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Emotion metaphor recognition based on synergetic analysis and multi-source knowledge space

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Abstract : *Emotional metaphor is not only a cognitive phenomenon, but also a special language use phenomenon. It is one of the central problems in artificial intelligence, especially in natural language processing. At present, the research methods of emotional metaphor analysis have reached the platform stage, and it is unable to use the deep semantic knowledge. To solve this problem, a multi-scale semantic vector space is proposed to meet the needs of emotional metaphor recognition, and a synergetic analysis based emotional metaphor recognition model is proposed. Furthermore, several key problems of the model are studied, including prototype vector reconstruction, order parameter reconstruction, and evolution equation reconstruction. The experimental results in the emotional metaphor corpus show that the model proposed in this paper has a greater advantage than the general model, and the F1 value of the general metaphor is as high as 82.92. It is clear that this study has a certain reference value for emotional metaphor calculation and other natural language processing tasks.*

Keywords -*metaphor analysis, synergetic neural network,emotion metaphor recognition*

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I. INTRODUCTION

Metaphor [1-2] is not only a special phenomenon of language use, but also a cognitive phenomenon of human thinking, which is full in every corner of our life. From different perspectives, metaphor is divided into different categories and has different concepts. With the rapid development of internet network, mobile phones, computers, mobile terminals, etc., a large amount of data information aregeneratedevery day. In particular, the rapid development of artificial intelligence and big data has brought the society into a new era. The machine intelligence is no longer unfamiliar to ordinary people [3-5]. To make the machine have intelligence, we need to make it constantly engage in learning in things, in order to improve the "intelligence" of the machine. Natural language processing (NLP) refers to the technology of communication and interaction between human natural language and computer system. It is an indispensable technology in many modern application scenarios. As an important research direction of artificial intelligence, NLP technology has begun to flourish in recent years, especially in voice, machine translation and other aspects, which greatly facilitates people's lives and promotes the development of science and technology. As an expression of human emotion and thinking, metaphor has a great impact on human life [6,7].

At present, NLP technology is mainly used to study the recognition and emotional judgment of metaphor. However, due to the special structure of metaphor, there is no general method to solve the problem of metaphor. Generally speaking, the study of metaphor has a long way to go, and it is of great significance to overcome the difficulties of metaphor [8-10].In recent years, with the development of mobile Internet, intelligent terminal and internet of things technology, especially the rapid rise of micro blog, forum and other network media, the public widely participate in all aspects of social comments, resulting in a large number of evaluation information with rich emotional tendency, people urgently hope that computers can quickly analyze and deal with the feelings of these text evaluation, so as to meet the needs of information prediction, public opinion monitoring and other aspects. In the academic circles at home and abroad, there has been a wave of research on emotional metaphor [11-13].

At present, the research methods of emotional metaphor at home and abroad are mainly based on semantic analysis and traditional machine learning algorithm. These methods cannot use the deep semantic information, so the effect is not good. Synergetic neural network is an effective semantic analysis method [14-16]. Therefore, this paper proposes a collaborative affective metaphor method, which can better analyze the semantics of affective metaphor and achieve better recognition performance.

The rest of this manuscript is organized as follows. In Section 2, we briefly review the notions of synergetic pattern recognition. In Section 3, a recognition model of synergetic emotional metaphor is introduced and some relative methods are discussed. Finally, some experimental tests, results and conclusions are given.

II. SYNERGETIC PATTERN RECOGNITION

According to the synergetic theory, the dynamic equation is used to evolve the model to be tested α from the intermediate state $\alpha(\mathrm{t})$ into a prototype model

$$\alpha(0) \to \alpha(\mathrm{t}) \to b_k \qquad (1)$$

The dynamic equation is as follows:

$$\dot{\alpha} = \sum_{k=1}^{M} \lambda_k (b_k^+ \alpha) v_k - B \sum_{k' \neq k} b_k (b_{k'}^+ \alpha)^2 (b_k^+ \alpha) - C\alpha(\alpha^+ \alpha) \qquad (2)$$

Where α is the mode to be tested, λ_{k} is the attention parameter, b_{k} is the prototype mode vector, b_{k}^+ is the adjoint vector of b_{k}, $F(t)$ is the rise and fall force, B and C are the given parameter. b_{k} must meet:

$$\sum_{l}^{N} b_{kl} = 0, \|b_k\| = (\sum_{l=1}^{N} b_{kl}^2)^{\frac{1}{2}} = 1 \quad (3)$$

At the same time,

$$(b_k^+ b_{k'}) = b_k^+ b_{k'} = \delta_{kk'} \quad (4)$$

where $\delta_{kk'} = \begin{cases} 1, & k = k' \\ 0, & k \neq k' \end{cases}$.

