

# INVESTIGATION OF EMOTIVE EXPRESSIONS OF SPOKEN SENTENCES

Wenjie Cao<sup>1,2</sup>, Chengqing Zong<sup>1</sup>, Bo Xu<sup>1</sup>

<sup>1</sup> National Laboratory of Pattern Recognition, Chinese Academy of Sciences  
No. 95, ZhongGuanCun EastRoad, Beijing 100080, China  
{wjcao, cqzong, xubo}@nlpr.ia.ac.cn

<sup>2</sup> GETA-CLIPS, IMAG, 385 rue de la Bibliothèque, BP 53.  
38041 Grenoble Cedex 9, France

**Abstract.** When we meet an emotion keyword in a sentence that expresses a kind of emotion, or a word that does not directly express emotion but carries an attitude clue, it could be the case that the speaker is just stating a truth without any affection; it could be an expression of attitudes or emotive states of the agent but using different ways, or it could be other cases. In this case, it seems doubtful to determine the exact communicative emotion function of a sentence just based on the “keywords”. This paper endeavors to investigate the collective influence of some factors to the communicative emotion function of a sentence. These factors include emotion keywords, and sentence features such as the mood, negation, etc. we believe that the results will be useful for emotion detection or generation of short sentences.

## 1. Introduction

Human emotion detecting and emotion generation have been paid much attention in physiological aspects, such as speech, facial expressions, hand gesture, and body movement [1]. Most of the researches are conducted by utilizing physiological features. While not so many efforts have been made to analyze or detect emotions in text. Though we accept the opinion that human could detect or express emotions through sounds, facial expressions, and gestures without using words or expressing meanings, it is also important to find out or to infuse emotion expressions into sentences when there is a meaning transfer. For example, understanding the meaning of sentences in order to grasp the exact emotions or attitudes of speakers (spoken language) or characters (written language); or in another aspect, selecting vocabulary according to the communicative emotive purpose of the speaker in order to generate affective texts.

In traditional natural language processing (NLP), notion of the meaning of text mainly refers to the literal meaning of text which is relatively objective. Accordingly, resources for NLP researches are also built up for such a purpose. Generally, they cannot provide emotive information in lexica and grammars. Or at least, they cannot provide information especially for emotive text processing.

Even for researches on emotive text, as far as known from our available literatures, at least for Chinese processing, most efforts have been made to researches on the emotion detecting methods such as keyword spotting, statistical approaches. However researches from the more basic angle of view have been neglected. The result is: all the approaches perform quite well for long text, while they are in vain for processing short sentences. Researchers have started to resolve this problem for English text, for

example by using an enormous enough commonsense knowledge base [5]. However, we haven't found similar work for Chinese from literatures.

So, no matter whatever we want to do, to detect emotion from text or to generate emotive text, the first thing we want to do is investigate a real emotive corpus.

This paper is to discover in Chinese spoken language, how do words and phrases that are correlated with emotions effect in a sentence? How do moods, negations, semantics of sentence elements influence the communicative emotive function of a sentence? How a human being expresses his subjective affections (including sentiments, attitude towards objects, and so on) through meaningful sentences?

This paper is structured as follows: section two briefly introduces some related theories and work. Section three presents the investigation results of the BTEC corpus. In the fourth section, the paper makes the conclusion.

## 2. Related Work

### 2.1 Emotion Models

Several emotion model have been proposed [2][11]. While OCC model (the acronym of Ortony, Clore, and Collins) has established itself as a standard computational emotion model for emotion detection and synthesis [7].

In OCC model, 22 emotion categories in three groups are specified based on the reactions of the agent to situations constructed either as being goal relevant events, as acts of an agent accountable, or as attractive or unattractive objects. The model also offers a structure of variables for emotional computation, such as the determination of the intensity of the emotion types.

