

# Construction and Evaluation of Chinese Emotion Classification Model

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*Abstract:* - Natural language has attracted importance to some researchers working on Emotion recognizing. Our study focuses on the semi-automatic acquisition technique to obtain the emotion information with the constructed emotion thesaurus we have made. In this paper, we made two models, one is the emotion thesaurus, the other is the emotion analyzer. Firstly we construct Chinese language emotion thesaurus, the word in which thesaurus has its own classifying of the corresponding emotion information. Secondly, using the thesaurus we set up a model to recognize the object sentence including functions of lexical analysis syntax analysis, emotion sensing and emotion computing. The following investigations are presented to show that the concept of “image value” can be used by the constructed system to obtain the emotion information from the sentence based on the constructed emotion thesaurus.

*Key-Words:* - Affect computing, Emotion analyzer, Image value, Emotion thesaurus

## 1 Introduction

Recent research has placed more emphasis on the recognition of nonverbal information, and has especially focused on emotion reaction. Many kinds of physiological characteristics are used to extract emotions, such as voice, facial expressions, hand gestures, body movements, heartbeat and blood pressure. Scientists have found that emotion technology can be an important component in artificial intelligence, especially for human-computer communication. The recent commercialization of robust speech recognition systems, and the rise of the Web, have placed speech and language processing applications in the spotlight, and have pointed out a plethora of exciting possible applications. Researchers like Picard have recognized the potential and importance of affect to human-computer interaction, dubbing work in this field as “affective computing” [1]. . In order for intelligent user interfaces to make use of user affect, the user’s affective state must invariably first be recognized or sensed. Researchers have tried detecting the user’s affective state in many ways, such as, inter alia, through facial expressions, speech, physiological phenomena, and text. In addition, affective information is pervasive in electronic documents, such as digital news reports, economic reports, e-mail, etc. The conclusions reached by researchers with respect to emotion can be extended to other types of subjective information [2]. Textual information is

also an important communication medium and can be retrieved from many sources, such as books, newspapers, web pages, e-mail messages, etc. It is not only the most popular communication medium, but also rich in emotion. With the help of natural language processing techniques, emotions can be extracted from textual input by analyzing punctuation, emotional keywords, syntactic structure, and semantic information. We believe that text is a particularly important modality for sensing affect because the bulk of computer user interfaces today are textually based. It follows that the development of robust textual affect sensing technologies can have a substantial impact in trans-forming today’s socially impoverished text-based user interfaces into socially intelligent ones. In addition, improved textual sensing can reinforce the accuracy of sensing in other modalities, like speech or facial expressions.

In this paper, we use verbal information to make a model to acquire emotional information from text with the constructed thesaurus and to recognize the textual sensing of Chinese in a semi-automatic way. We classify the emotion of vocabulary into 12 basic emotion categories, then we give an affect sensing model and give a detailed introduction of all the parts in this model. At last we give the evaluation of our model to prove our system as a feasible model

## 2 Emotion Word Classifying

Research on emotion is dogged by ad hoc selections of emotions to work with. There is no agreed benchmark, in the form of a range of emotion terms that a competent system should be able to apply. Without that, it is impossible to assess the performance of emotion detection systems in a meaningful way. In the past emotion has been divided into two categories by some people: pleasure / displeasure. But the classified pleasure/displeasure is too ambiguous to consider the user's emotion.

In psychology and common use, emotion is an aspect of a person's mental state of being, normally based in or tied to the person's internal (physical) and external (social) sensory feeling. Love, hate, courage, fear, joy, sadness, pleasure and disgust can all be described in both psychological and physiological terms.

In contemporary Chinese the emotion word based on psychology and susceptibility can be divided into 39 kinds [3]. But in all these kinds of emotions there are only part of them being used in our everyday life. We are trying to identify the main compounds (if such they are) that actually occur in everyday life. We have done that by trying to identify a relatively small vocabulary of words that people regard as sufficient to describe most emotional states and events that are likely to occur in everyday life. Using the 7 universal emotion categories defined by Ekman[4], and plus some categories which we have identified important in our research, such as nervous, regretful, love, for the reason of their frequency of being used, and strong sensation. Here we classified emotion into 12 categories. When there is no emotion we call this state equable. The kinds of emotion are shown in the table 1.

