the possibility for people to freely communicate. These discussion are rich with subjectivity and emotions, which is due to the anonymity of contributors. We propose to work on health fora in French and on subjective entities (*e.g.* emotions, feelings, uncertainties). Our specific interest is to study how the polarity of emotions is influenced by negation, uncertainty, modifiers and discoursive markers, and how the global polarity of sentences is constructed. We design a rule-based system and evaluate is against manually built reference data. Inter-annotator agreement is between 0.50 and 0.66. An evaluation of the automatic system shows between 40 and 56% precision.

1 Introduction

Social media dedicated to health topics provide the possibility for patients to freely communicate on their health conditions, drugs, procedures, medical doctors, etc. This communication is prone for expressing emotions, feelings [9], and more generally the subjectivity of patients, which is certainly due to their anonymity and to the topics discussed. Forum discussions may thus provide new insights on life and well being of patients. Health fora contain two main types of entities: conceptual (*e.g.* medical problems, drugs, procedures) and subjective (*e.g.* emotions, opinions, uncertainties). We propose to study the latter in order to observe how emotions interact among them, how they are influenced by negation and uncertainties, and how the global emotional polarity of sentences is constructed. Among the related studies, we can find those dedicated to the acquisition of emotion lexica in different languages [20, 2]; to the emotion categorization [14, 13, 19]; to their relation with events and entities [3, 18]; and to the exploitation of emotions in various NLP applications [4, 5, 15, 11]. Besides, some NLP studies combine emotions with negation [17], while in logic studies researchers analyze logical impact of modifiers, uncertainty and negation [21, 7].

2 Material and Material

Corpora. Two kinds of corpora in French are used: *QA* (993,383 occ.) and *Forum* (1,763,022 occ.) corpora. *QA* corpus is built from *MaSanteNet* website[1],

[1] www.masantenet.com

and contains questions submitted by patients and answers provided by medical professionals. *Forum* corpus also provides discussion threads, in which questions submitted by patients are usually answered by other patients with more personal experience. This corpus is built from *Doctissimo*[2] website.

Resources. Resources exploited for the detection of subjectivity and emotions cover different types of markers:

- Emotions (n=1,144) [2]. Lexicon entries are associated with over 30 emotions (*e.g. sadness*, *disgust*, *joy*, *shame*). Emotions are grouped in three categories: *sadness* is a negative emotion, *joy* is positive, *astonishment* is neutral.
- Uncertainty (n=101) is expressed with various linguistic units (*e.g. suppose*, *appear*, *suspect*, *possibility*, *hypothesis*, *likely*, *doubtful*, *maybe*), and indicates that given information is not fully certain and is to be taken with caution.
- Negation (n=20) can be expressed with various markers (*e.g. no*, *absence*, *negative*, *impossible*, *without*), and indicates that given information is absent.
- Modifiers or intensifiers (n=17) include markers such as *little*, *very little*, *extremely*, or *truly*. Two kinds of modifiers are distinguished: *modif-p* which increases the degree, and *modif-m* which decreases the degree.

Our work addresses the interaction between these various markers and discourse connectors, in order to compute the global emotion polarity of sentences.

Reference Data for the Evaluation of Global Polarity. Reference data are created by a manual annotation of sentences by two annotators (500 in *QA* and 80 in *Forum* corpora). The objective is to define the global emotion polarity of sentences. Possible categories are *positive*, *negative* and *neutral*.

2.1 Semantic Annotation of Corpora

Reaccenting the corpora. Forum corpora often miss accented characters, which may have negative impact on the annotation. Hence, we generate reaccented version of corpora through a comparison with the reference lexicon.

Semantic Annotation. Semantic annotation consists of detection of various markers from the resources, and of non-lexical emotion marks: smileys or emoticons (*=)*, *;-)*, *:-/*, *XD*), mark of laugh (*lol*, *mdr*, *haha*, *hihi*), emotional punctuation (*!!!??*, *!!!!!!!!!*, words with duplicated letters (*maaaaaaal (paaaaaaain)*, *nooooooon (nooooooo)*) These non-lexical emotion marks are also typed according to whether they denote positive (*e.g.*, *=)*, *mdr*, *looool*), negative (*e.g.*, *:-(*, *:-/*) or neutral (*e.g.*, *???!!?*, *ohhhhh*) emotions.

2.2 Rule-based system for computing the global emotion polarity

Context and rules. Emotions are the processed units. These units are studied in windows of maximum seven words on the left and on the right [8]. The window size can be reduced when strong (*?, ., !*) or medium (*:, ;, (), []*) punctuation, or discourse connectors (*e.g. car (because)*, *mais (but)*) are found. Within this window, we detect negation, uncertainty and modifier markers, and apply four rules that manage the scope of markers and their semantics:

[2] `forum.doctissimo.fr/sante/douleur-dos`

1. *Negation*. If negation (*e.g. ne...pas (no)*, *rien (nothing)*, *aucun (any)*) is found, then the polarity of emotion is inversed (positive and neutral → negative, negative → positive). Maximal size of the negation window is five tokens.
2. *Modifiers*. If modifier is found, then the emotion polarity is amplified or attenuated according to modifiers. Modifiers can combine with negation and uncertainty. Maximal size of the modifier window is three tokens. When several modifiers are found, all of them influence the unity processed.
3. *Uncertainty*. If uncertainty is found within a maximal window of seven tokens, then the emotion polarity is attenuated.
4. *Connector*. If discoursive connector (*e.g. car (because)*, *donc (hence)*, *mais (but)*, *cependant (however)*) is detected, then the emotion polarity is either amplified or attenuated according to connectors.