Haken gives the concept of order parameter in system dynamics

$$\alpha = \sum_{k=1}^{\mathrm{M}} \xi_{\mathrm{k}} b_{\mathrm{k}} + \mathrm{w}, \quad (b_{\mathrm{k}}^+ \mathrm{w}) = 0, \ k = 1, 2, \cdots, M$$

Haken points out that the process of cooperative pattern recognition can be described by potential dynamic equation. The potential function equation is:

$$G = -\frac{1}{2} \sum_{k=1}^{M} \lambda_{\mathrm{k}} \left(b_{\mathrm{k}}^+ \alpha \right)^2 + \frac{1}{4} \mathrm{B} \sum_{k' \neq \mathrm{k}} \left(b_{\mathrm{k}'}^+ \alpha \right)^2 + \frac{1}{4} \mathrm{C} \left(\sum_{k=1}^{\mathrm{M}} \left(b_{\mathrm{k}}^+ \alpha \right)^2 \right)^2 \quad (5)$$

where

$$\dot{\mathrm{b}} = -\frac{\partial \mathrm{G}}{\partial \mathrm{b}^+} \text{ 和 } \dot{\mathrm{b}}^+ = -\frac{\partial \mathrm{G}}{\partial \mathrm{b}} \quad (6)$$

By substituting the order parameter into the formula, we can get $\dot{\xi}_k = \lambda_{\mathrm{k}} \xi_{\mathrm{k}} - \mathrm{B} \sum_{\mathrm{k}' \neq \mathrm{k}} \xi_{\mathrm{k}'}^2 \xi_{\mathrm{k}} - \mathrm{C} \left(\sum_{\mathrm{k}'=1}^{\mathrm{M}} \xi_{\mathrm{k}'}^2 \right) \xi_{\mathrm{k}}$ (7)

$$\mathrm{G} = -\frac{1}{2} \sum_{k=1}^{\mathrm{M}} \lambda_{\mathrm{k}} \xi_{\mathrm{k}}^2 + \frac{1}{4} \mathrm{B} \sum_{\mathrm{k}' \neq \mathrm{k}} \xi_{\mathrm{k}'}^2 \xi_{\mathrm{k}}^2 + \frac{1}{4} \mathrm{C} \left(\sum_{\mathrm{k}'=1}^{\mathrm{M}} \xi_{\mathrm{k}'}^2 \right)^2 \quad (8)$$

When the dynamic energy of the order parameter is exhausted, the system will be in a stable state.

$$\dot{\xi}_{\mathrm{k}} = 0, \ 1 \leq k \leq M \quad (9)$$

III. RECOGNITION MODEL OF SYNERGETIC EMOTIONAL METAPHOR

(1)Knowledge space construction

As mentioned before, we use vector based semantic space to express semantics. In this research, we intend to improve the modeling from the above shortcomings of traditional vector space, and construct vector semantic space from context information, emotion information, word meaning information, and topic model. These information will be helpful to the disambiguation in emotional metaphor. The emotional metaphor space is shown in Figure 1.

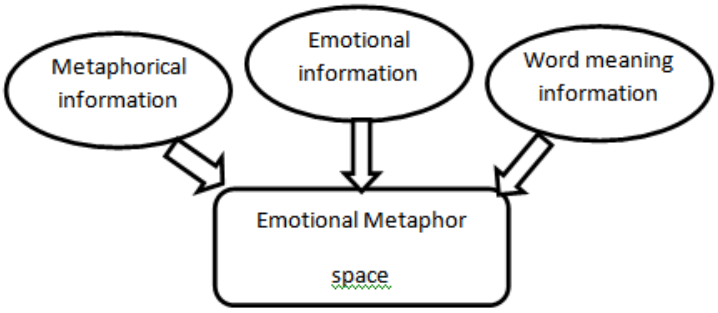

Fig.1. Knowledge space construction

(2) Synergetic analysis model

a)Prototype vector reconstruction

In the processing of structured information, we skip the transformation process from structured information to plane features, and use tree kernel function to directly introduce the captured effective structured information into emotional metaphor recognition. Let b_1 and b_2 are prototype vector, $\lambda_i (i=1,2,\cdots)$ is parameters.