The classification of emotions in OCC:

- Consequences of events: 1) positive: happy-for, gloating, hope, joy, satisfaction, relief; 2) negative: resentment, pity, fear, distress, fear-confirmed, disappointment;
- Actions of agents: 1) Positive: pride, admiration; 2) Negative : Shame, reproach;
- consequences of events & actions of agents: 1) Positive: gratification, gratitude; 2)Negative : remorse, anger;
- Aspects of objects: 1) Positive: like; 2) Negative: dislike.

Many studies employ OCC to generate emotions [1][8][10]. In 1996, Reilly W.S.N. produced an Em model. Em model is another computational model based on OCC, but it is more complicated and integrated. In this model, emotions are classified into 25 categories. Three other emotions are: frustration, startle, and other attitude-based emotions. The definition of each emotion is also slightly different from that of OCC; the Em model computes emotions mainly by measuring the fulfillment (or the possibility of the fulfillment) of the goal of an agent, and the importance of the goal to the agent [10].

Theory of Ortony forms the basis of our work. The classification of emotion keywords, as well as the emotional sentences, is based on the theory of Ortony, OCC model. The classification of emotions has been slightly modified according to the word usage status of the corpus. Categories *happy-for*, *joy*, and *gloating* have been

merged, categories *satisfaction*, *gratification*, and *relief* have been merged, and distress and pity have been merged into one category. Moreover, *surprise*, and *tension* are added into the emotion list.

## 2.2 Emotional Word Classification

A classic work on measuring affective meaning in words is Osgood's Theory of Semantic Differentiation [9]. Their semantic differential technique is using several pairs of bipolar adjectives, such as active-passive; good-bad; optimistic-pessimistic; positive-negative; strong-weak; serious-humorous, to scale the responses of agents to words, short phrases, or texts.

Each pair of bipolar adjectives is a factor in the semantic differential technique. As a result, the differential technique can cope with quite a large number of aspects of affective meaning. About the importance of the factors, Osgood et al. [9] gave an surprising answer after extensive empirical tests that most of the variance in judgment could be explained by only three major factors of the affective meaning: the *evaluative* factor (e.g., good-bad); the *potency* factor (e.g., strong-weak); and the *activity* factor (e.g., active-passive). The evaluative factor is the most important. [4]

Kamps J. and Marx M. explore how the structure of the WordNet lexical database might be used to assess affective or emotive meaning, and construct measures based on Osgood's semantic differential technique[4]. The measures could be effective for emotion detecting in long text.

Tao J.H. provided a clear classification of vocabulary [12]. He divides vocabulary into content words and emotion functional words. It is easy to tell the meaning of the two categories as their name imply. The emotion functional words consist of three categories: Emotional keywords, Modifier words, and Metaphor words. Emotional keywords provide the basic emotion value of the input sentence (such as “生气/angry”, “快乐/happy”, “悲伤/sad”). He uses a reduced set of OCC for tagging emotional keyword. Modifier words are modifiers in the sentence, such as “非常/very”, “太/too”, etc. They are most probably used to enhance or weaken, or even change (e.g. negation) the emotion. The metaphor words normally have no direct action on the emotion states but do have the latent influence on them. They are further divided by Tao into two types: one is for spontaneous expressing; the others only denote personal character.

For detecting emotion in text, Tao J.H. proposes a unified architecture based on Emotion eStimation Net (ESiN) which seamlessly integrates context dependent probabilistic hierarchical sub-lexical modeling.

In our work, since our investigation is just a qualitative one, which does not involve quantitative analysis such as the intensity of emotions, the emotional keywords are classified into two categories: EmoWord is the emotion word, which directly express emotion; PotEmoWord refers to the potential emotion word, which does not directly express emotion, but potentially carry a positive or negative attitudes of the speaker. We can understand better by using analogies: EmoWords are similar to the emotional keywords defined by Tao; and PotEmoWords are something analogous with the Metaphor words defined by Tao barring the part which signifies the intensity of emotions.

### 3. Investigation of Emotional Sentences from BTEC

#### 3.1 Overview of the Corpus

BTEC corpus of CSTAR (Consortium for Speech Translation Advanced Research, please refer to <http://www.c-star.org/> for more information) is used for providing emotional sentences. 162,320 Chinese-English parallel spoken utterances are involved in the corpus. After preprocessing such as dividing the utterances into sentences, wiping off repeated pairs, segmenting, and annotating with POS, we have finally got about 130,000 Chinese sentences in total.