Emotion				
Shy	Fearful	Happy	Expectant	
Sad	Disgusted	Angry	Surprised	Equable
Love	Regretful	Nervous	Praiseful	

**Table 1.** 13 kinds of emotion

### 3 Database Construction

Computer application on Chinese Natural Language Processing (NLP) is still in the starting stage. The main difficulty is the lack of a comprehensive electronic Chinese thesaurus as a tool to help for analysis. Thus, to overcome the problem we mentioned above, we intended to construct a machine tractable and readable Chinese emotion thesaurus to help the analysis of Chinese NLP.

Here we constructed a database filled with emotional information of Chinese words in order to help the next part of emotion sensing. On the other

hand, due to needing a thesaurus to acquire directly the emotional information of a word we also make this database able to be used singly as a thesaurus. There are about 4800 words collected from various dictionaries such as "ChangYongBaoBianYiXiangJie dictionary"[5], and People's Daily tagging corpus of Institute of Computational Linguistics Peking University. For each emotional word, the corresponding emotion descriptor is manually defined. The emotion descriptor is a set of descriptions of the emotion reactions corresponding to the keywords. Basically, it contains an emotional state label and an image value, which ranges from -2 to 2.

#### 3.1 Database Structure.

Base on the statistics result in People's Daily tagging corpus of Institute of Computational Linguistics Peking University, the word emotional trends are described and formulized in our dictionary. When constructing the database of emotional information we select the phonetic, part of speech, the image value, and the category of emotion is called emotional attribute. Sometimes the word is not only in one of the 12 categories of emotion, it is in two or three kinds of those emotions. In such an instance every emotion is recorded in our dictionary. Especially in our research, we define the concept of "image value" that is used to express the affective intensity of the emotional words. Many authors agree that emotions can be organized roughly into a two-dimensional space whose axes are evaluation (i.e. how positive or negative the emotion is) and activation (i.e. the level of energy a person experiencing the emotion is likely to display) [7]. That provides a useful basic continuum in which to embed emotion words. Worse than negative or better than positive we defined it as derogatory or commendatory and between them we use neutral as a median. Here are the five levels we have defined: derogatory->negative->neutral->positive->commendatory

### 4 Emotion Classification Model

The most popular method for performing emotion recognition from text is to detect the appearance of emotional keywords. Generally, not only the word level but also the syntactic and semantic levels may contain emotional information. We make a model of sentence analyzing system. The flow chart is as (Fig1). In our model there are five parts. They are: Lexical analysis, Syntax analysis, Emotion sensing, Emotion tagging, and Emotion computing. In this model two kinds of database are included in, because they are the basic elements of our research.

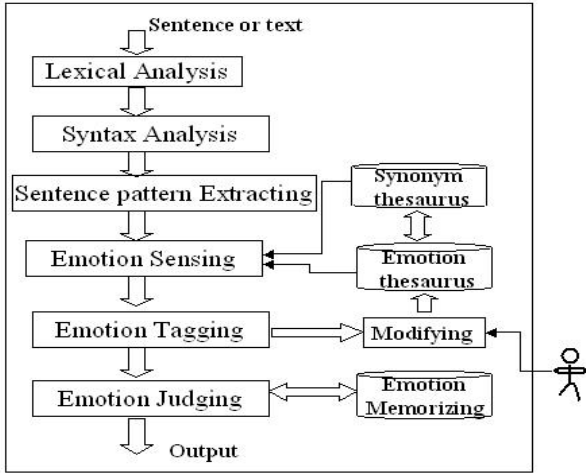


Fig. 1. Flow chart of the emotion classification model

#### 4.1 Lexical Analysis

In this part we select the ICTCLAS system for our research, because it is considered to be one of the best lexical analyzers in the Chinese natural language with the high segmentation accuracy reaching 97.58%. Basing on the Chinese Lexical Analyzer named ICTCLAS (Institute of Computing Technology, Chinese Lexical Analysis System) of using hierarchical hidden Markov model (HHMM). This Chinese lexical analysis is based on Shai's work given a formal description of HHMM. For convenience, they also use the negative log probability instead of the proper form. That is:

$$W^{\#} = \arg \min_W \sum_{i=1}^m [-\ln p(w_i | c_i) - \ln p(c_i | c_{i-1})] \quad (1)$$

According to the word class definition, if  $w_i$  is listed in lexicon, then  $c_i$  is  $w_i$ , and  $p(w_i | c_i)$  is equal to 1.0. Otherwise,  $p(w_i | c_i)$  is probability that class  $c_i$  initially activates  $w_i$ , and it could be estimated in its child HMM for unknown words recognition[6].