Combination of markers. Different markers can co-occur within emotion contexts. Their combination requires specific principles and additional rules:

1. *negation + modif-p*. When negation is followed by *modif-p* modifier, this attenuates the polarity of negation.
2. *modif-p + modif-p*. When modifier *modif-p* is followed by modifier *modif-p*, this leads to a doubled increase of the emotion polarity.
3. *modif-p + modif-m*. When modifier *modif-p* is followed by *modif-m*, *modif-p* amplifies *modif-m*, which leads to a double attenuation of the polarity.

Occurrence of connectors within right or left context of emotions reduces the scope of other markers. Still, the impact of connectors varies according to their own scope and to the size of window they operate within [10]:

- *mais (but)* and *cependant (nevertheless/yet)* introduce separation between the text that precedes and the text follows the connector;
- *car (because)* strengthens preceding information by the following information;
- *et (and)* means enumeration of emotions;
- *donc (hence)* gives more importance to information that follows.

Computing the global emotion polarity. Markers occurring in contexts of emotions modify their intensity and polarity. The starting point is the initial intensity associated with each emotion polarity [16, 17]: +0.5 for positive emotions, -0.5 for negative emotions, and 0 for neutral emotions. Modifiers modify these initial values with +0.1 if they increase the intensity, -0.1 if they decrease the intensity, and -0.05 if they bring uncertainty. Negation inverses the polarity. If several polarities have the same score S, we apply the following principles:

- if $S_{pos} = S_{neg} \Rightarrow$ global polarity is neutral;
- if $S_{pos} = S_{neu} \Rightarrow$ global polarity is positive;
- if $S_{neg} = S_{neu} \Rightarrow$ global polarity is negative.

2.3 Evaluation

Evaluation of global emotion polarity is done against the reference data prepared by manual annotation. Evaluation is performed with the precision measure in order to assess the correctness of the output of the system.

Table 1. Evaluation against the two annotators and the common dataset

Annotators	*Corpus*	*BL*	*E1*	*E2*	*E3*	*E4*
A1	*QA*	39.92	**42.07**	41.64	41.21	40.78
	Forum	41.08	**44.65**	41.08	40.00	40.00
A2	*QA*	49.79	**55.80**	55.80	54.94	54.51
	Forum	42.86	**42.86**	**42.86**	38.19	41.82
common	QA	44.06	**46.54**	46.04	46.04	45.55
	Forum	**45.10**	41.18	43.14	40.00	42.00

3 Discussion of Results and Future Work

Inter-annotator agreement. Inter-annotator agreement between annotators is computed with the Cohen kappa [6]: 0.63 agreement in *QA* corpus, and 0.58 in *forum* corpus, which corresponds to good and moderate agreement, respectively [12]. We can observe that annotators show poorer agreement with neutral polarity, for which there is an hesitation to assign neutral polarity or to consider that there is no polarity to be assigned. The two other polarities are more consensual.
Evaluation of the rule-based system. Precision values of the rule-based system are indicated in Table 1. Several versions of the system are evaluated:

- *BL*: the baseline version corresponds to original annotations, on which the global emotion polarity is computed, but without the application of rules;
- *E1*: the proposed rules are applied and the global polarity is computed;
- *E2*: the corpus is reaccented on which the proposed rules are applied and the global polarity is computed;
- *E3*: the global polarity corresponds to the last emotion, which shows to be suitable for processing of emotions in Chinese sentences [10];
- *E4*: the global polarity corresponds to the last emotion and is computed on the reaccented corpus.

Automatically computed results are compared with the reference annotations provided by each annotator and with the *common* set containing common annotations. The best results (up to 56% precision) are obtained with the rule-based system we propose *E1*, which main advantage is to manage semantics of emotions, negation, modifiers, uncertainty and discourse connectors, and their interactions. These results are comparable with the published work [17, 3]. With our system, we can gain up to 6% by comparison with our baseline. Besides, reaccenting of corpus is suitable for the task, while the last emotion uttered does not correspond to the global emotion polarity of sentences in French.

We have several direction for future work: producing larger reference set with consensual annotations; better adaptation of method and resources to forum discussions; exploitation of syntactic analysis for computing the scope of markers. The system can be applied to other fora and genres (*e.g.* novels, political texts). Besides, a fine-grained interaction between the operators used in our work can be defined [21, 1, 7]. These operators can also be transformed in order to be used by a supervised machine-learning system. Supervised approaches have shown to

be efficient in the processing of this kind of material [14]. In this way, we expect to improve global performance of our system and to obtain more precise results.

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