The BTEC corpus covers utterances and dialogues commonly used in 13 scenarios and domains, including: Restaurant, Airports, Emporium, Drinkery, Bank, Post office, Hospital, Personal services, Transportation, Travel, Hotel, Security and Others. The result of the investigation on the corpus may be influenced by the composition of the corpus, but it is still meaningful within these scenarios and domains.

Generally, sentences bearing emotions could be divided into two categories. The first category includes those sentences with obvious emotional keywords. The emotional keywords consist of EmoWords (e.g. “高兴/happy”, “悲伤/sad”), and PotEmoWords (e.g. “贤明/sage”, “愚蠢/stupid”). The second category includes those sentences which do not contain obvious emotional keywords, but through them people could still detect emotion delivery by deeply understanding the sentences. For example, “爷爷刚刚去世了/Grandpa has just passed away”. Although no word in the sentence bears evident emotions, profound sadness could be detected based on the content and the commonsense that the speaker loves his (or her) grandpa. Sometimes, domain correlated information is also required for emotion detecting. It is not practical for us to handle the second category for the moment, since we lack of commonsense and domain information. This paper tackles the first category of emotional sentences which contains emotional keywords.

The strategy for extracting emotional sentences from BTEC is “two-time filtering”.

The first time, a word list coming from the *Chinese thesaurus* [6] is used as the “base” for sentences extracting. The word list contains EmoWord categories and some of the PotEmoWords. About 8000 sentences are drawn out after this filtration.

For fear that some emotional sentences are missed due to the incompleteness of the word list, a second time extraction is conducted to extract sentences belonging to the first category that do not consist of distinct emotion words. We assume a supposition that sentences bearing emotions tend to express themselves with exaggerated degree adverbs (e.g. “很/very”, “太/too”). So a degree adverbs list is used to “pick out” those words missed in the first step. After this filtration, about 5800 sentences are extracted. Finally we obtain 13849 “emotional” sentences. Considering there are mis-extractions, and redundancies in that we have got the Chinese corpus from bilingual resources and one Chinese sentence may correspond to several English sentences, we remove the redundancy, and got 6683 sentences. These sentences make up of the basic corpus for our emotional investigation. The emotional corpus involves 5433 words.

### 3.2 Investigation of Emotional Sentences

In this sub-section, firstly, the investigation results of the emotional sentences are presented. Secondly, the influence of moods is given. Thirdly, the influence of domains to the composition of emotions is presented.

#### Statistical Results of Emotional Sentences

The POS constitution of emotional keywords (including emotion words and potential emotion words) is as table 1. In the 683 keywords, 197 are EmoWords and 486 are PotEmoWords.

**Table 1.** POS composition of emotional keywords

POS	nouns	adjectives	verbs	adverbs	total keywords
Number of words / frequency	123 / 344	365 / 5864	185 / 2864	10 / 48	683 / 9120
Percent (%)	18.0 / 3.8	53.4 / 64.3	27.1 / 31.4	1.5 / 0.5	100 / 100

From table 1, we can see the main three categories for emotion expression is adjective, verb, and noun. The adjectives are the premier portion, which take more than half of the emotional keywords, while verb takes the second important position. Averagely, per sentence includes 1.36 emotional keywords.

For sentences that contain EmoWords, totally 2881 sentences are detected.

**Table 2.** Composition of sentences with emotion words

Emotion of keywords	number of sentences	Emotion of keywords	number of sentences
admiration	19	disappoint	19
reproach	6	frustrate	25
gratitude	167	fear	197
anger	24	hope	327
happy-for/joy/gloating	498	pride	17
distress/pity	97	shame	166
like	1058	surprise	86
dislike	44	tension	54
faction/gratification/relief	87		

And totally 3802 sentences are extracted which contains the 486 PotEmoWords.