#### 4.2 Syntax Analysis

This part is inspired by the model of the structural context conditioned probabilistic parsing put forward by the Institute of Computing Technology. There are three probabilistic parsing models, which are successive augmentations of the conventional PCFG(probabilistic context-free grammar). In this sequence of models outlined, wider and wider structural context is taken as the conditioning events to condition the derivations.

Before emotion classification, there is another important point of our system we have to mention in

advance. It is how to construct a database to ensure our system runs smoothly.

#### 4.3 Emotion Recognition

Emotion classification has four processes consisting of sentence pattern extracting, emotion sensing, emotion tagging and emotion judging. Firstly, the sentence pattern will be extracted from the sentence which had been syntactically analyzed. Then how many emotion words in the sentence will be calculated and with this result the selected words will be tagged with the emotion attribute. At last, there will be a judgment of the sentence, which will express the central emotion of the whole sentence.

##### 4.3.1 Sentence Pattern Extracting

From the results of shown in 4.2. we found it is difficult to recognize emotion if the Sentence pattern is not examined. We also found in different sentence patterns, headwords to be extracted are different. For instance, S+V+P pattern "V" is used as copular, such as "shi(是)", "kanqilai(看起来)", "haoxiang(好像)", and so on. So the "P" composition of the sentence will be the main part expressing emotion. We look at this "P" part as our studying point. That is to say the final emotional state is determined based on all emotional keywords which are estimated based on the emotion thesaurus which is a collected emotion corpus we have made. There is also another element in syntax analysis.

There is also another element in syntax analysis. Conjunction plays a very important role in analyzing emotion sentences. From the grammatical knowledge-base of contemporary Chinese, we classify the connectives into six categories from 97 conjunctions. They are: parataxis, transition, concession, alternative, hypothesis and causation.

##### 4.3.2 Emotion Sensing

Basing the part of "P" mentioned in the section B we can use our database to recognize which category is obscured in the text. Sometimes there are more than one main word. All these main words are evaluated by their image values, and the average will determine the characteristic of the sentence. The accuracy of this type of sentence can reach 90%. The result of our first step proves our research is effective and feasible. On the other hand, in analyzing complicated sentences relying on The Grammatical Knowledge-base of Contemporary Chinese published by Peking University is also considered to be a good way. By using the grammatical knowledge-base we can get to know which word can

be used in which sentence pattern basing on the component of the word.

One more thing we have done is use the synonym thesaurus made by the Information Retrieval Laboratory of HIT (Harbin Institute of Technology University) in order to reduce the query of words, because words can be well classified.

### 4.3.3 Emotion Tagging

For every possible emotional word and its related intensity, the system also requires particular marks. Unless there is an emotional word in the sentence, all of the sentences will be disregarded. If the emotional word refers to the person himself / herself and it is referring to present continuous, then the parser might generate the output.

After the part of emotion sensing having been analyzed, this part of emotion tagging will apply the split sentence from the section A. Lexical Analysis to split sentence into words and detects through the emotion thesaurus to find the corresponding tag category of each word. In the following, tag all the emotional keywords by the image values and the features of emotion. There are five levels in that value form -2 to +2.

In a general way there is more than one emotional keyword in the sentence and all the keywords we have selected have an image value and are arranged in succession according to the order of appearance by the reference frame graph.

### 4.3.4 Emotion Judging

To extract the emotional state from the text, we assume that every input sentence includes one or more emotional keywords and emotion modification words. The final emotional state is the combination of the three outputs: the emotion descriptors of the emotional keywords, the image values of the emotion keyword and the memory graph of the context sensitivity. Using the image value and memory graph of the keywords which have been tagged over, we can consider the average value of sentences inputted as the sentence's image value. By considering the memory graph of context sensitivity we can also get the emotion features of the sentences. First, we gather all the kinds of the emotion appeared in sentences according to the result of part E. Using the context-sensitive knowledge we can eliminate the most impossible emotion and sort out several kinds of most primary emotions, then finish the part of emotion computing and get the result of computing. Commonly the result is not only the singleness of one

kind of emotion but the admixture of several kinds of emotion.

