A Framework for Confusion Mitigation in Task-Oriented Interactions

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Introduction

Confusion is a mental state that can be triggered in task-oriented interactions. Previous work [1] has demonstrated that confusion can be detected in situated human-robot interactions from social cues collected. In the next step, we propose appropriate ***interaction structures*** in this study, which should be used to mitigate confusion.

We motivate and describe this dialogue mechanism through an information state-style ***dialogue framework and policies***, and also outline the approach we are taking to integrate such a meta-conversational goal alongside core task-oriented considerations in modern data-driven conversational techniques.
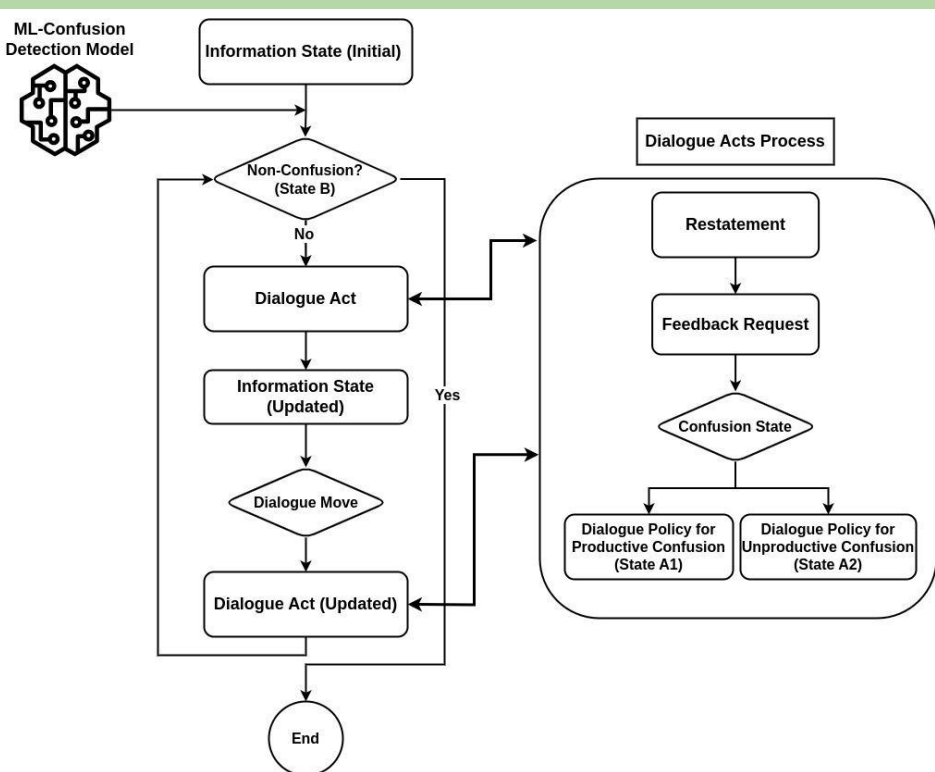
Methods

➤ Information State Structure for confusion mitigation
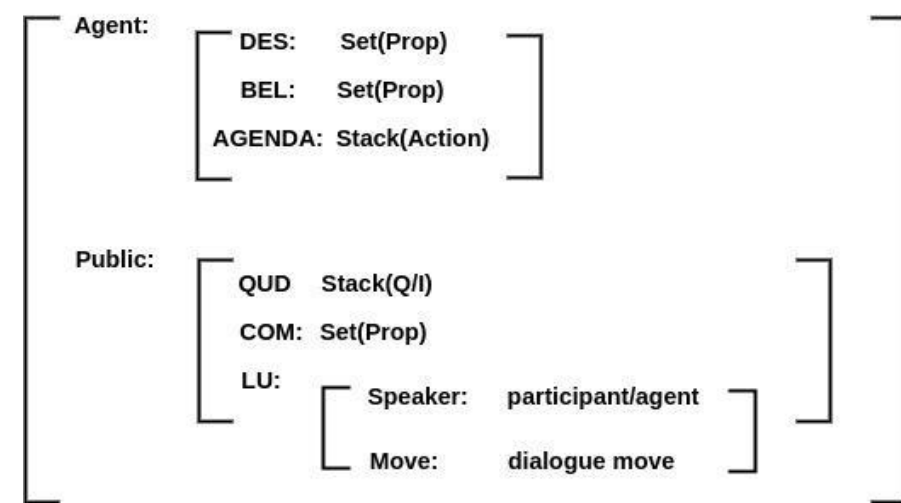
DES: Desire; Prop: Propositions; BEL: Believe;
QUD: Question Under Discussion; COM: commitment;
LU: Last Utterances

