A sticker-based dialog system considering shared emotions in group chat

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Abstract: In this paper, we propose a sticker-based dialog model considering shared emotion in group chats. Previous communication robots support only one-on-one conversations. It, therefore. was difficult for the robot to communicate with multiple people. Opportunities for people to communicate using group chat are increasing with the development of SNS.
The dialog system, therefore, must behave properly in a group chat. The proposed model estimates the shared emotion in a group chat and judges the emotion sympathy. Our experiments reveal that the proposed model can estimate the shared emotion in a group chat. Further study, however, is required to construct a dialog system for human-like dialog.
Keywords: *Kansei, Shared emotion, LINE sticker, Sympathy judgment*

1. INTRODUCTION

In recent years, robots have become increasingly common, particularly regarding the development of partner robots [1]. Partner robots cooperate with people and are often used for human care [2]. To communicate effectively, partner robots must understand complicated emotions, such as human sensitivity, and behave like a human. Current robots, however, are limited in this aspect, and users often lose interest because robot algorithms are too simple to generate appropriate responses to human emotions.

To solve such problems, we studied a robot that understands complex minds such as human sensibility and expressions [3].

Furthermore, most conventional dialog systems are based on one-to-one dialog, and research on a dialog system that supports text-based group chat is not yet adequate.

In this study, we construct a system that estimates the emotions shared in a group chat and output it in an image format such as a LINE sticker.

A group chat has a shared emotion because multiple people participate in a group chat and various opinions are written. If robots could consider shared emotion in group chat, they could join multi-person conversations. Also, a sticker-based output function could express emotions more visually than a text-based output [4].

Unlike one-on-one conversations, multi-person conversations do not have to reply to all inputs. To solve this problem, the robot outputs using sympathy [5].

2. PROPOSED MODEL

2.1 Sticker-based dialog system

The proposed model considers shared emotion and outputs stickers in a group chat. Fig.1 is a schematic of the dialog system. Emotion extraction API, long short-term memory (LSTM), and an output judgment system were used to construct the proposed model.

At first, the proposed model estimates emotion values from statements in a group chat. Next, the system estimates shared emotions from emotion values by using LSTM. The system judges the stickers and sympathy based on shared emotion.

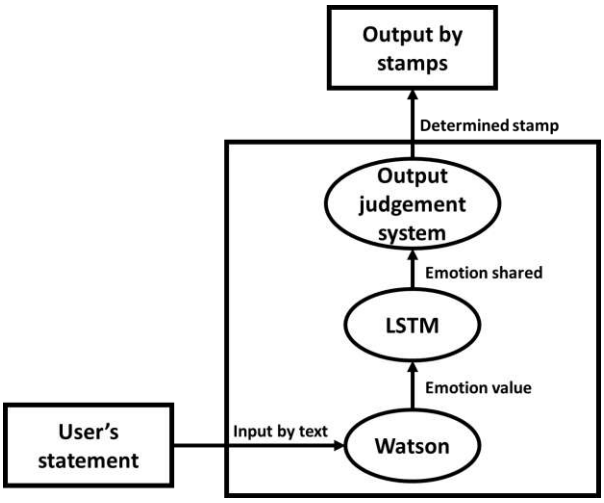

Fig 1: Schematic of the dialogue system

2.2 Watson

Watson is a technology platform provided by IBM [6].

The proposed model uses Watson to extract emotion value from statements to estimate shared emotion. This

study uses the Watson Tone Analyzer (Watson TA). Watson TA can classify emotions into five types and estimate.

2.3 LSTM

LSTM is a type of RNN, LSTM, specifically good at learning long-term dependencies [7]. Fig.2 is a schematic of LSTM. LSTM has three sigmoid layers, namely the forget gate, input gate, output gate.

The forget gate determines how much current information is retained.

The input gate judges whether current information is appropriate based on past information. If the current information is not appropriate, delete the current information and send the information to the output gate.

The output gate determines the output and information to leave the next time.

The proposed model estimates shared emotion from the emotion value by LSTM.