#### Some Analysis

Sentence could be viewed as a tool that express specific meanings, perform specific functions or achieve specific goals of the speaker. The real emotive meanings and the communicative functions of the sentences above are unlikely to be accordant with the keywords in the sentences. This paper gives some other factors that influence the emotive meaning of sentences. They are: 1) the moods of the sentences; 2) domain classification.

Before analysis, to differentiate the emotional function of a sentence from the literal meaning of the sentence, it is necessary to explicitly enounce the factors for the function of emotional communication:

- EmoKeywd: the emotion borne by the emotion keyword;
- EmoAgent: the person who generate the emotion;
- EmoObject: the object that arouse the emotion. It could be a thing, a person, an event, or anything. It could be empty if the sentence is just a description of the emotion state of the agent;
- EmoReason: the reason why the agent has the emotion;
- EmoPurSpeaker: the purpose for the speaker to speak the emotive sentence.

With these factors, we could perform the emotional analysis without being affected by other factors such as the syntactic structure of a sentence.

### (1) Influence of Mood

Different mood of a sentence has influence on the emotional function of a sentence. The paper notifies different cases, and exemplifies them with some typical sentences.

a) *Imperative* mood is commonly accompanied by an expectation of emotion transition. Phenomena occur in the corpus could be divided into the following two cases.

If the EmoAgent is the interlocutor, the EmoPurSpeaker is to request the interlocutor to change his emotion to EmoKeywd, or not to EmoKeywd (if there is a negation), e.g.

- 1) 不要骄傲/don't be proud;
- 2) 放松你自己/relax yourself!

If the EmoAgent is the speaker himself, the EmoPurSpeaker is to request the interlocutor (to do something) to meet the speaker's demand of changing emotion state, e.g.

- 1) 请不要让我失望/Please don't let me down.
- 2) 请给我一个满意的理由/ Please give me a gratifying excuse.

A third possibility is blessing sentences, which normally express the hope of the speaker that wish the interlocutor to be in a good status, e.g.

- 1) 圣诞快乐! Merry Christmas!
- 2) 祝你度过美好的一天! / Have a nice day!
- 3) 祝你<旅途/飞行>愉快! / Wish you have a nice <trip/flight>!

b) The emotional function of *interrogative* sentences is to enquire the emotion factors. Examples of enquiring for the attitude of the EmoAgent to an object:

- 1) 杰克遇见你很高兴, 不是吗?/ Jack was very happy to meet you, wasn't he?
- 2) 喜欢棒球吗?/ Do you like baseball?
- 3) 旅行令人愉快吗?/ Was the trip enjoyable?

Enquiring for the emotion state of the EmoAgent:

你高兴吗? / Are you glad?

Enquiring for the EmoObject:

- 1) 你喜欢吃哪个, 苹果还是橙子? / Which one do you like to eat, apple or orange?
- 2) 应该怪谁? / Who should be blamed?

Enquiring for the EmoReason:

你为什么那么生气? / Why do you get so angry?

Enquiring for other information:

你找到你喜欢的了吗? / Have you found what do you like?

c) *Exclamatory* mood is relatively safer to detect the attitude of the speaker directly from the EmoKeywd. E.g.

多么美妙的音乐片啊！/ What a wonderful music film!

太吓人了！/ How terrible it is!

#### (2) Influence of Domain

The distribution of emotional words in different domain is given in Table 3.

**Table 3.** Distribution of emotional words in different domain

Domain	Sentences number	Nouns Number/freq	adjectives Number/freq	verbs Number/freq
Restaurant	451	5 / 5	45 / 480	21 / 177
Airlines	364	17 / 22	54 / 387	23 / 132
Emporium	553	9 / 16	58 / 404	20 / 292
Drinkery	107	0 / 0	34 / 78	16 / 57
Bank	15	0 / 0	8 / 13	5 / 5
Post office	14	0 / 0	4 / 11	4 / 4
Hospital	799	20 / 56	64 / 940	39 / 96
Personal services	60	1 / 2	12 / 41	8 / 30
Transportation	259	8 / 11	43 / 329	21 / 105
Travel	965	23 / 33	106 / 677	60 / 473
Hotel	390	9 / 14	50 / 337	30 / 177
Security	161	11	143	64
Others	2545	66 / 174	241 / 2023	111 / 1252

And the distribution of EmoWord in some domains is shown in Table 4. We just select the top three categories in each domain.