➤ Working process of dialogue framework for confusion mitigation

➤ Detail General Dialogue rules

Communicative Update Rules associated with Dialogue Moves and related Acts		
Moves	**Acts**	**Communication Rules**
restate(q/i)	Restatement	Repeat the question/information either at the same speed or more slowly.
ask(q)	Feedback request	Option 1: Ask the participant whether they can follow what the agent has said. Option 2: Ask the participant whether it is difficult for them to answer this question. Option 3: Ask the participant whether they want to continue to answer this question by themselves.
inforExten(q)	Information extension	Provide more explanations to fix the issued questions or lost information.
inforSply(q)	Information supplement	Provide the full information / question in different ways to easily understand without confusion.
confirm(help)	Confirmation	Get a help confirmation from the participant to overcome their confusion.
affirm(q)	Affirm	Affirm that this information or question has issues or is difficult leading to the participant cannot answer.
ack(a)	Acknowledge	Acknowledge the participant's response correctly to remove the participant's source of confusion.
Freetalk(sbj)	Subject change	Option 1: Raise a simple question that the participant can answer without confusion. Option 2: Bring up another interesting topic to arise the participant's engagement.

➤ Examples of updated information state policy with dialogue acts

1. <ask_question_to_usr>
Information state:
[Agent/BEL: {NULL}]
[Agent/DES: {nonconfusion(usr)}]
[Agent/AGENDA: <notify confusion(usr)>]
[Public/QUD: <?a.wordproblem(agent)>]
[Public/COM: {State A1}]
[Public/LU: {Speaker: agent;
Move: {answer(wordproblem(usr))}]
Dialogue Act: {notify confusion(usr)}

2. <ask_question_to_usr_A1>
Information state 2.1:
[Agent/BEL: {State A1(usr), tohelp(agent)}]
[Agent/DES: {nonconfusion(usr), tohelp(agent)}]
[Agent/AGENDA:
<restate(wordproblem(agent))>]
[Public/QUD: <?a.wordproblem(agent)>]
[Public/COM: {State A1}]
[Public/LU:
{Speaker: usr; Move: {confirm(help)}]
Dialogue Act 2.1: {confirmation(usr)}

Information state 2.2:
[Agent/BEL: {State A1(usr), tohelp(agent)}]
[Agent/DES: {nonconfusion(usr), tohelp(agent)}]
[Agent/AGENDA:
<inforExten(wordproblem(agent))>]
[Public/QUD: <?a.wordproblem(agent)>]
[Public/COM: {State A1}]
[Public/LU: {Speaker: agent;
Move: {restate(wordproblem(agent))}]
Dialogue Act 2.2: {restatement(agent)}

3. <ask_question_to_usr_insufficient>
Information state:
[Agent/BEL: {State A1(usr), tohelp(agent)}]
[Agent/DES: {nonconfusion(usr), tohelp(agent)}]
[Agent/AGENDA:
<inforSply(wordproblem(agent))>]
[Public/QUD: <?a.wordproblem(agent)>]
[Public/COM: {State A1}]
[Public/LU: {Speaker: usr;
Move: {inforExten(wordproblem(agent))}]
Dialogue Act: {information extension(agent)}

Discussion & Outlook

- ➤ The key motivators were (a) whether confusion states can be induced; and (b) whether it is possible to detect confusion states extraverbally.
- ➤ The policy highlights one way: identify and mitigate confusion as a pragmatic phenomenon.
- ➤ Folding in the goals of embodied structured conversation with the naturalness and task-oriented appeal of integration with large language model-based solutions.
- ➤ The semantics and pragmatics of dialogues study.

Reference

[1] Na Li and Robert Ross. 2023. Hmm, you seem confused! tracking interlocutor confusion for situated task-oriented hri. In Proceedings of the 2023 ACM/IEEE International Conference on Human-Robot Interaction, HRI '23, page 142–151, New York, NY, USA. Association for Computing Machinery.

Acknowledgment