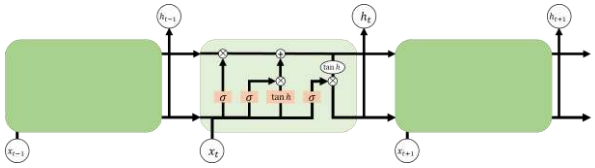

Fig 2: Schematic of LSTM

2.4 Sympathy judgment function

In this study, emotions are defined based on the Russell Circumplex Model [8]. Emotions are expressed as points in the circumplex model. We, therefore. judge sympathy based on a cosine similarity using the vector from the origin. The judgement of sympathy is based on shared emotion and emotion value. If the cosine similarity is high, the two emotions are similar. If the cosine similarity is low, the two emotions are not similar. Fig.3 is a schematic of the sympathy judgment function.

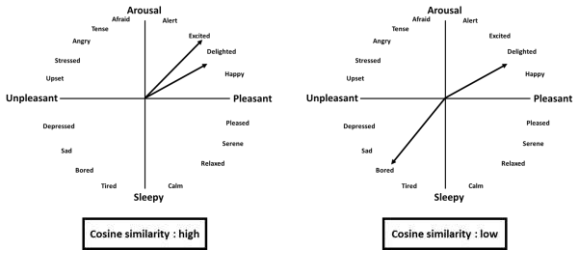

Fig 3: Schematic of sympathy judgment function

2.5 Sticker determination function

In this study, emotions are expressed as points in the circumplex model. Sticker output, therefore. is based on the Euclidean distance between the emotion point and sticker point on the circumplex models. The proposed model outputs the sticker closest to the emotion point. Fig.4 and Fig.5 are Russell circumplex models and a list of stickers.

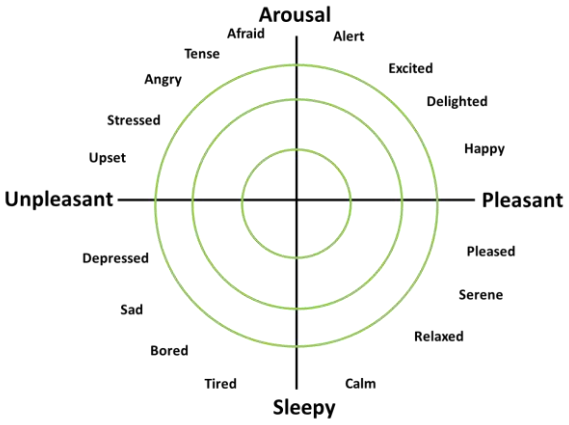

Fig 4: Russel circumplex model

Fig 5: List of stickers

3. SURVEY EXPERIMENTS

3.1 Survey on sticker placed

The proposed model outputs stickers based on the shared emotion in a group chat. Sticker decisions are based on the Euclidean distance on the circumplex model. We, therefore, must place the stickers on the circumplex model. We experiment with subjects to get a general sticker placement. The subjects were 20 men and women. The average age of men and women is 24 years.

The type and size of emotions are critical values in the proposed model. We, therefore, prepare three circles of different sizes. The subjects choose one of three circles depending on the size of the sticker's emotion. The result is the unit vector and circle number of the placed sticker. Circle numbers are 3, 2, and 1 from outside, and the number size and emotion value size are the same. Table 1 shows the result of the experiment, and Fig.6 is stickers placed on the circumplex model based on the result.

Table 1: Result of the experiments

Sticker number	$x-axis$	$y-axis$	*size*
1	0.98	0.20	1.80
2	1.00	0.03	2.35
3	-0.70	0.72	1.75
4	-0.68	0.73	2.60
5	-0.84	-0.54	1.70
6	-0.86	-0.52	2.35
7	-0.24	0.97	2.05
8	-0.18	0.98	2.55
9	-1.00	0.01	2.35
10	-0.65	0.76	1.55
11	-0.22	0.98	1.75
12	0.70	0.72	1.70
13	0.99	0.16	2.20
14	-0.21	-0.98	1.90
15	0.78	-0.62	2.05

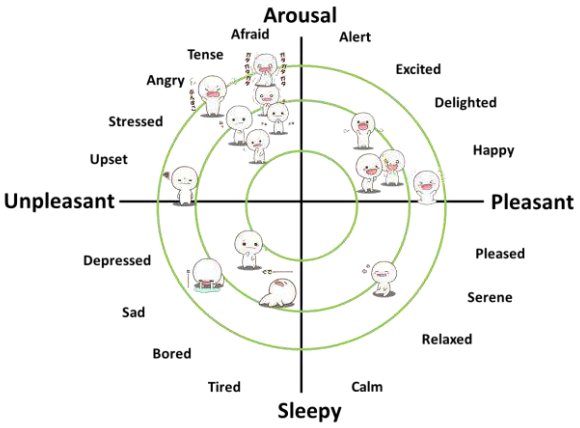

Fig 6: Sticker placed on the Russel circumplex model

3.2 Results and Discussions

The subjects were given only the sticker image as information. The average of the emotion value size is 2.04. Most stickers concentrated on nearby coordinates. The result, however, is different for the 10th sticker, as 80% of the subjects placed the sticker near Afraid, but 20% placed the sticker near Stressed. Consequently, the 10th sticker is placed near Angry.