The interface of our model is shown in Fig.2 below. People can catch an intuitionistic image from the figure.

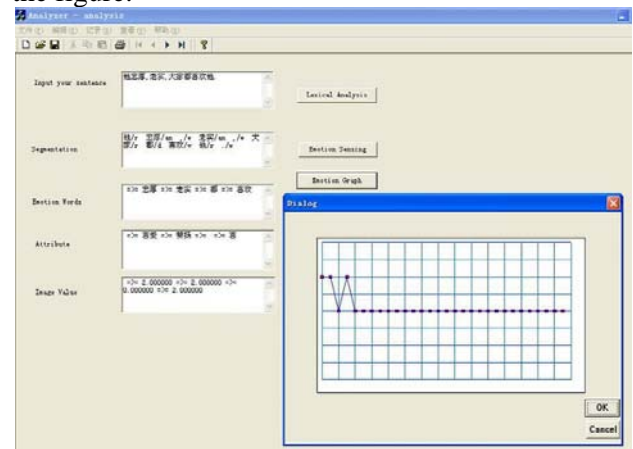


Fig 2. Emotion Classification Model

## 5. Experiments and Evaluation

In order to indagate the correct extent of our system we have done experiments. The experiment is about the emotion definition extracted from the sentences. News (<http://www.people.com.cn/>) (about 410 sentences) pulled out from web is as testing data used to the system which we have constructed, and the experiment that classify emotions from every one sentence was done. Whether the output of our system is correct is checked by person manually. Here is the table:

	Sentence pattern	Sentences
Sentences (Emotional expression is contained.)	"...shi..." : 120 "...you..." : 30 Others : 50	200
Number of correct answers	"...shi..." : 110 "...you..." : 25 Others : 25	160
Number of incorrect answers	"...shi..." : 10 "...you..." : 5 Others : 15	30
Number of indetermination	"...shi..." : 0 "...you..." : 0 Others : 20	20

Table 2. The accuracy of emotion classification model.

From table 2. we can see the accuracy is divided into three parts according to the sentence pattern. In Chinese sentence pattern "...you..." is like the "...is..." sentence pattern of English. This pattern is used to show speaker's view, opinion, and attitude chiefly. The predicate usually used to express the explanation and the explanation to the subject. When emphasizing or concluding, a hard will is expressed,

sometime a soft tone or a euphemistic tone is also shown.

(1) **Sentence Pattern of "...是/shi...":** The result of the experiment obtained by "...shi..." sentence pattern was very high, and the accuracy can reach to 92%(110/120).

**Successful Example:**

1. 今天的报告真是太精彩了. (Today's lecture was indeed wonderful.) output-->praiseful
2. 这真是件好事. (This is really good thing.) output-->happy

**Faulty example:**

1. 这孩子淘气是淘气,可并不是一点儿也不听话. (This child is persuasible although he is naughty.) output-->praiseful correct answer-->love

(2) **Sentence Pattern of "...有 /you...":**The meaning of sentence pattern "...you..."in Chinese is same like the pattern of "there is/are "or "sb./sth. has/have.... ". This is also a sentence pattern which expresses the attribute of the subject and has the secondary accuracy reaching to 83.3%.

**Successful example:**

1. 教书这个工作很有意义 (Teaching is a meaningful work). output-->praiseful
2. 这家伙有一肚子坏水. (He has lots of evil plans in his brain) output-->disgust

**Faulty example:**

1. 去年国民收入有了增长. (National income has increased last year.) output-->equable correct answer-->happy

There is a possibility that the judgment is not accurate when the particle is modified by the adverb and put in the last.

From this experiment we can find The system can not interpret from the character when vague information came out, so there are often sentence that was not able to be understood. The ability of man "Common sense" is necessary.

## 6 Conclusion

In this paper we have firstly talked about our emotion thesaurus and how we constructed it, then we using the already constructed thesaurus as our emotion database constructed the emotion classification model which was used to conjecture the emotion one or more in the sentence or text and whether is positive or negative the text or sentence is used to express. Then at last we have done two experiments and from the results we work on evaluation.

So far we have outlined is in order to prove the model we have tried constructing is feasible and useful although now is on the preliminary stage. This research can be used in special domain such as

E-mail quick look user can chose which mail he needs to read firstly. We also think it could be used for the language applications someday in the future.

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