

An Approach to Construct an Emotional Dialogue System Based on Subjective Observation

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Abstract: This paper introduces basic concept of an emotional dialogue system and shows how to construct the system by computer simulation. We discuss a dialogue between two simulated persons who know only emotional words. At first, we show Image Code Table (ICT) of mixed emotions which are regarded as emotions in usual life, introduced by R. Plutchik[4]. Secondly, we also show how to design an emotional dialogue system based on the theory for Subjective Observation Model (SOM)[1], which have high applicability to several kinds of fields [2][3]. We explain the outline of the theory. Finally, we show several attractive dialogues by computer simulation.

Keywords Emotion psychology, Emotion processing, Mixed emotion, Subjective observation model, Fuzzy inference, Emotional dialog.

1. Introduction

We, human beings are almost impossible to recognize the absolute meanings of objects or the true relationships among them directly, then we usually understand the meanings concerning the objects by dropping the order of dimension and aggregating the observed information from several angles.

Subjective Observation Model (SOM) stands on the philosophy that all cognition and understandings can be done only on the observation space, mapping the objects defined on the high dimensional space onto the observation space.

And we consider a number of observation spaces as a kind of cognition (or interpretation). The system has two observation spaces corresponding to two persons on dialogue. The emotional words on each observation space dispatched to the partners are mapped on the particular observation space on which the origin of mapping and the scaling are taken into special consideration.

2. Eight Pure Emotions and Image Code Dictionary

We introduce and outline of Plutchik's theory. In emotional psychology, R. Plutchik proposed a four pair emotional ring constructing by eight pure emotions (see Figure 1), whose constructive idea came from the analogical inference for the three-dimensional, mixed-color model (Plutchik [4]).

These are regarded as four-dimensional attributes, constructing a Rectangular Basal Coordinates Frame (RBCF). And the mixed emotions which are felt in usual human life, are supposed to be defined by the vectors on RBCF in the form of linear combination of the coefficients. In fact, as for some mixed emotions, R. Plutchik in his paper[4], considered some intensities on the 8 pure emotions constructing a mixed emotion. So, in the similar way to him, we made an image code dictionary (see Table 1) consisting of sixty-eight mixed emotional words.

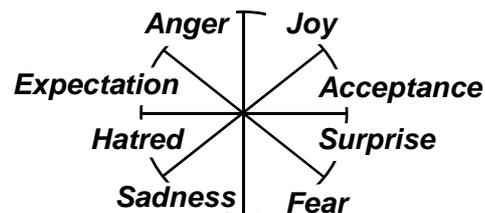


Fig.1. The ring of 8 pure emotions

3. Outline of the Theory for Subjective Observation Model

3.1. Expression of Emotions by Vectors

We explain SOM shortly, because detail of the theory is in the paper[1].

Image codes of the mixed emotions $\{x_k\}$ ($k=1,2, \dots, 68$) can be expressed by the vectors $\{\bar{x}_k\}$ consisting of the coefficients on 4 attributes of a Normalized Rectangular Basal Coordinate (NRBC)

whose system is denoted by, $\{\bar{e}_i\}$, i.e.;

Tab.1. A part of Image-Code dictionary of the Mixed Emotional Words ($\times 0.01$)

Mixed Emotional words	Joy-Sad.	Ang.-Fear	Exp.-Sur.	Acc.-Hate.
ecstasy	91	0	30	30
joy	74	0	50	30
happiness	65	0	50	30
pleasant	52	0	30	30
quiet	40	0	10	30
calm	30	0	10	30

Abbreviations: Ang, anger; Exp, expectation; Sad, sadness; Sur, surprise; Acc, acceptance

$$\bar{x}_k = x_{k1}\bar{e}_1 + x_{k2}\bar{e}_2 + \dots + x_{k4}\bar{e}_4, \quad (1)$$

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"My emotion is *hopeful*.". Miss B replied, "I wanted to *attack* somebody."

Fig.9 shows an simulated example of the dialogue in the case the coefficient $\alpha = 1$.

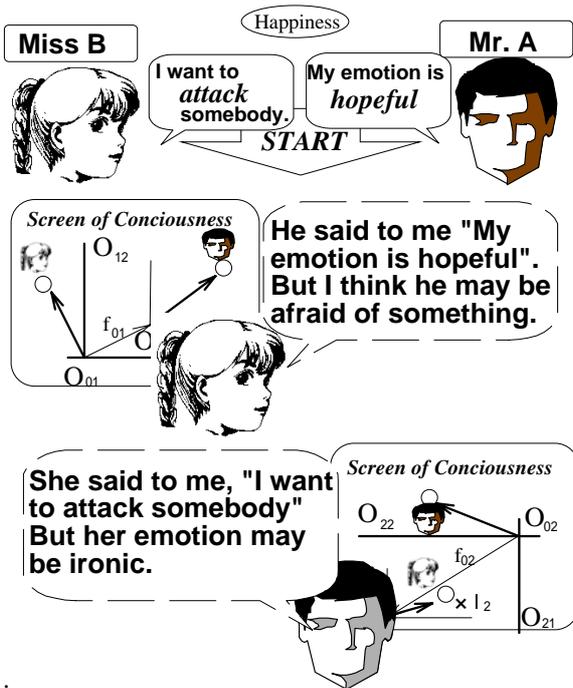


Fig. 9. An simulated example of the dialogue

4. Conclusion

We have applied the basic theory behind our subjective observation model to an emotional dialogue system. The simulations suggest that it is possible to use the system to mathematically extract human's emotional views against another person. This study is in its infancy; a lot of subjects for research have not yet been studied. However, it is considered that the idea of this research will be very useful for construction of artificial emotional dialog system in the near future, or for creating some new type of processing system containing subjective emotional functions in the background.

References

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Photograph of the first author

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