$$K(b_1,b_2)=\sum_i \lambda_i g_i(b_1) g_i(b_2) \quad (10)$$

b) Order parameter reconstruction

The order parameter reflects the similarity between the prototype and the test mode. By using dense, multi-dimensional vector representation method to calculate word similarity, we can better model large-scale context, thus greatly improving the language model. In this way, the process of emotional metaphor recognition is regarded as the competition process of many order parameters, and the result of metaphor recognition is obtained through the evolution of dynamic equation.

c) Reconstruction of evolution equation

In the traditional synergetics, the rise and fall forces are ignored in the evolution equation of potential function. The rise and fall of facts makes effective use of prior knowledge. The evolution equation will be reconstructed according to the global constraints between multiple knowledge sources to ensure that only one order parameter wins in the order parameter layer.

$$\dot{\xi}_k=\lambda_k\xi_k-B\sum_{k'\neq k}\xi_{k'}^2\xi_k-C\left(\sum_{k'=1}^{M}\xi_{k'}^2\right)\xi_k+F(t). \quad (11)$$

The metaphorical model of collaborative emotion is shown in Figure 2.

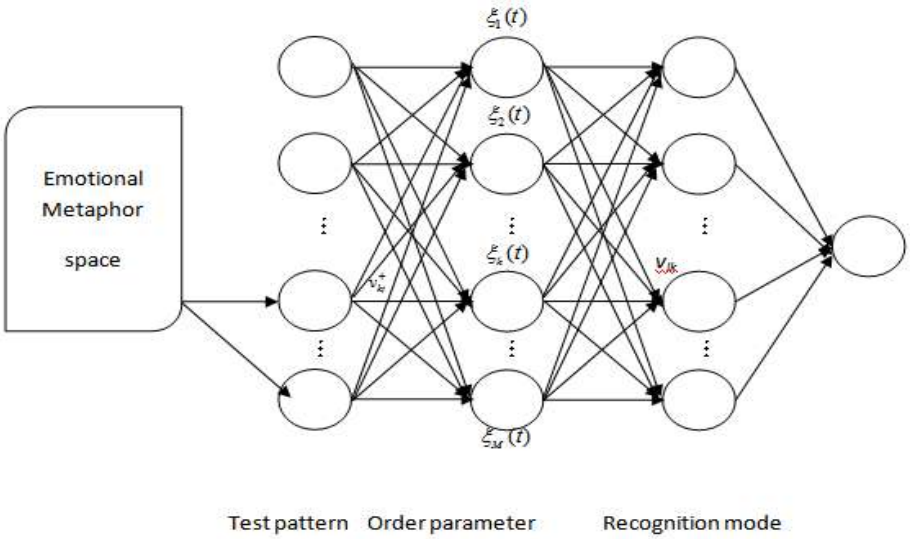

Fig.2. Synergetic emotional metaphor based on synergetic neural network

IV. EXPERIMENTAL RESULTS

In this section, we use the trifold cross validation method to train with 2 / 3 of the training set data in each step. The remaining 1 / 3 of the corpus are tested,and the relevant performance indicators are calculated respectively. The average value of three times is taken as the experimental result. Table 1 shows the details of the experimental corpus.

Table 1. Experimental corpus

Data description	Number of sentences
Metaphorical sentence	180
Non metaphorical sentence	125

In this paper, precision, recall and F1 are used to evaluate the performance of the model.

$$F_1 = \frac{2 \times precision \times recall}{precision + recall} .$$

In order to make a better comparison, we use three different order parameter construction methods.
Pseudo-inverse method: Construction of order parameters based on pseudo inverse;
Weighted distance method: Construction of order parameters based on weighted distance;
ST: Emotional MetaphorRecognition model based on synergetic neural network.
The experimental results are shown in Table 2.