**Table 4.** Distribution of EmoWord in some domains

Domain	Emotion of EmoWords	Percent (%)	Total frequency of EmoWord
Restaurant	Shame, satisfaction, like	81.3	283
Airlines	Happy, hope, like	64.3	235
Emporium	Like, shame, hope	93.4	372
Drinkery	Like, happy-for, hope	71.9	64
Hospital	Distress, fear, distress	54.9	91
Transport	Distress, happy-for, like	73.3	217
Travel	Like, happy-for, shame	62.9	536
Hotel	Remorse, happy-for, like	74.7	261
Security	Remorse, tension, surpris	68.4	117

From Table 4, we can see that all the analyzed domains are concentrated on specific emotion dimensions, which could show the characteristics of the domains.

## 4. Conclusion

This paper briefly presents our primary work on emotional analysis of spoken sentences. The classification of emotion and potential emotion words are discussed. The main contribution of the paper is that it opens out the composition of an emotion spoken corpus to researchers in forms of statistical data which shows an overview of

the corpus, statistical data, and enumerative examples which describe the composition of the corpus in more details. The results discover the relation between the emotion word categories and some syntactic features of sentences, and the emotional communicative functions of sentences. An emotive feature set is brought forward for computable analysis of the sentences. The feature set is quite simple and primary. But it provides an important idea of representing the emotional function of a sentence in a new level other than the syntactic level or semantic level. This will be significant for building up the computable emotion model, as well as for easily analyzing the relation between structures of different level of representations, the latter of which is really important for emotion detection or generation of short sentences.

## 5. Acknowledgements

The research work described in this paper has been supported by the natural science foundation of China under the grant number 60375018 and 60121302, the PRA project (No. SI02-05) of the Ministry of Science and Technology of China, and also the Outstanding Overseas Chinese Scholars Fund of the Chinese Academy of Sciences (No. 2003-1-1).

## References

1. Bartneck C.: Integrating the OCC Model of Emotions in Embodied Characters. Workshop on Virtual Conversational Characters: Applications, Methods, and Research Challenges. Melbourne (2002)
2. Elliott, C.: The Affective Reasoner: A Process Model of Emotions in a Multi-agent System. PhD thesis, Northwestern University, The Institute for the Learning Sciences, Technical Report No. 32. (1992)
3. Gratch J., Marsella S.: Technical Details of a Domain-independent Framework for Modeling Emotion. Technical Report ICT-TR, University of Southern California, Los Angeles, CA (2004)
4. Kamps J., Marx M.: Words with Attitude. BNAIC, Groningen (2002)
5. Liu H., Lieberman H., Selker T.: A Model of Textual Affect Sensing using Real-World Knowledge. Proceedings of the ACM International Conference on Intelligent User Interfaces, Miami, USA (2003) 125-132
6. Mei J., Zhu Y., et al: Chinese Thesaurus. Shanghai Lexicographical Publishing House (1983)
7. Ortony A., Clore G. L., and Collins A.: The Cognitive Structure of Emotions. Cambridge University Press (1988)
8. Ortony A.: On making believable emotional agents believable. in Trappale, R. P. ed.: Emotions in humans and artifacts, MIT Press, Cambridge, USA (2003)
9. Osgood, Suci G., and Tannenbaum P.: The Measurement of Meaning. University of Illinois Press, Urbana IL (1957)
10. Reilly W.S.N.: Believable Social and Emotional Agents. PhD thesis, CMU USA (1996)
11. Sloman, A.: Motives, mechanisms and emotions. *Cognition and Emotion*, 1 (1987) 217-234
12. Tao J.H.: Context Based Emotion Detection from Text Input. ICSLP Jeju Island, Korea (2004) 1337-1340