Paper 2

NTT

EFFECTS OF SELF-DISCLOSURE AND EMPATHY IN HUMAN-COMPUTER DIALOGUE

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1. Summary

- We want to reveal the effects of system self-disclosure and empathy on user's felt closeness and satisfaction in human-computer dialogue
- By statistically analyzing dialogues between users and systems, we found the following:
  - ✓ Empathic utterances of users strongly indicate increasing user's felt closeness and satisfaction
  - ✓ System's empathic utterances are effective for inducing empathic utterances from users
  - ✓ Self-disclosure of users increase when they have positive preferences on topics being discussed

2. Problem and Approach

- Self-disclosure and empathy are known to play an important role in social dialogues
- However, it is not known how system's individual linguistic acts influence dialogue qualities

- We collect dialogues in which users converse with systems with different occurrence distributions of self-disclosure and empathic utterances
- We analyze correlation between the counts of dialogue acts related to self-disclosure/empathy and user's felt closeness/satisfaction

3. Dialogue System

- Japanese keyboard-based dialogue system
- Domain: likes and dislikes about animals
- System and user can make self-disclosure / agreement (empathy) / disagreement (antipathy)
- System can change the occurrence probabilities of its self-disclosure / agreement / disagreement
- System's understanding grammar was realized as a WFST (2,276 words)
- Hand-crafted templates and rules for dialogue management and surface generation

4. Dialogue Sample

	Utterance	Dialogue act
System	Hello	Greeting
User	Hello	Greeting
System	Lets' discuss likes and dislikes about animals.	Open dialogue
User	Do you like insects?	Question
System	Do you like insects?	Question
User	I like fireflies.	Self-disclosure (preference)
System	You like fireflies.	Agreement (empathy by repetitions)
User	I like fireflies because they glow.	Self-disclosure (reason)
System	I also like them very much.	Agreement (empathy)
User	Why do you like fireflies?	Question
System	I like them too. They are evanescent.	Agreement (empathy) Self-disclosure (reason)

5. Data Collection and Analysis

- Users: 50 Japanese adults (25 males/females)
- System with 18 different occurrence distributions of self-disclosure / agreement / disagreement
- Each user talked to the system with 18 occurrence distribution settings (total: 900 dialogues)
- After each dialogue, users filled out a questionnaire for subjective evaluation of the dialogue
- We annotated user's correct dialogue acts
- We analyzed correlation between the counts of dialogue acts and user's felt closeness/satisfaction

6. Indicator of User's Felt Closeness and Satisfaction

- Among various types of dialogue acts, user agree count is relatively more correlated with both user's felt closeness and satisfaction
- User agree count (count of dialogue acts related to the user's empathy) is an strong indicator of increasing user's felt closeness and satisfaction

Closeness and satisfaction in dialogues with more than one user agree count	>	Closeness and satisfaction in dialogues with zero or one user agree count

ANOVA: $F = 20$, $p < 0.0001$; Multiple comparison test: $p < 0.002$

7. How to Increase User Agree Count

- We need to increase user agree count for better user's felt closeness and satisfaction
- Multiple linear regression analysis

  objective variable: user agree counts

  explaining variables: counts related to system acts

System agreement (performed independently of user utterances) is effective for inducing agreement from users

	Regression coefficients
System disclosure count	0.393
System agree count	**0.245**
System acknowledge count	0.189
System question count	-0.172

8. How to Increase User Self-disclosure

- Inducing self-disclosure is important for marketing/recommendation purposes
- Multiple linear regression analysis

  objective variable: user self-disclosure count

  explaining variables: counts of animals that user/system likes or dislikes

User's self-disclosure tends to increase when users have a positive preference for topics being discussed

Regression coefficients

User preference positive count	**0.496**
User preference negative count	0.358