Table 2.Performance comparison of different methods (%)

Algorithm	Performance		
	Precision	Recall	F1
Pseudo-inverse method	70.49	68.52	69.49
Weighted distance method	72.13	76.39	74.20
ST	81.31	84.59	82.92

As can be seen from Table 2, compared with pseudo-inverse method and weighted distance method, the method proposed in this paper can make better use of semantic knowledge, so as to improve the performance of emotional metaphor recognition.

V. Conclusion

To meet the needs of emotional metaphor recognition, a multi-scale semantic vector space is proposed, and a model of emotional metaphor recognition based on synergetic analysis is proposed. On this basis, several key problems of the model are studied, including prototype vector reconstruction, order parameter reconstruction and evolution equation reconstruction. Finally, a series of numerical experiments are carried out to prove the validity and feasibility of the method.

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REFERENCES

[1]. Fass D,Met: a method for discriminating metonymy and metaphor by computer, Computational Linguistics, 17(1), 1991,49-90.
[2]. Ghosh A, Li G, Veale T, et al, SemEval-2015 Task 11: Sentiment analysis of figurative language in twitter, International Workshop on Semantic Evaluation, 2015.
[3]. Kozareva Z. Multilingual affect , polarity and valence prediction in metaphor-rich texts, ACL 2013-51st Annual Meeting of the Association for Computational Linguistics, Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics, 2013, 682–691,
[4]. Lakoff G, Johnson M. Metaphors we live by, Journal of Aesthetics & Art Criticism, 19(2),1980,75–96.
[5]. Mason Z J. CorMe, A computational, corpus-based conventional metaphor extraction system, Computational Linguistics, 30(1),2004,23-44.
[6]. Diana McCarthy, Rob Koeling, Julie Weeds, and John Carroll,Finding predominant senses in untagged text ,In: Proceedings of the 42th Annual Meeting of the Association for Computational Linguistics (ACL 2004), Barcelona, Spain, 2004,280-287.
[7]. Sebastian Padó and MirellaLapata,Dependency-based construction of semantic space models ,Computational Linguistics, 33(2),2007, 161-199.
[8]. Reyes A, Rosso P, On the difficulty of automatically detecting irony: beyond a simple case of negation, Knowledge & Information Systems, 40(3),2014,595-614.
[9]. Chris Rowles and Xiuming Huang. Prosodic aids to syntactic and semantic analysis of spoken English ,In: Proceedings of the 30th

Annual Meeting of the Association for Computational Linguistics (ACL 1992), Newark, USA, 1992,112-119.
[10]. ShutovaE,Automatic metaphor interpretation as a paraphrasing task, Human Language Technologies: the 2010 Conference of the North American Chapter of the Association for Computational Linguistics,Association for Computational Linguistics, 2010,1029-1037.
[11]. Sun X, Lin H,Topical community detection from mining user tagging behavior and interest.,Journal of the Association for Information Science & Technology, 64(2),2013,321-333.
[12]. Strzalkowski T, Shaikh S, Cho K, et al, Computing affect in metaphors,communications of the ACM,57(1),2008,107-113.
[13]. Turney P D, Neuman Y, Assaf D, et al, Literal and metaphorical sense identification through concrete and abstract context, Conference on Empirical Methods in Natural Language Processing, EMNLP, John Mcintyre Conference Centre, Edinburgh, Uk, A Meeting of Sigdat, A Special Interest Group of the ACL. 2011,680-690.
[14]. YorickWilks, Lucian Galescu, James Allen, Adam Dalton,Automaticmetaphor detection using large-scale lexical resources and conventional metaphor extraction. Proceedings of the First Workshop on Metaphor in NLP, 2013,36–44.
[15]. Haken,Synergeticcomputers and cognition–atop-down approach to neural nets. Springer-Verlag, Berlin , 1991.
[16]. Liu S, Liu Z, Sun J, et al,Application of synergetic neural network in online writeprint identification, International Journal of Digital Content Technology and its Applications, 5(3),2011,126-135.
[17]. Maorui B, Mingming F, YuzhengZ,Speechrecognition system using a wavelet packet and synergetic neural network,IEEE International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 3, 2010, 453-456.

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