4. EXPERIMENTS

4.1 Experiment of the proposed model

The proposed model outputs stickers based on the shared emotion of a group chat. We conducted a questionnaire experiment to verify the proposed model. The proposed model is compared with stickers output by humans in the experiment. Fig.7 is part of an experimental movie.

First, we prepared five sample chat scenarios. We created two types of movies with stickers for the sample scenarios. Stickers were added in two ways: the proposed model and human power. The subjects watched two movies and determined which is the more human-like response. The subjects did not know which movie was created by the proposed model.

Fig 7: Part of an experimental movie

4.2 Results and Discussions

Fig.8 is a comparison result and the questionnaire is a five-point rating scale. In Scenario 1 and Scenario 4, the proposed model cannot be evaluated. These scenarios contained many proper nouns such as “hot spring trip”. In scenario 5, the proposed model is evaluated. This scenario contains many expressions of emotion. From the results, the proposed model is effective as a method to express emotions.

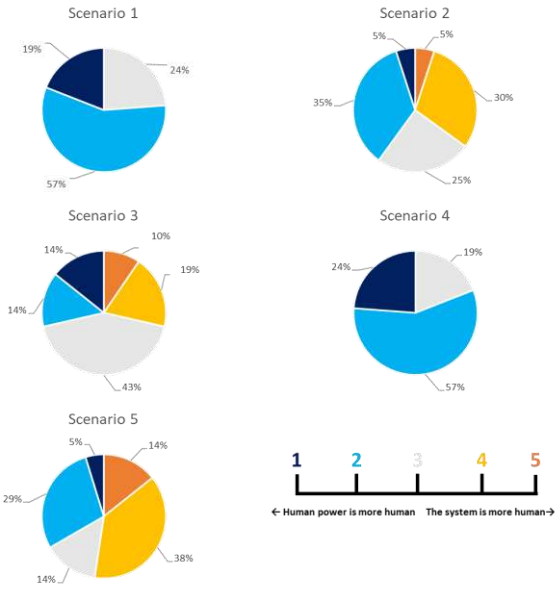

Fig 8: Comparison result

We asked in each scenario, "Can the proposed model estimate the shared emotion in a group chat?". Fig.9 shows the result of the question. The proposed model performed well in most scenarios and could estimate the shared emotion in a group chat. For the proposed model to have a natural conversation, the proposed model, however, must improve responsiveness to words without emotion.

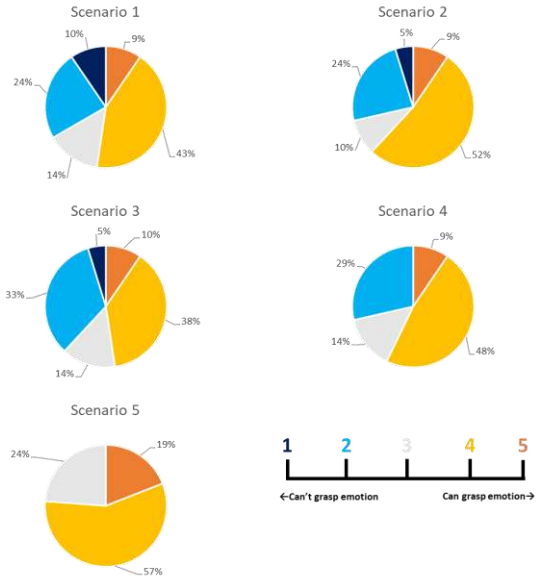

Fig 9: Result of the question

5. CONCLUSION

In this study, we proposed a model to estimate the shared emotion in a group chat. The proposed model estimates the shared emotion from the emotion value of the speaker and outputs a line sticker. The experiment results reveal that the proposed model could estimate the shared emotion in a group chat. We, however, did not get any superior results when comparing the proposed model with human power. In the future, the proposed model will be equipped with a system that considers context.

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